

ARE

2014

Construction Documents & Services Vignettes

Ronald Fergle

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INTRODUCTION

VIGNETTE INTRODUCTION

Congratulations on purchasing these practice vignettes in an effort to prepare for the Architectural Registration Examinations (ARE). You should utilize these exercises as one facet of a comprehensive study program that prepares you for the exams by familiarizing yourself with typical exam subject matter and design relationships, as well as the mechanics of the actual testing procedures. The intent of these vignettes are to help you prepare for the subject matter and design relationship requirements of the ARE by simulating the types of conceptual problems you are likely to face on the actual exam.

The vignettes were developed by Cayl Hollis with enhancements by Ronald Fergle AIA, LEED AP BD+C. The solutions shown are ideal responses and representative of what successful solutions look like. There may be some variations in a solution you create that will also generate a successful answer to the vignette problem. Try to study and understand fully the concepts involving the relationships of the program elements and attention to program details presented in the successful solutions. These are key to passing the NCARB examination. Naturally, the actual exam will present different specific problems that you must solve, but the general concepts and overall relationships presented here will be the same. You should be comfortable solving problems with these types of constraints.

The actual ARE is a computer-based test. The ARE vignettes are presented via a computer program, and you must create and submit your solutions using only a keyboard and mouse interface. Therefore, it is imperative that you also become familiar with the NCARB vignette software. Sample vignettes that involve using the computer interface are available from the NCARB Web site (www.ncarb.org). Plan on practicing the NCARB vignettes in order to become fluent in the specific types of computer commands utilized within the ARE. Having proficiency using a commercial CAD program will not replace being intuitively familiar with the specific commands and unique interface of the NCARB CAD software. Utilize the software tutorials and practice the commands repeatedly until they become second nature to you.

TESTING PROCEDURES

The ARE testing occurs in a facility authorized by NCARB to administer the test. You will need to schedule an appointment and understand the rules for the examination. Refer to the NCARB and Prometric Web sites for further details (www.ncarb.org and www.prometric.com/NCARB).

You are not permitted to bring any reference materials with you into the testing site. Scratch paper and pencils are available within the testing facility for your use. Try to replicate those restrictions while using these practice vignettes. However, because these vignettes are on paper instead of a computer program, you may utilize a scale and trace paper when necessary to complete the problems.

The ARE tests must be completed within a certain amount of time. You should also plan on attempting to solve these vignettes as quickly as possible. Understand that the computer interface of the actual exams will permit you to create a solution quicker than you create a solution by the paper and pencil method of these vignettes, but the concepts and testing relationships are the same in both formats.

KAPLAN VIGNETTE FORMAT

If you are viewing a PDF version of these vignettes, first plan on printing out the vignette problem sheets on 8½-inch by 11-inch paper. The vignette problems are located in the first half of this document.

- Draw your solution directly on to the vignette problem sheet.
- Some vignettes may have shapes pre-printed for you to use as templates or guides when solving the problems. The NCARB software will automatically draw many of these shapes, so these pre-printed symbols are an attempt to replicate that feature.

Avoid looking at the suggested solutions until you have already attempted to complete the vignettes on your own. The solutions and the discussions describing the solutions are located in the second half of the PDF.

VIGNETTE SUGGESTIONS

“CONSTRUCTION DOCUMENTS & SERVICES” KEY TIPS AND TOOLS

The Building Section Vignette will require you to draw a section through a multi-story building.

- Generally there are two floors and a multi-height space.
- You will need to determine the correct minimum height of the second floor and roof levels. (Because the heights must be kept to a minimum, you cannot simply make the roof over the multi-height room the same as the second floor. You will need to calculate each roof height separately.)
- You will also need to draw the section with the correct structural and mechanical elements that are cut by the section line.

Grade

- Start by drawing your section grade line. Make sure you continue to draw your section at this grade line and not at the cut line on the floor plan. (Keep the lines separate in your mind and just use the cut line for information.)

Slab on grade

- Draw the slab so that the bottom in at the grade line.
- The computer program will automatically draw the slab four inches thick.

Footings

- Make sure to draw the perimeter footings at the proper frost depth dimension.
- Interior footings under bearing walls should be located right under the wall at the grade line.

Walls

- Make sure to use the proper “draw” tool in the computer program to draw the appropriate wall in the section—“Exterior/Bearing Wall,” “Interior Partition,” and “Interior Fire Rated Partition.”
- Corridors will have a two-hour fire rating, which means an “Interior Fire Rated Partition” wall will need to be drawn from the floor slab all the way to the underside of the roof/floor slab above.
- One-hour rated interior walls only need to have the “Interior Partition” wall extend just above the ceiling.

Joists

- Pay attention to the direction of the joists in plan view, and draw them the same way in the section.
- The joists in the section need to line up exactly with the location of the individual joists on the plan view.

Mechanical ducts

- Select the proper size when drawing the ducts in the section. They need to match the exact locations and dimensions noted on the floor plans.
- No matter what size the ducts are, draw them just touching the bottom of the joists above.

Floor/roof deck

- When the bar joists are drawn, the computer program will automatically draw a four-inch concrete slab/roof deck above them. (For the paper practice vignettes, you'll need to draw the four-inch floor slab/roof deck manually.)
- If it is a roof condition, remember to start measuring from the top of the roof slab for the required parapet dimension.
- If it is a second floor condition, remember to start measuring from the top of the second floor slab for the second floor ceiling dimension.
- Unless specifically stated otherwise, assume all roofs are flat. There is zero slope to the roof joists and roof deck. (This applies for all conditions, both parallel and perpendicular to the cut line.)

Parapet

- Remember to draw a parapet between the roof over the multi-height space and the roof over the second floor.

Determine the floor/roof slab heights.

- For each ceiling height noted in the program (i.e., first floor, second floor, multi-height room), calculate the largest combined joist and duct dimension.
- Remember for duct sizes, the first number listed is the width and the second number listed is the height.
- After determining the largest duct/joist dimension per ceiling area, use this value to help determine the overall roof or ceiling height.
- Remember to use this largest duct/joist dimension (per ceiling area) when drawing the section, even if the ducts or joists at the section cut line are less than this maximum dimension. The correct roof or floor height is still determined based on this maximum dimension even if it doesn't occur at the cut line. You will probably get this scenario on the exam, so be aware.
- To determine the top of the floor slab to the top of joist dimension, add the following:
 - Floor to ceiling height (listed in program)
 - Clear space for light fixtures (listed in program, usually eight inches)
 - Largest duct/joist combined dimension (calculated from floor plan information)
- To determine the top of the floor slab to the top of floor slab dimension, or top of the floor slab to the top of the roof slab dimension, add the following:
 - Floor to ceiling height (listed in program)
 - Clear space for light fixtures (listed in program, usually eight inches)
 - Largest duct/joist combined dimension (calculated from floor plan information)
 - Four-inch roof/floor slab located on top of the joists

The following are checklists for determining various height dimensions. Add up the following items:

- Grade line to the top of parapet at the multi-height space
 - First floor slab, four inches
 - Multi-height ceiling (height given in program)
 - Clear space for light fixtures (distance given in program, usually eight inches)
 - Largest combined joist/duct dimension (calculated from floor plan information)
 - Roof slab, four inches (drawn automatically by computer program)
 - Parapet (height given in program)
- Grade line to the second floor level
 - First floor slab, four inches
 - First floor ceiling (height given in program)
 - Clear space for light fixtures (distance given in program, usually eight inches)
 - Largest combined joist/duct dimension (calculated from floor plan information)
 - Second floor slab, four inches (drawn automatically by computer program)

- Grade line to the top of parapet at the second floor level
 - First floor slab, four inches
 - First floor ceiling (height given in program)
 - Clear space for light fixtures (distance given in program, usually eight inches)
 - Largest combined joist/duct dimension (calculated from floor plan information)
 - Second floor slab, four inches (drawn automatically by computer program)
 - Second floor ceiling (height given in program)
 - Clear space for light fixtures (distance given in program, usually eight inches)
 - Largest combined joist/duct dimension (calculated from floor plan information)
 - Roof slab, four inches (drawn automatically by computer program)
 - Parapet (height given in program)

When drawing the section, only draw elements that are cut by the section line. Do not draw elements that are in front of or behind the cut line. An exception is for joists that run parallel to the cut line. In that case, you should draw the first joist that is located just behind the cut line. (Remember, if there is a large duct that is located entirely in front of the cut line, you need to account for its size when determining the dimension between the ceiling and the joists. But you do not actually draw the duct.)

Additional specific NCARB exam computer interface issues

- Utilize a sketch circle to measure vertical clearances.
- To prevent having to scroll between your section and the information on the floor plans, draw the grade line and section directly on top, or as close as possible to the north wall of the floor plan. Just make sure you can still see the cut line.
- Make sure that you draw your grade line and section information beginning at the “Exterior Face of Section” line noted at the left side of the floor plans.
- Zoom in to verify that the individual walls, joists, and ducts drawn in section line up exactly with those same elements on the floor plan.

“CONSTRUCTION DOCUMENTS & SERVICES” COMMON MISTAKES TO AVOID

- Misalignments of walls, joists, or ducts; the section and plans need to match exactly.
- Missing interior partitions
- Drawing footings to the wrong depth
- Missing parapet between different roof levels
- Not leaving enough space between the ceiling and joists; candidates frequently leave enough space between the ceiling and the duct that is being cut but do not leave enough space between the ceiling and the joist to account for the largest duct in that floor’s ceiling cavity.
- Ducts that are not located directly against the bottom of joists; remember that no matter what the duct size is, it should be drawn so that the top of the duct touches the bottom of the joists above.
- Forgetting to draw a grade line for the section; you must use the specific “draw/Grade Line” command in the NCARB computer program for your section to be considered complete.

VIGNETTE #1 BUILDING SECTION

“PRODUCTION FACILITY”

Problem

Develop a schematic building section corresponding to the section cut lines indicated on the following floor plans. Your section should accurately reflect the dimensions, structural relationships, and all other components indicated in the program and on the plans.

Instructions

1. Draw your solution starting at the Grade Line located on the “Section” area on the following sheet.
2. Draw only the elements intersected by the section cut line as well as joists in elevation immediately adjacent to the cut line.
3. Indicate the elevations of all floor and roof levels on the section. (Note: You will not be specifically required to do this on the NCARB exam. However, your solution will be analyzed for the accurate vertical placement of all the elements based on their graphic coordinates.)

Program Requirements

- The structural system consists of top-chord-bearing steel joists on masonry bearing walls with continuous 12-inch by 24-inch concrete spread footings and a concrete slab on grade.
- Non-bearing hall walls have a one-hour (minimum) fire-resistance rating.
- Exterior and bearing walls have a two-hour (minimum) fire-resistance rating.
- Assume the width of walls, as drawn on the plan, are adequate for all structural loads.
- The frost depth is five feet below grade.
- Parapets must extend two feet above the top of adjacent roof decks.
- All ceilings and roofs are flat.
- Ceilings are used as return air plenums. All ceilings are non-rated. (Show ceilings graphically as a single line.)
- Assume fire/smoke dampers and transfer grilles are provided as needed.
- The space between each ceiling and floor or roof slab above must be held to the minimum dimension required to accommodate structural, mechanical, and lighting components.
- All ducts must be placed below the joists.
- Provide eight inches of clear space between the bottom of ducts and the finish ceilings to accommodate light fixtures.
- All floor and roof slab sections are four inches thick.
- The ceiling height of all spaces except the production area is eight feet.
- The production area does not have a finished ceiling and is exposed to the underside of the roof deck above.
- The roof slab above the production area is four feet higher than the adjoining roof slab.
- Door openings are seven feet high and window openings are from three feet top-of-slab to seven feet top-of-slab.

Draw your solution to the vignette problem in the Section area below. The floor plans are on the following sheet.

SECTION

EXTERIOR FACE OF SECTION

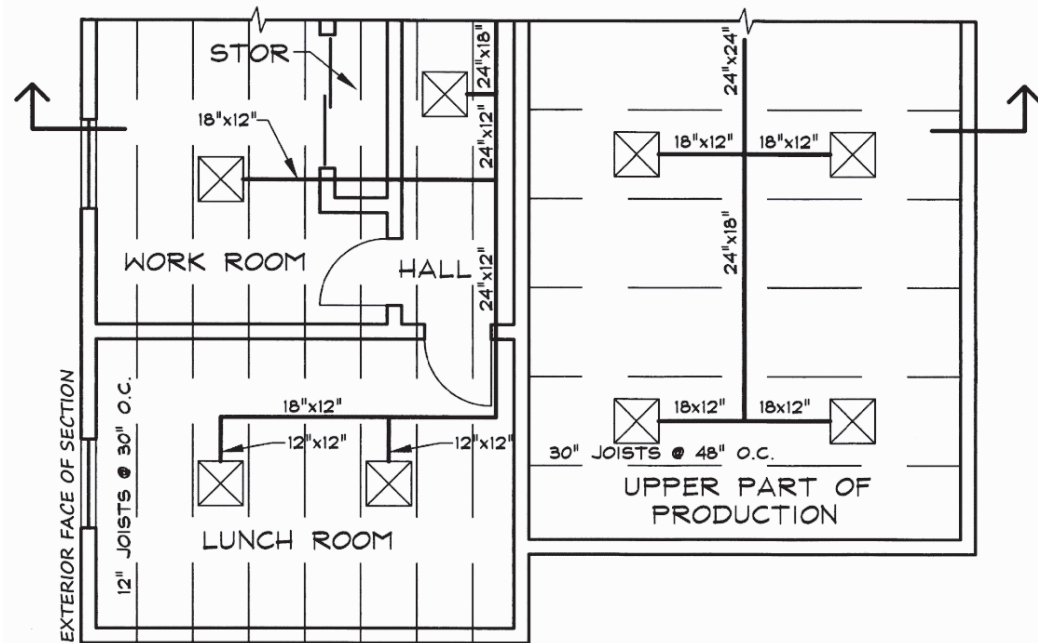
GROUND ELEV: 0'-0"

SCALE: 1/8" = 1'-0"

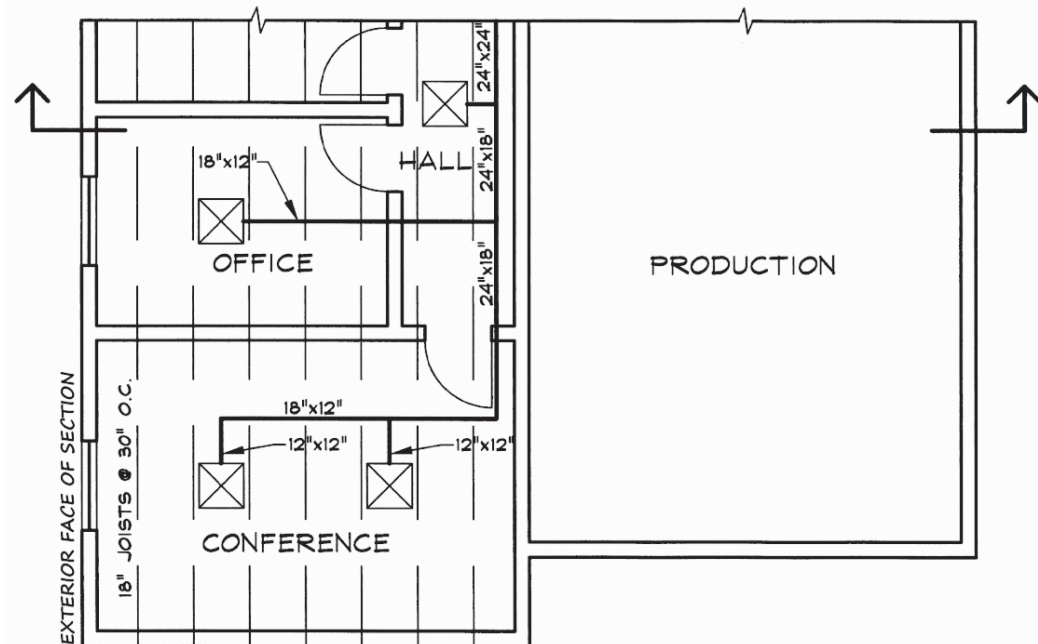


Draw your section on the preceding sheet per these floor plans.

UPPER
LEVEL
FLOOR
PLAN



LOWER
LEVEL
FLOOR
PLAN



SCALE: 1/8" = 1'-0"



VIGNETTE #2 BUILDING SECTION

“REHABILITATION CENTER”

Problem

Develop a schematic building section corresponding to the section cut lines indicated on the following Rehabilitation Center floor plans. Your section should accurately reflect the dimensions, structural relationships, and all other components indicated in the program and on the plans.

Instructions

1. Draw your solution starting at the Grade Line located on the “Section” area on the following sheet.
2. Draw only the elements intersected by the section cut line as well as joists in elevation immediately adjacent to the cut line.
3. Indicate the elevations of all floor and roof levels on the section. (Note: You will not be specifically required to do this on the NCARB exam. However, your solution will be analyzed for the accurate vertical placement of all the elements based on their graphic coordinates.)

Program Requirements

- The structural system consists of top-chord-bearing steel joists on masonry bearing walls with continuous 12-inch by 24-inch concrete spread footings and a concrete slab on grade.
- Non-bearing hall walls have a one-hour (minimum) fire-resistance rating.
- Exterior and bearing walls have a two-hour (minimum) fire-resistance rating.
- Assume the width of walls, as drawn on the plan, are adequate for all structural loads.
- The frost depth is five feet below grade.
- Parapets must extend two feet above the top of adjacent roof decks.
- All ceilings and roofs are flat.
- Ceilings are used as return air plenums. All ceilings are non-rated. (Show ceilings graphically as a single line.)
- Assume fire/smoke dampers and transfer grilles are provided as needed.
- The space between each ceiling and floor or roof slab above must be held to the minimum dimension required to accommodate structural, mechanical, and lighting components.
- All ducts must be placed below the joists.
- Provide eight inches of clear space between the bottom of ducts and the finish ceilings to accommodate light fixtures.
- All floor and roof slab sections are four inches thick.
- The ceiling height of all spaces is nine feet, except the activity room area which is 14 feet.
- Door openings are seven feet high and window openings are from three feet top-of-slab to seven feet top-of-slab.

Draw your solution to the vignette problem in the Section area below. The floor plans are on the following sheet.

SECTION

EXTERIOR FACE OF SECTION

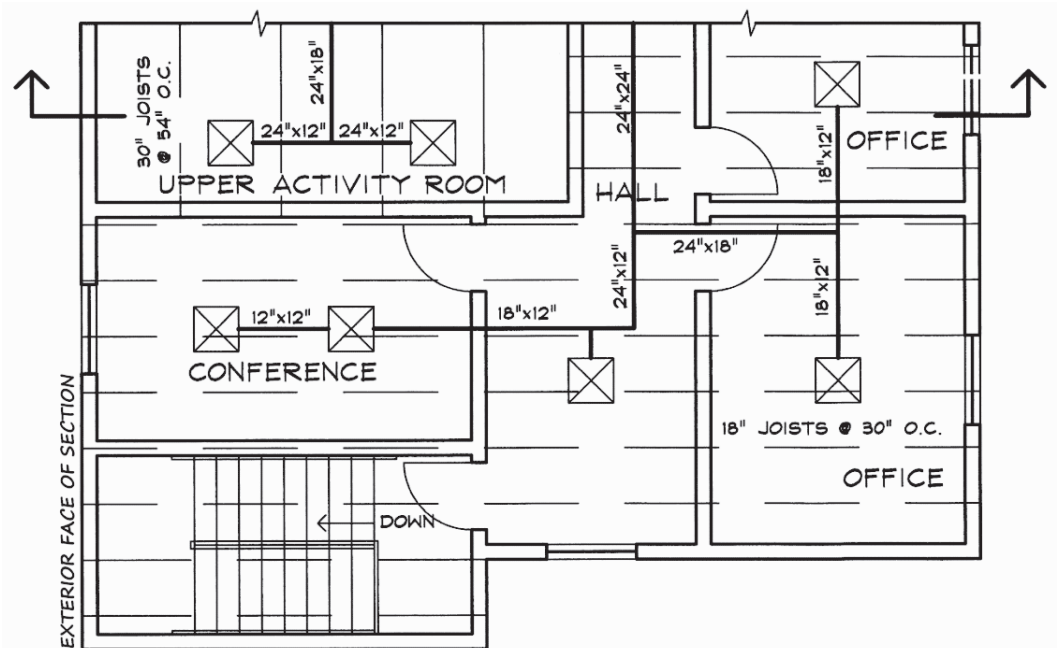
GROUND ELEV: 0'-0"

SCALE: 1/8" = 1'-0"

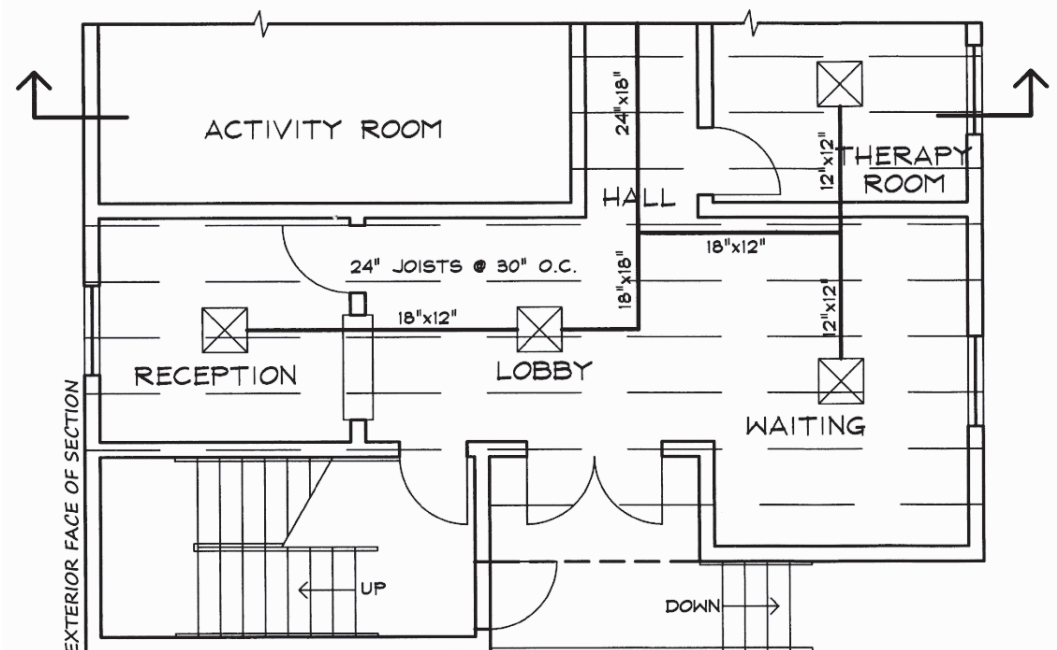


Draw your section on the preceding sheet per these floor plans.

UPPER
LEVEL
FLOOR
PLAN



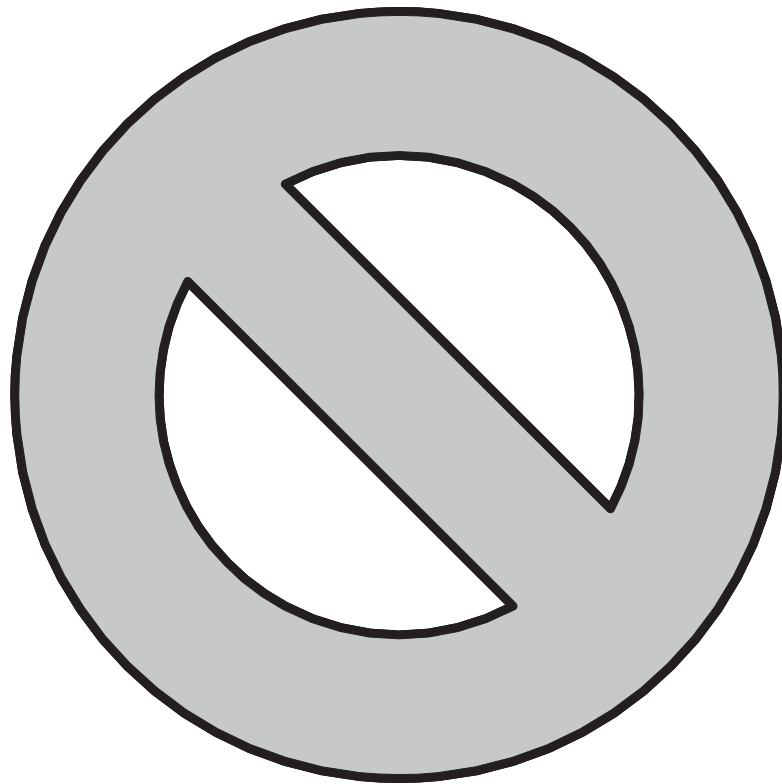
LOWER
LEVEL
FLOOR
PLAN



SCALE: 1/8" = 1'-0"



Suggested solutions follow.



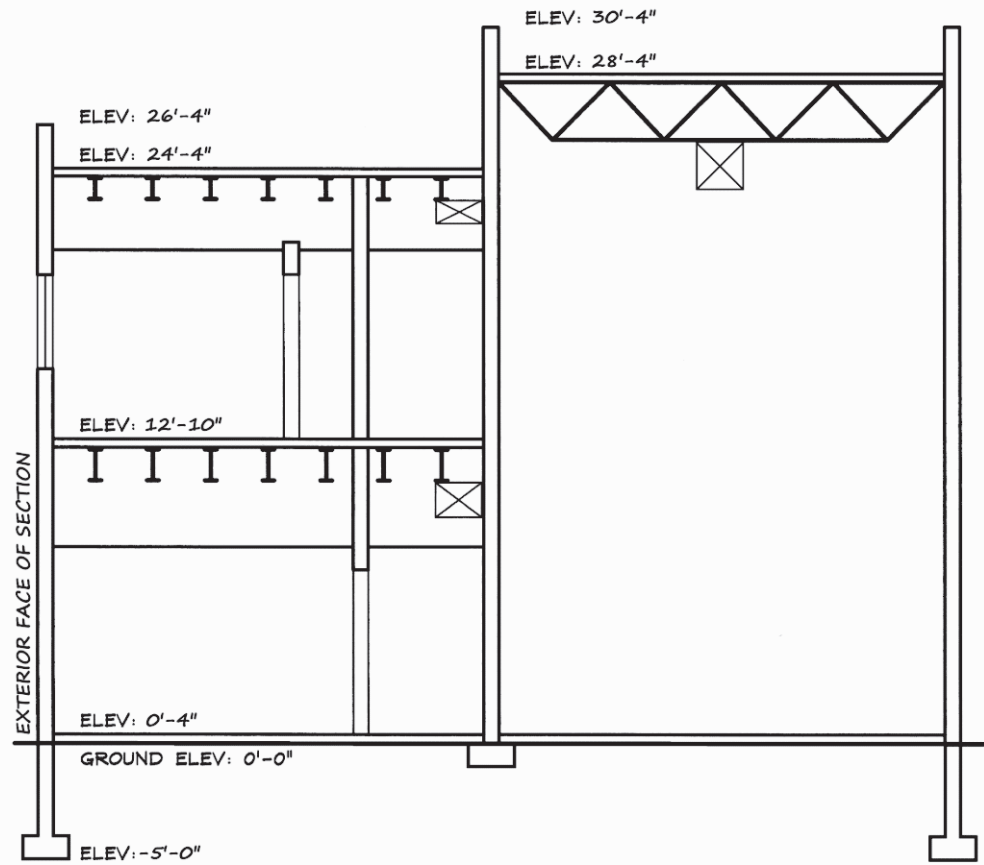
Do not view until you have completed your attempts to solve the problems.

VIGNETTE #1 BUILDING SECTION

"PRODUCTION FACILITY"

Suggested solution. Refer to the following sheets for the discussion regarding this solution.

SECTION



SCALE: 1/8" = 1'-0"



Suggested Solution Discussion

The Building Section exercise is relatively straightforward. The things to solve are listed in the program requirements and must be followed exactly.

Things to pay close attention to in this example include the following:

- Masonry bearing walls
 - This is stated to let you know that the structural system does not have columns. The location of the bearing walls must first be determined. These in turn will sit on footings. The location of the footings will determine how they are drawn.
 - Bearing walls are those that carry structural load. In our example, these will be any wall that carries a floor or roof structural load. The plans show structural members running in two directions. Any wall

at which the structural member ends will be a bearing wall. Also, any exterior wall will be a bearing wall, regardless of the direction of the structural members. This is because these walls will carry at least a small portion of the roof and floor slab loads. For the section to be drawn, the bearing walls will be the two exterior walls, plus the west wall of the production area.

- For the NCARB software, the “draw/Exterior/Bearing Wall” tool is used.

- Spread footings

- Footings at the perimeter of the building will be subject to soil frost during the wintertime. The requirements state that frost depth is five feet. This means that any footing subject to frost must be exactly five feet below the outside grade line at the bottom of the footing. For this solution, those footings are at the west and east walls of the building.
- The interior bearing wall will also need a footing. However, since this wall is not subject to frost (it is not exposed to cold weather), the bottom of its footing does not have to be deep. The top of the footing is at grade level. All footings are 12 inches thick.
- For the NCARB software, the “draw/Foundation with Footing” tool is used. The same tool is used to draw the perimeter footings as well as the interior footings. When you draw the footings, as you drag the cursor down from the beginning grade line elevation, the numerical depth of the foundation is displayed in a status box at the bottom of the screen. Simply drag the cursor until you reach the desired depth (one foot in the case of the interior footings).

- Floor and roof elevations

- Methodology

- These will have to be determined through the various program requirements. The easiest method is to start at ground level and methodically work upward. On a scratch sheet of paper, incrementally write down the required height of each building component that has to be accounted for. For a graphical method on the NCARB software, you can also use the “sketch – rectangle” tool to draw rectangles representing each of these height requirements. Simply stack one rectangle box directly on top of the other. By beginning at the grade elevation of zero feet, zero inches to start stacking the boxes, you can use the appropriate rectangle level as a guide to draw the required element. For instance, start with a four-inch-high rectangle for the slab, then an eight-foot-zero-inch-high rectangle for the height of the ceiling, and so on. The NCARB software will display the height of the rectangle in the status area as you drag the cursor up. Simply drag the cursor until you reach the height you want. (Consider “zooming” in to enable you to position these rectangles more accurately.) On the exam when you place the building components, you will have to do it graphically. You cannot specify coordinates. Therefore, using the graphical rectangle approach in combination with a numerical tabulation of each component height is an effective way to approach drawing your section.

- Remember, with “slab on grade,” the bottom of the first floor slab is placed directly on the grade line.

- Second floor slab elevation

- To determine the second floor slab elevation, add up the following:

First floor slab	0 ft, 4 in.
First floor ceiling height	8 ft, 0 in.
First floor light fixture clearance	0 ft, 8 in.
Largest first floor mechanical duct height (24 in.)	2 ft, 0 in.
Second floor joists (18 in.)	1 ft, 6 in.
Second floor slab	0 ft, 4 in.
Second floor slab elevation →	12 ft, 10 in.

- West roof slab elevation (over work room, lunch room, and hall)
 - To determine the west roof slab elevation, add up the following:

Second floor slab elevation	12 ft, 10 in.
Second floor ceiling height	8 ft, 0 in.
Second floor light fixture clearance	0 ft, 8 in.
Largest second floor mechanical duct height (18 in.)	1 ft, 6 in.
Roof joists (12 in.)	1 ft, 0 in.
Roof slab	0 ft, 4 in.
West roof slab elevation →	24 ft, 4 in.

- East roof slab elevation (over production area)
 - To determine the east roof slab elevation, add up the following:

West roof slab elevation	24 ft, 4 in.
East roof offset specified in requirements	4 ft, 0 in.
East roof slab elevation →	28 ft, 4 in.

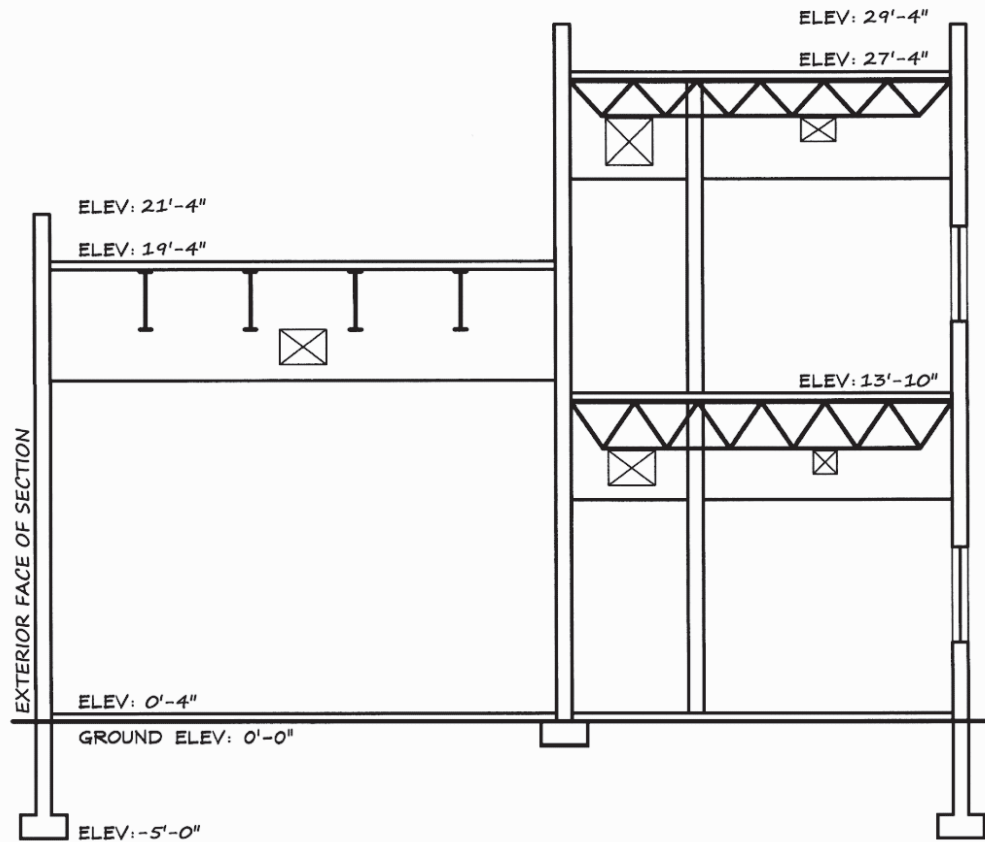
- Rated walls
 - The hall walls are required to be a minimum one-hour fire rated. This means that on the section, these walls must be shown to be continuous from the floor slab to the structural slab above.
 - Any other non-rated partition, such as the west wall of the second-floor storage, can end just above the ceiling line.
- Joists
 - Note that in the NCARB software when you select and specify a joist size from the “draw/Joist with Deck (Elevation),” or “draw/Joist with Deck (Section)” tool, the joists are placed graphically per the cursor location on the screen, starting with the slab on top of the joists. The joists are sized per your selection and then drawn with the four-inch slab on top of them. Remember to include the slab height when placing the joists in the section.
 - For the “draw/Joists with Deck (Section)” tool, the NCARB software will draw them per your selected on-center spacing beginning with a joist four inches below the cursor location. You will then need to select the “move, adjust” tool to slide the series of joists over so that they line up with the joists as located in the plan view. The slab above the joists will stay where it was initially drawn. (The “move group” tool will move the slab along with the joists.)
- Mechanical ducts
 - The mechanical ducts should be drawn tight to the underside of the joists above. This is the same for large ducts as well as small ducts.
 - Remember, duct sizes are specified as “width” by “height.”
- Other
 - All other program requirements are relatively straightforward.
 - Refer to the solution shown for proper placement.

VIGNETTE #2 BUILDING SECTION

"REHABILITATION CENTER"

Suggested solution. Refer to the following sheets for the discussion regarding this solution.

SECTION



SCALE: 1/8" = 1'-0"



Suggested Solution Discussion

The Building Section exercise is relatively straightforward. The things to solve are listed in the Program Requirements and must be followed exactly.

Things to pay close attention to in this example include the following:

- Masonry bearing walls
 - This is stated to let you know that the structural system does not have columns. The location of the bearing walls must first be determined. These in turn will sit on footings. The location of the footings will determine how they are drawn.
 - Bearing walls are those that carry structural load. In our example, these will be any wall that carries a floor or roof structural load. The plans show structural members running in two directions. Any wall

at which the structural member ends will be a bearing wall. Also, any exterior wall will be a bearing wall, regardless of the direction of the structural members. This is because these walls will carry at least a small portion of the roof and floor slab loads. For the section to be drawn, the bearing walls will be the two exterior walls, plus the east wall of the activity room.

- For the NCARB software, the “draw/Exterior/Bearing Wall” tool is used.
- Spread footings
 - Footings at the perimeter of the building will be subject to soil frost during the wintertime. The requirements state that frost depth is five feet. This means that any footing subject to frost must be exactly five feet below the outside grade line at the bottom of the footing. For this solution, those footings are at the west and east walls of the building.
 - The interior bearing wall will also need a footing. However, since this wall is not subject to frost (it is not exposed to cold weather), the bottom of its footing does not have to be deep. The top of the footing is at grade level. All footings are 12 inches thick.
 - For the NCARB software, the “draw/Foundation with Footing” tool is used. The same tool is used to draw the perimeter footings as well as the interior footings. When you draw the footings, as you drag the cursor down from the beginning grade line elevation, the numerical depth of the foundation is displayed in a status box at the bottom of the screen. Simply drag the cursor until you reach the desired depth (one foot, zero inches in the case of the interior footings).
- Floor and roof elevations
 - Methodology
 - These will have to be determined through the various Program Requirements. The easiest method is to start at ground level and methodically work upward. On a scratch sheet of paper, incrementally write down the required height of each building component that has to be accounted for. For a graphical method on the NCARB software, you can also use the “sketch–rectangle” tool to draw rectangles representing each of these height requirements. Simply stack one rectangle box directly on top of the other. By beginning at the grade elevation of zero feet, zero inches to start stacking the boxes, you can use the appropriate rectangle level as a guide to draw the required element. For instance, start with a four-inch-high rectangle for the slab, then a nine-foot-zero-inch-high rectangle for the height of the ceiling, and so on. The NCARB software will display the height of the rectangle in the status area as you drag the cursor up. Simply drag the cursor until you reach the height you want. (Consider “zooming” in to enable you to position these rectangles more accurately.) On the exam when you place the building components, you will have to do it graphically. You cannot specify coordinates. Therefore, using the graphical rectangle approach in combination with a numerical tabulation of each component height is an effective way to approach drawing your section.
 - Remember, with “slab on grade,” the bottom of the first floor slab is placed directly on the grade line.
 - Second floor slab elevation
 - To determine the second floor slab elevation, add up the following:

First floor slab	0 ft, 4 in.
First floor ceiling height	9 ft, 0 in.
First floor light fixture clearance	0 ft, 8 in.
Largest first floor mechanical duct height (18 in.)	1 ft, 6 in.
Second floor joists (24 in.)	2 ft, 0 in.
Second floor slab	0 ft, 4 in.
Second floor slab elevation →	13 ft, 10 in.

- East roof slab elevation (over therapy room and hall)

- To determine the east roof slab elevation, add up the following:

Second floor slab elevation	13 ft, 10 in.
Second floor ceiling height	9 ft, 0 in.
Second floor light fixture clearance	0 ft, 8 in.
Largest second floor mechanical duct height (24 in.)	2 ft, 0 in.
Roof joists (18 in.)	1 ft, 6 in.
Roof slab	0 ft, 4 in.
East roof slab elevation →	27 ft, 4 in.

- West roof slab elevation (over activity room)

- To determine the west roof slab elevation, add up the following:

First floor slab	0 ft, 4 in.
Activity room ceiling height	14 ft, 0 in.
Activity room light fixture clearance	0 ft, 8 in.
Largest activity room mechanical duct height (18 in.)	1 ft, 6 in.
Activity room roof joists (30 in.)	2 ft, 6 in.
Activity room roof slab	0 ft, 4 in.
West roof slab elevation →	19 ft, 4 in.

- Rated walls

- The hall walls are required to be a minimum one-hour fire rated. This means that on the section, these walls must be shown to be continuous from the floor slab to the structural slab above.

- Joists

- Note, in the NCARB software when you select and specify a joist size from the “draw/Joist with Deck (Elevation),” or “draw/Joist with Deck (Section)” tool, the joists are placed graphically per the cursor location on the screen, starting with the slab on top of the joists. The joists are sized per your selection and then drawn with the four-inch slab on top of them. Remember to include the slab height when placing the joists in the section.
 - For the “draw/Joists with Deck (Section)” tool, the NCARB software will draw them per your selected on-center spacing beginning with a joist four inches below the cursor location. You will then need to select the “move, adjust” tool to slide the series of joists over so that they line up with the joists as located in the plan view. The slab above the joists will stay where it was initially drawn. (The “move group” tool will move the slab along with the joists.)

- Mechanical ducts

- The mechanical ducts should be drawn tight to the underside of the joists above. This is the same for large ducts as well as small ducts.
 - Remember, duct sizes are specified as “width” by “height.”

- Other

- All other program requirements are relatively straightforward.
 - Refer to the solution shown for proper placement.