AFQTP 3E3X1-14
31 JANUARY 2003

AIR FORCE
QUALIFICATION TRAINING PACKAGE (AFQTP)

FOR

STRUCTURAL
(3E3X1)

MODULE 14

PROJECT PLANNING

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MODULE 14

PROJECT PLANNING

Career Field Education and Training Plan (CFETP) references from 1 August 2002 version.

OPR: HQ AFCESA/CEOF
(SMSgt Dan Sacks)
Supersedes AFQTP 3E3X1-13, 14 Jul 00

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AIR FORCE QUALIFICATION TRAINING PACKAGES

FOR

STRUCTURAL

(3E3X1)

INTRODUCTION

Before starting this AFQTP, **refer to and read the "AFQTP Trainer/Trainee Guide"**

AFQTPs are mandatory and must be completed to fulfill task knowledge requirements on core and diamond tasks for upgrade training. ***It is important for the trainer and trainee to understand*** that an AFQTP ***does not*** replace hands-on training, nor will completion of an AFQTP meet the requirement for core task certification. AFQTPs will be used in conjunction with applicable technical references and hands-on training.

AFQTPs and Certification and Testing (CerTest) must be used as minimum upgrade requirements for Diamond tasks*.*

MANDATORY minimum upgrade requirements:

Core task:
AFQTP completion
Hands-on certification

Diamond task:
AFQTP completion
CerTest completion (80% minimum to pass)

Note: *Trainees will receive hands-on certification training for Diamond Tasks when equipment becomes available either at home station or at a TDY location*.

Put this package to use. Subject matter experts under the direction and guidance of HQ AFCESA/CEOF revised this AFQTP. If you have any recommendations for improving this document, please contact the Structures Career Field Manager at the address below.

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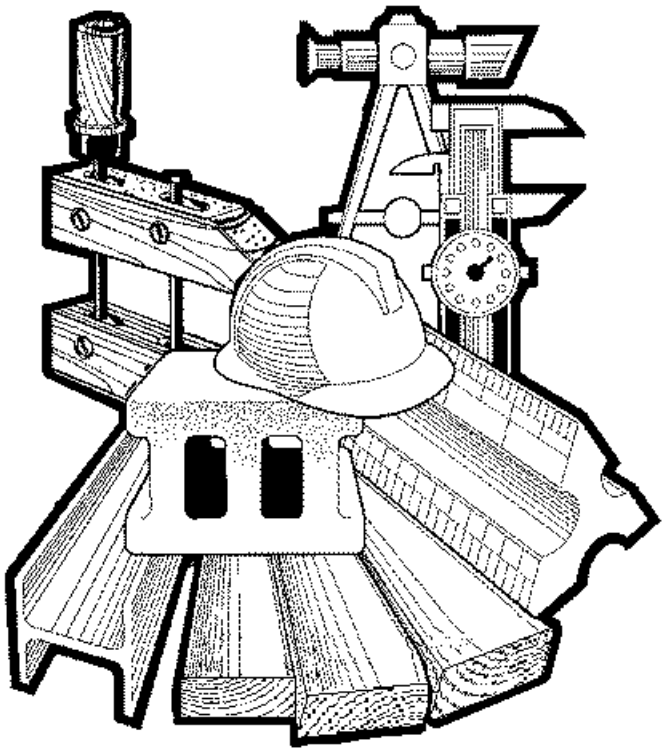
Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.



USE CONSTRUCTION DRAWINGS FOR

MODULE 14 AFQTP UNIT 2

CARPENTRY (14.2.1.)
MASONRY (14.2.2.)
METAL (14.2.3.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

USE CONSTRUCTION DRAWING FOR CARPENTRY

Task Training Guide

STS Reference Number/Title:	14.2.1. - Use construction drawing for carpentry. 14.2.2. - Use construction drawing for masonry. 14.2.3. - Use construction drawing for metal.
Training References:	1. Navy Advancement Training (NAVEDTRA) Course 14043, *Builder 3 & 2, Volume 1.* 2. NAVEDTRA Course 14040; *Blueprint Reading and Sketching.* 3. NAVEDTRA Course 14044; Builder 3 & 2, Volume 2. 4. Commercial Manual, *Modern Carpentry by Willis H. Wagner, 1992*. 5. Commercial Manual, *Modern Masonry by Clois E. Kicklighter, 1991*.
Prerequisites:	1. **Possess as a minimum a 3E351 AFSC**. 2. **Review the following references:** 2.1. NAVEDTRA 14043,Chapter 2; Drawing and Specifications. 2.2. NAVEDTRA 14040, Chapter 7; Structural and Architectural Drawing. 2.3. NAVEDTRA 14044, Chapter 9; Advanced Base Field Structures and Embarkation. 2.4. Modern Carpentry, Chapter 5; *Plans, Specifications, Codes*. 2.5. Modern Masonry, Chapter 9; *Construction Details; Reference Section*.
Equipment/Tools Required:	Complete set of construction drawings, to include one drawing of a PEB (Pre-engineered Building).
Learning Objective:	Trainee will be able to interpret construction drawings, have good working knowledge to identify all basic carpentry, masonry, and metal drawings, symbols, details, and specifications.
Samples of Behavior:	Trainee will demonstrate the knowledge of different types of construction drawings, various symbols, details, and be able to interpret blueprints.
Notes:	
1. This is a 7-level core task. 2. Trainer must develop an exercise scenario based on interpreting construction drawings to validate ability of trainee to meet learning objective and samples of behavior.	

USE CONSTRUCTION DRAWINGS FOR CARPENTRY, MASONRY, AND METAL

1. Background. Construction drawings, commonly known as blueprints, are essential parts of the planning process before beginning any major renovation or new construction project. They provide a complete graphic description of all phases of the construction process. Craftsmen must have a good general knowledge of the different types of construction drawings, symbols, and ultimately how to translate that information into a finished product. It is important for structures personnel to be able to interpret construction drawings, due to deployment tasks. New wartime requirements might expose the structural member to various types of building designs, some for expedient erection. First, we'll cover the various elements of construction drawings.

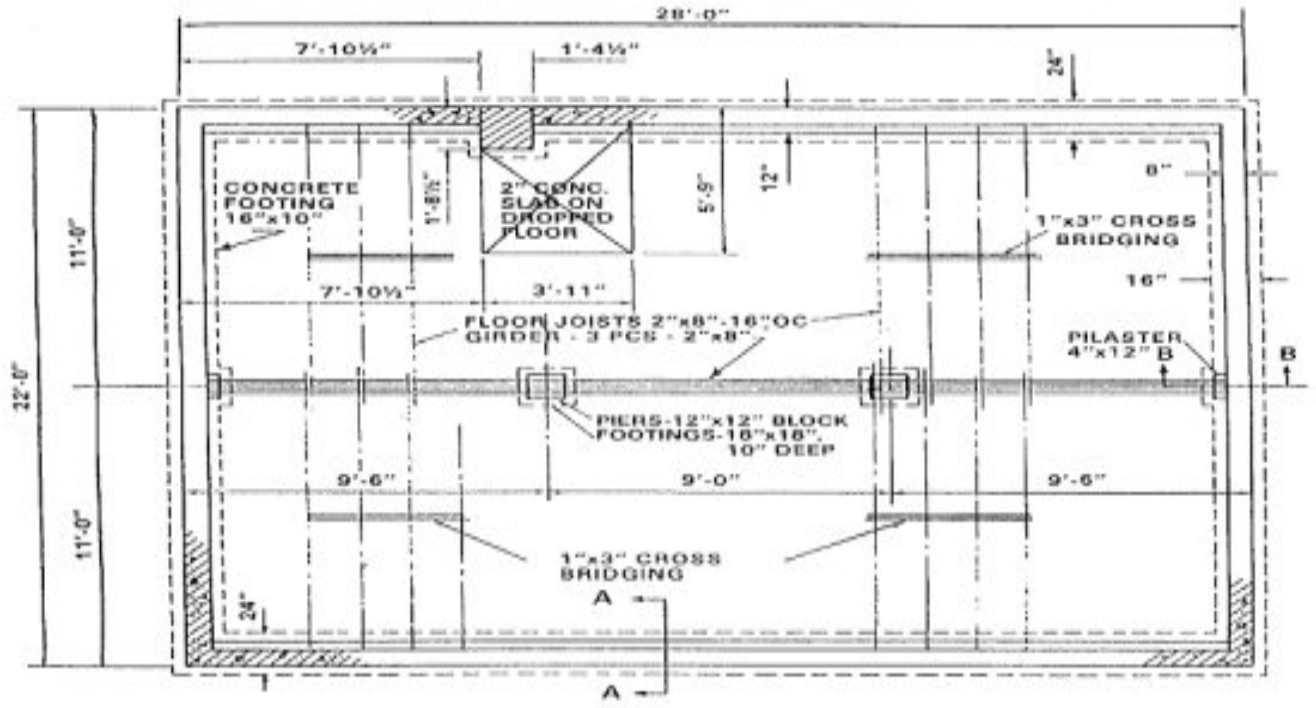
2. Types of Construction Drawings. Construction drawings show the proposed structure from different perspectives. They may include, but are not limited to, site plans, plot plans, foundation plans, floor plans, and elevation plans. For the purpose of this AFQTP, we will concentrate on the carpentry related plans and drawings. The type of drawing is annotated in the title block located on the bottom right corner of the drawing.

2.1. Site Plan. Shows boundaries, existing utilities, landmarks, and the location of the proposed structure.

2.2. Plot Plan. Shows survey marks, elevations, and grading requirements.

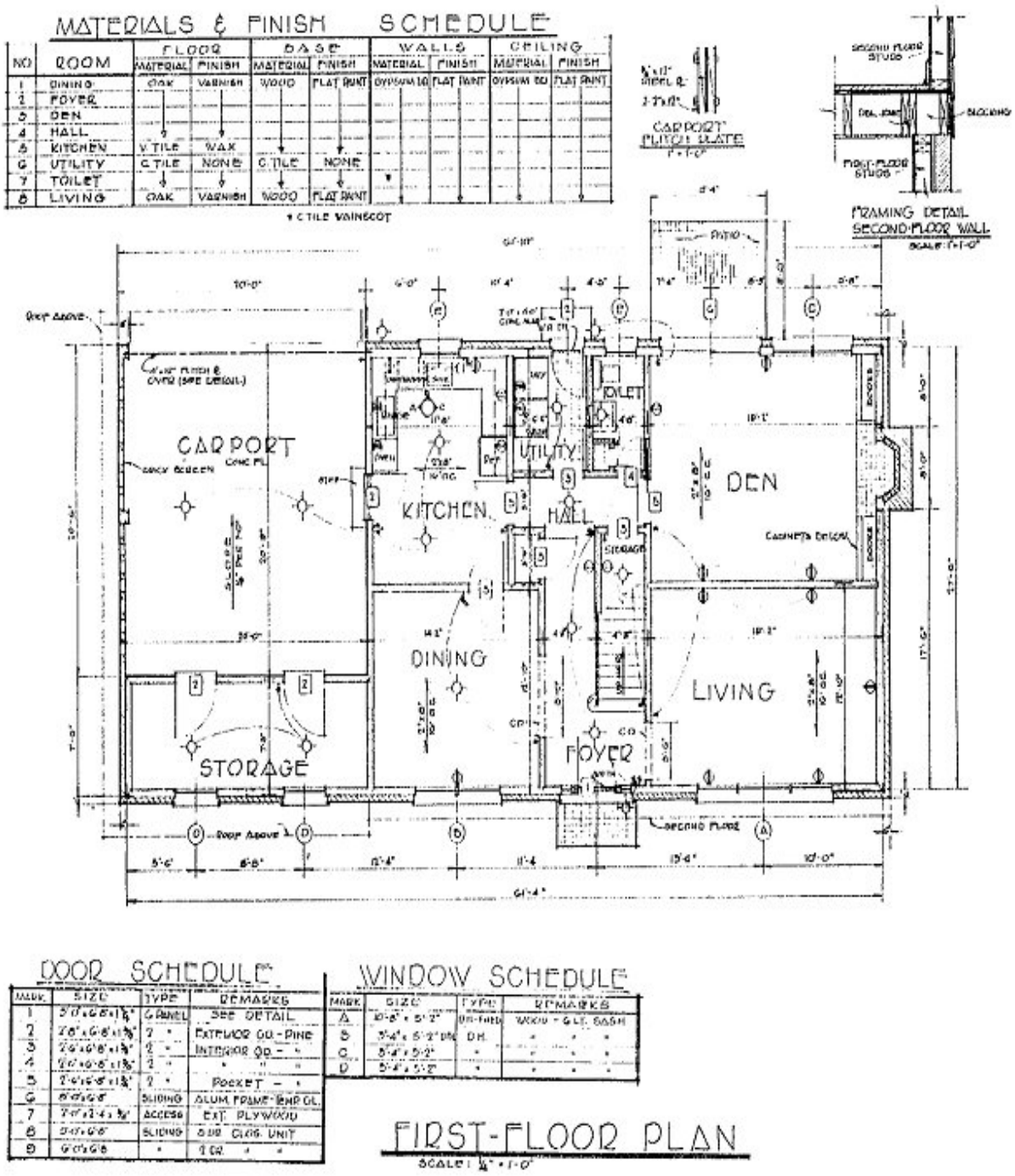
2.3. Foundation Plan. Shows how a foundation is to be constructed (Figure 2-1).

Figure 2-1. Foundation Plan.



2.4. Floor Plan. View as seen from above. This is a key drawing from which the building's walls are laid out. It provides building dimensions, utility placements, interior wall, window, and door locations (Figure 2-2).

Figure 2-2. Floor Plan.



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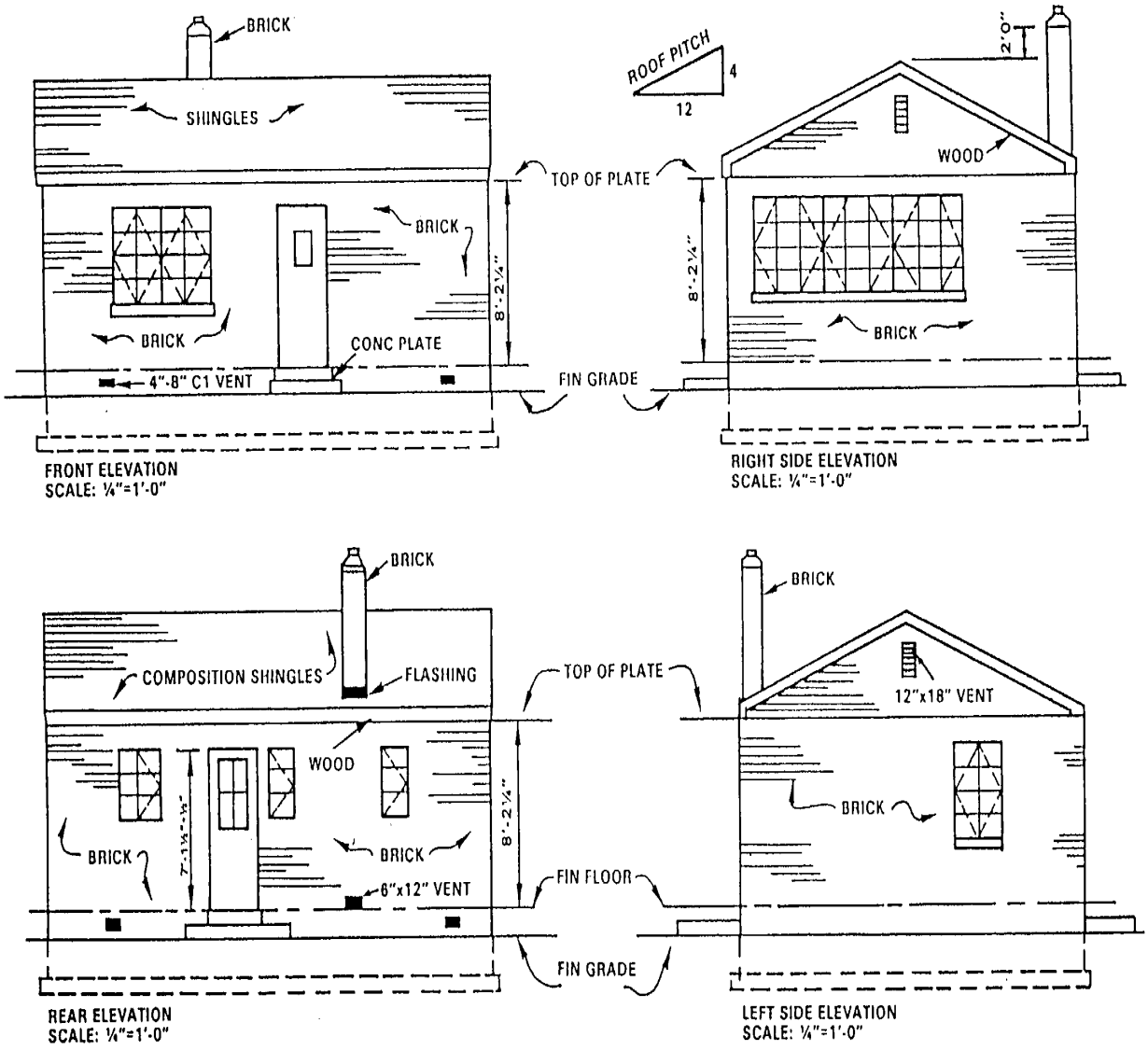
2.5. Elevation View. View as seen from the front, rear, or sides. Elevations show the finished structure as viewed from various side views (Figure 2-3).

Figure 2-3. Elevation View.



2.6. Framing Plan. Viewed from the top. Shows framing and gives dimensions and exact placement of structural framing members.

2.7. Roof Framing Plan. Shows the exact position and spacing of structural members for the roof, as viewed from above. In contrast, the roof plan outlines major elements of the roof such as ridges, valleys, hips, dormers, skylights, and chimneys. In this view, the roof frame is not exposed.

2.8. Specifications. Specifications supplement construction drawings. They explain:

2.8.1. How the work is to be accomplished.

2.8.2. Specific qualities of the materials to be used.

2.8.3. Procedures for doing the work or tasks.

> **NOTE:**
> If the construction drawings and the specifications conflict, the specifications take precedence.

2.9. Detail Drawings. Shows special features of construction that are normally too small to be seen on other drawings.

2.10. Notes. Give additional information or instructions on the drawing.

2.11. Schedules. The three most common schedules are material, door and window, and finish schedules (See Figure 2, Floor Plan).

2.11.1. Material schedules. These schedules list what materials are to be used on floors, walls, and ceilings by room.

2.11.2. Door and Window schedules. These schedules provide sizes, types, composition, and manufacturer of the doors and windows. They are cross-referenced to the floor plan.

2.11.3. Finish schedules. These schedules detail the interior and exterior finish of the structure.

2.12. Common Building Material Symbols include:

2.12.1. Brick.

2.12.2. Glass.

2.12.3. Concrete block.

2.12.4. Metal.

2.12.5. Earth.

2.12.6. Stone.

2.12.7. Wood.

2.12.8. Concrete.

2.13. Door and Window Symbols include:

2.13.1. Doors. On elevation drawings, doors are shown as a realistic representation. They are normally indexed to a door schedule (See Figure 3, Elevation View).

2.13.2. Windows. On elevation drawings, windows are also shown as a realistic representation. They too are normally indexed to a window schedule (See Figure 3, Elevation View).

2.14. Reference Symbols include:

2.14.1. A combination of letters and numbers within various geometric figures, such as circles or triangles.

2.14.2. Letters or numbers within a geometric figure.

3. Two of the most common foundations are the **matt foundation** and the **raft foundation**. Both foundations may be poured as entire units; this is commonly known as a monolithic pour. Resting on the slab, footer, or stem wall will be the concrete block, brick, metal or wooden frame. They are connected to the foundation by various means, which are detailed in the foundation details. Depending on the complexity of the project, numerous detail drawings will show how brick or stone veneer tie into the wall, anchoring requirements, bond beams, etc. Details will specify the laying patterns for concrete masonry units, (CMU) block, brick, or structural clay tile.

3.1. Matt Foundation (Figure 2-4). This type foundation consists of a poured slab with thickened outer edges that connect with the footings.

Figure 2-4. Matt Foundation.

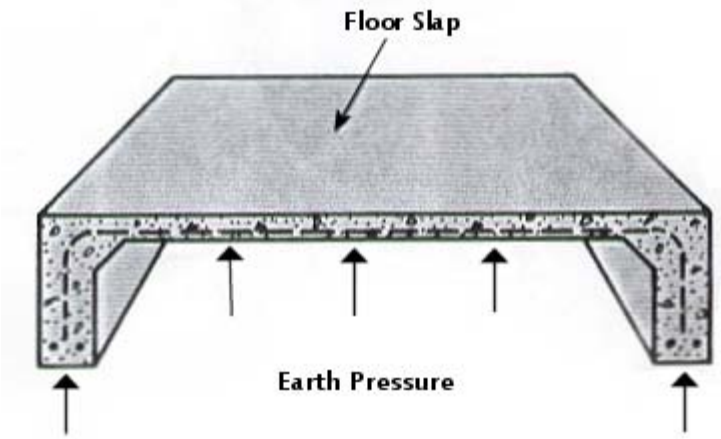
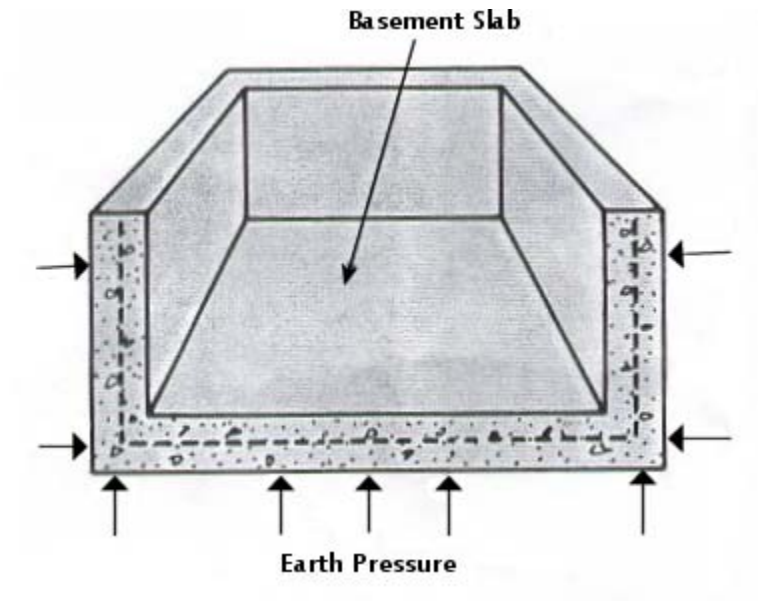


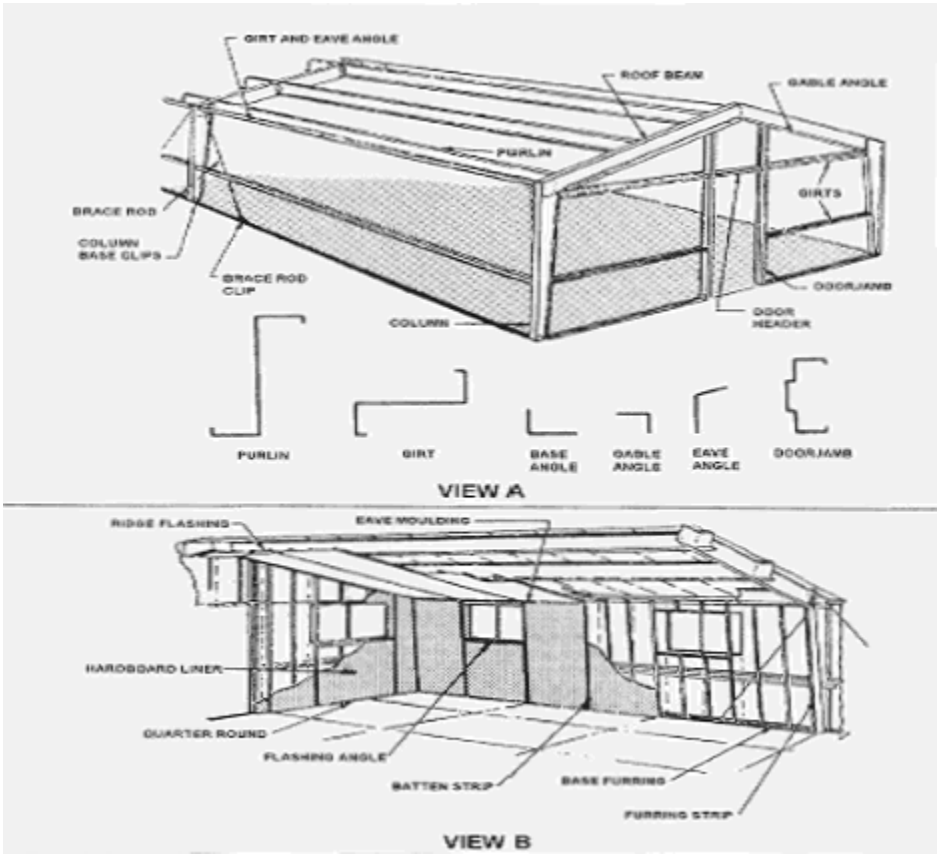
Figure 2-5. Raft Foundation.

3.2. Raft Foundation (Figure 2-5). This foundation is basically an inverted **matt foundation**. There are no footers; the slab equally distributes the weight of the structure. The stem walls along the perimeter of the raft are poured at the same time as the slab.



4. Pre-engineered Building (PEBs). PEBs are commercially designed structures, usually made of metal. Each PEB is shipped as a complete kit and contains all parts and instructions. It's advantage is it can be expediently assembled. This makes it and ideal choice for contingency use. It is made up of many structural members to include: base angle, frame, girts, purlins, brace rods, and panels. Figure 2-6 shows structural members of the exterior and interior of a PEB.

Figure 2-6. Pre-Engineered Building.



4.1. Base angle. Framing member secured to the foundation and supports the bottom of the panels.

4.2. Frame. The frame is erected first and is secured to anchor bolts located in the foundation. This "A" frame is fabricated from metal I-beam material.

4.3. Brace rods. Brace rods are used to square and plumb the building.

4.4. Girts. Horizontal beams that brace the building and supports the installation of panels.

4.5. Purlins. Horizontal beams that provides intermediate support for the common rafters of a roof construction.

4.6. Panels. Framing member that can be corrugated metal, plywood, or OSB used to strengthen the building and provide protection from the elements.

NOTE TO TRAINER/CERTIFIER:

In order for the trainee to complete this task, the trainer must provide the trainee with a full set of construction drawings and a scenario to identify the different site plans and building symbols in a set of drawing. One drawing must be of a pre-engineered building.

5. Procedures. Follow these steps to use construction drawings for carpentry, masonry, and metal:

Step 1: Trainee is provided a full set of construction drawings for carpentry, masonry, and metal.

Step 2: Interpret construction drawings by identifying:

2.1. Site plan.

2.2. Plot plan.

2.3. Floor plan and elevation plan.

2.4. Type of foundation.

2.5. Types of metal parts associated with a PEB.

2.6. Common building symbols.

REVIEW QUESTIONS
FOR
USE CONSTRUCTION DRAWINGS FOR CARPENTRY, MASONRY AND METAL

QUESTION	ANSWER
1. Which plan shows boundaries, existing utilities, landmarks, and the location of the proposed structure?	a. Floor plan. b. Elevation plan. c. Plot plan. d. Site plan.
2. Which plan is the primary plan from which the interior walls are laid out?	a. Floor plan. b. Elevation plan. c. Plot plan. d. Site plan.
3. Which plan is the primary plan from which the footers are laid out?	a. Floor plan. b. Elevation plan. c. Foundation plan. d. Site plan.
4. Which plan is the primary plan from which the concrete block walls are laid out?	a. Floor plan. b. Elevation plan. c. Plot plan. d. Site plan.
5. Specifications provide _____.	a. type of mortar to be used. b. specific qualities of the materials to be used. c. procedures for doing the work or tasks. d. All of the above.
6. Schedules provide _____.	a. specifications on how to build walls. b. details on how to tie columns to the slab. c. listing of doors and windows to be used. d. None of the above.
7. Detail drawings show construction features too small to see on other drawings.	a. True. b. False.
8. If specifications and construction drawings conflict, _____.	a. construction drawings take precedence. b. specifications take precedence. c. ignore the discrepancy. d. specifications and construction drawings never conflict.
9. It is not necessary to consult the construction drawings while performing metal projects?	a. True. b. False.
10. The PEB is excellent to use in contingency environment, because it can be _____.	a. used like a hammer. b. expediently assembled. c. purchased cheaply. d. cut easily with a saw.

USE CONSTRUCTION DRAWINGS FOR CARPENTRY, MASONRY AND METAL

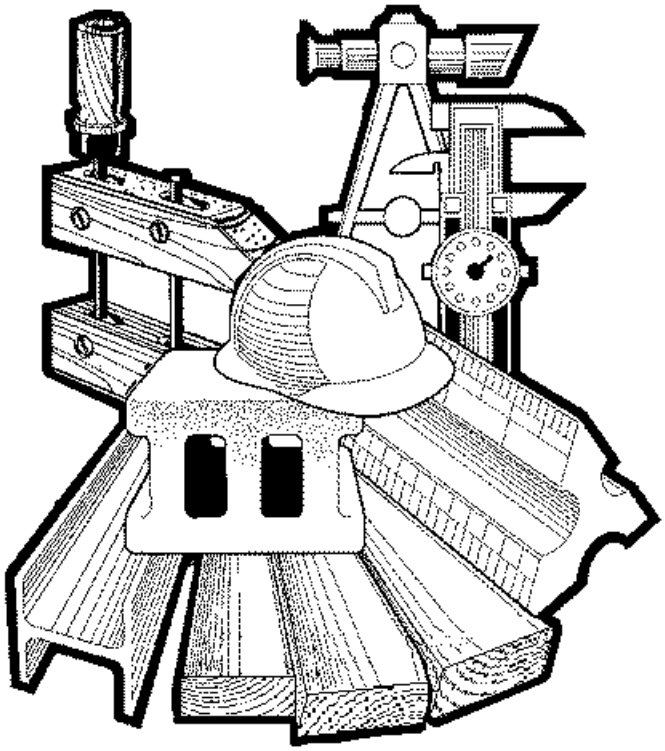
PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE….	YES	NO
1. have a complete set of construction drawing?		
2. correctly identify site plan?		
3. correctly identify the plot plan?		
4. correctly identify the floor plan and elevation plan?		
5. correctly identify the type of foundation?		
6. cross reference symbols on drawings to schedules?		
7. identify the most common building symbols for: (Or find the information in publications.) 7.1. Brick? 7.2. Glass? 7.3. Concrete block? 7.4. Metal? 7.5. Earth? 7.6. Stone? 7.7. Wood? 7.8. Concrete?		

FEEDBACK: Trainer/Certifier should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer/certifier.



IDENTIFY TYPE OF MATERIAL REQUIRED FOR

MODULE 14 AFQTP UNIT 3

CARPENTRY (14.3.1.)
MASONRY (14.3.2.)
METAL (14.3.4.)

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IDENTIFY TYPE OF MATERIAL REQUIRED FOR CARPENTRY, MASONRY, AND METAL

Task Training Guide

STS Reference Number/Title:	14.3.1. - Identify type of material required for carpentry. 14.3.2. - Identify type of material required for masonry. 14.3.4. - Identify type of material required for metal.
Training References:	1. Career Development Course (CDC) Structural Journeyman 3E351C, Volume 1, Unit 2, Section 2-1; *Construction Materials*, and Section 2-2, Lesson 018; *Fasteners*. 2. Navy Advancement Training (NAVEDTRA) Course 14043, *Builder 3 & 2, Volume 1.* 3. NAVEDTRA Course 14044; Builder 3 & 2, Volume 2. 4. Commercial Manual, *Modern Carpentry by Willis H. Wagner, 1992*. 5. Commercial Manual, *Modern Masonry by Clois E. Kicklighter.* 6. Commercial Manual, *Welding Skills by R. T. Miller, 1994*. 7. Commercial Manual, *Modern Metalworking by John R. Walker, 1993.*
Prerequisites:	1. **Possess as a minimum a 3E351 AFSC**. 2. **Review the following references:** 2.1. CDC Structural Journeyman 3E351C, Volume 1, Unit 2, Section 2-1 and 2-2, Lesson 018. 2.2. NAVEDTRA 14043, Chapter 9, *Planning, Estimating, and Scheduling*. 2.3. NAVEDTRA 14044, Chapter 9, *Advanced Base Field Structures, and Embarkation*. 2.4. Modern Carpentry, Unit 1, Building Material. 2.5. Modern Masonry, Unit 1, *Clay Masonry Materials*; Unit 2, *Concrete Masonry Units*; Unit 3, *Stone*; Unit 4, *Mortar*; Unit 5, *Masonry Anchors*, *Ties and Reinforcement*; and the *Reference Section* on page 215. 2.6. Welding Skills, Unit 9, *Heavy Steel Plate*; Unit11, *Aluminum*; Unit 20, *Cast Iron*; Unit 21, *Carbon Steels*; Unit 22, *Alloy Steels*; and Unit 23, *Nonferrous Metals*. 2.7. Modern Metalworking, Chapter 2, *Metals We Use*.
Equipment/Tools Required:	1. Construction drawings. 2. The above named training references, if available.
Learning Objective:	Upon completion of this module trainee should be able to identify the most common building materials, and their application is when appropriate.
Samples of Behavior:	Trainee will recognize basic building materials and their uses.
Notes:	
1. This is a 7-level core task. 2. Trainer must develop an exercise scenario based on identifying carpentry materials to validate the ability of the trainee to meet learning objective and samples of behavior.	

IDENTIFY TYPE OF MATERIAL REQUIRED FOR CARPENTRY, MASONRY, AND METAL

1. Background. Building materials are constantly evolving. The variety and types of building products available today is almost endless. As a member of a structural team, it is important to be able to identify types of materials for use on projects. This will ensure the right material is used for the job. Construction materials are still in the process of evolving. Make every effort to stay current with the latest advances as technology progresses. It is difficult to discuss this subject in the limited segment allotted in this AFQTP. Several excellent reference books are available to learn more about construction materials. For the purpose of this AFQTP, we will concentrate only on the most basic materials.

2. Lumber. Lumber is purchased in nominal sizes as opposed to actual sizes. The difference is partially due to the shrinkage of the wood during the curing process and surfacing. The most common sizes of soft woods available are 1x, 2x, and 4x material. Different sizes can be special ordered, including 6x and 8x material. Hard woods are rarely used in construction as structural lumber due to the cost, weight, and degree of difficulty to work. Hardwoods of large size are used as structural beams. Table 3-1 shows the lumber grading system.

Table 3-1. Lumber Grades and Characteristics.

SELECT LUMBER	
Grade A	This lumber is practically free of defects and blemishes.
Grade B	This lumber contains a few minor blemishes.
Grade C	This lumber contains more numerous and more significant blemishes than grade B. It must be capable of being easily and thoroughly concealed with paint.
Grade D	This lumber contains more numerous and more significant blemishes than grade C, but it is still capable of presenting a satisfactory appearance when painted.
COMMON LUMBER	
No. 1	Sound, tight-knotted stock containing only a few minor defects. Must be suitable for use as watertight lumber.
No. 2	Contains a limited number of significant defects but no knotholes or other serious defects. Must be suitable for use as grain-tight lumber.
No. 3	Contains a few defects that are larger and coarser than those in No. 2 common; for example, occasional knotholes.
No. 4	Low-quality material containing serious defects like knotholes, checks, shakes, and decay.
No. 5	Capable only of holding together under ordinary handling.

3. Wood Panels.

3.1. Plywood. Like lumber, there is a tremendous variety of different types and grades of plywood. These include interior, exterior, forming, marine, and cabinet grades. The primary differences between the classes are the grade of the outer veneers, and the type of glue used to bond the sheets together. Letters, A through D, designates plywood grades see Table 2-2 for a description of each grade. The most commonly used plywood grades in construction are AC and CDX. Figure 3-1 shows a typical back stamp on a sheet of plywood.

Table 2-2. Common Interior and Exterior Grades of Plywood.

INTERIOR GRADE PLYWOOD		
GRADE	**CHARACTERISTICS**	**APPLICATIONS**
A-A	Good veneer on both sides, sanded, very good quality, may have small, neat patches, paints well.	Used for inexpensive cabinets.
A-C	Good veneer on one side, backside has knots, knotholes, and other small defects, sanded.	Used for floor underlayment and concrete forms.
B-C	Select sheathing tight face. Unsanded. A uniform surface, minor surface defect, open splits on front side; back has knots, knotholes, and minor defects.	Used for sub floors. Sheathing, and concrete forms where smooth surface.
EXTERIOR GRADE PLYWOOD		
A-A	Manufactured with waterproof glue. Otherwise same veneer standards as interior A-A standards.	Used when high quality waterproof plywood is required.
A-B	Manufactured with waterproof glue. Otherwise same veneer standards as interior A-B standards.	Used when very good quality waterproof plywood is required.
B-B	Manufactured with waterproof glue. Otherwise same veneer standards as interior B-B standards.	Used extensively for concrete forming.
A-C	Manufactured with waterproof glue. Otherwise same veneer standards as interior A-C standards.	Used when good quality waterproof plywood is required.
C-C	Manufactured with waterproof glue. Otherwise same veneer standards as interior C-C standards.	Used primarily for concrete forming.
CDX	Manufactured with waterproof glue. Otherwise same veneer standards as interior C-D standards.	Used primarily for wall sheathing, roof decking or when perfectly smooth surface is not required.

Figure 3-1. Plywood Typical Back Stamp.

3.2. Particleboard. Particles and chips of wood are mixed with an adhesive and formed under pressure. These boards are used as underlayment for floors. It is extremely warp resistant.

3.3. Waferboard. Larger chips mixed with a waterproof adhesive and formed under pressure. It is mainly used as interior wall sheathing or paneling.

3.4. Oriented Strand Board (OSB). OSB is composed of strands of soft woods. The strands are dried, sorted and mixed with wax and a waterproof exterior-type binder and formed into sheets. In most modern residential and commercial construction, it has replaced plywood for exterior use in walls and roof sheathing.

4. Gypsum Wallboard. Gypsum wallboard is more commonly known as drywall, or by its trade name, Sheetrock. With the advent of drywall, finishing walls with traditional plaster became rare or used mainly in restoration work. This was due to the ease of installation, the excellent finished surface, its fire resistance, and the labor savings. Drywall is available in common thicknesses that range from $^{3}/_{8}$ to $^{5}/_{8}$ of an inch. The most commonly used sheets are 4 foot by 8 foot, and 4 foot by 12 foot. Larger thicknesses and lengths are available by special order, but are rarely used due to difficulty of handling.

5. Masonry Material.

5.1. Portland cement is of course the most basic element of masonry materials. Not all cement is Portland, but it is by far the most common. It is made of powdered limestone, shale, and clay. The five basic types of Portland cement are:

5.1.1. Type I: General-purpose cement. This is used to make concrete for sidewalks, bridges, culverts, and masonry units such as concrete blocks. Reaches full strength in 28 days.

5.1.2. Type II: Generates less heat during hydration than Type I. Used for building large structures. Reaches full strength in 45 days.

5.1.3. Type III: High early strength concrete. Reaches full strength in 7 days or less. Used for cold weather. Not used in pours of less than $2\ ^{1}/_{2}$ feet due to the danger of shrinking or cracking during the high heat produced during hydration.

5.1.4. Type IV: Slowest curing of all concrete. Used in massive concrete structures such as dams. Does not reach full strength for 90 days.

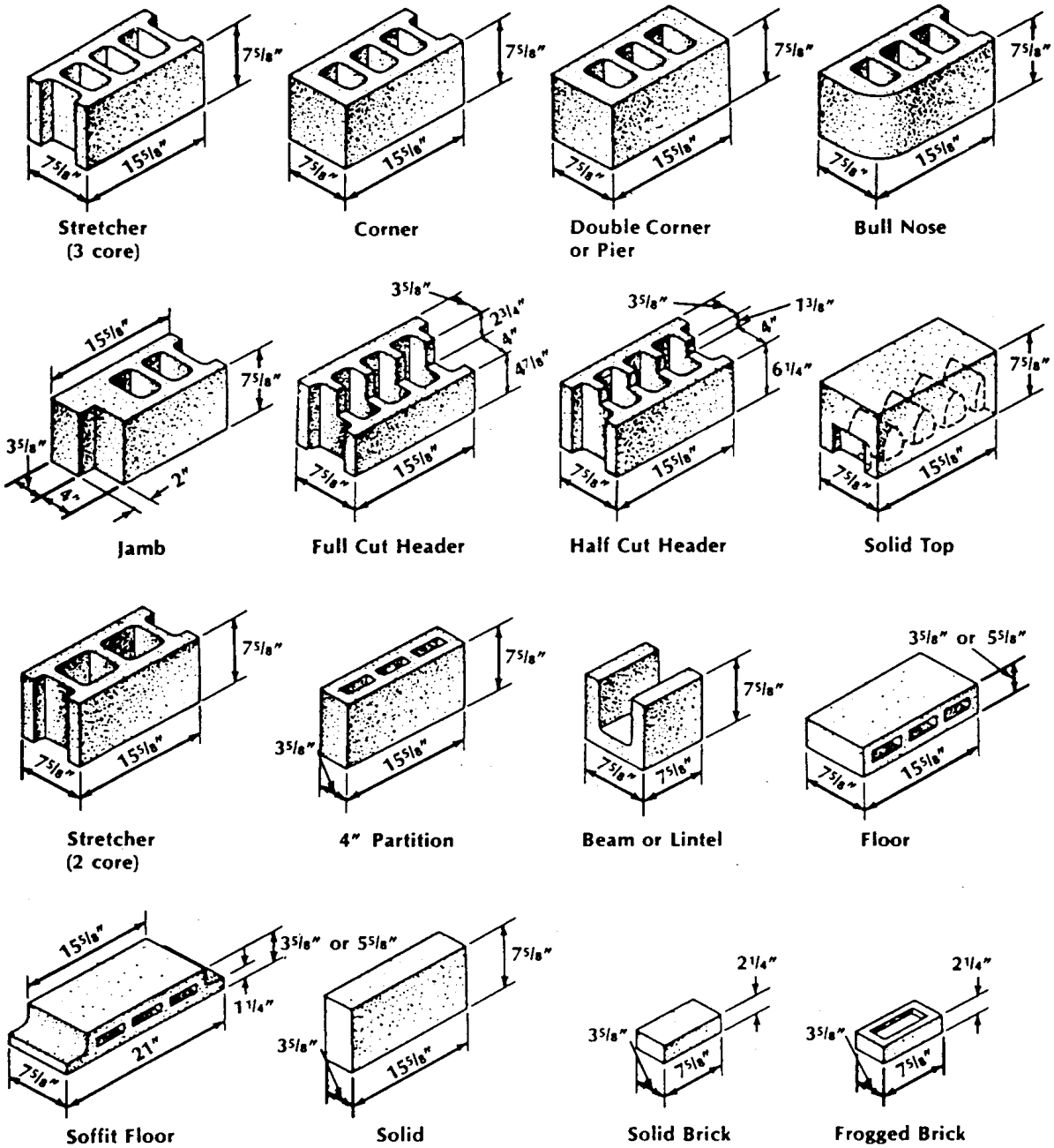
5.1.5. Type V: Sulfate resistant. Used where concrete comes in contact with soil or ground water with high sulfate content. Reaches full strength in 60 days.

5.2. Steel Reinforcement. More commonly known as rebar, these reinforcements provide the necessary tensile strength to concrete. The project engineer will determine their placement, size, and design of rebar. Most rebar is not smooth, but rather deformed, to aid in its mechanical bonding to the concrete. Natural bonding takes place as adhesion and shrinkage of the hydration process takes place. Steel reinforcement is categorized as a bar number. The diameter in inches is expressed as a fraction, by placing the bar number over eight.

Example: #3 bar = $^{3}/_{8}$ inch in diameter #8 bar = $^{8}/_{8}$ or 1 inch in diameter

5.3. Concrete Blocks. Concrete blocks are the basic masonry unit. Blocks can be lightweight or heavy weight. Exterior and load bearing walls need to be constructed of the heavier type for two reasons: support loads and they are less porous and less likely to absorb water. The standard size of a full block is 7-$^{5}/_{8}$ x 7-$^{5}/_{8}$ x 15-$^{5}/_{8}$-inches. With the standard $^{3}/_{8}$-inch mortar joint, it will measure 8 inches high and 16 inches long. There is a wide selection of block sizes, shapes, textures, and colors, as shown in Figure 3-2.

Figure 3-2. Standard Masonry Units.



5.4. Concrete Block Reinforcement. This type will probably be specified in new block construction. Project engineers will determine what reinforcement is required at what locations and spacing. The four basic types of concrete block reinforcement are:

5.4.1. Steel Reinforcement. This type of reinforcement is normally tied to steel projecting through the pad and extends through the cells of the block into the bond beam. Typically all corners of the structure as well as both sides of door and window openings require reinforcement. For non-load bearing use, #3 or #4 rebar is sufficient to reinforce block pony walls.

5.4.2. Tie bars. These bars are used only at intersections of load bearing walls.

5.4.3. Metal Lath or $^{1}/_{4}$ inch Galvanized Hardware Cloth. These two are used to tie together non-load bearing walls.

5.4.4. Block Bond. Block bond resembles a ladder fabricated of hardware fabric used in concrete pad construction. It is placed in the mortar bed every 2 or 3 courses. They provide strength horizontally.

5.5. Brick. Brick types vary widely according to their intended purpose such as: building brick, firebrick, paving brick, or brick veneer. The two standard sizes for brick are 2-1/4 inches high x 3-3/4 inches wide x 8 inches long, and 2-1/4 x 3 inches wide x 8 inches long. The most commonly used types of building brick in the Air Force are the common, face, pressed, and firebrick.

5.5.1. Common Bricks. Common bricks are known by a wide variety of slang terms such as clinker, rough hard, well burned, soft, and stretcher. Hardness varies widely and their shape is slightly irregular. The best common brick is known as a stretcher. They have the most uniform size, hardness, and durability.

5.5.2. Face Bricks. These bricks are a higher grade than common brick. They have uniform hardness, strength, size, color, and texture.

5.5.3. Pressed Brick. Pressed brick may be of almost any type brick, except the dry press at the factory hardens them.

5.5.4. Fire Brick. These bricks are resistant to extreme heat due to special clays they are formed from. They are used in fireplaces, furnaces, and out door BBQ grills.

6. Metal Materials. It is important to be able to identify types of metal. You will be called on to repair and fabricated metal parts. Being able to distinguish between types of metal will allow you to order the right material for the right job. There are many different sheet metal types on the market today. Table 3-3 shows the different shapes of metal commonly used, how they are measured, and how they are purchased. Some common types, sizes, and thicknesses are outlined below.

6.1. Galvanized metal. Most ductwork is made from galvanized metal. It is also used to manufacture gutters and roofing material. It can be purchased in 3 or 4-foot wide sheets that are 8 or 10 feet long or in rolls, depending on the thickness.

6.2. Aluminum. Aluminum is another metal commonly used. It can be ordered in sheets or in rolls depending on the thickness. It can be used for signs and fabrication near salt water to avoid rusting.

6.3. Stainless Steel. This is very hard steel that also comes in sheets or rolls. It is commonly used in kitchens or in hospitals where you need a non-corrosive metal.

6.4. Expanded Metal. This metal can be used for drain covers and many other jobs. It normally comes in 4 x 10-feet sheets.

Table 3-3. Common Shapes of Metals.

SHAPES	LENGTH	HOW MEASURED	HOW PURCHASED
Sheets less than 1/4 inch thick	Up to 12 ft	Thickness x Width x Length	Foot or Piece
Plate more than 1/4 inch thick	Up to 20 ft	Thickness x Width x Length	Foot or Piece
Rod	12 to 20 ft	Diameter	Foot or Piece
Angle iron	Lengths up to 40 ft.	Leg Length x Leg Length x Thickness of Legs	Foot or Piece
Channel	Lengths up to 40 ft.	Depth x Web Thickness x Flange Weight	Foot or Piece

6.5. These are only a few of the metals encountered on the job. It will depend on the specific task and the specifications for that project.

NOTE TO TRAINER/CERTIFIER:
Continue the scenario from Unit 2, have the trainee identify the different types material needed from the construction drawings that was provided.

7. Procedures. Follow these steps to identify types of material required for carpentry, masonry, and metal:

Step 1: Trainee is provided a full set of construction drawings for carpentry, masonry, and metal.

Step 2: Interpret construction drawings by identifying type of material for:

2.1. Carpentry.

2.2. Masonry.

2.3. Metal.

REVIEW QUESTIONS FOR IDENTIFY TYPE OF MATERIAL REQUIRED FOR CARPENTRY, MASONRY AND METAL

QUESTION	ANSWER
1. The most commonly used framing materials are made of _____.	a. white pine. b. yellow pine. c. spruce and fir. d. All of the above.
2. Which grade of interior plywood is used for floor underlayment when a very good quality surface is required?	a. A-C. b. C-C. c. CDX. d. All of the above.
3. Which type of sheathing is primarily used for exterior wall sheathing and roof decking, in modern residential construction?	a. Plywood. b. OSB. c. Masonry board. d. Both a and c.
4. The most commonly used sizes of gypsum wallboard are _____.	a. 4 ft x 8 ft. b. 4 ft x 12 ft. c. Both a and b.
5. Which of these types of cement would be used when the weather is cold?	a. Type V. b. Type I. c. Type III. d. Both a and b.
6. This brick is best known as a stretcher.	a. Face. b. Pressed. c. Common. d. None of the above.
7. Which is the key structural member in constructing a PEB?	a. Frame. b. Brace rods. c. Girts. d. All of the above.
8. What type concrete produces low heat and reaches full strength in 45 days?	a. Type I. b. Type II. c. Type III. d. Type IV.
9. # 5 steel reinforcement is what size (in inches)?	a. $^{1}/_{2}$". b. $^{5}/_{8}$". c. $^{3}/_{4}$". d. $^{7}/_{8}$".
10. Most metal comes in rolls or sheet.	a. True. b. False.
11. Metal ordered in rolls depends on the thickness of the metal.	a. True. b. False.
12. Metal rods can be ordered in pieces up to 40 foot.	a. True. b. False.

IDENTIFY TYPE OF MATERIAL REQUIRED FOR CARPENTRY, MASONRY, AND METAL

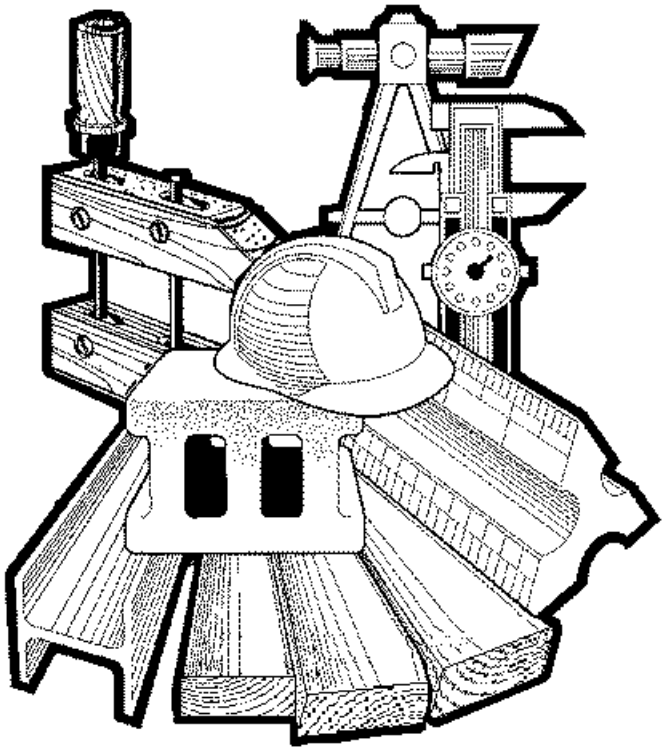
PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE….	YES	NO
1. correctly identify the different sizes of structural lumber?		
2. correctly identify if plywood was needed?		
3. correctly identify the sizes of drywall needed?		
4. correctly identify the types of portland cement and their properties?		
5. correctly identify the types of steel reinforcement used?		
6. identify the standard masonry units?		
7. correctly identify metal components?		

FEEDBACK: Trainer/Certifier should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer/certifier.



ESTABLISH QUANTITY OF MATERIAL REQUIRED FOR:

MODULE 14 **AFQTP UNIT 4**

CARPENTRY (14.4.1.)
MASONRY (14.4.2.)
METAL (14.4.4.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

ESTABLISH QUANTITY OF MATERIAL REQUIRED FOR CARPENTRY, MASONRY, AND METAL

Task Training Guide

STS Reference Number/Title:	14.4.1. - Establish quantity of material required for carpentry. 14.4.2. - Establish quantity of material required for masonry. 14.4.4. - Establish quantity of material required for metal.
Training References:	1. Career Development Course (CDC) Structural Journeyman 3E351C, Volume 2, Unit 4, Section 4-2, Lesson 035; *Estimating Construction Materials.* 2. Navy Advancement Training (NAVEDTRA) Course 14043, *Builder 3 & 2, Volume 1.* 3. NAVEDTRA Course 14044; Builder 3 & 2, Volume 2. 4. NAVEDTRA 14043, 14044, Builders 3 and 2; Volumes 1 & 2; Chapter 1. 5. Commercial Manual, *Modern Carpentry by Willis H. Wagner, 1992*. 6. Commercial Manual, Modern Masonry by Clois Kicklighter.
Prerequisites:	1. **Possess as a minimum a 3E351 AFSC**. 2. **Review the following references:** 2.1. CDC Structural Journeyman 3E351C, Volume 2, Unit 4, Section 4-2, Lesson 035. 2.2. NAVEDTRA 14043, Chapter 9, *Planning, Estimating, and Scheduling.* 2.3. Modern Carpentry, Unit 1, **Building Materials**; Unit 6, *Footings and Foundations*; Unit 7, *Floor Framing*; Unit 8, *Wall and Ceiling Framing*; Unit 9, *Roof Framing*; and Unit 15, *Finish Flooring*. 2.4. Modern Masonry, Unit 7, *Concrete Fundamentals* and Unit 11, *Mathematics for Masonry Trades*.
Equipment/Tools Required:	1. Tape measure. 2. Calculator. 3. Complete set of construction drawings.
Learning Objective:	Trainee will be able to calculate the amount of materials required for carpentry, masonry, and metal projects.
Samples of Behavior:	Trainee will demonstrate a basic knowledge of formulas, waste factors, etc., for estimating materials for carpentry, masonry, and metal projects.
Notes:	
1. This is a 7-level core task. 2. Trainer must develop an exercise scenario based on establishing the quantity of carpentry materials to validate the ability of the trainee to meet learning objective and samples of behavior.	

ESTABLISH QUANTITY OF MATERIAL REQUIRED FOR CARPENTRY, MASONRY, AND METAL

1. Background. Planning projects are not exclusive to the Planning Section in CE. Chances are you will be asked to plan projects that range from a simple job order to a complex work order. It is the responsibility of the craftsman to check all materials received and to ensure the proper quantities are on hand. This will prevent job stoppages and loss of time. When estimating materials, be as accurate as possible. Excessive material wastes government money, while material shortages cause job stoppages.

2. Establish Quantity of Material Required for Carpentry. Trainees should familiarize themselves with the basic formulas for estimating carpentry materials. These include the following:

2.1. Estimating Ceiling Area for Drywall. Simply multiply the room's length by its width. Divide the total square feet by 32 and add 5 percent to find the total number of sheets.

Formula: $\frac{Length \times Width}{32} + 5\%$

2.2. Estimating Ceiling Tile. Simply multiply the room width by its length to determine the area. Next, divide the square footage by the square footage of one tile. One 2' x 2' and one 2' x 4' tile would be 4 square feet or 8 square feet respectively. Add 5% for waste.

Formula: $\left[\left(\frac{Length \times Width}{4 \text{ or } 8}\right)\right] + 5\% = total\ amount\ of\ tiles\ required$

2.3. Estimating Floor Tile. Start by finding the area to be covered by multiplying the room's width by length. For 12" floor tile, the total square footage to be covered will equal the number of tile required. Then add 10% for waste. For 9" floor tile, multiply the total square footage to be covered by 1.77. This formula plus 10% allowance for waste will give you the total number of tiles required.

Formula: *12-inch tile: Length x Width + 10%*
9-inch tile: Length x Width x 1.77 + 10%

2.4. Estimating Board Feet. Lumber is procured in board feet. When calculating board feet, remember to use the nominal measurement, not the actual measurement. Multiply the width by the thickness (in inches), by the length in feet. Divide that sum by 12 to get the total number of board feet.

Formula: $\frac{Length \times Width \times Thickness}{12}$

2.5. Estimating Wall Studs. To determine the number of wall studs required, spaced 16 inches on center (O/C), find the total length of all exterior walls and interior partition walls. Next, multiply that by $^3/_4$ (.75). Add one additional stud. For each corner post, partition, or opening (such as a door or window), add two more studs. When walls are specified with 24-inch on center, use the same formula as above, except multiply by $^1/_2$ (.50) instead of $^3/_4$.

Formula: *16 Inches O/C.: Wall Length x .75 + 1*
24 Inches O/C.: Wall Length x .50 + 1

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

2.6. Estimating Plates. Calculate linear feet for all walls. Multiply the total by 3 (1 sole plate and a double top plate) and add 10%.

Formula: [*(Length of walls) x 3***] +** ***10%***

2.7. Estimating Roofing Felt. Measure the roof's length and width and then multiply to get the square footage. (If parapet walls are used, include their square footage also). Deduct the square footage of any roof opening, only if it is over 100 sq. ft. See chart below for recommended deductions for roof openings. Divide the total square footage by 100 to get the total number of squares. One square is 100 square feet. Although roofing felt normally comes in a 200 square foot roll (2 squares), it may be ordered by the square. Take the total square footage to be covered and divide it by 200 to get the total number of rolls required.

Formula: $\frac{(\text{Length x Width + Parapets}) - (\text{roof openings over 100 sq. ft.})}{100}$ = number of squares

number of squares / 2 = number of rolls

For roof openings of:	Deduct
Less than 100 sq. ft.	0
100 sq. ft. to 500 sq. ft.	½ the opening area
Over 500 sq. ft.	the entire opening area

2.8. Estimating Built-Up Roofs. Determine the total square footage by the same method used above. Multiply that by the number of plies specified. To estimate asphalt or bitumen requirements consult with manufacturers specifications**.**

Formula: [*(Length x Width + Parapets) minus roof openings over 100 sq. ft.] x number of plies specified.*

2.9. Estimating Roof Shingles. See formula in 2.9.2. Include all cornice and eave overhangs. For a common gable roof multiply the length by the width and multiply that product by 2 (two sides of the roof).

2.9.1. To estimate roof square footage from the ground requires considerably more calculations. Using this method multiply the structures length by its width. Add eave and cornice overhangs on both sides. This is the area of a flat roof. Next an allowance must be added for the pitch of the roof. Use the following formulas to determine the allowance:

ROOF SLOPE	ALLOWANCE
3 / 12	Add 3 %
4 / 12	Add 5 $^1/_2$ %
5 / 12	Add 8 $^1/_2$ %
6 / 12	Add 12 %
8 / 12	Add 20 %

2.9.2. Divide the total square footage by 100 (1 square), add 10% for waste. This will give you the total number of squares required. It is obviously more difficult to calculate by starting with the structures base measurements. Remember, it takes 3 bundles of shingles to make 1 square.

Formula from the roof: $\frac{[(\textit{One side of the Roof Length x Width}) \times 2]}{100} + 10\%$

Formula from the ground:

$\frac{[(\textit{Length + eave and cornice overhang}) \times \textit{Width}] + \textit{pitch allowance}}{100} + 10\ \%$

NOTE:
This AFQTP covers only the major material requirements for the tasks listed above. Don't forget all other essential materials to finish the project. Consult applicable Training References to find all material requirements.

3. Estimating Masonry Material. To be proficient, structural personnel must be able to take measurements and perform some basic mathematical calculations. Mistakes can mean, either an insufficient amount of materials, or an overage of materials. For most jobs, add 5% to calculate for waste and spillage. One critical point to remember, keep your units consistent throughout the entire process. All measurements must be converted into feet, when estimating for concrete.

3.1. Estimating Concrete. Concrete is estimated in cubic yards and is a fairly simple process. First, determine the area in feet, to be covered. Multiply by the desired thickness**.** Thickness must be computed, by the decimal equivalent. The decimal equivalents are listed in Figure 1. Once those dimensions have been determined, divide their product by 27 (because there are 27 cubic feet in a cubic yard of concrete). Add 5% for waste.

Concrete Thickness	Decimal Equivalent
4 inches	.33
6 inches	.50
8 inches	.75

Formula: $\frac{\textit{Length x Width x Thickness}}{27} = \textit{cubic yards}$

Example: *Concrete Pad: 17' long 14' wide 4" deep (pad thickness)*

Cubic yards = $\frac{17 \times 14 \times .33}{}$

Cubic yards = (238 x .33)=78.54 sq. ft

Cubic yards = $\frac{78.54}{27}$ *= 2.908 cu yd. + 5% for waste*

Total cubic yards = 2.908 + 5%

Therefore you would order 3 cubic yards of concrete.

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

3.2. Estimating Brick. Determine the dimensions of the proposed walls to be built. To find total area, multiply the width by the height. To determine the total number of bricks, multiply the total square feet by 7. Add 5% for breakage. If the wall is of double thickness, multiply your total by 2.

Formula: *total number of brick =(width x height x 7) + 5%*

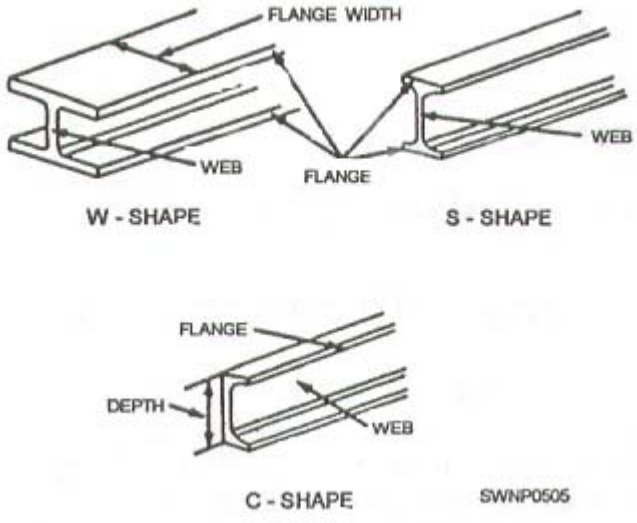
3.3. Estimating Concrete Blocks. As with brick, first determine the area to be covered. Then multiply the area by .889. (One 8" x 16" block covers just under one square foot). Add an additional 10% for cut pieces and breakage.

Formula: *total number of block = (width x height x .889) + 10%*

4. Estimating for Metal Material. Metal is used more and more in construction of building it can be employed to substitute for wood studs, be used to fabricate duct systems, doors, and to provide structural support to a structure.

4.1. Metal Structural Members. Many types of metals can be used as structural members. S shaped beams are known as American Standard I-beam. Engineered I-beams are used to provide strength in buildings. PEBs use I-beams to make the frame. These are measured in size and thickness, but estimated by length. See Figure 4-1 for the different shapes.

Figure 4-1. Structural Shapes.



4.2. Duct Systems. For estimating a duct system project, get measurements for all ducts. To do this, make a scale drawing of the job.

4.2.1. After determining the measurements for the ducts, multiply the width by 2, and the height by 2, and that should give you the overall measurements for your duct. Remember to add for your seams. A sheet of metal comes in 3 ft and 4 ft widths and can be 8 ft to 10 ft in length. To limit amount of waste, use the correct size sheet metal for the job and plan for hangers, drives, and S-slips. If more metal is needed for drives and slips, order another sheet.

4.2.2. The size of the supply and return registers are on the blueprints. Always make sure that the right size is ordered to insure proper airflow is achieved in the building.

4.2.3. After the material list has been built, double-check the list once more, using the blueprints to ensure that all of the materials have been covered.

NOTE TO TRAINER/CERTIFIER:
Continue the scenario from Unit 2 and 3, have the trainee identify the quantity of the material needed from the construction drawings that was provided.

5. Procedures. Follow these steps to establish quantity of materials:

Step 1: Trainee is provided a full set of construction drawings for carpentry, masonry, and metal.

Step 2: Interpret construction drawings by estimating material requirements for:

2.1. Carpentry.

2.2. Masonry.

2.3. Metal.

REVIEW QUESTIONS
FOR
ESTABLISH QUANTITY OF MATERIAL REQUIRED FOR CARPENTRY, MASONRY, AND METAL

QUESTION	ANSWER
1. When estimating the amount of drywall required to cover the entire room the first step is to _____.	a. Determine what size sheets will be used. b. Measure the door and window openings. c. Add 5 % for waste. d. Calculate wall and ceiling square footage.
2. Given a 16 x 32 ft. room, how many 2" x 2" drop ceiling tiles are required?	a. 115. b. 118. c. 125. d. 128.
3. How many cubic yards of concrete, including the waste allowance, are required for a 12'x 12' x 4" pad? Round off to the next higher whole number.	a. 22. b. 23. c. 2. d. 3.
4. What is the formula for estimating board **4.1.** feet?	a. Multiply the width by the thickness by the length in inches divided by 27. b. Multiply the width by the thickness in inches by the length in feet divided by 27. c. Multiply the width by the thickness in inches by the length in feet divided by 12. d. Multiply the width by the thickness by the length in inches divided by 12.
5. How many wall studs, 16" on center are required to build a 24-foot partition wall with a door?	a. 18. b. 19. c. 21. d. 22.
6. How many linear feet of top and sole plates are required to construct a 24-foot partition wall with a door?	a. 24. b. 48. c. 72. d. 96.
7. What is the formula for estimating concrete blocks?	a. (Width x Height) x7. b. (Width x Height) divided by 7. c. (Width x Height) x .889 + 10%. d. (Width x Height) divided by .889 + 10%.
8. The formula for estimating material requirements for a built up roof is: Total area + parapets minus roof openings over 100 sq. ft. X _____.	a. Number of plies specified. b. Type of plies specified. c. Both a and b. d. None of the above.

REVIEW QUESTIONS (CONTINUED)

QUESTION	ANSWER
9. I-beams are Manufacturer specifications must be consulted to determine asphalt or bitumen requirements.	a. True. b. False.
10. How many squares of shingles are required to cover a 2400 sq. ft. roof, excluding waste? How many bundles of shingles excluding the waste allowance?	a. 15 squares / 45 bundles. b. 18 squares / 54 bundles. c. 20 squares / 60 bundles. d. 24 squares/ 80 bundles.
11. What is the manufactured size of a sheet of metal?	a. 4 x 8. b. 4 x 10. c. 3 x 8. d. 3 x 10. e. e. All the above.

ESTABLISH TYPE OF MATERIAL REQUIRED FOR CARPENTRY, MASONRY, AND METAL

PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

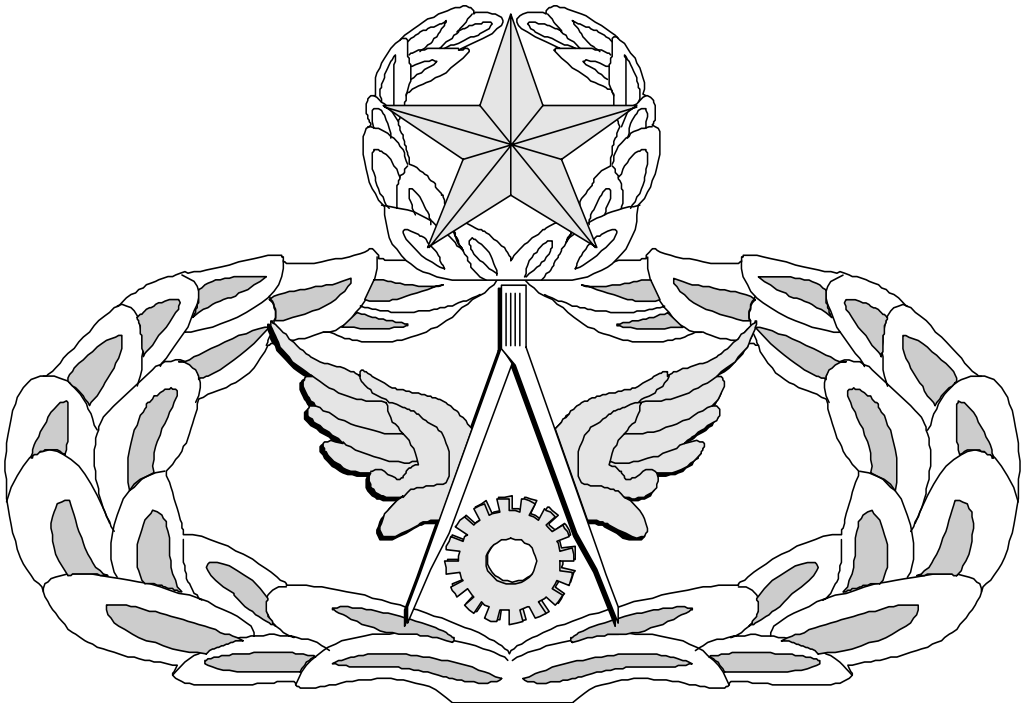
DID THE TRAINEE….	YES	NO
1. correctly estimated the amount of ceiling tile needed?		
2. correctly estimated the amount of floor tile needed?		
3. correctly estimated the amount of lumber needed?		
4. correctly estimated the amount of plywood needed?		
5. correctly estimated the amount of roofing felt needed?		
6. correctly estimated the amount of roof shingles or material needed for the roof?		
7. correctly estimated the cubic yards of concrete needed?		
8. correctly estimated the amount of brick needed?		
9. correctly estimated the amount of concrete block needed?		
10. correctly estimated the amount of reinforce steel needed?		
11. correctly estimated the amount of sheet metal needed for duct work?		

FEEDBACK: Trainer/Certifier should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer/certifier.

Air Force Civil Engineer

QUALIFICATION TRAINING PACKAGE (QTP)

REVIEW ANSWER KEY



FOR

STRUCTURAL

(3E3X1)

MODULE 14

PROJECT PLANNING

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

USE CONSTRUCTION DRAWINGS FOR CARPENTRY, MASONRY, AND METAL
(3E3X1-14.2.1., 14.2.2., 14.2.3.)

QUESTION	ANSWER
1. Which plan shows boundaries, existing utilities, landmarks, and the location of the proposed structure?	d. Site plan.
2. Which plan is the primary plan from which the interior walls are laid out?	a. Floor plan.
3. Which plan is the primary plan from which the footers are laid out?	a. Foundation plan.
4. Which plan is the primary plan from which the concrete block walls are laid out?	a. Floor plan.
5. Specifications provide _____.	b. All of the above.
6. Schedules provide _____.	c. listing of doors and windows to be used.
7. Detail drawings show construction features too small to be seen on other drawings.	a. True.
8. If specifications and construction drawings conflict, _____.	b. specifications take precedence.
9. It is not necessary to consult the construction drawings while performing metal projects?	b. False.
0. The PEB is excellent to use in contingency environment, because it can be _____.	b. expediently assembled.

IDENTIFY TYPE OF MATERIAL REQUIRED FOR CARPENTRY, MASONRY, AND METAL
(3E3X1-14.3.1.,14.3.2.,14.3.4.)

QUESTION	ANSWER
1. The most commonly used framing materials are made of _____.	d. All of the above.
2. Which grade of interior plywood is used for floor underlayment when a very good quality surface is required?	a. A-C.
3. Which type of sheathing is primarily used for exterior wall sheathing and roof decking, in modern residential construction?	c. OSB.
4. The most commonly used sizes of gypsum wallboard are _____.	b. Both a and b.
5. Which of these types of cement would be used when the weather is cold?	c. Type III.
6. This brick is best known as a stretcher.	c. Common
7. Which is the key structural member in constructing a PEB?	d. All of the above.
8. What type concrete produces low heat and reaches full strength in 45 days?	b. Type II.
9. # 5 steel reinforcement is what size (in inches)?	b. $^{5}/_{8}$.
0. Most metal comes in rolls or sheet.	a. True.
1. Metal ordered in rolls depends on the thickness of the metal.	a. True.
2. Metal rods can be ordered in pieces up to 40 foot.	b. False.

ESTABLISH QUANTITY OF MATERIAL REQUIRED FOR CARPENTRY, MASONRY, AND METAL
(3E3X1-14.4.1., 14.4.2.,14.4.4.)

QUESTION	ANSWER
1. When estimating the amount of drywall required to cover the entire room the first step is to _____.	d. calculate wall and ceiling square footage.
2. Given a 16 x 32 ft. room, how many 2" x 2" drop ceiling tiles are required?	d. 128.
3. How many cubic yards of concrete, including the waste allowance, are required for a 12' x 12' x4" pad? Round off to the next higher whole number.	c. 2.
4. What is the formula for estimating board feet?	b. Multiply the width by the thickness in inches by the length in feet divided by 12.
5. How many wall studs are required to build a 24-foot partition wall with a door?	c. 21.
6. How many linear feet of top and sole plates are required to construct a 24-foot partition wall with a door?	c. 72.
7. 7. What is the formula for estimating concrete blocks?	c. (Width x Height) x .889 + 10%.
8. Total area + parapets minus roof openings over 100 sq. ft. X _____.	a. number of plies specified.
9. Manufacturer specifications must be consulted to determine asphalt or bitumen requirements.	a. True.
10. How many squares of shingles are required to cover a 2400 sq. ft. roof, excluding waste? How many bundles of shingles are required, excluding waste allowance?	d. 24 squares/ 80 bundles.
11. What is the manufactured size of a sheet of metal?	e. All of the above.

MEMORANDUM FOR HQ AFCESA/CEOF
139 Barnes Drive Suite 1
Tyndall AFB, FL 32403-5319

FROM:

SUBJECT: Qualification Training Package Improvement

1. Identify module.

   Module # and title_____

2. Identify improvement/correction section(s):

   _____ STS Task Reference
   _____ Training Reference
   _____ Evaluation Instructions
   _____ Performance Resources
   _____ Steps in Task Performance
   _____ Performance Checklist
   _____ Feedback
   _____ Format
   _____ Other

3. Recommended changes--use a continuation sheet if necessary.

   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

4. You may choose to call in your recommendations to DSN 523-6445 or FAX DSN/Commercial 523-6488 or (850) 283-6488 or email ceof.helpdesk@tyndall.af.mil.

5. Thank you for your time and interest.

YOUR NAME, RANK, USAF
Title/Position