

UNIT 702 BLUEPRINT 1



Carpenters Training Committee for Northern California
CTCNC

Unit 702 Blueprint 1

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Chapter 1

Introduction to Construction Blueprint Reading

Objectives:

At the end of this chapter, students will be able to:

- 1) Distinguish how construction drawings are organized into a set of blueprints.
- 2) Recognize the various types of plans contained in a set of blueprints.
- 3) Determine how different views of a construction project are used to gather information.
- 4) Properly care for a set of blueprints.

Introduction

Before a building is built, someone has to determine the specific needs for the building. Whether it is a school, hospital, house or a commercial building, the owner hires an architect to design a building with the needs of the end user in mind. The architect relates these needs to the builders in a set of blueprints sometimes called working drawings.

The blueprints define the scope of work to be performed for each trade. A set of specifications is written to further define the scope of work. Specifications, often called specs, define the material, quality of work and other legally binding terms of the contract between the owner, general contractor and subcontractors. Builders use the blueprints and specifications together to gain a clear understanding of the construction project.

Views

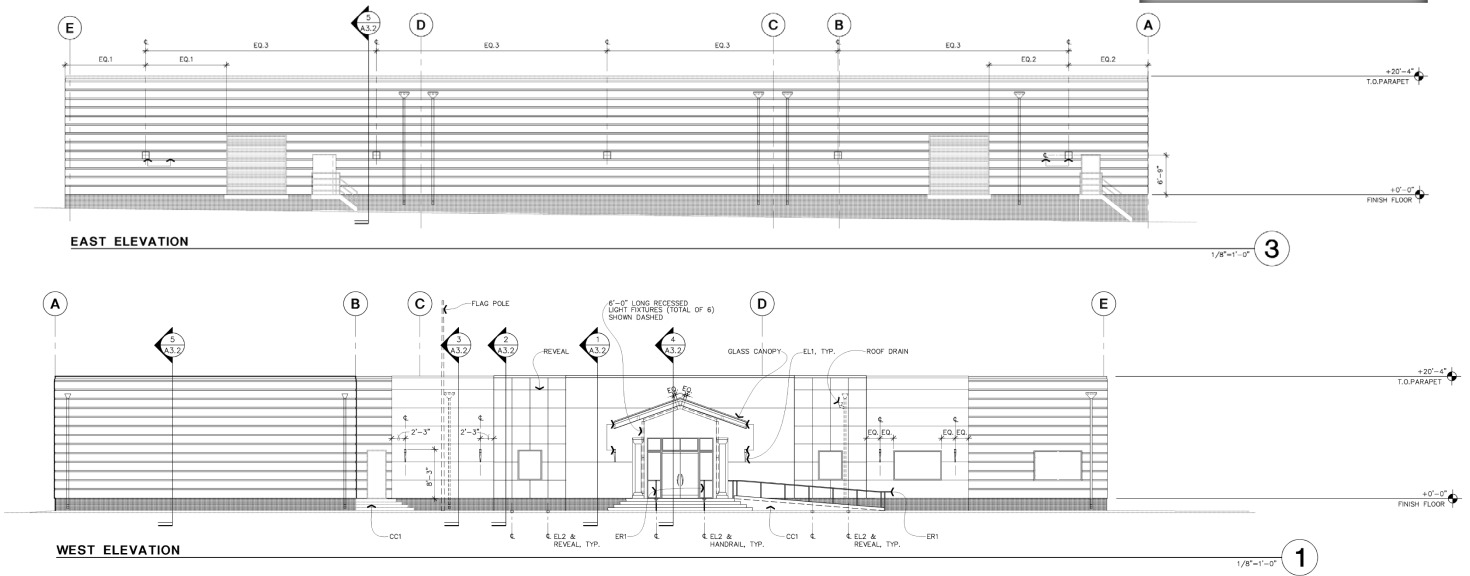
One of the most important aspects of reading blueprints is to understand how the types of drawings relate to each other. Each drawing is a particular view of the project. One of the easier drawings to visualize and therefore understand is the pictorial drawing. A pictorial drawing as shown in Figure 1, is a rendering of the building with trees; shrubs and shading that makes a picture look more realistic. However, they are not practical drawings from which to build.



Figure 1 – Pictorial Drawing

Architects show many views of the building in a set of blueprints. These views are called orthographic projection. Each view is taken from a different reference point, but each view is perpendicular to one another. Imagine a square box and rotate it looking at all sides, each side represents a different view. This is the same process when looking at a building in a set of prints. The top view looking down is called a plan view. A plot plan, floor plan, reflected ceiling plan are all examples of plan views. The front, sides, and back of the box are called elevations. See Figure 2.

Figure 2 – Elevation Drawings



Cutting through the box and looking inside would be called a section. The acoustical ceilings are easily recognized on a building section drawing along with other features like the roof and floor. When a section is given through the longest portion of a building it is called a longitudinal section as shown in Figure 3. Note how the architect references an enlarged section of the Seminar room within the section drawing. This means there will more information about the Seminar room in another drawing. Figure 4 is a section through the shortest portion of the building called a transverse section.

Figure 3 – Longitudinal Section

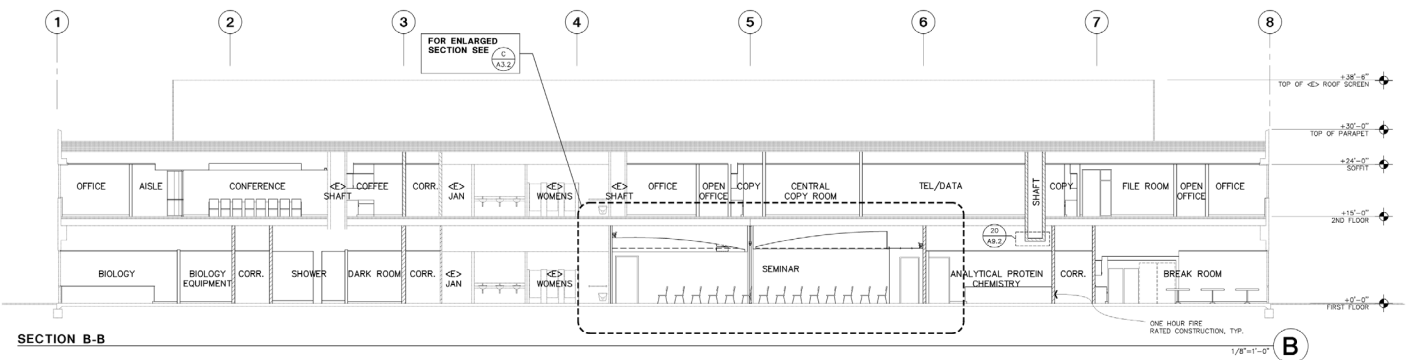
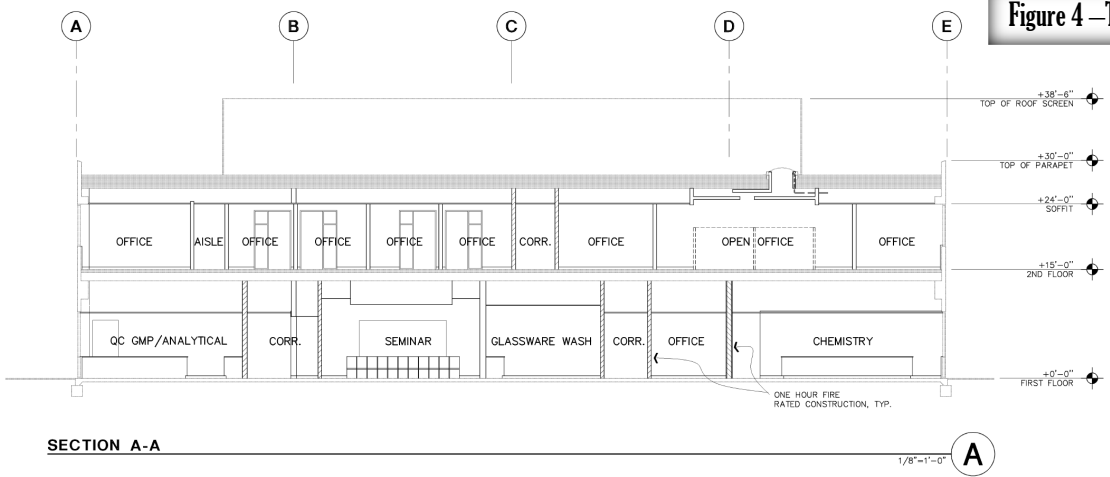


Figure 4 – Transverse Section



Nearly all construction drawings are created using orthographic projection. This allows for more detailed information to be shown, but the appearance of the building is not as obvious as it would be in a pictorial drawing. With practice, the completed structure can be visualized by combining the various views. Finding the information needed to build a project using orthographic drawings will become second nature.

Isometric Views

Isometric views convey how each component of the feature relate to one another. These drawings converge to a point in the distance. Pictorial drawings are usually illustrated in this manner. In Figure 5, note how much information can be construed by the architect using an isometric drawing.

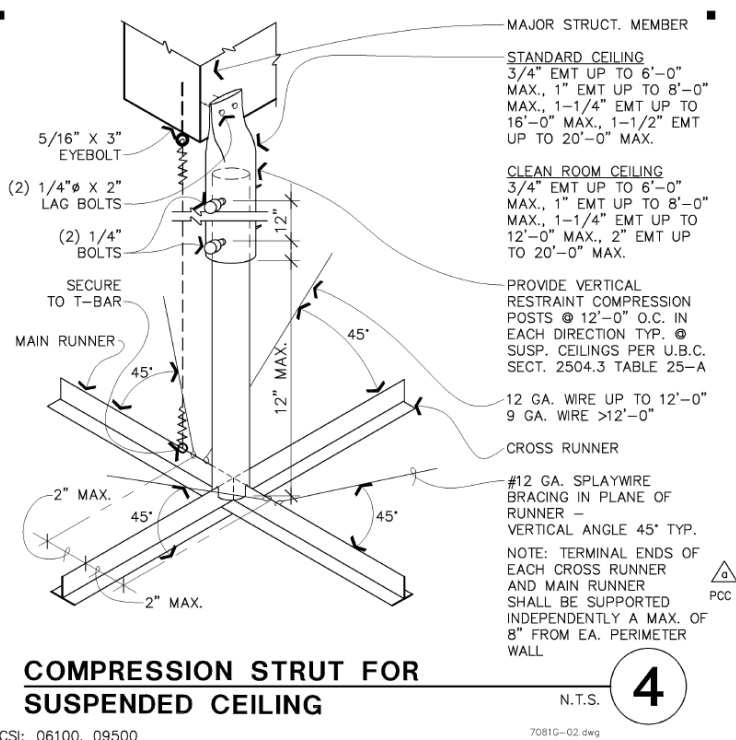


Figure 5 – Isometric Drawing

COMPRESSION STRUT FOR SUSPENDED CEILING

CSI: 06100, 09500

N.T.S. **4**

7081G-02.dwg

Organization of Construction Blueprints

The architect develops the original set of blueprints. These drawings are kept on file so changes can be made to the project. All drawings are computer aided drawings, called CAD. Blueprints are increasingly becoming electronic and are often viewed with tablets or kiosks on the jobsite. Regardless of whether the drawings are electronic or printed on paper, they are organized into sections as to the sequence of construction.

Listed below are some common sections found in a set of blueprints and some of the plans they may contain. Keep in mind, not all blueprints contain every section or every type of plan. For example, a remodel of a building interior would probably not contain landscaping drawings. There are many views, symbols, abbreviations, lines and drawings common to each plan.

- **S - Structural:** Foundation plan, columns, concrete, wood and metal stud load bearing structures
- **A - Architectural:** Title sheet, plot/site plan, floor plan, reflected ceiling plan, elevations, sections and details
- **E - Electrical:** Power plan, lighting plan
- **M - Mechanical:** Heating and cooling ducting plan, ventilation plan
- **L - Landscaping:** Irrigation plan, planting plan
- **FS - Fire Sprinkler:** Riser and piping plan
- **P - Plumbing:** Water supply and waste systems

Types of Prints

Finding information is logical and easier when prints are divided into sections based on the type of work. Work related specifically to architectural, structural, electrical and mechanical construction is found within that particular section. Some architects typically use a letter classification of the section when numbering each individual sheet or print. The architectural section would be A-1, A-2, A-3, and so forth for the sheets within this section. The mechanical section would be M-1, M-2, M-3 and so forth. Sometimes architects simply number the sheets of the set 1, 2, 3 and up and use no letter classification.

These sections contain many types of individual prints. The acoustical ceiling installer gathers the most information from the architectural prints for the installation of the acoustical ceilings. The architectural section includes a floor plan, reflected ceiling plan, elevations, sections, details, and door/window schedules. In addition, each sheet contains a heading along with the sheet number. Sheet A-1 could have the heading “Floor Plan” and sheet A-2 could contain the heading “Elevations”. Sheet A-3 would be the “Reflected Ceiling Plan”.

On these sheets, the acoustical ceilings are represented by lines along with symbols and written information. Symbols direct the reader to other drawings within the prints. Information is often given on the prints in the form of notations. Written information is presented on the drawings in these ways:

- Descriptive titles are placed near a specific item and connected with a leader line terminated by an arrowhead or a dot.
- Specific information that refers to only one situation may be placed near the situation.
- General information applying to several sheets in the prints may be placed in any convenient space, usually the title sheet.

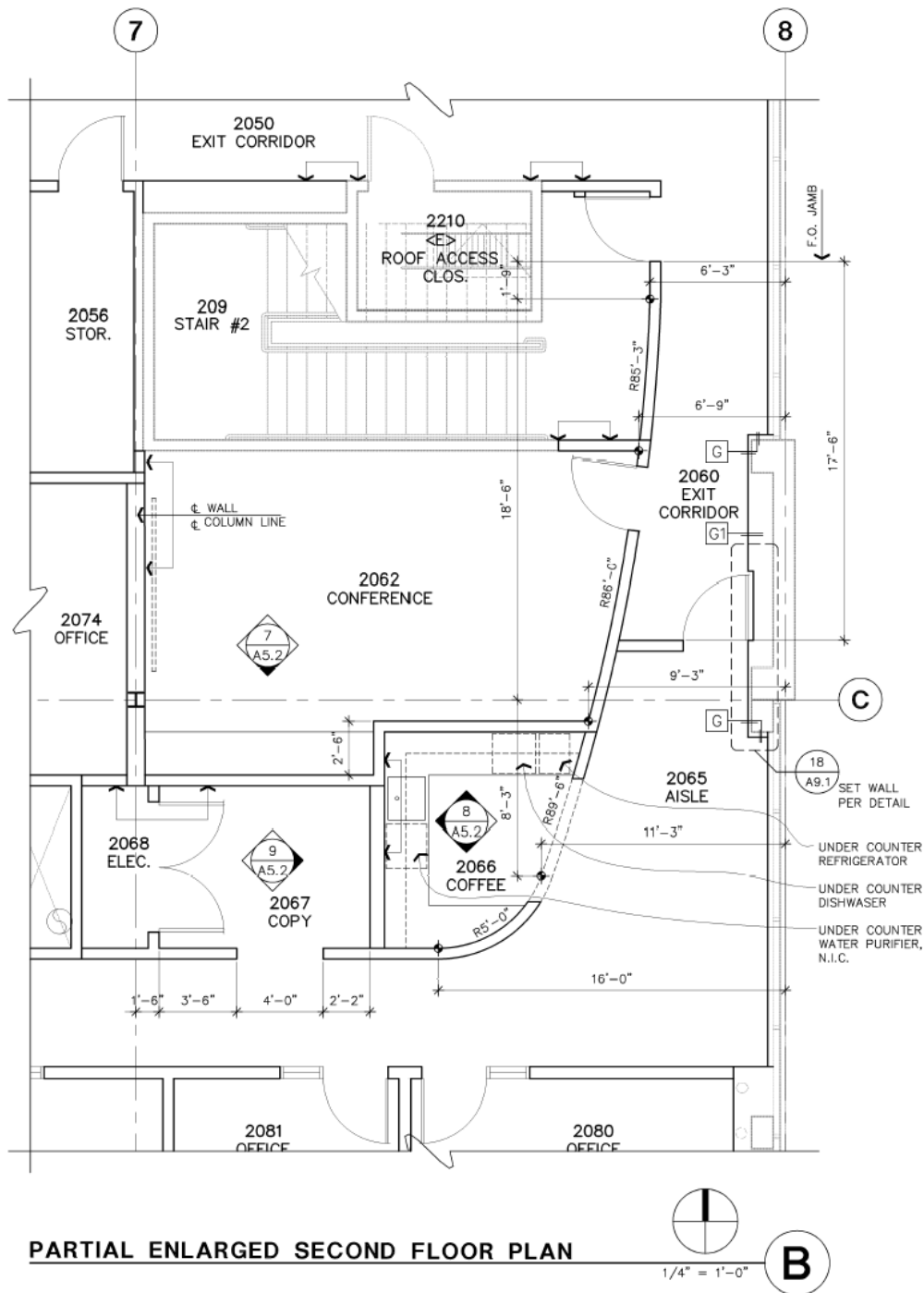
Title Sheet

The title sheet is basically the cover sheet for the set of drawings. The title sheet contains the architects' name, along with any engineers and consultants used on the project. Also found on the title sheet is the location map of the project and name of the project. A list of the drawings contained in the set and a list of abbreviations used in the prints is shown. The plan symbols, sheet title block and revision area is explained. Most importantly, a general notes section is listed which pertains to the entire project. The general notes must be read thoroughly. These notes describe the type of dimensions used on the project, whether they are to finished surfaces or to the frame lines. In addition, these notes contain information about daily clean up, existing finishes, and other directives by the architect.

Floor Plan

The floor plan is an important drawing because it contains the most information and is used to direct attention to other areas of the prints. The floor plan shows the location of columns, arrangement of the interior and exterior walls, doors and windows, duct shafts, stairways and built-in cabinets. Dimensions are given along with a partition legend describing how the partitions are constructed. Important notes are listed under the general notes section relating to the floor plan. Floor plans are drawn in plan view, meaning the view is looking down. The floor plan is used to direct the acoustical ceiling installer to other drawings contained in the blueprints by the use of elevation, detail and cutting plane symbols noted on this plan. Note the symbols and dimensions used in the partial floor plan shown in Figure 6. Partial floor plans are referenced from larger floor plans to give more detail and clarity to the items contained in the partial drawing. High-rise buildings have a separate floor plan and reflected ceiling plan for each floor. Some information is not always shown on a partial floor plan. For instance, the door identification numbers are not shown the enlarged plan but are shown on the floor plan.

Figure 6 – Partial Floor Plan



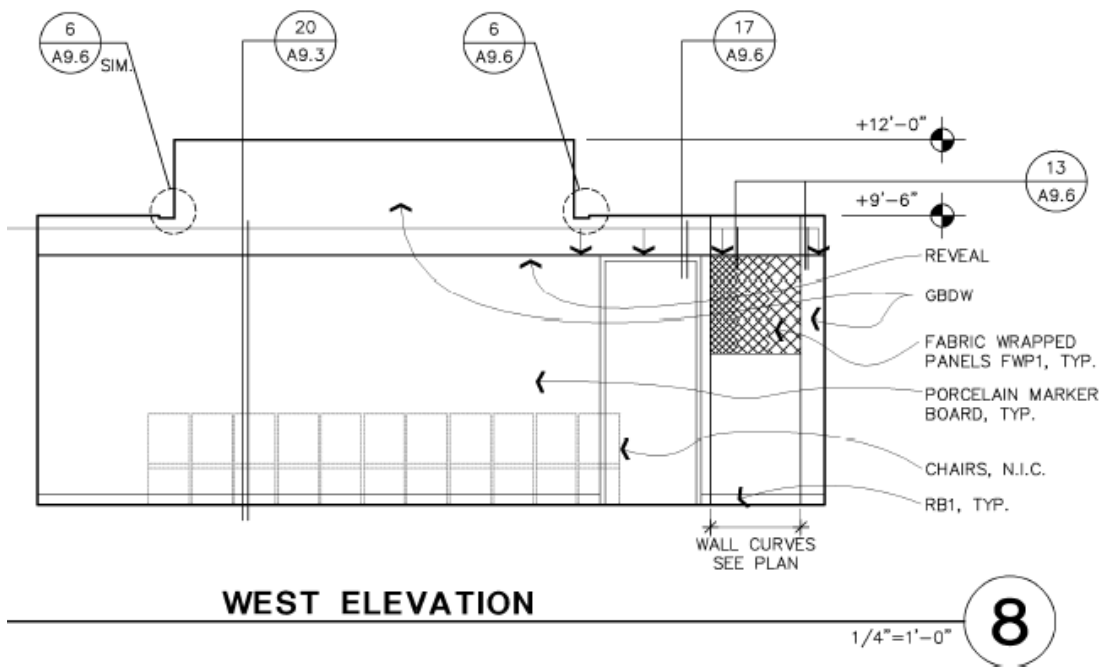
Elevations

Elevations views are drawn for the exterior or interior portions of a building. Instead of looking down as in a plan view, elevations look directly at the object. Studying the elevations provides an idea how a room or structure appears. Usually four views are shown and may be designated as front, rear, right side and left side;

however, it is more common to refer to them by geographic direction. Each side of the building is facing North, South, East or West in relation to the North arrow designation on the prints. Elevation views are useful for confirming vertical dimensions, particularly the height of ceilings and soffits. These drawings represent the elevation in a completed condition.

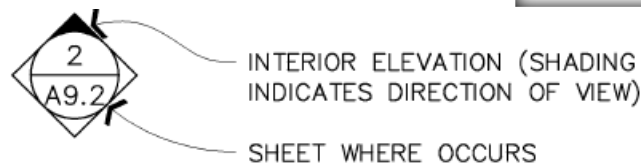
When elevations show the inside of a room, they are interior elevations as shown in Figure 7. The horizontal lines represent the floor and ceilings and the vertical lines represent the inside corners of the walls and soffits. The height of the ceilings are 9' - 6" and 12' - 0" as noted by the elevation symbols. Other symbols direct the acoustical ceiling installer to details with more information. For example, there is a detail for attaching the ceilings to the vertical soffits. The architect lists fabric wrapped panels along with a porcelain marker board on the West wall.

Figure 7 – Interior Elevation



The symbol for an elevation view is shown in Figure 8. This view is in relation to the symbol placement in the room. The architect is guiding the reader to the direction of the view by shading the arrow around the callout. The elevation callout refers to elevation #2 on sheet A9.2.

Figure 8 – Elevation Symbol

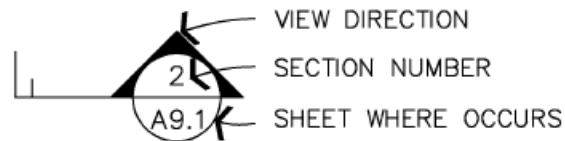


Sections

Sections are referred to as cut drawings through an object. These drawings can be drawn either horizontally or vertically depending on the placement of the cutting plane symbol. Section drawings provide important information about height, materials, fastening and support systems, along with concealed features. If a perpendicular cut was made through an acoustical ceiling, the major components used in the construction would be shown. Main runners, cross tees, hanger wires and ceiling tile would be illustrated in the section drawing. Section drawings are customarily drawn to a larger scale than plan views or elevations, unless it is a section drawing through the entire building. This aids in the reading and provides information that cannot be given on elevation or plan views.

Typical sections represent the average condition throughout a structure and are used when construction features are repeated many times. Cutting plane symbols direct the acoustical installer to the specific section number and sheet as shown in Figure 9. The architect gives the reader the direction of view for the section, the section number and the sheet where the drawing is located.

Figure 9 – Cutting Plane Symbol



In Figure 10, this section drawing illustrates how a partition penetrates an acoustical ceiling. Finding the section drawing in the prints and understanding the information is key to properly constructing an item.

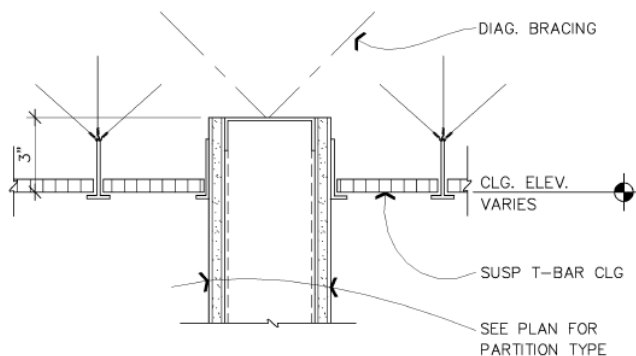


Figure 10 – Section Drawing

WALL TO 3" ABOVE SUSP. CEILING

3"=1'-0"

2

In the section drawing shown in Figure 11, the soffit framing is 4" metal studs at 24" on center. The architect guides the acoustical ceiling installer to the finish schedule to confirm the ceiling heights. If the situation called for a fire rated soffit, the gypsum board would extend to the structure above. This is important to confirm before installing the acoustical ceilings, because access to the structure would not be possible and could result in removal of the ceilings to allow for the installation of gypsum board.

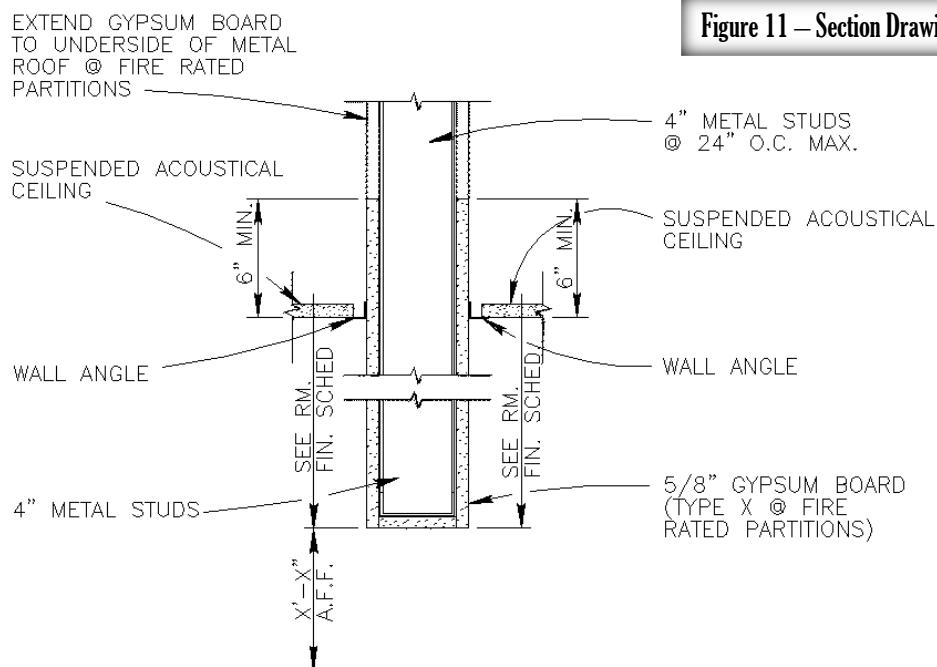


Figure 11 – Section Drawing

Details

Details are provided when special or unusual construction is performed. Details are drawn to a larger scale, expanding the feature, allowing the acoustical ceiling installer to see the materials used and the methods of attachment for the feature. Although details do not use the cutting plane symbol, they are closely related to sections. Detail drawings are used whenever the information provided in elevations, plan views and section drawings are not precise enough for construction. If an item is important enough to detail, it is important enough to build properly. Detail drawings are usually grouped on individual sheets so references may be made easily from the drawings. Detail callouts provide a detail number and sheet number where the detail is drawn. See Figure 12. When the abbreviation TYP. is used, it means the detail is the same for all identical conditions whether they are detailed or not.

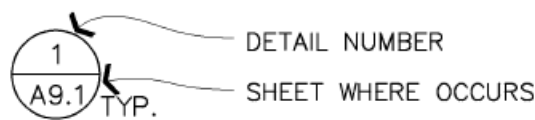
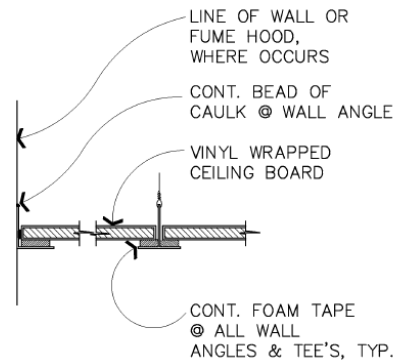


Figure 12 – Detail Callout

In Figure 13, the acoustical ceiling is completely gasketed. The main runners, called tees in this detail, wall angle and cross tees must have some type of gasket applied to each component. The top of the wall angle shows caulking and vinyl wrapped gypsum board tiles. This type of ceiling is often used in clean rooms and other dust sensitive areas.

Figure 13 – Acoustical Ceiling Detail



**GASKETED
CEILING**

3"=1'-0"

16

Reflected Ceiling Plan

The reflected ceiling plan is the most important plan for the acoustical ceiling installer. It gets its name from the idea of looking straight down on a mirror lying on a floor and seeing the reflection of the ceiling in the mirror. Like a floor plan, the reflected ceiling plan shows certain building elements cut through. But unlike a floor plan, where the cut plane usually exists about half way between the floor and ceiling, the cut plane for the ceiling plan occurs just below the ceiling, thereby excluding windows and doors from the cut. Suspended drywall ceilings, acoustical ceilings, soffits, skylights and draft stops are shown on this plan. Another important piece of information found on reflected ceiling plans is the ceiling heights. The reflected ceiling plan is often the main reference point for specifying ceiling heights.

The reflected ceiling plan contains a ceiling legend identifying the types of ceilings as shown in Figure 14. For example, acoustical ceilings are shown by a grid pattern, gypsum board ceilings are shown shaded or with a texture, and areas open to the structure do not contain a pattern or texture.

Dimensions or notes given on the reflected ceiling plan govern the ceiling layout. Dimensions are typically given to a light fixture or series of fixtures and from the center of column lines. Most often, the architect writes a sheet note telling the installer to center the grid in the room in both directions. Figure 15 are sheet notes from a set of drawings.

Figure 14 – Ceiling Legend

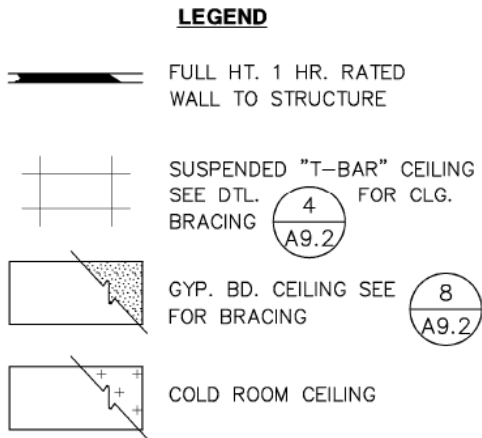
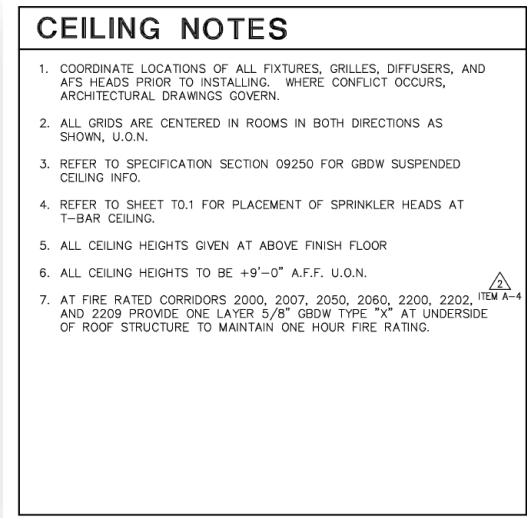


Figure 15 – Sheet Notes



Recessed lighting is drawn on the plan and should be evaluated to determine the grid layout. 2' x 4' light fixtures typically have the main runners spaced parallel to the 2' direction of the fixture or in other words 4' apart.

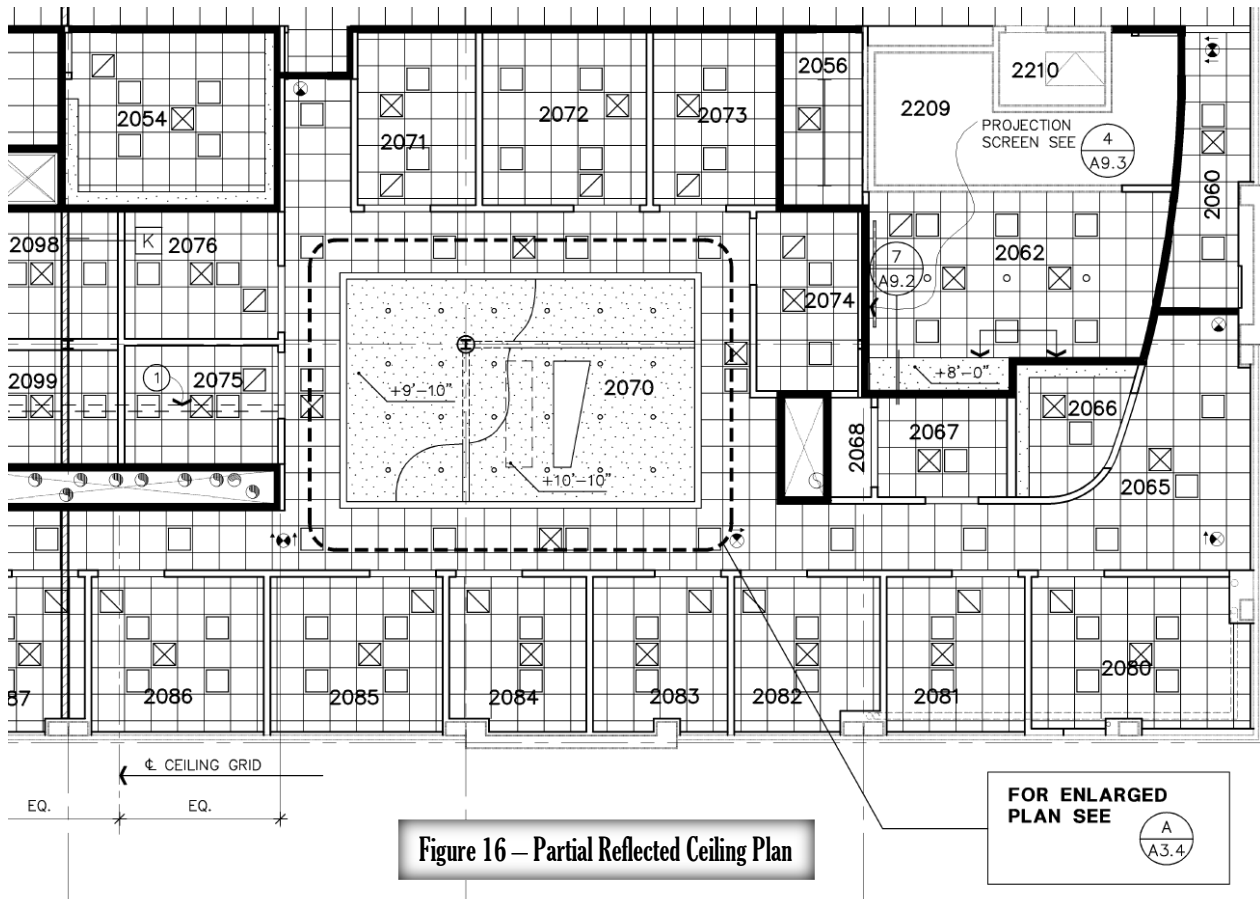


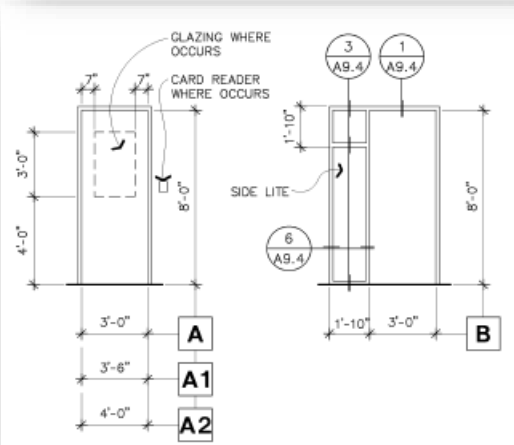
Figure 16 – Partial Reflected Ceiling Plan

The light layout is important in the determination of the grid layout. In addition, the reflected ceiling plan is overlaid on the floor plan with the walls shown, but the walls will not be defined as they are on the floor plan. Section, details, and enlarged drawing callouts can also be noted on the reflected ceiling plan. See Figure 16 for a partial reflected ceiling plan.

Door, Window and Finish Schedules

Schedules are material lists presented in chart form. Door schedules contain information listing door type, door material and hardware group by letters or abbreviations. See Figure 17. These letters and abbreviations are referenced to other drawings, notes and lists which contain more information than the schedule. Elevation views are often referenced in the schedule as shown in Figure 18. Hardware groups are given a group number instead of individually listing each piece. The doors or windows listed in a schedule are referenced to the floor plan. The number or letter used in the schedule is placed next to the door or window on the plan. Usually the room number corresponds with the door number. There are other types of schedules with useful information such as finish and lighting schedules.

DOOR SCHEDULE															
DOOR NUMBER	DOOR TYPE	DOOR MATERIAL	HARDWARE GROUP	DOOR NUMBER	DOOR TYPE	DOOR MATERIAL	HARDWARE GROUP	DOOR NUMBER	DOOR TYPE	DOOR MATERIAL	HARDWARE GROUP	DOOR NUMBER	DOOR TYPE	DOOR MATERIAL	HARDWARE GROUP
1000A	<E>	<E>	SEE NOTE #13 ITEM A-16	1088A	A1	SC/LP	3	2075A	B	SC/WV	3	2127A	B	SC/WV	3
1000B	H	AL/P	8 SEE NOTE #13	1088B	A1	SC/LP	3	2076A	B	SC/WV	3	2128A	B	SC/WV	3
1002A	J	SC/LP	17 RCC #4	1089A	A1	SC/LP	3 CR#2 ITEM A-5	2080A	B	SC/WV	3	2129A	B	SC/WV	3
1003A	A	SC/LP	11	1091A	A	SC/LP	2	2081A	B	SC/WV	3	2130A	B	SC/WV	3
1005A	A1	SC/LP	1 SEE NOTE #13	1092A	A	SC/LP	3	2082A	B	SC/WV	3	2131A	B	SC/WV	3
1007A	A	SC/LP	2	1093A	A	SC/LP	2	2083A	B	SC/WV	3	2132A	B	SC/WV	3
1007B	L	-	CR#2 ITEM A-5	1094A	A	SC/LP	3	2084A	B	SC/WV	3	2133A	B	SC/WV	3



Figures 17 & 18 – Door Schedule & Elevations

GROUP 1		(SINGLE DOOR, FIRE RATED- LOCK)
	BUTTS	TA2714
1	LOCK	D50
1	CLOSER	8581BF
1	DOORSTOP	433ES
GROUP 2		(SINGLE DOOR, FIRE RATED- LATCH)
	BUTTS	TA2714
1	LATCHSET	D10
1	CLOSER	8581BF
1	DOORSTOP	433ES
GROUP 3		(SINGLE DOOR, ROOM - LOCK)
	BUTTS	TA2714
1	LOCK	D50
1	DOORSTOP	433ES

A finish schedule identifies the materials for each room in the building, providing information for the walls, floors and ceilings. Most importantly, the ceiling type, the type of ceiling tile, and the installation height. Each wall in the room is given a North, South, East or West designation. In some instances, the architect references interior elevations or details from the finish schedule. See Figure 19.

Figure 19 – Finish Schedule

FINISH SCHEDULE												
ROOM NUMBER	ROOM NAME	FLOOR	BASE	NORTH WALL	EAST WALL	SOUTH WALL	WEST WALL	DOOR / FRAME COLOR	CEILING	CEILING HEIGHT	INTERIOR ELEVATION	REMARKS
2070	OPEN OFFICE	C1	RB1	P1	P1	P1	P1	LP6/AL	A8	VARIES	1/A3.4	(7) (11) (18)
2071	OFFICE	C1	RB1	P1	P1	P1	P1	WV1/AL	A2	+9'-0"	-	
2072	OFFICE	C1	RB1	P1	P1	P1	P1	WV1/AL	A2	+9'-0"	-	
2073	OFFICE	C1	RB1	P1	P1	P1	P1	WV1/AL	A2	+9'-0"	-	
2074	OFFICE	C1	RB1	P1	P1	P1	P1	WV1/AL	A2	+9'-0"	-	
2075	OFFICE	C1	RB1	P1	P1	P1	P1	WV1/AL	A2	+9'-0"	-	
2076	OFFICE	C1	RB1	P1	P1	P1	P1	WV1/AL	A2	+9'-0"	-	
2080	OFFICE	C1	RB1	P1	P1	P1	P1	WV1/AL	A2	+9'-0"	-	
2081	OFFICE	C1	RB1	P1	P1	P1	P1	WV1/AL	A2	+9'-0"	-	
2082	OFFICE	C1	RB1	P1	P1	P1	P1	WV1/AL	A2	+9'-0"	-	
2083	OFFICE	C1	RB1	P1	P1	P1	P1	WV1/AL	A2	+9'-0"	-	

The letters and abbreviations are explained in much the same way for a finish schedule as a door and window schedule. The architect will give an abbreviation list located near the schedule. The ceilings represented as A2 in the schedule uses a USG suspension system and Armstrong ceiling tile as defined in Figure 20. Note the majority of ceiling types are A2 with an AB ceiling in Open Office Area 2070. The ceilings heights are mostly +9' – 0" with the exception of Open Office Area 2070 where the ceiling heights vary. The remarks column of the chart list notes 7, 11 and 18 for the Open Office Area 2070 providing additional information.

A2	<u>CEILING TILES</u>
MFG:	ARMSTRONG
QUALITY:	MINATONE
TYPE:	CORTEGA ANGLED REGULAR EDGE LAY-IN
COLOR:	WHITE
NO:	704
SIZE:	24" X 24" X 5/8"
	<u>SUSPENSION SYSTEM</u>
MFG:	USG INTERIORS
QUALITY:	DONN SUSPENSION SYSTEMS
TYPE:	EXPOSED FACE, INTERMEDIATE DUTY
COLOR:	WHITE
NO:	DX24
SIZE:	15/16" TEE

Figure 20 – Abbreviation Explanation

Structural Plans

Structural plans include the steel columns, beams, girders along with the concrete footing plans and foundation wall plans. Structural plans include section views, elevation views and detail drawings relating to the overall support structure of the building. Structural drawings are highly detailed. Roof screen framing is often located in the structural plans because of the wind loads applied to these structures.

Electrical Plans

The electrical drawings show switches, convenience outlets, dedicated outlets, distribution panels and lights. The electrical drawings are similar to architectural drawings because they show the walls and ceilings, but references electrical construction. Electrical drawings are useful to confirm any lighting, switches, outlets, and other electrical components which may affect the acoustical ceiling installation.

Mechanical Plans

Sometimes called HVAC plans, these heating, ventilation and air-conditioning plans show ducting, supply and return air registers, fire dampers, and thermostat locations. Mechanical drawings are referred to when coordinating the job. The acoustical ceiling foremen needs to confirm all ducting is inspected before beginning the grid installation and may need to coordinate with the HVAC contractor when planning the hanger wire layout for the ceilings to avoid conflicts. The placement of supply and return registers is shown on these plans, but not as precise as the reflected ceiling plan.

Plumbing Plans

The plumbing plan shows the layout of the piping system for the hot and cold water lines, waste systems, and the fixture locations. Isometric drawing are used to diagram the connections of water closets, sinks, hose bibs, and other plumbing items.

Care for Blueprints

The contractor places a lot of trust in the acoustical foreman to complete the job on time and efficiently. Blueprints are just another tool the acoustical ceiling installer uses to perform his or her work. Although many of the drawings are becoming increasingly electronic, paper blueprints will be around for the near future. Care should be exercised when using paper drawings, so they must be handled properly. Here are some guidelines:

- Do not eat or drink near prints

- Roll prints carefully
- Keep prints out of direct sunlight, otherwise they fade and discolor
- Store prints in a clean, dry place
- Clean prints do not contribute to errors or difficulty in reading
- Misplacing or losing a set of prints goes without saying

Chapter 1 Study Guide

Directions:

Answer the following questions using the bubble answer sheet.

- 1) Regardless of whether the drawings are electronic or printed on paper, they are organized into sections as to the sequence of construction.
 - A. True
 - B. False

- 2) The architectural section of the drawings usually contains the title sheet, plot/site plan, floor plan, _____, _____, _____, elevations, sections and details.
 - A. electrical piping plan
 - B. reflected ceiling plan
 - C. air condition plan
 - D. water piping plan

- 3) Another reason architect's divide a set of blueprints into sections is to make finding _____ easier.
 - A. information
 - B. details
 - C. sheets
 - D. drawings

- 4) Architects typically use a letter classification when numbering each individual sheet or print, for example, the architectural section would be A-1, A-2, A-3.
 - A. True
 - B. False

- 5) Project drawings are computer aided drawings called CAD drawings.
 - A. True
 - B. False

6) General information applying to several sheets in the prints may be placed in any convenient space, usually the _____ sheet.

- A. elevation
- B. detail
- C. title
- D. section

7) Which of the following would not be found on the title sheet?

- A. Architects' name
- B. Project location map
- C. Detail drawing
- D. List of abbreviations

8) Detail drawings are used whenever the information provided in elevations, plans and sections is not precise enough for construction.

- A. True
- B. False

9) Floor plans are drawn in plan view, meaning the view is looking

- _____.
- A. down
 - B. up

10) The floor plan is used to direct the acoustical ceiling installer to other drawings contained in the blueprints by the use of elevation, detail and cutting plane symbols.

- A. True
- B. False

11) The reflected ceiling plan contains a _____ identifying the types of ceilings.

- A. symbol
- B. detail
- C. legend
- D. section

12) Elevations showing the inside of a room are called inside elevations.

- A. True
- B. False

- 13) Sectional drawings provide important information about height, materials, fastening and _____ systems, along with concealed features of a structure.
- A. support
 - B. connecting
 - C. sound
 - D. steel
- 14) _____ symbols direct the acoustical installer to the specific section and sheet.
- A. Cutting plane
 - B. Detail callout
 - C. Transverse section
 - D. Longitudinal section
- 15) The floor plan contains the most information and is used to direct attention to other areas of the prints.
- A. True
 - B. False
- 16) Detail drawings are usually _____ on individual sheets so that references may be made easily from the blueprints.
- A. labeled
 - B. grouped
- 17) The _____ is the most important plan for the acoustical ceiling installer.
- A. electrical piping plan
 - B. reflected ceiling plan
 - C. air condition plan
 - D. water piping plan
- 18) Elevation views are useful for confirming _____ dimensions, particularly the height of ceilings.
- A. linear
 - B. horizontal
 - C. vertical
 - D. diagonal

19) Dimensions for acoustical ceilings are typically given to a light fixture, a series of fixtures, from the center of column lines or has equal borders.

- A. True
- B. False

20) Recessed or surface mounted lighting is drawn on the reflected ceiling plan and should be evaluated to determine the grid _____.

- A. spacing
- B. elevation
- C. layout
- D. direction

21) The reflected ceiling plan is overlaid on the floor plan with the walls shown, but the walls will not be defined as they are on the floor plan.

- A. True
- B. False

22) Section and detail _____ can also be noted on the reflected ceiling plan.

- A. elevations
- B. directions
- C. callouts
- D. notes

23) Schedules contain a lot of information in the form of a _____.

- A. chart
- B. graph
- C. symbol
- D. note

24) A finish schedule identifies the materials for each room, providing information for the walls, floors and ceilings.

- A. True
- B. False

25) Care should be exercised when using paper drawings, so they must be handled properly.

- A. True
- B. False

Chapter 1
Blueprint Reading Exercise

Directions:

Match the following items found in a set of blueprints to the choices given below. Each choice may be used more than once.

- | | |
|----------------------------------|-----------------------------------|
| A. Title Sheet | G. Door or Window Schedule |
| B. Floor Plan | H. Structural Plan |
| C. Elevation Sheet | I. Electrical Plan |
| D. Section Sheet | J. Mechanical Plan |
| E. Detail Sheet | K. Plumbing Plan |
| F. Reflected Ceiling Plan | L. Finish Schedule |

- | | |
|---------------------------------------|--|
| 1. _____ North View Drawing | 21. _____ Material for Flooring |
| 2. _____ Location of Columns | 22. _____ Load Bearing Wall |
| 3. _____ Project Location Map | 23. _____ Index List of Drawings |
| 4. _____ Longitudinal View | 24. _____ Switches & Outlets |
| 5. _____ Special/Unusual Construction | 25. _____ Water Closet (Toilet) |
| 6. _____ Acoustical Ceiling | 26. _____ Thermostat Location |
| 7. _____ General Notes Section | 27. _____ Beams & Girders |
| 8. _____ Transverse View | 28. _____ Soffits |
| 9. _____ Light Layout | 29. _____ Type of Door |
| 10. _____ Door Location | 30. _____ Partition Legend |
| 11. _____ Hot & Cold Water Piping | 31. _____ Stairway |
| 12. _____ HVAC Fire Dampers | 32. _____ South View Drawing |
| 13. _____ Skylight | 33. _____ Door Rough Opening |
| 14. _____ Door Size | 34. _____ Acoustical Ceiling Direction |
| 15. _____ List of Abbreviations | 35. _____ Carpet |
| 16. _____ Acoustical Ceiling Layout | 36. _____ Foundation Wall |
| 17. _____ Left Side View | 37. _____ Power Plan |
| 18. _____ Type of Window Frame | 38. _____ Built-in Cabinets |
| 19. _____ Ceiling Legend | 39. _____ “Cut” View |
| 20. _____ Toilet Fixtures | 40. _____ Methods of Attachment |

Chapter 2

Lines and Symbols

Objectives:

At the end of this chapter, students will be able to:

- 1) Differentiate between the types of lines used in construction drawings.
- 2) Recognize the significance of construction symbols.

Introduction

Architect's use a variety of lines to convey a purpose to the acoustical ceiling installer and other tradesmen. Some lines vary in width, some are solid, some are broken, and some have long or short dashes. There may be a combination of these types of lines. The alphabet of lines is a common term used when working with blueprints. Each type of line conveys a different meaning. Once these lines are recognized as to their meaning, reading blueprints becomes easier and eventually second nature.

Border Line

Border lines, see Figure 1, are used to keep the individual drawings separated and organized. They are wider in width, heavy in weight, and darker than other lines in the drawings. Border lines are located near the edge of the sheet of drawing paper. They are also used to separate the various portions of the drawing, such as the title block, notes, and revision block. They do not have any relationship to the drawing being represented other than to keep the drawing organized.

Figure 1 – Border Lines

ABBREVIATIONS	DESCRIPTION
∠	AND
∠	ANGLE
⊕	AT
⊕	CENTERLINE
⊕	DIAMETER or ROUND
<E>	EXISTING
<F>	FUTURE
A	CEILING TILE
A.B.	ANCHOR BOLT
A.C.	ASPHALT CONCRETE
ACOUST.	ACOUSTICAL
ADA	AMERICANS WITH DISABILITIES ACT
ADJ.	ADJUSTABLE
A.F.	ACCESS FLOOR
A.F.F.	ABOVE FINISH FLOOR
A.F.S.	AUTOMATIC FIRE SPRINKLERS
ALUM.	ALUMINUM
ATT.	ATTENUATION
BD.	BOARD
BLDG.	BUILDING
BLK.	BLOCK
BLKTS.	BLANKETS
C	CARPET
C.F.S.	CHANNEL FRAMING SYSTEM
C.G.	CORNER GUARD
C.H.	COAT HOOK
C.L.G.	CEILING
CLR.	CLEAR
CONF.	CONFERENCE
CONC.	CONCRETE
CONT.	CONTINUOUS
C.P.	CARPET PAD
CSK.	COUNTERSUNK
C.T.	CARPET TILE

THIS PROJECT CONSISTS OF INTERIOR IMPROVEMENTS FOR THE FIRST AND SECOND FLOOR OF AN EXISTING TWO STORY 48,638 S.F. BUILDING. THERE ARE B OCCUPANCY OFFICES AND LABORATORIES AS WELL AS A 1,375 S.F. A-3 SEMINAR ROOM, 450 S.F. OF H-3 CHEMICAL STORAGE AND 3,025 S.F. OF H-7 OCCUPANCY LABORATORIES. THE H-7, H-3 AND A-3 OCCUPANCY SPACES ARE AN ACCESSORY TO THIS B FACILITY, COMPRISING OF LESS THAN 10% OF THE FIRST FLOOR SQUARE FOOTAGE. IN ADDITION, THERE ARE TWO B OCCUPANCY CONTROL AREAS ON THE FIRST FLOOR. THERE IS NEW ROOFTOP EQUIPMENT AND SKYLIGHTS. THE EXISTING PARKING LOT MEETS CURRENT H.C. ACCESSIBILITY REQUIREMENTS

Object Line

Object lines represent the main outline of an object, building, ceiling or wall. See Figure 2. The object line is a medium weight with medium width. Object lines are drawn continuous showing all edges and surfaces. These lines can be straight, curved, angled or in any other shape, but must be continuous.

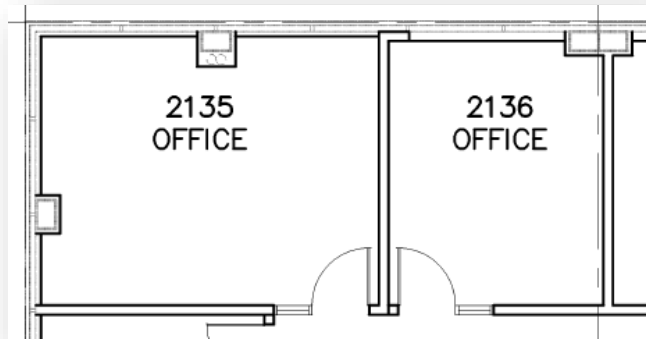
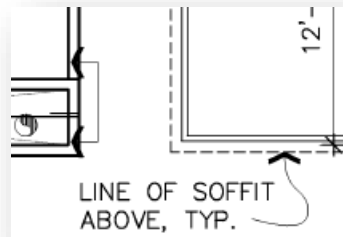


Figure 2 – Object Lines

Hidden Line

Hidden lines define edges and surfaces not visible in a particular view. See Figure 3. They are medium weight and width and composed of short dashes. The acoustical ceiling installer must locate another view in the drawings to determine the object represented by the hidden line. Soffits drawn on a floor plan are shown as hidden lines, but are defined on the reflected ceiling plan as object lines. Often, these hidden objects are revealed in an elevation or sectional drawing.

Figure 3 – Hidden Lines



Center Line

The center line is used to indicate centers of objects such as columns, lights, doors and ceilings. See Figure 4. This line is lightweight and composed of alternating long and short dashes. The center line is also used to indicate a finished floor line. In most instances, the object is symmetrical around the center line, meaning it is the same on both sides of the center line.

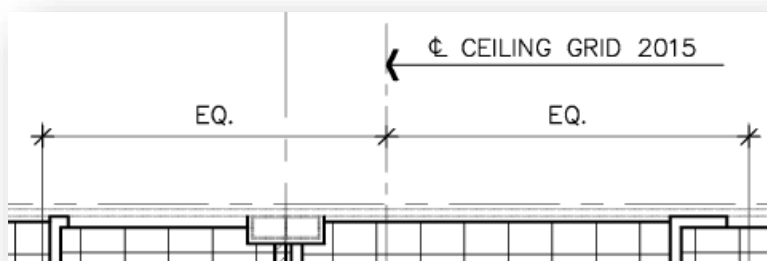


Figure 4 – Center Lines

Dimension and Extension Lines

Dimension and extension lines are thin lines that indicate the extent and direction of dimensions. See Figure 5. Dimension lines extend the length of the distance being measured. A marking device such as an arrow, dot or tick is placed at each end of the dimension line. Extension lines are drawn perpendicular to the dimension lines to identify the features which the dimension applies.

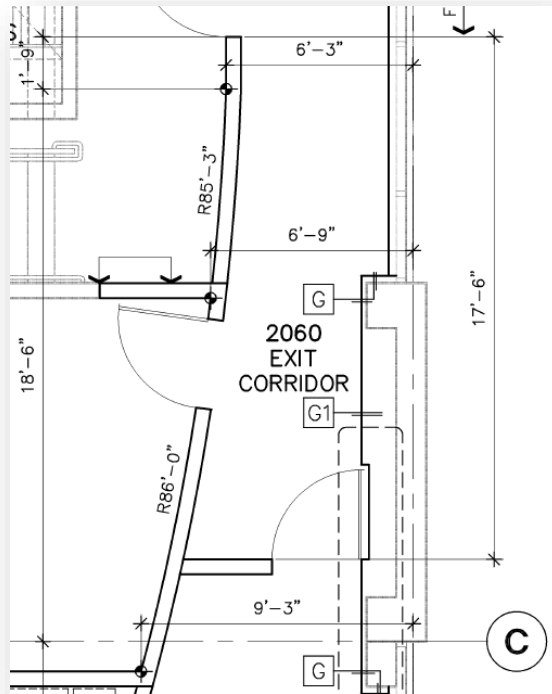
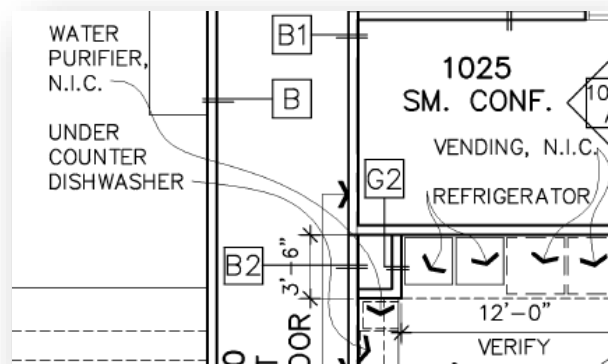


Figure 5 – Dimension and Extension Lines

Leader Line

Leader lines are used to place a dimension, note or label in a particular area. See Figure 6. These are often used when the drawing is crowded with other symbols or notes. Leader lines show exactly what and where the architect is directing the information. Leader lines connect the note or dimension to the object and have an arrow at the end where they connect to the object.

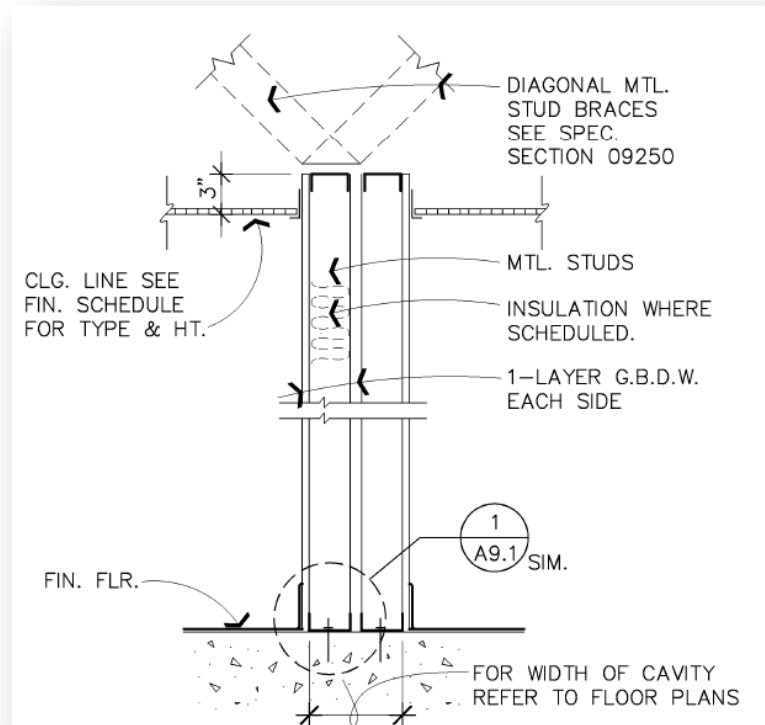
Figure 6 – Leader Lines



Break Line

Break lines are used when a portion of an object is shown. See Figure 7. This saves space on a drawing however, be aware a portion of the object has been omitted. For example, a full height wall may be drawn to show the intersection of the acoustical ceiling. The top and bottom of the wall have been omitted. The important part is the ceiling intersection, not the top and bottom of the wall. The break line has a zigzag inserted in it.

Figure 7 – Break Lines



Cutting Plane Line

Cutting plane lines indicate an item has been cut revealing the features inside, thus the term cutting plane. See Figure 8. The arrows, tabs, or additional lines placed at the end of the callout indicate the direction the section is being viewed. Cutting plane lines are passed through the object at the most advantageous point to provide information important to the construction. The section number and the sheet where the section is found are given within the symbol callout.

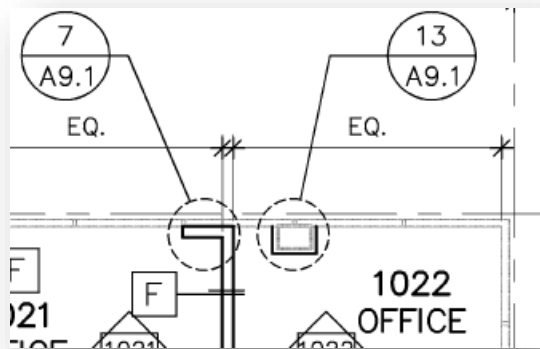


Figure 8 – Cutting Plane Lines

Detail Callout

Detail callouts indicate where a detail is found in the drawings. See Figure 9. Although these callouts are not lines, they convey an important reference to the reader. Inside the dashed circle is the item detailed and drawn to a larger scale in another drawing. Larger scale drawings allow the architect to present more information about the object. The detail number and sheet are given in the same manner as cutting plane callouts. Enlarged area plan drawings of bathrooms, reception areas, lobbies, and reflected ceiling plans use a callout similar to a detail callout, see Figure 10.

Figure 9 – Detail Callouts



FOR ENLARGED
PLAN SEE

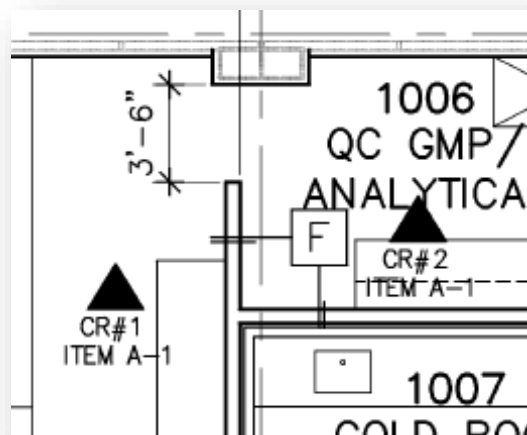


Figure 10 – Enlarged Area Callout

Revision Callout

A revision callout indicates a change to the drawings. See Figure 11. The symbol “Δ”, called a delta, is placed near the changed area and the acoustical ceiling installer has to compare the new drawing to the old drawing. The change becomes obvious once the comparison is made. The architect may issue an entire new sheet or an 8 ½" x 11" one page drawing. The date of the revision is included.

Figure 11 – Revision Callouts



Elevation Drawing Symbol

Elevation drawing symbols are used to direct the reader to the elevation and the sheet where the elevation is drawn. See Figure 12. Interior elevations are specific to a direction of the elevation drawing symbol, usually denoted as a solid arrowhead(s) around a circle. Elevations can be labeled as North, South, East or West or by numbers or letters. When the architect provides an elevation view for each wall in a room, each view is projected at a right angle to one another.

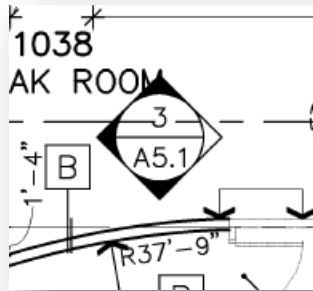


Figure 12 – Elevation Symbol

Partition Callout

Partition callouts, as shown in Figure 13, are used to label the different types of partitions found on the floor plan. These callouts are cross referenced with a partition legend or to a detail which defines the construction. The tab of the symbol is placed on the wall, marking the partition type and a letter is placed inside the box for identification. Not all prints use this type of symbol; some architects identify the partition by using different patterns within the wall lines on the floor plan. The acoustical ceiling installer must confirm the wall type and construction. It is important to understand the partitions which are framed under the grid and the partitions penetrating the acoustical grid.

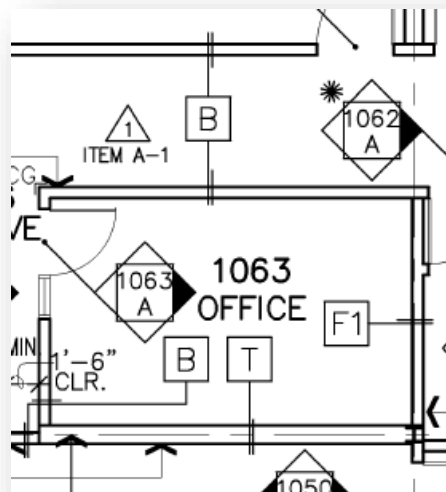
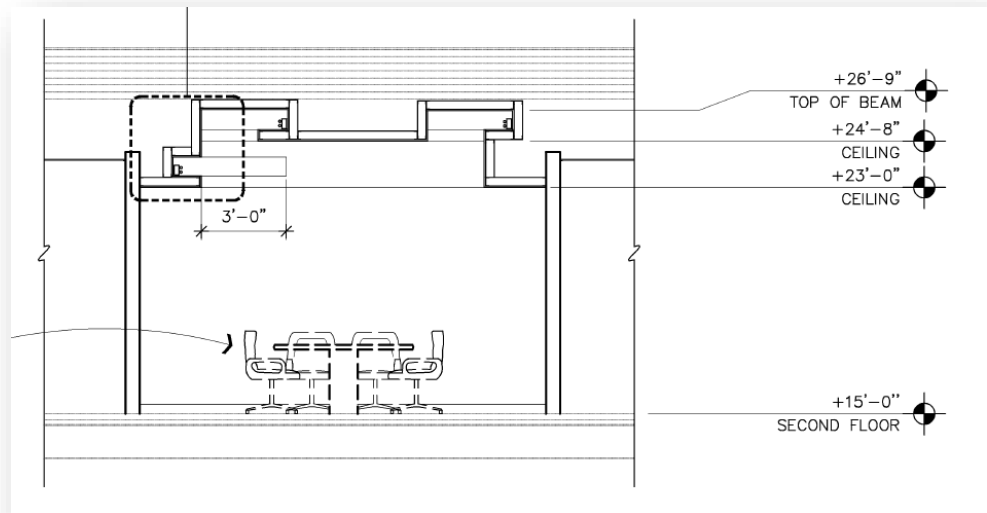


Figure 13 – Partition Callouts

Elevation Symbol

Elevation symbols establish a finished height and are typically found on elevation and section drawings. The finished height of an acoustical ceiling, the bottom of a soffit or the crown of a dome ceiling are locations where elevation symbols are used. The elevation dimension is measured from the finished floor. The line of the elevation symbol points to the item being dimensioned. The item being dimensioned is written below the line and the elevation is written above the line as shown in Figure 14. On section views there may be multiple elevation symbols used. The floor dimension is set as 0'- 0" or 100'- 0". If the floor elevation is set at 100'- 0" it should be thought of as 0'- 0". Architects use 100'- 0" instead of 0'- 0" to avoid negative dimensions. For example, an elevator pit is 5'- 0" below the floor, it would show an elevation of 95'- 0" instead of -5'- 0" when the floor is referenced as 100'- 0".

Figure 14 – Elevation Symbols



Title Block

The title block is located in the bottom right hand corner of each sheet or along the outer right hand side of each sheet. See Figure 15. The title block is the most logical place to start when reading blueprints. The information contained in the title block varies with each sheet, but it contains the name of the project, the title of the sheet, the sheet scale, the sheet number, the name of the architect and the original drawing date.

Coulter PHARMACEUTICAL 800 GATEWAY BOULEVARD SOUTH SAN FRANCISCO, CA	
SHEET TITLE: BUILDING SECTION DETAILS	
DRAWN: ET	SHEET
CHECKED: ERT	
DATE: 5/13/98	A3.3
SCALE: AS SHOWN	
JOB NO: 97081	OF 35 SHEETS

Figure 15 – Title Block

Revision Block

In the vicinity of the title block, there is an area for revisions called a revision block. See Figure 16. The architect lists the date of any change to the drawings on that sheet. The date is cross-referenced to the drawing with a “Δ” symbol and some architects place a cloud around the change. It is important to have the most current set of drawings available.

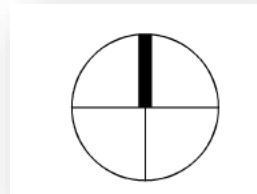
REV.	BY	DESCRIPTION	DATE
	ERT	ISSUED FOR PERMIT	5/13/98
	ERT	ISSUED FOR BID	6/10/98
▲	ERT	CONSTRUCTION SET	7/30/98

Figure 16 – Revision Block

North Arrow

The north arrow, shown in Figure 17, is found on most plan views. If the walls of the structure are not parallel to the compass direction of true north, then a plan north is designated. Plan north aligns with the building, which simplifies the description of elevation views.

Figure 17 – North Arrow



Recap of Lines

Figure 18 is a recap of the types of lines found in a set of drawings. This alphabet of lines helps the acoustical ceiling installer read and interpret the meaning each line conveys.

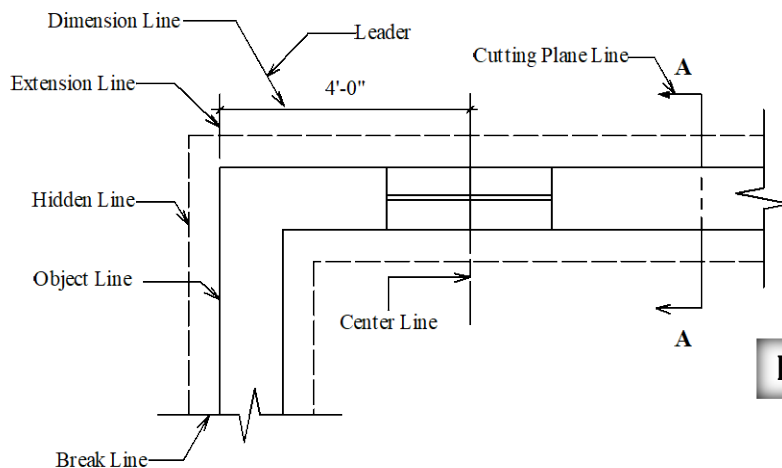


Figure 18 – Recap of Lines

Symbols

Architects use graphic symbols to keep drawings legible instead of cluttering the drawing with notes. Symbols are used for materials, fixtures and completed systems such as acoustical ceilings. See Figure 19. Normally, symbols are identified in a legend which lists the symbols and their corresponding meaning.

Wood is often shown with a wood grain and glass has three small lines drawn on the pane of glass. Electrical and plumbing fixtures have symbols which often look like the fixture itself. Symbols are used on detail drawings to show different parts and materials, while other symbols are used on plan views, elevation views and section drawings. Depending on the drawing, the architect may use a section or elevation symbol to express his or her view.

Some symbols have a function or operation shown. For example, closet doors can be bi-folding, sliding or hinged and the symbol reflects the operation. Try to become familiar with common symbols relating to acoustical ceilings as shown in Figure 20.

Figure 19 – Fixture Symbols

	SURFACE MTD. LIGHT FIXTURES
	WALL MTD. LIGHT FIXTURES
	STRIP LIGHTING
	SUPPLY AIR DIFFUSER
	RETURN AIR DIFFUSER
	AFS HEAD
	EXIT SIGN (WALL OR CLG. MTD.)
	DUCTS MECH.
	SMOKE DETECTOR
	SPEAKER
	OVERHEAD SHOWER

Figure 20 – Acoustical Ceiling Symbols

	FULL HT. 1 HR. RATED WALL TO STRUCTURE
	SUSPENDED "T-BAR" CEILING SEE DTL. FOR CLG. BRACING
	GYP. BD. CEILING SEE FOR BRACING
	COLD ROOM CEILING
	2'x4' SUSPENDED FLUORESCENT LIGHT FIXTURE
	2'x2' SUSPENDED FLUORESCENT LIGHT FIXTURE
	DOWN LIGHT
	WALL WASHER

Chapter 2 Study Guide

Directions:

Answer the following questions using the bubble answer sheet.

- 1) Extension lines are drawn perpendicular to the dimension lines to identify the features between which the dimension applies.
 - A. True
 - B. False

- 2) _____ are used to keep the individual drawings separated and organized.
 - A. Center lines
 - B. Border lines
 - C. Hidden lines
 - D. Object lines

- 3) _____ represent the main outline of an object, building, ceiling or wall.
 - A. Center lines
 - B. Border lines
 - C. Hidden lines
 - D. Object lines

- 4) Break lines are used when only a portion of an object is shown.
 - A. True
 - B. False

- 5) Extension lines extend the length of the distance being measured.
 - A. True
 - B. False

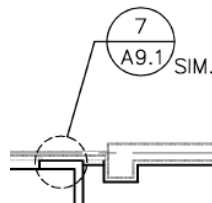
- 6) The hidden line is used to indicate centers of objects such as columns, lights, windows and equipment.
 - A. True
 - B. False

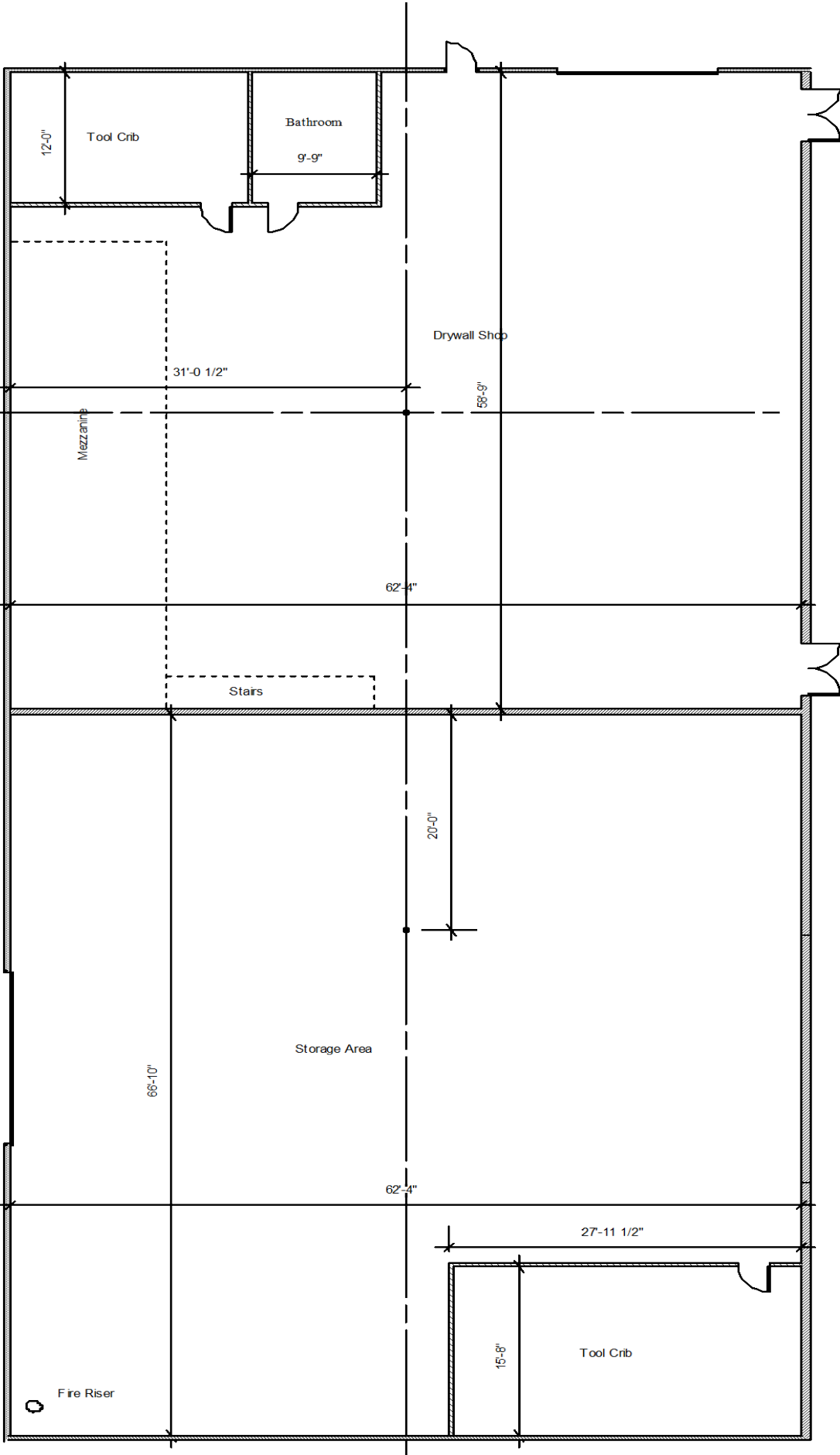
- 7) _____ define edges and surfaces not visible in a particular view.
- A. Center lines
 - B. Border lines
 - C. Hidden lines
 - D. Object lines
- 8) _____ are used to place a dimension, note or label in an area.
- A. Leader lines
 - B. Cutting planes
 - C. Object lines
 - D. Break lines
- 9) The arrows or tabs on the end of the cutting plane lines indicate the direction in which the section is being viewed.
- A. True
 - B. False
- 10) _____ are drawn to a larger scale with more information.
- A. Details
 - B. Elevations
 - C. Revisions
 - D. Indexes
- 11) Revision call-outs indicate a change in the drawings from the original drawings.
- A. True
 - B. False
- 12) Elevations can be labeled as North, South, East or West or by numbers or _____.
- A. symbols
 - B. letters
 - C. abbreviations
 - D. lines
- 13) Some symbols have a function or operation.
- A. True
 - B. False




- 14) Elevation dimensions are measured from the finished floor.
 A. True
 B. False
- 15) The _____ is the most logical place to start when reading blueprints.
 A. section drawing
 B. floor plan
 C. title block
 D. contractor list
- 16) If the walls of the structure are not parallel to the compass direction of true north, then a _____ north is designated.
 A. designated
 B. plan
 C. labeled
 D. selected
- 17) Architect use graphic _____ in order to keep drawings legible instead of cluttering the drawing with notes.
 A. drawings
 B. fixtures
 C. symbols
 D. materials
- 18) What type of drawing would this symbol show:
 A. Detail
 B. Cutting plane
 C. Elevation
 D. Revision



- 19) Dimension lines will only terminate with an arrow.
 A. True
 B. False
- 20) What type of symbol is this?
 A. Detail
 B. Cutting plane
 C. Elevation
 D. Revision





- Wall Legend:
-  Interior Partition +/- 96"
 -  Interior Full Height Partition
 -  Exterior Concrete Wall



Chapter 2
Plan Reading Exercise

Directions:

Review the floor plan on page 36 and answer the questions using the bubble answer sheet.

- 1) Based on the North arrow, what exterior walls have the rollup doors?
 - A. South & North
 - B. West & North
 - C. East & South
 - D. West & South

- 2) What is the hidden line referring to?
 - A. Tool Crib
 - B. Storage Area
 - C. Mezzanine
 - D. Fire Riser

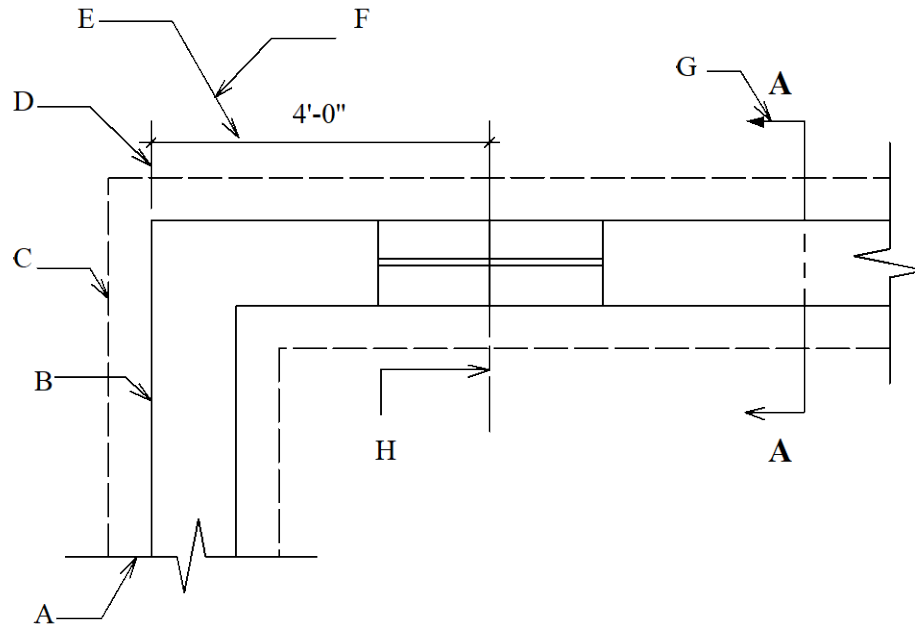
- 3) What are the dimensions of the bathroom?
 - A. 9'-9" x 12'-0"
 - B. 15'-8" x 27'-11 ½"
 - C. 66'-10" x 62'-4"
 - D. None of the above

- 4) What corner of the building is the fire riser located?
 - A. Northwest
 - B. Southeast
 - C. Southwest
 - D. Northeast

- 5) What is the dimension to the wall separating the Drywall Shop from the Storage Area starting at the North exterior wall?
 - A. 66'-10"
 - B. 20'-0"
 - C. 58'-9"
 - D. 62'-4"

- 6) What are the inside measurements of this building?
- A. 62'-4" x 125'-7"
 - B. 62'-4" x 58'-9"
 - C. 31'-0 1/2" x 58'-9"
 - D. 62'-4" x 66'-10"
- 7) How many door openings would be shown in an East exterior elevation?
- A. 1
 - B. 2
 - C. 3
 - D. 6
- 8) How many door openings would be shown in a North interior elevation, including the rollup door?
- A. 2
 - B. 3
 - C. 4
 - D. 5
- 9) How many windows are shown?
- A. 2
 - B. 1
 - C. 6
 - D. None
- 10) How far is the West exterior wall from the centerline of the column?
- A. 62'-4"
 - B. 31'-0 1/2"
 - C. 20'-0"
 - D. 58'-9"

Chapter 2 Line Identification Exercise



Directions: Match the letter to the type of line shown.

- | | |
|-------------------------|-----------------------------|
| 1. _____ Break Line | 5. _____ Dimension Line |
| 2. _____ Object Line | 6. _____ Leader |
| 3. _____ Hidden Line | 7. _____ Cutting Plane Line |
| 4. _____ Extension Line | 8. _____ Center Line |

Chapter 3

Scales and Dimensioning

Objectives:

At the end of this chapter, students will be able to:

- 1) Use an architectural scale.
- 2) Recognize different drawing scales.
- 3) Comprehend dimensioning techniques.
- 4) Establish perpendicular lines and perform a partition layout.

Scale

If construction drawings were drawn full size, the drawings would be as large as the building. Therefore drawings are reduced in size. The building is drawn using a reduced scale to maintain proportion with other parts of the building. For example, a scale of $1/8" = 1'-0"$ means that every $1/8"$ represents $1'-0"$ of the actual building. Another way to think of this is $1/8"$ scale is $1/96$ size, because there are ninety six $1/8$ inch units in $1'-0"$. Typical drawing scales for floor plans and reflected ceiling plans are $1/8" = 1'-0"$ or $1/4" = 1'-0"$. Drawings scales for details range from $1/2" = 1'-0"$ to full scale, whereas elevations and section drawings are commonly $1/4" = 1'-0"$.

The scale of a drawing is indicated on the sheet, either in the title block or beneath the drawing. Examples are shown in Figure 1. The most common scale used for commercial building plan views is $1/8" = 1'-0"$, due to the size of commercial buildings and the need to fit the entire drawing on one page.

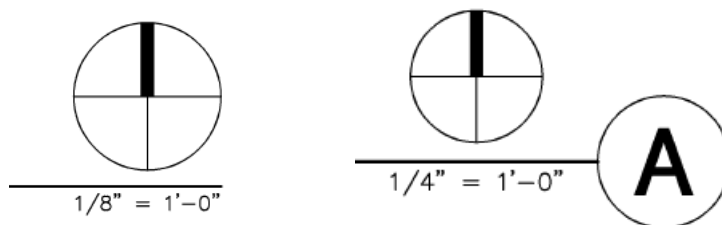


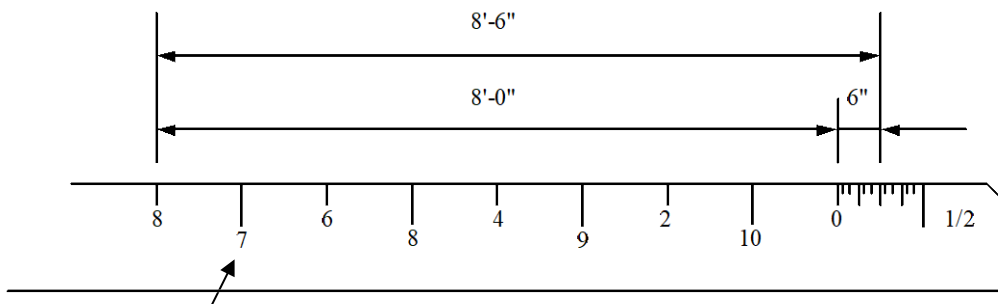
Figure 1 – Drawing Scales

Architect's Scale

The term scale also refers to the measuring ruler the architect would use to hand draw blueprints. Available to the architect are ten different drawing scales on the ruler. Reading and using an architect's scale is a simple process. The first step is to locate the scale on the drawings and then match this scale on the ruler. An architect's scale has two scales on each edge of the ruler, both scales have feet

measurements marked along the body of the ruler and can be read from right to left or left to right. Some measurements will read in feet increments of one foot, some two feet and others in four feet. Inches are marked to the left or right of 0 depending on which scale and end is used.

Using Figure 2, to draw a line 8' - 6" in length using the 1/2" = 1' - 0" scale, locate 8 at the top of the scale. Draw a line going left to right, starting at 8 going past 0 and on to 6. 8 represents 8' - 0" and each mark past 0 represents an inch, therefore 6 marks equals 6".



The lower numbers are the 1" scale coming from the left.

Figure 2

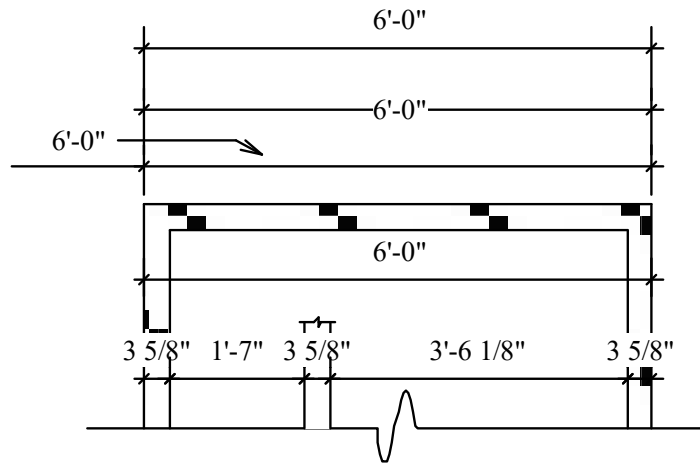
An architect's scale is preferred when taking a measurement from a drawing, but a tape measure can be used. For example, if the scale of a drawing is 1/8" = 1' - 0" and the object measures 1 5/8", the scaled distance would be 13' - 0". 1 5/8" equals thirteen 1/8" inches. It is not recommended to scale a drawing and written dimensions always take precedence over a scaled dimension. However, if a drawing has a missing dimension it may be necessary to scale. Scaled dimensions should be cross-checked with other dimensions on the drawings if possible. A better procedure is to request the missing dimension from the general contractor or architect.

Dimensioning Techniques

The acoustical ceiling installer needs to know some basic rules for reading dimensions. Dimensions are given to locate points from other points on the prints. It is a preference of the individual architect whether they use a tick, dot or arrowhead when terminating a dimension line. The extension lines are drawn so the point of reference is clear. The dimension can be placed above the dimension line, within the dimension line and sometimes outside of the extension lines with the use of a leader line pointing to the dimension line, as shown in Figure 3. Not all

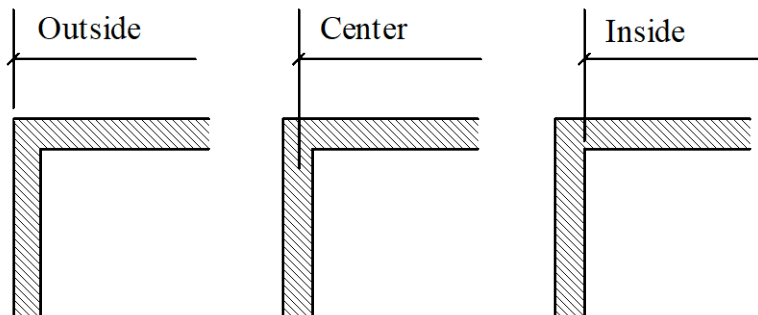
dimensions are pulled away from the drawing with extension lines, they may also be placed within the room or drawing. Dimensions should be shown in each room on a floor plan giving its exact size, location and relationship to other objects.

Figure 3 – Dimension Examples



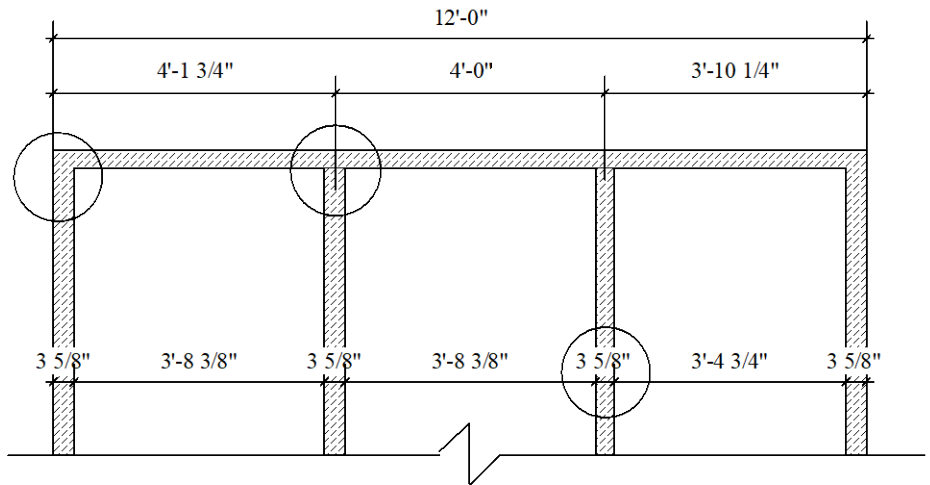
The extension lines or the termination of the dimension line should be carefully studied. The acoustical ceiling installer must understand where the extension lines are originating or terminating for proper layout when dimensions are given. Note how the extension lines in Figure 4 terminate at three different locations along the same wall.

Figure 4 - Dimension Termination Examples



In Figure 5, the cumulative dimensions add up to the overall dimension along the top of the figure. The architect is using outside of the walls, center of the wall and inside dimensions. Extension and dimension lines are important to read carefully, but the type of dimension is important as well.

Figure 5 – Cumulative Dimensions



Some architects use centerline dimensions, finish dimensions or frame line dimensions, also called face of stud dimensions. The architect always writes a sheet note explaining the type of dimension used in the drawings. Note 7 in Figure 6 explains the type of dimension used for a set of drawings. U.N.O. is an abbreviation for “unless otherwise noted.”

Figure 6 – General Notes

GENERAL NOTES

1. VERIFY <E> CONDITIONS ON-SITE & REVIEW MODIFICATIONS REQUIRED TO SUIT <E> CONDITIONS PRIOR TO FABRICATIONS & INSTALLATIONS.
2. "TYP" – REPEAT WHEREVER THIS CONDITION OCCURS.
3. "SIM" – REPEAT & MODIFY AS REQUIRED TO SUIT CONDITION.
4. ALL DOORS ADJACENT TO WALLS ARE GIVEN AS 6" FROM FACE OF JAMB TO F.O.F. OF ADJACENT WALL U.O.N.
5. FIRE EXTINGUISHERS SHALL BE LOCATED WITHIN A MAXIMUM AREA OF 2,500 SQ. FT. OF COVERAGE AND WITH A MAXIMUM TRAVEL DISTANCE OF 75'-0" TO EXTINGUISHER.
6. PRESERVE AND MAINTAIN <E> EXITS DURING DEMOLITION AND CONSTRUCTION PHASES.
7. ALL DIMENSIONS GIVEN TO FACE OF STUD, U.O.N.
8. PROVIDE EXIT SIGNS PER UBC 1013.
9. PARTITION ASSEMBLIES SHALL CONFORM TO MINIMUM STANDARDS DESCRIBED IN U.B.C. TABLE 43B ITEM 15-1.1
SUSPENDED CEILING ASSEMBLIES SHALL CONFORM TO MINIMUM STANDARDS IN ICBO REPORT NO. 2244.
10. REFER TO SHEETS A2.1, A2.2, A6.1, AND A6.2 FOR DRAWING SYMBOLS USED WITHIN THE DOCUMENT SET.
11. DATUM ELEVATION 0'-0" IS GIVEN AS BENCHMARK.

The reflected ceiling plan in Figure 7 has dimensions to a light fixture which govern the acoustical ceiling layout in Room 1049. In Figure 8, the acoustical ceiling has equal borders in one direction and a full 2' - 0" tile starting from the exterior wall. These dimensions are considered finish dimensions because the ceiling grid bays are 2' x 4' or 2' x 2' and the ceiling tile does not affect the dimensions when installed.

Figure 7 – Light Fixture Dimensions

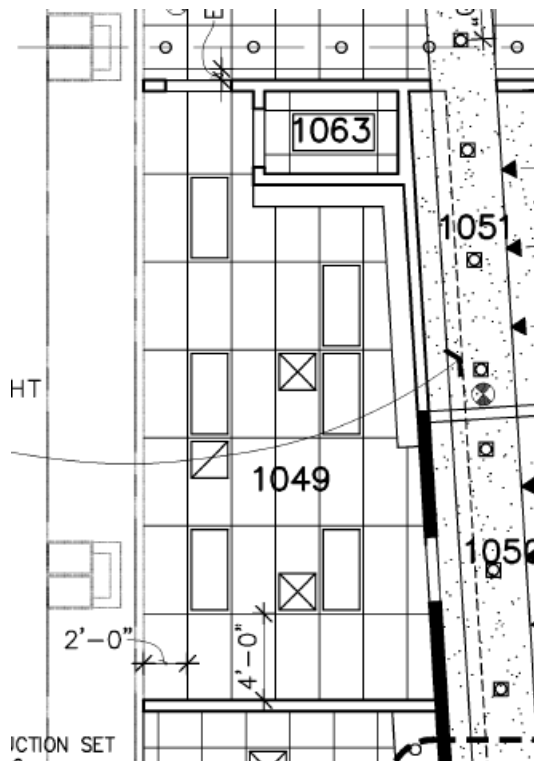
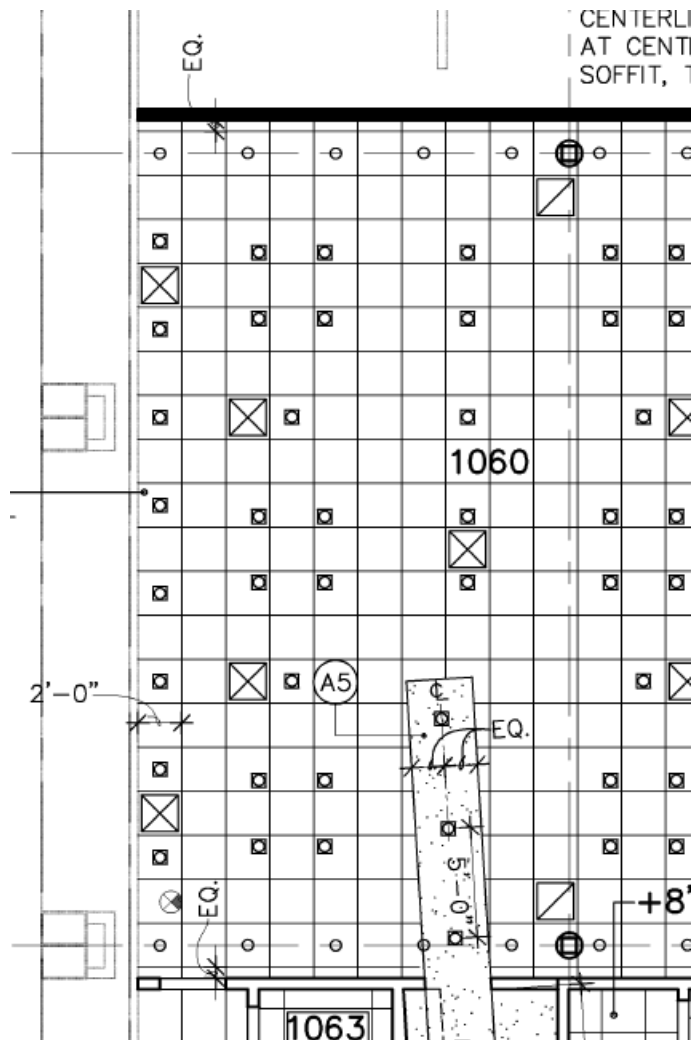


Figure 8 – Equal Border Dimensions

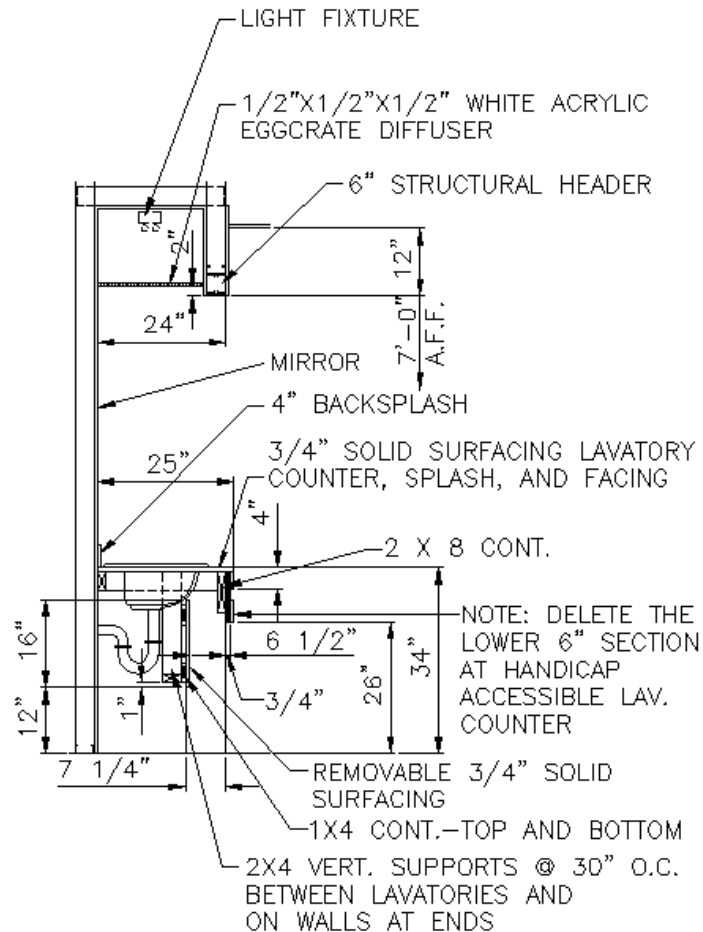


Dimensioning of Elevation or Section Drawings

Dimensions can be found on elevation, section and detail drawings. Mounting heights for grab bars, soffit heights and ceiling heights are some of the examples of vertical dimensions. Elevation and section drawings are used to show materials and their placement. Information about the materials is provided through notes placed on the elevation drawing.

In Figure 9, note the vertical dimensions. The bottom of the header is 7' - 0" above the finished floor, abbreviated as A.F.F. The ceiling is 12" above the bottom

of the soffit and the acrylic egg crate diffuser is mounted 2" above the bottom of the soffit. The top of the counter is 34" above the floor. Also shown, are some horizontal dimensions. The soffit is 24" away from the back wall to the outside edge and the counter top is 25" wide. Understanding where to find information is an important element to reading blueprints.



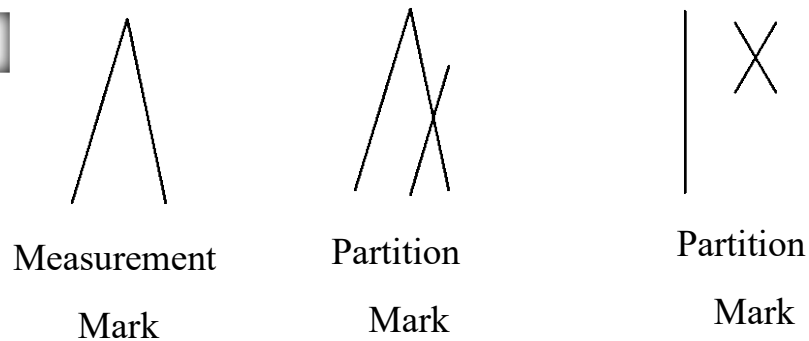
LAVATORY
W/RECESSED LIGHT
 SCALE: 1/2" = 1' - 0"

How to Make Layout Marks

This may seem very basic, but correctly marking layout lines is important. Certain marks are used to avoid confusion. Layout marks are made in the form of an arrowhead for soffits and partitions. These arrowhead marks are flagged to locate which side of the mark and subsequent chalk line to place the track. Some installers prefer to mark each side of the wall with an arrowhead or just to mark one side. A flagged mark, also known as a partition mark, is when one leg of the arrowhead has another line struck through it.

Use a carpenter's pencil or Sharpie to make your marks. Use a point on your marker that clearly defines the mark, measurement or arcs when creating square lines. Crayon markers or dull pencils should not be used for accuracy reasons. Correct marks are shown in Figure 10.

Figure 10 – Layout Marks



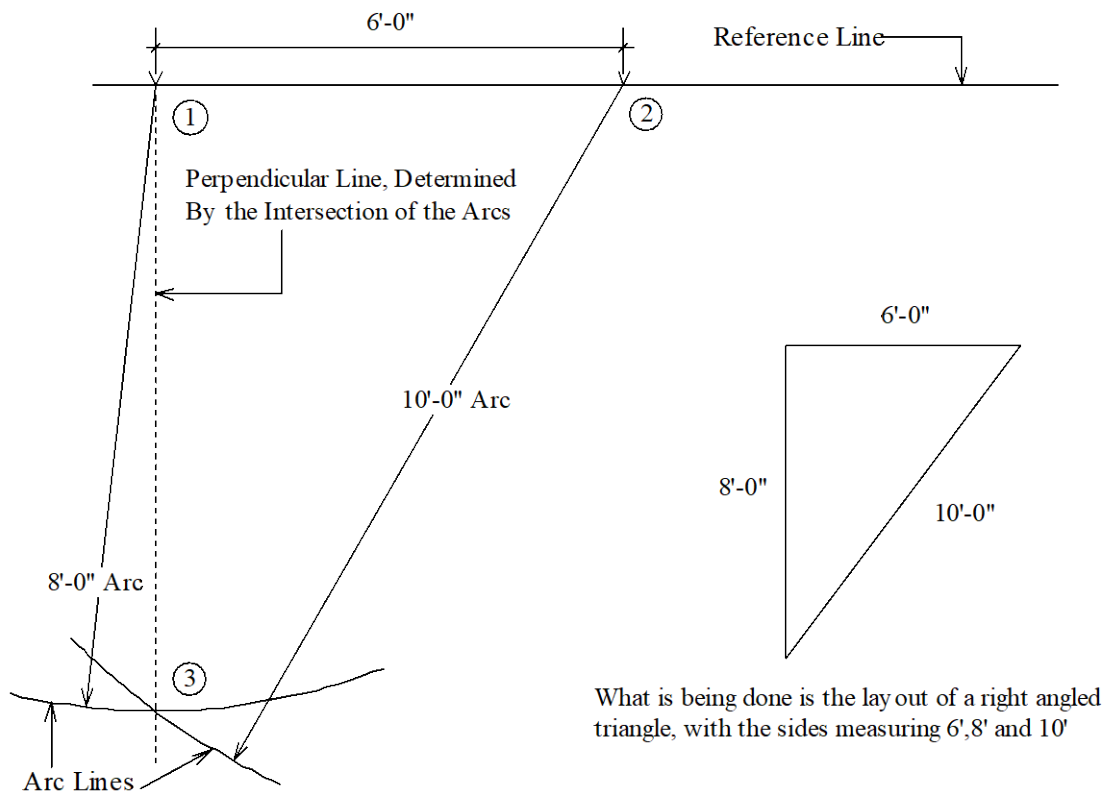
How to Establish a 90° Angle

Many times the general contractor create 90° control lines for the project. These control lines intersect along a set of building column lines in two directions producing a 90° angle establishing “Building Square.” All trades on the job use these reference lines. When the partition layout is parallel and square to the control lines, the acoustical ceiling typically installs square and true.

Square control lines for the partition layout are established if the general contractor did not provide them. Locate the column line most useful for layout purposes, usually the column line where the dimensions start. Go to the two columns farthest apart in the line and mark the center of these columns. Measure 12 inches or more from the center marks and make another set of marks. Snap a line parallel to the columns through the marks. Once the initial control line is established, another line is snapped perpendicular to the control line.

The perpendicular line is created using 3:4:5 method, also known as the ship builder’s method. Any triangle whose sides have the ratio 3:4:5 is a right triangle. Any triangle whose sides have the ratio 3:4:5 is a right triangle. To find other multiples of 3:4:5 simply multiply these numbers by any number. For example, multiply each number 3:4:5 by the number 8. The resulting ratio is 24:32:40. The numbers 24:32:40 are used to create a perpendicular line to the first control line. An example using the ship builder’s method is shown in Figure 11, using the ratio 6:8:10.

Figure 11 – Establishing Square



Creating a Perpendicular Line

The following steps should be followed to create the perpendicular line:

- 1) Snap a reference line approximately 10' in length.
- 2) Determine the multiple of $3:4:5 = 6:8:10$.
- 3) Mark point #1 on the reference line where the perpendicular line starts.
- 4) Measure 6' - 0" along the reference line from point #1 to establish point #2.
- 5) Swing a 10' - 0" arc from point #2.
- 6) Swing an 8' - 0" arc, from point #1.
- 7) Snap a line connecting points #1 and #3 at the intersection of the two arcs.

Perpendicular lines are used every day in construction. The ship builder's method is a common element in laying out partitions, soffits and other features. Acoustical ceiling installers often install ceilings at a 45° angle to the surrounding walls. 45° angles are created from the 90° angle by a method known as bisecting, which will be covered in a later class.

Layout Procedures

On the next few pages is a simple layout project. The method to laying out this project are given step by step. As mentioned before, the dimensions shown on a set of blueprints vary depending upon the type. A dimension given to the face of stud, also called face of framing, is completely different from dimensions given to the face of finish or centerline dimensions. Dimensions to the face of the stud do not require a mathematical adjustment. Finish dimensions require the acoustical ceiling installer to add or subtract the thickness of the finish material to the dimension in most cases.

Laying out a project is simply a matter of snapping parallel lines from the perpendicular lines using the dimensions. Figure 12 is the layout project in the following procedure. Reading the notes state the dimensions are to face of framing.

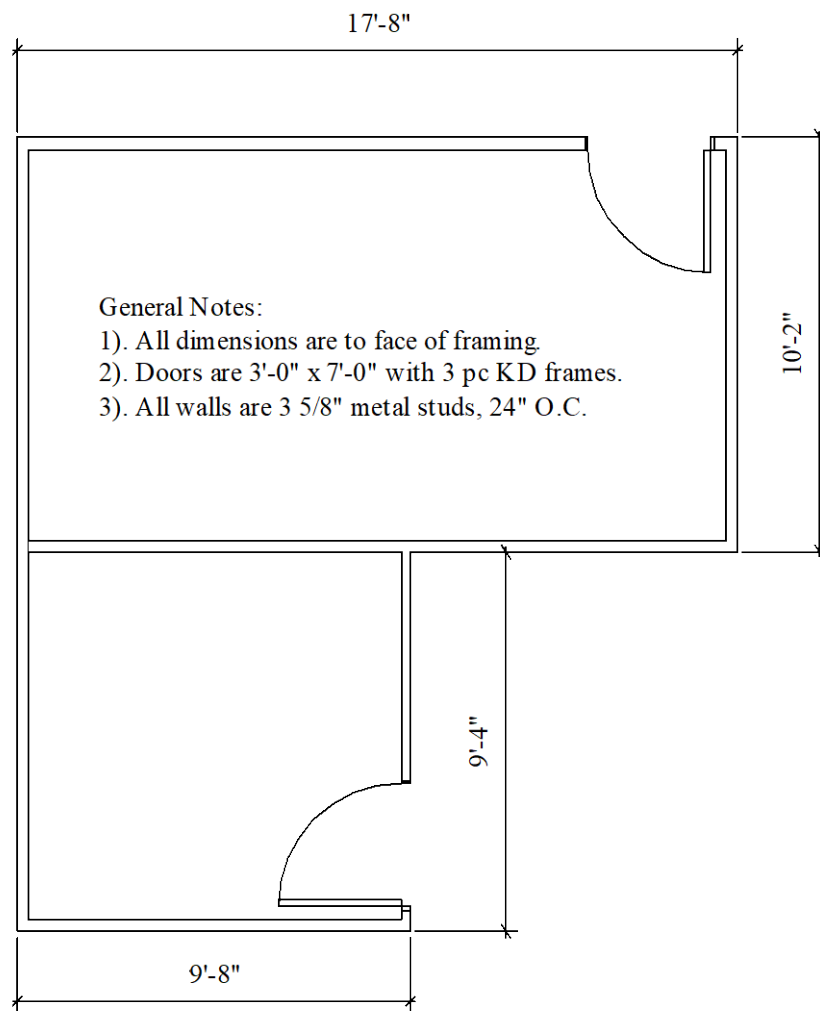


Figure 12

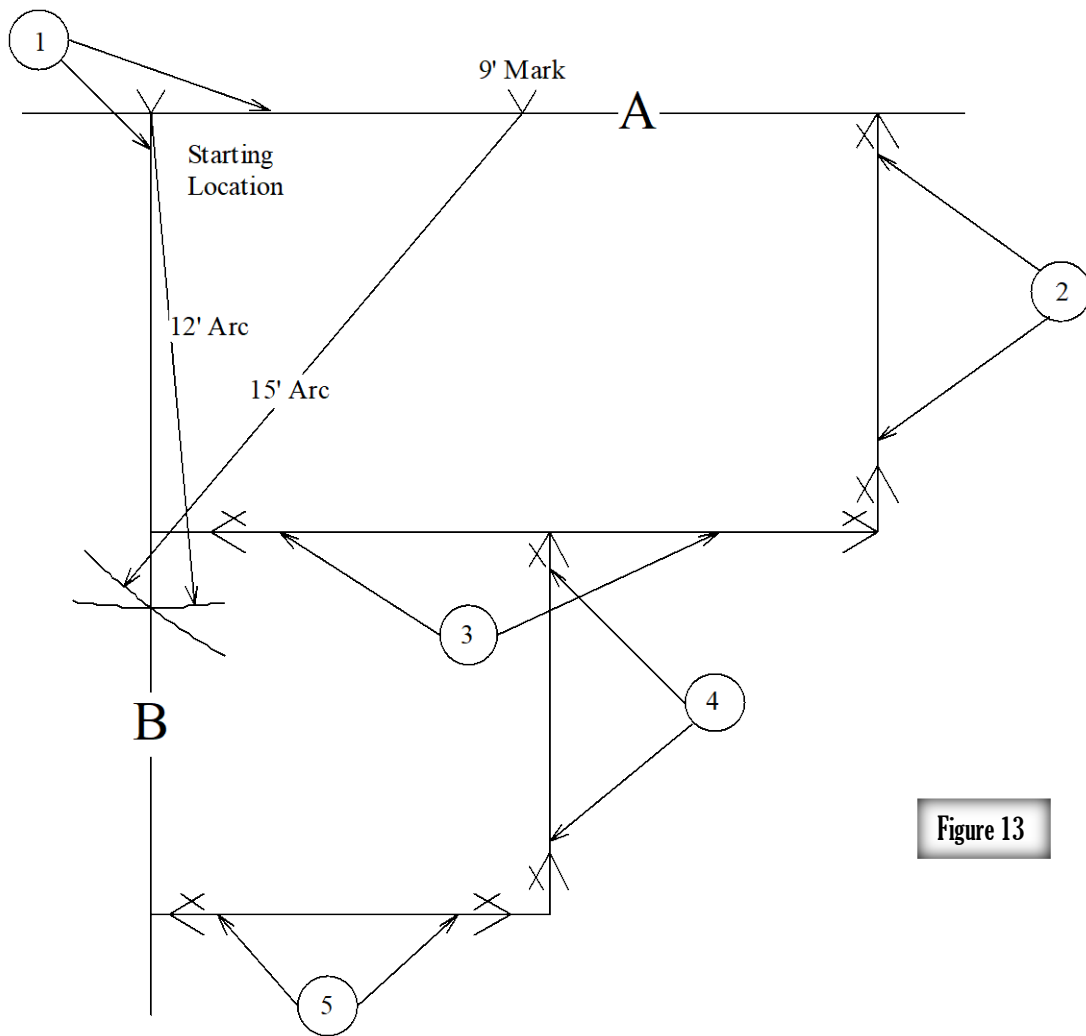


Figure 13

Layout Procedure

- 1) Snap layout line A shown by Note 1, flagging to the inside. See Figure 13.
- 2) Determine the ratio of $3:4:5 = 9:12:15$.
- 3) Swing arcs to determine line B.
- 4) Snap layout line B, shown by Note 1, flagging to the inside.
- 5) Measure over 17'-8" in two locations from line B and place marks, flagging to the inside.
- 6) Snap the layout line, shown by Note 2, at the marks made in step 5.
- 7) Measure over 10'-2" in two locations from line A and place marks, flagging to the inside.
- 8) Snap the layout line, shown by Note 3, at the marks made in step 7.

- 9) Measure over 9'-8" in two locations from line B and place marks, flagging to the inside.
- 10) Snap the layout line, shown by Note 4, at the marks made in step 8.
- 11) Measure over 9'-4" in two locations from the line shown as Note 3, flagging to the inside.
- 12) Snap the layout line, shown by Note 4, at the marks made in step 11.
- 13) Measure over 9'-4" in two locations from the line shown as Note 3, flagging to the inside.

The outside wall lines are laid out, but the layout is not complete. Measure over 3 5/8" and make a mark at the ends of each wall line. Snap lines through these marks to establish the inside wall lines. The next step is to measure and mark the rough opening dimensions for the door openings. It is important to realize all layout lines paralleled the perpendicular lines and only one 90° angle was created for the layout.

Chapter 3
Study Guide

Directions:

Answer the following questions using the bubble answer sheet.

- 1) Cumulative dimensions within a room must add up to the overall dimension of the room.
 - A. True
 - B. False

- 2) The scale $1/4" = 1' - 0"$ is understood as:
 - A. 1/96 size
 - B. 1/48 size
 - C. 1/8 size
 - D. 1/24 size

- 3) The architect always writes a sheet note explaining the type of dimension used in the drawings.
 - A. True
 - B. False

- 4) Dimensions can be found on elevation, section and detail drawings.
 - A. True
 - B. False

- 5) Dimensions can be:
 - A. Placed above the dimension line.
 - B. Placed within the dimension line.
 - C. Placed outside of the dimension line with the use of a leader line.
 - D. All of the above.

- 6) The extension lines or leader lines are drawn so the point of _____ is clear.
 - A. location
 - B. reference
 - C. relation
 - D. position

- 7) It is not recommended to scale a drawing and written dimensions always take precedence over a scaled dimension.
- A. True
 - B. False
- 8) Dimensions are shown to locate points from other points on the prints.
- A. True
 - B. False
- 9) The term _____ also refers to the measuring ruler the architect would use to hand draw blueprints.
- A. proportion
 - B. scale
 - C. CAD
 - D. gauge
- 10) The scale of a drawing is indicated on the sheet, either in the title block or beneath the drawing.
- A. True
 - B. False
- 11) Building control lines intersect along a set of building column lines in two directions producing a 120° angle establishing "Building Square."
- A. True
 - B. False
- 12) Perpendicular line are created using 3:4:5 method, also known as the ship builder's method.
- A. True
 - B. False
- 13) Any triangle whose sides are in the ratio 3:4:5 is a (n) _____ triangle.
- A. left
 - B. right
 - C. 45°
 - D. angled

- 14) To find multiples of 3:4:5 for the ship builder's method, simply multiply these numbers by any number.
- A. True
 - B. False
- 15) Finish dimensions require the acoustical ceiling installer to add or subtract the _____ of the finish material to the dimension in most cases.
- A. type
 - B. quantity
 - C. thickness
 - D. length
- 16) Project layout is simply a matter of snapping parallel lines from the perpendicular lines using the dimensions.
- A. True
 - B. False
- 17) Layout arrowhead marks are _____ to locate which side of the mark and subsequent chalk line to place the track.
- A. flagged
 - B. marked
 - C. erased
 - D. painted

Chapter 3 Scaling Exercise

Exercise 1:

In the right margin of this sheet, draw a line 5 inches long, using the 16 Scale. Place thin, short extension lines at each end. Using each of the indicated scales, record the measured length of the line and its scale ratio in space provided.

Architect's Scale	Scale Ratio	Measured Line Length
16 Scale: 1" = 1"	1:1	5"
1 Scale: 1" = 1'		
1/4 Scale: 1/4" = 1'		
3 Scale: 3" = 1'		
3/16 Scale: 3/16" = 1'		

Exercise 2:

In the right margin of this sheet, draw a line 4 inches long, using the 16 Scale. Place thin, short extension lines at each end. Using each of the indicated scales, record the measured length of the line and its scale ratio in space provided.

Architect's Scale	Scale Ratio	Measured Line Length
16 Scale: 1" = 1"	1:1	4"
3/4 Scale: 3/4" = 1'		
1/8 Scale: 1/8" = 1'		
3/32 Scale: 3/32" = 1'		
1/2 Scale: 1/2" = 1'		

Exercise 3:

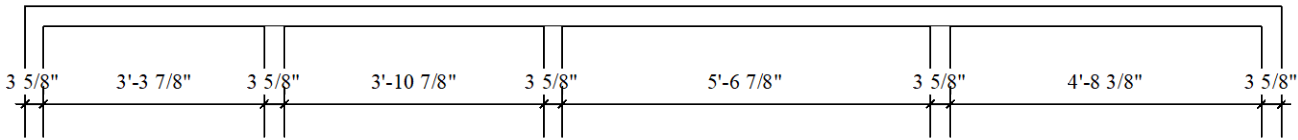
Using the indicated scale, draw a horizontal line to the right of the distance shown. Place extension lines at each end.

Architect's Scale	DISTANCE	Length of Line
1/4 Scale	9' - 5"	

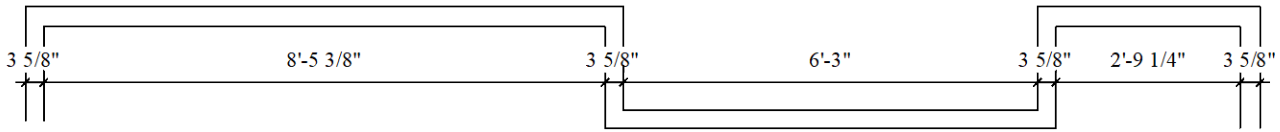
3/4 Scale	2' - 4"
1/8 Scale	18' - 8"
3/32 Scale	26' - 0"
1 1/2 Scale	1' - 7 3/4"
1/2 Scale	5' - 10"

Cumulative Dimension Exercise

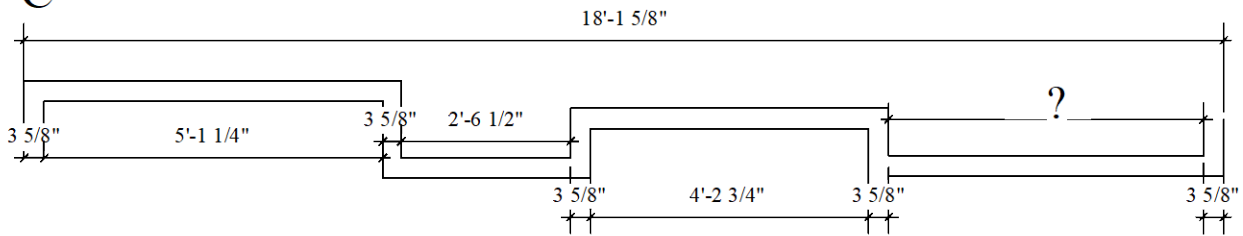
A



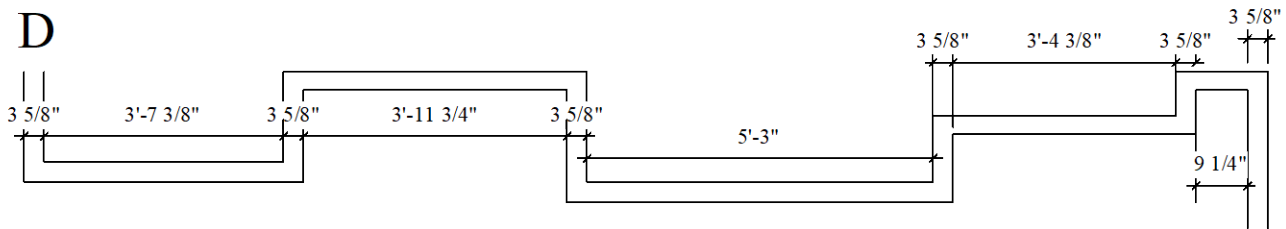
B



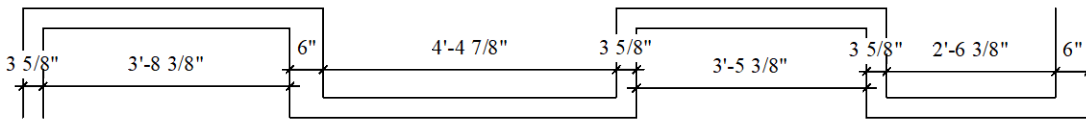
C



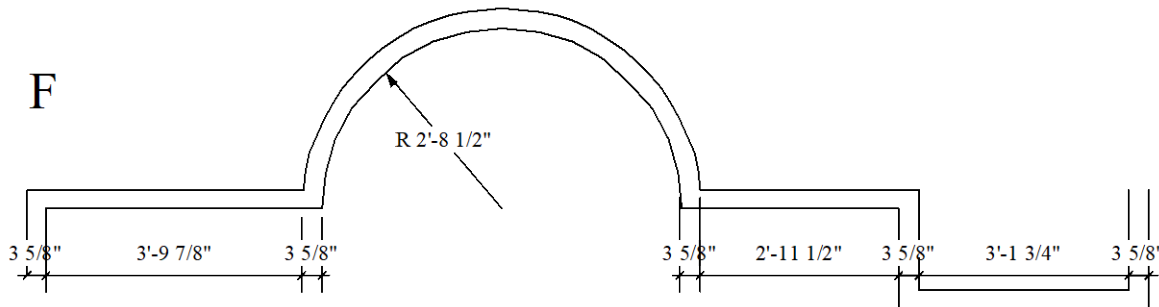
D



E



F



Directions: Find the cumulative or missing dimension for A thru F.

A. _____

D. _____

B. _____

E. _____

C. _____

F. _____

Chapter 4

Reading Blueprints

Objectives:

At the end of this chapter, students will be able to:

- 1) Comprehend the basic concept of reading and visualizing blueprints.
- 2) Realize the process for gathering information as it relates to an acoustical ceiling installation.
- 3) Determine equal borders for an acoustical ceiling.

Introduction

The best way to learn blueprint reading is to study real prints. Print reading is not something learned overnight, but becomes easier over time. The first steps to blueprint reading have been taken and much has been learned. Symbols and lines were explained in earlier chapters along with section, elevation, plan, and detail drawings. The next step is to find information pertaining to the installation within the drawings.

One of the best ways to find information for the acoustical ceiling installation is to ask questions. What is the ceiling height? Are there differing ceiling heights? What is the typically grid layout? What type of ceiling material and tile is specified? These questions require answers and finding this information is the focus of this chapter.

Print Reading Guidelines

There is not one absolute way to read prints. What works for one person may seem confusing to another. The most basic guideline is to read all sheet and leader notes found on the plans, details, sections and elevations. When the acoustical ceiling installer becomes familiar with a set of prints, finding information is fairly simple.

At first, become familiar with the blueprints instead of being concerned about the actual installation. Check the plans against the sheet index to make sure the titles in the title block match the index, especially for the architectural drawings. It is rare not to have a complete set of drawings, but mistakes happen. The next step is to check each sheet to correlate the information presented.


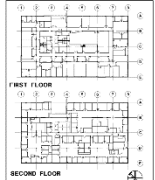


Title Sheet

The title sheet is much like the cover sheet of a book. See Figure 1. Start reading the title sheet and each note in the general notes section. Important information is

contained in the general notes which should not be overlooked. Review the symbol legend if one is given. Each architect draws his or her symbols a little differently than others. Review the list of abbreviations used in the drawings. If there is information about the dimensions, confirm if they are finish or otherwise. If there is a location map for the work in an existing building, locate the project. For example, the project is located in the west corner of the second floor.

Review each architectural sheet to get a “feel” for the drawings. Nothing in particular is being looked for at this point. Become familiar with the drawings and the project starting with the title sheet and ending with the last architectural sheet.

Figure 1 – Title Sheet

<p>ABBREVIATIONS</p> <p>1. ALL THE SYMBOLS SHOWN SHALL COMPLY WITH THE LATEST EDITION OF THE SYMBOLS AND ABBREVIATIONS FOR ARCHITECTS AND ENGINEERS, PUBLISHED BY THE NATIONAL ARCHITECTURAL ACADEMY, INC., 1200 15TH STREET, N.W., WASHINGTON, D.C. 20004.</p> <p>2. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>3. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>4. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>5. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>6. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>7. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>8. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>9. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>10. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p>	<p>DESCRIPTION</p> <p>THIS SET OF DRAWINGS IS PREPARED IN ACCORDANCE WITH THE ARCHITECT'S CONTRACT AND THE NATIONAL ARCHITECTURAL ACADEMY, INC., PUBLISHED BY THE NATIONAL ARCHITECTURAL ACADEMY, INC., 1200 15TH STREET, N.W., WASHINGTON, D.C. 20004.</p> <p>1. ALL THE SYMBOLS SHOWN SHALL COMPLY WITH THE LATEST EDITION OF THE SYMBOLS AND ABBREVIATIONS FOR ARCHITECTS AND ENGINEERS, PUBLISHED BY THE NATIONAL ARCHITECTURAL ACADEMY, INC., 1200 15TH STREET, N.W., WASHINGTON, D.C. 20004.</p> <p>2. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>3. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>4. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>5. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>6. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>7. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>8. 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THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>DATA</p> <p>BUILDING ORIGIN: -15.00 SF AREA OF WORK: -15.00 SF CONTRACTOR TYPE: 01 OCCUPANCY: B, 4-1, 4-2, 4-3 BUILDING CODE: 1995 IBC, 2010 IBC FIRE CODE: 2010 IBC MECHANICAL CODE: 2010 IBC PLUMBING CODE: 2010 IBC ELECTRICAL CODE: 2010 IBC SCHEDULED: DISTRICT FULLY SCHEDULED PARTIAL: 1500 HRS</p> <p>LOCATION</p>  <p>KEY PLANS</p>  <p>FIRST FLOOR</p>  <p>SECOND FLOOR</p> 	<p>DRAWING INDEX</p> <p>ARCHITECTURAL</p> <p>TS-1 GENERAL INDEX, SYMBOLS, ABBREVIATIONS AD-1 FIRST FLOOR EXIST PLAN AD-2 SECOND FLOOR EXIST PLAN AD-3 SITE PLAN AD-4 FIRST FLOOR FINISH PLAN AD-5 SECOND FLOOR FINISH PLAN AD-6 ROOF PLAN & DETAILS AD-7 PARTITION TYPES AD-8 WINDOW SCHEDULE & DETAILS AD-9 EXTERIOR ELEVATIONS AD-10 BUILDING SECTIONS AD-11 BUILDING SECTIONS DETAILS AD-12 OPEN OFFICE FLOOR PLANS & SECTIONS AD-13 ENLARGED FLOOR PLANS & SECTIONS AD-14 FINISH SCHEDULE</p> <p>STRUCTURAL</p> <p>SD-1 GENERAL NOTES & TYPICAL DETAILS SD-2 PARTIAL FOUNDATION PLANS & DETAILS SD-3 ROOF TRUSSING PLAN SD-4 STRUCTURAL DETAILS</p> <p>MECHANICAL</p> <p>MD-1 LEGEND, SCHEDULES & NOTES MD-2 SCHEDULES MD-3 TITLES & CALCULATIONS MD-4 FIRST FLOOR HVAC PLAN MD-5 SECOND FLOOR HVAC PLAN MD-6 SECOND FLOOR HVAC PLAN MD-7 ROOF HVAC PLAN MD-8 ROOF HVAC PLAN MD-9 ROOF COORDINATION PLAN MD-10 ROOF COORDINATION PLAN MD-11 PIPING DIAGRAM MD-12 FIRST FLOOR PIPING PLAN MD-13 SECOND FLOOR PIPING PLAN MD-14 SECOND FLOOR PIPING PLAN</p> <p>ENERGY COMPLIANCE</p> <p>ED-1 ENLARGED DAYLIGHT FINISH SECTIONS ED-2 ENLARGED DAYLIGHT FINISH SECTIONS ED-3 ENLARGED DAYLIGHT FINISH SECTIONS ED-4 ENLARGED DAYLIGHT FINISH SECTIONS ED-5 ENLARGED DAYLIGHT FINISH SECTIONS ED-6 ENLARGED DAYLIGHT FINISH SECTIONS ED-7 ENLARGED DAYLIGHT FINISH SECTIONS ED-8 ENLARGED DAYLIGHT FINISH SECTIONS ED-9 ENLARGED DAYLIGHT FINISH SECTIONS ED-10 ENLARGED DAYLIGHT FINISH SECTIONS</p>	<p>PLUMBING</p> <p>PD-1 NOTES LEGEND, SCHEDULES & SYMBOLS PD-2 FIRST FLOOR ABOVE GROUND PLUMBING PLAN PD-3 FIRST FLOOR OVERHEAD SPRING PLUMBING PLAN PD-4 SECOND FLOOR PLUMBING PLAN PD-5 ROOF PLAN PD-6 UNDERGROUND WASTE & VENT PLUMBING PLAN PD-7 FIRST FLOOR ISOMETRIC VIEWS AND DETAILS</p> <p>ELECTRICAL</p> <p>ED-1 DRAWING INDEX, ABBREVIATIONS & SYMBOLS ED-2 FINISH SCHEDULE ED-3 TITLES & CALCULATIONS ED-4 LIGHTING CONTROL & DATA WIRE DIAGRAM ED-5 SINGLE LINE DIAGRAM ED-6 POWER PLAN, FIRST FLOOR ED-7 POWER PLAN, SECOND FLOOR ED-8 POWER & LIGHT PLAN, ROOF ED-9 LIGHT PLAN, FIRST FLOOR ED-10 LIGHT PLAN, SECOND FLOOR ED-11 PANEL SCHEDULES ED-12 PANEL SCHEDULES</p>	<p>FIRE PROTECTION</p> <p>1. ALL FIRE SPRINKLER SYSTEMS SHALL COMPLY WITH THE LATEST EDITION OF THE NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 13, 1998 EDITION, AND THE CALIFORNIA FIRE MARSHAL'S (CFM) 2010 EDITION, AND THE CALIFORNIA FIRE MARSHAL'S (CFM) 2010 EDITION, AND THE CALIFORNIA FIRE MARSHAL'S (CFM) 2010 EDITION.</p> <p>2. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>3. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>4. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>5. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>6. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>7. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>8. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>9. THE ARCHITECT'S SYMBOLS SHALL BE USED UNLESS OTHERWISE NOTED.</p> <p>10. 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<p>TITLE SHEET</p> <p>DATE: 01/15/10 DRAWN: [Name] CHECKED: [Name] DESIGNED: [Name] PROJECT NO.: [Number] SHEET NO.: 10.1</p>					

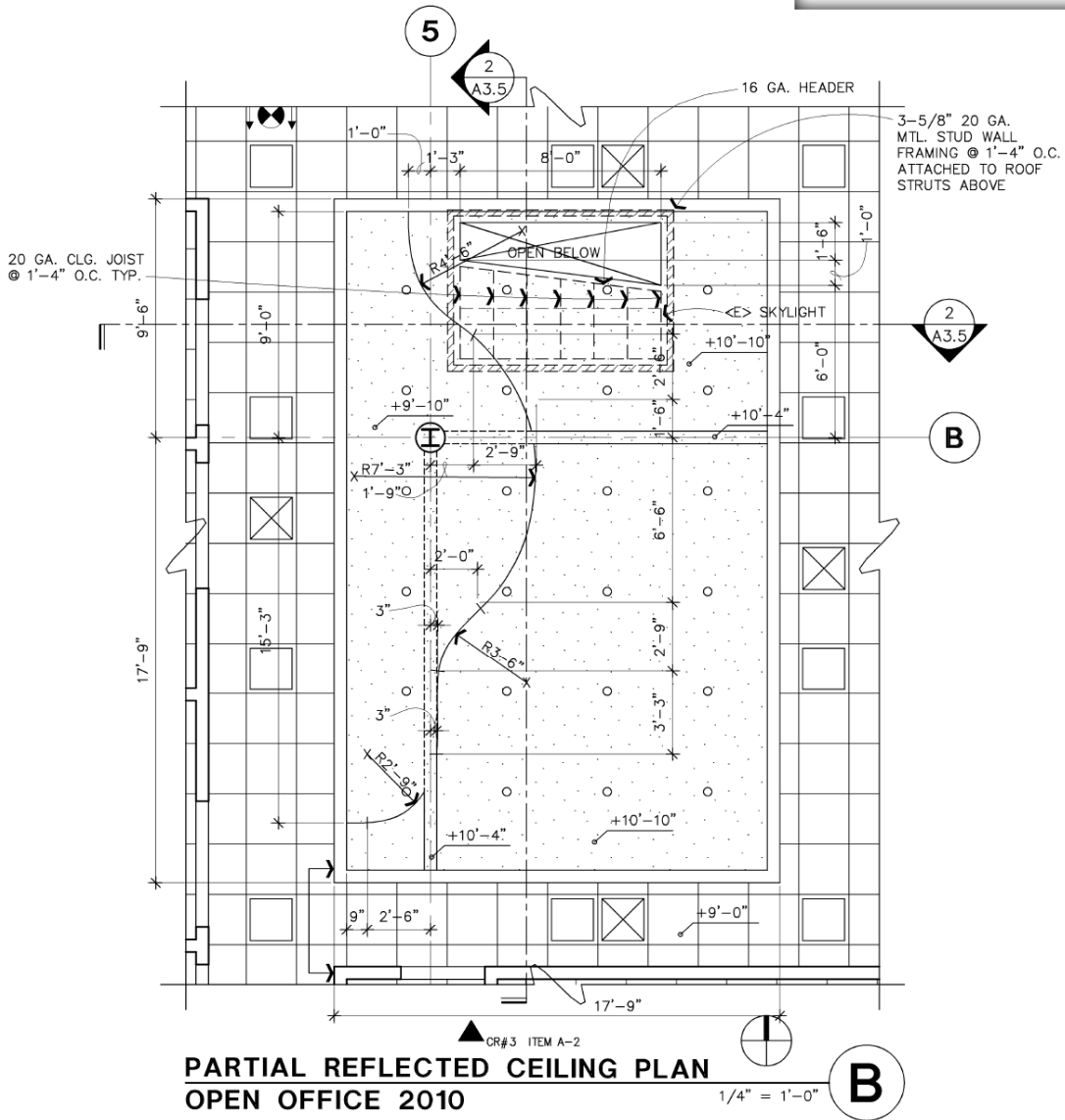
Floor and Reflected Ceiling Plans

Now is the time to study the floor plan and reflected ceiling plan in detail. See Figure 2 for a partial reflected ceiling plan. The reader should have a basic

understanding of the job and the drawings at this point. Study the legend found on the reflected ceiling plan to become familiar with the different ceilings. Are there 2' x 2' and 2' x 4' acoustical ceilings? Are there any enlarged drawings for acoustical ceilings? Are there any hidden lines shown? What is the primary acoustical ceiling installation height? These are all questions requiring answers at some point during construction and the answers will be found in the details, on the elevations, sections and schedules.

Color-code the ceilings that have a dimensioned layout or a special ceiling height. The majority of acoustical ceilings on the job are centered in the room and have the same height, but there probably will be some areas where the architect requires a specific grid layout or installation height. Color-coding makes it easier for quick referring, but use a marker that does not obscure any information.

Figure 2 – Partial Reflected Ceiling Plan



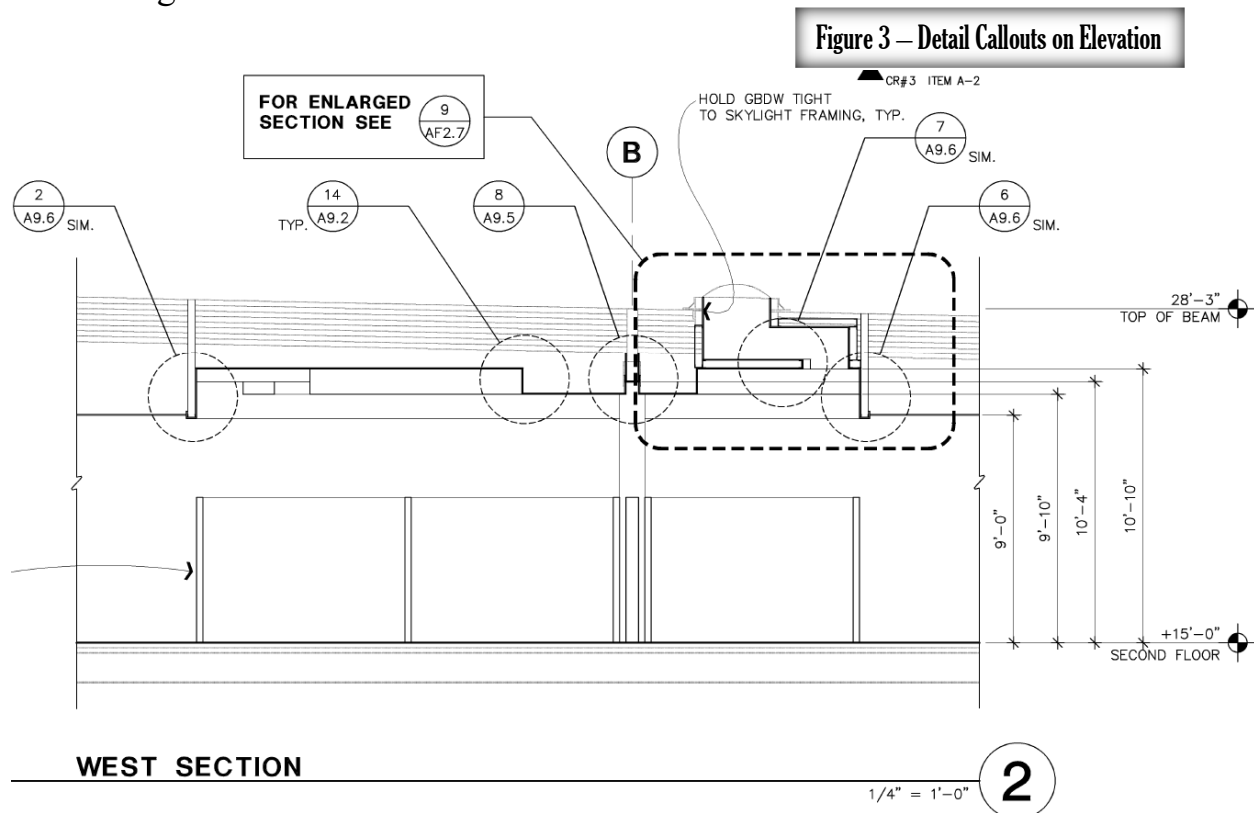
Review the wall legend on the floor plan to become acquainted with the wall types. The acoustical ceilings are drawn as a grid pattern. If the grid pattern is continuous and drawn over the top of a wall, then this partition is an under the grid wall. If the grid stops at the wall and starts on the other side, this partition penetrates the grid system.

The elevations, sections and detail callouts are researched at this point. Review the details related to the acoustical ceiling installation one more time. Details labeled as TYP. (typical), means the same conditions are built according to the typical detail. Typical conditions are not detailed over and over to save space on the drawings.

Review the enlarged area drawings found on the reflected ceiling plan. These drawings, drawn to a larger scale than the ceiling plan, give more information than could be placed on the smaller scaled drawing. Examples of enlarged area drawings for ceilings could include lobby areas, conference rooms, and break areas. The enlarged area drawings should always be used when they are given.

Elevations

Many times a cutting plane symbol or detail callout is placed on an elevation drawing. See Figure 3. The detail or section drawings give the reader a perspective of how to build the feature. Vertical lines represent the corners of the room and the edges of vertical construction such as soffits. Horizontal lines represent the floor and ceiling in the elevation.



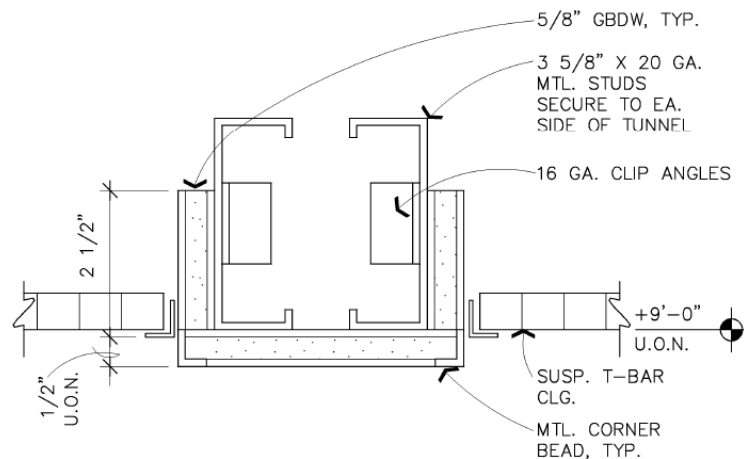
Schedules

Study the finish schedule and the abbreviations used in the schedule to define the types of ceilings on the project. There will be more than one type of ceiling used on commercial projects and usually more than one type of ceiling tile. Make note of special ceiling tile areas and color coded the reflected ceiling plan. The finish schedule has information on floor finishes. Items such as marble, tile, and hardwood flooring change the installation height of ceilings and soffits unless they were accounted for during installation.

Sections and Details

Section and details have been reviewed from cross-referencing the floor plan or other drawings, but some section views or details are not called out on the floor and reflected ceiling plans. Find the details or sections not studied within the drawings. Each detail, see Figure 4, defines how to build something, but the information needs interpretation. Enlarged construction details show the materials used and methods of attachment.

Figure 4 – Detail



SOFFIT

6"=1'-0"

15

7081G-54 DWG

C:

Determining Equal Borders

Acoustical ceiling layout with equal borders are specified more often than other layouts. The result of an equal border layout is a symmetrical grid. Installers determine equal borders by physically measuring the room. One method places the center of the tile in the center of the room so the borders are equal. The other

method places the main runner or cross tee in the center of the room so the borders are equal.

The reflected ceiling plan is checked to decide which method to use. Check the main runner or cross tee location. When the main runner or cross tee is exactly in the center of the room physically measure the room. The measurement is divided by the tile size and the remainder is divided in two for the equal borders. When a ceiling tile is centered in the room, the measurement of the room is divided by the tile size. The remainder has a full tile added to it and is divided by two to determine equal borders. The location of the main runner or cross tee changes when the grid is adjusted by a full tile. The acoustical ceiling can have a tile centered in one direction and a main runner or cross tee centered in the other direction. Both border methods could be used depending upon the layout on the reflected ceiling plan.

In addition, the equal border dimension sets the location of the starting main runner or cross tee. The equal border dimension determines how much to cut off the end of a main runner thereby locating the starting cross tee.

Determining Equal Borders with a Ceiling Tile Centered

There are four steps to follow:

- 1) Measure the room size.
- 2) Divide the foot size of the room by the size of the tile.
- 3) Add the feet and inches remainder of the room size to the tile size.
- 4) Divide this dimension by two to establish the equal border dimension.

For example, a room measures 10' - 4" x 18' - 10". Begin by determining the 4' direction of the tile by looking at the reflected ceiling plan. In this case, the 4' tile direction runs in the 10' - 4" direction. Following step #2, the foot size of 10' is divided by 4', leaving a remainder of 2' - 4". In step #3, add 2' - 4" to the size of the 4' tile for a total of 6' - 4". In step #4, divide 6' - 4" by 2, resulting in 3' - 2" as the equal border dimension. To check and see if the calculation is correct: $3' - 2" + 4' - 0" + 3' - 2" = 10' - 4"$.

Following step #2 going in the 2' tile direction, the foot size of 18' is divided by 2', leaving a remainder of 10". In step #3, add 10" to the size of the 2' tile for a total of 2' - 10". In step #4, divide 2' - 10" by 2, resulting in 1' - 5" as the equal border dimension. Checking the calculation, $1' - 5" + 16' - 0" + 1' - 5" = 18' - 10"$.

Determining Equal Borders with a Main or Cross Tee Centered

There are five steps to follow:

- 1) Count the number of full tiles shown on the reflected ceiling plan.
- 2) Multiple the full tile count by the size of the tile.

- 3) Measure from one wall the amount determined in step #2 and make a mark.
- 4) Measure from the mark made in step #3 to the opposing wall.
- 5) Divide the measurement from step #4 by two to determine the equal border measurement.

For example, a room measures 49' - 8" in one direction, the reflected ceiling plan shows 24 full 2' - 0" tiles in the direction of the layout. Multiplying $24 \times 2' = 48'$. Measure across the wall and make a mark at 48'. By measuring back from the opposing wall to the 48' mark, there is a dimension of 1' - 8" or 20". Dividing 20" by 2 would result in an equal border of 10". As a rule of thumb it is best to have equal borders greater than half a tile, but this may or may not be possible depending on the lighting layout. In the above example, to achieve a tile size greater than half a tile width, add a full tile to the left over dimension of 20". The adjusted dimension would become 3' - 8" or 44", divided by 2 would result in an equal border dimension of 1' - 10" or 22". Checking the calculation, $1' - 10" + 46' + 1' - 10" = 49' - 8"$.

Chapter 4
Study Guide

Directions:

Answer the following questions using the bubble answer sheet.

- 1) All plans should be checked against the _____ index to make sure all titles match the index, especially for the architectural drawings.
 - A. abbreviation
 - B. title
 - C. sheet
 - D. fixture

- 2) Important information is contained in the general notes which should not be overlooked.
 - A. True
 - B. False

- 3) The _____ found on the reflected ceiling plan should be studied to become familiar with the different ceilings.
 - A. details
 - B. callouts
 - C. legend
 - D. symbols

- 4) Details labeled as TYP. (typical), means the same conditions are built according to the typical detail.
 - A. True
 - B. False

- 5) The wall legend on the floor plan should be reviewed to become acquainted with the wall types.
 - A. True
 - B. False

- 6) The majority of acoustical ceilings on the job are centered in the room and have the same height, but there probably will be some areas where the architect requires a specific grid layout or installation height.
- A. True
 - B. False
- 7) _____ drawings, drawn to a larger scale than the ceiling plan, gives more information than could be placed on the smaller scaled drawing.
- A. Enlarged
 - B. Section
 - C. Architectural
 - D. Plan
- 8) Many times a cutting plane symbol or detail callout is placed on an elevation drawing.
- A. True
 - B. False
- 9) Vertical and horizontal lines in a (n) _____ view represent the floor and ceiling and corners of the room.
- A. section
 - B. detail
 - C. plan
 - D. elevation
- 10) Study the _____ schedule and the abbreviations used in the schedule to define the types of ceilings on the project.
- A. door
 - B. window
 - C. finish
 - D. symbol
- 11) A note should be made of any finishes which could affect the finished heights of soffits and ceilings.
- A. True
 - B. False

- 12) The most important guideline is to read all sheet and leader notes found on the plans, details, sections and elevations.
- A. True
 - B. False
- 13) Layout marks are made in the form of a (n) _____ for soffits and partitions.
- A. x
 - B. arrowhead
 - C. line
 - D. w
- 14) Acoustical ceiling layouts with equal borders are specified more often than other layouts.
- A. True
 - B. False
- 15) The main runner or cross tee locations _____ when adjusting the grid by a full tile, which could adversely affect the lighting layout.
- A. change
 - B. level
 - C. compound
 - D. transform

Chapter 4
Equal Border Exercise

Directions:

Determine the equal borders for an acoustical ceiling based on the room size and tile direction. The main and cross tee is centered in the room.

Room Size			
4' Tile Direction	2' Tile Direction	4' Equal Border	2' Equal Border
1. 12' – 4"	8' – 10"		
2. 24' – 11"	22' – 2"		
3. 32' – 9"	26' – 1"		
4. 45' – 10"	33' – 9"		
5. 53' – 8"	27' – 7"		
6. 59' – 1"	41' – 10"		
7. 63' – 7"	51' – 4"		
8. 78' – 3"	67' – 11"		
9. 88' – 1 ½"	60' – 6 ¼"		
10. 91' – 5 ¾"	73' – 9 ¼"		

Chapter 4
Equal Border Exercise

Directions:

Determine the equal borders for an acoustical ceiling based on the room size and tile direction. The ceiling tile is centered in both directions.

Room Size

4' Tile Direction	2' Tile Direction	4' Equal Border	2' Equal Border
1. 12' – 8"	8' – 9"		
2. 24' – 3"	22' – 7"		
3. 32' – 1"	26' – 0"		
4. 46' – 11"	34' – 3"		
5. 52' – 6"	26' – 8"		
6. 58' – 5"	44' – 5"		
7. 63' – 8"	51' – 0"		
8. 78' – 1"	67' – 10"		
9. 88' – 3 ½"	60' – 8 ¼"		
10. 91' – 9 ¾"	73' – 4 ¼"		

Chapter 4
Blueprint Reading Exercise

Directions:

Use the Kobza/Borelli blueprints to answer the following questions. Fill in the correct answer on the bubble answer sheet.

- 1) How many sheets are contained in the drawings?
 - A. 1
 - B. 2
 - C. 4
 - D. 6

- 2) What is the date of the drawings?
 - A. 1-10-03
 - B. 2-10-03
 - C. 9-11-58
 - D. None of the above

- 3) What does the abbreviation “FFE”, mean?
 - A. Finished Floor Equipment
 - B. Finished Face Entrance
 - C. Finished Floor Elevation
 - D. None of the above

- 4) How many plan and detail symbols are shown for materials?
 - A. 6
 - B. 10
 - C. 14
 - D. 17

- 5) Which item shown below is not on the Title sheet?
 - A. Site Plan
 - B. Abbreviations
 - C. Symbols
 - D. Sheet Index

- 6) Which building has the work performed?
A. Building 1
B. Building 8
C. Building 5
D. None of the above
- 7) Building 8 is located in the _____ corner of the property, according to the north arrow.
A. Southwest
B. Northeast
C. Northwest
D. Southeast
- 8) How many buildings have fenced storage yards?
A. 1
B. 2
C. 3
D. 4
- 9) What is the floor plan scale of Building #5?
A. $1/8" = 1'-0"$
B. $1/4" = 1'-0"$
C. $1\ 1/2" = 1'-0"$
D. $3" = 1'-0"$
- 10) What is the street address for Building # 5?
A. 929 Berryessa Road
B. 931 Berryessa Road
C. 927 Berryessa Road
D. 919 Berryessa Road
- 11) What is the scale of the site plan?
A. $1/8" = 1'-0"$
B. $1" = 30'-0"$
C. $1" = 40'-0"$
D. None of the above

- 12) How many single doors are shown on the floor plan, sheet A-2?
- A. 3
 - B. 4
 - C. 8
 - D. 10
- 13) What work is to be performed at the “cross hatched” area, on sheet A-2?
- A. Install 1 layer 5/8" gypsum board on the underside of the roof framing.
 - B. Insulate the underside of the roof.
 - C. Install 2 layers 5/8" gypsum board on the underside of the roof framing.
 - D. None of the above
- 14) What type of view is A/A-3?
- A. Elevation
 - B. Section
 - C. Detail
 - D. Plan
- 15) What gauge of metal studs should the two-hour separation wall be constructed with, as shown on sheet A-2?
- A. 25 gauge
 - B. 20 gauge
 - C. 18 gauge
 - D. 16 gauge
- 16) What on center spacing should the wall studs be for the two-hour separation wall, as shown on sheet A-2?
- A. 16" on center
 - B. 24" on center
- 17) Where is the architect locating the two-hour separation wall?
- A. Center of column line 4
 - B. In the middle of the building
 - C. Along column line B.5
 - D. 7'- 8" away from column line 4

- 18) How many layers of gypsum board is required for each side of the two-hour separation wall?
- A. 1
 - B. 2
- 19) What type of top track is to be used for the two-hour separation wall?
- A. Deep leg
 - B. Regular leg
 - C. Slip track slotted
 - D. None of the above
- 20) What is to be done to the existing 3 1/8" purlam beam at the top of the two-hour separation wall?
- A. Add framing and gypsum board on each side of purlam beam.
 - B. Continue the gypsum board up from the wall to cover purlam beam.
 - C. Nail or screw on gypsum board direct to purlam beam.
 - D. None of the above
- 21) What is the minimum "R" value required for insulation installed in the two-hour separation wall?
- A. R-8
 - B. R-11
 - C. R-19
 - D. R-30
- 22) What is the detail number for the top track application on sheet A-3?
- A. Detail 1
 - B. Detail 2