



U.S. DEPARTMENT OF
TRANSPORTATION

**Federal Highway
Administration**

Technical Advisory

Subject

DEVELOPMENT AND REVIEW OF SPECIFICATIONS

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1. **What is the purpose of this Technical Advisory?** This Technical Advisory:
 - a. describes the role the FHWA division office staff plays in the development, review, approval, and evaluation of specifications prepared by State departments of transportation (DOT);
 - b. identifies specification review points related to:
 - (1) legal and administrative issues,
 - (2) material and technical requirements, and
 - (3) general organization and writing style;
 - c. describes the various types of specifications (i.e., method, performance, reference standards, and proprietary) used in highway construction, including the required elements of each specification type and appropriate conditions for their use; and
 - d. describes the FHWA’s National Highway Specifications Web site (NHSW) and encourages active participation by the division offices to help ensure that the contents of the Web site remain reasonably current.
2. **Does this Technical Advisory supersede other Federal Highway Administration (FHWA) guidance?** Yes. This Technical Advisory supersedes [FHWA Technical Advisory 5080.16, Development and Review of Specifications](#), dated August 7, 1992.
3. **Who is the intended audience of this Technical Advisory?**
 - a. The primary audience for this document is FHWA division office staff that review and approve specifications. The document emphasizes division office oversight and the role of division office staff in the development and review of specifications.
 - b. While the primary audience is the FHWA division offices, the information presented in this document will also be of interest and use to State DOT personnel and others that draft and enforce contracts and specifications. The best practices and recommendations contained herein may be used by all to encourage and facilitate the writing of specifications that are clear, concise, correct, complete, and consistent.

4. **What are specifications and what role do they play on a project?**

- a. Specifications are written instructions describing the work that is to be undertaken.
- b. Specifications are part of the contract documents, which also include the drawings, bid or proposal documents, agreement forms, and contract modifications.
- c. Specifications communicate to bidders prior to contract award, and to the selected contractor thereafter, the definitive directions, procedures, and material and equipment requirements the State DOT considers necessary for completing the contract work. In this context, specifications can directly affect the quality of design and construction of every highway product, as well as the cost of construction and maintenance.

5. **What do specifications provide to a State DOT?** For a State DOT and its engineers and inspectors, specifications provide:

- a. a standard set of procedures for managing a project, including changes, and
- b. the minimum standards against which to evaluate the contractor's work, including allowable tolerances.

6. **What do specifications provide to contractors?**

- a. Specifications provide instructions on:
 - (1) how the prescribed work is to be performed, including material and equipment requirements and any restrictions or conditions on that performance;
 - (2) how the quality and acceptability of the work will be determined;
 - (3) allowable tolerances and how deviations from these tolerances will be handled;
 - (4) how payment for the work will be made; and
 - (5) how changed conditions are to be handled.
- b. Such information is important to contractors as they develop their bids and as they manage and execute the work if they are awarded the contract. After contract award, no additional duties or restrictions can be imposed on the contractor without a contract modification.

7. **What are the different forms of specifications used in highway construction?** The extent to which a division office will participate in a State DOT's development of a specification may vary based on the form of specification involved. It is therefore important to differentiate among the following forms or types of specifications commonly used in highway construction.
- a. **Standard specifications** – Specifications approved for general application and repetitive use, typically compiled and made available in book form.
 - b. **Supplemental specifications** – Additions and revisions to the standard specifications used to update the standard specifications between publications.
 - c. **Special provisions** – Additions and revisions to the standard and supplemental specifications that apply only to an individual project or a small group of projects.
 - d. **Developmental or pilot specifications** – Specifications developed around a new process, procedure, or material with the prior knowledge that subsequent adjustments might be necessary prior to adoption for standard usage.
8. **What is the relationship between plans and specifications?**
- a. Plans or drawings contain graphical or visual portrayals of the work required. Specifications contain written descriptions of the quality of materials, processes, and workmanship required to complete the work in a manner acceptable to the owner.
 - b. The information contained in drawings and specifications should be complementary; there should be no duplication or overlap between these documents. Hence, what is better described in the specifications should not be shown on the drawings, and, likewise, what is better shown on drawings should not be described in the specifications.
 - c. Drawings should generally show the following types of information, as appropriate:
 - (1) Location of the work,
 - (2) Details and dimensions,
 - (3) Schedules of construction items, and
 - (4) Plan notes.
 - d. Specifications should generally describe the following types of information, as appropriate:
 - (1) Type and quality of materials,
 - (2) Quality of workmanship,
 - (3) Methods of fabrication, installation, and construction,

- (4) Testing requirements,
 - (5) Alternates and options, and
 - (6) Method of measurement and payment.
- e. In preparing plans and specifications, the question often arises as to whether a particular instruction should be placed in the specifications, shown in the form of notes on the plans, or both.
- (1) As a general rule, information should *not* be included in *both* the specifications and the plans. Covering requirements in multiple places could lead to ambiguities or conflicts, especially if information is changed in one location but not the other.
 - (2) Plan notes should be used when it is necessary to communicate and clarify information that cannot be represented by a particular plan or detail alone, and the information cannot be highlighted advantageously in a specification.
 - (3) If the instructions apply to only one particular item, plan notes may be appropriate. For example, if only one connection requires a high strength bolt, a note to that effect should be placed beside the detail for that connection. If instead, *all* field connections are to be high-strength bolts tightened to a specific tension; this information would be better suited to a specification, as it would then be unnecessary to repeat this information on all affected plans.
 - (4) Plan notes may also be appropriate if it is necessary to highlight specific information (e.g., references to existing underground utilities, dimensional clarifications, work zone limitations related to noise or dust, locations of suitable soil, etc.) that could otherwise go unnoticed in a specification.
 - (5) Permitting agencies may also require the inclusion of certain notes on the plans. For example, agencies issuing National Pollutant Discharge Elimination System (NPDES) permits for construction activities often require plan notes to address the total area of disturbance, characteristics of the in situ soil, and the design capacity and associated maintenance schedule for erosion and sedimentation control measures. In this case, it would be important to verify that the associated soil erosion control specification does not duplicate or conflict with the requirements already stated in the plan notes.
 - (6) Plan notes are not a specification and should not be used to revise the approved specifications. Revisions to the specifications should instead be handled through a supplemental specification or a special provision.

9. **How should conflicting specifications or contract requirements be resolved?**

- a. Conflicting specifications or contract requirements may be resolved using an order-of-precedence (or coordination) clause. In highway contracts, such a

clause is often found in the Control of Work or Scope of Work sections of the General Conditions (Division 100).

- b. Under a typical order-of-precedence clause, project-specific information governs or takes precedence over the more generic, and written specifications govern over drawings. Thus, the hierarchy of documents imposed by a typical order-of-precedence clause is as follows:
 - (1) Project special provisions
 - (2) Project plans
 - (3) Supplemental specifications
 - (4) Standard specifications
 - (5) Standard plans
- c. The order-of-precedence clause also typically states that calculated dimensions take precedence over scaled dimensions.

10. **What are the different types of specifications used in highway construction?**

- a. Generally, four different types of specifications are used:
 - (1) Method specifications,
 - (2) Performance specifications,
 - (3) Reference standards, and
 - (4) Proprietary specifications.
- b. It is important for reviewers to understand each of these methods, particularly the content that they should contain, their relative advantages and disadvantages, and the conditions under which they can be best applied. See [Types of Specifying](#) for a full discussion on each of these methods.

11. **What is FHWA's policy on construction specifications?**

- a. Title 23 CFR 630 – Preconstruction Procedures, Subpart B, requires FHWA approval of plans, specifications, and estimates (PS&E) packages prepared for Federal-aid highway projects.
- b. Specifications are an essential part of the overall PS&E package, conveying how the contractor is to perform the contract work, and how the State DOT will measure, accept, and pay for the work performed.
- c. To facilitate the specification approval process, FHWA encourages the State DOTs to develop and maintain standard and supplemental specifications to address routine work items and requirements.

- d. Use of approved standard and supplemental specifications minimizes the need for project-specific special provisions, which reduces the time and effort to develop, review, and approve a PS&E package.

12. **What role do division office personnel play in the development, review, and approval of State DOT specifications?**

- a. The FHWA Division Administrators have been delegated the authority to review and approve State DOT construction specifications developed for use on Federal-aid construction projects. The [FHWA Delegations and Organization Manual](#), Chapter 5, outlines these delegations in detail.
 - (1) Typically, this review and approval authority is further delegated from the Division Administrator to a designated staff member that has been assigned responsibility for specification coordination and review as a collateral duty. In this role, the specification engineer should coordinate review of State DOT specifications with technical specialists in the division office, resource center, and Washington Headquarters as necessary.
 - (2) Some division offices have identified technical specialists or have formed subcommittees in specific program areas (e.g., traffic and safety, materials, pavement, geotechnical and environmental, finance and legal, etc.), and have assigned responsibility to such specialists for specifications developed in their specific area of expertise.
- b. A division office can capitalize on its review and approval authority by requesting to participate in the State DOT's specification development efforts. Such participation could include attending regular specification committee meetings, facilitating outreach efforts to industry and other local agencies, and promoting and disseminating information developed by Washington Headquarters and the resource center.

13. **What are some best practices related to division office participation in a State DOT's specification development efforts?**

- a. **Participate in the State DOT's specification development process as early as possible.**
 - (1) Early involvement in the development of specifications provides the opportunity to improve the State DOT's environmental, design, construction, and maintenance processes without micromanaging at the individual project level. By approaching specifications at a program level rather than at an individual project level, the division office can influence both the process itself and individual products.
 - (2) The division office should designate a staff member to regularly coordinate with the State DOT on specification matters. Coordination activities could include setting up and participating in specification committee meetings with the State DOT. Regular participation in such meetings will help keep the division office informed of upcoming specification activities

contemplated by the State DOT, such as major revisions to the standard specifications or development of new specifications. Advance notice of these activities can be used to schedule the necessary resources to ensure the timeliness of the review process.

- (3) A standing relationship with State DOT personnel also facilitates communication and helps identify technical areas of need for which additional training and assistance may be beneficial.

b. Recommend that the State DOT develop a written policy regarding specification updates (if it does not already have such a policy in place).

- (1) Specifications often require regular updates to keep up with technological advances, product changes, and lessons learned on prior projects. A written policy that defines the State DOT's procedures for developing and revising specifications and obtaining FHWA approval can facilitate the specification updating process, particularly for new staff.
- (2) Documentation could range from a guidance manual, complete with forms and checklists, to a simple flowchart that depicts the basic review steps and assigns responsibility for each step.
- (3) The exact procedures a State DOT chooses to adopt must meet its own unique needs; however, some best practices include the following:
 - (a) Establish standing committees with specialized expertise to focus on specifications in one particular functional area (e.g., soils, asphalt, concrete, general conditions, materials, etc.).
 - (b) Create an executive committee to oversee the work of these committees and make decisions regarding implementation of the revised specifications.
 - (c) Hold regular specification meetings, both with internal staff and with representatives from FHWA and industry.
 - (d) Gather feedback on the effectiveness of the specification after use on a project(s) and revise the specification as necessary.

c. Participate in joint State DOT/industry committees and activities.

- (1) State DOTs often seek input from industry representatives as they develop specifications, especially if it appears as though a specification may hold particular relevance to a certain industry or group (e.g., Associated General Contractors of America, concrete and asphalt associations, etc.).
- (2) Such involvement is designed to identify constructability issues or past problems related to enforceability or inconsistent administration in the field. For major revisions, State DOTs may also want to reach out to

industry representatives to get their perspective on how the change may impact business or operations.

- (3) Often a State DOT will engage industry representatives before the division office's formal review. However, it may be beneficial for division office personnel to attend joint DOT/industry specification development meetings to provide a national perspective on the issues and concerns that may emerge, and to enhance interaction and outreach among State DOT staff and industry representatives.

d. **Promote and disseminate information developed or provided by Washington Headquarters, the resource center, other State DOTs, and industry on specification issues, best practices, and new and emerging materials and technology.**

- (1) The division office, with assistance from Washington Headquarters and the resource center as necessary, can often provide a broader perspective on new ideas and trends than may be available or known to specification writers at the State DOT. This knowledge can be used to promote (or alternatively, to dismiss) material trends and new and emerging materials and technology.
- (2) Continuing involvement and coordination with the State DOT on specification matters allows the division office to be proactive rather than reactive in promoting new concepts and best practices. Such involvement can be used to foster a culture that seeks to continually improve the quality of specifications.

14. **What are some best practices related to the specification review and approval process?** The process of reviewing and approving specifications provides the division office with a clear opportunity to influence the quality and completeness of specifications. A division office's specification review and approval procedures will be largely driven by the internal processes of its counterpart State DOT. However, it may be beneficial for the division office to formalize its own internal procedures, if for no other reason than to retain continuity as new staff is hired. Development and documentation of review and approval procedures will not only help streamline coordination and review efforts at the division office level, but may also provide a framework to assist or influence the State DOT's own specification development activities. Some recommended elements to consider when developing procedures are discussed below:

a. **Responsibilities of division office staff**

- (1) A division office's review and approval process should address the following:
 - (a) Who coordinates with the State DOT on specification matters on a regular basis?

- (b) Who has approval authority (e.g., Division Administrator, or delegated to other staff member)?
 - (c) Who has expertise in different technical areas? When should technical experts be engaged?
- (2) When selecting reviewer(s), note that detailed knowledge of both the technical and the administrative requirements and concerns is not always available from one or two individuals. The use of a committee or group of knowledgeable individuals to develop and evaluate the specifications is preferred. Technical specialists should be consulted as necessary; however, a non-expert may also be well suited to identifying basic problem areas such as reliance on assumed knowledge and inclusion of unnecessary requirements.

b. **Review guidelines**

- (1) When evaluating specifications, reviewers should be alert to the types of issues discussed in the document [Specification Review Guidance](#).
- (2) Development of a review checklist can facilitate reviews of specifications and PS&E packages. [Specification Review Checklist](#) is a generic form that can be adapted to fit the needs of a particular State, agency, or project.
- (3) The timing of a review can be critical to maximize the ability of the division office to influence the quality of specifications. Typically, the best results can be achieved through early and continuous involvement with the State DOT in the development of the specification or update. Other options could include before, after, or concurrent with industry review, or at some predefined stages of development (e.g. 60 and 90 percent). For a major update to a State DOT's standard specifications, the division office may also want to consider approving specifications on a section by section basis, rather than wait until the entire document is ready. A staged review can fast-track the approval process as well as identify and resolve some common problems early on.
- (4) The review effort may vary based on the type of specifications or revisions involved. For example, correction of a spelling mistake would not warrant the same level of review as a new supplemental specification. Some general guidelines are provided below.
 - (a) **Standard and supplemental specifications** – Traditionally, the most intensive reviews are reserved for the State DOT's standard and supplemental specifications. Such specifications should be carefully reviewed for need and engineering merit, compliance with Federal laws and regulations, and format and clarity of language. Technical specialists should be consulted as necessary.

Also note that a single review done at one sitting may not adequately complete the evaluation. Once reviewed, the material should be set aside and rechecked later to provide a fresh approach to the language and content. The need for subsequent review will be reflected by the comments and revisions noted.

- (b) **Major revisions** – Once standard and supplemental specifications have been approved, all major revisions to these specifications that could affect the way the work is performed, tested, inspected, measured, or paid should go through a formal review process. If technical specialists were involved in the review of the original specifications, specialists should similarly review and comment on the proposed revisions as well. The State DOT should highlight and explain all proposed changes to the existing specifications.
- (c) **Minor revisions** – For minor revisions that do not alter or change the intent of the specifications, a more cursory review will likely suffice. The State DOT should be instructed to include with the revised specifications an explanation as to why the revisions do not change the original intent.
- (d) **Errata** – Although a formal approval by the division office of minor changes to correct typos, outdated information, and other grammatical errors is not necessary, the division office should reach an agreement with the State DOT on how errata will be handled. At a minimum, the division office should obtain a copy of the revised specifications and update its files and records accordingly.
- (e) **Pilot specifications** – If the State DOT wishes to use Federal funds to pilot a specification as a new or experimental feature, FHWA will have to review and approve the related work plan. In reviewing a work plan, consider the risk involved in incorporating the new feature on the project with respect to safety, quality, and cost (both initial construction and long-term maintenance). The length of the monitoring period should also be considered if the division office will have to assign some of its staff to the monitoring effort.

Developmental or pilot specifications are typically not finalized until after they have been field tested and shown to have met the State DOT's intended goals and objectives.

- (f) **PS&E packages** – The division offices are responsible for reviewing and approving PS&E packages developed for full oversight projects. The specifications contained in these packages typically consist of standard and supplemental specifications and recurring special provisions that have previously received FHWA approval. The prior approval of such specifications allows the review effort to focus on general contract coordination issues to

identify conflicts and missing information. Additional review points include ensuring that:

- 1 the package contains all required Federal and State provisions;
- 2 specifications and provisions represent the current approved versions and are applicable to the project at hand (having a listing of all current approved specifications can facilitate this effort); and
- 3 project-specific special provisions are needed, technically correct, and written using clear, concise, and consistent language.

In reviewing a PS&E package, it is also important to identify and track all elements for which Federal funds will not participate.

- (5) To help provide some context for the review effort, request that the State DOT provide an explanation of the following, preferably in written form:
 - (a) For proposed revisions to approved specifications, an explanation as to:
 - 1 what is being changed,
 - 2 what the change will accomplish, and
 - 3 why the change is necessary.
 - (b) For new specifications, an explanation as to:
 - 1 why the specifications are required,
 - 2 what the specifications consist of, and
 - 3 what other standard specifications, supplemental specifications, standard drawings, or standard details, if any, pertain to, or will be affected by, the proposed specification.
- (6) Procedures should also be developed to document the division office's reviews and approvals. Consider the following types of issues:
 - (a) Should reviewers use the editing features available in word processing programs (e.g., track changes feature in MS Word) to highlight added or deleted text?
 - (b) Should all comments be coordinated through the designated specification engineer?

- (c) Should comments be included in the text itself or formalized in a written letter? Because several individuals may comment on a specification, should the designated specification engineer compile the comments in a single letter before forwarding to the State DOT?
- (d) How should approvals be identified (e.g., with a stamp and date)? Should a cover letter accompany all approvals?
- (e) How should the division office's comments and the State DOT's responses be tracked to ensure that all comments have been satisfied?
- (f) How should the final specifications and any supporting documentation (e.g., approval letters, history of comments, and responses) be maintained?

c. Tracking systems

- (1) The division office should establish and maintain systems to track the specification approval process.
 - (a) A tracking system that identifies the division office's comments along with the State DOT's resolution can streamline the specification approval process. This system should also record the final approval or disapproval action. For most agencies, a spreadsheet can provide the necessary level of detail and functionality to record a specification's development history. Ready access to such information reduces subsequent efforts in approving updates to the standard specifications.
 - (b) As new versions are developed and approved, the new effective date of the specification should be recorded. The revised specifications should be filed by subject, whether revised as a special provision or as a supplemental specification, and maintained in a master file.
- (2) An up-to-date special provisions list should be maintained to allow a quick comparison of the contract requirements and the provisions available. This information can assist the review of PS&E packages.
- (3) The division office should develop an internal process to track the receipt and approval action of requests for a public interest finding (PIF). The duration the PIF remains in effect should also be tracked and monitored. Changes in market conditions, product availability, and technology may eliminate the continued need for a PIF. In addition, the division office should support the resource center's [PIF Database](#) (accessible to FHWA personnel only) by submitting approved PIFs for inclusion on the site. This database is a valuable resource, storing hundreds of approved PIFs, which can be used as examples to promote efficiency and uniformity in the development and approval of PIFs.

- (4) Specifications are influenced by the legal requirements of the States and the Federal Government. Therefore, a file should be maintained of State and Federal laws that impact the design and construction of highway contracts. Extra care in the purging or updating of these files is recommended.

15. **What are the key focus areas for division office personnel when conducting a review?** The specification review effort should focus on the following general areas:

- a. General administrative issues (i.e., compliance with Federal or State policy),
- b. Materials issues (e.g., proprietary products, agency-provided materials, experimental features),
- c. Technical content, and
- d. Organization, formatting, and writing style

The document [Specification Review Guidance](#) provides reviewers with detailed guidance related to each of these areas. To further support the review effort, the following documents contain writing tips intended to ensure specifications are clear, concise, complete, correct, and consistent: [Basic Specification Writing Principles](#), [Voice and Mood in Specifications](#), [Word Usage](#), [Vague Adjectives and Adverbs](#), and [Needless Words and Jargon](#).

16. **How can a division office remain involved with a specification after the review and approval period?**

- a. Division office personnel should follow-up with their counterparts at the State DOT to determine if new or revised specifications were used on a project and to what degree of success (i.e., were expectations in terms of quality, cost, time performance, contractor innovation, or other desired goals met).
 - (1) If application on a project suggests deficiencies in an approved specification, such problem areas should be noted and coordinated with the State DOT for future changes.
 - (2) If specifications are to be credible, all provisions must be enforceable and enforced. Provisions not enforced in field application may point to a flaw in the specifications or to administrative actions that must be corrected.
 - (3) The procedures used by the State DOT to administer the contract, monitor construction, design the work, and sample and test compliance with the contract requirements must complement the specifications. If a standard procedure might counteract the specifications, it may be necessary to recommend either a change in the procedures or a revision of the specifications to suit the State DOT's internal processes.
- b. The division offices should also strongly encourage the State DOTs to upload new and revised specifications to the FHWA NHSW and provide any necessary

assistance to support the ongoing maintenance of this Web site. (See paragraphs 19 through 21 below)

17. What are some common reasons for non-enforcement of specifications?

- a. Use of improper administrative procedures,
- b. Conflicts with other contract documents (plans and specifications),
- c. Lack of clarity in the specifications ,
- d. Lack of understanding of the purpose for having the requirement in the specification, and
- e. Specifications that are punitive, without justification, or are used to cover basic failures in contract administrative procedures or contract preparation.

The reason(s) for non-enforcement need to be identified and corrected wherever they exist.

18. How can the effectiveness of a specification be evaluated?

- a. Specification evaluation should be performed by a multi-disciplinary group that includes FHWA and State DOT representatives. A multi-disciplinary review group within the division office is also recommended.
 - (1) The group members evaluating the specifications should be carefully selected to minimize organizational “mind set” problems and bias on the part of any individual members. A free and comprehensive exchange of information between all members of the groups is needed.
 - (2) Feedback should be sought from the State DOT’s field personnel as well as industry representatives to determine if the specification was fairly administered and enforced.
 - (3) If the evaluation suggests a revision to the specification is needed, the division office’s designated specification engineer should follow-up with the State DOT to ensure that the specification is updated accordingly.
- b. A good guide for determining the success of an existing specification is to review the bid tabulations for the item in question. When the range of bidding is close, it indicates that all contractors are reading the specification in the same context. Conversely, a wide range of bidding may indicate confusion and ambiguity in the specification that calls for a rewrite.
- c. After specifications have been implemented in the field, problem areas can become apparent by reviewing the field inspection report findings prepared by the division office and the State DOT. Comments from industry groups should be considered as well.

- d. Year end summaries of common change orders, requests for information, variance requests, time extensions, and claims may also suggest that a specification revision is necessary.
- e. The specification should also be validated both before use and after use to ensure it provides the desired level of quality.
 - (1) Prior to use, statistical analysis may be performed (e.g., through the use of Operating Characteristic Curves and Expected Pay Curves) to ensure that the sampling and acceptance plans as designed provide the desired level of statistical risk to both the State DOT and contractor.
 - (2) Maintenance of a construction quality database would assist efforts to objectively evaluate specification effectiveness with regard to product quality. This would require the State DOT to conduct statewide evaluations of product quality as achieved through the use of the specification.
 - (3) Inconsistent performance or quality or routine processing of downward pay adjustments may suggest that a specification is too strict. Conversely, routinely paying maximum pay incentives may suggest a specification is too lax.

19. What is the National Highway Specifications Web Site (NHSW)?

- a. In 2003, FHWA launched its NHSW, a fully searchable electronic library of highway construction information obtained from all 50 States, the District of Columbia, and the FHWA Office of Federal Lands Highway. Consolidation of this information in one place has proven to be a valuable resource to its AASHTO and FHWA community of users. As a one-stop source for specification information, the Web site has saved users time and money, while improving practices and promoting higher quality in construction end products.
- b. The NHSW allows users to browse, search by keyword, and download standard specifications, innovative and emerging specifications and special provisions, and construction manuals. The NHSW also provides links to other online resources that may be of interest to specification writers, including State DOT Web pages containing standard drawings, specifications, and manuals.

20. How can the division offices help maintain the NHSW?

- a. As part of the specification review and approval process, the division offices should actively work with the State DOTs to ensure that all updated specifications are placed on the NHSW in a timely manner.
- b. Because the NHSW is an FHWA information system, State DOT personnel may only access the site if they are registered in FHWA's User Profile and Access Control System (UPACS) and are granted a UPACS ID and access rights to the NHSW.

- c. The process for a State DOT user to register and gain access to the NHSW requires approval by the UPACS Administrator within each division office, as well as a division office sponsor. The complete process for obtaining access rights is outlined in the reference [Accessing FHWA Information Systems](#).

21. How can the State DOTs access and help maintain the NHSW?

- a. The intent of the NHSW is to provide quick access to the latest approved specifications and related information from each State DOT and the Federal Lands Highway Divisions.
- b. To ensure that the NHSW remains reasonably up-to-date with the latest specifications available, it is essential that the State DOTs update the NHSW after their specifications receive approval from the division office.
- c. On the administrative side of the NHSW (accessible from the site's homepage via a [UPACS](#) login and password), designated State DOT personnel may upload, replace, or delete their respective agency's resources (e.g., standard specifications, construction manuals, Web site links) and contact information.
- d. The administrative home page also contains links to online training assistance related to maintenance of the Web site and creation of accessible documents that comply with Section 508 of the Rehabilitation Act.

22. What initiatives have helped advance quality and consistency in specification writing?

- a. This Technical Advisory is an outgrowth of several ongoing initiatives emphasizing the need for complete, clear, and fair specifications. These initiatives include the following:
 - (1) FHWA National Highway Institute, Course No. 134001, Principles of Writing Highway Construction Specifications – A course developed in 1991 and still offered today to provide instruction on general writing principles for ensuring the development of clear, concise, complete, correct, and consistent specifications.
 - (2) [FHWA Contract Administration Core Curriculum Workshop](#) – Training that addresses contract provisions and administrative procedures related to Federal-aid projects.
 - (3) FHWA National Highway Institute, Course 134061, Construction Program Management and Inspection – Training that promotes program management starting at the beginning of a project's "cradle to grave" development rather than solely in the construction phase.
 - (4) [FHWA National Highway Specifications Website](#) – A Web site launched in 2003 to provide users with a fully-searchable database of highway construction information. The Web site also contains pages dedicated to new and emerging technical specifications and alternative contracting provisions.

- (5) AASHTO Guide Specifications for Highway Construction – Guide specifications that provide specification writers across the country with information on standard topics that frequently appear in transportation construction projects. Specification writers can adapt these guide specifications to project-specific conditions. In doing so, the State DOTs can increase the uniformity by which construction is performed across the country. In addition to serving as a technical resource, the guide specifications also act as a model of clear and concise specification writing. The 1998 edition was updated using the active voice and imperative mood to clarify contractor responsibilities. The ninth edition, published in 2008, carries on this tradition, and also includes sample alternative contracting provisions.
 - (6) Plain Language Movement – An ongoing effort promoted by Federal Agencies since the mid-1990’s to write using language that is easy to read and understand. The [Plain Language](#) Web site provides information regarding the history of the plain language movement, along with related guidelines. Although the plain language movement was driven primarily to eliminate the use of complex language and sentence construction in Federal regulations and government reports, several of its general principles, as identified below, can be directly applied to specification writing as well.
 - (a) Organize material to serve the needs of the reader.
 - (b) Write sentences in the active voice.
 - (c) Use common, everyday words instead of technical jargon and abbreviations.
 - (d) Use easy-to-read design features, such as lists, tables, graphics, and “white space.”
 - (e) Write short sentences and sections.
- b. Several initiatives have also focused on improving the technical quality of specifications, particularly with regard to statistically based acceptance procedures. Such initiatives include the following:
- (1) Development of software, such as OCPLLOT, used for developing Operating Characteristic (OC) and Expected Payment (EP) curves, and SpecRisk, designed to assist users in analyzing and appropriately balancing the owner’s risk of erroneously accepting defective work against the contractor’s risk of having satisfactory work erroneously penalized or rejected.
 - (2) FHWA National Highway Institute, Course No. 134042, TCCC Materials Control and Acceptance - Quality Assurance – A course developed to provide a basic understanding of statistically-based quality assurance

programs, including a discussion on how such concepts can be incorporated into specifications.

- (3) FHWA National Highway Institute, Course No. 134070, SPECRISK Quality Assurance Specification Development – A Web-based course providing instruction on the use of SpecRisk software to help generate effective, statistically valid specifications.

23. How have specifications evolved, and what are the trends in specification writing?

- a. Method specifications have been a mainstay in construction since the introduction of professional licensing laws and separation of design and construction services in the early 1900's. The Interstate Highway System was built through the use of method specifications.
- b. Advances in design, technology, research, and testing have improved our understanding of the construction process and the materials incorporated into the work. These advancements, together with reductions in both the numbers and experience levels of DOT inspectors and engineers, have fostered the development of specifications that place more responsibility on the contractor to control the quality of the work. As a result, the trend in specifications has been moving towards greater use of performance specifications.
- c. As a practical matter, today's specifications for highway construction projects often still include a combination of method and performance requirements. Portions of the work that can be described in terms of end-product performance and that have measurable and testable criteria are developed as end-result specifications. Other portions of the work for which it is not yet feasible to measure end-result performance or performance over time, or which have no testable criteria, are maintained as method specifications. (See the attachment [Types of Specifying](#) for a more complete discussion of method versus performance specifying.)

24. How does the use of alternative contracting methods affect specifications?

- a. As an additional trend, several State DOTs are now implementing alternatives to the traditional design-bid-build delivery approach to accelerate project delivery, reduce initial or life-cycle costs, improve quality, or promote innovation. Nontraditional methods may include:
 - (1) Alternative delivery approaches, such as design-build, public-private partnerships, project alliancing, and construction manager (CM) at risk;
 - (2) Alternative procurement approaches, such as best-value procurement, cost-plus-time (A+B) bidding, alternate design, and alternate bid; and
 - (3) Alternative contracting methods such as incentive/disincentives related to time or quality, flexible notice to proceed dates, lane rental, and performance warranties.

The [NHSW](#) includes specifications, provisions, and guidance related to these methods on its innovative contracting Web page.

Note: Use of certain nontraditional contracting methods that deviate from the competitive bidding provisions found in 23 U.S.C. 112 require FHWA approval under [Special Project No. 14 \(SEP-14\)](#). Design-build contracting, cost-plus-time bidding, lane rental, and warranty provisions are no longer considered experimental and do not require this approval process.

The FHWA has also recently established [Special Experimental Project No. 15 \(SEP-15\)](#) under which the State DOTs may propose to conduct trial evaluations of new public-private partnership approaches to project delivery.

- b. Implementation of alternative contracting methods may require modifications to standard specification language to allow more risk and flexibility to be assigned to the contractor.
 - (1) Use of certain methods, such as design-build, will significantly alter traditional contract administration procedures. This may require changes to a State DOT's General Conditions.
 - (a) Definitions and terms
 - 1 Terms may have to be added to define the delivery process (e.g., design-build, CM at risk) and the participants in this process (e.g., design-builder, engineer or designer of record)
 - 2 If the contractor is taking on design responsibilities, any existing definitions for terms such as Work, Plans, and Drawings should be reviewed in the context of the contractor serving as the engineer-of-record.
 - 3 If the procurement process has changed to incorporate a two-step process or a best-value system, it may be necessary to introduce additional terminology (e.g., Request for Qualifications, Statement of Qualifications, Request for Proposal, Proposal, Price Proposal, and Technical Proposal).
 - 4 If the contractor will be assuming more responsibility for quality management, it may be necessary to add or modify definitions related to this process (e.g., Quality Management Plan, Quality Assurance, Quality Control, Verification Testing, etc.).
 - (b) Bidding requirements – Existing language may require modification if a State DOT's standard Invitation to Bid process will be replaced with a two-step Request for Qualifications/Request for Proposal process.

- (c) Award and execution of contract – Existing language may require modification to incorporate elements related to a proposal evaluation and/or scoring process if award will be to the contractor offering the best-value rather than the lowest bid.
 - (d) Scope of work – The project scope may require modification if the work entails more than just construction services. For example, the scope should be revised to include design as well as construction services under a design-build contract, and preconstruction as well as construction services under a CM at risk contract.
 - 1 Requirements related to differing site conditions, Right-of-Way, environmental permitting, and third-party (e.g., Utilities and Railroad) coordination should also be reviewed and modified to reflect the risk allocated to the contractor.
 - 2 If the contract work will be paid for on a lump sum basis, references to variations in unit-priced quantities should be removed from the changes clause.
 - (e) Control of work and control of materials – Provisions related to inspection and testing may require modification if the contractor will be responsible for both quality control and quality assurance, as the State DOT assumes more of a verification role.
 - (f) Legal relations and responsibility – Insurance requirements may require modification under design-build contracts to include the area of professional liability or Errors and Omissions (E&O) insurance.
 - (g) Prosecution and progress – Scheduling provisions may require modification if the schedule will be used as a basis for measuring progress for payment (e.g., under a lump-sum contract). Special provisions related to time incentives, lane rental, or flexible start dates may also modify standard language.
 - (h) Measurement and payment – Measurement and payment provisions may require modification if a lump sum or guaranteed maximum price contract is being used.
- (2) Technical specifications used with alternative contracting approaches should, to the extent possible, incorporate performance requirements that assign more risk and provide more flexibility to the contractor. This may require expanding the contractor's quality assurance requirements and the owner's verification role, and modifying the measurement and payment terms (particularly if a lump sum contract is being used). (See the attachment [Types of Specifying](#) for more information on performance specifications.)

c. Additional References

- (1) [FHWA Briefing on Innovative Contracting, Practices, SEP-14](#)
- (2) [FHWA Contract Administration Core Curriculum Participant's Manual and Reference Guide, Chapter IV.A, Non-traditional Contracting Practices](#)
- (3) [FHWA National Highway Institute, Course No. 134058, Alternative Contracting](#)
- (4) [AASHTO Primer on Contracting for the Twenty-First Century, Fifth Edition, 2006](#)

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Attachment 1 Types of Specifying

The following guidance has been prepared to help division office personnel recognize and understand the different types of specifications and provisions that a State DOT may prepare and submit for FHWA approval. These specification types may include:

- [method specifications](#),
- [performance specifications](#),
- [proprietary specifications](#), and
- [reference standards](#).

A description of each of these specification types is provided below, along with a discussion of their relative advantages and disadvantages, the project conditions under which they can be best implemented, and the general information that they should convey.

1. **Method specifications**

- a. **Description.** Method specifications (also called material and method specifications or prescriptive specifications) explicitly identify the materials and work methods or procedures a contractor should use to complete the work included in the contract. Method specifications typically operate on the principle that if the specified materials and methods worked in the past, then the end product is likely to perform well in service so long as the contractor strictly adheres to the prescribed requirements.
- b. **Advantages of method specifying**
 - (1) The State DOT can exert greater control over the work.
 - (2) The materials and construction steps included in method specifications are typically based on methods that historically provided satisfactory results. Method specifications thereby eliminate risk associated with newer, less proven methods and risk associated with varying contractor performance.
- c. **Disadvantages of method specifying**
 - (1) Traditional method specifications specify the materials and means and methods a contractor must use to construct a portion of the work. The contractor therefore has little opportunity to deviate from the specifications, and, provided that the specifications are met, is not responsible for performance deficiencies of the end product.
 - (2) Method specifications typically base acceptance on the “reasonable conformance” or “substantial compliance” of the work with the specification requirements, as established by the State DOT’s inspection of the work. If test results are used as a component of the acceptance determination, usually only individual or representative field samples are taken. These individual results may fail to recognize the inherent

variability in the material itself, potentially leading to disputes between the contractor and DOT over acceptance decisions.

- (3) Contractor payment is not tied to the performance or quality of the work. Because method specifications do not establish a range of quality levels, they generally do not include procedures for price adjustments. The contractor therefore typically receives 100 percent payment for the work completed when it complies with the requirements of the specification.
- (4) The prescribed procedures may prevent or discourage the contractor from using the most economical or innovative procedures and equipment to perform the work.
- (5) In order to ensure that the desired product is achieved, the owner must dedicate significant resources to ensure that the correct “method” was used.

d. **Appropriate conditions for use**

- (1) End product performance is not easily defined.
- (2) End product performance cannot be easily or economically measured and verified.
- (3) Limited methods exist that would satisfy the DOT’s minimum requirements.
- (4) The State DOT must retain performance risk because of permit requirements, maintenance considerations, need to tie into existing or adjacent construction, and similar issues.
- (5) Removing and replacing defective work would be impractical.

e. **Elements of a method specification.** Understanding the main elements of a method specification will help reviewers identify missing information that needs to be added to the specification and any nonessential information that can be eliminated. The following discussion assumes the specifications generally follow an AASHTO format. However, it is important to know and understand the format and organization used by a particular State DOT when reviewing a specification to ensure that (1) all the necessary information is included and (2) that this information is included in the correct location.

- (1) **Description of the work.** Technical specifications typically begin with a subpart entitled *Description of the Work*, *Scope of Work*, or similar. The intent of this subpart is to provide a concise statement of the work required.
 - (a) To clarify the work included, this subpart may also be used to describe the relationship of the work included under this specification to other work items, referring to related plans or specifications as necessary.

- (b) The Description of Work should not include methods of construction, construction details, and procedures for measurement and payment, as this information is better suited to other subparts.
 - (c) Similarly, phrases such as “...in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness, and typical cross-section shown on the plans, or as directed by the Engineer...” are generally not necessary to repeat in the Description of Work. Such information is already included in the General Provisions (Division 100), eliminating the need to repeat it elsewhere in the technical specifications.
 - (d) Some State DOTs also use this subpart to define terminology specific to the work required under the specification or to specify special submittal requirements.
- (2) **Material (and equipment) requirements.** This subpart should identify and describe the materials the contractor is to use to complete the work.
- (a) The Materials subpart often cross-references more detailed State DOT material specifications located in another division or book, or nationally recognized [reference standards](#). The specifications should address salient material properties, while avoiding unnecessary restrictions that may be difficult or impossible for the contractor to meet.
 - (b) The method(s) of sampling and testing and the applicable acceptance procedures are typically included with the construction requirements, not the materials requirements.
 - (c) A few agencies also use this section to describe equipment requirements (e.g., asphalt plants).
 - (d) When reviewing Materials subparts, consider the following:
 - 1 Is the specified material proprietary?
 - 2 Is the State DOT providing any material or designating material sources?
 - 3 Are cross-references to other material requirements or national reference standards appropriate?
 - 4 Does a cross-referenced specification allow the contractor to select materials from multiple options? If so, is it necessary to stipulate a specific option?
- (3) **Construction requirements.** This subpart should describe how the contractor is to accomplish the required work and how the State DOT will determine the acceptability of that work. The recommended Construction subpart should:

- (a) Provide sufficient specification requirements to ensure quality of workmanship and satisfactory completion of the work. Consider the extent to which prescriptive requirements regarding construction operations, special equipment, and other controls are necessary.
 - (b) Complement, not duplicate, the information on the plans.
 - (c) Describe the necessary submittal and shop drawing requirements.
 - (d) Include a clear description of restrictions applicable to the completion of the work. These restrictions may be in the form of administrative requirements, intermediate steps of approval or verification, or the methods of transfer of information between the State DOT and the contractor.
 - (e) Specify allowable tolerances and applied penalties, if any, for exceeding specified tolerances.
 - (f) Specify the type and frequency of testing required during construction.
 - (g) Identify the minimum quality control activities to be performed by the contractor.
 - (h) Identify the quality assurance activities (testing and inspection) that the State DOT will perform to determine the acceptability of the work.
- (4) **Measurement and payment.** The specification should identify how items of work will be measured and paid for. The recommended measurement and payment subpart(s) should:
- (a) Specify how quantities will be determined (e.g., in place, loose vs. compacted, etc.).
 - (b) Specify any adjustments to the measured quantity (e.g., waste, spillage, overlaps, etc.).
 - (c) Define all pay items needed to complete the work, and the units of measurement for each item.
 - (d) Ensure that the bid item includes all labor, materials, and equipment related to the work, or otherwise identifies work that is to be paid for under other bid items or that is incidental to the payment.
 - (e) Identify all necessary preceding and succeeding events that could have a bearing on the time and place of measurement.
 - (f) Reflect the responsibility and completion definitions included in the work description.

- (g) Identify the payment range (from increase of 100 percent or higher to reduction to the point of rejection/removal) for the applicable material to promote better quality. Reduction in pay factor should be based on sound engineering judgment and remaining material properties that account for subsequent maintenance concerns due to a reduced service life.

2. Performance specifications

- a. **Description.** Performance specifications describe the required work in terms of operational characteristics or ultimate use. The performance characteristics are designed to predict or monitor performance over time. Unlike method specifications, performance specifications tend not to include instructions that dictate or suggest methods, material definitions, material processing, time and temperature controls, constituent properties, construction equipment descriptions, and similar prescriptive elements.
- b. **Subsets of performance specifications.** The term *performance specification* can be used as an umbrella term to capture several types of specifications, including end-result specifications, QA specifications, performance-related specifications, performance-based specifications, and performance warranty provisions.

The AASHTO Highway Subcommittee on Construction, Quality Construction Task Force, has prepared a report entitled [Major Types of Transportation Construction Specifications, A Guideline to Understanding their Evolution and Application](#), which describes these various specification types and how they should be developed and implemented.

- (1) **End-result specifications** assign to the contractor complete responsibility and flexibility in selecting the procedures and equipment for supplying a product or an item of construction. The State DOT's responsibility is to either accept or reject the final in-place product or to apply a pay adjustment commensurate with the degree of compliance with the specifications.
 - (a) End-result specifications look to measure or test the in-place end product and, at the same time, reduce the amount of prescriptive elements of the specification.
 - (b) For example, one could specify a chip seal based on a measured chip density and retainage, and eliminate requirements related to the spreader equipment and flow details. Another common application of end-result requirements occurs in specifications that measure compaction but do not dictate roller types or roller passes.
 - (c) Because end-result specifications offer the contractor flexibility in exercising options for new materials, techniques, and procedures to improve the quality or economy, or both, of the end product, they

are often incorporated into design-build contracts as performance specifications.

- (2) **Quality assurance (QA) specifications** require contractor quality control and State DOT acceptance activities throughout the production and placement of a product. Final acceptance of the product is usually based on a statistical sampling of the measured quality level for key quality characteristics.
 - (a) The critical aspect of developing QA specifications is identifying the material attributes that are essential to good performance and the associated limits within which the material or work can be produced to suggest good performance over the design life of the product. For example, for asphalt pavements, key quality characteristics might include asphalt content, density of the compacted pavement, and pavement smoothness. For concrete pavement, quality characteristics could include compressive strength, air content, and smoothness.
 - (b) Note that many agencies have already implemented QA specifications as part of their standard specifications for asphalt and concrete pavement. Refer to [FHWA-RD-02-095, Optimal Procedures for Quality Assurance Specifications](#), for more detailed information regarding the development of acceptance plans and QA specifications.
- (3) **Performance-related specifications (PRS)** are essentially improved QA specifications that describe the desired levels of key materials and construction quality characteristics that have been found to correlate with fundamental engineering properties that predict performance. Price adjustments are based on life-cycle cost relationships.
 - (a) PRS identify and quantify those particular technical factors that influence product performance. They may use empirical data, engineering judgment, mechanistic modeling, and life-cycle costing as the basis for determining the potential for performance.
 - (b) Like QA specifications, PRS only specify characteristics (for example, air voids in asphalt and compressive strength of concrete) that lend themselves to acceptance testing at the time of construction. They do not specify the desired long-term product performance.
 - (c) “True” PRS use mathematical models to predict performance based on the measured quality characteristics (e.g., asphalt content, air voids) and design variables (e.g., traffic loading, climate). The models provide the rationale for acceptance and pay adjustments based on life-cycle costs.

- (d) Implementation of PRS is dependent on the development and validation of such models. To date, PRS have only been piloted on concrete pavements, though research is also being performed on asphalt.
- (4) **Performance-based specifications (PBS)** are QA specifications that describe the desired levels of fundamental engineering properties (e.g., resilient modulus, creep properties, and fatigue properties) that are predictors of performance and appear in primary prediction relationships (i.e., models that can be used to predict pavement stress, distress, or performance from combinations of predictors that represent traffic, environmental, roadbed, and structural conditions).
 - (a) Performance-based specifications differ from PRS in that they specify the desired levels of fundamental engineering properties, rather than key quality characteristics.
 - (b) Complete PBS have not yet been applied in highway construction, primarily because most fundamental engineering properties are only now becoming amenable to timely acceptance testing.
- (5) **Performance warranty provisions** incorporate performance indicators and thresholds to measure performance over a prescribed warranty period.
 - (a) Warranty performance indicators are measurable distresses, properties, or characteristics of the warranted component that can be linked to the end-product performance of the warranted component. For example, performance indicators for asphalt pavement may include rutting and cracking. Performance thresholds can be expressed in terms of physical dimensions per segment length or converted to a point system. Thresholds are the allowable limits not to be exceeded over the performance period.
 - (b) Warranties typically do not include all the factors that contribute to performance. For example, warranty provisions for pavements typically exclude subbase, drainage, and embankment features or other factors related to pavement design or construction methods that may affect performance.
 - (c) Although the scope of warranted work and performance indicators may not capture all of the factors contributing to performance, they provide a tool to assign more responsibility for performance to the private sector and ensure that the products of construction will meet targeted performance thresholds for part of the life-cycle of that product or component.
- c. **Elements of a performance specification.** A well-drafted performance specification generally contains the following elements.

(1) **Identification of owner's needs or goals**

- (a) In the ideal application of performance specifying, the owner defines its needs at the highest possible level. For example, for pavements such goals could be safety, comfort, accessibility, and capacity. Lower level requirements, such as material or manufacturing properties (e.g., aggregate gradation), should be included only when necessary and where definitions for desired performance cannot otherwise be expressed in clear and unambiguous terms.
- (b) In practical application, however, specifying at the user needs level can be difficult for highway agencies. For example, most road users and communities simply want a road that is safe and accessible and that meets traffic demands. However, the State DOTs must also consider the need to tie into existing systems, comply with permit conditions, meet right-of-way constraints, and suit existing maintenance operations. Such considerations, among others, often lead the State DOTs to develop specifications that contain a hybrid of performance and prescriptive elements.

(2) **Performance parameters**

- (a) Performance parameters are functional requirements that ideally can be measured or tested to ensure that the owner's project goals are satisfied. For example, possible performance parameters for an asphalt pavement could include smoothness, in-place density, and asphalt content. In warranty contracting, performance parameters are typically referred to as "performance indicators."
- (b) It can be a challenge to identify all of the parameters necessary to produce an acceptable product, without including nonessential requirements that will hinder contractor innovation, require additional testing resources, or force the State DOT to continue to retain the bulk of the performance risk.
- (c) When identifying performance parameters, consider the following:
 - 1 What physical properties are considered to be critical to performance?
 - 2 How can these properties be tested and measured?
 - 3 To what degree does each physical property influence performance?
 - 4 What price adjustment, if any, should be applied to these properties?
 - 5 Are all factors associated with the parameter within the contractor's control? (For example, if the contractor is not

responsible for the subgrade conditions, it may be reluctant to accept responsibility for certain parameters, such as structural deflection.)

- 6 Does the parameter reflect end-of-construction quality only? Is a warranty provision necessary to ensure that the required performance is met over time?

(3) **Measurement or testing technique.** The specification should identify a measurement strategy for each performance parameter. For example, pavement smoothness could be measured using a high speed profilograph.

(a) The most desirable performance parameters are measurable and testable. When identifying possible measurement techniques, consider the following:

- 1 Can measurement and testing be done in a manner that has minimal impact on traffic and lane closure?
- 2 Can the data be processed in a timely manner?
- 3 In comparison to other testing techniques (or use of method specifications), is the measurement and testing economical, considering the dollars per test multiplied by the number of tests required based on the uniformity of the material?
- 4 Do the measurement techniques require a high skill level from technicians? Are special certifications necessary?
- 5 Is specialized equipment necessary? If so, should the contractor provide this equipment or should the State DOT?
- 6 Are standardized tests available? Do the tests provide repeatable results?
- 7 Are “referee” tests available in the event that the State DOT or contractor disputes the results of the initial testing?

(b) Ideally, the performance parameters should be quantifiable. However, certain requirements (e.g., those involving aesthetics) may still involve the engineer’s judgment. For such subjective items, the engineer and contractor should mutually develop and agree to an acceptance standard for that parameter. For example, a visual standard can be established by inspecting a representative sample early in the project.

(c) In establishing and defining the overall measurement strategy, the specification should identify how often the measurements should be taken (e.g., continuously; start and end of project only; on some periodic basis; etc.), who should be collecting and witnessing the

taking of samples, and who should be taking the measurements (e.g., contractor, DOT inspector, independent inspection firm).

(4) Performance value or threshold

- (a) For each performance parameter, the specification should set a performance value, expressed in terms of ranges (minimum/maximum), thresholds, or a rating system. For example, a performance value associated with pavement smoothness could be expressed as a maximum IRI in inches/mile.
- (b) When setting performance values, consider the following:
 - 1 If the values for parameters are set based on the use of predictive models, has the model been tested and confirmed to produce reliable results? Does the model need to be calibrated to reflect regional conditions?
 - 2 Do the values represent end-of-construction conditions, or some point during a warranty or operation period?
 - 3 If the values are not met, should a pay adjustment be applied? Would remedial action be necessary?

(5) Verification tests or inspection

- (a) When using performance specifications, the contract should require the contractor to develop, submit, and implement a plan to control the quality of materials and construction. The State DOT may specify minimum requirements to ensure a base level of quality control is performed.
- (b) Even though the contractor may assume more responsibility for inspection and testing under a performance specification, this in no way relieves the State DOT of its responsibility to perform its own oversight and independent verification to ensure that the product meets or exceeds the stated objective or standard.
- (c) The type and extent of verification that the State DOT will perform as part of its acceptance plan should be clearly outlined in the specification. This information will help the contractor coordinate the testing and inspection schedule with the progress of the work.

(6) Price adjustment

- (a) Unlike method specifications, performance specifications allow the parties to acknowledge a range of acceptable work quality through the use of price adjustments that reflect the value of the work received.

- (b) Ideally, price adjustments should be based on a life-cycle cost analysis.
 - 1 A negative pay adjustment or disincentive would cover the cost of future maintenance and rehabilitation due to the construction not meeting the designed level of quality.
 - 2 A positive adjustment would reflect the savings in maintenance and rehabilitation due to the higher level of initial quality. The FHWA has traditionally endorsed the use of incentive payments of up to 5 percent of the unit bid price for improved quality.
 - 3 It is also important to ensure that specifying a positive pay factor for one property will not detract from achieving sufficient quality on another. (For example, for a continuously reinforced concrete pavement, a higher-than-designed thickness and strength could cause wider crack spacing or excessive stress in the reinforcing steel.)

d. **Advantages of performance specifying**

- (1) The contractor assumes more performance risk.
- (2) Contractors have the flexibility to select materials, techniques, and procedures to improve the quality or economy, or both, of the end product.
- (3) Performance specifications increase the potential for contractor innovation.

e. **Appropriate conditions for use**

- (1) End product performance is measurable.
- (2) Testing is rapid, available, and economical.
- (3) Contractors are willing to assume performance risk because they are in a position to control the risk or are attracted to the possibility of increased profit.

3. **National reference standards**

- a. **Description.** National reference standards refer to specifications prepared by recognized trade associations, professional societies, standards-writing organizations, or agencies that provide national standards of performance or measurement. These specifications have been proven over time to provide the desired quality. Reference standards may include prescriptive requirements, but more typically include end-result requirements, criteria, and tests to meet a desired standard of performance. They can be incorporated into a method or performance specification.

- b. **Examples.** National reference standards used in transportation specifications may include:
- (1) AASHTO Standards for Materials and Methods of Sampling and Testing,
 - (2) American Society of Testing and Materials (ASTM) standards for testing, materials and workmanship;
 - (3) American National Standards Institute (ANSI) product standards;
 - (4) Design standards from American Concrete Institute (ACI) and American Institute of Steel Construction (AISC);
 - (5) Federal Specifications and Standards (General Services Administration); and
 - (6) Military Specifications and Standards (Department of Defense).
- c. **Application.** To properly incorporate reference standards into a specification, they should be referred to by number, title, or other designation. This will make the standard part of the specification, just as if it were included in its entirety. Reiterating any part of the standard in the specification is therefore an unnecessary practice that should be avoided to prevent misinterpretation by contractors and inspectors (for example, users may think that they are held to only the quoted portions).
- (1) Verify that the reference standard does not duplicate or contradict other contract requirements. This requires a thorough review and understanding of the reference standard, including all other standards that may be referenced within the primary standard. If necessary, the specification can define exceptions to the reference. The order-of-precedence clause should also state that project-specific requirements govern over the requirements of reference standards.
 - (2) Reference standards often define quality in terms of minimum requirements. Ensure that the stated requirements match the designer's intent, and are not so liberal that practically anything will be considered acceptable. Similarly, the reference standard should not include requirements that are more restrictive than necessary, leading to higher costs or to a proprietary specification. The specification should explicitly define all exceptions taken to the reference standard.
 - (3) It is important to also recognize that the specification of an industry standard does not in and of itself ensure a competitive bid process. A reference standard may so narrowly define a product that only a single provider can meet the requirements, leading to a proprietary specification.

4. Proprietary products and specifications

a. Description

- (1) Proprietary specifications identify the desired products or processes by manufacturer's name, brand name, model number, or other unique characteristic. Even if a manufacturer is not explicitly stated, a specification can still be considered proprietary if only one manufacturer can meet the specified requirements.
- (2) Designers often specify proprietary products to produce what they perceive to be a "tight" specification that allows for close control of product selection and a higher level of design based on more precise information obtained from manufacturer's data. However, this practice introduces the potential disadvantages of unnecessarily eliminating or narrowing competition or requiring products with which the contractor has perhaps had little or poor experience (e.g., slow delivery) – situations that may lead to higher bid prices or charges of favoritism.

b. **Current policy.** 23 CFR 635.411(a) allows use of a patented or proprietary material, specification, or process under the following circumstances:

- (1) The item is obtained through competitive bidding with a reasonable number (as determined by the division office) of equally suitable proprietary and nonproprietary products.
- (2) The State DOT certifies that:
 - (a) the patented or proprietary product is necessary to ensure compatibility with existing facilities or systems (e.g., the proprietary product is necessary to match the visual appearance of existing facilities; the product is interchangeable with products in the DOT's existing maintenance inventory; or the product is necessary to ensure functionality, such as the need for a certain model of controller for an existing traffic signal system); or
 - (b) no equally suitable alternative exists.
- (3) The proprietary product is to be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Note that if this option is applicable, the State DOT must submit a written work plan to the division office for review and approval that describes the experimental feature and the objectives of incorporating it into a project. Refer to the FHWA Web page on [experimental features](#) for more information.

c. **State DOT certifications.** A State DOT certification as to the necessity of a proprietary product because "no suitable alternative exists," should contain the following information:

- (1) A description of how the proprietary product will benefit the public;

- (2) An evaluation of the available products, and why these products cannot meet the DOT's needs; and
- (3) An estimate of additional costs associated with specifying the proprietary product.

d. **Public interest finding (PIF)**

- (1) The Division Administrator may approve a single source if it can be determined that doing so would be in the public interest. The justification for the PIF should consist of an engineering and economic analysis that addresses the following questions:
 - (a) Are there other products on the market that meet the specifications?
 - (b) Are these products of satisfactory quality?
 - (c) Are the anticipated costs for the products approximately the same?
- (2) A PIF is not necessary when a reasonable number (as determined by the division office) of nonproprietary or proprietary products from multiple manufacturers are listed as possible sources. The specific characteristics of the proprietary product should also be identified in the specification (e.g., reflective properties of pavement marking tape or width and length of crashworthy end treatments). This information would help personnel determine if a substitute product is indeed "or equal".
- (3) When reviewing a PIF for approval, division office personnel should research the information contained in the [PIF Database](#) maintained on the research center's Stewardship Portal. The database is a valuable resource, storing hundreds of noted PIFs, which can serve as examples for the division offices to promote efficiency and uniformity in the development and approval of PIFs.

e. **References.** For more information related to proprietary products, consult the following references:

- (1) [Contract Administration, Core Curriculum, Participant's Manual and Reference Guide 2006](#), Chapter IIC.5.b., Patented/Proprietary Products
- (2) [FHWA Construction Guide, Patented and Proprietary Products](#)
- (3) [Guidance on Patented and Proprietary Product Approvals – FHWA Memo, January 11, 2006](#)
- (4) [Product Selection – FHWA Memo, November 25, 1987](#)
- (5) [Questions and Answers Regarding Title 23 CFR 635.411](#)
- (6) [FHWA Construction Projects Incorporating Experimental Features](#)

Attachment 2 Specification Review Guidance

When conducting a review of State DOT specifications, division office staff should focus on the following general areas:

- [Administrative issues](#)
- [Materials-related issues](#)
- [Technical content](#)
- [Organization, formatting, writing style, and coordination with plans and other specifications](#)

Guidance related to each of these areas is provided below.

1. **Administrative issues.** Reviewers should ensure that the State DOT complies with the following general types of policy and procedural issues related to construction lettings.

a. **Required contract provisions**

- (1) Federal, State, and local agencies have certain required contract provisions covering such items as employment, subletting or assigning of the contract, safety, termination, and environmental requirements that must be included in construction contracts. Because these requirements may change on relatively short notice, the required contract provisions are generally not included in bound books of standard specifications.
- (2) [Form FHWA-1273](#) contains the required contract provisions and proposal notices that are required by FHWA and other Federal agencies. Form FHWA-1273 must be incorporated into all contracts as well as appropriate subcontracts and purchase orders.
- (3) The [Contract Administration, Core Curriculum, Participant's Manual and Reference Guide 2006, Chapter II.A, Required Contract Provisions \(Form FHWA-1273\)](#), summarizes each of the provisions included in Form FHWA-1273 and provides related guidance.

b. **Other contract provisions**

- (1) The [Contract Administration, Core Curriculum, Participant's Manual and Reference Guide 2006, Chapter II.B, Other Contract Provisions](#), summarizes additional provisions applicable to Federal-aid construction projects.
- (2) These provisions address Buy America requirements, disadvantaged business enterprises, non-collusion statements, on-the-job training, and standardized changed conditions clauses (e.g., differing site conditions, suspension of work ordered by the Engineer, and material changes to the scope of work).

c. **State-specific provisions**

- (1) Reviewers should also be aware of any State-required provisions or project-specific conditions (e.g., permit requirements).
- (2) The State DOTs may not modify the provisions of Form FHWA-1273. Additional State requirements may be included in a separate supplemental specification as long as they do not change the intent of the required contract provisions.

d. **Public interest finding (PIF)**

- (1) Certain rules, policies, and procedures contain provisions that allow them to be waived under certain circumstances through a public interest finding.
- (2) As its name suggests, a PIF allows exceptions if it is in the public's best interest to do so. Usually, an exception is deemed to be in the public's interest if it is more cost effective than meeting the established rule, policy, or procedure. However, some situations may require consideration of other factors. A public interest finding is, by its very nature, an unusual situation. The Division Administrator should only concur with a State DOT's PIF after carefully considering the specific situation and the precedent that may be set.
- (3) Conditions that typically require a PIF include:
 - (a) Specification of proprietary materials, equipment, or processes;
 - (b) Mandated use of agency-provided materials or designated material sources; or
- (4) The justification for a public interest finding will vary depending upon the nature of the request; however, the justification should be objective and, to the extent possible, quantifiable. In general, the request for a PIF should include a written document that outlines the basis for the request and provides the necessary supporting information, such as a cost/benefit analysis, review of product availability and compatibility, logistical concerns, and other unique considerations.
 - (a) **Description of need** – The PIF should clearly describe the nature of the request, including all limitations and conditions as to the applicability of the finding (e.g., specific type of material and application; type of roadway or project)
 - (b) **Engineering/economic analysis** – The analysis provided in the request should be based on objective data, with all assumptions clearly identified. To the extent possible, the analysis should include quantifiable benefits, such as reduced life-cycle costs or a reduction in inventory.

(c) **Duration of approval** – The PIF should include a request for the specific date of approval, as well as the length of time the PIF will remain in effect. A PIF should be reviewed periodically (e.g., every two to five years) to reassess its need. Changes in market conditions, product availability, technology, or the agency’s performance objectives may eliminate the continued need for the PIF.

(5) For examples of approved PIFs, division office personnel may access the resource center’s [PIF Database](#).

2. **Materials-related issues.** To promote a competitive bidding environment, Federal regulations contain certain restrictions related to specifying the use of proprietary products and agency-provided materials. The guidance provided below describes these issues and identifies any allowable exceptions. Requirements related to incorporating experimental features on a Federal-aid project are also discussed.

a. **Proprietary products and use of trade names**

(1) A patented material or process that can only be obtained from one manufacturer is considered to be a proprietary item. Proprietary specifications are created when a description of a material or process either cites a specific brand name or is written so restrictively that only one vendor or manufacturer can supply the desired item.

(2) Federal regulations (23 CFR 635.411, “Material or Product Selection”) prohibit the expenditure of Federal-aid funds on proprietary products unless specific conditions are met (see [Types of Specifying](#) for a detailed description of proprietary specifications and the conditions under which they are justifiable). The intent of this regulation is to provide for full competition in the selection of materials, equipment, and processes, while also allowing the opportunity for innovation if a reasonable potential for improved performance exists.

(3) Generally, proprietary items are identified in the plans or specifications by a brand or trade name (e.g., 3M). However, even without referring to a trade name, a product can also be so narrowly specified that only a single provider can meet the specification. For this reason, it is important to thoroughly review all reference standards incorporated into a specification to ensure that they do not restrict an otherwise open specification to a single product. Likewise, specifications that refer to a State DOT’s Qualified or Approved Products List could also inadvertently incorporate proprietary, sole-source, or local preferences that would not be appropriate for a Federal-aid project.

(4) The use of trade names in specifications can sometimes be avoided by writing requirements in terms of desired results. A generic, end-result specification is preferable to specifying a proprietary product because it can promote competition. However, simply deleting the name of the product while retaining all of the salient characteristics from the

manufacturer's literature or cut sheets would not necessarily create a non-restrictive specification. Without providing some range of quality or performance, it may still be possible that only one manufacturer or vendor could meet the specification. Adding the phrase "or equal" next to a brand name similarly does not make a proprietary specification competitive if the technical requirements can only be met by the named brand. To ensure a specification is competitive, a reasonable number (as determined by the division office) of manufacturers or vendors should be able to provide or achieve the specified results.

b. State-provided material and equipment

- (1) Federal regulations (23 CFR 635.407) require a competitive bidding process to acquire the materials that will be incorporated into a project. If a specification requires use of materials or equipment provided by the State DOT, the contractor will not be able to select and provide materials from its own sources, a restriction that could result in higher project costs.
- (2) If a specification mandates use of State-provided materials or equipment, ensure that provision of these items by the State DOT is necessary (e.g., to tie into existing systems or for cost savings) and meets the allowable exceptions to the competitive bidding requirements found under 23 CFR 635.407.
 - (a) Exceptions require the Division Administrator to concur that the use of materials provided by the State DOT or from sources designated by the State DOT is in the public interest (refer to the discussion above on [public interest findings](#)). Factors that may lead to a PIF include cost effectiveness, system integrity, and local shortages of materials. When dealing with natural materials (e.g., borrow pits or stockpiled materials) the PIF may also be based on environmental considerations.
 - (b) The exception policy treats manufactured materials differently from local natural materials.
 - 1 Manufactured materials – When a PIF approves the use of manufactured materials provided by the State DOT, the specification must make such use mandatory. Allowing it to be optional would violate public policy that prevents government agencies from competing with private firms.
 - 2 Local natural materials – When the State DOT owns or controls a natural materials source, the specification may designate such materials for either optional or mandatory use; however, mandatory use will require a PIF.
- (3) For more information related to State-provided or designated materials, refer to [Contract Administration, Core Curriculum, Participant's Manual](#)

[and Reference Guide 2006](#), Chapter II C.5.d., State Owned/Furnished/Designated Materials.

- (4) To help prevent claims against owner-caused delays, it is also a good practice when specifying the use of State-provided materials to include a requirement for the contractor to identify in its schedule when it needs such materials. The specification should also require the contractor to inspect and accept the items provided by the State DOT before incorporating them into the work to help prevent later disputes regarding the quality of the furnished item.

c. **New materials or experimental features**

- (1) If a State DOT wishes to evaluate new or innovative materials or technology under actual construction and operating conditions, it can request its incorporation into a Federal-aid project as an [experimental feature](#).
- (2) An experimental feature is a material, process, method, equipment item, or other feature that has not been sufficiently tested under actual service conditions or has been accepted but requires comparison with alternative acceptable features to determine its relative merits and cost effectiveness.
- (3) Instruct the State DOT to submit a written work plan to the division office for review and approval that describes the experimental feature, along with the objectives of incorporating it into a project, and the measurements and evaluations that will be performed.
- (4) Encourage the State DOT to submit the results of its evaluations to the [AASHTO Product Evaluation Listing \(APEL\) database](#) so that others may benefit from its experience.

3. **Technical content.** The division office should ensure that the technical requirements included in a contract are relevant, realistic, biddable, and applicable to the proposed project. To this end, technical specialists at the division office, Washington Headquarters, and the resource center should be consulted as necessary for input. Such specialists may also be able to identify ongoing initiatives to develop or revise similar specifications. Additional issues to consider when reviewing specifications for technical merit are provided below.

a. **Fair and equal consideration**

- (1) A specification should clearly state the contractor's obligations and known risk. No specification should try to get something for nothing by concealing its intent.
- (2) In general, risk should be allocated to the party best able to avoid or manage the adverse impacts of the risk. Whether this party is the State DOT or the contractor is entirely dependent upon project-specific

conditions and the willingness of the State DOT to potentially pay a premium for the contractor to assume responsibility for a high-risk item.

- (3) When allocating project risks, some consideration should also be paid to the contract delivery approach. Certain contracting approaches (e.g., design-build) are more amenable to the contractor assuming risk for end-product performance.
- (4) Specifications should not specify impossibilities or near impossibilities, or contain unenforceable requirements. If ideal conditions cannot be obtained, tolerances should be specified to allow acceptable variations in the work. However, tolerances should not be too stringent, as unnecessarily tight tolerances may increase costs.
- (5) The issue of what will be done in the event that either party does not satisfy their respective contractual responsibilities must be addressed. The actions available to each party and the potential costs or delays that may result from the failure of either party should be considered in specific terms.

b. Clear and measurable requirements

- (1) Specifications should describe the required work with clarity and precision to prevent different interpretations by the contractor and the State DOT's representative. A specification should not include requirements that the State DOT does not intend to enforce.
- (2) Specification requirements should be based on procedures that are necessary to produce the measurable qualities desired by the State DOT. Specifying procedures or properties that cannot be justified by experience or that are not related to the product quality may lead to a conflict that cannot be equitably resolved.
- (3) All requirements should be definitive and measurable. Without a definitive method, the possibility for multiple interpretations could lead to conflicts over the measurements taken.
 - (a) Requirements that involve the "opinion of the Engineer" cannot be realistically bid as the quality requirements are left undefined.
 - (b) Similarly, if the work cannot be measured against a standard, the use of adjectives and other word modifiers will not clarify or provide additional substance to the directions. For instance, in field applications, what would be the difference between "thorough consolidation" and "consolidation" of fresh concrete? The judgment made in the field would be whether or not the fresh concrete has been consolidated.
 - (c) The inclusion of requirements beyond what can be measured equally by both parties to the contract, or requirements that are

open to differing opinions, should be eliminated. For example, instead of stating “The concrete surface must be clean,” consider “Broom clean the concrete surface” or “Provide a concrete surface free of dirt, grease, oil, or other foreign material.”

- (d) Use of words such as “satisfactory,” “adequate,” and “workmanlike” similarly often fail to convey a measurable standard. The reference [Vague Adjectives and Adverbs](#) list additional generic modifiers that should be avoided in specifications.
- (4) The specification should also clearly address where and when measurements are to be made.
- (a) If sequential measurement and approval actions will be necessary, the sequence should be clearly identified.
 - (b) Once the work responsibilities are identified, a review of the measurement and payment procedures is needed to ensure that the sequence of each party’s actions does not interfere with the measurement of the work quality and quantity.

c. Testing, inspection, and acceptance requirements

- (1) To ensure its expectations are met, a State DOT must be able to examine, analyze, demonstrate, or test what it buys. Specifications should therefore contain, for each requirement, a corresponding statement of the method by which the State DOT will verify that the requirement has been fulfilled.
- (2) As part of its stewardship and oversight role, the division office should ensure that the State DOT has adequate controls in place regarding project cost, schedule, and quality.
 - (a) Regardless of the exact manner in which acceptance activities will be performed (visual examination, mockups or test pads, sampling and testing, auditing of contractor QC data), the State DOT should have a clear process in place to ensure that its engineering and inspection staff, or outside consultants as applicable, are consistently performing and applying established procedures to prevent unintentional acceptance of non-conforming work or the appearance of arbitrary decisionmaking in the field. Inconsistent enforcement of requirements is a primary cause for ineffective specifications and would run contrary to the State DOT’s responsibility to safeguard the public’s interest.
 - (b) A State DOT’s quality management activities should start with the review and approval of the contractor’s submittals and shop drawings. Identification and correction of problems during the submittal stage can eliminate the need for costly and time consuming rework activities during construction.

- (c) Once construction is underway, inspectors should routinely monitor the progress of the work, both in terms of adherence to the project schedule and budget, and compliance with construction requirements.
 - (d) All sampling, testing, inspection, and other verification activities should be performed in accordance with the State DOT's established quality assurance procedures. Title 23 CFR 637 – Construction Inspection and Approval, describes the necessary components of a State DOT's construction inspection and approval program to ensure that the materials and workmanship incorporated into a Federal-aid highway construction project conform to the approved specifications.
- (3) Some best practices related to specifying inspection and acceptance activities are described below.
- (a) The specification should clearly define how the State DOT intends to conduct quality assurance and acceptance activities. This information is important to both the State DOT's inspection staff that will be performing this work and to contractors for factoring into their bids and construction schedule.
 - (b) When writing specifications and using them in the field, it should be remembered that “approval actions” and “acceptance” may be considered to be the same when conflict resolution reaches the claim stage or litigation. Generally, exculpatory clauses that are inserted into approval documentation (for example, false work design and structural design submittals) have not been successful as a defense in litigation.
 - (c) If either party has additional responsibilities for a contract item after measurement for payment, the nature and extent of that responsibility must be specified.
 - (d) To the extent necessary, the specification should also describe responsibilities regarding removal and replacement of defective work or contractor acceptance of reduced payment.
 - (e) Several State DOTs are now moving towards assigning contractors more responsibility for quality assurance sampling and testing, a role traditionally held by the State DOTs. This shift in traditional roles and responsibilities is primarily seen with alternative contracting techniques, such as design-build delivery, or with performance specifications. However, even if the contractor is performing the bulk of the testing, the State DOT should still perform sufficient verification to ensure that the desired quality level has been achieved. Failure to do so could compromise both end-product performance and future maintenance costs. For more details, refer to [T6120.3](#), Use of Contractor Test Results in the

Acceptance Decision, Recommended Quality Measures, and the Identification of Contractor/Department Risks.

d. **Method versus performance specifying**

- (1) When reviewing a specification, consider what type of specification is being used, and whether it is the best choice for meeting the project's needs and goals. Specification language may have to be adjusted accordingly. For example, performance specifications will typically require more emphasis on contractor quality control and end-product parameters that affect performance, whereas method specifications will require more detailed descriptions of materials and processes. Refer to the document [Types of Specifying](#) for more information on method and performance specifications.
- (2) Performance specifications can also serve as a welcome alternative to a proprietary specification. Proprietary specifications are generally disadvantageous to agencies because restricting competition may result in higher prices. Efforts to ensure open competition through the use of performance specifications can assist the State DOTs in controlling costs of construction projects while still maintaining quality.

4. **Organization, formatting, and writing style.** To effectively communicate requirements, specifications must be clear, concise, complete, correct, and consistent. Meeting these “five C’s” of good specification writing requires good grammar, proper sentence construction, consistent organization, formatting, and writing style, as well as technical accuracy and applicability to the project at hand. Some general guidance on evaluating a specification for organization, clarity, and writing style is provided below.

a. **Organization**

- (1) A standard, five-part format for specifications has evolved over the years through the concerted efforts of the FHWA and AASHTO, in coordination with highway construction industry organizations. Most agencies follow this five-part format, which provides distinct subparts for:
 - (a) Description of Work
 - (b) Materials
 - (c) Construction Requirements
 - (d) Measurement
 - (e) Payment
- (2) Some agencies have adapted the AASHTO format to create a four-part format, in which the measurement and payment subsections are combined. Others are using a modified Construction Specifications Institute (CSI) format. Regardless of the exact format used, a standard organizational structure provides the following benefits:

- (a) A standard format establishes a uniform approach to providing needed information, describing the work to be performed and identifying the responsibilities of the contracting parties. This standard format can thus act as a checklist of what information to include and where to include it. Information that does not fall within the standard subparts is considered nonessential.
 - (b) Separating the necessary parts of the specification into manageable increments allows the writer, and similarly the reader, to pay proper attention to the particular needs of each part.
 - (c) Having a consistent, logical framework allows the specifier, the contractor, estimator, manufacturer, and inspector to quickly find information within an individual section. A well organized specification eliminates confusion and results in a smoother contracting process that, in turn, provides economic benefits to all concerned.
 - (d) Establishing a base format numbering system and sequence of specifications provides an easier referral system for specification users.
- (3) Although all subparts may not always be applicable, they should not be deleted. The specifications should show all of the format parts using the notation “none specified” where the information is not applicable. For example, consider a specification on Section 201 - Clearing and Grubbing. To fully describe this work, the specification would require subsections for the description of work, construction requirements, method of measurement, and basis of payment. Although there would be no materials requirements, the materials subsection should not be eliminated. Instead, the subsection should be presented as follows: 201.02 Materials Requirements - None Specified.
- (4) The discussion on method specifications in the document [Types of Specifying](#) addresses the content considerations for each of these subparts. Adherence to this organizational structure can help ensure that the specification is complete.
- (5) The information within the subparts themselves should also be carefully organized to ensure continuity of thought and logic.
- (a) Requirements should be arranged into discrete and complete messages that can be expressed simply.
 - (b) The information should be presented in the same sequence as the contractor will perform the work (e.g, mix, place, finish, and cure).

b. Writing style

- (1) Specifications are a compilation of directions, provisions, and requirements pertaining to the performance of the work. They should describe the work with clarity, precision, and consistency and should have an organized and logical format. Well-written specifications inform the contractor of the work to be performed, the conditions and restrictions on the performance of the work, the expected quality of the work, the manner in which the work is to be measured for payment, and how the State DOT will pay for the work. With that in mind, reviewers should ensure that specifications:
 - (a) are clear, concise, and technically correct;
 - (b) do not use ambiguous words or phrasing that could lead to misinterpretation;
 - (c) clearly define roles and responsibilities;
 - (d) are written in simple words and short and easy to understand sentences and paragraphs;
 - (e) do not repeat requirements stated elsewhere in the contract; and
 - (f) are consistent in terminology, usage, format, and organization.
- (2) Additional review tips for ensuring that specifications are written in a manner that is clear, concise, complete, and consistent are provided in the document [Basic Specification Writing Principles](#).
- (3) If the State DOT has not already developed a specification style guide, encourage it to do so. Style guides provide guidance on writing style, organization, format, terminology and phrasing, and related drafting conventions. If the State DOT's specification writers adhere to the guidelines, the reviewers will be able to focus on content and technical matters, instead of grammar and consistency issues. Typical topics addressed in a style guide include:
 - (a) Standard terminology and phrasing;
 - (b) Proper use of voice and mood;
 - (c) Formatting conventions; and
 - (d) Additional conventions related to punctuation, capitalization, and use of abbreviations and acronyms.

c. Coordination with other requirements

- (1) Specifications are often written in a piecemeal manner by several different authors, depending upon the expertise needed. It is therefore important to read the contract as a whole to help identify conflicting requirements. A requirement occurring in one is binding as though occurring in all.

- (2) Conflicting requirements can be several pages apart, so finding the conflict often depends on the memory of the reviewer. Using a word processing program to search on key words and phrases can help identify conflicts.
- (3) Technical requirements should be coordinated with the administrative requirements in the General Conditions (typically Division 100 of the Standard Specifications). Conflicts often occur regarding submittal requirements, measurement and payment terms, responsibility for permits, coordination responsibilities, and definitions (i.e., using the correct terms).
- (4) Conflicting specifications or contract requirements may be resolved using an order-of-precedence clause. In highway contracts, such a clause is often found in the Control of Work section of the General Conditions (Division 100).
- (5) The basic philosophy is that project-specific information governs or takes precedence over the more generic, and written specifications govern over drawings. Thus, the hierarchy of documents imposed by a typical order-of-precedence clause is as follows:
 - (a) Project Special Provisions
 - (b) Project Plans
 - (c) Supplemental Specifications
 - (d) Standard Specifications
 - (e) Standard Plans
- (6) Reviewers should be aware of a State DOT's standard order-of-precedence clause when reviewing contract documents. Note, however, that the intent of this clause is not to eliminate the need to minimize contradiction among contract requirements. Reviewers should strive to identify and eliminate conflicting requirements as part of their review effort.

Attachment 3
Specification Review Checklist

Issue	Yes	No	N/A	Comments
Continuity of Thought and Logic				
Are sentences and paragraphs limited to single ideas?				
Is there an orderly arrangement of ideas throughout the specification?				
Do requirements follow the natural sequence of the work?				
Method of Presentation and Overall Organization				
Is the five-part format (or agency equivalent) used?				
Is the specification structured so that all information is easily accessible?				
Are headings used to make it easier for readers to find information?				
Language and Style				
Is the language of the specification free of vague and ambiguous words and phrases?				
Does the specification correctly use active voice and imperative mood?				
Does the specification use <i>shall</i> and <i>will</i> correctly?				
Is formatting consistent?				
Is capitalization consistent (e.g., work vs. Work, engineer vs. Engineer)?				
Is word choice consistent (e.g., pipe vs. conduit, select fill vs. gravel, reinforcing steel vs. rebar)?				

Issue	Yes	No	N/A	Comments
Measurable Standards				
Does the specification provide a clear description of what is to be measured for payment and the method of measurement?				
Does the specification identify where and when the measurements will be made?				
Can the inspector, using the specification as the standard of performance, determine whether the Contractor has complied with all of the specified work requirements?				
Have escape clauses been avoided (e.g., requirements involving the “opinion of the Engineer”)?				
Sampling and Testing Requirements: Does the specification describe how acceptance will be determined? Are the specified tests necessary, or will product certification suffice?				
Submittals: Does the specification describe the necessary submittal requirements? Are the submittal requirements realistic (i.e., are shop drawings really necessary or is catalog information sufficient)?				
Coordinating Information and Requirements				
Has the specification been closely examined for redundancies, contradiction, ambiguities, duplication, and overlap?				
Are the specifications and drawings compatible?				
Are drawings used where needed to amplify the work requirements?				

Issue	Yes	No	N/A	Comments
PS&E Submittals				
Are the current FHWA required standard provisions included as required by 23 CFR 633 Subpart A (i.e. FHWA-1273)?				
Are the DBE participation goals identified (49 CFR Section 26)?				
Are Buy America Act provisions included (23 CFR 635.410)?				
Are the standard clauses on differing site conditions, suspensions of work, and significant changes in the character of the work included?				
Do specifications satisfy all state, county, and local requirements and permit conditions?				
Are the current Department of Labor Minimum Wage Rates included?				
Are all proprietary products acceptable (ie. has a “finding in the public’s interest” been documented per 23 CFR 635.411)?				
For any materials to be provided by the State or from sources designated by the State, has a public interest finding been obtained? Do the bidding documents identify the location and any other conditions to be met for the contractor to secure the materials?				
Are guarantee or warranty clauses included? (23 CFR 635.413)				
Are alternative contracting procedures included? Is SEP-14 and/or SEP-15 approval needed?				

Issue	Yes	No	N/A	Comments
Are any experimental features included in the project? If so, do you concur with their incorporation into the project and have you coordinated with the Division's Technology Transfer Engineer?				
Are items shown as participating in fact eligible for federal funding?				
Are items shown as non-participating listed separately?				
Are all force account items reasonable (23 CFR 635 Subpart B)?				
Are itemized quantities/costs reasonable?				

Attachment 4
Basic Specification Writing Principles
(“Five C’s” of Good Specification Writing)

To effectively communicate requirements, specifications must be clear, concise, complete, correct, and consistent. Some general guidance to ensure that a specification meets these “five C’s” of good specification writing is provided below.

1. **Clear**

- a. Specifications are a tool to communicate an owner’s expectations regarding the performance of the work to the contractor. Specifications need to be understood by the contractor’s employees who will be doing the work. The purpose and effect of the specification should be clear from its language, and the language should convey only one meaning. To prevent possible ambiguities, conflicts, and confusion in words and sentence construction, consider the following:

- (1) **Are roles and responsibilities clearly established?** The specifications should clearly indicate the responsibility and authority of both the contractor and the State DOT. Proper use of active voice and imperative mood, as described in Attachment 5, can clarify responsibility. Otherwise, the traditional use of *shall* and *will* can also identify responsibility, with *shall* identifying contractor requirements and *will* identifying responsibilities of the State DOT or its representative.
- (2) **Is all information essential?** The requirements and procedures defined should be essential to the State DOT evaluation of the product for acceptance and payment purposes. Requirements and procedures that are not essential to evaluating product quality or quantity serve no useful function and lead to non-enforcement in the field.
- (3) **Does the specification exclude expository explanations?** Specifications should not explain the reasons for specific requirements. Explanations and justification for a requirement and instructions associated with its enforcement properly belong in a construction manual or in a design narrative, not in the specifications.
- (4) **Is consistent terminology used throughout the specifications and contract documents, including the Standard Specifications, drawings, and pay items?** For example, terms such as “borrow,” “structural fill,” and “backfill,” should not be used interchangeably on the drawings, specifications, and pay items.
- (5) **Is all terminology defined?** All terminology should be defined, particularly those terms pertaining to the required work of the contractor or terms that have a bearing on the quality of the work or its measurement.
- (6) **Has all unnecessary legal and technical jargon been eliminated to the extent possible?** See the list [Needless Words and Jargon](#) for some plain language substitutes for common wordy phrases.

- (7) **Are requirements expressed using plain and well understood terminology?** Words should be used in their true dictionary or technical meaning to avoid conflicts with ordinary or accepted usage. Colloquialisms and slang expressions should be removed from specifications. If a good technical word will clearly describe the idea to the contractor, it should be used exclusively. Specifications should not use synonyms for literary effect. For example, use “excavate” instead of “cut” or “dig” or “bulldoze.”
 - (8) **Does the specification include “escape clauses”?** Inclusion of phrases such as “as directed by the engineer,” “to the satisfaction of the engineer,” or “satisfactory to the engineer,” should be limited, as such language does not convey a measurable standard. This type of phrase may be used sparingly, such as in unit price items where action taken by the engineer will not involve changes in cost to the contractor.
 - (9) **Has all information been provided or otherwise appropriately referenced?** References to information not specifically included within the contract documents should be accompanied by notification of where the information can be obtained. The notification should include a contact office and telephone number so the information is available to the contractor, suppliers, and subcontractors.
 - (10) **Are all abbreviations and acronyms defined?** Typically, it is best to define abbreviations and acronyms at the time of first use, if they have not already been defined in the General Provisions (Division 100).
 - (11) **Do pronouns clearly refer to a specific noun?** If a pronoun could refer to more than one person or object in a sentence, repeat the name of the person or object instead of using the pronoun, or rewrite the sentence to add clarity.
 - (12) **Could punctuation cause misinterpretation?** Recast the sentence if a change in punctuation might change the meaning.
 - (13) **Are modifiers misplaced?** Place words carefully to avoid ambiguity. Keep subjects and objects close to their verbs. Place conditionals such as “only” or “always” and other modifiers next to the words they modify. For example, write “you are required to provide only the following,” not “you are only required to provide the following.”
 - (14) **Has all repetition been removed?** Requirements should only be stated once to avoid the possibility of conflicts.
- b. Visually appealing documents are easier to understand than traditional blocks of text and help improve overall clarity. Replacing blocks of text with headings, tables, and white space will help create a clear and uncrowded presentation, in which main points are readily apparent and related items are grouped together. Techniques to improve visual appeal include the following:

- (1) **Headings.** Headings break up information into logical, understandable pieces, which can assist the reader in locating information. Headings should be used consistently (i.e., all paragraphs at the same level within a particular subpart should either use or not use headings). The heading should have enough information to convey the main point of the paragraph, without being so long as to overwhelm the material in the paragraph itself.
- (2) **Short Paragraphs.** Paragraphs should be limited to only one issue. In addition to breaking up material into easily understood segments, this technique also improves readability by allowing the incorporation of informative headings that reflect the issue conveyed in the paragraph.
- (3) **Vertical Lists.** Vertical lists are a useful technique to present multiple items, conditions, and exceptions that readers would otherwise have difficulty absorbing in a block of text. Lists can be used to highlight levels of importance, identify the necessary steps in a process, and clarify the sequential order of steps in a process. However, be sure that the list explicitly conveys whether one, more than one, or all of the list items apply. This can be accomplished by introducing the list with a lead-in sentence. For example,
 - a. To indicate an OR situation, the list could be introduced with "...one of the following:"
 - b. To indicate an AND/OR situation, one of the following could be used:
 - "one or both of the following:" when one or two items apply in a list of two.
 - "one or more of the following:" when more than one item can apply individually.
 - "one or a combination of the following:" when items can be combined.
 - c. To indicate an AND situation, the lead-in "...all of the following:" would indicate that all items apply.

2. **Concise.** Concise specifications are essential to achieving quality and efficiency in highway construction. Use of the following techniques will help ensure concise language and phrasing.
 - a. Use of the active voice is preferred over the passive voice to directly state essential directions and procedures. A specification's goal is to be *specific*. Because the active voice clearly identifies the responsible party and uses fewer words, it ensures greater specificity than the passive. To convey directions to the contractor, use of the imperative mood can lead to even more concise statements. Used correctly, these techniques can add clarity, fix responsibility, and simplify sentence structure by eliminating words. See the attachment [Voice and Mood in Specifications](#) for more information on this topic.
 - b. Short sentences that break up information into smaller, easier-to-process units are better for conveying complex information. Long, complicated sentences filled

with dependent clauses and exceptions can confuse readers and obscure the main point. When reviewing specifications, see if complex sentences can be broken down into lists or individual sentences.

- c. Eliminate or replace wordy phrases and adjectives and adverbs that do not add to the meaning of the specification.

3. **Complete**

- (1) Specifications should provide the information necessary to enable a bidder to prepare a complete and responsible bid and to enable the contractor to construct the project properly.
- (2) Specifications should be complete and should complement and substantiate the applicable typical sections, dimensions, and details shown on the plans.
- (3) Omissions, ambiguities, or inconsistencies in the plans or specifications are not the responsibility of the contractor.

4. **Correct**

- (1) Specifications should be accurate and factual. Sources of data used in the specification should be reliable and current. Careless statements or statements based on unreliable data are frequently the cause of contract administration problems and contractor claims. Legalistic words and phrases may shorten or clarify specifications, but ensure that usage is correct and that alternate interpretations cannot contradict the intended meaning.
- (2) To ensure specifications are technically correct, research the topic area thoroughly and consult subject matter experts as necessary.

5. **Consistent**

- a. Consistency in language selection, usage, format, and organization will help prevent conflicts and ambiguities in specifications.
- b. In addition to the need for consistency in writing specifications, specifications must also be consistently enforced. Without consistent enforcement, even a well-written specification becomes ineffective.

Attachment 5 Voice and Mood in Specifications

I. Voice

Verbs have a property called voice, which may be active or passive. Each has its uses, but each can also be misused. Improper use can lead to misunderstanding, imprecision, omissions, and disputes.

In the active voice, the subject of the sentence performs the action expressed in the verb, leaving no doubt as to who is responsible for the action described. The following example illustrates active voice construction.

Example (Active Voice):

The Engineer	will identify	sampling locations.
(subject)	(verb)	(object)

As illustrated above, in the active voice, the subject of the sentence (i.e., the Engineer) performs the action (i.e., identifying sampling locations).

This same sentence, recast in the passive voice, would be as follows:

Example (Passive Voice with Agent Performing the Action):

Sampling locations	will be identified	by the Engineer.
(subject)	(verb phrase)	(prepositional phrase)

The above example illustrates the following traits of passive voice construction:

- The subject is acted upon.
- The action is expressed using a past participle (typically a verb ending in “-ed”) with a form of the “to be” verb (which includes “is,” “was,” “will be,” “shall be,” etc.).
- The agent performing the action appears after the verb in a prepositional phrase (“by the...”).

In passive voice, the agent can also be omitted entirely, as shown below.

Example (Passive Voice with Agent Omitted):

Sampling locations	will be identified.
(subject)	(verb phrase)

In the above example, the Engineer may be doing the identification, but the sentence does not make this explicitly clear.

Use of Passive Voice in Specifications

The use of active voice may not always be the preferred method if there is a good possibility that confusion may result. Method specifications may become stilted and awkward since the description necessary to explain the process and methods required can be quite involved.

In some instances, passive voice may be the best method to express a particular idea. This is typically the case when the agent performing the action is obvious or of secondary importance to the main focus of the sentence, or the agent is relatively unimportant compared to the action itself and what is acted upon.

For example, many State DOTs use the passive voice in their measurement and payment subparts.

The accepted quantities *will be paid* at the contract price per unit of measurement for the Section XXX pay item listed in the bid schedule.

In this example, the party responsible for making payment (i.e., the Department) is obvious from the surrounding context and the general contracting convention of owners being responsible for payment.

Misusing the Passive Voice

A specification's failure to explicitly assign responsibility for a required action can lead to disputes. In a specification, the passive voice is misused when it leaves the responsible party's identity subject to interpretation.

In specifications, this issue can occur when context calls for the auxiliary verb *may* to describe discretionary actions. Unlike *shall* and *will*, *may* can apply to either contracting party.

Examples (Misuse of Passive Voice with Discretionary Clauses):

Material may be sampled and tested at any time. (sampled and tested *by whom?*)

Better: The Engineer may sample and test material at any time.

Work may be eliminated from the contract without invalidating the contract. (eliminated *by whom?*)

Better: The Department may eliminate work from the contract without invalidating the contract.

II. Mood

Mood is a property of verbs that conveys the writer's or speaker's belief about the truth or nature of the sentence (i.e., whether it is meant to be fact, conjecture, or command). The English language uses three verb moods.

1. The *indicative mood* is the most common, and is used to indicate statements of fact and description.

Examples (Indicative Mood):

This work consists of...

The Contractor is responsible for placing the concrete.

Payment will be full compensation...

2. The *subjunctive mood* is used to convey doubt or conjecture, or to pose a “what if” situation. It is rarely, if at all, used in specifications.

Examples (Subjunctive Mood):

If initial testing were to confirm...

If the Engineer were to request...

3. The *imperative mood* is used to give a command or instruction. A distinctive feature of statements in the imperative mood is that they omit the subject of the sentence—that is, the subject is understood, but never explicitly stated.

Example (Imperative Mood):

Place the concrete.

Because the context of the specification already makes clear to whom the direction is addressed, the party responsible for carrying out the directive—the Contractor—is left unsaid. The complete sentence is understood to be:

[Contractor,] place the concrete.

Or, less awkwardly but no longer in the imperative:

[The Contractor shall] place the concrete.

III. Voice and Mood in Specifications

Constructing sentences using the active voice and imperative mood is the most efficient way to give a command, direction, or instruction when writing specifications.

1. Use the active voice and imperative mood to convey instructions to the contractor. Typically, this style is most appropriate for conveying contractor responsibilities in the Construction Requirements subpart of a State DOT’s specifications.

Examples (Active Voice/Imperative Mood to Convey Instructions to Contractor):

Scarify gravel roads to a minimum depth of 6 inches.

Clear the area of vegetation and obstructions according to Sections 201 and 203.

Remove and replace all concrete members that are cracked or damaged.

Where the wall is set on a rocky foundation, place 6 inches of select granular backfill under the reinforcing mesh or strips.

2. Use the active voice and indicative mood when it is necessary to clarify the party responsible for the action. This can occur when responsibilities of both the engineer and contractor are discussed in the same sentence, and for optional or alternative actions on the part of either the contractor or engineer (i.e., discretionary clauses using “may”).

Examples (Active Voice/Indicative Mood to Clarify Responsible Party):

The Department and the Contractor will agree to the negotiated price.

The Engineer may order the performance of the work to be stopped.

3. When stating a fact as opposed to directing an action, the indicative mood is most appropriate. The Description subpart of most State DOT specifications are typically written in the indicative mood.

Examples (Indicative Mood to State Fact or Define Terms):

This work consists of constructing mechanically-stabilized earth walls.

The Plans indicate limits of disturbance.

Practical driving refusal is defined as 15 blows per inch for steel piles, 8 blows per inch for concrete piles, and 5 blows per inch for timber piles.

Keyed riprap is rock placed on a prepared surface and set into place by impact pressure.

IV. Changing from Passive Voice to Active Voice and Imperative Mood

To change a passive-voice sentence to active voice, find the agent responsible for the action in a “by the...” prepositional phrase, or, if the agent has been omitted from the sentence, carefully infer the agent from the surrounding context. Make that agent the subject of the sentence, and change the verb accordingly.

To convert to the imperative mood, place the verb at the beginning of the sentence and exclude the agent. Note however, that the imperative mood should only be used to convey instructions to the contractor. It should not be used to identify the responsibilities of the State DOT or its representatives.

Original Passive Voice Sentence	Agent	Changed to Active Voice	Changed to Active Voice/Imperative Mood
<p>A mechanical broom or sweeper <i>shall be provided</i> which is adjustable to uniform contact with the surface and designed to thoroughly clean without cutting into the surface being swept.</p>	<p>Agent not specified; however, the traditional use of “shall” and the general context of the surrounding information suggest that the agent is the contractor.</p>	<p>The Contractor <i>shall provide</i> a mechanical broom or sweeper that can be adjusted to uniform surface contact and does not cut into the surface.</p>	<p><i>Provide</i> a mechanical broom or sweeper that can be adjusted to uniform surface contact and does not cut into the surface.</p>
<p>Concrete <i>shall be thoroughly consolidated</i> against the faces of all forms and joints, including concrete in a previously constructed lane of pavement, by means of vibrators inserted in the concrete.</p>	<p>Agent not specified; however, the traditional use of “shall” and the general context of the surrounding information suggest that the agent is the contractor.</p>	<p>The Contractor <i>shall consolidate</i> fresh concrete against all form faces, joints, and previously constructed pavement using insertion type vibrators.</p>	<p><i>Consolidate</i> fresh concrete against all form faces, joints, and previously constructed pavement using insertion type vibrators.</p>
<p>The gravel <i>shall be placed and shaped</i> by power equipment to the specified lines, grades, cross-sections, and depths, without segregation.</p>	<p>Agent not specified; however, the traditional use of “shall” and the general context of the surrounding information suggest that the agent is the contractor.</p>	<p>The Contractor <i>shall place and shape</i> gravel to the specified dimensions without segregation using power equipment.</p>	<p><i>Place and shape</i> gravel to the specified dimensions without segregation using power equipment.</p>
<p>The exact location of sampling <i>will be determined</i> by the Engineer.</p>	<p>The Engineer</p>	<p>The Engineer <i>will determine</i> the exact location of the sampling.</p>	<p>Use of Imperative Mood is inappropriate (not a contractor responsibility)</p>

Attachment 6 Word Usage

The following list identifies and describes word pairs and phrases that are often confused in specification writing.

Accept vs. Approve.

To *accept* is to recognize an obligation to pay, and is used in the context of, or in reference to, contracts. To avoid misunderstanding, reserve *accept* and related forms, such as *acceptance* and *acceptable*, for use in reference to the contract between the State DOT and the contractor.

Examples:

Payment will be made for the actual quantities of work performed and *accepted*.

The Engineer will decide questions concerning the quality or *acceptability* of materials.

In contrast, to *approve* is to confirm agreement with, or to indicate satisfaction with, a situation or circumstance. Use *approve* and related forms, such as *approval*, to indicate official sanction or endorsement of designs, documents, plans, or processes.

Examples:

Material may be *approved* at the source of supply before delivery to the project.

The Contractor shall obtain the Engineer's *approval* prior to starting the work.

Affect vs. Effect.

Affect is always a verb, meaning either "to influence" or "to pretend to have or feel."

Effect is nearly always a noun meaning "result" or "consequence." It is sometimes used in formal writing as a verb to mean "to bring about" or "to make happen."

Effective is an adjective that should be avoided in specification writing because it is open to multiple interpretations.

All vs Any. *Any* and *all* should not be used interchangeably. *All* refers to the entire amount, whereas *any* is a limited number selected at the discretion of the reader. In most situations involving specified requirements, *all* is the more appropriate word.

Restrict the use of *any* to those logical situations in which meeting one criterion among several is enough to satisfy a condition.

Examples:

The Contractor shall perform the action if *any* of the following occur:

1. event A,
2. event B, or
3. event C.

The Contractor may select from *any* of the materials listed.

Example (misuse of any):

Any voids greater than 1 mm across shall be filled.

This requirement says that some voids greater than 1 mm, but not necessarily all of them, must be found and filled. Most likely, the writer's intention was that "*All* voids greater than 1 mm across shall be filled."

When reviewing specifications that contain *any*, see if this term can be deleted without affecting the meaning of the sentence. For example, in the example above, the requirement could simply state "Voids greater than 1 mm across shall be filled."

Amount vs. Quantity. Use *amount* when money is the subject. Use *quantity* when volume, mass, or other unit of measurement is the subject.

And/Or. This construction is both awkward and confusing, and leaves it up to the reader to interpret if the statement is meant to include multiple items (*and*) or present an option (*or*). It would be better to write "A, B, or both," not "A and/or B."

As a Minimum & Not Limited To. Such phrases should be avoided in specifications. Requirements should be clearly defined in full. If elements remain unknown, more research and design work may be necessary.

As approved by the Engineer. Often this phrase is not necessary as the General Requirements have already established the Engineer's authority over the job. However, a variant of the phrase – *The Contractor shall obtain the Engineer approval before* – is often quite useful to ensure that the Contractor consults with the Engineer at a critical decision point or before proceeding from one stage to another in a multi-step process.

At the Contractor's Expense vs. At no additional cost to the Department. Use *at no additional cost to the Department* instead of *at the Contractor's expense*. The Department cannot insist that the Contractor pay for something (because the Contractor might well turn to another source to cover a cost), but it can indicate that *the Department will not pay*.

Because. Specifications identify requirements; they should not explain. Explaining may provide grounds for disputes.

Capable. Be careful when using *capable* to describe equipment. This adjective does not require the contractor to provide equipment that is actually ready to perform the intended function. The equipment merely has to be compatible with performing that function, i.e., adjustments, attachments, or other modifications not included in the contract may be necessary.

Comprise. *Comprise* means to include or contain. The phrase “is comprised of” is often seen in specifications, but is logically incorrect. The whole *comprises* the parts.

Consist vs. Include. Use *consists of* or its variants to refer to a complete set or to all the possible items in a collection. Using *consists of* before a list of items or choices means there are no possibilities other than those listed. Use this phrasing to avoid ambiguity when a list is meant to be exhaustive.

Example:

Dampproofing *consists of* a coating of primer and 2 moppings of waterproofing asphalt.

In contrast, the term *include* is used to introduce or identify a partial list of items or possibilities from among a larger set or collection. Because *include* introduces a partial list only, it is not necessary to add a further qualification such as *but not limited to* or *as a minimum*.

Example:

Each design submittal shall include the following...

Each vs. Either. Use *either* only when a choice is implied; otherwise, use *each*.

Example:

Construct a stable shoulder on *each* side of the roadway.

Not:

Construct a stable shoulder on *either* side of the roadway.

Ensure vs. Insure vs. Assure. These are three different verbs with three different meanings. The correct word in specifications will almost always be *ensure*, which means “to make sure or certain.”

Only use *insure* when speaking of financial protection of the sort offered by insurance companies. Misusing *insure* can create or suggest an obligation vastly different from what was intended.

Example:

Ensure that protected sites are not disturbed or damaged. (suggests that Contractor should make every effort to protect and restore surrounding protected areas)

Not:

Insure protected sites are not disturbed or damaged. (suggests Contractor is to provide financial protection against loss)

Assure means to declare earnestly. Use *assure* only when giving reassurance to another person. *Assure* will rarely be the right word in a specification.

Provide vs. Furnish. Though similar, these words are not identical in meaning. *Provide* has a broader meaning, which is “to supply or make available.” In contrast, *furnish* means “to equip.”

Use *provide* when requiring a contractor to supply an item; because this is usually the intention in a specification, *provide* is usually the better choice of the two words.

Example:

Provide technically qualified survey crews experienced in highway construction survey and staking.

When the intention is to additionally require that a contractor not only provide an item but also do something with it, couple *provide* with such additional verbs as *use*, *place*, or *install*.

Example:

Provide and place shims as necessary to prevent bending the bracing more than 1 inch out of line when bracing bolts are tightened.

Provide and Place vs. Construct. *Provide (or furnish) and place* should generally be reserved for items that are prefabricated. *Construct* should be used for items that are built or assembled in the field.

Shall vs. Will. The word *shall* indicates an obligation to act and is reserved for Contractor responsibilities. (Or, alternatively, use the imperative mood, active voice to avoid the use of *shall*.)

The word *will* indicates an anticipated future action or result and is reserved for actions and responsibilities of the Department and Engineer.

That vs. Which. Do not use *that* and *which* interchangeably. *That* is properly used to introduce information essential to the meaning of a sentence and is not preceded by a comma unless the comma serves another purpose. *Which* introduces nonessential

information. *That* will be the right word choice in a specification more often than *which*, for the simple reason that specifications express essential requirements.

Use the following rules to decide if a clause should start with *that* or *which*:

- If you can drop the clause and not lose the point of the sentence, use *which*. If dropping the clause would change the meaning of the sentence, use *that*.
- A *which* clause goes inside commas, a *that* clause does not.

When vs. Where vs. If. These words are not interchangeable. *When* refers to time. *Where* refers to place. *If*, among its many uses, introduces a conditional clause or sentence.

Use *when* in discussions about time or chronology. The presence of words about time, periods of time, dates, or duration are clues that point to *when* as the appropriate choice. Another clue is that *before* or *after* can often replace *when* without changing the meaning of the sentence.

Use *where* to discuss or refer to a physical place, location, or area.

Use *if* to introduce, or as part of, an *If A, then B* sentence. Do not use “when” or “where” for this purpose.

Attachment 7

Vague Adjectives and Adverbs

Ideally, specifications should state requirements in terms of measurable and quantifiable standards. The inclusion of adjectives and adverbs to modify a requirement rarely adds meaning to a specification, and actually may lead to disputes over interpretation. Listed below are some vague adjectives and adverbs that should generally be avoided in specifications.

About	Insufficient	Safe
Adequate	Less	Satisfactory
Appropriate	Low	Secure
Better	Major	Significant
Careful	Neat	Similar
Deep	Normal	Simple
Dependable	Periodically	Smooth
Desirable	Pleasing	Some
Easy	Practicable	Stable
Economical	Practical	Substantial
Efficient	Proper	Sufficient
Entirely	Quick	Suitable
Excessive	Reasonable	Variable
Good	Recognizable	Wide
High	Relevant	Workmanlike
Highest quality	Reputable	Worse

Attachment 8 Needless Words and Jargon

To increase the clarity and readability of specifications, avoid wordy phrases and complex words that can be replaced with fewer or simpler words that convey the same meaning. The list below identifies some common wordy phrases alongside possible plain language substitutes.

<i>Instead of:</i>	<i>Consider:</i>
a minimum of	at least
a number of	some
absolutely essential	essential
accordingly	so
aforementioned	the, that, those
as concerned with	concerns
as a means of	to
as may be necessary	as needed
as prescribed by	in, under
at a later date	later
at the option of the contractor	the contractor may
at the present time	now
by means of	by
capability	can
cease and desist	stop
commence	start
consequently	so
contract requirement	contract
due to the fact that	because
enclosed herewith	enclosed
endeavor	try
facilitate	help
for a period of	for
for the purpose of	for, to
free from	without
give consideration to	consider
give due and sufficient written notice	give written notice
give recognition to	recognize
heretofore	until now
however	but

<i>Instead of:</i>	<i>Consider:</i>
if the contractor so elects	The contractor may
implement	start, carry out
in a manner such that	so that
in a timely manner	promptly, on time
in advance of	before
in an effort to	to
in lieu of	instead of
in many cases	often
in many instances	sometimes
in order to	to
in the amount of	for
in the event of	if
in the event that	if, when
in the near future	soon
in such a manner as to	so as to
initiate	start
is applicable to	applies to
is hereby authorized	may
is indicative of	shows
it is intended	shall
it shall be incumbent upon	shall
it shall be the responsibility of the contractor	the contractor shall
it shall be the duty	shall
make payment	pay
make preparations for	prepare for
make use of	use
methodology	method, way
not less than	at least
on a quarterly basis	quarterly
on a regular basis	regularly
pertaining to	of, about
prior to	before
should it appear that	if
so as to	to
subsequent to	after

<i>Instead of:</i>	<i>Consider:</i>
successfully complete	complete
such that	so
terminate	end
the month of June	June
the question as to whether	whether
through the use of	by
throughout the construction period	during construction
timely	prompt
undertake an analysis	analyze
until such time as	until
utilize	use
