

**Chapter Four**  
**CONTRACT DOCUMENTS**

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## Chapter Four

# CONTRACT DOCUMENTS

In addition to preparing clear and concise construction plans, as described in [Chapters Three, Ten, Seventeen, Twenty-three and Thirty-five](#), the designer is responsible for compiling an accurate estimate of the project construction quantities, preparing any special provisions and providing a cost estimate with the construction plans. Chapter Four provides information on preparing quantities, special provisions and cost estimates for traffic design projects. The designer should note that, for projects with roadway elements (i.e., Geometrics and Safety projects), Chapter Five of the MDT Road Design Manual presents guidelines for determining roadway quantities.

### 4.1 QUANTITY ESTIMATES

#### 4.1.1 Guidelines for Preparing Quantity Summaries

When preparing quantity summaries, the designer should consider the following guidelines:

1. Specifications. Cross check all items against the Standard Specifications and the Supplemental Specifications to ensure that the appropriate pay items, methods of measurement and bases of payment are used.
2. Computations. For the preliminary summaries, prepare a separate computation sheet for each item used on the project. Include all computation sheets in the project work file.
3. Rounding. The quantity of any item provided in the summaries should check exactly with the figure provided on the computation sheets. Indicate any rounding of the estimated figures on the computation sheets. Unless stated otherwise, do not round the calculations until the value is incorporated into the summary frames.
4. Significant Digits. Calculation of quantities should reflect the implied correspondence between the accuracy of the data and the given number of digits. In all calculations, retain the number of significant digits such that accuracy is neither sacrificed nor exaggerated. Use the following rules to determine the appropriate number of significant digits:

- a. Number of Digits. Any digit that is necessary to define the specific value or quantity is considered significant. When measured to the nearest 1 ft, a distance may be recorded as 157 ft; this number has three significant digits. If the measurement had been made to the nearest 0.1 ft, the distance may have been 157.4 ft; this number has four significant digits.

Zero may be used either to indicate a specific value, like any other digit, or to indicate the order of magnitude of a number. The area of sheet aluminum shown on a set of plans, rounded to thousands, was 12 000 ft<sup>2</sup>. The two left-hand digits of this number are significant; each measures a value. The three right-hand digits are zeros which merely indicate the order of magnitude of the number rounded to the nearest thousand. The identification of significant digits is only possible through knowledge of the circumstances. For example, the number 1000 may be rounded from 965, in which case only one zero is significant, or it may be rounded from 999.7, in which case all three zeros are significant.

- b. Addition and Subtraction. When adding and subtracting quantities, the answer should not contain significant digits further to the right than occurs in the least precise number. The following illustrates this rule:

Consider the addition of three numbers drawn from three sources, the first of which reported data in millions, the second in thousands, and the third in single units:

$$\begin{array}{r} 163\,000\,000 \\ 217\,885\,000 \\ \underline{95\,432\,768} \\ 477\,317\,768 \end{array}$$

The total should be rounded to 477 000 000.

- c. Multiplication and Division. The product or quotient for multiplication and division calculations should not contain any more significant digits further to the right than occurs in the least precise number. The following illustrates this rule:

Multiplication:

$$113.2 \times 1.43 = 161.876; \text{ round to } 161.9$$

Division:

$$113.2 \div 1.43 = 79.16; \text{ round to } 79.2$$

5. Multiple Estimates. Estimating splits are used for gathering costs for billing FHWA and local governments, as well as providing cost information for counties, financial districts and cost-benefit analysis. There are two types of project splits — a hard split, which is a detailed separation of quantities, and a soft split, which splits the final costs using a ratio based on the major cost items on a project. The following will apply:

a. Hard Splits. Hard splits are required for the following:

- safety activities (STPHS funding) for cost-benefit analysis;
- new bridge structures (split by structure no.) for Federal requirements;
- local government involvement for precise billing to local governments;
- projects that cross reservation boundaries for participation considerations;
- phase of work (PE, RW, IC, CE, CN, other) for Federal requirements; and
- projects that cross financial districts for secondary funds.

Show the quantity subtotals in the plan summaries for all hard splits. If more than one hard split applies to a specific item, show subtotals for the split that encompasses the greatest quantity of that item. Provide station callouts on the plan sheets at the locations of the hard splits.

b. Soft Splits. Quantity subtotals are not required for soft splits. Station callouts are also not required on the plan sheets. The ratio for the soft split will be provided to Fiscal Program Section for their use in determining the actual costs for the various splits upon completion of the project. Soft splits are used for the following:

- portions of the project that are in different counties,
- major and minor bridge rehabilitation,
- projects that are inside and outside of an urbanized boundary,

- where the functional classification of the route changes within the project limits, and
- the improvement type changes within the project limits.

To determine the ratio for a soft split, calculate the cost of major items on a project. These typically include surfacing (e.g., plant mix and base, seal and cover), grading (including unclassified borrow), major structures (excluding bridges) and lump sum items. The ratio is then determined based on the cost in each portion of the project.

Include the split ratio in the transmittal memo when the project is submitted to the Contract Plans Bureau. The Contracts Plans Bureau will submit this information to Fiscal Program Section. If the soft splits are required due to bridge rehabilitation, the soft splits need to be identified by NBI number for the total bridge costs, not the project costs.

6. Preliminary Cost Estimate. Only use the total values from the summary frames to develop the Preliminary Cost Estimate. Most items described in the plans that will be included in the cost estimate should be shown in the summaries except as noted below:
  - a. Some items are State furnished and contractor installed. There is an item number for installation and an item number for the material cost. Both of these items need to be shown in the cost estimate. The installation item shows up on the summaries but the material cost item does not.
  - b. Some small items (e.g., radios) only have a material cost because they are State furnished and installed. Show the material cost in the cost estimate. Do not include the installation item in the summaries for an item the State installs.

[Section 4.3](#) provides Department criteria for preparing construction cost estimates. The Preliminary Cost Estimate is used by the Board of Review and Contract Plans Bureau in their preparation of the final Engineer's Estimate.

#### **4.1.2 Computer Estimates**

If practical, the computer (GEOPAK) should be used to develop the quantity estimates for most items. However, some quantities may need to be calculated manually. For small projects, it may be more efficient to manually calculate the quantities for all elements.

The designer should review GEOPAK's instruction manuals to determine how to properly use the software for estimating purposes. GEOPAK can generate most, but not all, project quantities. Give special consideration to how the design is prepared on the computer (e.g., cell names, levels, processing procedures) to allow the software to determine the quantities. Contact the MDT CADD Coordinator or the section lead CADD operator for assistance with GEOPAK.

#### **4.1.3 Units of Measurement**

Report quantity estimates in the summary frames for all contract bid items consistent with the terms and units of measurement presented in the Standard Specifications, Supplemental Specifications or Special Provisions. Show the values determined from the computations in the summary frames. [Figure 4.1A](#) illustrates typical rounding criteria that should be used on the Summary Sheets. Note that certain elements are rounded based on standard manufacturer sizes. Unless stated elsewhere in this Chapter, calculate quantities to the nearest unit as shown in [Figure 4.1A](#).

#### **4.1.4 Item Codes**

Each item used for measurement and payment in construction is identified by a 9-digit number with a title and description. These numbers are used by the Department's Construction Management System for tracking the project through construction. Note that the first three digits of the item number are coordinated with the Standard Specifications. For example, Item #606010030 "Guard Rail-Steel" is referenced to Section 606 "Guardrail, and Median Barrier Rail" of the Standard Specifications.

The Contract Plans Bureau is responsible for numbering and naming the various items used in construction. The designer should contact the Contract Plans Bureau to obtain a copy of the official item list. Only use the official name and description in contract plans. Submit all proposed changes and additions to this list to the Contract Plans Bureau.

#### **4.1.5 Lump-Sum Items**

Only use lump-sum bid items where the scope of the work for the item is clearly defined, and the amount of work has a minimal chance of changing during construction. Lump sum measurements may be considered where the end result is defined but there are various methods of achieving the desired results. Including an item of work in another item should only be done where the scope of the work for both is clearly defined and the chance of the quantity of either item changing is minimal. Wherever practical, list the

quantities of the separate items that will be included in the lump-sum item. The list should note that the separate “quantities are for estimating purposes only.” Provide a clear definition of work for each item whether it will be bid by the unit, included in the cost of other items or bid lump sum. Where there is a significant chance of quantity changes, the work must be bid by the unit. Where lump-sum items are used, the total quantity for the project should always equal one. If more than one item or location is included in the lump sum, show the decimal proportion of the work of each location.

Item	Measured Unit	Rounding Criteria
<b>Signing and Delineation Quantities</b>		
Signs-Sheet Aluminum-Reflective Sheeting	square foot, ft <sup>2</sup> square meter, m <sup>2</sup>	0.1
Signs-Aluminum Sheet-Increment Sheeting	square foot, ft <sup>2</sup> square meter, m <sup>2</sup>	0.1
Overlay-Sheet Aluminum	square foot, ft <sup>2</sup> square meter, m <sup>2</sup>	0.1
Posts-Steel "U"	pound, lb kilogram, kg	0.1
Poles-Treated Timber-Barn	2 foot increment, ft 0.6 meter increment, m	2.0 0.6
Posts-Tubular Steel (round)	pound, lb kilogram, kg	0.1
Posts-Tubular Steel (square perforated)	pound, lb kilogram, kg	0.1
Posts-Structural Steel	pound, lb kilogram, kg	0.1
Overhead Structure-Metal-Cantilever	each, ea	1
Overhead Structure-Metal-Bridge	each, ea	1
Delineator	each, ea	1
Remove Signs	each, ea	1
Reset Signs	each, ea	1
Frangible Sign Post Breakaway Device	each, ea	1
Square Tubular Slipbase Breakaway Device	each, ea	1
Remove Signs (Guide)	each, ea	1
Reset Signs (Guide)	each, ea	1
Barricade	linear foot, ft meter, m	1
Historic Marker	each, ea	1
Remove & Reuse Historic Marker	each, ea	1
Snowpoles	each, ea	1
Poles-Treated Timber - Class 3	5 foot increment, ft 1.5 meter increment, m	5 1.5
Delineator - Flexible-Surface Mount	each, ea	1
Delineator - Flexible-Driveable	each, ea	1
Reset Delineators	each, ea	1

**SUMMARY FRAMES ROUNDING CRITERIA**

**Figure 4.1A**

Item	Measured Unit	Rounding Criteria
Reset Reference Posts	each, ea	1
<b>Pavement Marking Quantities</b>		
Paint	gallons, gal liter, L	1
Epoxy	gallons, gal liter, L	1
Pavement Striping (plastic)	linear foot, ft meter, m	1
Words and Symbols (plastic)	square foot, ft <sup>2</sup> square meter, m <sup>2</sup>	0.1
Painted Curb Markings	gallons, gal liter, L	1
Temporary Pavement Markings	mile, mi kilometer, km	0.1
Remove Pavement Markings	linear foot, ft meter, m	1
Remove Pavement Markings	square foot, ft <sup>2</sup> square meter, m <sup>2</sup>	1
<b>Traffic Signal Quantities</b>		
Foundation-Concrete	cubic yard, yd <sup>3</sup> cubic meter, m <sup>3</sup>	0.1
Conduit-Steel	linear foot, ft meter, m	1 0.1
Conduit-Plastic	linear foot, ft meter, m	1 0.1
Pull Box	each, ea	1
Cable-Copper (number, size)	linear foot, ft meter, m	1 0.1
Conductor-Copper (size)	linear foot, ft meter, m	1 0.1
Luminaire Assembly	each, ea	1
Service and Control Assembly	each, ea	1
Traffic Signal Head (Size)	each, ea	1
Pedestrian Signal Head	each, ea	1
Controller (type)	each, ea	1

**SUMMARY FRAMES ROUNDING CRITERIA**

(Continued)

**Figure 4.1A**

Item	Measured Unit	Rounding Criteria
Signal Standard (type)	each, ea	1
Detector Loop	each, ea	1
Detector/Loop Shielded Cable	linear foot, ft meter, m	1 0.1
Push Button/Pedestrian	each, ea	1
Treated Timber Poles	5 foot increment, ft 1.5 meter, increment, m	5 1.5
<b>Lighting Quantities</b>		
Foundation-Concrete	cubic foot, ft <sup>3</sup> cubic meter, m <sup>3</sup>	0.1
Conduit-Steel	linear foot, ft meter, m	1 0.1
Conduit-Plastic	linear foot, ft meter, m	1 0.1
Pull Box	each, ea	1
Cable-Copper	linear foot, ft meter, m	1 0.1
Conductor-Copper	linear foot, ft meter, m	1 0.1
Standard (type)	each, ea	1
Luminaire Assembly (type)	each, ea	1
Service and Control Assembly	each, ea	1
Photoelectric Control	each, ea	1
Treated Timber Poles	5 foot increment, ft 1.5 meter increment, m	5 1.5
<b>New Metal Guardrail Quantities</b>		
New Metal Guardrail	12.5 foot increment, ft 3.81 meter increment, m	12.5 3.81
Remove Guardrail	linear foot, ft meter, m	0.1 0.01
Intersecting Roadway Transition - Unit	Guardrail-Stl Int Rdwy Term Sect	0.1 0.01
Intersecting Roadway Transition End Anchor	each, ea	1
Bridge Approach Section	unit	1
New End Anchor	each, ea	1

**SUMMARY FRAMES ROUNDING CRITERIA**

(Continued)

**Figure 4.1A**



## 4.2 SPECIFICATIONS/SPECIAL PROVISIONS/DETAILED DRAWINGS

In addition to the construction plans, contractors, material suppliers and Department personnel assigned to supervise and inspect the construction of the project use the Standard Specifications for Road and Bridge Construction (Standard Specifications), Supplemental Specifications, Special Provisions and the MDT Detailed Drawings to assist them in the project design and construction. The Montana Public Works Specifications may also be used, particularly for urban projects and projects involving water lines and sanitary sewers. The following Sections describe the purpose of these other documents and how to prepare Special Provisions.

### 4.2.1 Hierarchy of Importance

The Standard Specifications, Supplemental Specifications, MDT Detailed Drawings, Supplemental Detail Drawings, Special Provisions, Question and Answer Forum, and construction plans all are essential parts of the contract. Except for the construction plans, these documents can be found on the Department's website. They are intended to complement each other and are used to describe and provide complete instructions for the work to be accomplished. If a discrepancy does exist between these documents, the following presents the hierarchy of importance among them:

1. Question and Answer Forum
2. Special Provisions
3. Plans
4. Supplemental Specifications
5. Standard Specifications
6. Supplemental Detailed Drawings
7. MDT Detailed Drawings

A Question and Answer Forum is provided for each project on the Department's website.

### 4.2.2 Specifications

#### 4.2.2.1 Standard Specifications for Road and Bridge Construction

The Standard Specifications for Road and Bridge Construction (Standard Specifications) are the standards adopted by the Department for work methods and materials that are used for construction. The Standard Specifications are intended for general use on all projects. They provide the Department's criteria for:

1. bidding,
2. awarding of the contract,
3. the contractor's duties,
4. controlling the material quality,
5. the contractor and the Department's legal requirements,
6. executing the contract, and
7. measuring and paying for contract items.

The Standard Specifications are published in book form and are typically updated and reprinted every five to seven years. Copies of the Standard Specifications can be obtained from the Contract Plans Bureau or can be found on the Department's website.

All proposed changes to the Standard Specifications must be forwarded to the Contract Plans Bureau for evaluation and action.

#### **4.2.2.2 Supplemental Specifications**

Supplemental Specifications are additions, deletions and/or revisions to the Standard Specifications that have been adopted by the Department since the last printing of the Standard Specifications. The intention is that they will be incorporated into the Standard Specifications at the next revision. As indicated in [Section 4.2.1](#), Supplemental Specifications supersede the Standard Specifications. Complete sets of Supplemental Specifications are added to the contract documents for all projects and are intended for general use.

Supplemental Specifications are typically updated and reprinted in their entirety every two months. Copies of the latest versions can be obtained from the Contract Plans Bureau or the Department's website.

All proposed changes to the Supplemental Specifications must be forwarded to the Contract Plans Bureau for evaluation and action.

#### **4.2.3 Special Provisions**

Special Provisions are additions or revisions to the Standard Specifications and the Supplemental Specifications setting forth conditions and requirements for a special situation on a particular project. Special Provisions are included in the contract documents for that project and are not intended for general use. Special Provisions supersede all other contract documents. They are prepared by the designer for inclusion into the project documents. [Section 4.2.5](#) discusses guidelines for preparing Special Provisions.

Standard Special Provisions are special provisions that are commonly used on many projects. In the Traffic Engineering Section, only the Signing Unit is currently using Standard Special Provisions. This list is routinely updated and sent to the designers and consultants. The designer is responsible for calling out the number and title of the special provisions that are referenced in the plans. The designer should not send the text of the Standard Special Provisions unless it contains revisions. If there are revisions, the revisions should be indicated in bold. The designer must ensure that they are applicable for the particular project before their inclusion in the contract document. The Electrical Unit is responsible for including their special provisions with the contract documents.

#### **4.2.4 MDT Detailed Drawings**

The MDT Detailed Drawings provide details on various design elements that are consistent from project to project (e.g., guardrail, sign posts). They provide information on how to layout or construct the various design elements. The MDT Detailed Drawings are provided on the Department's website.

Note that the first three numbers of the detailed drawing number is coordinated with the Standard Specifications. For example, Detailed Drawing #606-05 "Metal Guardrail" is referenced to Section 606 "Guardrail and Median Barrier Rail" in the Standard Specifications.

Hard copies of the MDT Detailed Drawings can be obtained from the Contract Plans Bureau. In addition, all drawings are provided on the Department's CADD system. Users can review the drawings on the Department's website. However, the designer will be unable to make changes to these files. The drawings are updated by the Contract Plans Bureau on an as-needed basis. All proposed changes to the MDT Detailed Drawings must be forwarded to the Contract Plans Bureau for evaluation and action.

Supplemental Detailed Drawings are updates to the MDT Detailed Drawings.

#### **4.2.5 Special Provision Preparation**

Special provisions are required whenever a project contains work, material, sequence of operations, or any other requirements that are necessary for the completion of the project but are not "described completely" in the construction plans, Standard Specifications, Supplemental Specifications, the MDT Detailed Drawings or the Supplemental Detailed Drawings. "Described completely" should be interpreted to mean that the prospective bidder will be able to clearly understand the work to be

accomplished, type of materials or equipment required, construction methods or details to be used, how the item of work will be measured and the basis of payment. The following sections provide guidelines for preparing special provisions.

#### **4.2.5.1 Preparation Steps**

Do not prepare special provisions using the “cut-and-paste” method. Instead, the designer should use the following steps when preparing a special provision:

1. Define Need. Review existing specifications, detailed drawings or construction plans to ensure that there is a need for the special provision. If the topic is not adequately covered in one of the other contract documents, only then should a special provision be prepared.
2. Research. Research the topic so that complete and detailed information is available before writing the special provision. This may require contacting manufacturers, contractors or suppliers for the latest information. Local conditions and problems should also be fully investigated.
3. Format. Prepare special provisions in the same manner as the Standard Specifications. [Section 4.2.5.2](#) presents the format that should be used.
4. Type. Analyze the type of construction to be covered in the special provision to determine the type of special provision to be used. There are two basic types of special provision presentations — material or method presentation, and performance or end-result presentation. The material or method presentation describes the procedure or materials that should be used to construct the element. The performance presentation describes the end result of construction. The types of procedures and materials to achieve the end result are at the contractor’s discretion. Only use one or the other form of presentation. In general, the performance specification is preferred over the material or method specification.
5. Develop Outline. The outline should cover the basic requirements of the work to be completed or the materials to be used. It should define the essential physical characteristics of the material or work (e.g., dimensional limitations, time, strength, weight, size, shape, configuration). Organize all relevant factors under each appropriate heading.
6. Writing the Special Provision. Once the outline has been developed and all research has been completed, the first draft can then be prepared. The designer

may want to review existing Special Provisions for guidance. The following presents several grammatical recommendations for preparing special provisions:

- a. **Wording.** Write the special provision in the active voice (sentence begins with a verb) and the imperative mood (sentence expresses a command).

Active Voice: "Apply tack coat on existing pavement."

Passive Voice: "Tack coat shall be applied to existing pavement."

- b. **Sentences.** Prepare the special provision using simple language and words. Keep words and sentences short (20 words or less), unless complexity is unavoidable.
  - c. **Paragraphs.** Limit paragraphs to 3 to 4 sentences.
  - d. **Terminology.** Use words consistent with their exact meaning. Use the same word throughout; do not use synonyms. Avoid any words that have a dual meaning. [Section 4.2.5.4](#) presents the recommended terminology that should be used. Omit extraneous words and phrases.
  - e. **Pronouns.** Avoid the use of pronouns, even if this results in frequent repetition of nouns.
  - f. **Punctuation.** Carefully consider the punctuation using the minimum number of punctuation marks consistent with the precise meaning of the language. Ensure that there can be no doubt on the meaning of any sentence.
  - g. **Parentheses.** Avoid the use of parentheses ( ). Instead, use commas or rewrite the sentence.
  - h. **Numbers.** It is usually unnecessary to write numbers both in words and figures (e.g., "Use four (4) 1 inch bolts."). Write numbers less than or equal to ten as words. Write numbers higher than ten numerically. When writing dimensions, use numerals (e.g., 5 ft, 3.0 m, 6.5 in). Do not write 2 inches x 4 inches (50 mm x 100 mm), but 2 inches by 4 inches (50 mm by 100 mm). Times and dates should be written numerically. Write fractions as decimals. Decimals less than one should be preceded by the zero (e.g., 0.02 ft).
7. **Reviewing.** The designer should review the previously completed paragraphs as succeeding ones take shape. Where necessary, redraft preceding paragraphs to reflect later thoughts.

The designer should prepare and distribute the preliminary draft of the special provisions for review and comment at the Plan-in-Hand. The designer will be responsible for incorporating the reviewers' comments into the final draft. The final draft will also be distributed for comment at the final plan review.

8. Presentation. Special provisions should be presented as follows:
  - a. Type special provisions that are specific to a project in Microsoft Word. Store these files in a long-term retention file until the project is advertised.
  - b. Type Standard Special Provisions that are modified in Microsoft Word with the changes in bold type and stored in a long-term retention file with the provisions from Item 8a.
  - c. Identify Standard Special Provisions that are used without modification by their title and number.

#### 4.2.5.2 Format

Prepare special provisions in the same format as the Standard Specifications. The sections of the special provision that should be addressed include:

1. Description. Describe the work to be performed, with references to specifications, plans or other special provisions that further define the work. Where necessary or desirable for clarity, describe the relationship of this work item to other work items or other phases of construction.
2. Materials and/or Equipment. Designate the materials and/or equipment to be used in the work item and establish its requirements. Delineate complete specifications of the properties of each material and the method of tests. References may be made to AASHTO, ASTM or other recognized specifications.
3. Construction Details. Describe the sequence of construction operations or the desired end product. Do not mix the two types of presentations as described in [Section 4.2.5.1](#). Where practical, use the performance presentation. This will permit the contractor to use improved equipment and new and advanced ideas in construction methods. Only use the presentation for the sequence of construction operations if it is critical to achieving the desired result. Specify quality control and quality assurance requirements, and specify who is responsible for testing.
4. Method of Measurement. Describe the components of the completed work item that will be measured for payment, the units of measurement and whether

measured in original position, in transporting vehicles or in the completed work. Designate any modifying factors and other requirements needed to establish a definite, measured unit (e.g., disturbed or undisturbed, temperature, waste, etc.).

5. Basis of Payment. Describe the units for which payment will be made, and define the scope of the work covered by the payment.

#### **4.2.5.3 Guidelines**

In addition to [Sections 4.2.5.1](#) and [4.2.5.2](#), the following presents several guidelines the designer should consider when developing special provisions:

1. Completeness. When developing the special provision, ensure that the essentials have been included and that each requirement is definitive and complete. The special provision should not be vague.
2. Clarity. To ensure the special provision is clearly presented, review the following:
  - a. Clearly delineate the method of measurement and payment.
  - b. Make a clear, concise analysis of the job requirements for general conditions, types of construction and quality of workmanship. Do not leave the bidder in doubt, as the contractor, on what will be required.
  - c. Give directions, never suggestions.
  - d. Never assume the engineer or contractor “knows” what is meant.
  - e. Do not use phrases such as “as approved by the engineer,” “at the discretion of the engineer,” or “as directed by the engineer” in place of definite workmanship requirements. These phrases may lead to confusion or misunderstanding. The contractor may not know what the engineer is thinking.
  - f. Avoid conflicting or ambiguous requirements. Every specification should have only one meaning.
  - g. Never conceal difficulties or hazards from the contractor.
3. Conciseness. Write each special provision as concise as practical. When reviewing the special provision, the designer should consider the following suggestions:

- a. Avoid duplications between the special provision and any related contract documents.
  - b. Do not give reasons for a specification requirement.
  - c. Do not provide additional information that is unnecessary for the preparation of bids and the accomplishment of the work.
  - d. Once stated, do not repeat any instruction, requirement, direction or information given elsewhere in the contract documents.
  - e. Do not include mandatory provisions that are required in general by the contract.
  - f. Minimize the use of cross references.
  - g. Write the specification in the positive form (e.g., use “will” instead of “will not”).
4. Correctness. To ensure that the special provision is written correctly, review the following:
- a. Where practical, independently cross-check every factual statement.
  - b. Do not include items that cannot be required or enforced.
  - c. Ensure that the specification does not punish the contractor or supplier.
  - d. Ensure that the specification does not unintentionally exclude an acceptable product, construction method or any equipment.
  - e. Ensure that the provision does not change the basic design of the item.
  - f. Do not specify impossibilities. The practical limits of workmen and materials must be known and recognized.
  - g. Specify standard sizes and patterns wherever practical.
  - h. Avoid personal whims and pet requirements.
  - i. Ensure that the contractor will not be held responsible for the possible inaccuracy of information furnished by the Department.
  - j. Ensure that sufficient attention has been provided to assessing the durability or reliability of the material or procedure discussed. The use of

permanent and recognized standards should be quoted to ensure that the specified performance or characteristics are achieved. If not, completely and accurately define the testing criteria.

- k. Make a careful, critical examination of manufacturers' or trade associations' recommendations, and require supporting evidence before adopting them.
- l. Keep requirements stringent. A strong requirement can be relaxed more economically, when the need arises. Weak specifications cannot be strengthened without increasing cost and generating claims.
- m. Ensure that the provision gives directions that are consistent with the standard practice currently used by the Department.

#### 4.2.5.4 Terminology

1. Abbreviations. Generally, avoid abbreviations. However, they may be used if they are defined and the definitions are consistent with the accepted meanings.
2. Amount, quantity. Use "amount" when writing about money only. When writing about measures of volume, such as m<sup>3</sup>, gallons, etc., use "quantity."
3. And/or. Avoid using "and/or"; instead, use "and" alone, or "or" alone, or "or ... or both." For example, "Unless otherwise specified by the plans or special provisions or both, ..."
4. Any, all. The word "any" implies a choice and may cause confusion. Use the term "all" in place of "any." For example, "Make good all defects."
5. As per. Do not use "as per"; instead, use "as stated," "as shown," "conforming to," or other similar phrases.
6. At the contractor's expense. Do not use the phrase "at the contractor's expense"; instead use, "at no cost to the Department" or "absorbed in the cost of other contract items."
7. Balance, remainder. Use the term "balance" when referring to money. Use "remainder" to describe something or material left over.
8. Coarse, course. Use "coarse" to describe textures and "course" for layers.

9. Conform. Use the word “conform” to refer to dimensions, sizes and fits that must be strictly adhered to (e.g., “cut bolt threads conforming to ASA Standards, Class 2 fit, coarse thread series”). Where a better product is acceptable, use the phrase “meeting the requirements of...”.
10. Contractor. Use the word “contractor” in place of the word “bidder” when writing special provisions for construction. Only use the term “bidder” for proposals.
11. Or equivalent. Use this phrase for only minor parts. The contractor may not know what is truly equivalent before awarded the contract. It is better to clearly specify those things that will be accepted as “equivalent.”
12. Proposal. Do not use the word “proposal” when the word “contract” is intended. Only use the term “proposal” to describe requirements during the bidding process.
13. Resisting, resistant. Do not use “corrosion-resisting,” but instead use, “corrosion-resistant.”
14. Said. Do not use “said pipe,” “said aggregates” but instead, use “this pipe,” “these aggregates.”
15. Same. Do not use “same” to replace a pronoun like “it” or “them” standing alone, such as “connected to same,” “specified for same,” “same will be given consideration,” “conforming to requirements for same.” Rewrite the sentence to clearly describe what is meant.
16. Shall, will. Do not use “shall.” Rewrite the sentence using the active voice. Use “will” to describe actions performed by the Department.
17. Such. Do not end a sentence with the word “such.” “Such” usually means “of this or that kind,” or similar to something stated. Instead, state that which is actually meant, or name the work to be completed or rephrase the sentence.
18. Symbols. Do not use the following symbols when writing special provisions:

<u>Symbol</u>	<u>Write Instead</u>
/	per, or “a”
X°	°F (°C) or degree Fahrenheit (Celsius)
%	percent
+	plus
-	minus
x	by

19. The. Do not eliminate “the” for brevity.
20. Thoroughly. Avoid using the adverb “thoroughly,” as in thoroughly wet, thoroughly dry, thoroughly clean, etc., as it is unenforceable. Preferably, state the value of the intended requirements in percent, dimensions, number of passes, etc.



### 4.3 CONSTRUCTION COST ESTIMATES

Section 4.1 presents the Department's procedures for the preparation of quantity summaries. These quantities are used by the Department and contractors to determine the cost for project construction. This Section provides information on the various traffic cost estimates required during project development and the procedures for developing these estimates.

#### 4.3.1 Project Timing

During project development, several cost estimates are prepared to determine and refine the expected project construction costs. These estimates are used by the Rail, Transit and Planning Division to ensure that sufficient funds are available for construction. The following Sections present the various cost estimates that are prepared during project development and who is responsible for preparing each estimate. Figure 4.3A provides the recommended distribution list for these cost estimates.

##### 4.3.1.1 Project Programming

The District Office is responsible for nominating projects to be included on the Department's Program of Projects. When the District Office submits these nominations, they are also required to submit a rough cost estimate for project construction. This estimate is typically determined using a cost per mile (kilometer) of roadway based on similar, recent projects in the area. Unless they can be reasonably and quickly calculated, individual quantities are typically not used. The various Traffic Engineering Units are generally not involved in this estimate.

##### 4.3.1.2 Road Design Projects

Through various stages of project development, the Traffic Engineering Section will be responsible for providing the Road Design Section with a cost estimate of the various traffic control elements included on a road design project. The Traffic Engineering Units are responsible for providing the following information:

1. Alignment and Grade Review. The Electrical Unit is responsible for providing the road designer with a rough estimate (e.g., cost per intersection) for traffic signals and highway lighting. This estimate is based on similar type projects.

Distribution	Programming Project	Alignment and Grade Review	Project Scope Changes	Plan-in-Hand	Final Review	Designer's Final Estimate
Rail, Transit and Planning Division	X	X	X			X
District Administrator(s)	X	X	X	X	X	X
Engineering Information Management Section	X	X	X	X	X	X
Contract Plans Bureau						X
Statewide Section — (STPS Projects Only)	X	X	X	X	X	X
Urban Planning Section — (Urban Projects Only)			X	X	X	X
Project Files	X	X	X	X	X	X

### COST ESTIMATE DISTRIBUTION

Figure 4.3A

2. Scope-of-Work Report. If an Alignment and Grade Review was not conducted, the Electrical Unit will provide the road designer with a rough estimate for traffic signals and highway lighting. If an estimate was prepared for the Alignment and Grade Review, the Electrical Unit generally will not be required to update the estimate for the Scope-of-Work Report.
3. Plan-in-Hand. At this stage of project development, the traffic designer should have a good estimate for the majority of the project quantities. [Section 4.3.2](#) describes the procedures that should be used to develop the cost estimate based on these project quantities. The applicable Traffic Engineering Units will be responsible for providing the road designer with cost estimates for signing, pavement markings, lighting and traffic signal items.
4. Final Review. The construction cost estimate for the final review will generally only be an update of the cost estimate from the Plan-in-Hand. Where necessary, the applicable Traffic Engineering Unit will provide the road designer with

updated cost estimates for signing, pavement markings, lighting and traffic signals.

5. Project Scope Changes. Whenever the scope of the project changes and includes traffic control devices, the applicable Traffic Engineering Unit will be responsible for determining a new construction cost estimate. Estimates for scope of work changes are typically based on general quantities and engineering judgment.

#### **4.3.1.3 Traffic Engineering Projects**

For Traffic Engineering Section projects, cost estimates are generally provided at following projects stages:

1. Preliminary Field Review Report. The designer is responsible for determining the first detailed construction cost estimate at this stage of project development. Copies of the Road Design Section estimate sheets can be found in the MDT CADD Standards Manual. The designer should not use the initial project estimate developed by the District Office but, instead, should develop a new estimate based on the latest available information. Where applicable, this estimate should be based on the following:
  - a. Grading and Surfacing. The designer should develop a rough estimate of summaries for grading and surfacing. Use the Average Bid Prices to determine the unit prices for the various items.
  - b. Bridges. The designer should contact the Bridge Bureau to determine the estimated cost for bridges within the project limits. These estimates are typically based on the square feet (meters) of bridge surface.
  - c. Traffic Signals and Highway Lighting. The Electrical Unit is responsible for providing a rough estimate (e.g., cost per intersection) for traffic signals and highway lighting. This estimate is based on similar type projects.
  - d. Signing and Pavement Markings. At this project stage, cost estimates are generally not provided for signing and pavement marking quantities.
  - e. Drainage. The designer is responsible for determining the cost for drainage elements on the project. This cost is typically determined assuming a percentage of the grading and surfacing quantities based on similar projects recently completed in the area.

- f. **Other Elements.** The costs for most other elements on the project are determined using a percentage of the total cost for all other elements listed in Comments 1a. through 1e. This percentage is determined using similar projects recently completed in the area.
2. **Scope-of-Work Report.** If a cost estimate was not prepared for the Preliminary Field Review Report, the first construction cost estimate will be developed by the designer for the Scope-of-Work Report. This estimate should be prepared similar to the discussion in Comment #1 for the Preliminary Field Review Report. If an estimate was prepared for the Preliminary Field Review Report, the designer generally will not be required to update the estimate for the Scope-of-Work Report.
3. **Plan-in-Hand.** The designer is responsible for updating the Preliminary Field Review or Scope-of-Work Report construction cost estimate for the Plan-in-Hand. At this stage of project development, the designer should have a good estimate for the majority of the project quantities. [Section 4.3.2](#) describes the procedures that should be used to develop the cost estimate based on these quantities.
4. **Project Scope Changes.** Whenever the scope of the project changes, the designer will be responsible for determining a new construction cost estimate. Estimates for scope of work changes are typically based on general quantities and engineering judgment.

#### **4.3.1.4 Engineer's Estimate**

The Engineer's Estimate is developed by using the final estimates from the various Sections and Bureaus involved with the project. The Contract Plans Bureau will be responsible for collecting and distributing to the Board of Review the various units' final cost estimates. The Board of Review includes representatives from the Construction Program, Road Design Section, Pavement Design Section and Contract Plans Bureau. The Board of Review will review and adjust the major bid item prices as necessary. These items typically may include excavation, aggregate surfacing, plant mix surfacing, asphalt milling, erosion control, mobilization and miscellaneous work. The Contract Plans Bureau will review all other bid prices and prepare the Engineer's Estimate.

#### **4.3.2 Estimating Procedures**

When preparing detailed cost estimates for the Plan-in-Hand or later estimates, the designer should note the following:

1. Funding Splits. Some projects may have two or more funding sources. For example, where a project crosses from urban to rural, it may be funded under separate project codes. For these types of projects, separate cost estimates are required for each funding source based on the quantities within that particular funding source. For additional guidance on funding splits, see [Section 4.1.1](#).
2. Estimate Form. The type of estimating form that should be used will depend on the project type and are discussed below:
  - a. Safety, Geometric and Road Design Projects. The Department has developed two estimating forms to determine the construction cost estimate — a manual form and a computer program. Desirably, the computer program will be used. A copy of this program and instructions on its use are provided in the Safety and Geometric Units, or a copy can be found in the [MDT CADD Standards Manual](#) or from the Department's website. Where manual calculations are used to determine the cost estimate, use the form provided in the [MDT Road Design Manual](#).
  - b. Signing and Electrical Projects. The Department has developed an estimating form to determine the construction cost estimate using an Excel computer program. A copy of this program and instructions on its use are provided in the Signing and Electrical Units. A copy of this form is shown in [Figure 4.3B](#).
3. Quantities. Show all project quantity estimates on the Summary Sheets within the contract plans. The totals from the appropriate summary frames are used in determining the cost estimate. Note that some summary frame totals are added to other frames (e.g., Additional Surfacing Frame totals are added to the Surfacing Frame). Therefore, the designer must be careful not to double count these quantities. Some items may have quantities shown in more than one frame. Combine these quantities when computing the cost estimate.
4. Rough Estimates. In the early project stages, the designer may be required to provide a rough cost estimate for the project. This estimate is typically determined based on similar projects in the area or District and is expressed in general terms (e.g., cost per intersection, cost per mile (kilometer) of roadway).
5. Unit Prices. For later project stages, the designer will generally have detailed quantities for the project. These quantities are placed on the Summary Sheets and the appropriate average bid unit prices on the estimate form. The average bid unit prices are provided by the Contract Plans Bureau twice a year and are



available on the Contractor's System website. The designer should review average bid unit prices and make any necessary adjustments based on engineering judgment. If the project is small, the designer should base the cost estimate on similar recent projects with small quantities in the same project area. For Geometric and Safety Projects, the designer will submit the completed estimate form to the District for its review. The District will incorporate its recommended unit prices on the estimate form. The District's review of similar projects should be used to aid in determining the adjusted unit prices.

6. Inflation Factors. Adjust all estimates by an annual inflation factor. Apply the inflation factor using the following formula:

$$\text{Adjusted Estimate} = (\text{Estimate}) \times (1 + i)^n$$

where:  $i$  = inflation factor (typically 3 percent)

$n$  = the number of years from the time the estimate is prepared to the project ready date.

The inflation factor is provided by the Engineering Information Management Section.

7. Quantity Descriptions. Only use the quantity description as provided in the average bid unit prices for the quantity description on the estimate form.
8. Lump-Sum Items. Desirably, do not use lump-sum items on a project. However, this is not always practical. Where necessary, only use lump-sum bid items where the scope of work for the item is clearly defined and the amount of work has a minimal chance of changing during construction. [Section 4.1.5](#) provides additional information on how to treat lump-sum items. In determining the unit price for lump-sum items, the designer should consider the following:
- a. Mobilization. Estimate mobilization using 10 percent of total roadway construction items (e.g., grading, surfacing, fencing, drainage). This percentage is exclusive of the other design elements that are calculated by other units (e.g., traffic signals, bridge structures).
  - b. Traffic Control. A percentage is used for the preliminary estimates of traffic control until quantities for units of traffic control are established by the District in the final estimate. The final traffic control quantities provided by the District will include separate items for hours of pilot car and hours of flagging. List these items separately on the estimate sheet.

- c. Other Items. Most lump-sum bid items can be divided into individual parts for estimating purposes. For example, overhead sign bridge structures can be divided into the mass of the steel, installation, maintenance of traffic, etc. Once the elements have been segregated, the designer uses engineering judgment to determine the appropriate cost for the lump-sum bid item on the project.
9. Contingencies and Construction Engineering. In developing the detailed cost estimate, assume a cost for construction contingencies and construction engineering costs. Calculate contingencies assuming a percentage of all construction items. The percentage should decrease as the project develops and the quantities become more certain. Use a 15 percent contingency for the initial estimate. Reduce this percentage for the other preliminary estimates and use 5 percent contingency for the final estimate. Do not use contingencies to account for inflation. Calculate construction engineering assuming 10 percent of all construction items, excluding the contingency amount. The Board of Review will set the final contingencies and construction engineering costs.
10. Approval and Distribution. All construction cost estimates prepared by the designer must be submitted through the Traffic Engineer. A final estimate must be included with contract documents when the plans are forwarded to the Contract Plans Bureau. Include copies of all cost estimates in the project files. In addition to the project file, the Geometric and Safety Units should provide a copy to the District Administrator(s).