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ADDIS ABABA UNIVERSITY

**ADDIS ABABA INSTITUTE OF TECHNOLOGY
DEPARTEMENT OF CIVIL ENGINEERING**

**Contract, Specification and Quantity Survey
(CENG 5101)**

**CHAPTER-2
SPECIFICATION**

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(NASIR B.)

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2. SPECIFICATION

2.1. Introduction

- ❑ **Specification** is defined as the *designation* or *statement* by which written instructions are given distinguishing and/or limiting and describing the particular trade of work to be executed.
- ❑ In short Specification is a statement of particular instructions of how to execute some task.
- ❑ In terms of an engineering project a specification contains a detailed written description of the *quality of materials* and *workmanship* necessary to complete the work.
- ❑ In the construction activity therefore, the scope of the work that is described in drawings includes such information as *dimensions, form, or details* while the specifications provide the description of the *qualities of materials* for construction.

2. SPECIFICATION

2.1. Introduction Cont.

- ❑ Information that is best transmitted in **written form** is addressed in the **specification** while that which is best transmitted **graphically** will be addressed in **drawings** where both are so defined as to be **mutually complementary** and understood in conjunction.
- ❑ In other words drawings show **what** is **to be done in graphics form**, specifications show **how** it **is to be done by furnishing written descriptions** to supplement the drawings.
- ❑ Generally, specifications are **written instructions** which supplement the drawing to set forth the **complete technical requirements** of the work.
- ❑ Therefore **drawings** and **specifications** in combination define the project in sufficient detail to enable the carrying out of the works.

2. SPECIFICATION

2.1. Introduction Cont.

- ❑ Drawings and specifications should compliment each other and neither should overlap or duplicate the other.
- ❑ Specifications are devices for organizing the information depicted on the drawings and they are written descriptions of the **legal** and **technical requirements** forming the **contract document**.
- ❑ The main difference b/n specification and drawing is that **drawings** should generally show the following:
 - Dimensions, extents, size, shape, and location of component parts.
 - Location of materials, machineries and fixtures.
 - Interaction of furniture, equipment and space.
 - Schedules of finishes, windows and doors.

2. SPECIFICATION

2.1. Introduction Cont.

- Specifications generally describe the following:
 - Type and quality of materials, equipments, labor or workmanship
 - Methods of fabrication, installation and erection
 - Standards, codes and costs
 - Allowance submittals and substitutions
 - Cost included, insurance and bonds
 - Project record and site facility

2. SPECIFICATION

2.1. Introduction Cont.

- ❑ Specifications are written based on the *prepared design, drawings, general and scientific trends of workmanship, quality expected, equipment involved*, and *materials to be used* for the particular trade of work
- ❑ The specifications should clearly specify:
 - Design and drawing
 - Labor employment
 - Materials to be used
 - Construction method
 - Equipment used
- ❑ Specifications should be *clear, concise*, and *brief description* of what is required to execute the proposed trade of work.

2.SPECIFICATION

2.2. Purpose of Specification

- The purpose of specifications generally include:
 - i. Guide the bidder at the time of tendering to arrive at a reasonable cost for the work.
 - ii. Provide guidance for the execution of the work
 - iii. Guide contractor for the purchase of materials
 - iv. Serve as part of contract document to limit and describe the rights and obligations of each contracting parties.
 - v. Guide the bidder to identify his capacity to execute the work
 - vi. Serve as fabrication and installation guide for temporary and permanent works.
 - vii. Guide the contractor for purchase and/or hiring of equipments.
 - viii. Serve the owner to know what she/he is intended to receive.

2.SPECIFICATION

2.2. Purpose of Specification Cont.

- ❑ The purpose of specifications generally include:
 - ix. Serve for the manufacturers of construction materials, equipments, tools etc. to grade, classify, and improve qualities of their products.
 - x. Indicates method of testing and acceptance of final products.
 - xi. Guide parameters for rejection of non conforming works.
 - xii. Indirectly, the specifications are very much related to the legal considerations, insurance considerations, bidding requirements, alternates and options, rights, obligations and remedial measures for the contracting parties.
- ❑ ***Note: in the events of conflicts between specification and drawings, the specification governs.***
- ❑ A clearly written specification will enable proper quality control and avoid disputes in administering construction projects.

2.SPECIFICATION

2.3.Types of Specifications

- ❑ In general, specifications can be broadly classified into four categories:
 1. **Manufacturer's specification:** Manufactures prepare specification of their product for guidance of their users, which may include property description and installation guide lines.
 2. **Guide specification:** specification prepared by an individual or group of individuals based on manufacturer's specifications, established trends of workmanship, service and laboratory tests and research findings to be used as guide lines for preparation of contract specification.
 3. **Standard specification:** specifications which are intended to be used as reference standard in the construction of a project. The guide specification which has been standardized by recognized authority.

2.SPECIFICATION

2.3.Types of Specifications Cont.

4. ***Contract (Project) Specification***: The specification prepared for a particular project to accompany the drawings and other contract documents.
 - The specifications described above can be prepared following the format which has ***general*** and ***specific*** parts (***General Specification*** and ***Specific Specification***).
 - In the general part of the specification the following items are included:
 - Administrative and Procedural Requirements
 - Scope, definition
 - Reference Organization and Standards

2.SPECIFICATION

2.3.Types of Specifications Cont.

- Project Description, site facilities
 - Submittals and quality assurance
 - Delivery, storage and handling
 - Project records, Insurances other general requirements
- In the specific part of the standard specification the following are included:
- Detailed description of the quality of items to be used
 - Preparatory actions and methods of incorporating the items
- “**Technical Specification and Methods of Measurement for Construction of Buildings**”, of March 1991 is the standard specification which has been used as one of the contract document in our country.

2.SPECIFICATION

2.3.Types of Specifications Cont.

- ❑ In the general requirement part the following items which may be applied to any project and any trade of work are described in general terms
 - ◆ *011 - General*
 - ◆ *012 - Site Description*
 - ◆ *013 - Quality Assurance*
 - ◆ *014 - Project Records*
 - ◆ *015 - Site Facilities*
 - ◆ *016 - Cleaning Up*
- ❑ In the specific part the **different trade of works** (excavation and earth works, concrete works, etc.) are described in details and the method of measurement are given.

2.SPECIFICATION

2.3.Types of Specifications Cont.

- Specification can also be classified as Material and Workmanship Specification and Performance Specification.

I. *Material and Workmanship Specifications*

- This form of specification includes,
 - The description of the scope of the works,
 - The *general and specific requirements* that are necessary for the execution of the work,
 - Material requirements,
 - Construction details, and
 - Method of measurement and payments for completed works.

2.SPECIFICATION

2.3.Types of Specifications Cont.

A. *Material Specifications*

- For some items may focus on the physical and or chemical properties that can also be cross checked by tests.
- For others the performance characteristics may be the governing factors.
- In some cases, a composition of the two types may be also applicable.
- These descriptions generally include;
 - Physical properties, such as strength, durability, hardness, and electricity.
 - Chemical composition
 - Electrical and thermal and acoustical properties
 - Appearance including color, texture, pattern and finishes.

2.SPECIFICATION

2.3.Types of Specifications Cont.

- B. *Workmanship Specifications:*** describes the desired results that need to be achieved in the works which include;
- Specify the desired results as to the quality of workmanship
 - State any detailed construction methods or procedures necessary for the accomplishment of particular purposes.
 - Stipulate any desired limitations or restrictions to be placed on the contractor's methods in the interest of coordination of the work.
 - Give any precautions necessary for the protection of the work or adjacent property.
 - Specify the methods of inspection and tests to which the work is to be subjected

2.SPECIFICATION

2.3.Types of Specifications Cont.

II. Performance Specifications

- Such types of specification, define the performance requirements for machinery and plant operating equipment.
- This allows the advance manufacturer and procurement of such equipment, or the of the standard brands.

2.SPECIFICATION

2.3.Types of Specifications Cont.

- ❑ Specification could be written in several ways, with the prime emphasis given to either the producer company's brand or the performance capacity of the material and so on.
- ❑ Accordingly, there are the following types of technical specifications:

A. *Proprietary Specifications*

- This specifications call for desired materials, producers, systems, and equipment by their trade names and model numbers.
- For detailed descriptions reference should be made on manufacture's specifications.
- They are of two types; *Closed* (sole) and *Open* or equal source.

2.SPECIFICATION

2.3.Types of Specifications Cont.

B. *Performance Specifications*

- Specifications which define products based on desired end results which are performance oriented.
- Most appropriate when new or unusual products or systems are required or when innovation is necessary.
- Describing the problems or condition under which the products or system must operate, and the parameters for the acceptable solutions is difficult and challenging.
- Testing methods and evaluation procedures for defining the required performance must be explicitly specified.

C. *Reference Specifications*

- Specifications which refer to levels of quality established by recognized testing authority or standards set by quality control authority. They are used in conjunction with other types.

2.SPECIFICATION

2.3.Types of Specifications Cont.

D. *Descriptive Specifications*

- Specifications which describe all components of products, their arrangements, and method of assembly, physical and chemical properties, arrangement relationship of parts of numerous other details.
- The specifier shall take total responsibility for the function and performance of the product.

E. *Cash Allowance Specifications*

- Specifications meant to direct bidders to set aside a specified amount of money to be applied to the construction work at the direction of the specifier.

2.SPECIFICATION

2.4. Specification Writing

- ❑ Basically specifications are not to be created; they are prepared based on existing standards, codes, guidelines, and laws.
- ❑ When planning to write specifications one should start first of all with:
 - An **overall analysis of the work** to be done, and
 - The **requirements necessary** to achieve the required level of quality,
 - **Conditions** under which it must be done,
 - **Materials required**, and the
 - **Details** of the construction
- ❑ Hence **preparing an outline** of the details of the work is the first step in writing a good specification.

2.SPECIFICATION

2.4. Specification Writing

- ❑ Specification writing embodies certain methods of presenting information and instructions.
- ❑ When specifications are to be written, the following shall be taken to considerations:
 - a. Specification writing require:
 - i. **Visualization** (Having clear picture of the system)
 - ii. **Research** (to know the legal impact correctly)
 - iii. **Clear thinking** (understanding things directly without misleading)
 - iv. **Organizing** (organizing what we know to write the specification)
 - b. Specification writing **requires professional ability** to read drawings.
 - c. Specification writing **require wide knowledge** of the **construction materials, various levels of workmanship, different construction equipments** and **method of construction** to be employed.

2.SPECIFICATION

2.4. Specification Writing Cont.

- d. Specifications *use simple and clear language* such that it can readily be understood.
- e. Specifications shall be *brief and short* as much as possible (avoid long sentences with out punctuation)
- f. Specifications shall include *all items affecting the cost* of the work.
- g. Specifications *shall be fair* and do not attempt to throw all the risks and responsibilities on one of the parties signing the contract.
- h. Specifications *shall avoid repetition* of information shown on drawings to avoid mistakes and duplication within the specification drawings.
- i. Specification *shall not include inapplicable text* and do not specify the impossible or anything not intended to be enforced.

2.SPECIFICATION

2.4. Specification Writing

References for Specification Writing

- The following are useful references in specification writing:
 - a. *Codes and ordinances of governments*, cities, or municipalities.
E.g. EBCS
 - b. *Standards* prepared by *distinct societies and government agents*.
E.g. ACI standards, ASTM standards, BS, ES.
 - c. *Standards or model specifications* prepared by manufacturers, professional societies, and government bodies.
 - d. *Master Specification* and *previous specifications*.
 - e. *Information or experience* acquired by personal observation and contract with trained or experienced people in the construction industry.

2.SPECIFICATION

2.4. Specification Writing

Specification Language

- The specification writer should present his instructions regarding the particular work under consideration in such a manner that:-
 1. The drawings are more clearly interpreted, not duplicated.
 2. Rights, Obligations, and remedial measures shall be designated without ambiguity or prejudice .
 3. Clearly express the extent of works under consideration therefore, the phraseology used in this regard shall be: -
 - i) Judged by its quality not its length
 - ii) Should be concise and short and written with commonly used words.
 - iii) Punctuations are important but their usage shall be limited to few

2.SPECIFICATION

2.4. Specification Writing

Specification Language Cont.

4. Capitalizing the first letters is mandatory for the following expressions: -
 - a) Parties to the contract; e.g. Employer/Client/Contractor/Engineer
 - b) Space within the building; e.g. Bed Room, Toilet, Living Room
 - c) Contract documents; e.g. Bill of Quantity, Working Drawing, Specification
5. Rights, Obligations, and remedial measures shall be designated without ambiguity or prejudice.
6. Minimize the use of symbols.

2.SPECIFICATION

2.4. Specification Writing

Specification Language Cont.

8. Do not use foot notes, do not underline within a sentence for emphasis
9. Words shall be used as follows:-
 - a) shall in place of must; use “shall” for the duties of the contractor or the consultant to represent the word “must”
 - b) “will” is used for the duties of the employer to represent the word “must”
 - c) Avoid the use of the word “must” and substitute by the word shall to prevent the inference of different degrees of obligation
 - d) Avoid the use of words which have indefinite meanings or limitless and ambiguous in their meanings. For example, any, either, same, similar, etc.

2.SPECIFICATION

2.4. Specification Writing

Specific Guidelines for Specification Writing

- Below are some specific guidelines that one needs to follow when preparing a specification:
 - Be specific and not indefinite
 - Be brief, avoid unnecessary words or phrases
 - Give all the necessary facts
 - Avoid repetition
 - Specify in the positive form
 - Use correct grammar
 - Direct rather than suggest
 - Use short rather than long sentences
 - Do not specify both methods and results
 - Do not specify requirements in conflict with each other
 - Do not justify a requirement

2.SPECIFICATION

2.4. Specification Writing

Specific Guidelines for Specification Writing Cont.

- Avoid sentences that require other than the simplest punctuation.
- Avoid words that are likely to be unknown to the user of the specification (words with more than one meaning)
- Arrange the specification in the order of the execution of the work. E.g. Formwork, concrete mixing, concrete placing, curing, etc..
- Address measurement and payment issue
- Refer only to the principal parties in the contract, Owner, Engineer, Contractor.
- Use “these specifications” rather than “this specifications”. Use the plural.
- Workmanship should be in accordance with....
- Materials should confirm to A reference specification.

2.SPECIFICATION

2.5. Technical Specification and Method of Measurements for Building Project

2.5.1. Substructure

I. Excavation and earth works

a) Site clearance

- ❑ Carbonatious elements are not good in concrete, steel and timber works. In soils under structures even 5% of these elements will damage the structure.
- ❑ Therefore, these materials (including trees, bushes and the top 20 to 30 cm soil), termite hills, any other obstruction, have to be cleared.
- ❑ **A working space of 1m** is required on each side. It is sometimes necessary to prepare separate specification for **obstructions (demolition works)** because reusable items like doors and windows are there.

2.SPECIFICATION

2.5. Technical Specification and Method of Measurements for Building Project

2.5.1. Substructure

b) Excavation (bulk excavation)

- ❑ Excavation to get reduced levels of every structural element below the ground level is called bulk excavation. They are subdivided as follows depending on the subsurface condition.
 - Ordinary soil - with boulders and without boulders and can easily be removed by shovel.
 - Weathered rock - it can be divided easily without blasting
 - Rock- bedded rocks that cannot be dug without blasting (requires using explosives)
- ❑ Note: - Working space for bulk excavation is 25 cm (not used for shallow masonry).
- ❑ Depth of excavation less than 30 cm – measured per m^2 , depth > 30 cm per m^3

2.SPECIFICATION

2.5. Technical Specification and Method of Measurements for Building Project

2.5.1. Substructure

c) Fill/ Embankment

- ❑ Shall be measured in m^3 of net volume to be filled.
- ❑ Fill is required because the reduced level of every structural element above the structure has to be covered.
- ❑ Excavation and embankment should not be added at a time in computing their volume, because their costs are different.
- ❑ The major consideration under embankment is compaction. Compaction is done usually at 20 cm lift thickness. The subdivisions under fill are:
 - **Back fill**: - filling by using the excavated soil but by removing coarse particles.
 - **Borrow fill**: - filling by using fill material from another place when there is shortage of fill or when better quality material is required.

2.SPECIFICATION

2.5. Technical Specification and Method of Measurements for Building Project

2.5.1. Substructure

d) Disposal

- ❑ **Disposal** - cleaning the building area including cart away.

d) Sundry Items

- ❑ application of termite proof solution, providing hard coring, dust blinding, expansion joints, etc are itemized as sundry items; measured in m².
- ❑ Excavation and embankment should not be added at a time in computing their volume, because their costs are different.
- ❑ The major consideration under embankment is compaction. Compaction is done usually at 20 cm lift thickness. The subdivisions under fill are:

2.SPECIFICATION

2.5. Technical Specification and Method of Measurements for Building Project

2.5.1. Substructure

II. Concrete works

a) Concrete

- ❑ **Cast in situ concrete** – formed on site and requires formwork and reinforcement.
 - Cast in situ concrete shall be measured by volume except in ribbed slabs and grouting.
- ❑ **Prefabricated concrete** –fabricated (manufactured) in a factory and brought to the site and joined to make a building. It does not require formwork but needs a special care when connecting the different elements.
- ❑ **Pre-tensioned (Post tensioned) Concrete** –involves in bending up the concrete itself to make it ready for the downward bending due to load

2.SPECIFICATION

2.5. Technical Specification and Method of Measurements for Building Project

2.5.1. Substructure

II. Concrete works

a) Concrete

- ❑ **Concrete ancillaries** - include windowsills, lintels, expansion joints, and permanent and temporary embedded materials. It is measured in ml or enumerated.
- ❑ **Grades of Concrete**
 - C5 - lean concrete, to protect the structural concrete from damage.
 - C15 - for totally supported structural elements
 - C20 - used for slabs; mix proportion is 1:2:4
 - C25 - Commonly used grade of structural Concrete; mix proportion is 1:2:3
 - C30 –Used for chemical stores and nuclear plants

2.SPECIFICATION

2.5. Technical Specification and Method of Measurements for Building Project

2.5.1. Substructure

II. Concrete works

b) Formwork

- ❑ A temporary structural element, which supports slabs, beams in casting concrete. It shall be designed and erected to safely support, vertical and lateral loads that might be applied until such load can be supported by the concrete structure.
- ❑ *Period of removal (minimum):*
 - Vertical formwork to columns, walls and beams: 16 hrs
 - Soffits formwork to slab: 21 days
 - props to cantilever slabs: 14 days
 - Soffits formwork to beams: 21 days
 - Props to cantilever beams: 14 days

2.SPECIFICATION

2.5. Technical Specification and Method of Measurements for Building Project

2.5.1. Substructure

II. Concrete works

c) Reinforcement Bars

- ❑ The type and diameter should be clearly stated and shall be measured in Kg.

III. Masonry Works

- ❑ Masonry works are works that are executed by laying building material units of specified dimension through a binding material such as mortar.
- ❑ Stone obtained from quarries shall be hard and sound, free from vents, cracks, fishers, discoloration or other defects that will adversely affect strength or appearance.

3. QUANTITY SURVEYING

2.5. Technical Specification and Method of Measurements for Building Project

2.5.1. Substructure

III. Masonry Works

- ❑ Stone chips to be produced shall not be less than 450 mm average and 380 mm in individual length. Stone for various masonry works shall be selected and shaped as follows:
 - stone for facing works shall generally be selected for consistency in grain, color and texture ,throughout the work
 - stone for below ground work shall be chiseled from natural stone
- ❑ Stone wall is measured by volume, whereas stone pavement is measured by area, specifying thickness.

For Superstructure work refer “Technical Specification and Methods of Measurement for Construction of Buildings”!!!!

THANK YOU!