Principles of Writing Highway Construction Specifications

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Hammurabi's Code of Laws Babylon (1795 – 1750 B.C.)

If a builder build a house for some one, and does not construct it properly, and the house which he built fall in and kill its owner, then that builder shall be put to death.

Liquidated Damages??

Hammurabi's Code of Laws Babylon (1795 – 1750 B.C.)

If it kill the son of the owner, the son of that builder shall be put to death.

Risk Management??

Hammurabi's Code of Laws Babylon (1795 – 1750 B.C.)

If it kill a slave of the owner, then he shall pay slave for slave to the owner of the house.

Asset Management??

Hammurabi's Code of Laws Babylon (1795 – 1750 B.C.)

If it ruins goods, he shall make compensation for all that has been ruined, and inasmuch as he did not construct properly this house which he built and it fell, he shall re-erect this house from his own means.

Liability Insurance??

Hammurabi's Code of Laws Babylon (1795 – 1750 B.C.)

If a builder build a house for some one, even though he has not yet completed it, if then the walls seem toppling, the builder must make the walls solid from his own means.

Final Acceptance??

Principles of Writing Highway Construction Specifications

READY ……

SET ……

WHERE DO WE START?

Definition & Purpose

- AASHTO defines specifications as a "Compilation of provisions and requirements to perform prescribed work."
- Written to the Contractor or the Bidder
- They are a standard that all parties to the construction contract are required to meet
- They are a statement of the requirements considered necessary by the buyer for performance of the work

Definition & Purpose

- What do the specifications do for the agency? They provide:
  - A standard set of procedures for the management and execution of a project, including changes
  - A set of criteria for the individual components that will become a part of the work (i.e., material requirements and certifications)
  - Minimum standards—A defined measure or set of minimum standards against which the work in place or underway can be evaluated

Definition & Purpose

- What do the specifications do for the contractor? They provide:
  - A standard set of procedures for the management and execution of a project
  - A written amplification of the information contained on the plans
  - Specific requirements for measurement of and payment for work performed
  - A mechanism to handle situations not contemplated by the contract
  - Information, together with the plans, for developing bids

The Restaurant Analogy

- What Do We Want?
- How Do We Order It?
- How Do We Know If We Got What We Ordered?
- What Happens If We Didn't Get What We Ordered?
- How Do We Pay For What We Got?

The Triple Constraint

Performance ..... "Good"

Time ..... "Fast"

Cost ..... "Cheap"

Can Get Any 2 Out of 3

Look for Flexibility in 3rd

AASHTO Specification Format

- Description
- Materials
- Construction Requirements
- Method of Measurement
- Basis of Payment

AASHTO Specification Format

Description:

1. Think of this as “Scope of Work” or “Work Included”
2. Should be Short & Concise
3. Provide Relationships to Plans or Other Work Items
4. Do NOT Specify Scope in Detail (Redundant, Can be Dangerous, Lengthens the Spec)
5. Do NOT Duplicate or Elaborate on Plans
6. Do NOT Attempt Non-Specific Catch-alls, e.g., “The Contractor shall furnish and include everything necessary for the work whether shown or not”

AASHTO Specification Format

Materials:

1. Prominently Provide Specific References to Other Specification Sections that Apply to the Work
2. Cross References Will Primarily be to Materials Sections (Division III)
3. Cross References May Also be to Other Construction Requirement Sections (Division II)
4. Where No Division III Specs Apply, May Include Full Applicable Material Requirements
5. Do NOT Repeat Plan Details or Other Specs

AASHTO Specification Format

Construction Requirements:

1. The “How To” of Highway Specifications, Whether Prescriptive or End Result
2. The “Real Meat” of Any Division II Spec
3. Can Be as Simple as a Single Paragraph or as Complex as Many, Many Pages
4. May Include Sequence of Operations, End Product Desired, Required Testing (All Phases), Acceptance Criteria, QC/QA/Inspection Requirements

AASHTO Specification Format

Method of Measurement:

1. In Short, Must Provide a Clear Cut Method and Mechanism for Measurement of Pay Quantities
2. May Reflect Plan Quantity Method, if Applicable

Basis of Payment:

1. Usually Begins with "Price and Payment will be Full Compensation for ……"
2. Provides Cross Reference to Pay Items

Key Principles to Good Spec Writing

- Good specification writing demands a simplified writing style, a style that provides the writer's exact meaning, leaving no room for other interpretation.
- In theory, this style may seem relatively easy to achieve.
- In practice, writing in this style requires consistent attention to organization, format, and grammar.

Getting Organized

- Research the Topic: Get feedback from field personnel, including the construction industry
- Research Standards: Be sure all referenced standards are current and applicable
- Research State of the art for new materials, equipment, and construction methods
- Identify Best Practices
- Research the National Highway Specifications Website

Getting Started

- Gather Technical References
- Start with an Outline of your Spec
- Write the First Draft; No Cut & Paste
- Collaborate with Experts Outside your Expertise
- Identify your Peer Reviewers
- Implement a Style Guide for formatting
- Comply with Project Scope and all Federal Requirements

The Five Cs of Spec Writing

Remember These Key Principles – The Five Cs

- Concise - Use simple words, short sentences, active voice
- Clear - Avoid ambiguities with measurable standards. Use words that convey exact meaning.
- Complete - Use the AASHTO five-part format
- Correct - Be technically and grammatically correct
- Consistent – Follow a Style Guide for consistency in how information is presented

Concise

- Aim for the eighth grade level
- Choose the simplest words that accurately convey your thought
- Avoid using non-essential adjectives, adverbs & prepositional phrases
- Use short sentences
- Use short paragraphs
- Use Active Voice to clearly identify who has responsibility for action

Clear

- Avoid ambiguities: Select words that say what you mean
- Be careful with commonly confused word pairs
- Choose words with intended meaning
- Match words with their best definitions
- Use measurable or definable standards
- Put statements in positive form
- Avoid using “and/or”, inappropriate adverbs, and ambiguous words
- Do not conflict with other requirements, repeat requirements or provide reasoning for requirements
- Use discretionary words judiciously

Complete

- Follow the AASHTO five-part format
  - Description
  - Materials
  - Construction Requirements
  - Method of Measurement
  - Basis of Payment
- Use AASHTO as a Checklist
- Avoid developing new specs using cut & paste methods from other specs. Break down the older spec into its essential elements, and then develop the new spec from those essential elements

Correct

- Do the research to be technically correct
- Use abbreviations correctly
- Write units of measure correctly
- Follow rules for writing numbers
- Use words in text and symbols in tables
- Be grammatically correct, including punctuation, capitalization, spelling and grammar

Consistent

- Apply the previous four Cs consistently to avoid ambiguity from one spec to another
- Use a style guide when writing specifications; one is available on the FDOT website
- Specs must be consistently enforced to be effective. Get feedback from field personnel on reasons for non-enforcement and use it for updates and corrections

How Many Types of Specs??

Materials & Methods Specifications:

- Also called ***method specs, recipe specs or prescriptive specs***, they direct the Contractor to use specified materials in definite proportions and specific types of equipment and methods to place the material. Each step is witnessed or inspected by the owner.
- The owner should get exactly what he ordered.
- Tends to obligate the owner to accept the completed work, regardless of quality.

How Many Types of Specs??

End Result Specifications:

- Specs that require the Contractor to take the entire responsibility for a product or item of work. The owner is obligated to accept or reject the work based only on the end result.
- Sometimes include price adjustments related to degree of quality.
- Contractor has great flexibility and can innovate.
- The owner may get something very different from what he envisioned.

How Many Types of Specs??

Statistically Based Specifications:

- Also called ***statistical specs or statistically oriented specs,*** they are based on random sampling in which properties of the desired product or construction are described in terms of appropriate, measurable statistical parameters.

How Many Types of Specs??

Adjustable Payment Specifications:

- Also called ***incentive-disincentive specs,*** these specs make provisions for positive and/or negative pay adjustments which reflect changes in the worth of the product resulting from departures in the level of quality acceptance measurements.
- Contractors normally work very hard to earn Incentives.
- Example - FDOT pavement smoothness specs.

How Many Types of Specs??

Performance Specifications:

- Specs that describe how the finished product should perform over time, typically described in terms of physical condition of the product in relation to a definition of failure.
- Warranty specs are a form of performance specs.
- Developing measurable acceptance criteria truly indicative of long term performance is tough.
- In my opinion, can be the hardest specs to write.
- Must sometimes specify what is NOT acceptable.

How Many Types of Specs??

Performance Modeled Specifications:

- Specs based on attributes related to performance of the finished product through quantitative relationships, or models, that have been validated for specific materials and climactic conditions anticipated.
- Heavily dependent on computer prediction model.
- Inflexible for changes such as variability in available material sources.
- Must be calibrated to differing conditions.

How Many Types of Specs??

Performance Based Specifications:

- Specs that describe desired levels of fundamental engineering properties (e.g., modulus, creep, fatigue) that are predictors of performance and appear in primary prediction performance relationships that can be modeled to predict performance over time.
- For the most part, such properties are not amenable to timely acceptance testing.
- These specs are very model dependent as well.

How Many Types of Specs??

Performance Related Specifications:

- Specs describe desired levels of materials and construction factors correlated to fundamental engineering properties (e.g., modulus, creep, fatigue) that are predictors of performance.
- Aimed to field measure properties that are more amenable to timely acceptance testing.
- Often tied to payment adjustments for individual parameters.
- These specs are very model dependent as well.

Classifying Highway Construction Specs

- Who is Primarily Responsible for Quality?
  - Method (Owner); End Result (Contractor)
- What Type of Sampling?
  - 100% Sampling; Representative (Statistics, Models, Predicted Performance)
- What is Relationship Between Quality Criteria and Constructed Performance?
  - Method (Intuitive); End Result (Predicted Performance)

Checklist for End Result Specs

1. Can you adequately describe product or service performance?
2. Is the performance requirement objective or subjective?
3. Is the performance requirement measurable?
4. Can tolerances be applied to the performance requirement?
5. Is the value of performance quantifiable, for I/D clauses?
6. Are the factors contributing to performance within the control of the Contractor?
7. Clear performance measures? Who? When? Where? How?
8. Provisions for contractor quality management systems?
9. Are there provisions to resolve disputes clearly and concisely?
10. Method spec clauses removed to maximum practical extent?

Checklist for Eliminating Method Specs

1. Is it essential to safety?
2. Is it mandated by statutes, laws, ordinances or regulations?
3. Is it essential for convenience to the public?
4. Is providing the instruction essential to get the desired result?
5. Is it essential for quality assurance?
6. Is it essential for certification or permanent documentation?
7. Is the desired result measurable in the finished product?
8. Will elimination lead to much higher inspection & testing costs?
9. Is the ultimate desired result clear to the Contractor?
10. Is it required to match existing work or for a functional system interface?

Method Specs vs. End Results

- Historically, FDOT Has Used Method Specs
- Contractor Quality Control (CQC) Specs Were a Move Toward End Results
- Warranty Specs Have Been an Additional Move in that Direction

Method Specs vs. End Results

- Use End Result Specs Whenever Possible
- Don't Try to Tell the Contractor "How" to Perform the Work
- Designers are Responsible for Specifying "What" is to be Built (Their Strength); Let the Contractors use their Knowledge and Resources to Decide "How" to Build It (Their Strength)

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Time For
Questions (and Answers)!!