

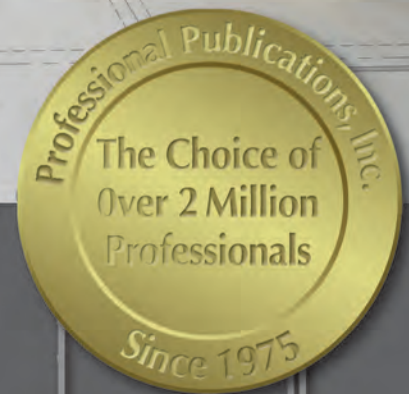
# STUDENT WORKBOOK

for the fifth edition of

# INTERIOR CONSTRUCTION & DETAILING



**DAVID KENT BALLAST, FAIA**  
**NCIDQ CERTIFICATE NO. 9425**



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# TABLE OF CONTENTS

---

INTRODUCTION .....	vi
<b>1 PARTITIONS</b>	
Exercises .....	1-1
Further References .....	1-9
Questions for Evaluating Student Knowledge .....	1-11
<b>2 CEILINGS</b>	
Exercises .....	2-1
Further References .....	2-11
Questions for Evaluating Student Knowledge .....	2-13
<b>3 DOORS</b>	
Exercises .....	3-1
Further References .....	3-8
Questions for Evaluating Student Knowledge .....	3-9
<b>4 HARDWARE</b>	
Exercises .....	4-1
Further References .....	4-3
Questions for Evaluating Student Knowledge .....	4-5
<b>5 GLAZING</b>	
Exercises .....	5-1
Further References .....	5-11
Questions for Evaluating Student Knowledge .....	5-13
<b>6 ARCHITECTURAL WOODWORK</b>	
Exercises .....	6-1
Further References .....	6-9
Questions for Evaluating Student Knowledge .....	6-10

<b>7</b>	<b>DECORATIVE METALS</b>	
	Exercises .....	7-1
	Further References .....	7-4
	Questions for Evaluating Student Knowledge .....	7-5
<b>8</b>	<b>FLOORING CONSTRUCTION</b>	
	Exercises .....	8-1
	Further References .....	8-3
	Questions for Evaluating Student Knowledge .....	8-4
<b>9</b>	<b>APPLIED FLOOR FINISHES</b>	
	Exercises .....	9-1
	Further References .....	9-3
	Questions for Evaluating Student Knowledge .....	9-4
<b>10</b>	<b>WALL FINISHES</b>	
	Exercises .....	10-1
	Further References .....	10-3
	Questions for Evaluating Student Knowledge .....	10-5
<b>11</b>	<b>ACOUSTICS</b>	
	Exercises .....	11-1
	Further References .....	11-2
	Questions for Evaluating Student Knowledge .....	11-3
<b>12</b>	<b>STAIR DESIGN AND CONSTRUCTION</b>	
	Exercises .....	12-1
	Further References .....	12-8
	Questions for Evaluating Student Knowledge .....	12-9
<b>13</b>	<b>SIGNAGE SYSTEMS</b>	
	Exercises .....	13-1
	Further References .....	13-2
	Questions for Evaluating Student Knowledge .....	13-3
<b>14</b>	<b>SECURITY SYSTEMS</b>	
	Exercises .....	14-1
	Further References .....	14-2
	Questions for Evaluating Student Knowledge .....	14-3
<b>15</b>	<b>DESIGNING FOR AUDIOVISUAL SPACES</b>	
	Exercises .....	15-1
	Further References .....	15-2
	Questions for Evaluating Student Knowledge .....	15-3
<b>16</b>	<b>MECHANICAL AND ELECTRICAL SYSTEMS COORDINATION</b>	
	Exercises .....	16-1
	Further References .....	16-2
	Questions for Evaluating Student Knowledge .....	16-3

<b>17</b>	<b>STRUCTURAL COORDINATION</b>	
	Exercises .....	17-1
	Further References .....	17-4
	Questions for Evaluating Student Knowledge .....	17-5
<b>18</b>	<b>BARRIER-FREE DESIGN</b>	
	Exercises .....	18-1
	Further References .....	18-3
	Questions for Evaluating Student Knowledge .....	18-4
<b>19</b>	<b>BUILDING CODES AND REGULATIONS</b>	
	Exercises .....	19-1
	Further References .....	19-3
	Questions for Evaluating Student Knowledge .....	19-4
<b>20</b>	<b>MEANS OF EGRESS</b>	
	Exercises .....	20-1
	Further References .....	20-9
	Questions for Evaluating Student Knowledge .....	20-10
<b>21</b>	<b>SUSTAINABLE DESIGN</b>	
	Exercises .....	21-1
	Further References .....	21-3
	Questions for Evaluating Student Knowledge .....	21-4
<b>22</b>	<b>BUILDING INVESTIGATION</b>	
	Exercises .....	22-1
	Further References .....	22-3
	Questions for Evaluating Student Knowledge .....	22-4
<b>23</b>	<b>LICENSURE FOR INTERIOR DESIGNERS AND ARCHITECTS</b>	
	Exercises .....	23-1
	Further References .....	23-2
	Questions for Evaluating Student Knowledge .....	23-4
<b>APPENDICES: HANDOUTS</b>		
	How to Sketch Details .....	A-2
	Common Abbreviations.....	A-5
	Isometric Grid .....	A-8

# INTRODUCTION

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## ABOUT THIS WORKBOOK

The *Student Workbook for the fifth edition of Interior Construction & Detailing* is a companion to the fifth edition of *Interior Construction & Detailing for Designers and Architects* (ICD). If you are a student in a course in interior design using ICD as a text, this workbook will provide you with exercises, further references, multiple-choice questions, and appendices that supplement and reinforce the subject areas covered in ICD.

The *ICD Student Workbook* is organized into numbered chapters that correspond with those in ICD. The materials that go with Ch. 1 of ICD are in this workbook's Ch. 1, and so on. Although exercises in different chapters will often be related to one another in various ways, the chapters of this workbook are independent and can be used in any order.

For each chapter in ICD, the *ICD Student Workbook* contains the following sections.

- *Exercises*: One or more design problems that you can do (or may be assigned to do), including base sheets. Possible solutions to the exercises are available from your instructor.
- *Further References*: Pointers to websites, books, and other publications that support the material in the chapter.
- *Questions for Evaluating Student Knowledge*: Multiple-choice questions to help you assess how well you have learned the chapter's material. Answers are available from your instructor.

The appendices at the end of this workbook contain the following three handouts, which you may find helpful.

- *How to Sketch Details*: A guide to developing details through hand sketching.
- *Common Abbreviations*: A list of standard abbreviations, used on construction drawings and other documents.

- *Isometric Grid*: An aid in developing three-dimensional sketches and isometric details, for use either as an underlay or for drawing on directly.

## ABOUT THE EXERCISES

Most of the exercises in this workbook are based on the same imaginary interior design project: a showroom on the second floor of a large merchandise mart building. This showroom, which is open only to the trade, specializes in selling chairs.

Because the exercises concern a single project of limited scope and size, you can get a sense of the interrelationships among the design and detailing decisions on different aspects of a project without being overwhelmed by the project's size.

The floor plan for this showroom is shown in Fig. I.1. Figure I.2 shows a schematic section through the exterior window wall and structural grid. In the west portion of the showroom, a corridor is shown that includes an exit door for an adjacent space. For the purposes of this hypothetical project, it is assumed that the owner of the showroom has an option on leasing additional space for another showroom, which would include an assembly area for product demonstrations, seminars, and meetings. This space would require a second exit to the public corridor, which the owner has elected to provide in the build-out of this space. This layout, then, gives you the opportunity to learn about egress, dead-end corridor requirements, door-swing planning, fire-rated doors, and fire-rated demising partitions.

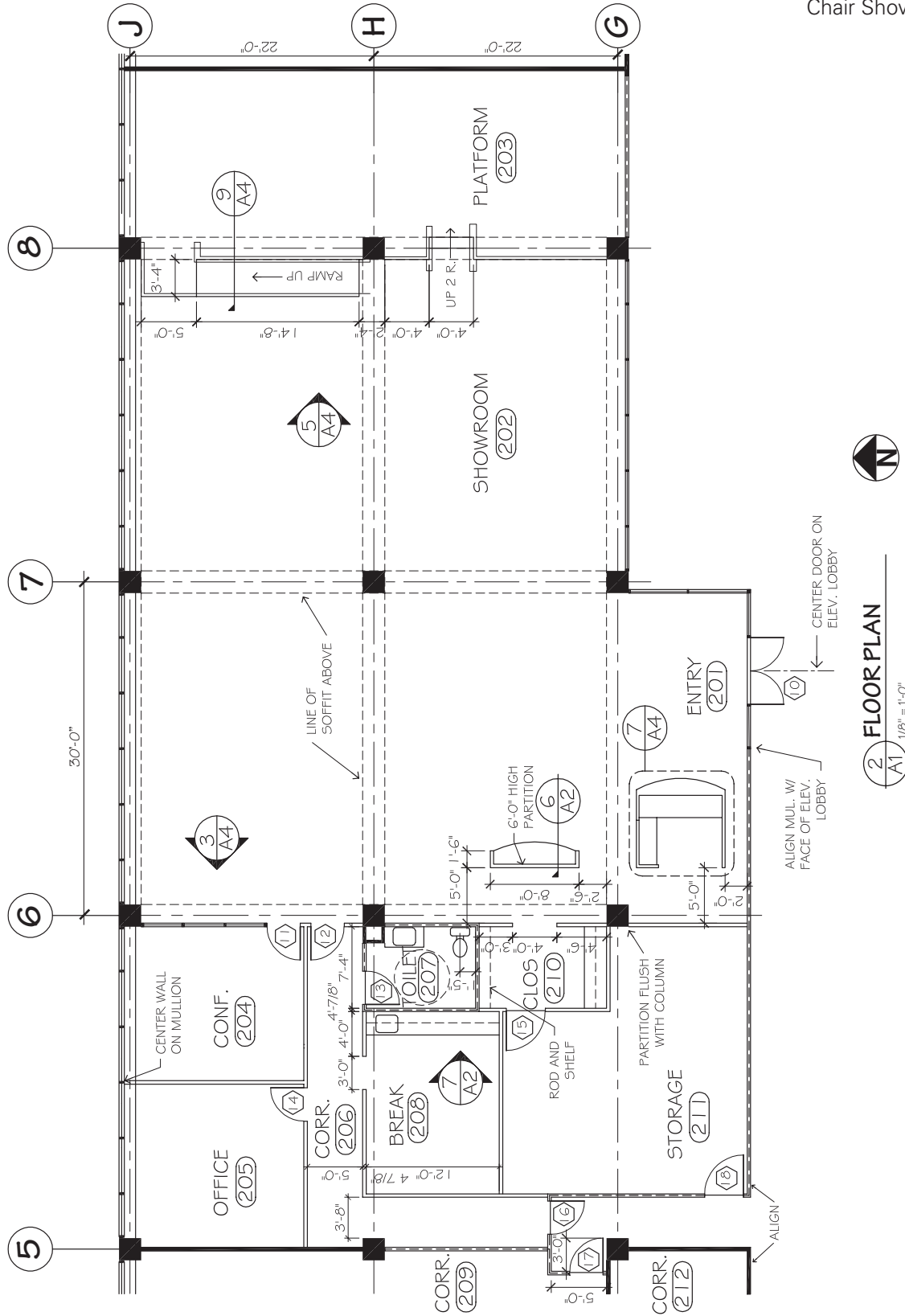
It is also assumed that a new 1-hour rated partition must be constructed between columns H5 and G5. This must include the partition around doors 16 and 17 and the partition between the storage room and the dead-end corridor. The demising partitions at the west end of the showroom, between columns J5 and H5, and between column G5 and the public corridor are existing 1-hour rated partitions that will not be modified except to apply new finishes.

The building has a sprinkler system, so in accordance with Table 1018.1 of the *International Building Code* (IBC), this corridor would not require a fire rating, and standard glazing would therefore be allowed for the showroom windows. However, your instructor may set different requirements, which will affect the detailing requirements of the door and windows along the public corridor.

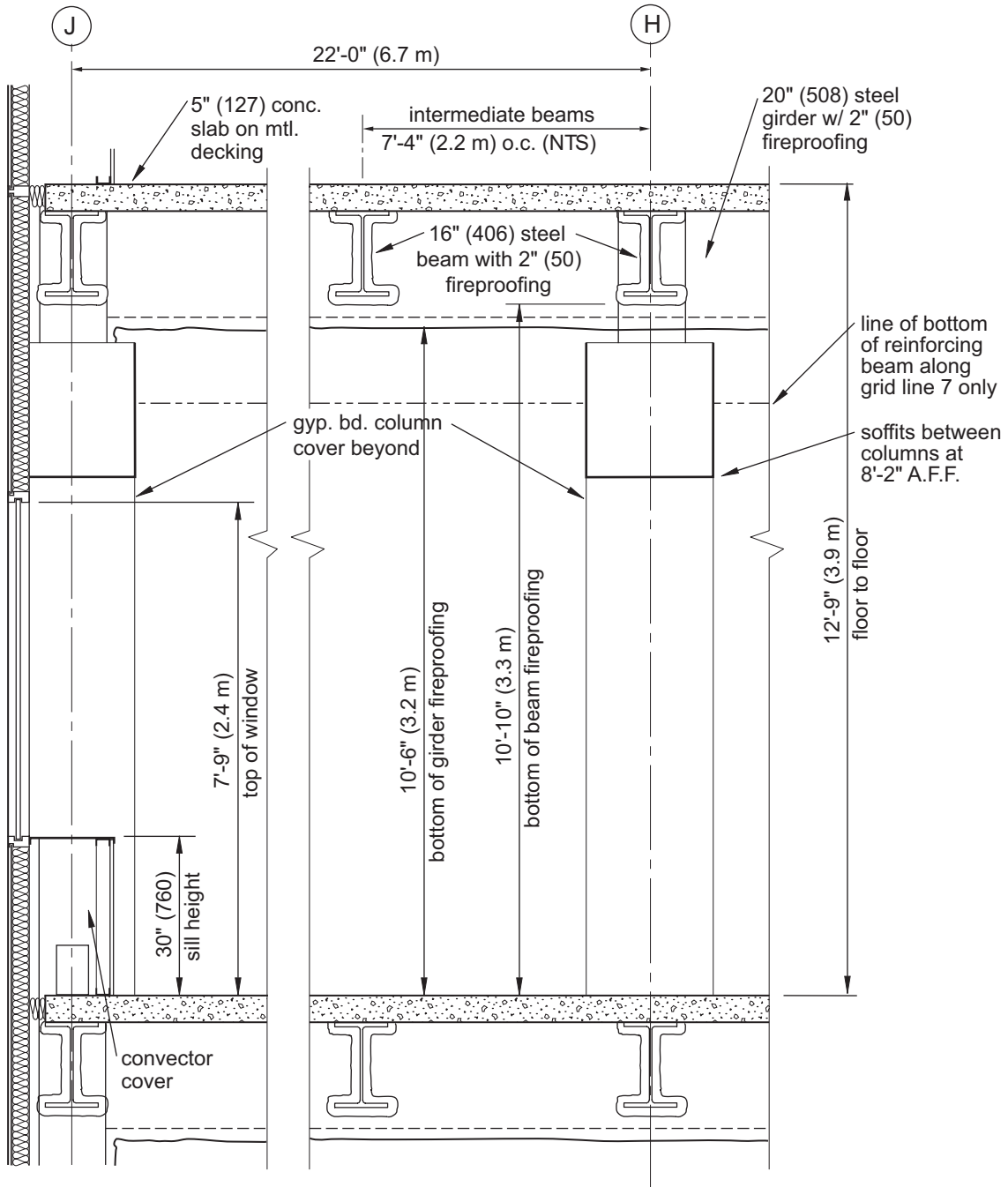
For this project, assume that the designer has worked with the owner to develop the space plan shown. The project is now moving into design development and the development of individual details in preparation for construction documents.



**Figure I.1**  
Chair Showroom



**Figure I.2**  
 Partial Section  
 Through Chair  
 Showroom



**1** WALL SECTION  
 SCALE: 3/16" = 1'-0" [1:64]

# 1

# PARTITIONS

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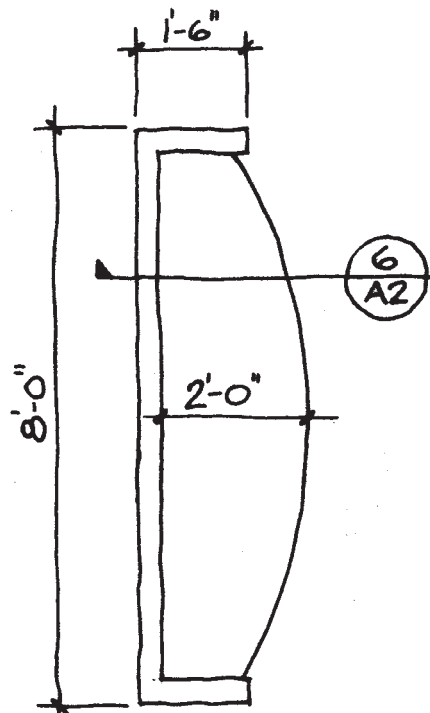
## EXERCISES

### Exercise 1

The client wants to have a computer available near the reception desk in the Chair Showroom so that customers can view photographs and information online about the chairs that the client sells. The client and the designer have earlier agreed that the computer will be on a counter surrounded by a low wall that is capped with a durable material. A plan of this display counter is shown.

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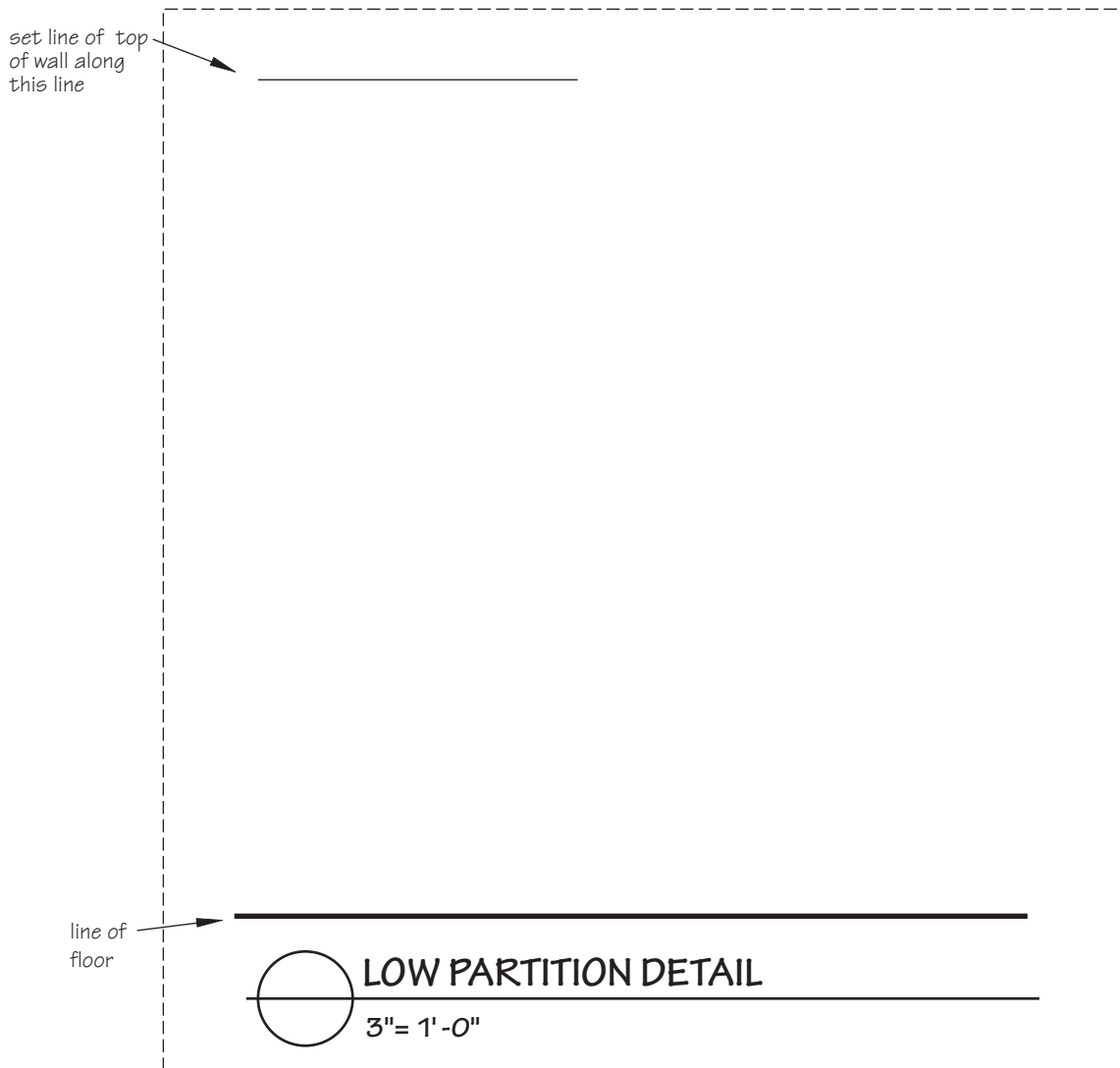
Plan



**Procedure**

Develop a vertical section detail through the low partition that will later be used to surround and support a built-in countertop. The countertop will be 42 in (1067 mm) above the floor. All that must be detailed is the low wall; do not draw the countertop. However, provide wood blocking in the partition for secure attachment of the counter. The basic construction will be  $\frac{5}{8}$  in (15.9 mm) drywall on  $\frac{3}{8}$  in (92.1 mm) metal studs. A  $3\frac{1}{2}$  in high by  $\frac{3}{4}$  in (89 mm high by 19 mm) thick wood base will be used.

**Base Sheet**



**Final Product**

Draw a vertical section through the partition at a scale of 3 in = 1 ft 0 in (1:4). Neatly sketch freehand using break lines as necessary so that the entire wall height is shown in the drawing module. Use the base sheet shown and at least three overlays to develop the detail. Include critical dimensions and notes as needed to describe your detail. The detail must be drawn within the drawing module and on an 8<sup>1</sup>/<sub>2</sub> in × 11 in (216 mm × 279 mm) sheet.

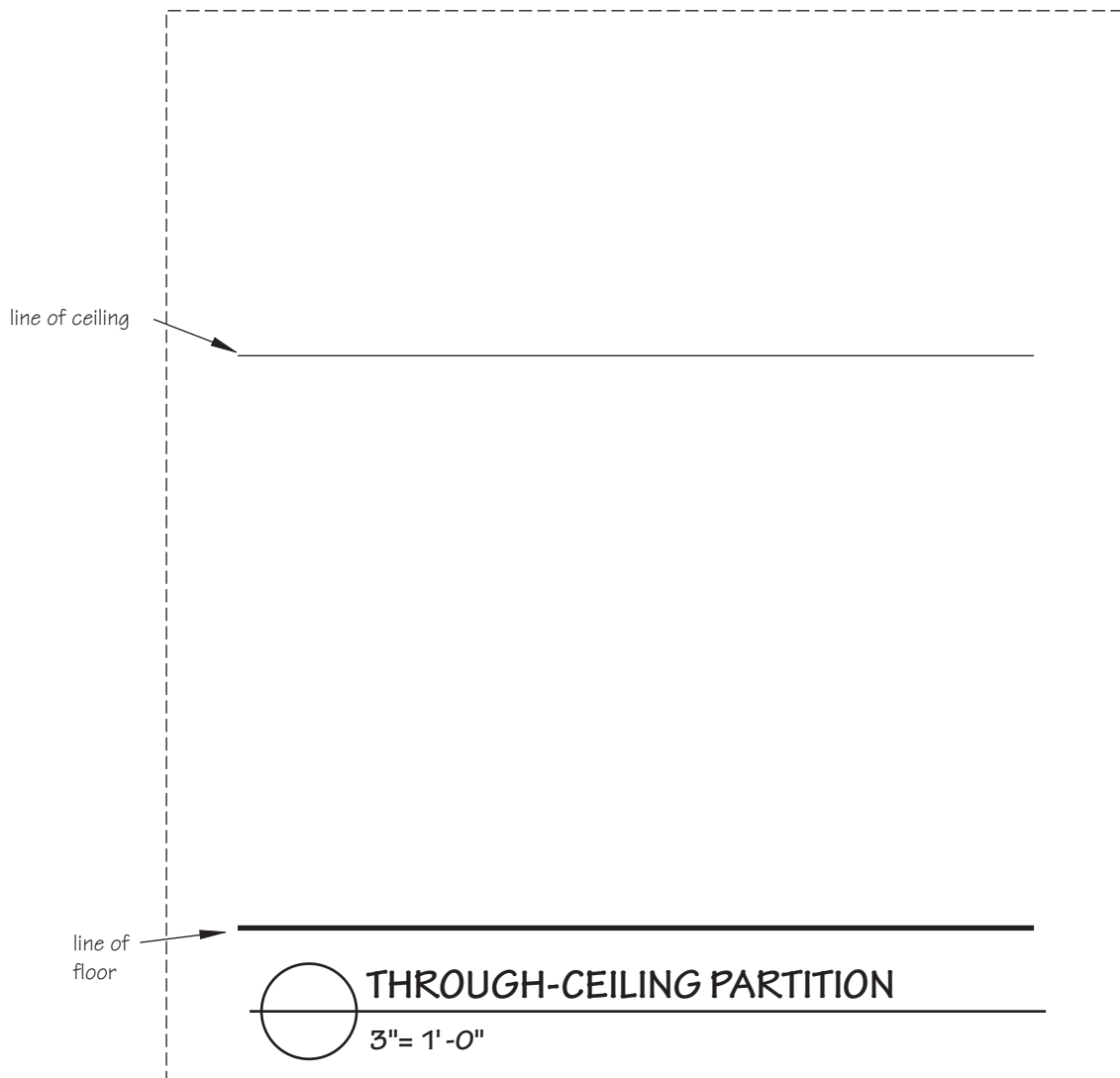
## Exercise 2

For the Chair Showroom project, the partition type must allow the ceiling grid to have a different layout on each side. However, the drywall does not need to extend all the way to the structure above. Therefore, the partition must extend slightly above the acoustical ceiling. Sketch freehand a partition detail that stubs 4 in (100 mm) above the line of the ceiling. Also show the condition at the floor. Use  $3\frac{5}{8}$  in (92.1 mm) studs with  $\frac{5}{8}$  in (15.9 mm) gypsum wallboard.

### Procedure

Draw a vertical section through the partition at a scale of 3 in = 1 ft 0 in (1:4). Use the base sheet drawing shown here. Two lines are indicated to help you get started. Using inexpensive tracing paper, develop the detail for this partition type. The final detail must fit within the drawing module on an  $8\frac{1}{2}$  in  $\times$  11 in (216 mm  $\times$  279 mm) piece of paper.

### Base Sheet



**Final Product**

When completed, the partition detail should be drawn at the scale indicated on the base sheet with dark pencil lines or black felt-tip marker. The paper used for the final product should be 8<sup>1</sup>/<sub>2</sub> in × 11 in (216 mm × 279 mm).

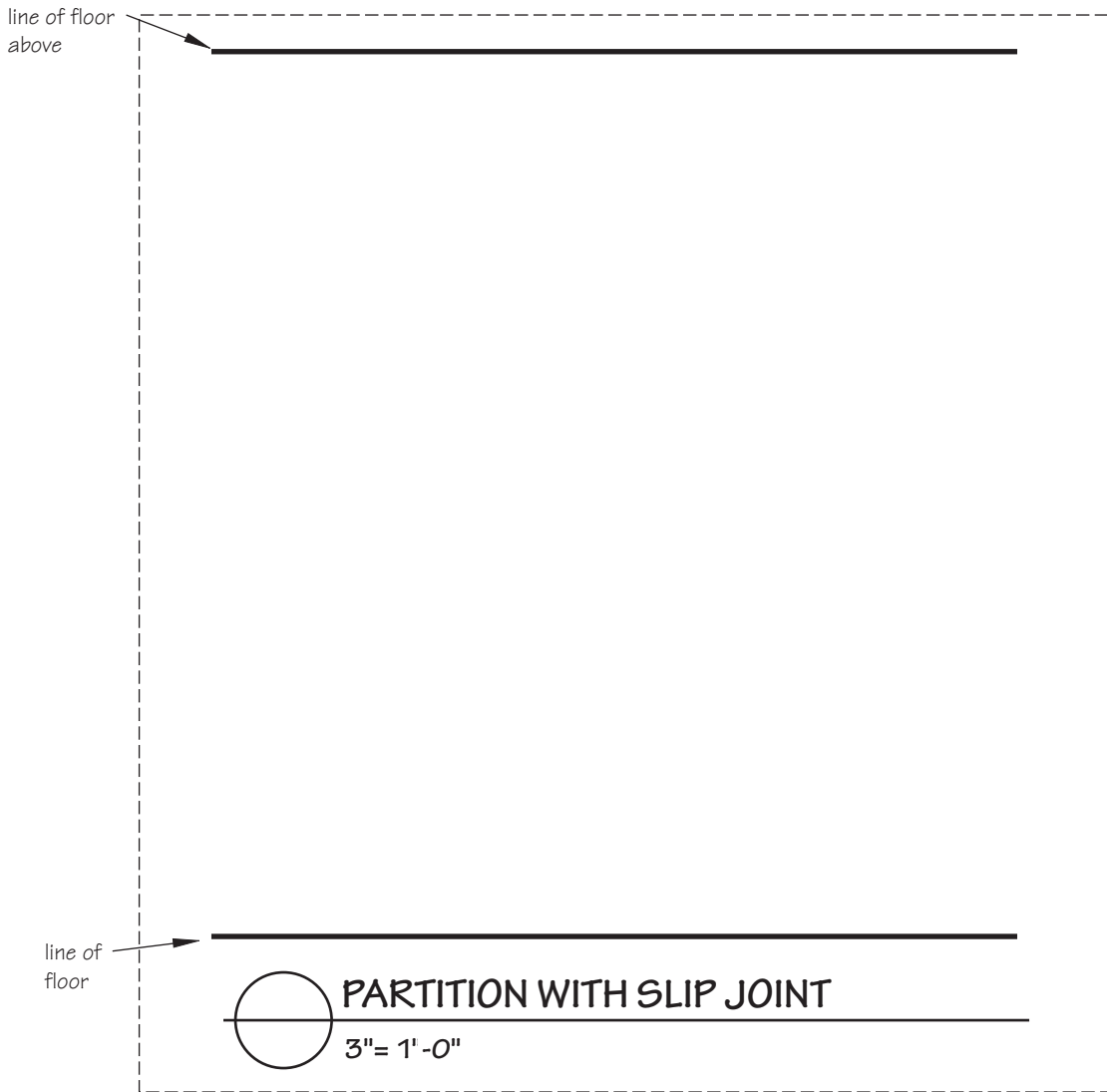
**Exercise 3**

The floors in the Chair Showroom’s building are known to deflect slightly. Therefore, any fire-rated partition or other slab-to-slab wall requires a slip joint at the top. The structural engineer suggests that allowance be made for a  $\frac{3}{4}$  in (19 mm) deflection.

**Procedure**

Develop a standard vertical section through a partition showing the conditions at the base, acoustical ceiling, and deflection head. Use  $\frac{5}{8}$  in (15.9 mm) wallboard on  $\frac{3}{8}$  in (92.1 mm) studs.

**Base Sheet**



**Final Product**

One section drawn freehand at a scale of 3 in = 1 ft 0 in (1:4) using the base sheet shown. Include dimensions and notes as required to explain the detail and allow a CAD operator to add it to the final set of drawings.



### Exercise 4

Develop a base detail for a partition in the Chair Showroom that separates the office and conference room from the corridor. At this point in the design process, the designer wants to use a simple 4 in (100 mm) high rubber base on the corridor side of the partition while exploring various options for the office and conference room side. Using sustainable materials for detailing is desired, but not an absolute requirement. The following guidelines will get you started.

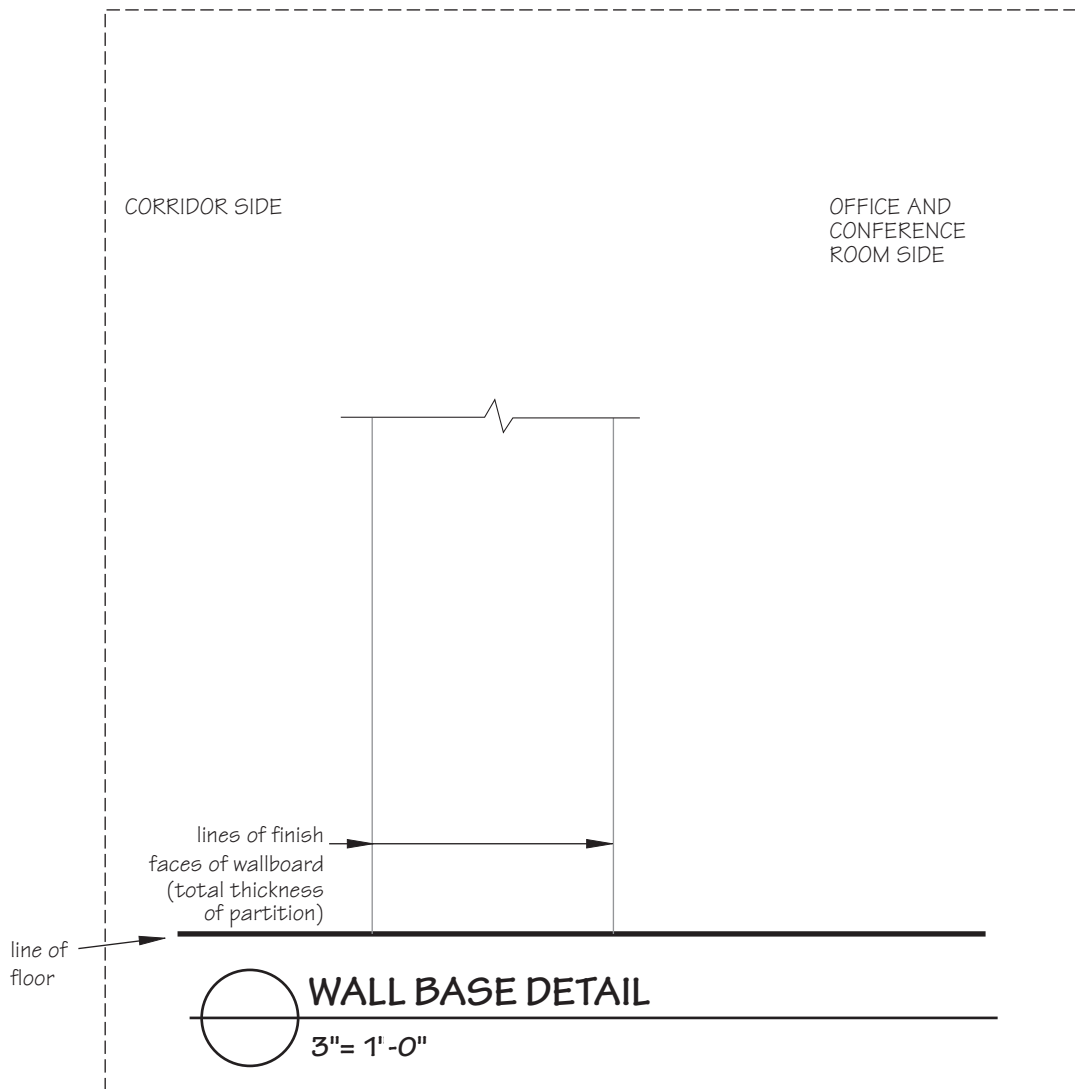
#### Design Requirements

- Partition is  $3\frac{5}{8}$  in (92.1 mm) wide metal stud construction with  $\frac{5}{8}$  in (15.9 mm) gypsum wallboard on each side.
- Floor substrate is concrete with glue-down carpet as the finish.
- One side of the partition (corridor side) should have a standard rubber base 4 in (100 mm) high, while the other side should use something other than a standard surface-applied rubber, vinyl, or wood base.
- There are no special requirements for sound isolation or fire resistance.

#### Procedure

Using the base sheet shown, develop a possible base detail for this partition. This may not necessarily be the final design detail used; you should explore various options for review. Options should include applied, flush, and recessed base configurations. Save all your sketches for possible use in later assignments.

**Base Sheet**



**Final Product**

Sketches showing various options that meet the criteria as given in the design requirements. Be sure to show the interior construction of the partition as well as the designs for the base. Include one section drawn freehand at a scale of 3 in = 1 ft 0 in (1:4) that includes dimensions and notes.

## FURTHER REFERENCES

### Gypsum Wallboard

*CertainTeed*: gypsum wallboard and accessories, [www.certainteed.com](http://www.certainteed.com)

*Georgia-Pacific Gypsum*: gypsum wallboard and accessories, [www.gp.com/build](http://www.gp.com/build)

*Gypsum Association*: trade association, [www.gypsum.org](http://www.gypsum.org)

*National Gypsum*: gypsum wallboard and accessories, [www.nationalgypsum.com](http://www.nationalgypsum.com)

*Serious Materials*: sound deadening wallboard, [www.seriousenergy.com](http://www.seriousenergy.com)

*United States Gypsum*: gypsum wallboard and accessories, [www.usg.com](http://www.usg.com)

### Gypsum Wallboard Trim

*Fry Reglet*: aluminum trim pieces, [www.fryreglet.com](http://www.fryreglet.com)

*Gordon Grid*: aluminum trim pieces, [www.gordongrid.com](http://www.gordongrid.com)

*Pittcon Industries*: wallboard trim and extrusions, [www.pittconindustries.com](http://www.pittconindustries.com)

*Plastic Components*: PVC trim pieces, [www.plasticcomponents.com](http://www.plasticcomponents.com)

*Trim-Tex*: vinyl trim pieces, [www.trim-tex.com](http://www.trim-tex.com)

*Superior Metal Trim*: steel, aluminum, zinc trim pieces, [www.superiormetalproducts.com](http://www.superiormetalproducts.com)

### Metal Framing

*AMICO Alabama Metal Industries*: metal lath and accessories, [www.amico-lath.com](http://www.amico-lath.com)

*Clark Western*: metal framing and accessories, [www.clarkwestern.com](http://www.clarkwestern.com)

*Dietrich Metal Framing*: metal framing and accessories, [www.dietrichmetalframing.com](http://www.dietrichmetalframing.com)

*Fire Trak*: fire-rated, head-of-wall joint framing, [www.firetrak.com](http://www.firetrak.com)

*Flex-Ability Concepts*: adjustable stud track, [www.flexabilityconcepts.com](http://www.flexabilityconcepts.com)

*Phillips Manufacturing*: metal framing and trim, [www.phillipsmfg.com](http://www.phillipsmfg.com)

### Movable Wall and Panel Manufacturers

*Avanti Systems USA*: [www.avantisystemsusa.com](http://www.avantisystemsusa.com)

*Dirtt Environmental Solutions*: [www.dirtt.net](http://www.dirtt.net)

*Haworth*: [www.haworth.com](http://www.haworth.com)

*Infinium Architectural Wall Systems*: [www.infiniumwalls.com](http://www.infiniumwalls.com)

*KI*: [www.ki.com](http://www.ki.com)

*Livers Bronze*: [www.liversbronze.com](http://www.liversbronze.com)

*LOFTwall*: [www.loftwall.com](http://www.loftwall.com)

*Modernfold*: [www.modernfold.com](http://www.modernfold.com)

*Panel Systems Manufacturing*: [www.roomdividers.org](http://www.roomdividers.org)

*Panelfold Doors & Partitions*: [www.panelfold.com](http://www.panelfold.com)

*Steelcase*: [www.steelcase.com](http://www.steelcase.com)

*Teknion*: [www.teknion.com](http://www.teknion.com)

*Transwall*: [www.transwall.com](http://www.transwall.com)

## Trade Associations

*Association of the Wall and Ceiling Industries International:* [www.awci.org](http://www.awci.org)

*Gypsum Association:* [www.gypsum.org](http://www.gypsum.org)

## Books

Gypsum Association. *Fire Resistance Design Manual, GA-600*. Washington: Gypsum Association.

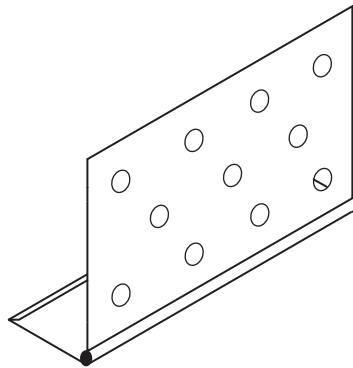
———. *Recommended Levels of Gypsum Board Finish*. Washington: Gypsum Association.

Underwriters Laboratories. *Building Materials Directory*. Northbrook, IL: Underwriters Laboratories.

United States Gypsum. *Gypsum Construction Handbook*. Chicago, IL: United States Gypsum.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

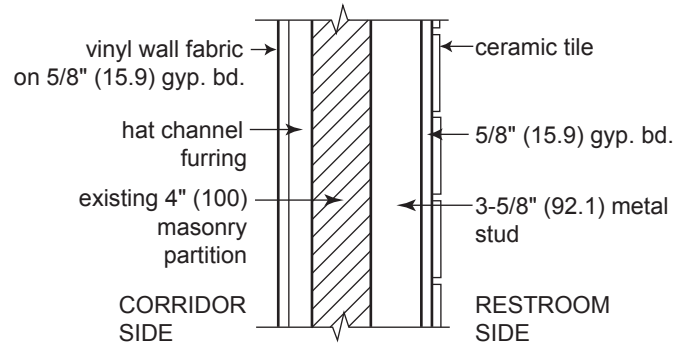
1. In a commercial building, a partition constructed from the floor to the underside of the structure above is most likely to be
  - A. separating two offices
  - B. part of a soffit
  - C. separating a corridor from an office
  - D. concealing a vertical plumbing pipe
2. A heavy cabinet is to be wall-mounted on a partition framed with metal studs. The detail of the partition should show
  - A. kickers
  - B. blocking
  - C. a hanging strip
  - D. a soffit
3. Where would the wallboard accessory shown most likely be used?



- A. on a 90° outside corner
  - B. along the edge of a raised panel of wallboard
  - C. where expansion and contraction are expected
  - D. behind the casing of a wood door frame
4. The levels of finish as standardized in the gypsum wallboard industry refer to the
    - A. quality of workmanship of the final finish
    - B. thickness of joint compound used
    - C. number of coats of joint compound used
    - D. type of texturing used

5. A partition extends 4 in (100 mm) above a suspended acoustical ceiling and is 2 ft (600 mm) below the structural slab above. To provide stability, the partition detail should show a
- A. runner
  - B. header
  - C. plate
  - D. kicker
6. Slip joints are used in partition construction when
- A. floor deflection is expected
  - B. the building is expected to sway in the wind
  - C. the structure is expected to expand and contract
  - D. the building is in an earthquake zone
7. When a residential gypsum wallboard partition is constructed with 2 in  $\times$  4 in (38 mm  $\times$  89 mm) studs, what combination of wallboard thickness and stud spacing is typically used?
- A.  $\frac{1}{2}$  in board with 16 in spacing (12.7 mm board with 400 mm spacing)
  - B.  $\frac{1}{2}$  in board with 24 in spacing (12.7 mm board with 600 mm spacing)
  - C.  $\frac{5}{8}$  in board with 16 in spacing (15.9 mm board with 400 mm spacing)
  - D.  $\frac{5}{8}$  in board with 24 in spacing (15.9 mm board with 600 mm spacing)

8. During a remodeling project, a designer plans to use an existing 4 in (100 mm) concrete block partition to separate a new corridor from a new restroom. The drawing shown illustrates how the designer proposes to detail new gypsum wallboard construction on either side of this existing partition. What might be the designer's primary reason for selecting this construction?



- A. to provide space for plumbing piping
- B. to give a solid substrate for the ceramic tile
- C. to add additional acoustical control
- D. to establish a smooth, plumb surface for finishes
9. A client wants to remove part of a partition that the interior designer thinks may be a bearing wall. What is the designer's best course of action?
- A. Look above the ceiling to see if the wall supports any beams or joists.
- B. Have an architect or structural engineer review the situation and make a recommendation.
- C. Review the structural drawings of the building.
- D. Ask the client to give direction on how to proceed.
10. The purpose of resilient channels in partitions is to
- A. increase the space for insulation
- B. allow for drywall installation on concrete block
- C. provide space for placing conduit
- D. decrease sound transmission

# 2

## CEILING

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### EXERCISES

#### Exercise 1

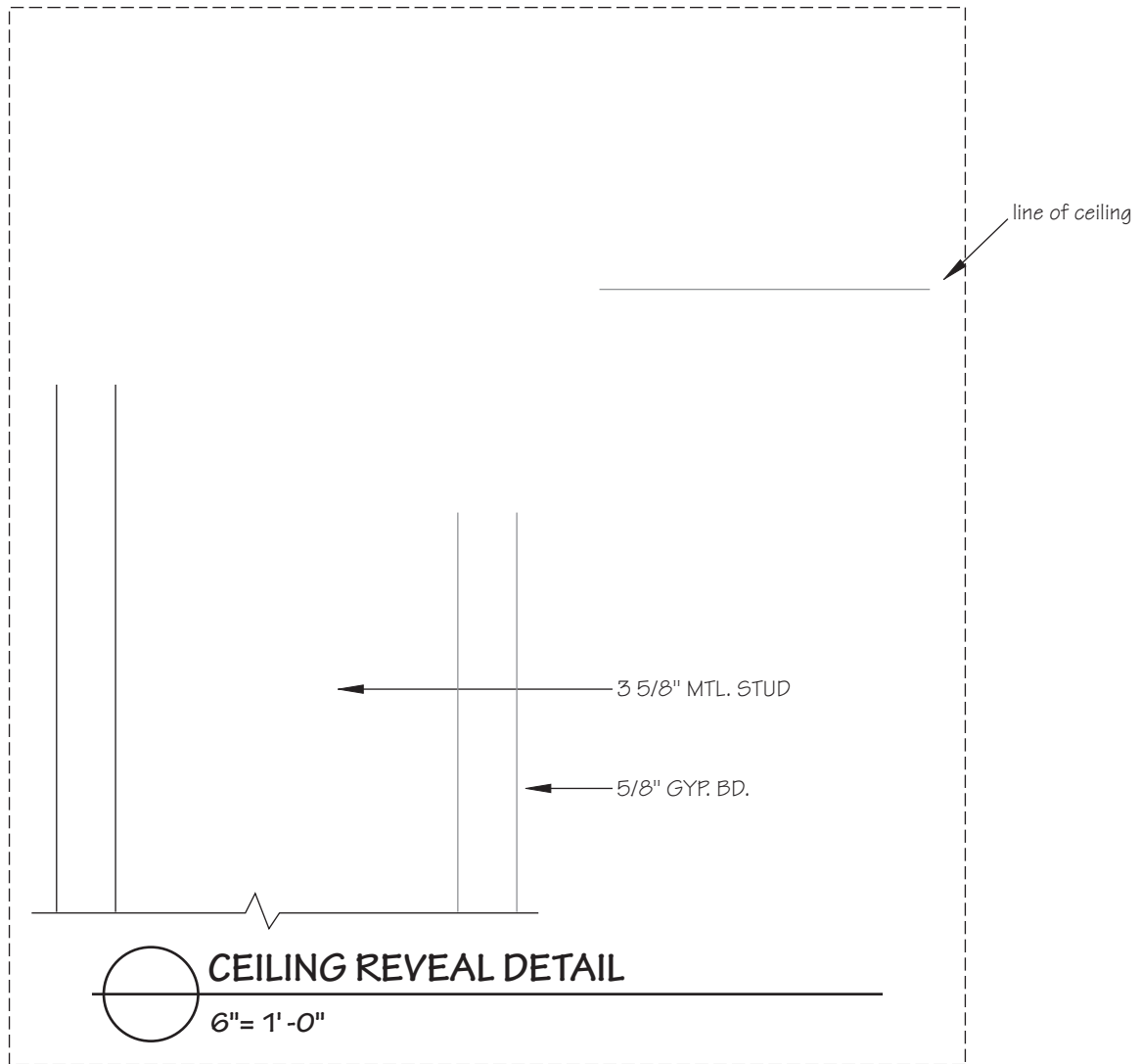
The designer of the Chair Showroom wants to investigate a detail where the acoustical ceiling meets the wall by using a reveal. This is intended to coordinate with possible reveal details at the base and doors.

#### Procedure

Sketch several possible solutions using the base sheet shown. This time, draw at a scale of 6 in = 1 ft 0 in (1:2), or half size, with the drawing oriented as though you were viewing the section with the wall line on your left. There are several possible alternatives to this detail study. Review the manufacturers' web sites given in the reference section. Investigate reveal details where the partition stops at the ceiling line as well as where the partition continues through the ceiling.



## Base Sheet



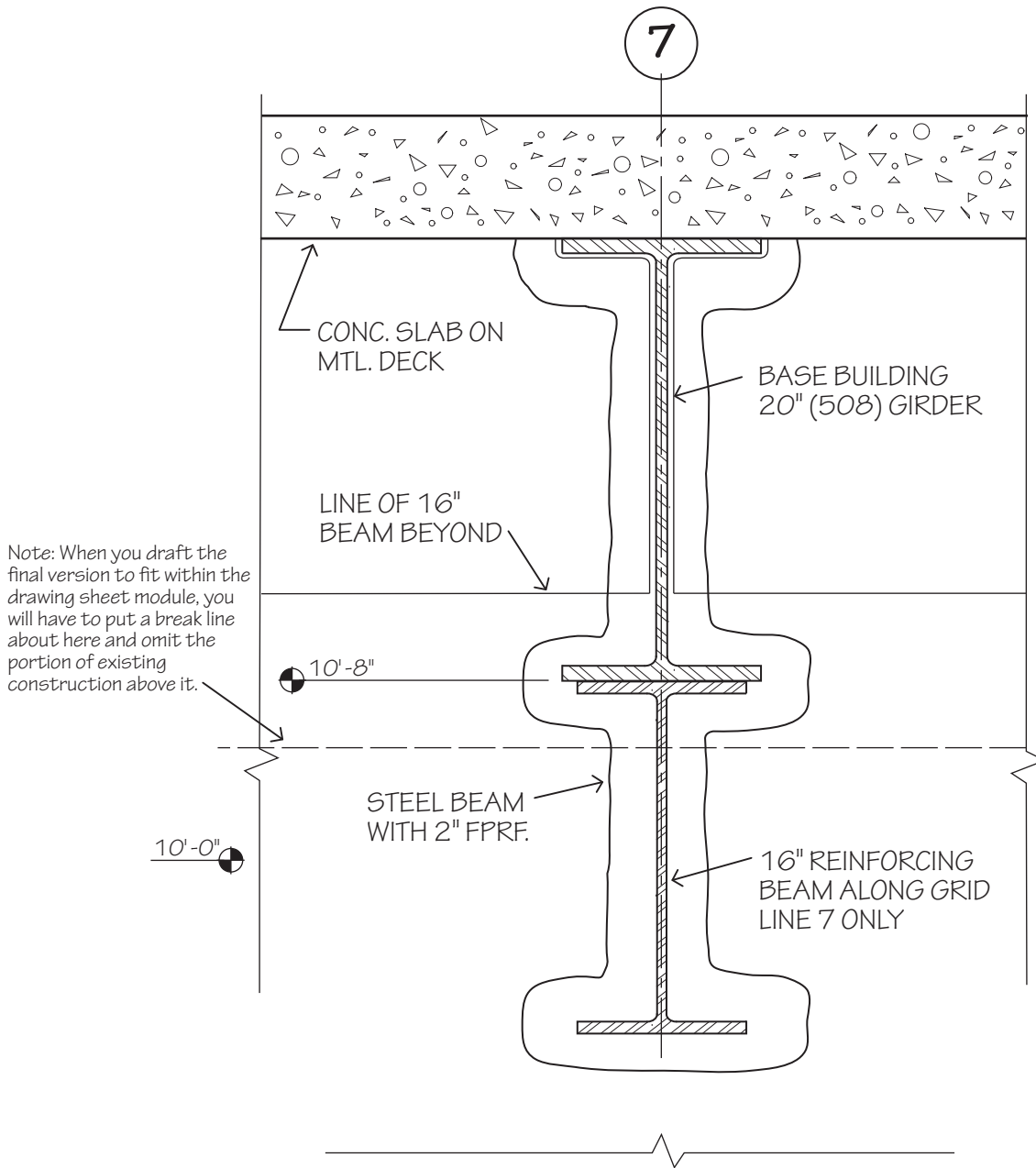
## Final Product

A minimum of four sketches trimmed to 8½ in × 11 in (216 mm × 279 mm) showing several possible solutions with the top sheet drawn with felt tip marker with necessary dimensions and notes to fully describe your detail. The detail should work with various partition types, including both partitions that stop at the underside of the acoustical ceiling and partitions that continue through the ceiling.

**Exercise 2**

The basic structure of the building in which the Chair Showroom is located consists of 20 in (508 mm) steel girders spanning between columns in the short direction (22 ft 0 in (6.7 m) on center) and 16 in (406 mm) steel beams spanning between the girders as shown in Fig. I.2. The designer has discovered that an additional 16 in (406 mm) beam was previously added along grid line 7 to reinforce the existing beam in order to carry the extra weight of a tenant's showroom on the floor above. This places the bottom of the new beam 9 ft 4 in (2845 mm) above the floor. (See the base sheet shown.) When this additional beam was added, the mechanical ductwork and sprinkler pipes were relocated to allow a higher suspended ceiling between the beams.

**Base Sheet**

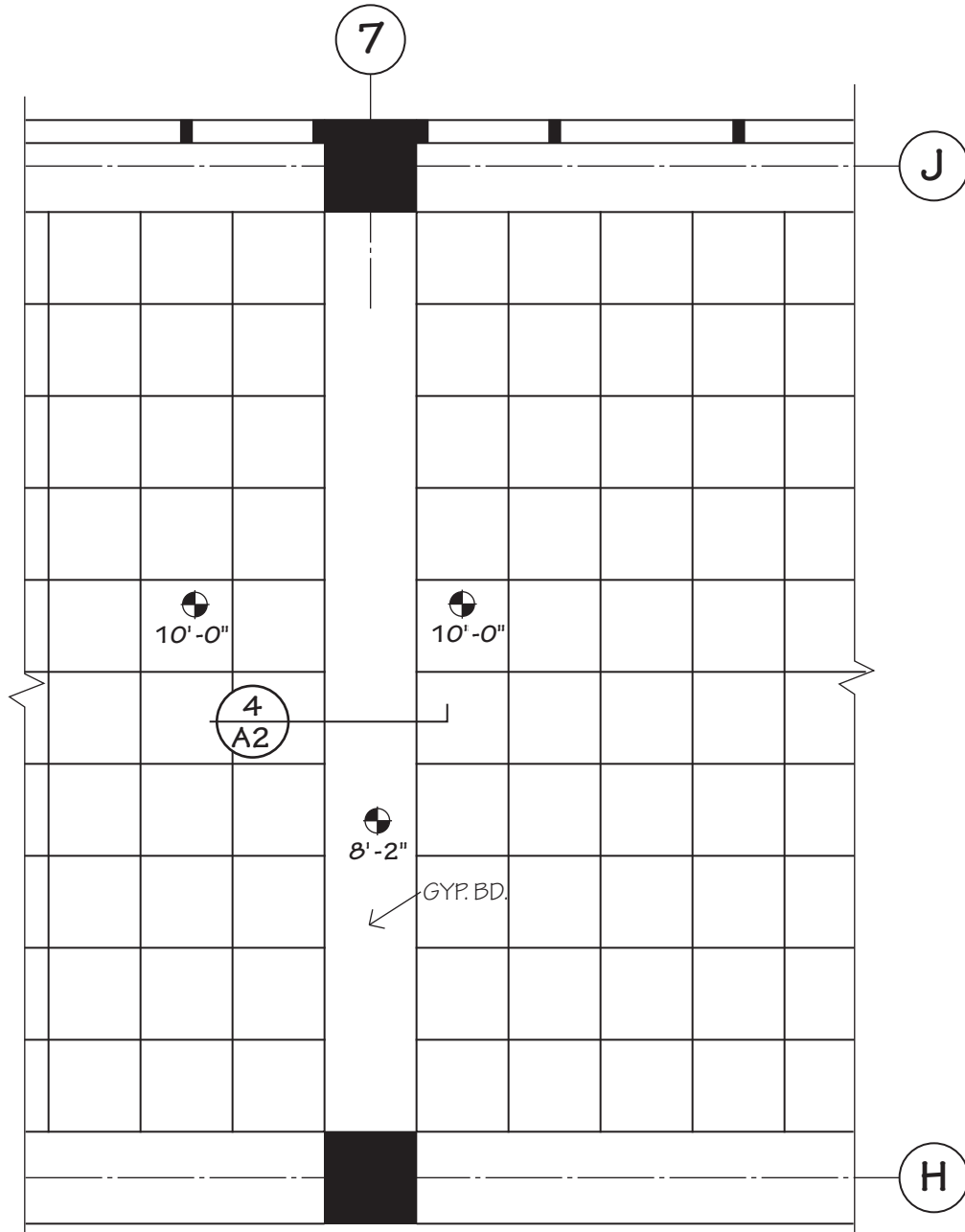


**4** SECTION THROUGH BEAMS--GRID LINE 7 ONLY  
**A2** 1-1/2" = 1'-0"

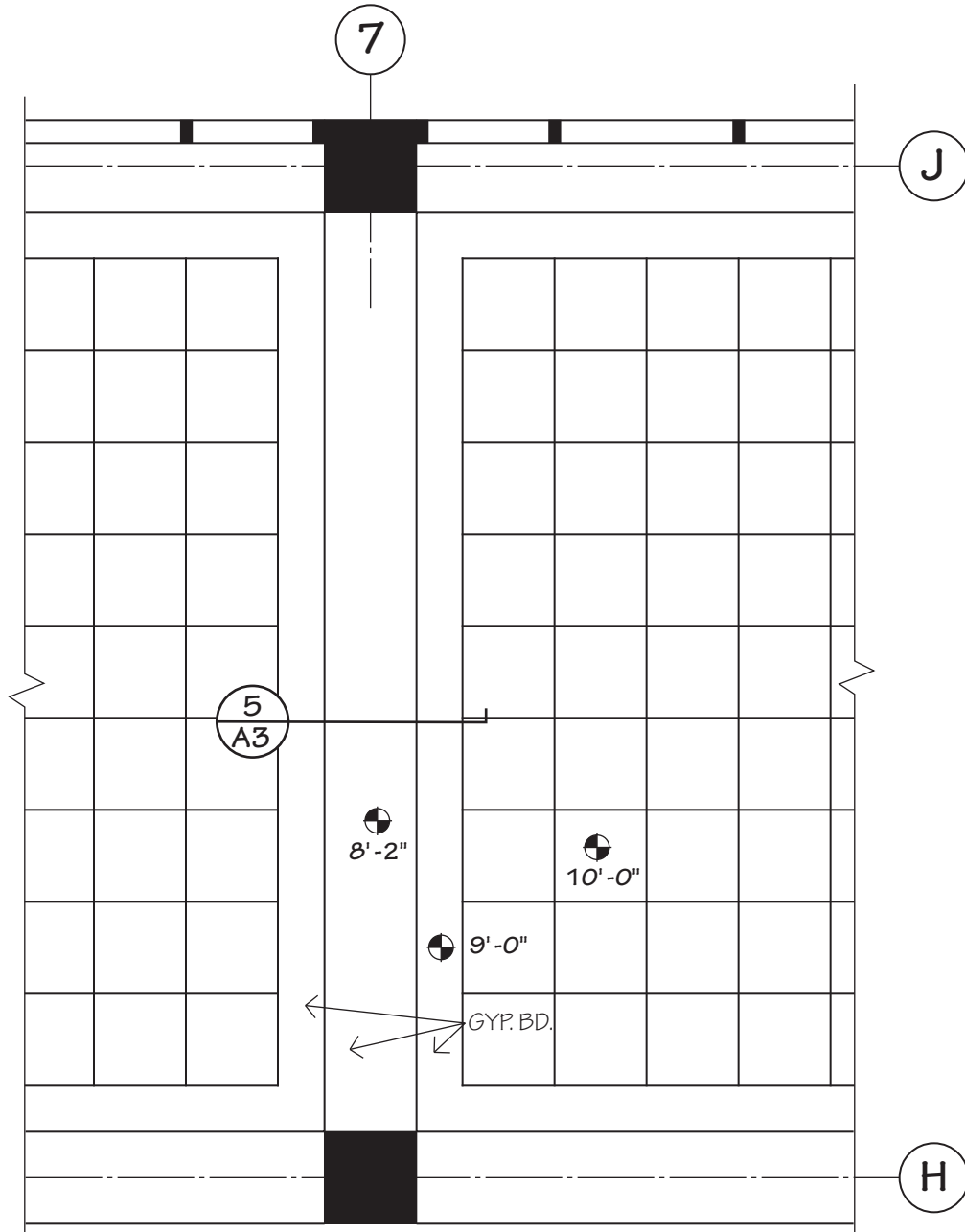
Although the designer of the showroom wants to make the ceiling in the showroom as high as possible, this low beam must be accommodated. One way of doing this is to drop a soffit below the low beam and repeat the soffit elevation below the other beams while making the acoustical ceiling elevation between beams higher, at 10 ft 0 in (3050 mm). The designer has suggested that the enclosure be 2 ft 0 in (610 mm) wide to match the width of the column enclosures with the height of the bottom of the enclosure at 8 ft 2 in (2489 mm) to allow for sprinkler heads and recessed light fixtures.

The designer wants to explore two possible solutions. One would include a dropped ceiling just as wide as the columns as shown in partial reflected ceiling plan A. The acoustical ceiling would abut this dropped gypsum wallboard soffit. The other solution would involve creating a stepped, coffered ceiling indicated in partial reflected ceiling plan B. By creating a 1 ft 0 in (305 mm) wide step, there can be an odd number of acoustical tiles in both directions, making it easier to locate luminaires symmetrically within each structural bay.

**Figure 2.1**  
Partial Reflected  
Ceiling Plan A



**Figure 2.2**  
Partial Reflected  
Ceiling Plan B



**Procedure**

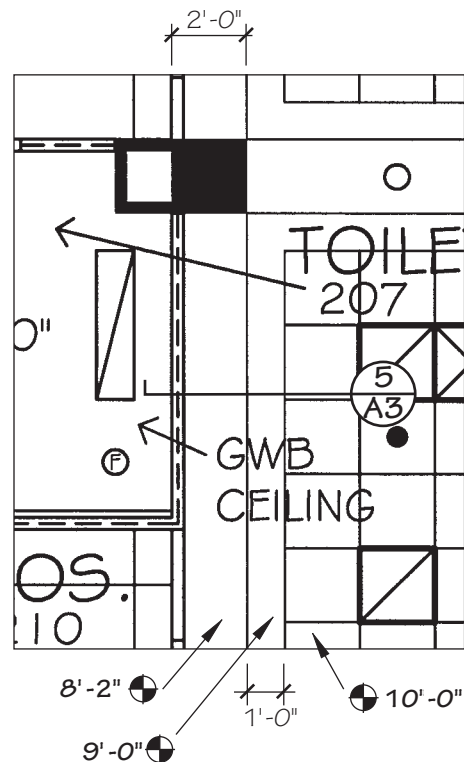
Sketch two sections, 4-A2 and 5-A3, as referenced on the partial reflected ceiling plans A and B. Sketch the details at a scale of  $1\frac{1}{2}$  in = 1 ft 0 in (1:8) using the base sheet shown. Include all notes and dimensions that you feel would be needed to fully communicate the construction of the detail to the designer for approval and so that someone else could put in the other CAD details for this project. For this assignment you do not have to draw within the drawing module, although it is possible to include all the information in a single drawing module.

**Final Product**

Two groups of sketches trimmed to  $8\frac{1}{2}$  in  $\times$  11 in (216 mm  $\times$  279 mm) with the top sheet drawn with felt tip marker with necessary dimensions and notes to fully describe your detail. The bottom sheet should be the base plan and the middle two sheets should be development sketches.

### Exercise 3

Draw a ceiling detail at the partition between the toilet room and the showroom as shown in the partial reflected ceiling plan. The designer wants to explore using a 1 ft 0 in (305 mm) width of gypsum wallboard around all four sides of the bay where the acoustical tile will be used. This will create a “stepped” effect from the high acoustical ceiling of the showroom down to the 8 ft 2 in (2490 mm) elevation of the soffit, as explored in Exercise 2. The elevations of the various ceiling components are indicated in the partial plan shown. Remember that the toilet room wall runs slab to slab.



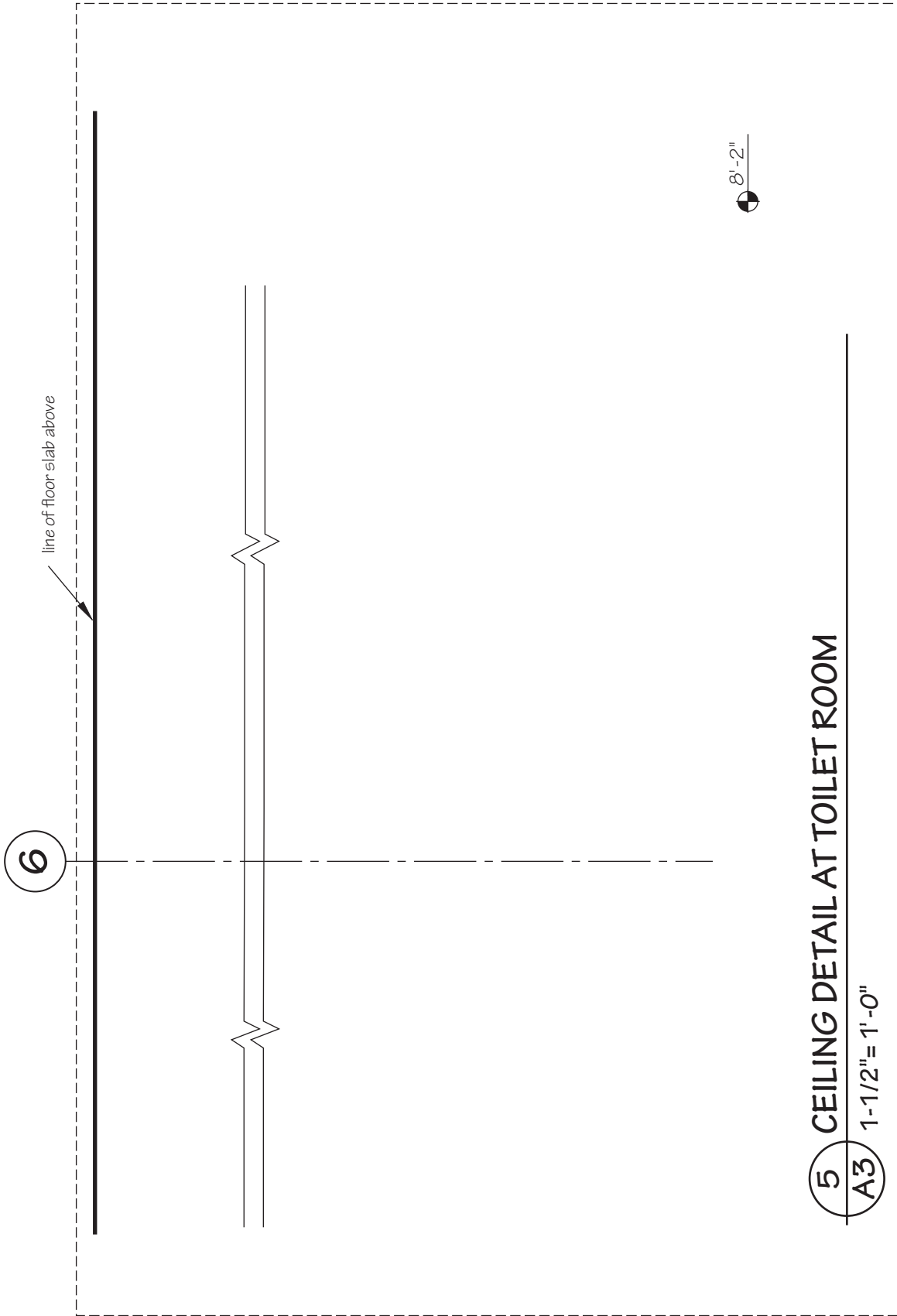
**Figure 2.1**  
Partial Reflected  
Ceiling Plan

### Procedure

Sketch this detail using the base sheet shown with at least three overlays. Draw at a scale of  $1\frac{1}{2}$  in = 1 ft 0 in (1:8) with the drawing oriented so that the view looks north. This is the direction indicated in the partial plan.

Instead of just one drawing module, use two modules side by side. This will give a total drawing area  $5\frac{1}{2}$  in high by 10 in wide (140 mm  $\times$  254 mm). Using two modules will allow the detail to be drawn without any vertical break lines. A pair of horizontal break lines will be needed to separate the portion of the detail near the floor above from the ceiling assembly. Grid line 6 and the 8 ft 2 in (2490 mm) elevation points are indicated to help you get started.

Base Sheet





**Final Product**

One group of sketches trimmed to  $8\frac{1}{2}$  in  $\times$  11 in (216 mm  $\times$  279 mm) with the top sheet drawn with felt tip marker with necessary dimensions and notes to fully describe your detail. Make a copy for your notebook.

## FURTHER REFERENCES

### Ceiling Trim Manufacturers

*Alpro Acoustical Systems*: edge trim for T-bar systems in straight and curved sections, [www.alproacoustics.com](http://www.alproacoustics.com)

*Armstrong*: edge trim for floating ceilings, drapery pocket assemblies, panel transitions to drywall, and standard sized floating “clouds,” [www.armstrong.com](http://www.armstrong.com)

*Chicago Metallic*: metal ceiling grids in a variety of configurations as well as FRP grid sections, [www.chicagometallic.com](http://www.chicagometallic.com)

*Fry Reglet*: aluminum ceiling grid and specialty trim pieces, [www.fryreglet.com](http://www.fryreglet.com)

*Gordon Incorporated*: aluminum trim pieces for ceiling-to-ceiling transitions as well as ceiling-to-wall transition moldings and perimeter pockets for drapery and cove lighting, [www.gordon-inc.com](http://www.gordon-inc.com)

*Trim-Tex*: vinyl wallboard trim in a variety of configurations for wallboard ceilings, vinyl crown molding, and some specialty ceiling trim, [www.trim-tex.com](http://www.trim-tex.com)

### Open-Grid Ceiling Manufacturers

*Alpro Acoustical Systems*: acoustical baffles, [www.alproacoustics.com](http://www.alproacoustics.com)

*Armstrong*: Metalworks™ aluminum system, [www.armstrong.com](http://www.armstrong.com)

*Ceilings Plus*: Beams rectangular or square systems, in a variety of baffle sizes and grid sizes, [www.ceilingplus.com](http://www.ceilingplus.com)

*Chicago Metallic*: Magna T-Cell™, Intaline™, CubeGrid™, BeamGrid™, and Graph-Grid™ systems, [www.chicagometallic.com](http://www.chicagometallic.com)

*Gordon Incorporated*: Beam Mate wide-open grid system and Fin Mate suspended fins in flat and curved configurations, [www.gordon-inc.com](http://www.gordon-inc.com).

*Simplex Ceilings*: aluminum grids from 1 in to 6 in (25 mm to 152 mm) square and in custom sizes, [www.simplexceilings.com](http://www.simplexceilings.com)

*USG*: GridWare™, WireWorks™, and WireWorks™ Forms, [www.usg.com](http://www.usg.com)

### Suspended Ceiling Manufacturers

*Alpro Acoustical Systems*: corrugated, perforated metal acoustical panels of aluminum or steel in flat panels, curves, and floating sections, [www.alproacoustics.com](http://www.alproacoustics.com)

*American Decorative Ceilings*: specialty ceilings including tin ceiling replications, open grids, wood panels, corrugated, linear plank, linear metal ceilings, translucent panels for backlighting, metal panels, and floating “clouds,” [am-dec.com](http://am-dec.com)

*Armstrong*: wide variety of ceiling suspension systems, ceiling tiles, and specialty ceiling products, [www.armstrong.com](http://www.armstrong.com)

*BPB America*: standard ceiling tiles and grids, [www.bpb-na.com](http://www.bpb-na.com)

*Ceilings Plus*: variety of specialty ceiling types including curved, serpentine, canted arc, corrugated, metal and wood open grid, linear metal, wood slat, wood panel, modular, and triangular grid shapes, [www.ceilingplus.com](http://www.ceilingplus.com)

*Chicago Metallic:* wide variety of grids and panels as well as specialty items such as curved grids for floating “clouds,” curved ceiling sections, and perforated panels, [www.chicagometallic.com](http://www.chicagometallic.com)

*Gordon Incorporated:* ceiling grid systems and aluminum, steel, and stainless steel panels in flat, curved, and custom configurations, as well as luminous ceilings and perforated panels, [www.gordon-inc.com](http://www.gordon-inc.com)

*Hunter Douglas:* Techstyle® suspended ceilings consisting of honeycomb panels snapped to concealed grid, [www.hunterdouglascontract.com](http://www.hunterdouglascontract.com)

*Pinta acoustic:* patterned, bevel-edged ceiling tiles with backer board for grid or adhesive installation, [www.pinta-acoustic.com](http://www.pinta-acoustic.com)

*Simplex Ceilings:* metal pan ceilings for flat or curved installation, concealed plank panels, curved ceilings, linear metal ceilings, open grids, and custom designs, [www.simplexceilings.com](http://www.simplexceilings.com)

*Tectum:* wood fiber ceiling panels, abuse resistant, paintable, [www.tectum.com](http://www.tectum.com)

*USG:* wide variety of ceiling grids and panels including specialty systems, [www.usg.com](http://www.usg.com)

### **Trade Associations**

*Association of the Wall and Ceiling Industries International:* [www.awci.org](http://www.awci.org)

*Ceilings and Interior Systems Construction Association:* [www.cisca.org](http://www.cisca.org)

### **Books**

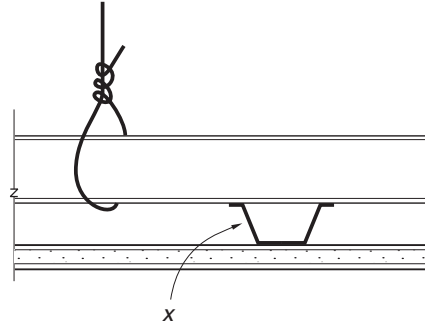
Binggeli, Corky, ed. *Interior Graphic Standards*. Hoboken, NJ: John Wiley & Sons.

United States Gypsum. *Gypsum Construction Handbook*. Chicago, IL: United States Gypsum.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. Acoustical ceilings are designed primarily to
  - A. attenuate sound
  - B. absorb sound
  - C. block the transmission of sound
  - D. both absorb and block the transmission of sound
  
2. The measure of the average sound absorption of an acoustical ceiling tile is the
  - A. ceiling attenuation class
  - B. articulation class rating
  - C. noise reduction coefficient
  - D. articulation index
  
3. Which of the following values is most important for evaluating the acoustical performance of ceiling tile and is commonly published in manufacturers' literature?
  - A. AC
  - B. CAC
  - C. NRC
  - D. SRA
  
4. Which of the following ceiling systems is the most appropriate for a large commercial remodeling project where an economical acoustical ceiling and plenum access are required?
  - A. linear metal strip
  - B. concealed grid
  - C. integrated
  - D. lay-in
  
5. Which of the following statements about concealed spline ceilings is FALSE?
  - A. They use suspension components similar to those of lay-in ceilings.
  - B. Upward accessible systems are necessary.
  - C. Beveled edges prevent chipping.
  - D. They are less expensive than drywall ceilings.

6. Which of the following is NOT a standard tile and grid size for suspended, lay-in, acoustical ceilings?
- 12 in  $\times$  12 in (300 mm  $\times$  300 mm)
  - 24 in  $\times$  24 in (600 mm  $\times$  600 mm)
  - 24 in  $\times$  48 in (600 mm  $\times$  1200 mm)
  - 20 in  $\times$  60 in (500 mm  $\times$  1500 mm)
7. In the drywall ceiling detail shown, the component labeled *x* is the



- cold-rolled steel channel
  - channel spacer
  - furring channel
  - main runner
8. In lay-in ceiling construction, ceiling angles should be used only
- at all partitions
  - at the room perimeter and around registers
  - at all vertical penetrations of the ceiling
  - wherever ceiling materials change
9. To most prominently show a reveal wherever the suspension grid occurs in a lay-in acoustical ceiling system, which tile type should be specified?
- tapered
  - square edge
  - beveled
  - tegular

10. One of the major disadvantages of a commercial, suspended, gypsum wallboard ceiling is that
- A. it requires access panels
  - B. it has no texture
  - C. it requires an extensive support grid
  - D. it is difficult to install

# 3

## DOORS

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### EXERCISES

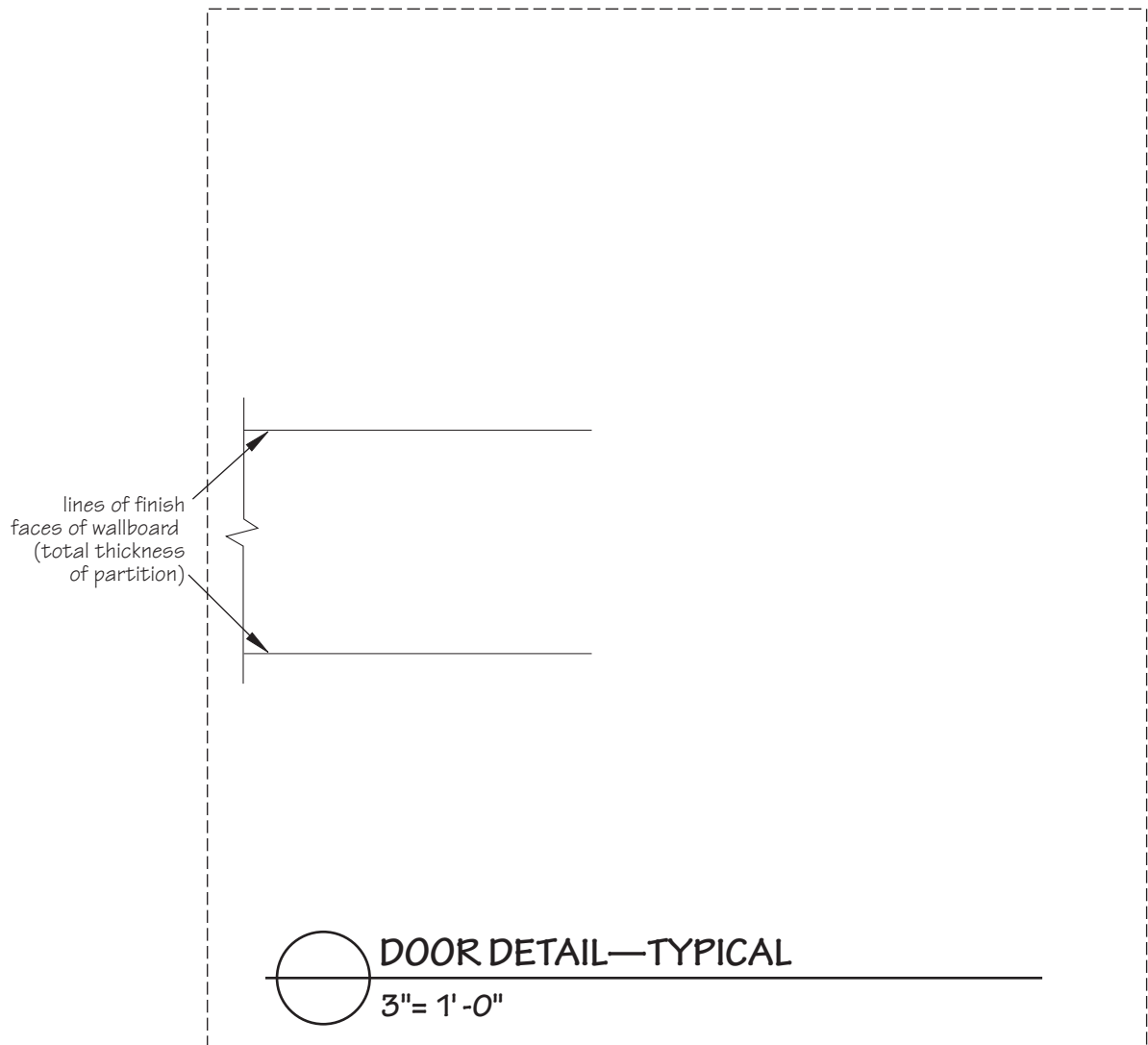
#### Exercise 1

Develop a typical door detail for the Chair Showroom. The construction should consist of a solid core wood door in either a hollow metal frame or an aluminum frame. You may want to explore both. For this standard detail, assume that the designer will specify a standard 4 in (100 mm) high rubber base.

#### Procedure

Develop a standard horizontal section through a partition showing the condition at one jamb. Use a partition consisting of  $\frac{5}{8}$  in (15.9 mm) wallboard on each side of  $\frac{3}{8}$  in (92.1 mm) metal studs. Use the guidelines on the base sheet shown to get started.

## Base Sheet

**Final Product**

The final product should be a section drawn freehand at a scale of 3 in = 1 ft 0 in (1:4), including dimensions and notes as required to explain the detail and allow a CAD operator to add it to the final set of drawings.

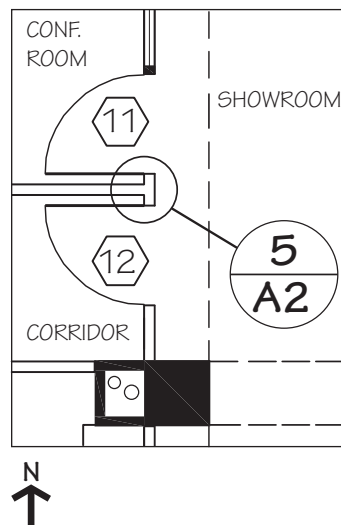


## Exercise 2

Develop the doorjamb detail for the hinge jamb of the door leading from the showroom into the conference room of the Chair Showroom (door 11), as shown in the partial floor plan here. In your detail, include a small portion of the corridor partition running east-west and show where it intersects the partition just to the south of the door frame. Do not draw any portion of the doorjamb of the door leading into the corridor (door 12).

Door 11 should be a solid core wood door with a wood frame. The inside edge of the door opening should be located 4 in (100 mm) from the finish face of the partition to allow room for the door handle when the door is open at 90°. You may choose whatever profile and design for the frame that you like, as long as you follow the standard requirements for wood door frames.

In Ch. 5, Exercise 1, you will develop the opposite jamb as part of the jamb/glazing mullion. You should give that detail some consideration now, because that detail is the opposite of the profile for this one.

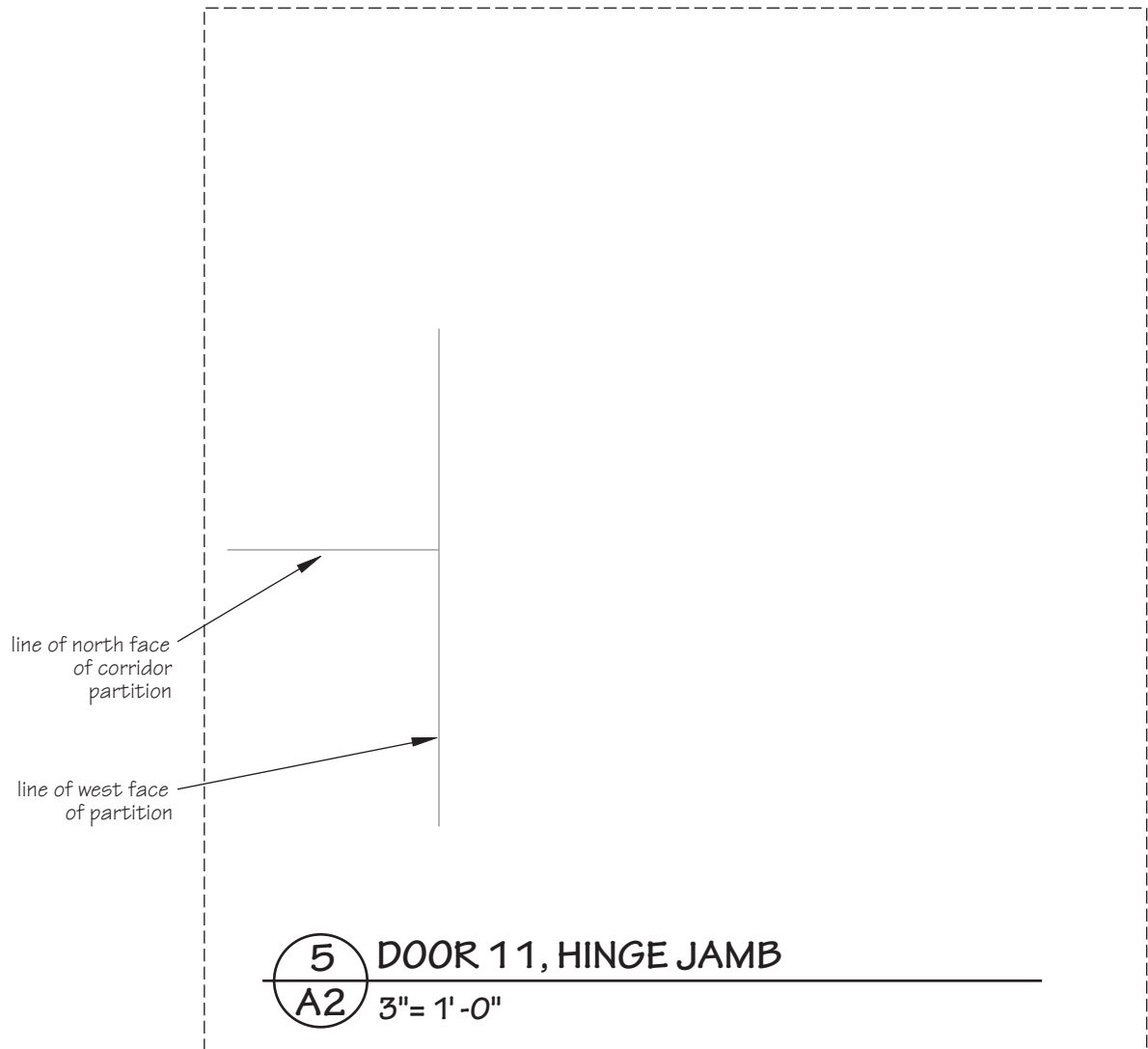


**Figure 3.1**  
Partial Floor Plan

## Procedure

Using the base sheet shown and working within the standard drawing module, develop this detail. It may change slightly when the opposite detail is developed in a later exercise. Both details may be developed together.

## Base Sheet

**Final Product**

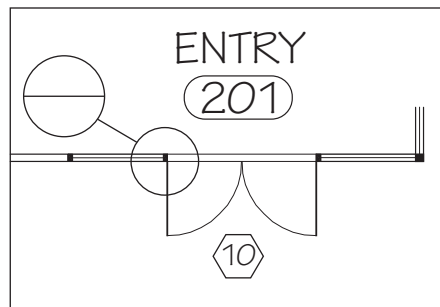
The final product should be a freehand sketch at a scale of 3 in = 1 ft 0 in (1:4), including dimensions and notes as required to explain the detail. Include the sketch overlays used to develop the detail.

### Exercise 3

Develop the doorjamb mullion detail for the hinge jamb of the entry door to the Chair Showroom (door 10, as shown in the partial floor plan in Fig. 3.2.) This doorjamb will include the framing for the sidelite adjacent to the door. Assume that the door will be a  $\frac{3}{4}$  in (19 mm) thick all-glass door mounted on offset pivots and that the sidelite will consist of  $\frac{1}{4}$  in (6 mm) tempered glass. Use hollow metal framing for the mullion.

This detail may change slightly as the opposite detail is developed in a later exercise (Ch. 5, Exercise 2). Both details may be developed together.

As an additional exercise, develop the same detail using aluminum framing.

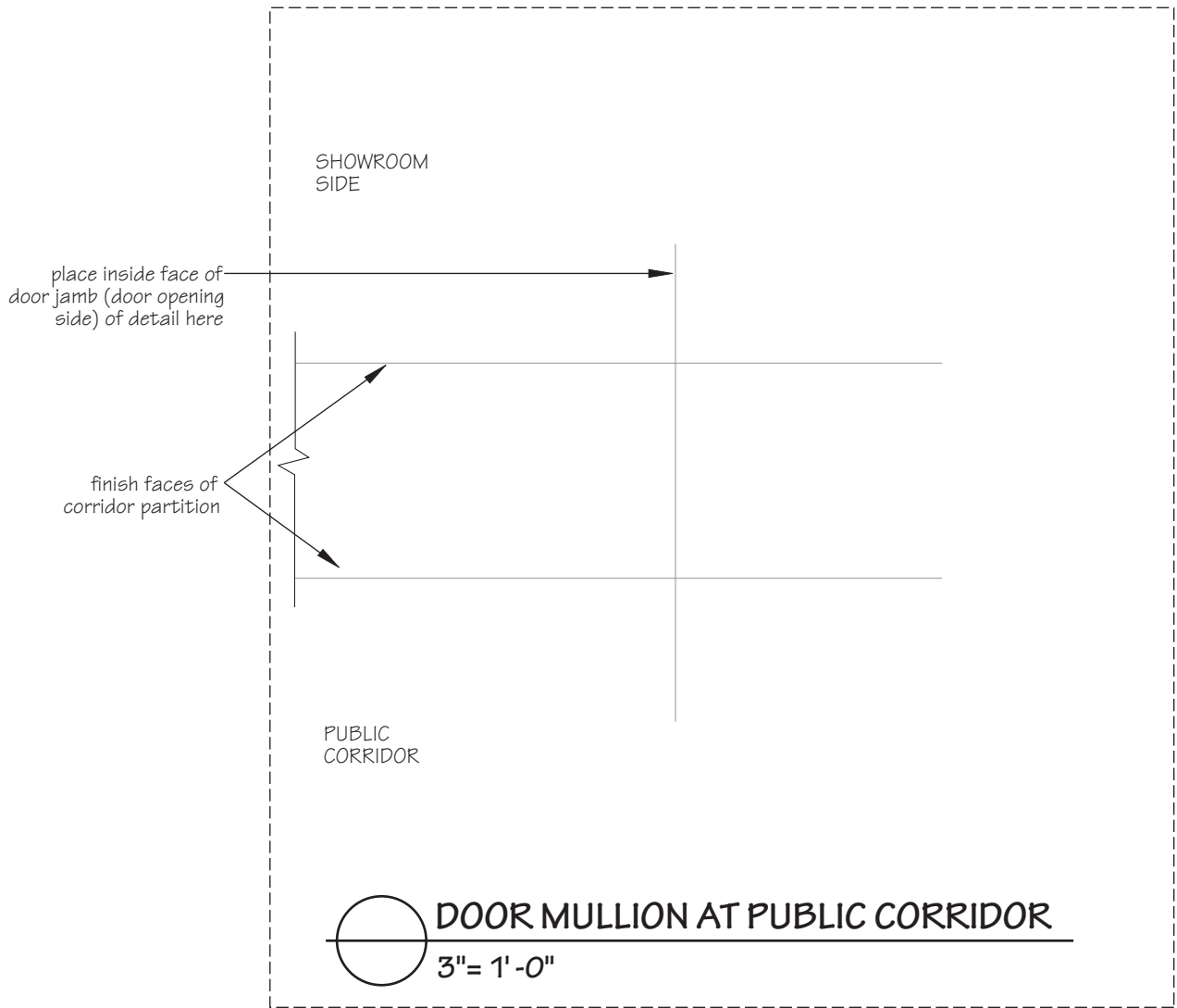


**Figure 3.2**  
Partial Floor Plan

### Procedure

Develop this detail using the base sheet shown and working within the standard drawing module.

Base Sheet



**Final Product**

The final product should be a freehand sketch at a scale of 3 in = 1 ft 0 in (1:4), including dimensions and notes as required to explain the detail. Include the sketch overlays used to develop the detail.

**Exercise 4**

Instead of the double glass door shown on the floor plan of the Chair Showroom (see Fig. I.1 and the partial floor plan for Exercise 3), design and detail a new entry door. This should be a unique opening that will stand out among the other showroom doors and enhance the experience of moving into the showroom.

**Procedure**

Develop at least four different concepts and then select one to develop into a set of details. At a minimum, create a jamb and head detail. Develop any other details that may be needed to describe the construction of your entrance.

**Final Product**

The student should decide on the most appropriate formats for presenting the concepts and developing the set of details.

## FURTHER REFERENCES

### Doors

*Algoma Hardwoods*: flush and panel wood doors, [www.algomahardwoods.com](http://www.algomahardwoods.com)

*Amweld*: steel doors, [www.amweld.com](http://www.amweld.com)

*Artistic Doors and Windows*: stile and rail doors, [www.artisticdoorsandwindows.com](http://www.artisticdoorsandwindows.com)

*Ceco Door*: hollow metal doors and frames, [www.cecodoor.com](http://www.cecodoor.com)

*Curries/Assa Abloy*: hollow metal doors and frames, [www.curries.com](http://www.curries.com)

*Karona*: stile and rail and sash doors, [www.karonadoor.com](http://www.karonadoor.com)

*Krieger Specialty Products*: specialty doors, [www.kriegerproducts.com](http://www.kriegerproducts.com)

*Overly Door Company*: specialty door products, [www.overly.com](http://www.overly.com)

*Republic Doors*: hollow metal doors and frames, [www.republicdoor.com](http://www.republicdoor.com)

*Steelcraft*: hollow metal doors and frames, [www.steelcraft.com](http://www.steelcraft.com)

*VT Industries*: wood and HPDL doors, [www.vtindustries.com](http://www.vtindustries.com)

### Frames

*Avalon International*: aluminum door frames and glazing components, [www.avalonint.com](http://www.avalonint.com)

*DIRTT*: interior walls systems and framing, [www.dirtt.net](http://www.dirtt.net)

*Western Integrated Materials*: aluminum frames and glazing components, [www.aluminumdoorframes.com](http://www.aluminumdoorframes.com)

*Wilson Partitions*: aluminum frames, [www.wilsonpart.com](http://www.wilsonpart.com)

### Trade Associations

*Architectural Woodwork Institute (AWI)*: [www.awinet.org](http://www.awinet.org)

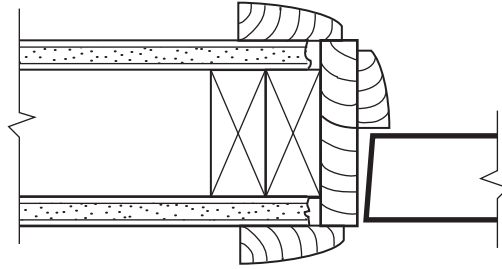
*Door and Hardware Institute (DHI)*: [www.dhi.org](http://www.dhi.org)

*Steel Door Institute (SDI)*: [www.steeldoor.org](http://www.steeldoor.org)

*Window and Door Manufacturers Association (WDMA)*: [www.wdma.org](http://www.wdma.org)

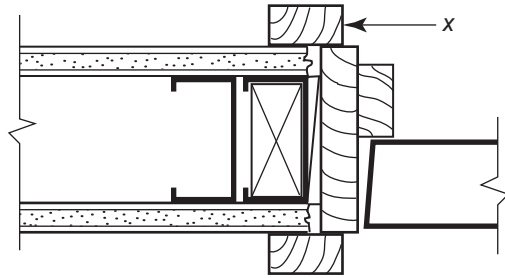
## QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE

1. If the doorjamb detail shown was constructed as drawn, what would be the most significant problem?



- A. The door closing would be excessively noisy.
- B. The door might bind against the frame.
- C. There would be insufficient space for hardware.
- D. Sound would leak through the wall.
2. Which of the following would be the best choice for the doors of the patient examination rooms in a doctor's office?
- A. 34 in (850 mm) width, hollow core wood door, wood frame
- B. 34 in (850 mm) width, solid core wood door, wood frame
- C. 36 in (900 mm) width, solid core wood door, hollow metal frame
- D. 36 in (900 mm) width, hollow metal door, hollow metal frame
3. Which of the following is NOT a reason for the frequent use of 3 ft 0 in (900 mm) wide doors in commercial construction?
- A. They meet accessibility standards.
- B. They do not have to be custom made.
- C. They meet fire-resistance rating requirements.
- D. They provide the minimum width required for exit doors.
4. Which of the following is the most common thickness for a solid core wood door?
- A.  $1\frac{3}{8}$  in (34.9 mm)
- B.  $1\frac{1}{2}$  in (38.1 mm)
- C.  $1\frac{5}{8}$  in (41.3 mm)
- D.  $1\frac{3}{4}$  in (44.4 mm)

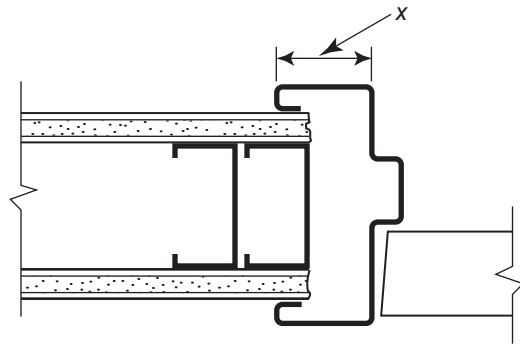
5. According to the *International Building Code*, a door in a 1-hour-rated corridor requires a fire rating of
- 20 minutes
  - 30 minutes
  - 45 minutes
  - 60 minutes
6. What kind of frame does a 1<sup>1/2</sup>-hour fire-rated door assembly require?
- metal with double rabbeted profile
  - labeled hollow metal
  - extruded aluminum or steel
  - steel or rated wood
7. The horizontal portion of the door frame is called the
- jamb
  - head
  - rail
  - sill
8. In the detail shown, what is the name of the construction component labeled *x*?



- jamb
- casing
- soffit
- face



9. Which of the following components is LEAST needed on the strike jamb of a wood door frame?
- A. frame
  - B. stop
  - C. double stud
  - D. casing
10. In the detail shown, what is the name of the portion of the frame labeled *x*?



- A. soffit
- B. stop
- C. face
- D. rabbet

# 4

# HARDWARE

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## EXERCISES

### Exercise 1

For the Chair Showroom, develop a door schedule and door and frame elevations. Use the information about doors 10, 11, and 12 from the exercises in Ch. 3. Assume that the door and frame for door 18 from the public corridor into the storage room will be hollow metal. For each of the other doors on the project, select the door and frame type that would be appropriate for its use and consistent with the overall design of the space. Draw the door and frame elevations at a scale of  $\frac{1}{4}$  in = 1 ft 0 in (1:50).

**Exercise 2**

Select hardware for the Chair Showroom project and develop a hardware schedule. The hardware should be appropriate for the function of the various doors on the project. The style and finishes can be whatever you deem appropriate.

## FURTHER REFERENCES

The following includes only a very small sampling of the hardware companies available on the internet.

### General Materials

*Arcat*: [www.arcat.com](http://www.arcat.com)

*Reed Construction Data*: [www.reedconstructiondata.com](http://www.reedconstructiondata.com)

*Spec Simple*: [www.specsimple.com](http://www.specsimple.com)

*Transstudio*: [www.transstudio.com](http://www.transstudio.com)

### Hinges and Pivots

*ASSA Abloy*: hinges, locksets, other hardware, [www.assaabloydss.com](http://www.assaabloydss.com)

*Hager*: hinges, locksets, closer, other, [www.hagerco.com](http://www.hagerco.com)

*McKinney*: hinges and other interior hardware, [www.mckinneyhinge.com](http://www.mckinneyhinge.com)

*PBB, Inc.*: commercial grade hinges, [www.ppbinc.com](http://www.ppbinc.com)

*Rixon*: concealed closers, pivots, and mechanical/electromechanical door holders, [www.rixon.com](http://www.rixon.com)

*Soss*: concealed hinges, [www.soss.com](http://www.soss.com)

### Locksets and Latchsets

*ASSA Abloy*: various types of bored and mortise locksets and other locking mechanisms, [www.assaabloydss.com](http://www.assaabloydss.com)

*Corbin Russwin*: mechanical and electrical locks and other types of door control hardware, [www.corbinrusswin.com](http://www.corbinrusswin.com)

*Dorma*: locksets and other door control hardware, [www.dorma-usa.com](http://www.dorma-usa.com)

*Sargent*: locksets, closers, exit devices, access control systems, and other hardware, [www.sargentlock.com](http://www.sargentlock.com)

*Schlage*: mechanical and electrical locks, [www.schlage.com](http://www.schlage.com)

*Yale*: locksets, exit devices, closers, [www.yalecommercial.com](http://www.yalecommercial.com)

### Closers

*Baldwin*: closers and other residential hardware, [www.baldwinhardware.com](http://www.baldwinhardware.com)

*Dorma*: variety of door control hardware, [www.dorma-usa.com](http://www.dorma-usa.com)

*LCN Closers*: various types of door closers, [www.lcn.ingersollrand.com](http://www.lcn.ingersollrand.com)

*Norton Door Controls*: mechanical and electrical door closers and ADA operators, [www.nortondoortcontrols.com](http://www.nortondoortcontrols.com)

*Rixon*: concealed closers, [www.rixon.com](http://www.rixon.com)

## Other Hardware

*Accuride International:* drawer glides, [www.accuride.com](http://www.accuride.com)

*Adams Rite:* exit devices, narrow stile locks, electric strikes, [www.adamsrite.com](http://www.adamsrite.com)

*Häfele America:* specialized architectural hardware and cabinet hardware, [www.hafele.com/us](http://www.hafele.com/us)

*Pemko:* gasketing, thresholds, automatic door bottoms, [www.pemko.com](http://www.pemko.com)

*Reese Enterprises:* weatherstripping, gasketing, thresholds, floor grates, [www.reeseusa.com](http://www.reeseusa.com)

*Selby Hardware:* wide variety of cabinet hardware, [www.selbyhardware.com](http://www.selbyhardware.com)

*Trimco:* wide variety of accessory hardware, [www.trimcobbw.com](http://www.trimcobbw.com)

*Ultra Hardware:* residential and commercial locksets, cabinet and other hardware, [www.ultrahardware.com](http://www.ultrahardware.com)

*Von Duprin:* exit devices, electric security devices, [www.vonduprin.ingersollrand.com](http://www.vonduprin.ingersollrand.com)

*Zero International:* gasketing, hinges, and photo luminescent products, [www.zerointernational.com](http://www.zerointernational.com)

## Trade Associations

*Builders Hardware Manufacturers Institute:* [www.buildershardware.com](http://www.buildershardware.com)

*Door and Hardware Institute:* [www.dhi.org](http://www.dhi.org)

*Steel Door Institute:* [www.steeldoor.org](http://www.steeldoor.org)

## Books and Other Publications

Builders Hardware Manufacturers Association. ANSI/BHMA Standard Series A156. New York: Builders Hardware Manufacturers Association. (35 standards for hardware.)

———. ANSI/BHMA A156.9, *American National Standard for Cabinet Hardware*. New York: Builders Hardware Manufacturers Association.

———. ANSI/BHMA A156.18, *American National Standard for Materials and Finishes*. New York: Builders Hardware Manufacturers Association. (BHMA also sells a set of matchplate samples for use with this standard.)

Door and Hardware Institute. *Basic Architectural Hardware*. Chantilly, VA: Door and Hardware Institute.

———. *Sequence and Format for the Hardware Schedule*. Chantilly, VA: Door and Hardware Institute. (The Door and Hardware Institute also publishes a series of Tech Talks on specific subjects such as exit devices, butts and hinges, and pivots. See their website at [www.dhi.org](http://www.dhi.org) for a complete list.)

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. Two of the most commonly used types of locksets are
  - A. bored and interconnected
  - B. mortise and bored
  - C. preassembled and interconnected
  - D. mortise and preassembled
  
2. A client requests a design for a concealed door; that is, one that looks like the surrounding wall. What kind of pivots should be used to hang the door?
  - A. offset
  - B. reinforced
  - C. intermediate
  - D. center-hung
  
3. What type of lock is most appropriate for a large office building?
  - A. bored
  - B. interconnected
  - C. mortise
  - D. unit
  
4. Door closers may be mounted
  - A. on the side away from the direction of swing
  - B. on the side toward the direction of swing
  - C. in the floor
  - D. in all the above locations
  
5. The type of finish the designer wants on hardware is found
  - A. on the hardware schedule
  - B. on the door schedule
  - C. in the specifications
  - D. with the hardware group

# 5

## GLAZING

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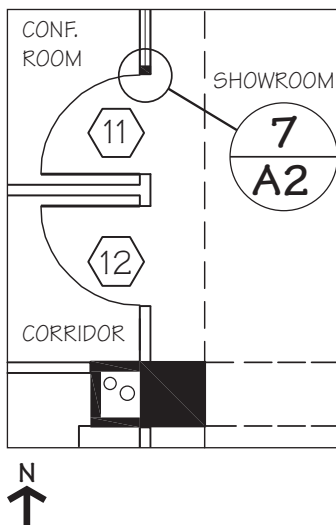
### EXERCISES

#### Exercise 1

For the partial floor plan provided, draw the doorjamb on the strike side of door 11 (leading into the conference room). This is a continuation of Ch. 3, Exercise 2. However, the doorjamb in this exercise is slightly different in that it is really a mullion between the door and the glass lite next to the door. As such, the doorjamb must provide both a frame for the door and framing for the glass. Review the solution for Ch. 3, Exercise 2, to coordinate with this exercise.

Although in these exercises the opposite jamb details for door 11 are developed separately, in practice they are usually developed at the same time and drawn on the final set of drawings side by side or one above the other, so that the relationship between them is easy to see. The jamb in this exercise must be constructed of wood like the jamb in Ch. 3, Exercise 2. Use  $\frac{1}{4}$  in (6 mm) glass positioned approximately in the middle of the frame.

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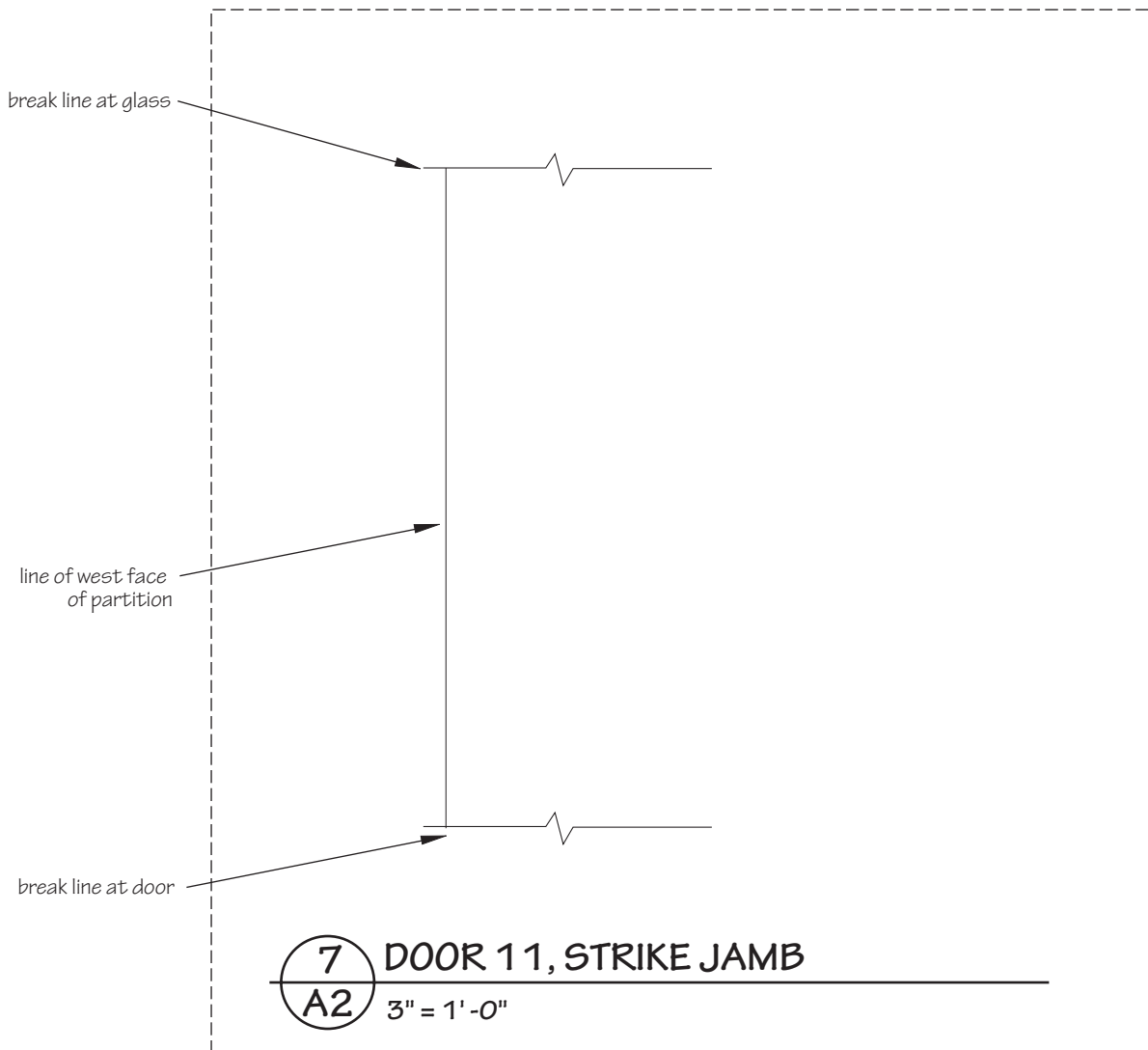


**Partial Floor Plan**

**Procedure**

Sketch this detail as the previous ones, using the base sheet provided with at least three overlays showing the development of the detail. Draw at a scale of 3 in = 1 ft 0 in (1:4) with the drawing oriented vertically; that is, in the same orientation as the partial plan. It may be helpful to draw this detail with that from Ch. 2, Exercise 2, taped directly below it so that they line up.

**Base Sheet**



**Final Product**

The final product should be one group of sketches trimmed to 8½ in × 11 in (216 mm × 279 mm), the top sheet drawn with felt tip marker, including dimensions and notes as needed to fully describe the detail.



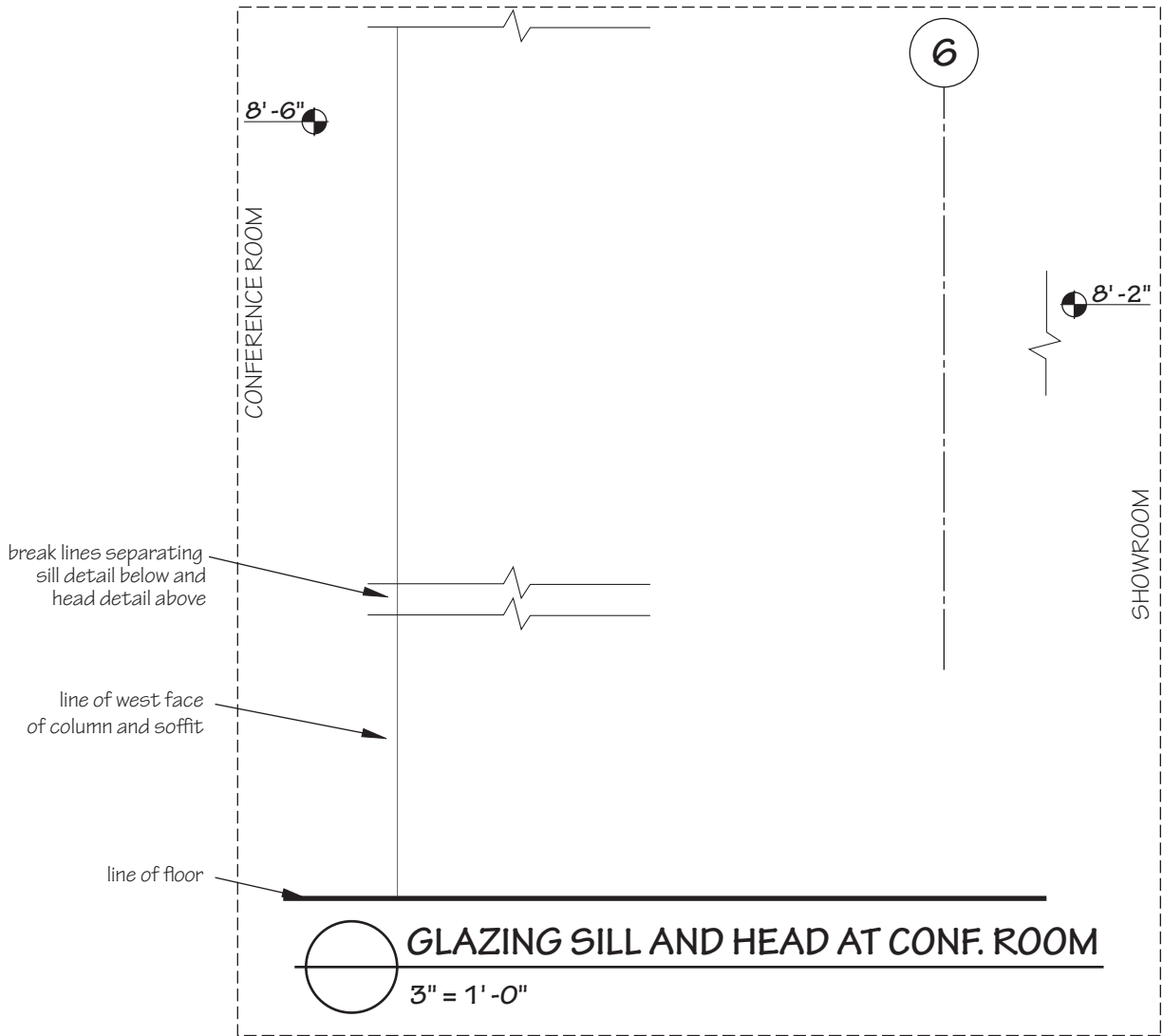
**Exercise 2**

As a continuation of Exercise 1, draw the sill and head of the glazing that separates the showroom from the conference room. Sill and head details are usually developed at the same time and drawn on the final set of drawings one above the other so that the relationship between them is easier to see. These details must be constructed of wood like the jamb and mullion details. The soffit elevation is at 8 ft 2 in (2490 mm). Assume that the ceiling in the conference room will be at an elevation of 8 ft 6 in (2590 mm) and will be an exposed grid acoustical ceiling. The exact detail configuration must be coordinated with the mullion detail completed in Exercise 1.

**Procedure**

Sketch this detail as the previous ones, using the base sheet provided with at least three overlays. Draw at a scale of 3 in = 1 ft 0 in (1:4) with the drawing oriented vertically; that is, with the head detail directly above the sill detail so that elements in common, such as the face of the frame, are aligned. Use the guidelines and elevation points on the base sheet to get started. Drawn at 3 in (1:4) scale, it will be a tight fit, but both details will fit within the drawing module.

**Base Sheet**

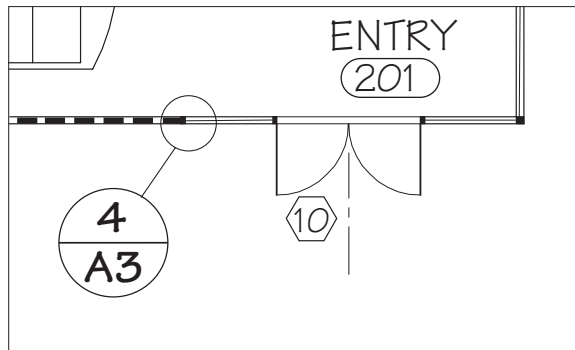


**Final Product**

The final product should be one group of sketches trimmed to 8½ in × 11 in (216 mm × 279 mm), the top sheet drawn with felt tip marker, including dimensions and notes as needed to fully describe the detail.

### Exercise 3

The designer of the Chair Showroom has indicated glazing between the showroom and the public corridor. As with any showroom, this glazing is intended to give a clear view of the displays inside the showroom. Develop the glazing details for this window wall. For this assignment, develop a jamb detail where the glazing is framed adjacent to the corridor partition as shown in the partial plan. The corresponding sill and head details will be developed in Exercises 4 and 5. Refer to Ch. 3, Exercise 3, where the door detail was developed. The doorjamb detail may need to be modified to coordinate with the jamb detail in this exercise.

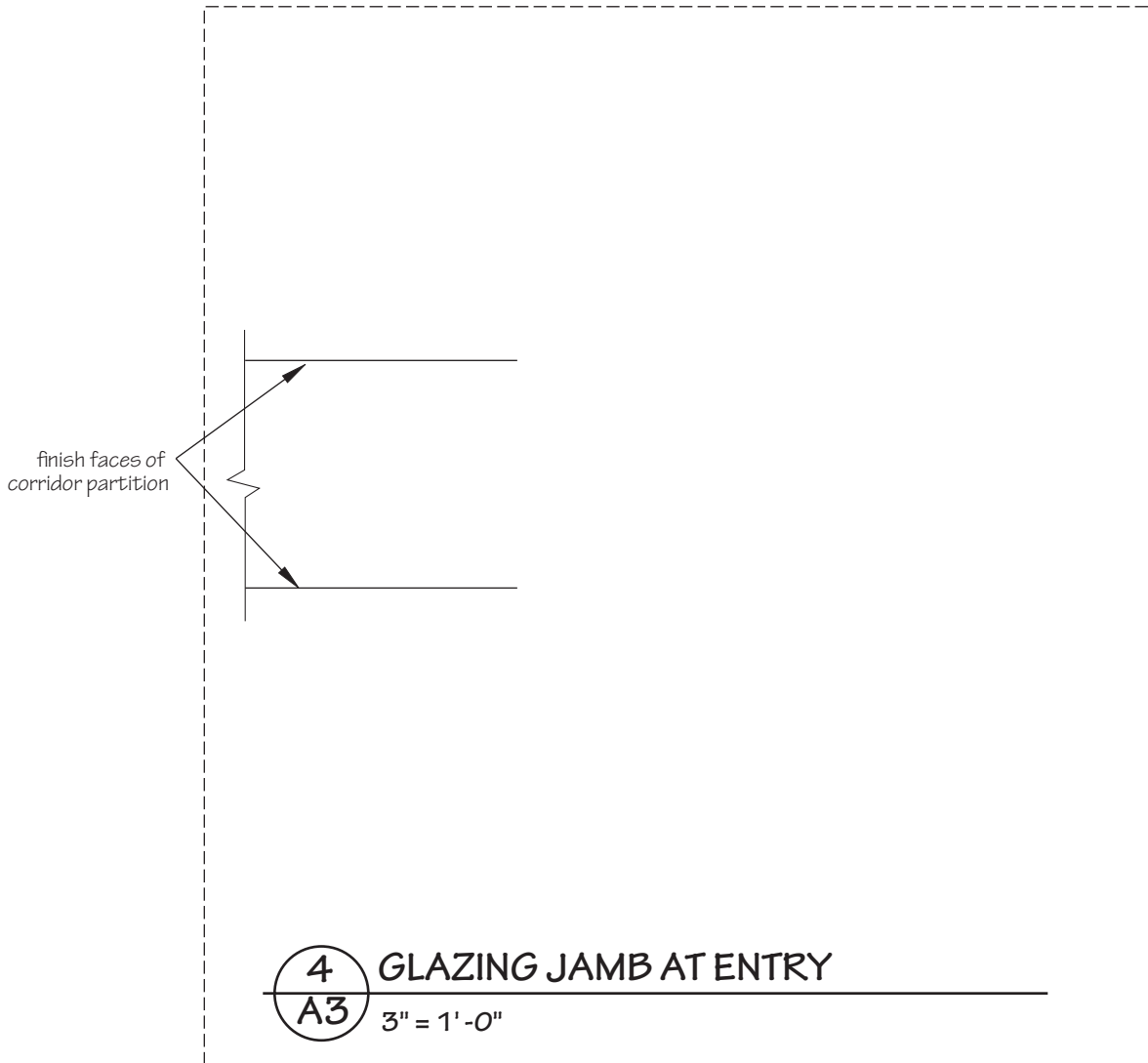


**Partial Plan  
of Public  
Corridor  
Window**

**Procedure**

Although this wall does not have to be fire rated according to the IBC because the building is sprinklered, the local building official is requiring that the partition be constructed as a 1-hour rated partition. The official is allowing the use of standard glass instead of wire glass or fire-resistance-rated glazing, but the glass must be set in a hollow metal frame. Use a frame with a 2 in (50 mm) face dimension and a 1/2 in (13 mm) backbend. As with the other partitions, the wall will be 5/8 in (15.9 mm) wallboard on 3 3/8 in (92.1 mm) studs. Use the base sheet provided to get started.

**Base Sheet**



**Final Product**

The final product should be a horizontal section through the jamb that indicates how the glass will be framed into the wallboard partition. Include overlays showing the progression of detail development. Complete one section drawn freehand at a scale of 3 in = 1 ft 0 in (1:4), including dimensions and notes as needed to explain the detail.

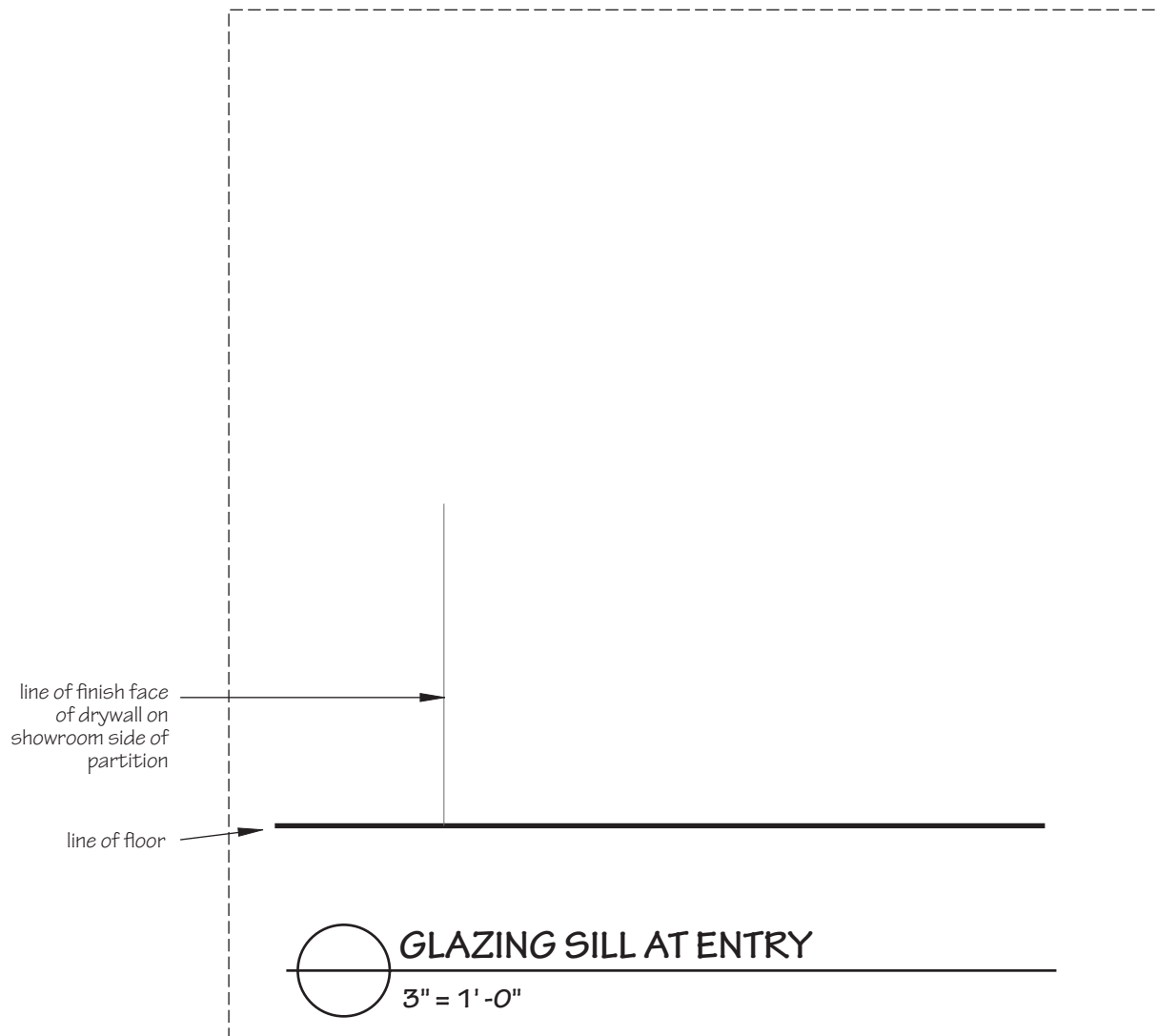
**Exercise 4**

As a continuation of Exercise 3 and as part of the development of the glazing details for the window wall at the public corridor, detail the sill. It will use the same profile as the jamb and head. To gain as much visibility as possible, locate the sill as close to the floor as possible. The base on the showroom side will be the 3<sup>1</sup>/<sub>2</sub> in (89 mm) high wood base used elsewhere in the showroom and there will be a 4 in (100 mm) topset rubber base in the corridor. Any wood blocking used must be noncombustible.

### Procedure

Develop a workable sill detail using the base drawing provided and drawing completely within the standard drawing module.

### Base Sheet



### Final Product

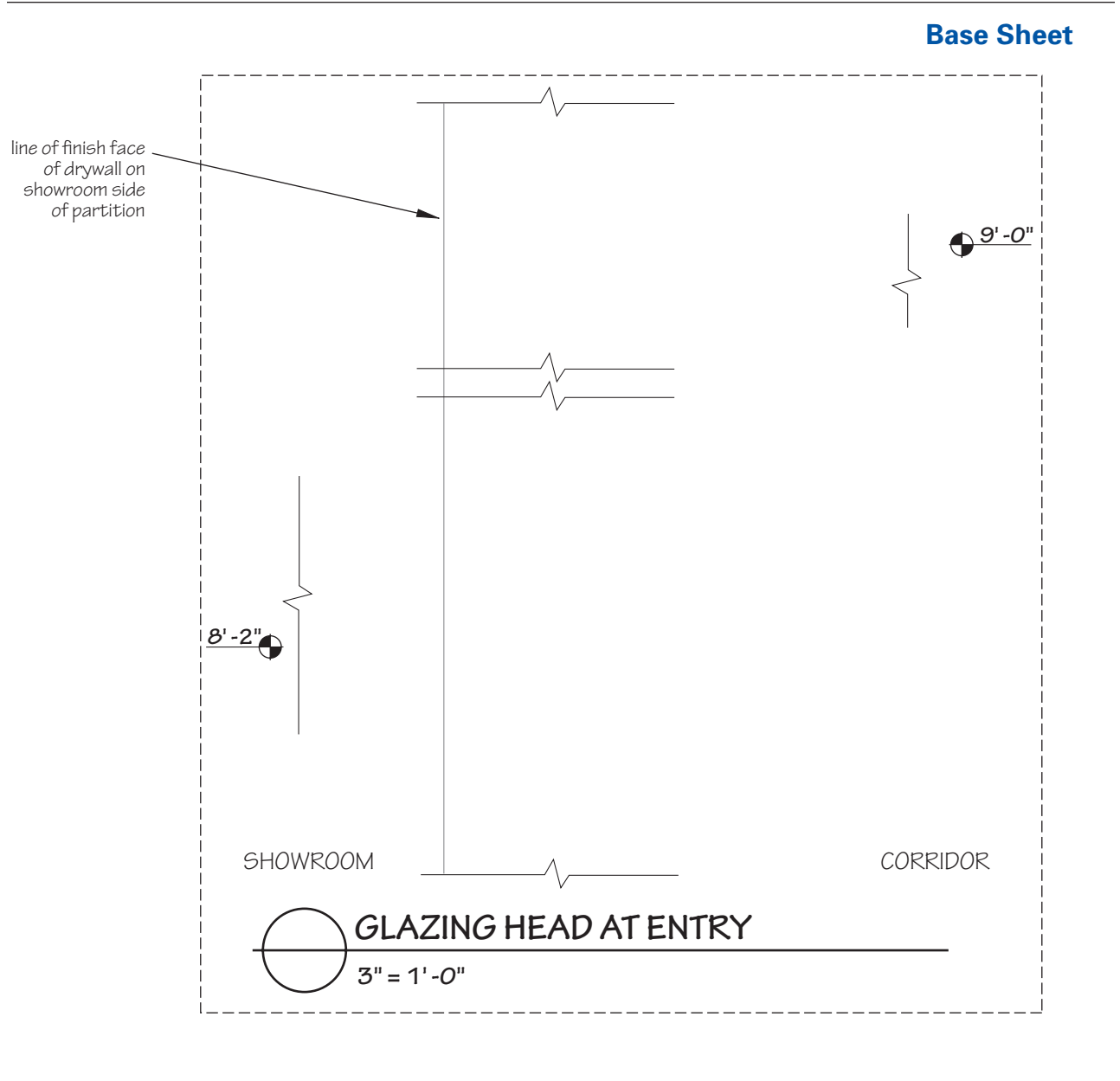
The final product should be one section drawn at a scale of 3 in = 1 ft 0 in (1:4), including dimensions and notes as needed to explain the detail to a CAD operator.

**Exercise 5**

As a continuation of Exercises 3 and 4, detail the head of the window wall separating the showroom from the public corridor. The ceiling height of the showroom in the entry area is 8 ft 2 in (2490 mm) and the height of the public corridor is 9 ft 6 in (2896 mm). The showroom ceiling between grid line G and the public corridor is gypsum wallboard on  $3\frac{5}{8}$  in (92.1 mm) metal studs 24 in (600 mm) o.c. The public corridor has a suspended acoustical ceiling in a standard 24 in  $\times$  24 in (600 mm  $\times$  600 mm) T-bar grid. To maximize visibility, put the top of the window frame at the same elevation as the showroom ceiling, 8 ft 2 in (2490 mm). That will place the inside face of the frame at elevation 8 ft 0 in (2438 mm). As in Exercise 3, the local building official is requiring that this partition be a 1-hour rated wall.

**Procedure**

Develop a workable head detail using the base sheet provided and drawing completely within the standard drawing module. Draw the detail from the head of the window to the suspended ceiling; do not carry the detail all the way to the structural slab of the floor above. This detail may be developed with the sill detail directly below it for reference.



**Final Product**

The final product should be one section drawn at a scale of 3 in = 1 ft 0 in (1:4), including dimensions and notes as needed to explain the detail to a CAD operator.



## FURTHER REFERENCES

### General Information

*GPD*: a forum for exchanging information on the global architectural and automotive glass industries, [www.glassfiles.com](http://www.glassfiles.com) (requires registration)

### Fire-resistance-rated Glazing

*Safti First*: safety glass and fire-rated glazing and framing, [www.safti.com](http://www.safti.com)

*Schott North America*: special glass and glass-related systems, [www.us.schott.com](http://www.us.schott.com)

*Technical Glass Products*: fire-rated glass and framing systems and specialty architectural glass products, [www.fireglass.com](http://www.fireglass.com)

### Decorative Glazing

*Avanti Systems USA*: straight and curved glass wall systems, [www.avantisystemsusa.com](http://www.avantisystemsusa.com)

*Berman Glass*: textured glass, [www.bermanglasseditions.com](http://www.bermanglasseditions.com)

*Evonik Industries*: wide variety of acrylic sheet products, [www.acrylite-magic.com](http://www.acrylite-magic.com)

*Forms + Surfaces*: patterned glass for doors, railings, and panels, [www.forms-surfaces.com](http://www.forms-surfaces.com)

*Glow*: custom translucent solid surfacing that is available with LED backlighting, [www.robin-reigi.com](http://www.robin-reigi.com)

*McGrory Glass*: laminated, acid-etched, and sandblasted glass, [www.mcgrory-glass.com](http://www.mcgrory-glass.com)

*Meltdown Glass*: wide variety of custom, kiln-cast glass, [www.meltdownglass.com](http://www.meltdownglass.com)

*Nathan Allan Glass Studios*: textured, colored, cast, and dichroic glass, [www.nathanallan.com](http://www.nathanallan.com)

*Oldcastle Glass*: patterned, silk-screened, colored, and rice paper textured glass in their Montage series, [www.oldcastlebe.com](http://www.oldcastlebe.com)

*Polytronix*: electrochromic glass using polymer-dispersed liquid crystal (PDLC) technology, [www.polytronix.com](http://www.polytronix.com)

*Priva-Lite by Saint-Gobain*: electrochromic glass, [www.sggprivalite.com](http://www.sggprivalite.com)

*Pulp Studios*: wide variety of specialty glass products including colored, textured, electrochromic, and laminated glass with wide selection of textures and decorative patterns, [www.pulpstudio.com](http://www.pulpstudio.com)

*Palace of Glass*: stock and custom art glass, [www.palaceofglass.com](http://www.palaceofglass.com)

*Saint-Gobain Glass*: embossed, patterned, and colored glass, [www.saint-gobain-glass.com](http://www.saint-gobain-glass.com)

*Schneller*: architectural resin panels custom detailed or with manufacturer's aluminum pole system for mounting, [www.veritasideas.com](http://www.veritasideas.com)

*SmartWall*: transparent, translucent, and opaque panels up to 32 ft<sup>2</sup> (3.0 m<sup>2</sup>) edge-lit with LEDs, which can change colors, [www.insightlighting.com](http://www.insightlighting.com)

*Studio Productions, Inc.*: loose-weave fabric that is used for theatrical scrim effects, [www.studio-productions-inc.com](http://www.studio-productions-inc.com)

*SwitchLite Privacy Glass*: electrochromic glass, [www.switchlite.com/home.html](http://www.switchlite.com/home.html)

*Visual Impact Technologies*: holographic laminated and patterned glass, [www.vitglass.com](http://www.vitglass.com)

## Trade Associations

*Glass Association of North America:* [www.glasswebsite.com](http://www.glasswebsite.com)

*Protective Glazing Council International:* [www.protectiveglazing.org](http://www.protectiveglazing.org)

## Books and Other Publications

Amstock, Joseph S. *Handbook of Glass in Construction*. New York: McGraw-Hill Professional Publishing.

Glass Association of North America (GANA). *Engineering Standards Manual*. Topeka, KA: Glass Association of North America.

———. *Fully Tempered Heavy Glass Door and Entrance Systems Design Guide*. Topeka, KA: Glass Association of North America.

———. *GANA Glazing Manual*. Topeka, KA: Glass Association of North America.

———. *GANA/PGC International Protective Glazing Manual*. Topeka, KA: Glass Association of North America.

———. *Guide to Architectural Glass*. Topeka, KA: Glass Association of North America.

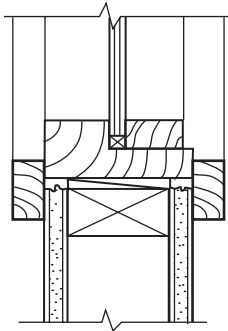
———. *Sealant Manual*. Topeka, KA: Glass Association of North America.

———. *Laminated Glazing Reference Manual*. Topeka, KA: Glass Association of North America.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

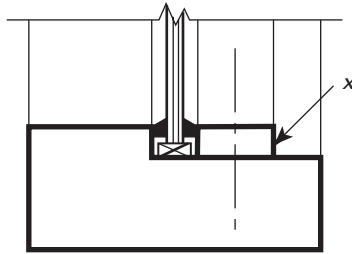
1. Glass produced by annealing is called
  - A. heat-strengthened glass
  - B. kiln-formed glass
  - C. float glass
  - D. tempered glass
  
2. Which types of glass will meet the requirements for safety glazing in a hazardous location?
  - A. tempered or heat-strengthened glass
  - B. laminated or wire glass
  - C. heat-strengthened or laminated glass
  - D. tempered or laminated glass
  
3. In which of the following locations is safety glazing NOT required?
  - A. any full-height glass panel where the sill is greater than 18 in (460 mm) above the floor
  - B. any glass panel greater than 12 in (305 mm) from a solid wood door
  - C. any glass panel less than 10 ft<sup>2</sup> (0.93 m<sup>2</sup>) in area
  - D. any full-height glass panel more than 18 in (457 mm) from a door
  
4. When developing a wood frame detail for glass, what must be provided to allow for an out-of-plumb rough opening?
  - A. shim space
  - B. sub frame
  - C. setting blocks
  - D. casing trim
  
5. When detailing a glazed opening in a 1-hour rated partition, which of the following types of glazing must be specified?
  - A. annealed
  - B. ceramic
  - C. laminated
  - D. tempered

6. In simplifying the detail of a glazing sill in a long, horizontal opening using butt-jointed glazing, the minimum requirements include using a
- (a) silicone sealant
  - (b) removable stop
- A. (a) only
  - B. (b) only
  - C. both (a) and (b)
  - D. neither (a) nor (b)
7. The primary purpose of glazing tape is to
- A. seal the gap between edges of butt glazing
  - B. cushion the glass against the frame
  - C. hold the glazing in place
  - D. support the weight of the glazing
8. Laminated glass is commonly used for all of the following reasons EXCEPT
- A. safety
  - B. security
  - C. acoustical control
  - D. fire protection
9. If the sill detail shown were to be constructed as drawn, what would be the most significant problem with it?



- A. The glass could not be replaced easily.
- B. The frame could not be installed so as to be level.
- C. The glass could crack or break easily.
- D. The glass would be difficult to install.

10. What is the name of the component labeled *x* in the drawing?



- A. blocking
- B. frame
- C. setting block
- D. stop

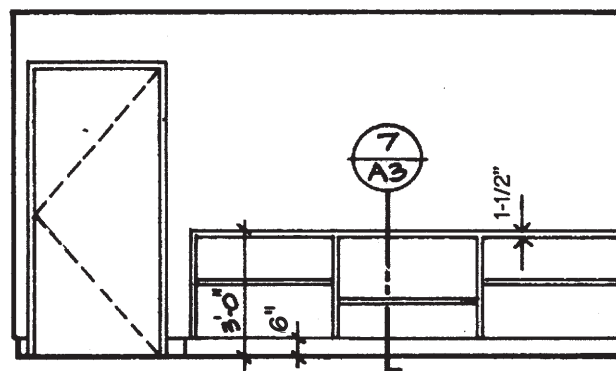
# 6

## ARCHITECTURAL WOODWORK

### EXERCISES

#### Exercise 1

The owner of the Chair Showroom has decided to put a built-in bookcase in the corner of the office. The designer's sketch of the room elevation, including the bookcase, is shown. The owner wants the bookcase to have a natural wood finish and one adjustable shelf in each section. The bookcase should be 1 ft 0 in (300 mm) deep from the wall to the finished front. Use a 1½ in (38 mm) face frame. The room will have a 6 in (150 mm) high wood base ¾ in (19 mm) thick.

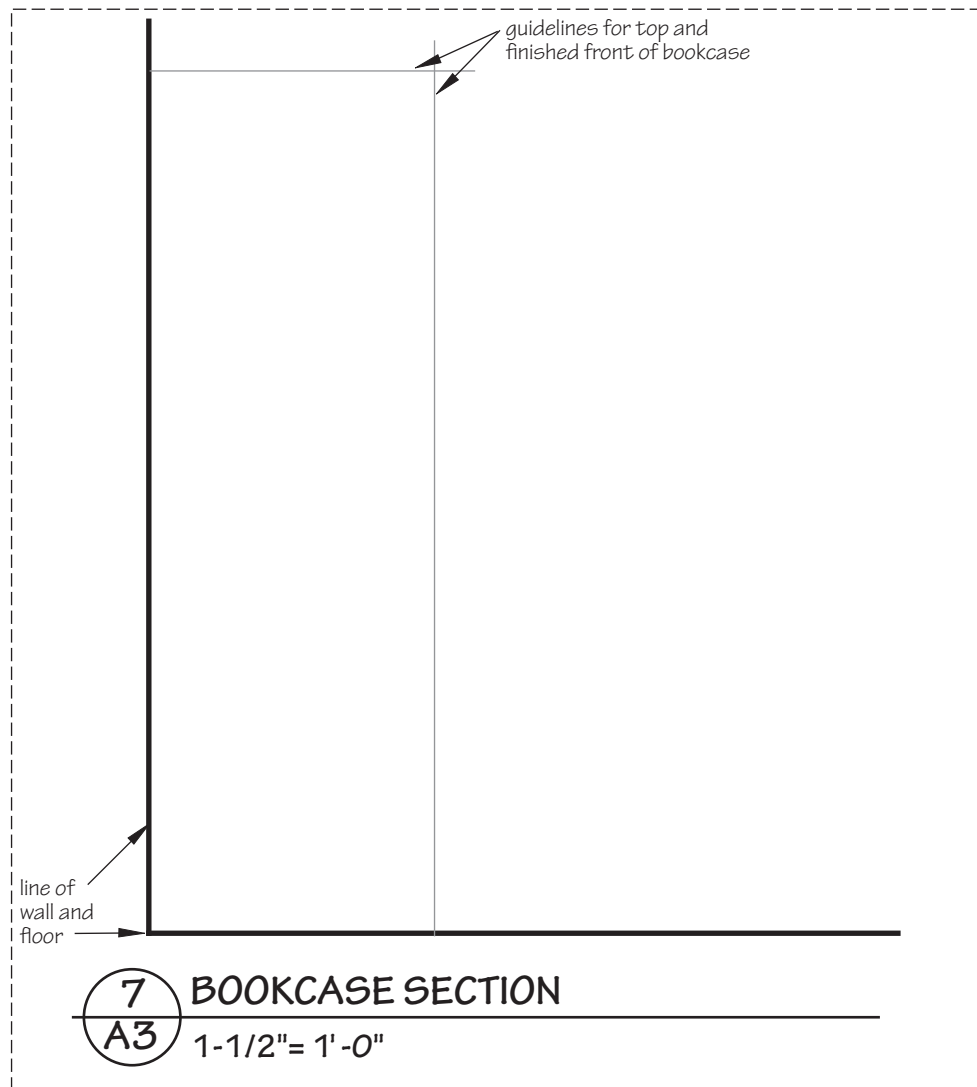


**Figure 6.1**  
Bookcase  
Elevation

### Procedure

Using the base drawing given, complete the section of the bookcase cut at the point shown in the elevation. Use a scale of  $1\frac{1}{2}$  in = 1 ft 0 in (1:8). Use at least three overlays to develop the detail. In addition to the information given, you may make any design assumptions you need to in order to complete the detail.

### Base Sheet



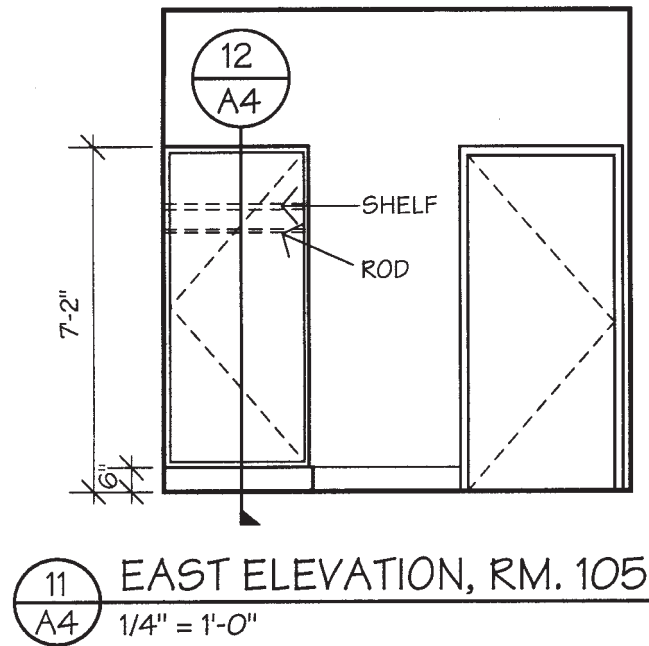
### Final Product

The final product should be a group of sketches showing the development of the detail, with the top sheet drawn with felt tip marker and including the dimensions and notes necessary to fully describe the detail.

**Exercise 2**

The owner of the Chair Showroom wants to put a small coat closet in the corner of the break room (room 208). The owner wants the closet to be like one that exists in another office suite; the designer's sketch of the existing closet is shown. The new closet should be made from wood with a natural finish, and it should have a 1 in (25 mm) round hanging rod mounted 5 ft 6 in (1680 mm) above the floor midway in the depth of the closet and a shelf 6 ft 0 in (1830 mm) above the floor. Use reveal overlay framing with a 1½ in (38 mm) face frame. The closet should be 1 ft 10 in (560 mm) deep from the wall to the finished front and 3 ft 0 in (900 mm) wide. There will be a 6 in (150 mm) high wood base in the room.

**Figure 6.2**  
Closet Elevation

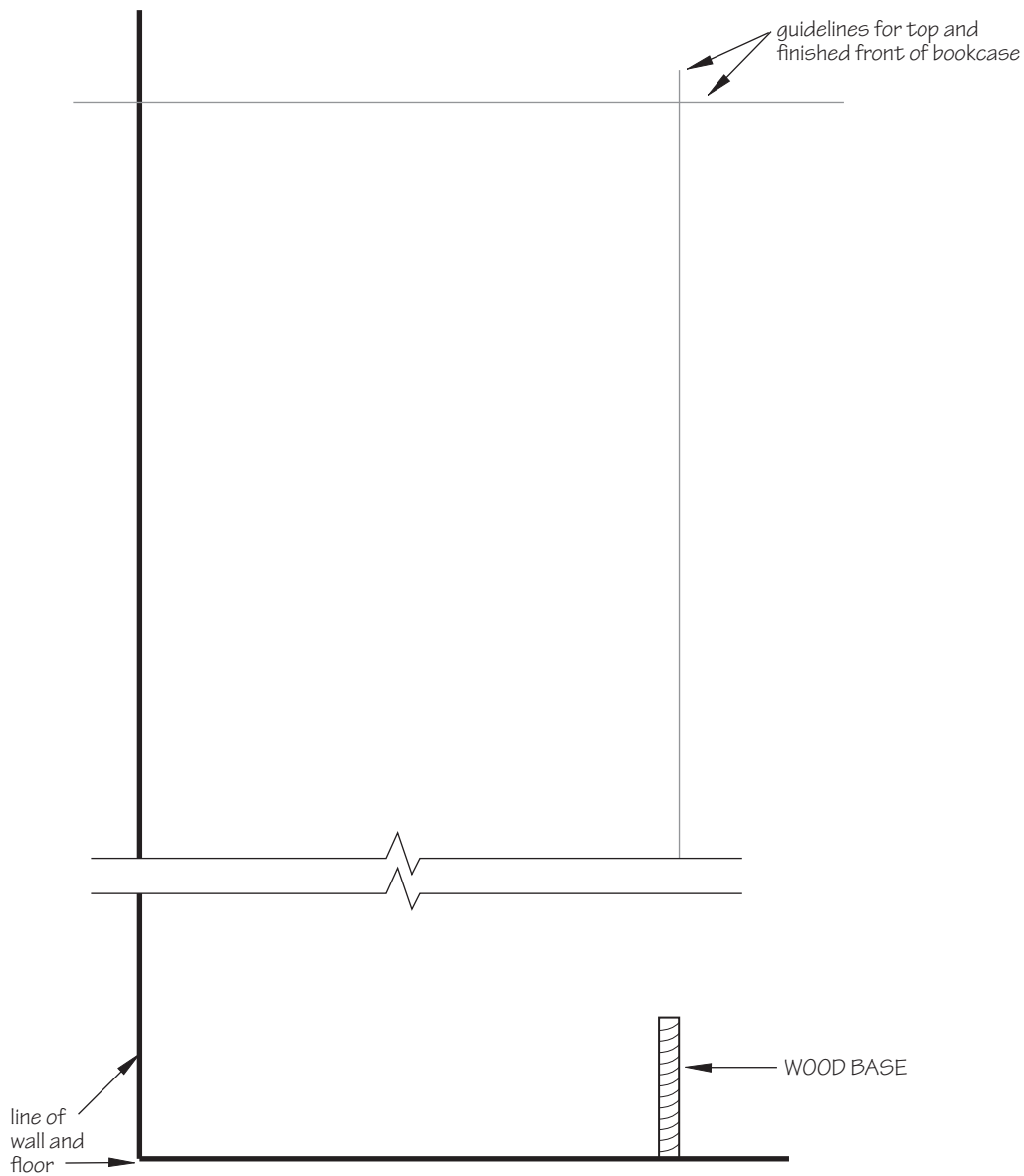


**Procedure**

Using the base sheet shown, sketch the section of the closet cut at the point shown in the previous elevation. Use a scale of 1½ in = 1 ft 0 in (1:8). Make any design assumptions you need to in order to complete the detail.



Base Sheet



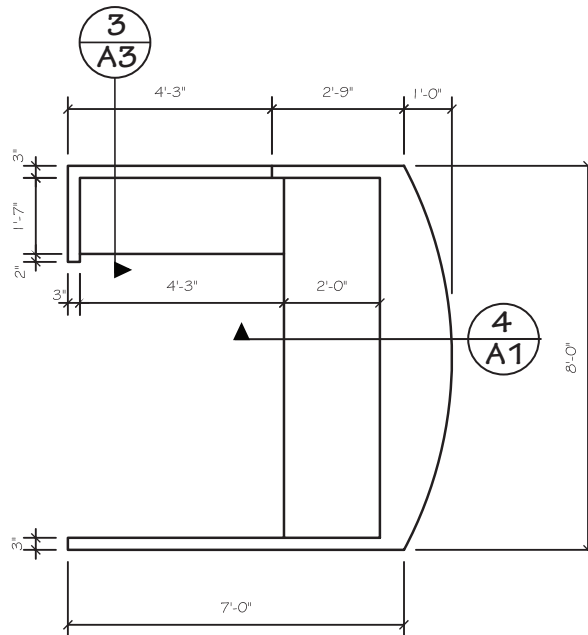
12 CLOSET SECTION  
A4 1-1/2" = 1'-0"

Final Product

The final product should be a group of sketches showing the development of the detail, with the top sheet drawn with felt tip marker and including the dimensions and notes necessary to fully describe the detail.

### Exercise 3

The designer of the Chair Showroom needs to develop details of the reception desk. At least two sections will be needed, one cut through the keyboard return and one through the main work surface. For this exercise, sketch a section through the lower keyboard return as shown in the partial plan here. This will be section 3-A3.



**Figure 6.3**

Reception Desk  
Plan

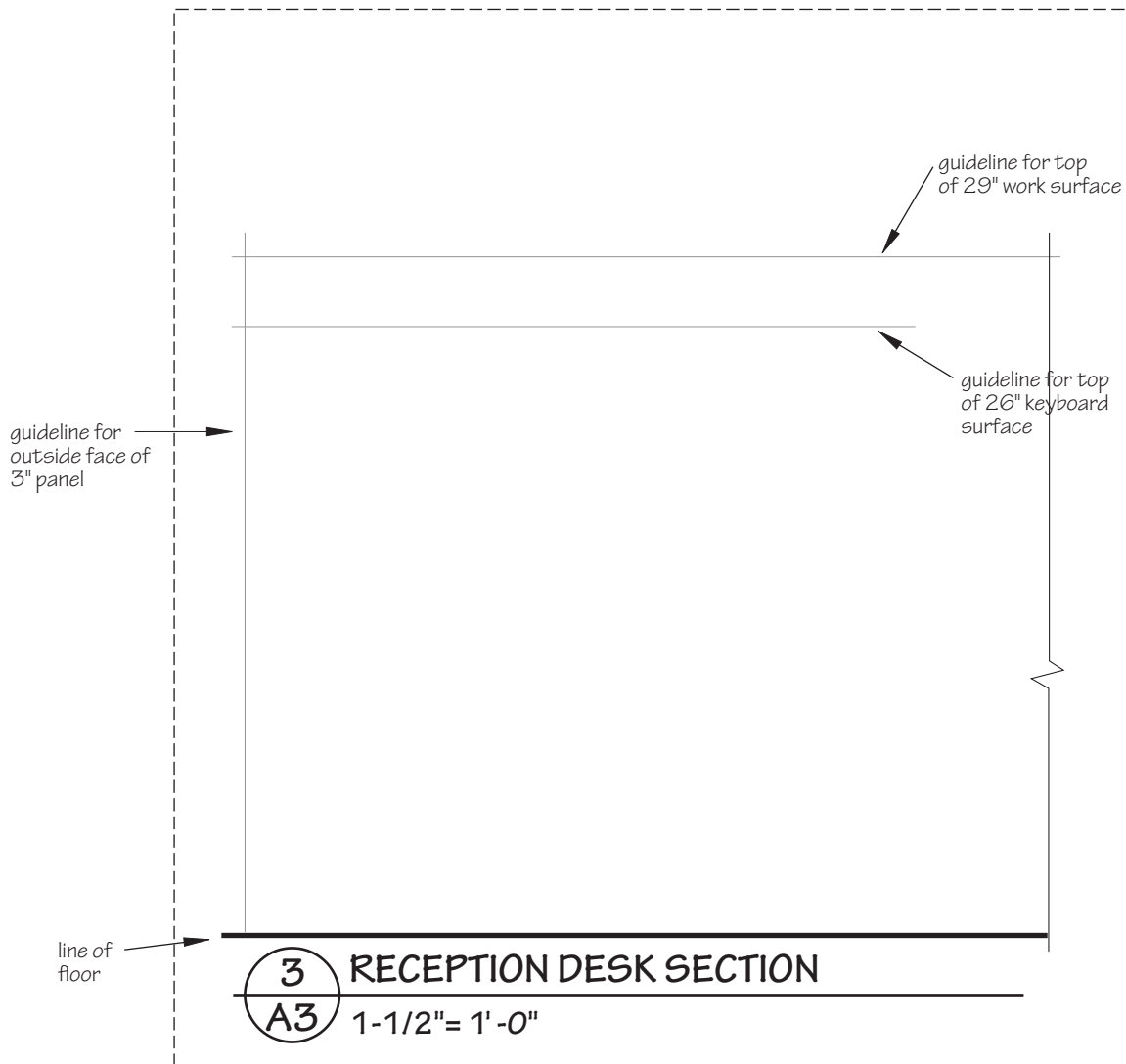
### Design Requirements

- Keyboard surface: 26 in (660 mm) above finish floor (AFF) with 1½ in (38 mm) drop edge
- Depth of keyboard surface: 21 in (533 mm)
- Work surface: 29 in (732 mm) above finish floor
- Work surfaces material: HPDL
- Height of panel at keyboard: 36 in (914 mm)
- Transaction ledge: 42 in (1067 mm) AFF
- Finish face of drop edge: natural finish cherry veneer
- Framing (panels) for front and sides of desk to be total of 3 in (76 mm) wide
- Base: ¾ in (19 mm) × 4 in (100 mm) solid cherry

### Procedure

Using the base sheet shown here, sketch the section of the keyboard return at the point shown in the partial plan. Use a scale of 1½ in = 1 ft 0 in (1:8). Make any design assumptions you need to in order to complete the detail.

**Base Sheet**



**Final Product**

The final product should be a group of sketches showing the development of the detail, with the top sheet drawn with felt tip marker and including the dimensions and notes necessary to fully describe the detail.

## Exercise 4

Continue developing the details of the reception desk by sketching a section through the work surface portion as shown in the partial plan in Exercise 3.

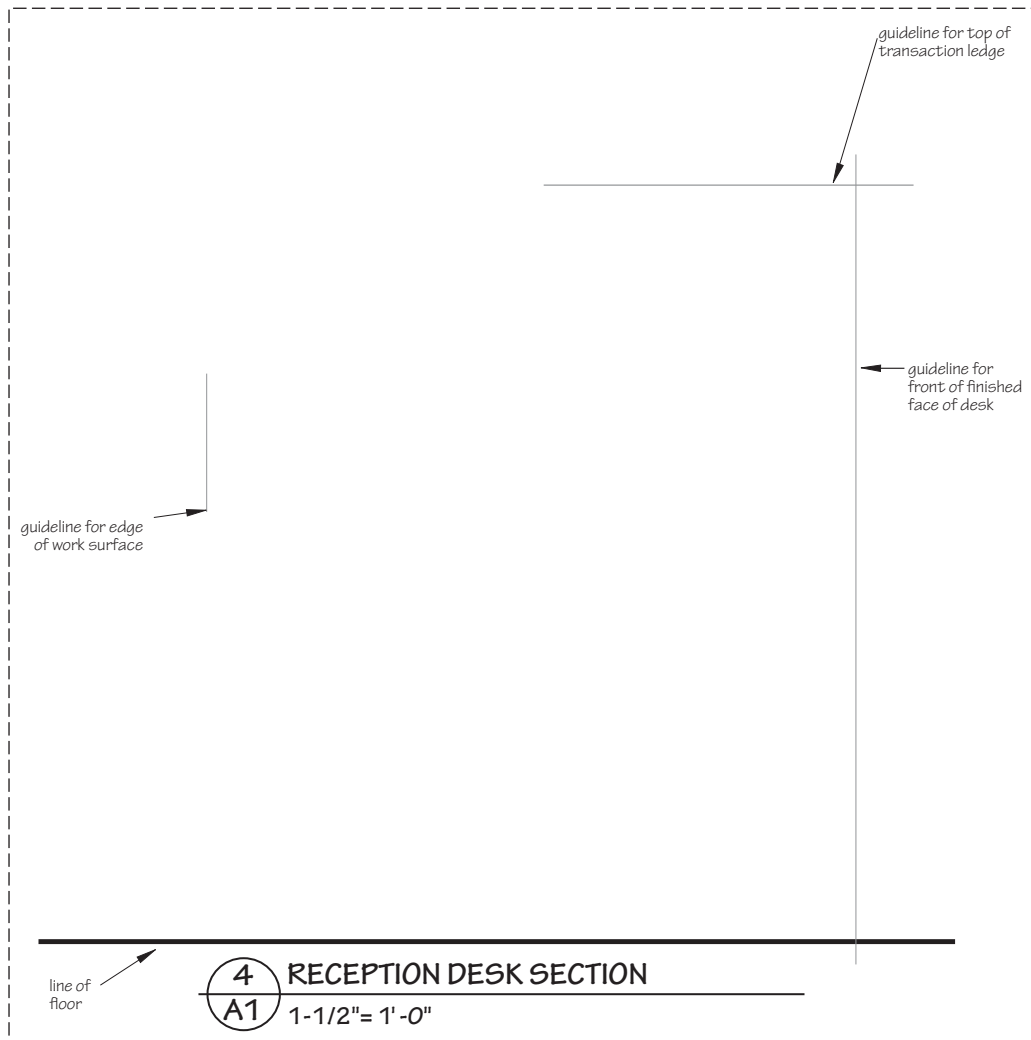
### Design Requirements

- Work surface: 29 in (732 mm) above finish floor (AFF) with 1<sup>1</sup>/<sub>2</sub> in (38 mm) drop edge
- Work surface material: HPDL
- Transaction ledge: 42 in (1067 mm) AFF
- Ledge material: <sup>3</sup>/<sub>4</sub> in (19 mm) thick polished granite with 2 in (51 mm) high drop trim on both edges
- Finish face of desk: natural finish cherry veneer
- Under-counter light: 4 in (102 mm) wide × 2 in (51 mm) high × 4 ft (1220 mm) long
- Total framing for front and sides of desk: 3 in (76 mm) wide

### Procedure

Use the base sheet shown in Fig. 6.7 to develop a hand-drawn sketch of this detail without using break lines. Because of the size of the desk and the scale of 1<sup>1</sup>/<sub>2</sub> in = 1 ft 0 in (1:8), the section will occupy an area larger than the standard drawing module shown. Later, break lines can be used to fit it within the drawing module.

Base Sheet



Final Product

The final product should be a group of sketches showing the development of the detail, with the top sheet drawn with felt tip marker and including the dimensions and notes necessary to fully describe the detail.

## FURTHER REFERENCES

### General

*American Hardwood Information Center:* [www.hardwoodinfo.com](http://www.hardwoodinfo.com)

*The Wood Explorer:* [www.thewoodexplorer.com](http://www.thewoodexplorer.com)

### Product Manufacturers

*Accuride:* drawer, door, and specialty slides, [www.accuride.com](http://www.accuride.com)

*Blum:* hinges, drawer runner systems, and other cabinet hardware, [www.blum.com/us](http://www.blum.com/us)

*Häfele:* cabinet and closet hardware, [www.hafele.com/us](http://www.hafele.com/us)

*Grass America:* hinges, [www.grassusa.com](http://www.grassusa.com)

*Knape & Vogt:* drawer slides, storage, closet and specialty hardware, [www.kv.com](http://www.kv.com)

### Trade Associations

*American Walnut Manufacturers Association:* [www.walnutassociation.org](http://www.walnutassociation.org)

*Architectural Woodwork Institute:* [www.awinet.org](http://www.awinet.org)

*Association of Millwork Distributors:* [www.amdweb.com](http://www.amdweb.com)

*Composite Panel Association:* [www.pbmdf.com](http://www.pbmdf.com)

*Concrete Countertop Institute:* [www.concreteccountertops.net](http://www.concreteccountertops.net)

*Hardwood Plywood and Veneer Association:* [www.hpva.org](http://www.hpva.org)

*Kitchen Cabinet Manufacturers Association:* [www.kcma.org](http://www.kcma.org)

*Moulding and Millwork Producers Association:* [www.wmmpa.com](http://www.wmmpa.com)

*National Kitchen and Bath Association:* [www.nkba.org](http://www.nkba.org)

*Woodwork Institute:* [www.wicnet.org](http://www.wicnet.org)

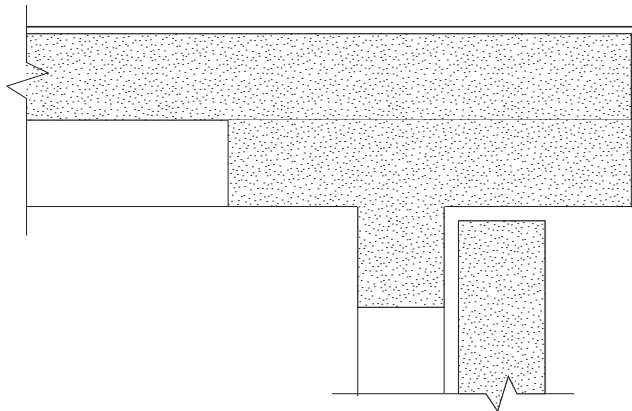
### Books

Architectural Woodwork Institute. *Architectural Woodwork Quality Standards Illustrated*. Potomac Falls, VA: Architectural Woodwork Institute.

Binggeli, Corky, ed. *Interior Graphic Standards*. Hoboken, NJ: John Wiley & Sons.

## QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE

- An interior designer is designing and detailing a 10 in (2545 mm) high wood base with a complex profile at the top. The base is to receive a transparent finish. Which of the following would best combine economy and practicality?
  - using individual pieces of solid stock, edge glued together
  - using wood veneer over medium-density particleboard
  - using a combination of veneer and solid stock
  - using custom milling of a premium-grade solid stock
- In order to get a cabinet or countertop to fit snugly against a slightly irregular partition, which of the following should be specified or called out on the drawings?
  - scribe
  - trim edge
  - shoe molding
  - extended frame
- The detail shown most typically illustrates



- the top of a bookcase
  - a cabinet countertop edge
  - a closet edge
  - the edge of a display cabinet
- Built-in bookshelves in a commercial office would commonly be considered
    - finish carpentry
    - modular casework
    - cabinet construction
    - architectural woodwork

5. The most unpredictable appearance of wood grain pattern in veneer can be achieved by specifying
  - A. plain slicing
  - B. rotary slicing
  - C. quarter slicing
  - D. rift slicing
  
6. According to the *International Building Code* (IBC), interior finish requirements for woodwork are most stringent for
  - A. recessed shelving
  - B. cornice molding
  - C. wainscoting
  - D. built-in furniture
  
7. The three grades for cabinet construction as established by the Architectural Woodwork Institute are
  - A. Custom, Select, and Premium
  - B. C, B & Better, and Clear All Heart
  - C. Economy, Custom, and Premium
  - D. Grade I, Grade II, and Grade III
  
8. What veneer slicing method should be specified for the clearest, straightest grain possible from oak?
  - A. rift
  - B. plain
  - C. quarter
  - D. half-round
  
9. What thickness of solid stock hardwood is needed to produce a single piece of standing and running trim with a finished thickness of  $1\frac{1}{4}$  in (32 mm)?
  - A.  $\frac{4}{4}$
  - B.  $\frac{5}{4}$
  - C.  $\frac{6}{4}$
  - D.  $\frac{8}{4}$



10. A residential client has asked for a complex, nonstandard cornice molding that can receive a paint finish. However, the client wants the molding to be as economical as possible. The best course of action would be to
- A. use several rectangular shapes together
  - B. find a paintable plastic molding from a standard catalog
  - C. use a built-up assembly of standard molding shapes
  - D. have a mill shop shape one special piece and combine it with standard shapes

# 7

# DECORATIVE METALS

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## EXERCISES

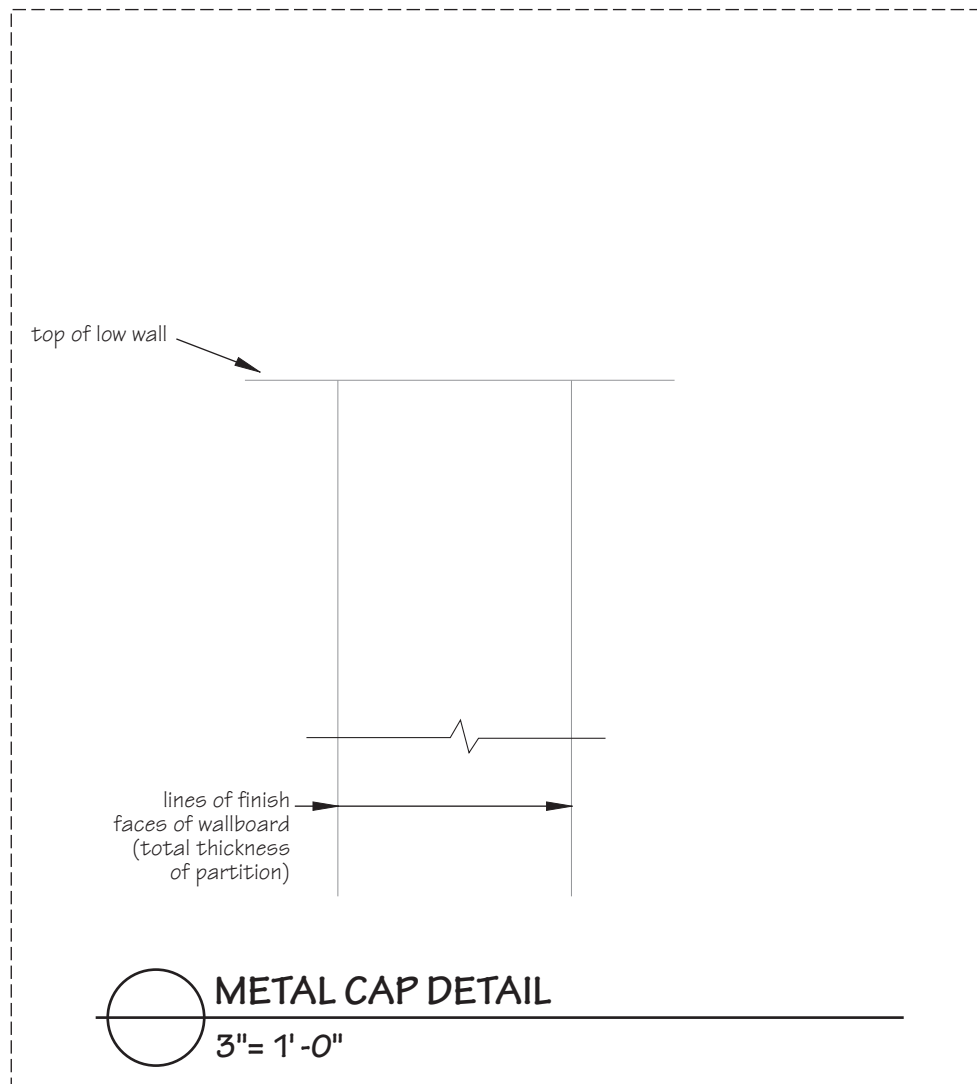
### Exercise 1

Chapter 1, Exercise 1, required the use of a “durable material” on top of a low wall. For this exercise, use a metal cap of stainless steel. Determine the configuration, size, and thickness of the cap. Develop a way of attaching the metal to the wall that will minimize the appearance of visible fasteners.

### Procedure

Develop a vertical section through the upper portion of the low partition as was done in Ch. 1, Exercise 1. Show the stainless steel cap with the method of attachment. Do any necessary research to determine possible attachment methods, thicknesses, and finishes.

## Base Sheet

**Final Product**

A vertical section through the partition, drawn at a scale of 3 in = 1 ft 0 in (1:4). Use at least three overlays to develop the detail using the base sheet shown. Include critical dimensions and notes as necessary to describe your detail. Your detail must be drawn within the drawing module and on an 8½ in × 11 in (216 mm × 279 mm) sheet.

## Exercise 2

The owner of the Chair Showroom is concerned about the long-term durability of the column finishes as chairs are moved in and out and displays are rearranged. The owner wants to protect the columns with some type of decorative metal. The lower edge of the metal finish must align with the top of the 3<sup>1</sup>/<sub>2</sub> in (90 mm) high wood base and extend to at least 6 ft 0 in (1830 mm) above the floor, and it may extend to the ceiling or soffit.

Decide the type and form of the metal to be used. The metal may be a smooth sheet, perforated, architectural mesh, or in another form. The preferred method of attaching the decorative metal is to anchor it to the gypsum wallboard and/or to the metal studs behind it. Alternatively, separate posts anchored to the floor may be used.

### Procedure

Develop details for a decorative metal finish on the columns. The gypsum wallboard finish will remain. The finish dimension is 2 ft 0 in (610 mm) when the finish is not adjacent to partitions or glazing. When a column abuts another partition or window wall, the thickness of the partition must be subtracted from the 2 ft 0 in (610 mm) dimension (see the solution to Ch. 2, Exercise 3, for another example). Your details must accommodate the various column conditions in the showroom, including the change in level at column H8 (see Fig. I.1) and the columns with three- or four-sided exposures.

### Final Product

At a minimum, draw a vertical section through a typical attachment, a plan view of how the metal would surround a column, and a typical elevation of a column. Draw the section at a scale of 3 in = 1 ft 0 in (1:4). Draw the plan view at a scale of 1<sup>1</sup>/<sub>2</sub> in = 1 ft 0 in (1:8) and the elevation at a scale of 1/2 in = 1 ft 0 in (1:25). Use at least three overlays to develop the details. Include critical dimensions and notes as necessary to describe the details.

## FURTHER REFERENCES

### General Information

*Adhesive and Sealant Council:* [www.adhesives.org](http://www.adhesives.org)

*MatWeb:* material property data, [www.matweb.com](http://www.matweb.com)

*Metalinfo Metals Database:* [www.metalinfo.com](http://www.metalinfo.com)

### Trade Associations

*Architectural Anodizers Council:* [www.anodizing.org](http://www.anodizing.org)

*Copper Development Association:* [www.copper.org](http://www.copper.org)

*National Association of Architectural Metal Manufacturers:* [www.naamm.org](http://www.naamm.org)

### Books and Other Publications

Copper Development Association. *Copper Brass Bronze Design Handbook*. Greenwich, CT: Copper Development Association.

Zahner, L. William. *Architectural Metals*. Hoboken, NJ: John Wiley & Sons.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. Stainless steel is an alloy composed primarily of steel and
  - A. iron
  - B. nickel
  - C. chromium
  - D. zinc
  
2. Bronze is an alloy of
  - A. copper and tin
  - B. copper and zinc
  - C. brass and tin
  - D. tin and zinc
  
3. For stainless steel that will be used for column covers, restaurant equipment, or elevator interiors, the most commonly used finish is number
  - A. 4
  - B. 6
  - C. 7
  - D. 8
  
4. A common difficulty in using large, flat sheets of metal with polished surfaces is
  - A. bending reflection
  - B. break forming
  - C. scratch variation
  - D. oil canning
  
5. Which of the following is NOT a common finish for aluminum?
  - A. anodized
  - B. chromated
  - C. as forged
  - D. mechanical (polished, buffed, sanded)

# 8

## FLOORING CONSTRUCTION

---

### EXERCISES

#### Exercise 1

The flooring in the corridor of the Chair Showroom will be glue-down carpet with a pile height of approximately  $\frac{1}{2}$  in (13 mm). The flooring in the restroom will be  $\frac{1}{8}$  in (3 mm) thick linoleum.

#### Procedure

Develop a transition detail (section) between the two materials. The detail should show the door as well as lines of the construction beyond the section cut. Do any research necessary to locate appropriate materials.

#### Final Product

The final product should be a detail drawn at a scale of 6 in = 1 ft 0 in (1:2), including dimensions and notes needed to fully describe the detail.

## Exercise 2

The owner of the Chair Showroom wants to have an area near the entry door to highlight products as designers enter. This will be a hardwood floor insert surrounded by carpet between grid lines 6 and 7 and G and H (see Fig. I.1). A square area of wood 10 ft by 10 ft (3.05 m by 3.05 m) is needed. The wood floor will be  $\frac{5}{16}$  in (8 mm) parquet flooring adhesive applied to  $\frac{3}{4}$  in (19 mm) plywood. The carpet will be approximately  $\frac{1}{2}$  in (13 mm) high. Do any research needed to locate appropriate materials.

### Procedure

Develop a transition detail (section) between the two materials. The detail should show the two materials and a transition strip. Sketch several possible solutions and do any research necessary to locate appropriate materials.

### Final Product

The final product should be a detail section drawn at a scale of 6 in = 1 ft 0 in (1:2), including dimensions and notes needed to fully describe the detail.



## FURTHER REFERENCES

### General Information

*National Terrazzo and Mosaic Association:* [www.ntma.com](http://www.ntma.com)

*The Tile Doctor:* [www.thetiledoctor.com](http://www.thetiledoctor.com)

*National Wood Flooring Association:* [www.woodfloors.org](http://www.woodfloors.org)

### Transition Strip Manufacturers

*Ceramic Tool Company:* edge, joint, bar, and carpet trim as well as ramp transitions, [www.ceramictool.com](http://www.ceramictool.com)

*Genotek:* wide variety of carpet trims, reducers, edge dividers, thresholds, movement joints, and transition edges including adjustable transitions, [www.genotek.com](http://www.genotek.com)

*Johnsonite:* transitions in a wide variety of colors for various thicknesses and material types including reducers, edge guards, T molding, adaptors, wheeled traffic transitions, and expansion joint seals as well as stair treads and nosing strips, [www.johnsonite.com](http://www.johnsonite.com)

*National Metal Shapes:* variety of trim shapes and styles in metal and vinyl for all flooring materials, [www.nationalmetalshapes.com](http://www.nationalmetalshapes.com)

*Schluter Systems:* wide variety of products for different materials and material thicknesses, [www.schluter.com](http://www.schluter.com)

### Trade Associations

*Building Stone Institute:* [www.buildingstoneinstitute.org](http://www.buildingstoneinstitute.org)

*Ceramic Tile Institute of America:* [www.ctioa.org](http://www.ctioa.org)

*Indiana Limestone Institute of America:* [www.iliai.com](http://www.iliai.com)

*Maple Flooring Manufacturers Association:* [www.maplefloor.org](http://www.maplefloor.org)

*Marble Institute of America:* [www.marble-institute.com](http://www.marble-institute.com)

*National Building Granite Quarries Association:* [www.nbgqa.com](http://www.nbgqa.com)

*National Terrazzo and Mosaic Association:* [www.ntma.com](http://www.ntma.com)

*National Tile Contractors Association:* [www.tile-assn.com](http://www.tile-assn.com)

*National Wood Flooring Association:* [www.nwfa.org](http://www.nwfa.org)

*Tile Council of North America:* [www.tileusa.com](http://www.tileusa.com)

### Books

Tile Council of North America. *Handbook for Ceramic Tile Installation*. Princeton, NJ: Tile Council of North America.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. Which of the following types of wood flooring would be the most functional choice for the lobby of a hospital?
  - A. end grain block
  - B. laminated block
  - C. resilient
  - D. strip
  
2. The interior designer's specifications for wood flooring over concrete should always include the requirement that, before the flooring is installed, the contractor should perform
  - A. an alkalinity test
  - B. a survey of the concrete's flatness
  - C. a moisture emission test
  - D. the application of a leveling compound
  
3. When specifying a hardwood floor over a concrete slab on grade, which of the following should the interior designer also specify?
  - A.  $\frac{3}{4}$  in (19 mm) plywood subflooring and 15# building felt
  - B. 15# building felt only
  - C. treated wood sleepers on mastic and a layer of polyethylene vapor barrier
  - D.  $\frac{3}{4}$  in (19 mm) tongue-and-groove plywood over a layer of mastic
  
4. Thin-set ceramic tile flooring should be installed over
  - A. a 1 in (25 mm) layer of mortar
  - B. cementitious panels
  - C. exterior grade plywood
  - D. cleavage membrane
  
5. The preferred width for ceramic tile and quarry tile expansion joints is
  - A.  $\frac{1}{8}$  in (3 mm)
  - B.  $\frac{3}{16}$  in (5 mm)
  - C.  $\frac{1}{4}$  in (6 mm)
  - D.  $\frac{3}{8}$  in (10 mm)

# 9

## APPLIED FLOOR FINISHES

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### EXERCISES

#### Exercise 1

As part of developing the floor finish schedule for the Chair Showroom, select floor finishes for all rooms in the project. Use the following guidelines.

- The showroom and conference room should be carpeted. The ramp may be carpeted or may have a different flooring material to improve accessibility.
- The storeroom must have a durable surface that is resistant to damage caused by moving and storing furniture.
- The floors of the toilet room and break room must have surfaces that are water resistant and easily cleaned.
- All other room finishes are at the student's discretion.
- All materials should be selected for maximum sustainability.

#### Procedure

Determine what generic types of material are appropriate for each of the rooms in the project. Do the necessary research to select sustainable materials most appropriate for their application.

#### Final Product

The final product should be a list of rooms with corresponding material selections. These selections may be generic (such as cork flooring), or a specific manufacturer's product may be used if it is unique in composition, design, or finish. Have backup data available to justify your selections.

**Exercise 2**

Select one type of flooring material, such as carpet. Thoroughly research the available sustainable products in that category, and summarize your findings. Your research should include unit costs for each product. This information may become useful in other classes, and it may become the basis for your own database of information for practice.

## FURTHER REFERENCES

### Trade Associations

*Carpet and Rug Institute:* [www.carpet-rug.com](http://www.carpet-rug.com)

*Carpet Cushion Council:* [www.carpetcushion.org](http://www.carpetcushion.org)

*Resilient Floor Covering Institute:* [www.rfci.com](http://www.rfci.com)

*World Floor Covering Association:* [www.wfca.org](http://www.wfca.org)

### Books

Bingeli, Corky. *Materials for Interior Environments*. Hoboken, NJ: John Wiley & Sons.

Hall, William R. *Contract Interior Finishes*. New York: Whitney Library of Design.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. Which of the following would be the LEAST desirable fiber choice for a direct-glue carpet installation for a day-surgery reception area that has concrete floors?
  - A. acrylic
  - B. modacrylic
  - C. nylon
  - D. olefin
  
2. Carpet cushioning is generally used for all the following reasons EXCEPT to
  - A. help absorb sound
  - B. increase carpet life
  - C. lessen impact noise
  - D. improve accessibility
  
3. Which of the following flooring types has the highest resilience?
  - A. asphalt
  - B. cork
  - C. linoleum
  - D. vinyl composition tile
  
4. Which carpet type is generally the LEAST expensive and most widely used?
  - A. Axminster
  - B. tufted
  - C. velvet
  - D. Wilton
  
5. A carpet with a 189 pitch has
  - A. 15.75 stitches per inch (per 25 mm)
  - B. an equivalent gauge of  $\frac{1}{6}$
  - C. 189 stitches per square inch
  - D. 7 surface yarns per inch (per 25 mm)

# 10

## WALL FINISHES

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### EXERCISE

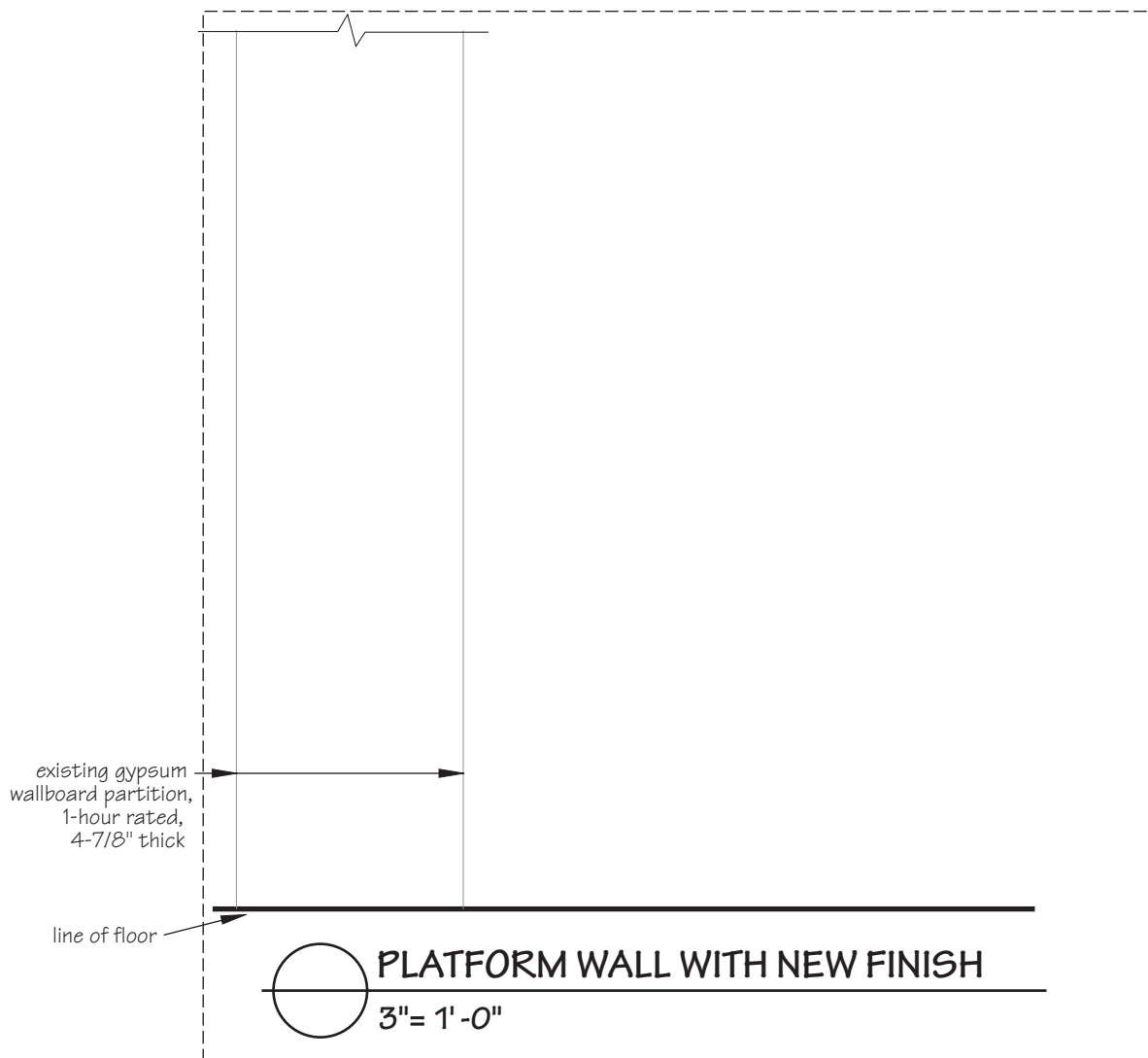
#### Exercise 1

The owner of the Chair Showroom is interested in exploring options for the east wall of the platform area. This wall is an existing 1-hour-rated partition constructed of  $\frac{5}{8}$  in (15.9 mm) gypsum wallboard on both sides of a  $3\frac{5}{8}$  in (92.1 mm) metal stud framing. This existing wall must remain, but you can place other materials or construction over it. A sustainable finish is desired.

#### Procedure

Come up with one possible solution for the finish of the wall other than painted wallboard, vinyl wallcovering, or similar standard finishes. Explore alternative materials and construction techniques. You will need to do some research to get started. Use some of the internet sites given in “Further References” to get started.

## Base Sheet



## Final Product

The final product should be one vertical section drawn freehand at a scale of 3 in = 1 ft 0 in (1:4) or greater, including dimensions and notes as required to explain the detail. You may include additional details if the construction materials call for them. Use at least three overlays and either the base sheet given here or your own base sheet. Your detail doesn't have to fit within the base sheet shown here, but it should fit on an 8<sup>1</sup>/<sub>2</sub> in × 11 in (216 mm × 279 mm) sheet. It may be useful (but it isn't required) to draw the detail at the floor line to show how the base detail would work with the material/construction you design.



## FURTHER REFERENCES

### Applied Textures

*Architectural Systems*: carved, woven, and embossed wood panels made with sustainable materials, [www.archsystems.com](http://www.archsystems.com)

*Ceilings Plus*: metal wall panel systems, [www.ceilingplus.com](http://www.ceilingplus.com)

*Forms+Surfaces*: wide variety of metal panels in various finishes and surface patterns and textures, [www.forms-surfaces.com](http://www.forms-surfaces.com)

*Fry Reglet*: 24 in × 24 in (610 mm × 610 mm) standard and custom panels of steel, aluminum, wood, glass, or laminate on grid attached to gypsum wallboard, [www.fryreglet.com](http://www.fryreglet.com)

*GageCast*: cast metal surfacing mastic applied or mounted with Z-clips or rail system, [www.gagecorp.net](http://www.gagecorp.net)

*Interlam*: wide variety of textured panels on sustainable core material, [www.interlam-design.com](http://www.interlam-design.com)

*Rimex Metals Group*: colored and patterned stainless steel, [www.rimexmetals.com](http://www.rimexmetals.com)

*Robin Reigi*: custom-formed panels of solid surfacing materials, opaque or translucent, [www.robin-reigi.com](http://www.robin-reigi.com)

### Illuminated Panels

*Evonik Industries*: Acrylite® brand edge-lighted acrylic sheet for signage and wall panels, [www.acrylite-magic.com](http://www.acrylite-magic.com)

*Green American Lighting*: Thin wall and floor panels up to 5 ft × 10 ft (1525 mm × 3050 mm), edge-illuminated with LEDs, white and colors, [www.greenamericalighting.com](http://www.greenamericalighting.com)

### Other Finishes

*American Clay*: earth plaster with natural finish, [www.americanclay.com](http://www.americanclay.com)

*CaesarStone*: engineered stone, [www.caesarstoneus.com](http://www.caesarstoneus.com)

*Instyle*: sustainable textiles, [www.instyle.com.au](http://www.instyle.com.au)

*Mio*: 3-D wallpaper, [www.mioculture.com](http://www.mioculture.com)

*modularArts*: mineral composite sculptured panels, [www.modulararts.com](http://www.modulararts.com)

*Wovin Wall*: thin veneer finish, [www.wovinwall.com](http://www.wovinwall.com)

### Woven Wire Fabric

*Cascade Coil Drapery*: suspended wire mesh or mesh in fixed framing, [www.cascadecoil.com](http://www.cascadecoil.com)

*Gage Woven*: variety of metal products including architectural wire mesh, [www.gagecorp.net](http://www.gagecorp.net)

*GKD*: wide variety of products including mesh with integrated LED lighting, [www.gkdusa.com](http://www.gkdusa.com)

## Architectural Mesh

*Cambridge Architectural*: wide variety of woven wire and mesh products,  
[www.architecturalmesh.com](http://www.architecturalmesh.com)

*GKD Metal Fabrics*: wide variety of woven wire and mesh products,  
[www.gkdmetailfabrics.com](http://www.gkdmetailfabrics.com)

*McNichols*: woven wire mesh, perforated metal, [www.mcnichols.com](http://www.mcnichols.com)

## Trade Associations

*American Coatings Association*: [www.paint.org](http://www.paint.org)

*Association for Contract Textiles*: [act.monumental-i.com](http://act.monumental-i.com)

*Chemical Fabrics and Film Association*: [www.chemicalfabricsandfilm.com](http://www.chemicalfabricsandfilm.com)

*Marble Institute of America*: [www.marble-institute.com](http://www.marble-institute.com)

*Painting and Decorating Contractors of America*: [www.pdca.com](http://www.pdca.com)

*Tile Council of North America*: [www.tileusa.com](http://www.tileusa.com)

## Books

Binggeli, Corky. *Materials for Interior Environments*. Hoboken, NJ: John Wiley & Sons.

Hall, William R. *Contract Interior Finishes*. New York: Whitney Library of Design.

Marble Institute of America. *Interior Stone Wall Cladding Installation Guidelines*. Farmington, MI: Marble Institute of America.

Tile Council of North America. *Handbook for Ceramic Tile Installation*. Princeton, NJ: Tile Council of North America.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. Which vinyl wallcovering would be most appropriate for a public corridor?
  - A. Type I
  - B. Type II
  - C. Type III
  - D. Type IV
  
2. Which paint contains the LEAST percentage of pigment?
  - A. flat
  - B. satin
  - C. semigloss
  - D. gloss
  
3. The portion of paint that evaporates or dries is called the
  - A. binder
  - B. pigment
  - C. solvent
  - D. vehicle
  
4. When fabric wallcovering is being applied to walls primarily for the purpose of absorbing sound, which of the following is the LEAST important consideration?
  - A. location of tuck joints
  - B. flame spread rating
  - C. permeability of the fabric
  - D. thickness of the batting
  
5. Which of these types of coating is best at resisting graffiti?
  - A. acrylic
  - B. alkyd
  - C. oil
  - D. urethane

# 11

# ACOUSTICS

---

## EXERCISES

### Exercise 1

Find a space or building that you feel has undesirable acoustic qualities. For example, this could be a noisy restaurant, a home with poor sound separation between rooms, or an auditorium in which it is difficult to understand the speaker. Note what you believe to be the causes of the acoustic qualities, and be prepared to discuss them in the classroom.

### Exercise 2

Look for acoustical devices that are incorporated into an interior space, either to enhance or to control sound. These spaces could include gymnasiums, auditoriums, concert halls, lecture rooms, malls, classrooms, restaurants, and libraries. For each device you find, note

- what the device is
- whether you think it is successful
- how it affects the appearance of the space
- the size or thickness of the device
- how it was installed
- approximately what percentage of total surface area is covered
- any other pertinent data

Be prepared to discuss these in the classroom.

## FURTHER REFERENCES

### Trade Associations

*Acoustical Society of America:* [www.asa.aip.org](http://www.asa.aip.org)

*National Council of Acoustical Consultants:* [acousticalsociety.org](http://acousticalsociety.org)

### Books

Binggeli, Corky. *Building Systems for Interior Designers*. Hoboken, NJ: John Wiley & Sons.

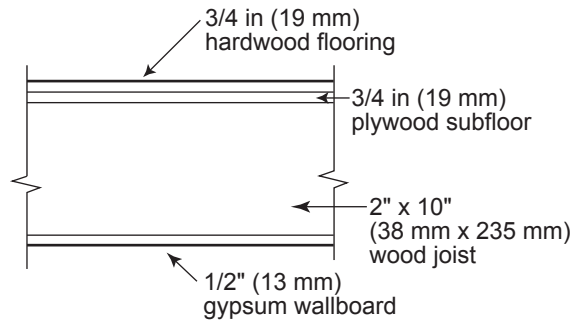
Egan, M. David. *Architectural Acoustics*. Fort Lauderdale, FL: J. Ross Publishing.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. The STC value of a construction component represents
  - A. the component's average transmission loss
  - B. a rating of the component's sound absorption
  - C. the effectiveness of the component's reverberation control
  - D. the effectiveness of the component's impact noise reduction control
  
2. Speech is composed of sounds in approximately what frequency range?
  - A. 20–5000 Hz
  - B. 150–5000 Hz
  - C. 500–6000 Hz
  - D. 3000–4000 Hz
  
3. The NRC rating of a ceiling tile indicates the
  - A. level of attenuation
  - B. sound transmission loss
  - C. average sound absorption
  - D. rating for speech privacy
  
4. As the frequency of a sound increases, its wavelength
  - A. stays the same
  - B. increases
  - C. decreases
  - D. changes with the medium

5. Assuming that all joints and penetrations are sealed, which of the following components or techniques should be used in a detail to provide good sound transmission control in a partition?
- I. double layer drywall
  - II. proprietary studs
  - III. furring
  - IV. batt insulation
  - V. extending the partition to the slab
- A. I, II, IV, and V
  - B. I, IV, and V
  - C. II, III, and IV
  - D. II, III, and V
6. The most difficult sounds to control within a space are those with
- A. frequencies of mid-range values
  - B. very low frequencies
  - C. very high frequencies
  - D. both very low and very high frequencies
7. To limit sound transmission through glazing in a recording studio, the designer should detail
- A. two layers of laminated glass with an air space between them
  - B. one layer of single glass and one layer of laminated glass with an air space between them
  - C. one very thick layer of laminated glass
  - D. two or more layers of thick glass with an airspace between them
8. All of the following elements are desirable for a good acoustical partition with a high STC rating EXCEPT
- A. extra layers of wallboard
  - B. batt insulation
  - C. plaster veneer
  - D. resilient channels

9. The impact insulation class (IIC) rating of the floor assembly shown could be improved the MOST by



- A. adding acoustic insulation between the joists
- B. covering the floor with carpet
- C. adding an extra layer of  $\frac{5}{8}$  in (16 mm) wallboard to the ceiling
- D. replacing the existing wallboard with wallboard on resilient channels
10. To improve the sound transmission through a solid core door that already has jamb seals, the designer should specify
- A. replacement with a heavier, acoustic door
- B. sealing the cracks between the partition and the frame
- C. the addition of an automatic door bottom
- D. adding a secondary jamb seal



# 12

## STAIR DESIGN AND CONSTRUCTION

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### EXERCISES

#### Exercise 1

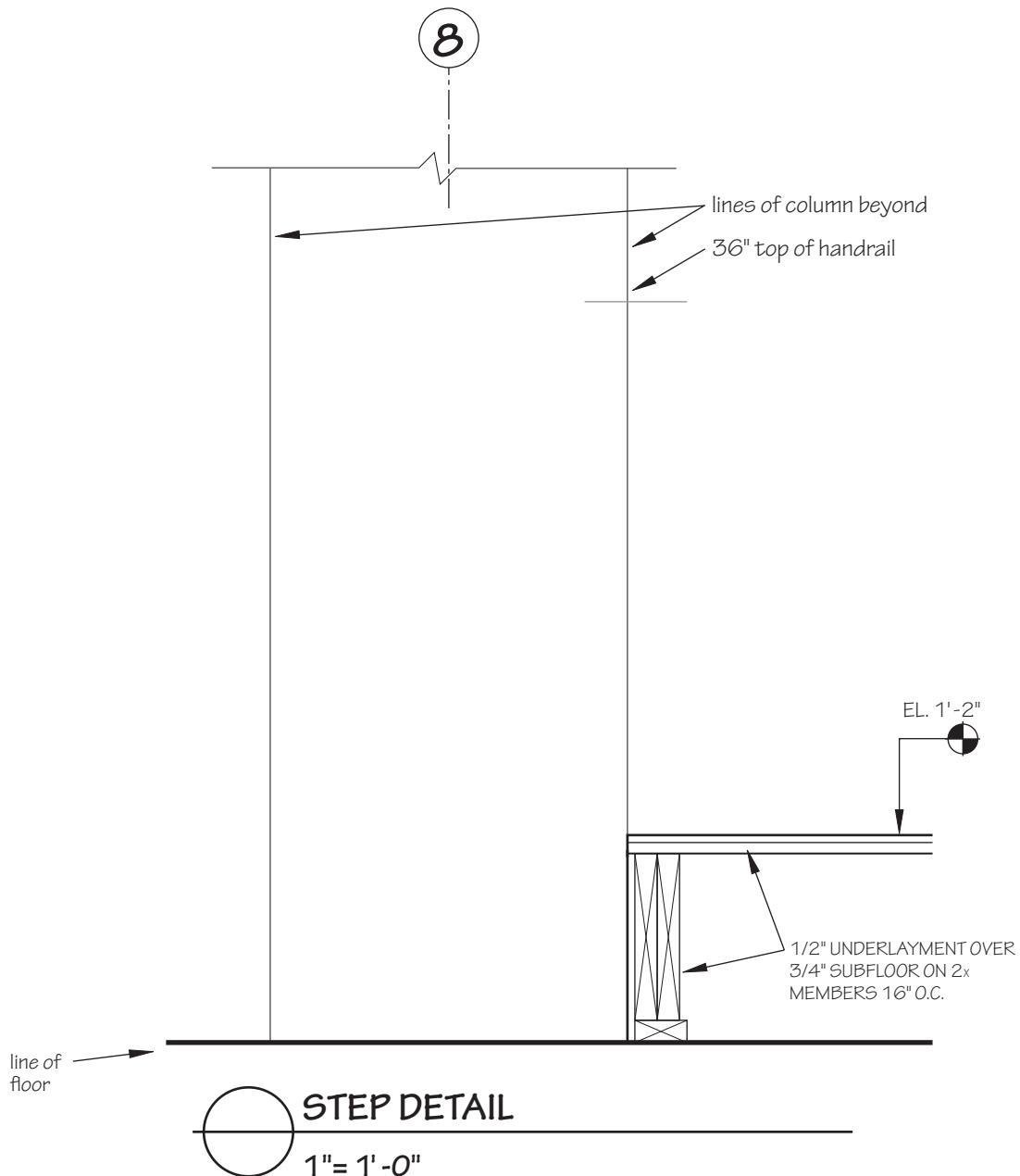
The platform area of the Chair Showroom must have both a stairway and ramp for access. The location of the stairway is shown in the floor plan of the showroom in Fig. I.1. The elevation of the underlayment of the platform is 1 ft 2 in (356 mm) above the main showroom floor. Two risers at approximately 7 in (178 mm) each (with one tread) will be required, the exact height depending on the finish floor of the platform.

The construction of the platform is shown in the base sheet and consists of the  $\frac{1}{2}$  in (13 mm) underlayment on a  $\frac{3}{4}$  in (19 mm) plywood subfloor supported by nominally 2 in thick (2 $\times$ ) fire-retardant-treated wood members. Finish flooring of the main showroom will be direct-glue carpet. Select and detail whatever finish for the platform and steps seems appropriate.

#### Procedure

Develop a section through the steps along with the handrail and any balusters that may be included. Be sure to show handrail extensions as required by the IBC. A guideline is shown on the base sheet for the top of a handrail at 36 in (914 mm) above the platform. Additional drawings and three-dimensional sketches may be useful in designing how the handrail terminates at the bottom of the step and how it transitions to the platform guard. For this exercise, assume that the style and materials of the stair handrail will also be used for the ramp and the guard. Elevation sketches of the handrail, ramp, and guard may be useful for studying how the entire system of railings works.

Base Sheet



Final Product

The final product should be a detail section looking north, drawn at a scale of 1 in = 1 ft 0 in (1:12) using the base sheet given. Include any additional details as required by the instructor to show how the handrail transitions into the guard and how the guard is detailed for attachment to the edge of the platform framing. Details may also be required for the ramp.

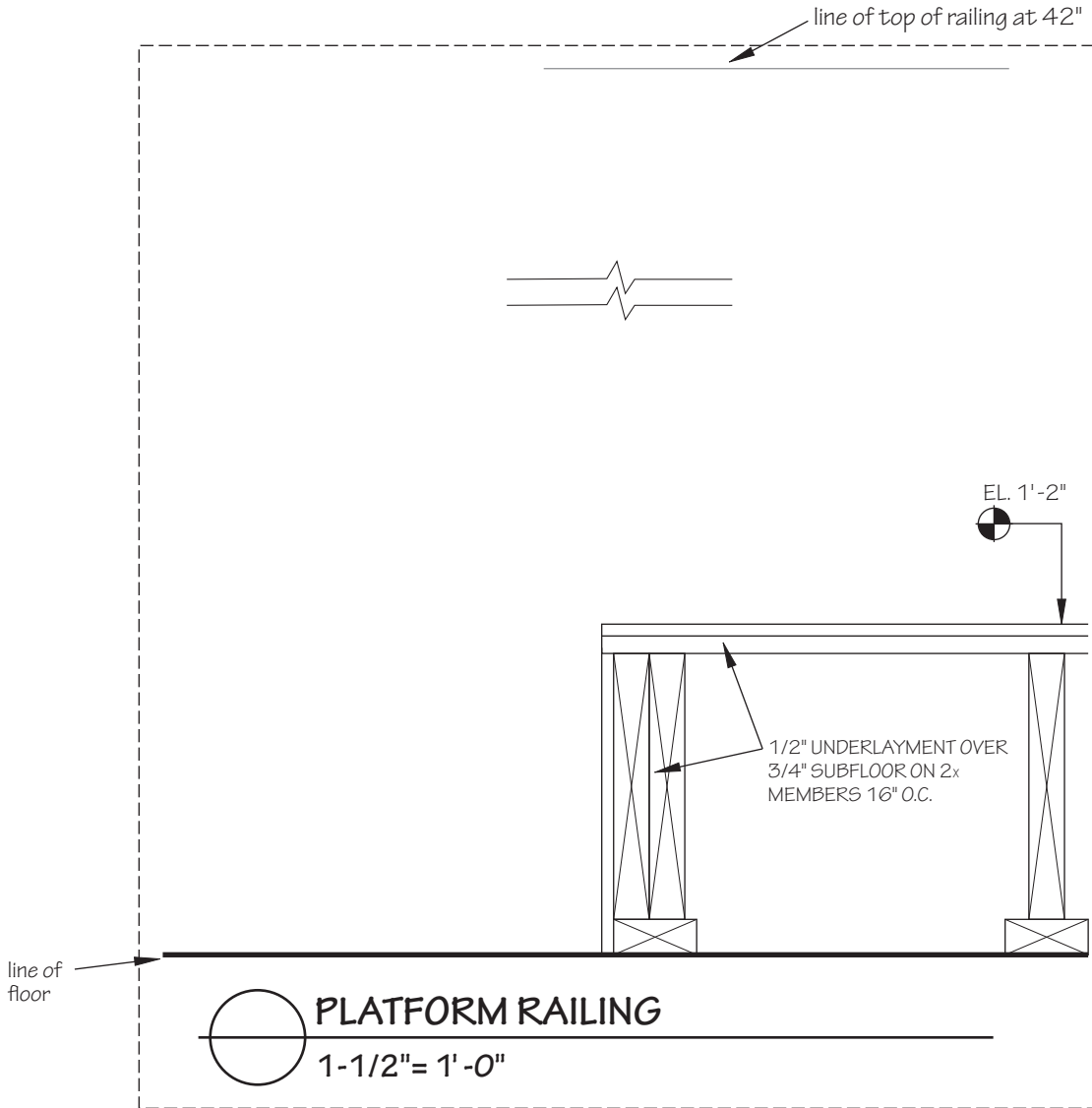
## Exercise 2

Even though the code does not require a guard (because the platform is less than 30 in (762 mm) above the adjacent surface), the client of the showroom has requested that a low wall railing be designed along the platform. The client and designer have decided to study possible designs for a railing that provides a clear view of the furniture displayed on the platform, possibly using a standard “out of the catalog” system. They have agreed that the material of the railing should be glass with a metal or wood top rail.

### Procedure

Develop a design for the railing that meets the agreed-on requirements. Make any additional design assumptions that are needed to develop the detail. Develop the design by sketching a vertical section through the railing. Assume that the platform is constructed of  $\frac{1}{2}$  in (13 mm) underlayment on a  $\frac{3}{4}$  in (19 mm) plywood subfloor supported by nominally 2 in (50 mm) thick (2 $\times$ ) fire-retardant treated wood members and that the edge consists of a double 2 $\times$  member as shown in the base sheet. Use one of the attachment methods described in the illustration that follows it. These represent common, industry-standard methods of fastening glass and metal railings to a floor or vertical surface. Investigate railing manufacturers to research other aspects of glass railings. Some manufacturers are given in the reference section of this chapter.

Base Sheet

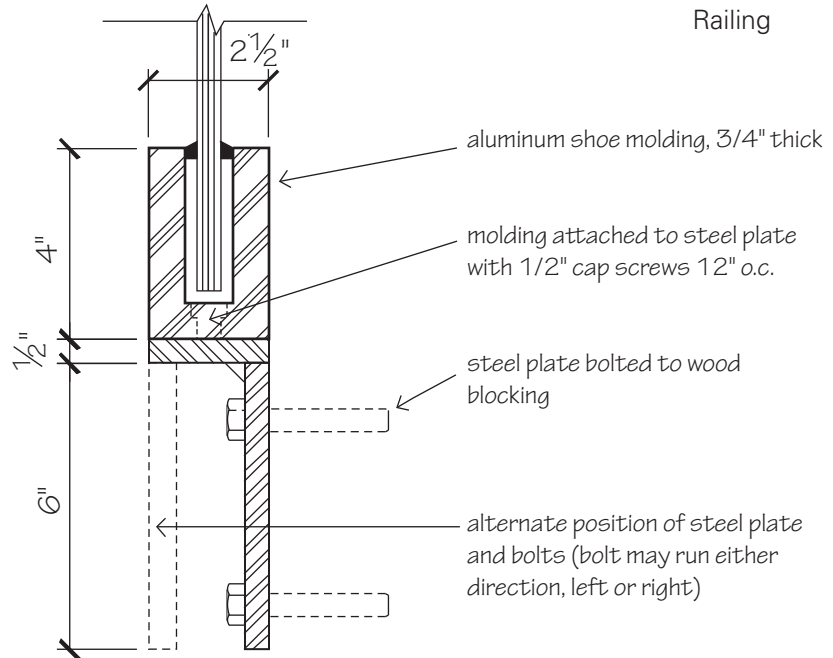


Options for attaching glass rail shoe molding to wood structure

**Figure 12.1**  
Shoes for Glass Railing

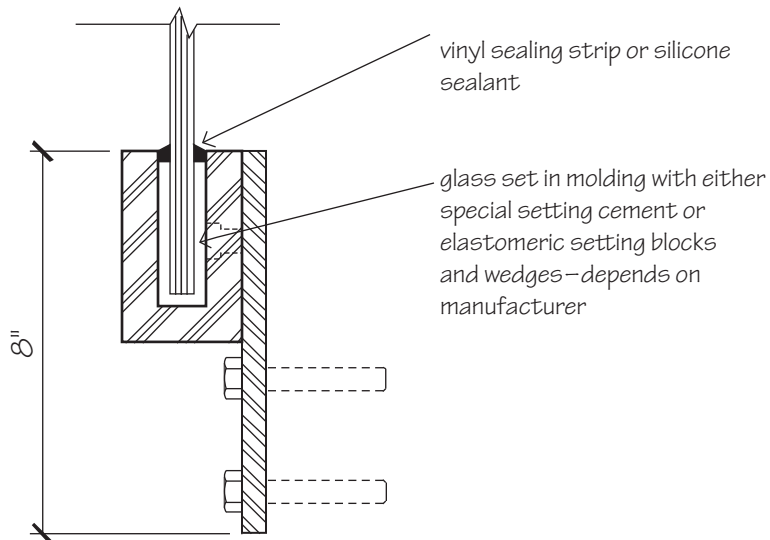
**OPTION A**

Shoe molding is attached to 1/2" steel plate below the molding, which is welded to a 1/2" x 6" steel plate bolted to solid wood blocking either on the right side (as shown) or on the left side.



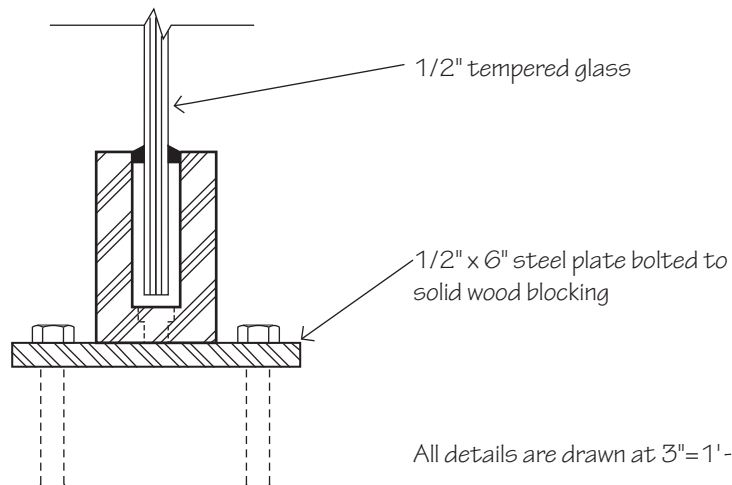
**OPTION B**

Shoe molding is attached to 1/2" steel plate bolted to solid wood blocking. Edge of steel plate is flush with top of molding. Steel plate is bolted to solid wood blocking on the right (as shown) or on the left.



**OPTION C**

Shoe molding is attached to 1/2" steel plate bolted to solid wood blocking.



**NOTE:**

With all options, all steel plates are connected to wood blocking with 1/2" lag screws or 1/2" through-bolts. Length of bolts or screws varies with blocking thickness; minimum bolt length = 3". Steel plate is continuous along the length of the shoe molding.

All details are drawn at 3"=1'-0".

Additional drawings and three-dimensional sketches may be useful in designing how the guard terminates at the top of the step and how it terminates at the bottom of the step and ramp. For this exercise, assume that the style and materials of the guard will be used for the ramp and the stairway. Elevation sketches of the handrail, ramp, and guard may be useful to study how the entire system of railings work.

### Final Product

The final sketch should fit within the given base sheet within the dashed lines at a scale of  $1\frac{1}{2}$  in = 1 ft 0 in (1:8). However, to develop the detail you may draw at a scale of 3 in = 1 ft 0 in (1:4) and without using a break line. Your instructor may require additional details to show how the guard transitions into the handrail and how the handrail is detailed for attachment to the stair framing. Details may also be required for the ramp.

**Exercise 3**

The owner is not satisfied with the original layout of the steps and ramp as shown on the plan in Fig. I.1. Develop alternative locations and configurations for the steps and ramp leading to the platform in the Chair Showroom. Develop stair, ramp, and guard details to accommodate the new plan. Your instructor will give you specific requirements for this exercise.

## FURTHER REFERENCES

### Railing Systems

*Blumcraft of Pittsburgh:* [www.blumcraft.com](http://www.blumcraft.com)

*Livers Bronze:* [www.liversbronze.com](http://www.liversbronze.com)

*Newman Brothers:* [www.newmanbrothers.com](http://www.newmanbrothers.com)

*TACO Metals:* [www.tacorailing.com](http://www.tacorailing.com)

*Wagner Companies:* [www.wagnercompanies.com](http://www.wagnercompanies.com)

### Trade Associations

*National Association of Architectural Metal Manufacturers:* [www.naamm.org](http://www.naamm.org)

*Specialty Steel Industry of North America:* [www.ssina.com](http://www.ssina.com)

### Books

Templer, John. *The Staircase: Studies of Hazards, Falls, and Safer Design.* Cambridge, MA: The MIT Press.



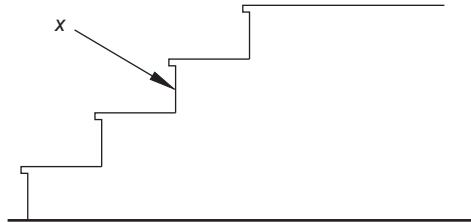
**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. According to the IBC, the minimum width of a stair for an occupant load over 49 is
  - A. 36 in (914 mm)
  - B. 42 in (1067 mm)
  - C. 44 in (1118 mm)
  - D. 48 in (1219mm)
  
2. A stairway constructed around a central steel post is called
  - A. circular
  - B. curved
  - C. spiral
  - D. winder
  
3. According to the IBC, the maximum clear space between balusters on a stair railing or guard is
  - A. 3 in (76 mm)
  - B. 4 in (102 mm)
  - C. 5 in (127 mm)
  - D. 6 in (152 mm)
  
4. Considering comfort and safety only, but without increasing the total rise and run excessively, the minimum recommended depth of a stair tread is
  - A. 11 in (279 mm)
  - B. 12 in (305 mm)
  - C. 13 in (330 mm)
  - D. 14 in (356 mm)
  
5. At the bottom of a flight of stairs, the handrail must extend beyond the last riser to a distance of
  - A. one tread in the same line as the rest of the handrail
  - B. at least 12 in (305 mm) in the same line as the rest of the handrail
  - C. one tread horizontally
  - D. at least 12 in (305 mm) horizontally

6. For a change in level of 4 ft 9 in (1448 mm) in a house, how many stair risers are required in order to minimize the number of treads?
- A. 6
  - B. 7
  - C. 8
  - D. 9
7. Which of the following is the LEAST critical for stairway safety?
- A. nosing configuration
  - B. coefficient of friction of the tread
  - C. handrail size and shape
  - D. minimum riser height
8. What would be the best combination of dimensions for a stair that serves the mezzanine of a law library where space is at a premium and the floor-to-floor dimension is 8 ft 2 in (2489 mm)?
- A. 7 in (178 mm) riser, 11 in (279 mm) tread
  - B. 7 in (178 mm) riser, 12 in (305 mm) tread
  - C. 7.54 in (192 mm) riser, 11 in (279 mm) tread
  - D. 7.54 in (192 mm) riser, 12 in (305 mm) tread
9. For a switchback stair, what is the effect of offsetting the first riser of the upper flight of steps at the intermediate landing from the last tread of the lower flight by the depth of one tread?
- A. The inside faces of the two flights of stairs must be separated by the depth of one tread.
  - B. The handrail on the upper flight of stairs will not be parallel to the line of the nosings.
  - C. The handrail on the inside of the stair can be returned 180 degrees without a vertical jog.
  - D. It will be difficult to meet the handrail extension requirements of the building code.

10. What is the name for the portion of stair identified by  $x$  in the following diagram?

- A. riser
- B. tread
- C. nosing
- D. rise



# 13

## SIGNAGE SYSTEMS

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### EXERCISE

#### Exercise 1

Plan the signage for the Chair Showroom, including a sign in the public corridor that identifies the suite by name, room plaques, and necessary exit sign locations. Develop a floor plan at a scale of  $\frac{1}{8}$  in = 1 ft 0 in (1:100) showing the location of all signs. Develop elevations at a scale of  $\frac{1}{2}$  in = 1 ft 0 in (1:25) showing the suite identification sign and a typical room plaque. Select sign types, sizes, colors, and typography from a manufacturer's standard product line.

## FURTHER REFERENCES

### Trade Associations

*International Sign Association:* [www.signs.org](http://www.signs.org)

*Society for Environmental Graphics:* [www.segd.org](http://www.segd.org)

### Books

Calori, Chris. *Signage and Wayfinding Design: A Complete Guide to Creating Environmental Graphic Design Systems*. Hoboken, NJ: New York: John Wiley & Sons.

Meuser, Philipp, and Daniela Pogade, eds. *Wayfinding and Signage: Construction and Design Manual*. Berlin: Dom Publishers.

Uebele, Andreas. *Signage Systems and Information Graphics: A Professional Sourcebook*. London: Thames & Hudson.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. A graphic containing words and symbols that tells the location of a building manager's office is an example of what type of signage?
  - A. directional
  - B. exit
  - C. identification
  - D. informational
  
2. For an accessible room identification sign to meet the *ADA/ABA Guidelines*, the distance from the floor to the baseline of any tactile character must be between
  - A. 36 in and 48 in (915 mm and 1220 mm)
  - B. 44 in and 52 in (1118 mm and 1300 mm)
  - C. 48 in and 60 in (1220 mm and 1525 mm)
  - D. 48 in and 64 in (1220 mm and 1625 mm)
  
3. Which of the following plastics is typically NOT used for interior signs?
  - A. acrylic
  - B. butyrate
  - C. polycarbonate
  - D. polyvinyl chloride
  
4. According to the *ADA/ABA Guidelines*, the minimum height of visual characters of words and numbers on accessible signs is
  - A. variable depending on the height of the characters and the horizontal viewing distance
  - B. determined by the local authority having jurisdiction for exit signs
  - C. 1/2 in (13 mm)
  - D. 2 in (51 mm)
  
5. A client has retained a large sign company to design and install the signage for an interior installation. Which of the following design and detailing elements would be LEAST important for the interior designer to consider?
  - A. indicating wood blocking in partitions where heavy signs will be installed
  - B. including in the specifications an allowance for supplying and installing signage
  - C. developing a space plan that is easy to navigate and gives visual clues for orientation
  - D. locating light switches and other wall-mounted devices to avoid conflicts

# 14

## SECURITY SYSTEMS

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### EXERCISE

#### Exercise 1

Instead of a chair showroom, imagine that the showroom suite shown in Fig. I.1 is to be used as a wholesale showroom for the jewelry trade or some other valuable commodity. How would the layout of the space, construction elements, and electronic protection need to be changed to accommodate security needs? Be prepared to discuss these issues in class.

## FURTHER REFERENCES

### Trade Associations

*American Society for Industrial Security:* [www.asisonline.org](http://www.asisonline.org)

*Continental Automated Buildings Association:* [www.caba.org](http://www.caba.org)

*Electronic Security Association:* [www.alarm.org](http://www.alarm.org)

*National Systems Contractors Association:* [www.nasca.org](http://www.nasca.org)

*Protective Glazing Council (PGC) International:* [www.protectiveglazing.org](http://www.protectiveglazing.org)

*Security Industry Association:* [www.siaonline.org](http://www.siaonline.org)

### Books

Demkin, Joseph A., ed. *Security Planning and Design: A Guide for Architects and Building Design Professionals*. Hoboken, NJ: John Wiley & Sons.

Nadel, Barbara A. *Building Security: A Handbook for Architectural Planning and Design*. New York: McGraw-Hill Professional.



**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. An interior designer is developing a space plan for a large outpatient clinic, and needs to enhance security while minimizing cost. Which of the following is the best first action?
  - A. Plan for clear lines of sight for receptionists, nurses, and other personnel.
  - B. Recommend to the client where guard stations should be located.
  - C. Suggest a central reception area with camera surveillance and door control.
  - D. Ask the client to retain the services of a health-care security consultant.
  
2. Which of the following can control access to a door at the door location?
  - A. card key
  - B. card reader
  - C. electric lock
  - D. electromagnetic lock
  
3. Which of the following types of intrusion device is LEAST likely to be used for interior construction?
  - A. audio detector
  - B. pressure sensor
  - C. photoelectric beam
  - D. microwave detector
  
4. Which of these types of access control devices is the most secure?
  - A. card readers
  - B. punched key cards
  - C. biometric devices
  - D. number pads
  
5. Which type of glazing would be most appropriate for a store's display case that will be used to display expensive watches?
  - A. laminated polycarbonate
  - B. glass-clad polycarbonate
  - C. laminated glass
  - D. tempered glass

# 15

## DESIGNING FOR AUDIOVISUAL SPACES

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### EXERCISE

#### Exercise 1

The owner of the Chair Showroom has an option on leasing additional space to the west of the existing suite. Part of this space will be an assembly area for product demonstrations, seminars, and meetings. The door labeled 17, opening into the exit corridor (212), is one of the two egress doors for this future space. When set up for a seminar, the assembly area will need a capacity of 40 people seated at small tables 18 in (457 mm) deep; space for a speaker's lectern will also be required. For other functions, only chairs will be used in the room, and the tables will be stored in an adjacent storeroom. The designer has estimated that a rectangular room approximately 950 ft<sup>2</sup> to 1000 ft<sup>2</sup> (88 m<sup>2</sup> to 93 m<sup>2</sup>) will be required. The available space will allow a finished ceiling height of 9 ft 6 in (2900 mm) and a flat floor.

#### Procedure

Design a space for audiovisual presentations. The space should be suitable for presentations using computer-generated images (PowerPoint™, for example) as well as for those using DVD recordings. The space should be able to accommodate tables and chairs as described above as well as a chairs-only configuration. Develop a space plan showing the tables and chairs and determine approximately what size screen will be needed (or possible).

#### Final Product

The final product should be one floor plan and one section. The floor plan should be drawn at a scale of 1/4 in = 1 ft 0 in (1:50) showing the room with small seminar-type tables and chairs to accommodate a minimum of 40 people with a speaker's lectern. Include sight lines from the edges of the seating area. The section should be drawn at a scale of 1/4 in = 1 ft 0 in (1:50) showing the length of the room and the sight lines from the seated positions to the screen.

## FURTHER REFERENCES

### Projection Screens

*Da-Lite*: projection screen fabrics and materials, [www.da-lite.com](http://www.da-lite.com)

### Trade Associations

*InfoComm International*: [www.infocomm.org](http://www.infocomm.org)

*International Communication Association*: [www.icahdq.org](http://www.icahdq.org)

### Books

Englich, Guido. *Planning Guide for Conference and Communication Environments*. New York: Birkhäuser Architecture.

Neith, Oleta. *Power Rooms: Executive Offices, Corporate Lobbies, and Conference Rooms*. Atglen, PA: Schiffer Publishing.

Penner, Richard H. *Conference Center Planning and Design*, New York: Watson-Guption.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. Which of the following kinds of display would be best for a small conference room with ambient light from windows?
  - A. cathode ray tube
  - B. digital light processing
  - C. liquid crystal
  - D. plasma
  
2. The aspect ratio for the most commonly used HDTVs is
  - A. 2.35:1
  - B. 3:2
  - C. 4:3
  - D. 16:9
  
3. The minimum height of a projection screen is based on all the following EXCEPT the
  - A. distance to the closest viewer
  - B. angle of view to the top of the screen from horizontal
  - C. average eye level of the audience
  - D. resolution of the projection system
  
4. For business and educational uses, the primary advantage of rear projection over front projection is that
  - A. security is improved
  - B. screens tend to reflect less ambient light
  - C. screens can be larger
  - D. the seating area can be larger
  
5. A good rule of thumb for determining the minimum distance from the screen to the closest viewer for larger screen sizes and older projection techniques is
  - A. two times the screen height
  - B. two and a half times the screen height
  - C. three times the diagonal screen dimension
  - D. four times the diagonal screen dimension

# 16

## MECHANICAL & ELECTRICAL SYSTEMS COORDINATION

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### EXERCISE

#### Exercise 1

Plan a tentative layout for HVAC diffusers and sprinkler locations on a reflected ceiling plan of the Chair Showroom. Allow for the dropped soffits and beam enclosures as described in Ch. 2 and shown in Fig. I.2. The space will be heated along the perimeter with the convectors along the exterior wall, as shown schematically in Fig. I.2. Diffusers are required in the showroom as well as in the individual rooms. Provide at least six diffusers in the showroom, one in the reception area, and one in each of the individual rooms. Provide three return air grilles in the showroom, one in the reception area, and one in each of the individual rooms.

#### Procedure

Determine a layout for the acoustical ceiling grid in each of the rooms except the reception area and the toilet room, which will have a gypsum wallboard ceiling. Then develop a layout of diffusers, grilles, and sprinkler heads. The sprinkler head spacing should be as discussed in Ch. 16.

#### Final Product

The final product should be a reflected ceiling plan showing the layout of the ceiling grid, sprinkler heads, exit signs, and luminaires at a scale of  $\frac{1}{8}$  in = 1 ft 0 in (1:100). The sketch may be either neatly drawn freehand or hardlined.

## FURTHER REFERENCES

### Air Diffuser Manufacturers

*Acutherm*: A variety of diffuser types, [www.acutherm.com](http://www.acutherm.com)

*AirConcepts, Inc.*: A variety of diffuser types, [www.airconceptsinc.com](http://www.airconceptsinc.com)

*Anemostat*: A variety of diffuser types, [www.anemostat.com](http://www.anemostat.com)

*Carnes*: A variety of diffuser types, [www.carnes.com](http://www.carnes.com)

*Krueger*: Round and square diffusers, linear slot diffusers, grilles, and registers, [www.krueger-hvac.com](http://www.krueger-hvac.com)

*Nailor Industries*: Linear slot diffusers, square and round ceiling diffusers, and perforated diffusers, [www.nailor.com](http://www.nailor.com)

*Titus*: A variety of diffuser types, [www.titus-hvac.com](http://www.titus-hvac.com)

*Trox USA*: Nozzle and swirl diffusers: [www.troxusa.com](http://www.troxusa.com)

*Tuttle & Bailey*: A variety of diffuser types, [www.tuttleandbailey.com](http://www.tuttleandbailey.com)

*Seiho International*: Nozzle diffusers, [www.seiho.com](http://www.seiho.com)

### Trade Associations

*Air Conditioning, Heating, and Refrigeration Institute*: [www.ahrinet.org](http://www.ahrinet.org)

*American Society of Heating, Refrigerating and Air-Conditioning Engineers*: [www.ashrae.org](http://www.ashrae.org)

*American Society of Sanitary Engineering*: [www.asse-plumbing.org](http://www.asse-plumbing.org)

*International Association of Plumbing and Mechanical Officials*: [www.iapmo.org](http://www.iapmo.org)

*National Electrical Manufacturers Association*: [www.nema.org](http://www.nema.org)

*National Fire Protection Association*: [www.nfpa.org](http://www.nfpa.org)

*Plumbing and Drainage Institute*: [www.pdionline.org](http://www.pdionline.org)

### Books

Binggeli, Corky. *Building Systems for Interior Designers*. Hoboken, NJ: John Wiley & Sons.

Gordon, Gary, and James L. Nuckolls. *Interior Lighting for Designers*. Hoboken, NJ: John Wiley & Sons.

Stein, Benjamin, and John S. Reynolds. *Mechanical and Electrical Equipment for Buildings*. Hoboken, NJ: John Wiley & Sons.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. Before determining the types of recessed light fixtures and their locations for a commercial interior design project, the designer should first
  - A. finalize the type of ceiling system used
  - B. locate sprinkler heads and smoke detectors
  - C. determine the depth of the plenum
  - D. verify the type of HVAC system used
  
2. Very large plumbing pipes or groups of pipes are best accommodated with
  - A. oversized studs
  - B. back-to-back studs
  - C. Z-furring
  - D. chase walls
  
3. A designer is laying out a suspended acoustical ceiling that will contain recessed downlights, sprinkler heads, and HVAC supply air diffusers. The space is 40 ft × 80 ft (12.2 m × 24.4 m) with an 8 ft 6 in (2590 mm) high ceiling. As the construction documents are nearing completion, the designer discovers that the mechanical engineer has sized and located a large, major duct that interferes with many 12 in (305 mm) high downlights by about 4 in (102 mm). What is the designer's best course of action?
  - A. Find alternative light fixtures.
  - B. Reduce the ceiling height to 8 ft 2 in (2490 mm).
  - C. Ask the engineer to modify the location of the ductwork.
  - D. Ask the mechanical engineer to resize the ductwork to make up the 4 in (102 mm).
  
4. In most commercial office buildings, sprinkler systems are hydraulically designed by a fire protection engineer or contractor. What is the maximum spacing between sprinkler heads that the interior designer needs to consider in laying out a reflected ceiling plan?
  - A. 7.5 ft (2286 mm)
  - B. 10 ft (3048 mm)
  - C. 12 ft (3658 mm)
  - D. 15 ft (4572 mm)

5. In a commercial building, the maximum distance from a new toilet installation to existing plumbing is determined primarily by the
  - A. slope of the waste pipe
  - B. waste pipe size and the plenum space in the floor below
  - C. minimum distance from the vent to a vent stack
  - D. available space below the floor
  
6. The device that controls the volume of air and its distribution in an HVAC system is called a
  - A. duct
  - B. convector
  - C. register
  - D. grille
  
7. When working with an electrical engineer on a project, which of the following would an interior designer most likely put on the interior design power plan?
  - A. switch locations
  - B. dedicated outlets
  - C. conduit sizing
  - D. speaker locations
  
8. Air is most effectively distributed along an exterior window wall by a
  - A. round diffuser
  - B. square grille
  - C. series of square diffusers
  - D. slot air diffuser
  
9. An interior designer wants to specify new window coverings and tracks to replace building standard window coverings. Which of the following actions is the LEAST important?
  - A. asking the electrical engineer if the new light reflectance is detrimental
  - B. verifying that the building owner does not care about the change in the building's exterior appearance
  - C. determining if the mechanical engineer objects to the replacement plans
  - D. checking with the architect to see that the new coverings do not adversely affect the heating of the glass



10. A power distribution system must be specified for an open office area. Which of the following is the most flexible and economical alternative?
- A. access floor system
  - B. underfloor raceway system
  - C. cellular metal floor raceways
  - D. ceiling raceway system with power poles

# 17

## STRUCTURAL COORDINATION

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### EXERCISE

#### Exercise 1

To give the Chair Showroom more flexibility in locating displays and vignettes, the designer wants to provide electrical outlets in the floor. This will require core drilling of the floor for the installation of poke-through type outlets. Before the precise locations of the core drills can be decided, the reinforcing bars must be located by X-raying or another method. However, the designer would like to know approximately where the possible locations for floor outlets are. To determine this, the approximate areas where core drilling is possible must be identified.

#### Procedure

Using the partial floor plan shown in Fig. 17.1, sketch the approximate areas where floor outlets can be placed in the main showroom area, the platform, and the entry area. Use the floor plan and schematic section shown in Figs. I.1 and I.2 for reference.

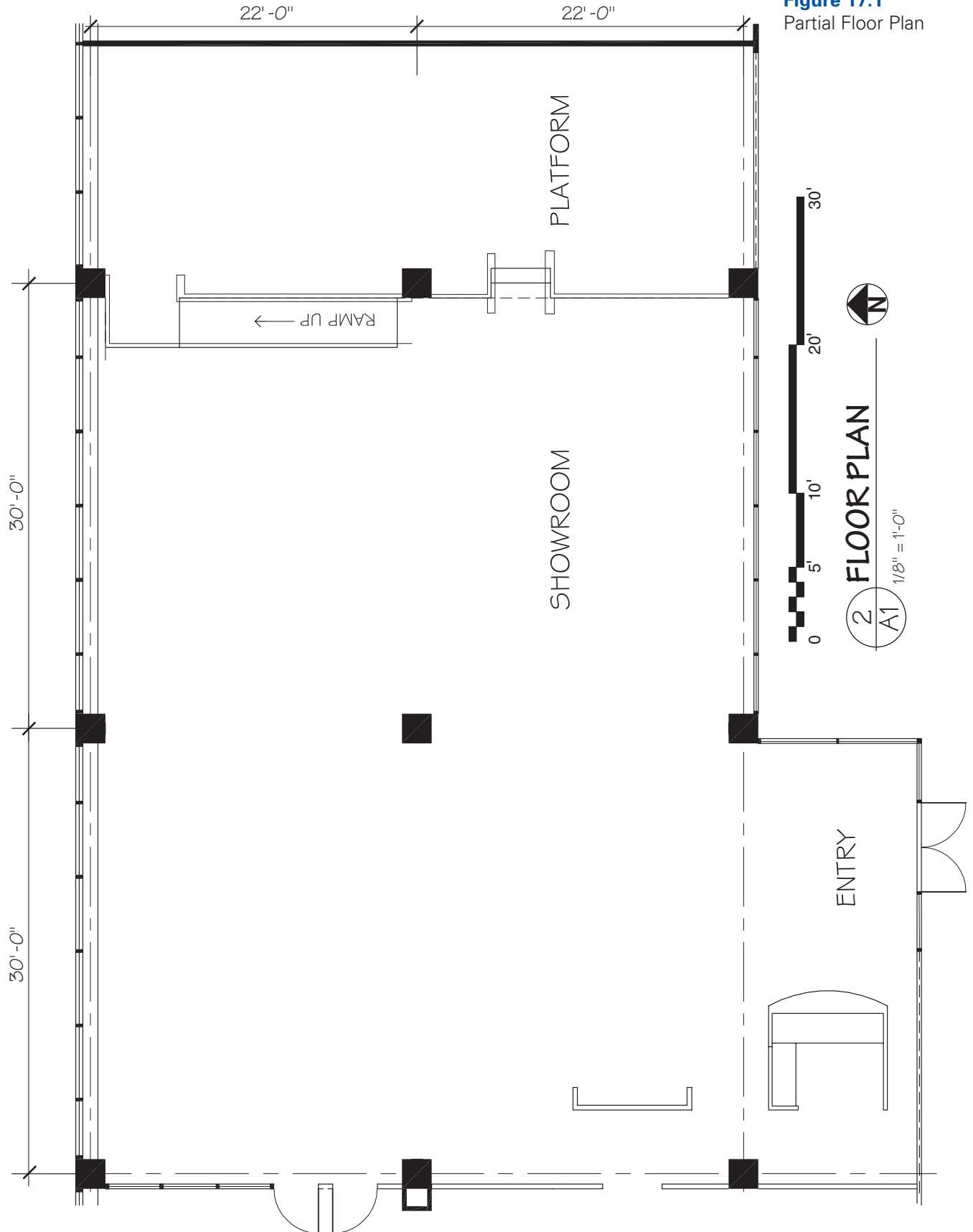


Figure 17.1  
Partial Floor Plan

**Final Product**

One freehand sketch drawn on the floor plan shown with the areas shaded in where floor outlets could be placed. Include any dimensions as required to locate the areas.

## FURTHER REFERENCES

### Books

Binggeli, Corky, and Patricia Greichen. *Interior Graphic Standards*. Hoboken, NJ: John Wiley & Sons.

Salvadori, Mario. *Why Buildings Stand Up: The Strength of Architecture*. New York: W.W. Norton.

Underwood, James R., and Michele Chiuini. *Structural Design: A Practical Guide for Architects*. Hoboken, NJ: John Wiley & Sons.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. In designing for a high-rise building, an interior designer may be involved with developing details to accommodate building movement caused by all of the following EXCEPT
  - A. building expansion
  - B. floor deflection
  - C. seismic events
  - D. wind sway
  
2. A residential client with a two-story building wants to remove a 10 ft (3050 mm) length of exterior wall to create an opening for a large new window. What is the most appropriate advice the interior designer can give?
  - A. The opening can be made, but a structural engineer will be needed.
  - B. An architect will have to be retained to sign the drawings for the building department.
  - C. The opening can be framed by using laminated veneer lumber of the appropriate size.
  - D. The proposed opening cannot be made because the wall is loadbearing.
  
3. A compact bookcase system for a law library is an example of a
  - A. dead load
  - B. dynamic load
  - C. lateral load
  - D. live load
  
4. In a large, three-story building, an interior designer has been commissioned to design a 30,000 ft<sup>2</sup> (2787 m<sup>2</sup>) office. An existing building expansion joint runs through the space in one of the open office areas, detracting from its appearance. What is the best way for the interior designer to minimize the visual impact of the expansion joint?
  - A. request that the expansion joint be moved to another location
  - B. design another expansion joint that is concealed below finish level and cover the new joint with the designer's finishes
  - C. suggest replacement of the expansion joint covers with ones that can incorporate the designer's finishes
  - D. conceal the existing expansion joint by covering it over with the designer's finishes

5. Small ductwork could most easily be placed within which of the following types of structural systems?
- A. beam-and-girder steel
  - B. flat plate concrete
  - C. open-web steel joist
  - D. twin-T concrete
6. The ends of two joists cut away to form an opening for a residential stair would be framed with a
- A. lintel
  - B. header
  - C. beam
  - D. trimmer
7. A residential client is building a new house with a high, vaulted ceiling in the great room. The client wants to emphasize the structure of this room and has asked the interior designer for some suggestions that the client can give to the architect. Which of these is the best suggestion for the interior designer to give?
- A. Frame in false beams with gypsum wallboard.
  - B. Use large laminated veneer lumber for ceiling beams.
  - C. Employ exposed wood decking for the ceiling structure.
  - D. Use glued laminated beams and columns.
8. In which type of structural system would core drilling be easiest?
- A. concrete over steel deck
  - B. flat slab concrete
  - C. one-way pan joist concrete
  - D. post-tensioned concrete
9. In a steel-framed building, wide flange members are most likely to be used for
- A. beams
  - B. girders
  - C. columns
  - D. bracing

10. In most residential construction, the interior designer can expect a two-story house to be framed with
- A. 2 in × 4 in studs, 16 in o.c. (38 mm × 89 mm, 400 mm o.c.)
  - B. 2 in × 4 in studs, 24 in o.c. (38 mm × 89 mm, 600 mm o.c.)
  - C. 2 in × 6 in studs, 16 in o.c. (38 mm × 152 mm, 400 mm o.c.)
  - D. 2 in × 6 in studs, 24 in o.c. (38 mm × 152 mm, 600 mm o.c.)



# 18

## BARRIER-FREE DESIGN

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### EXERCISE

#### Exercise 1

Review the Chair Showroom project for compliance with the requirements of the Americans with Disabilities Act.

#### Procedure

Use the headings in ICD Ch. 18 as a sequential checklist, and consider the following elements.

- accessible routes
- turning space
- doorways
- maneuvering clearances
- plumbing fixtures
- floor surfaces
- ramp
- stairs
- protruding objects
- signage and alarms

If a particular element is not shown on the floor plan, determine what the requirements would be for this space.

**Final Product**

Develop a list of the major elements given above, and note whether the space conforms to requirements or does not. If something does not conform, or if there is not enough information shown in the floor plan in Fig. I.1, note what must be done to correct it or what would be needed to comply.

## FURTHER REFERENCES

### Websites

*Access Board:* [www.access-board.gov](http://www.access-board.gov)

*ADA regulations:* [www.ada.gov/regs2010/ADAregs2010.htm](http://www.ada.gov/regs2010/ADAregs2010.htm). (An electronic file of the *2010 ADA Standards for Accessible Design* that is suitable for printing is available at [www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards\\_prt.pdf](http://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards_prt.pdf).)

*Center for Inclusive Design:* [www.ap.buffalo.edu/idea](http://www.ap.buffalo.edu/idea)

*Center for Universal Design:* [www.design.ncsu.edu/cud](http://www.design.ncsu.edu/cud)

*National Rehabilitation Information Center:* [www.naric.com](http://www.naric.com)

*U.S. Department of Justice:* [www.usdoj.gov/crt/ada/adahom1.htm](http://www.usdoj.gov/crt/ada/adahom1.htm)

### Books

Evan Terry Associates. *Pocket Guide to the ADA: Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities*. Hoboken, NJ: John Wiley & Sons.

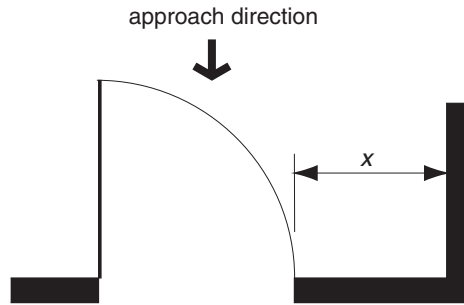
Jordan, Wendy Adler. *Universal Design for the Home: Great Looking, Great Living Design for All Ages, Abilities, and Circumstances*. Minneapolis, MN: Quarry Books.

Rhoads, Marcela A. *The ADA Companion Guide: Understanding the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and the Architectural Barriers Act (ABA)*. Hoboken, NJ: John Wiley & Sons.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. An accessible route must serve
  - A. all accessible spaces and parts of a building
  - B. the corridors, stairs, elevators, and toilet rooms of a building
  - C. entrances, parking, toilet rooms, corridors, and drinking fountains
  - D. entrances, corridors, toilet rooms, and elevators except those available only for maintenance personnel.
  
2. Which type of sink is BEST for barrier-free design?
  - A. vanity
  - B. pedestal
  - C. wall hung
  - D. free standing
  
3. According to the *International Building Code* (IBC), handrails in commercial construction are required along both sides of a stairwell
  - A. when the stair width exceeds 44 in (1118 mm)
  - B. when the stair width exceeds 60 in (1525 mm)
  - C. in all cases, except for aisle stairs
  - D. in all cases
  
4. According to the *ADA/ABA Guidelines*, the maximum permissible slope for an accessible ramp rising up to 30 in (762 mm) is
  - A. 1:8
  - B. 1:10
  - C. 1:12
  - D. 1:15
  
5. According to the *ADA/ABA Guidelines*, the minimum clear width for a hinged door is
  - A. 30 in (760 mm)
  - B. 32 in (815 mm)
  - C. 34 in (865 mm)
  - D. 36 in (915 mm)

6. According to *ADA/ABA Guidelines*, what is the MINIMUM dimension of the distance  $x$  as indicated in the diagram shown?



- A. 12 in (395 mm)  
 B. 16 in (406 mm)  
 C. 18 in (457 mm)  
 D. 24 in (610 mm)
7. The minimum wheelchair turning diameter for accessibility is
- A. 54 in (1372 mm)  
 B. 56 in (1422 mm)  
 C. 60 in (1525 mm)  
 D. 64 in (1626 mm)
8. When doing design work for remodeling toilet rooms to make them accessible, the designer finds that it is impossible to provide adequate clearance on one side of a door. What is the BEST course of action?
- A. Propose to the client that walls be demolished and replanned to provide the necessary clearance.  
 B. Apply to the building department for a variance because of the remodeling problem.  
 C. Specify a power-assisted door opener that meets accessibility standards and incorporate this into the design.  
 D. Suggest that a unisex toilet be built nearby that complies with all accessibility requirements.
9. The minimum clear width between handrails for an accessible stairway is
- A. 32 in (815 mm)  
 B. 36 in (915 mm)  
 C. 44 in (1118 mm)  
 D. 48 in (1219 mm)

10. When doing preliminary space planning for an office suite which of the following elements of accessible design would be of LEAST concern during this planning?
- A. grab bar locations in toilet rooms
  - B. maneuvering space at doors
  - C. turnaround width in the corridors
  - D. spacing in toilet rooms

# 19

## BUILDING CODES AND REGULATIONS

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### EXERCISES

#### Exercise 1

Using Table 19.1 as a guide, go through the steps of a code search. Read through the sections of the ICD referred to in Table 19.1. Choose one step related to egress (IBC Ch. 10) to examine more closely. Carefully read all the references, tables, cross references, and footnotes for this step. This should give you a good idea of the complexity (and sometimes the obtuseness) of the code.

**Exercise 2**

Get a set of an architect's drawings for a midsize to large project, and review them for key points in code compliance. Look at the first page for the code information that is typically required to be part of the drawing set. Try to identify the various occupancies, fire-resistance requirements, and other elements (other than egress) discussed in ICD Ch. 19.



## FURTHER REFERENCES

### Websites

*American National Standards Institute:* [www.ansi.org](http://www.ansi.org)

*ASTM International:* [www.astm.org](http://www.astm.org)

*California Building Standards Commission:* [www.bsc.ca.gov](http://www.bsc.ca.gov)

*California Department of Housing and Community Development:* [www.hcd.ca.gov](http://www.hcd.ca.gov)

*International Association of Plumbing and Mechanical Officials:* [www.iapmo.org](http://www.iapmo.org)

*International Code Council:* [www.iccsafe.org](http://www.iccsafe.org)

*International Code Council Online Library:* [publicecodes.citation.com](http://publicecodes.citation.com)

*National Fire Protection Association:* [www.nfpa.org](http://www.nfpa.org)

### Books

Ching, Francis D. K., and Steven R. Winkel. *Building Codes Illustrated; A Guide for Understanding the International Building Code*. Hoboken, NJ: John Wiley & Sons.

Harmon, Sharon Koomen, and Katherine E. Kennon. *The Codes Guidebook for Interiors*. Hoboken, NJ: John Wiley & Sons.

International Code Council. *International Building Code*. Washington, DC: International Code Council.

———. *International Residential Code*. Washington, DC: International Code Council.

———. *2009 IBC Handbook: Fire- and Life-Safety Provisions*. Washington, DC: International Code Council.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. When beginning a code search for an interior design project, which of the following should be the first determination made?
  - A. construction type
  - B. occupant load
  - C. number of exits required
  - D. occupancy group
  
2. What test gives the most accurate evaluation of the safety of a partition?
  - A. ASTM E84
  - B. ASTM E119
  - C. room corner test
  - D. Steiner tunnel test
  
3. As defined by the *International Building Code* (IBC), a fire-resistant assembly is one that
  - A. contains only noncombustible components
  - B. does not support the spread of flame across its surface
  - C. has a low rate of thermal expansion
  - D. can confine a fire while performing its function
  
4. ASTM International is
  - A. a model code group
  - B. an organization that writes industry standards
  - C. a testing laboratory
  - D. an agency that writes federal codes
  
5. Restrictions on surface finishes in the IBC are based primarily on
  - A. location in the building and occupancy
  - B. occupant load and sprinklering
  - C. sprinklering and occupancy
  - D. occupancy and construction type

6. According to the IBC, fire-rated doors in a 1-hour-rated corridor partition in a non-sprinklered building must have a rating of
  - A. 20 minutes
  - B. 30 minutes
  - C. 45 minutes
  - D. 1 hour
  
7. Column enclosures that provide fire protection must have the highest fire-resistance ratings in a building of construction type
  - A. I-A
  - B. II-A
  - C. III-B
  - D. V-B
  
8. An interior finish material is designated in a product catalog as having a flame spread rating of 32. The material is considered to be in Class
  - A. A
  - B. B
  - C. C
  - D. D
  
9. According to the IBC, what type of occupancy group is an apartment building with four units classed as?
  - A. R-1
  - B. R-2
  - C. R-3
  - D. R-4
  
10. Flame spread ratings in buildings are most restrictive in
  - A. enclosed spaces
  - B. lobbies
  - C. exit enclosures
  - D. access ways to exits

# 20

## MEANS OF EGRESS

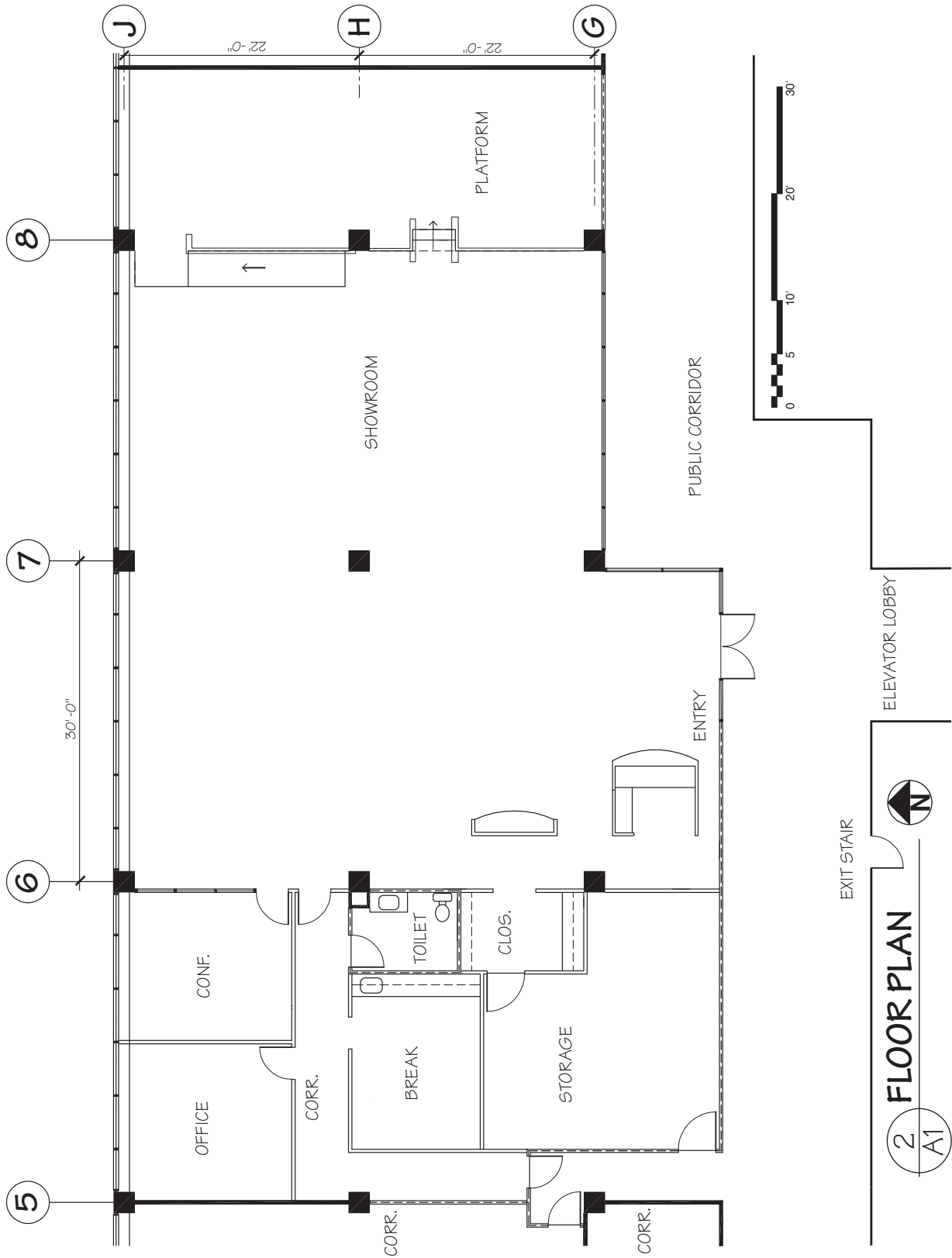
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### EXERCISES

#### Exercise 1

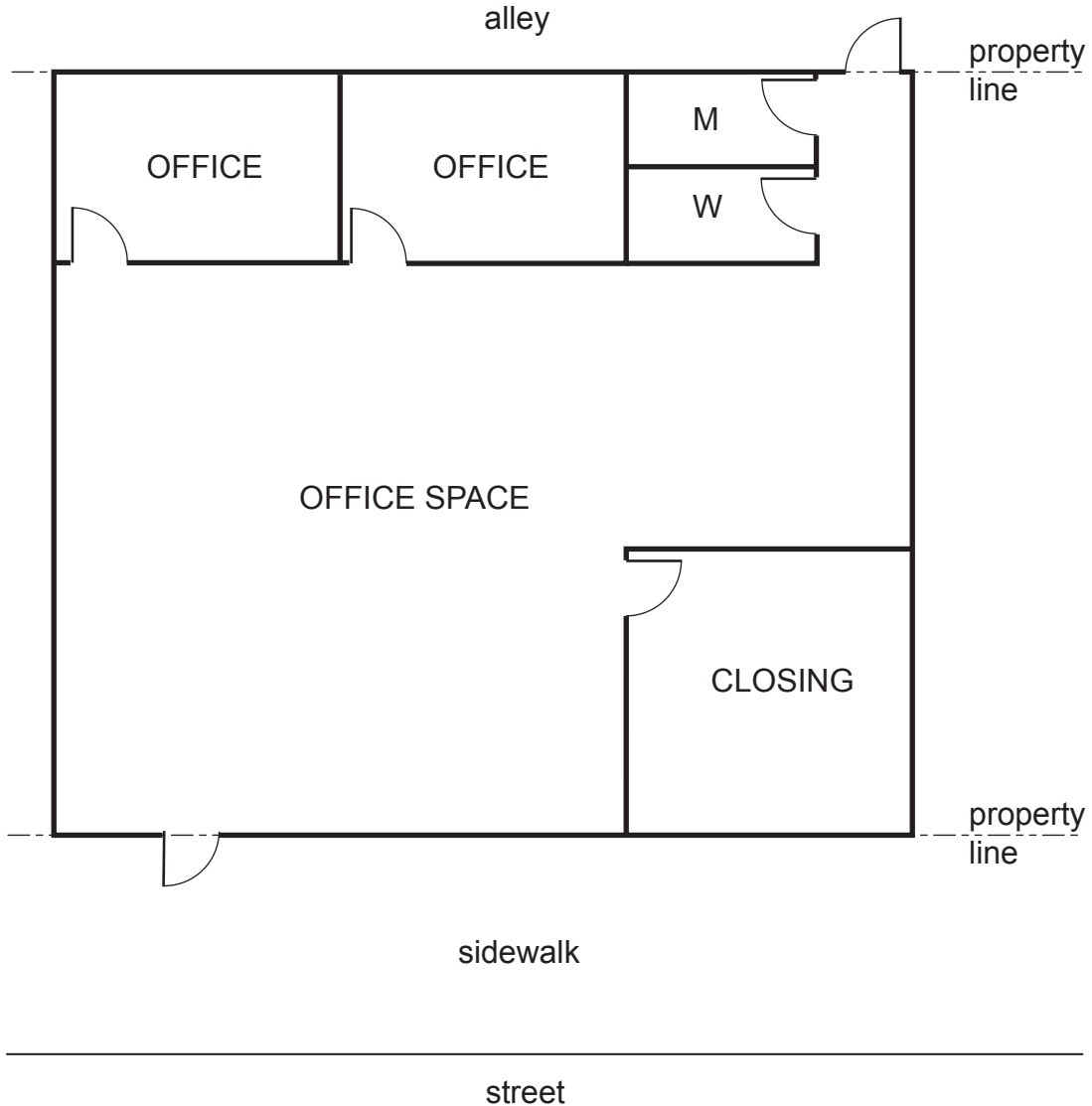
Using the sequence of steps in Table 19.1, perform a project code review on the Chair Showroom. A simplified version of the floor plan is shown here, including the location of the nearest exit stairway from the building in which the showroom is located.

Assume that the second exit door from the future assembly space in phase 2 must be placed somewhere between columns G5 and H5. Also assume that the local building official is requiring that any partitions separating a lease space from the public corridor be 1-hour rated, but that glass does not have to be rated, the sprinkler system substituting for fire-rated glass in this case.







**Exercise 2**

Using the following diagram of a small, free-standing, single-story building, identify the components of the egress system and the public way. You may use the shading legend shown, or use colors or other graphic means to indicate the four components.

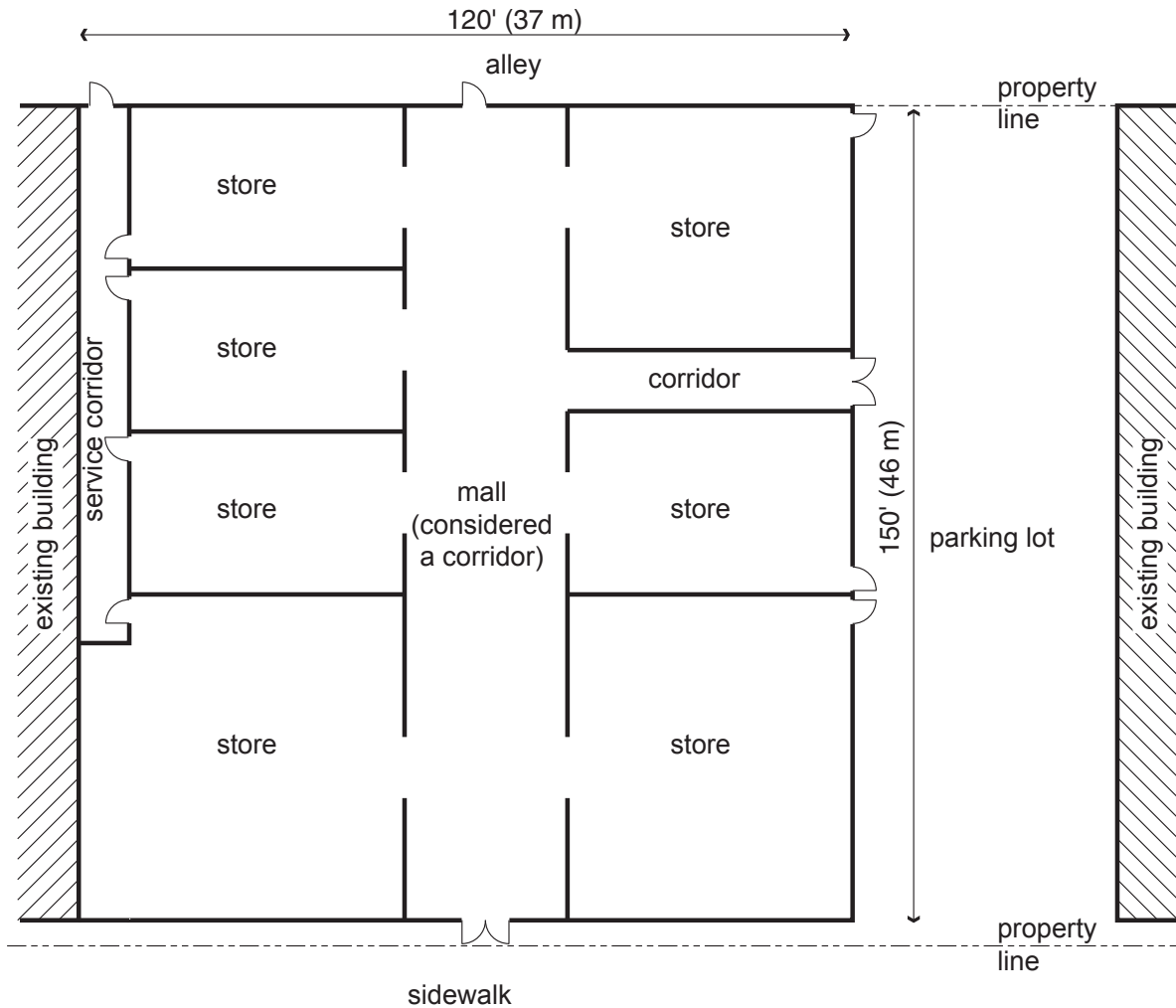


SMALL REAL ESTATE OFFICE

-  exit access
-  exit
-  exit discharge
-  public way

**Exercise 3**





Using the following diagram of a small, single-story mini-mall building, identify the components of the egress system and the public way. You may use the shading legend shown, or use colors or other graphic means to indicate the four components. Use the dimensions given on the diagram to estimate any other distances needed.



Assume all doors and other egress components have been sized and located correctly.  
The maximum travel distance to an exit from any point in a tenant space to an exit cannot exceed 200 ft (61 m).



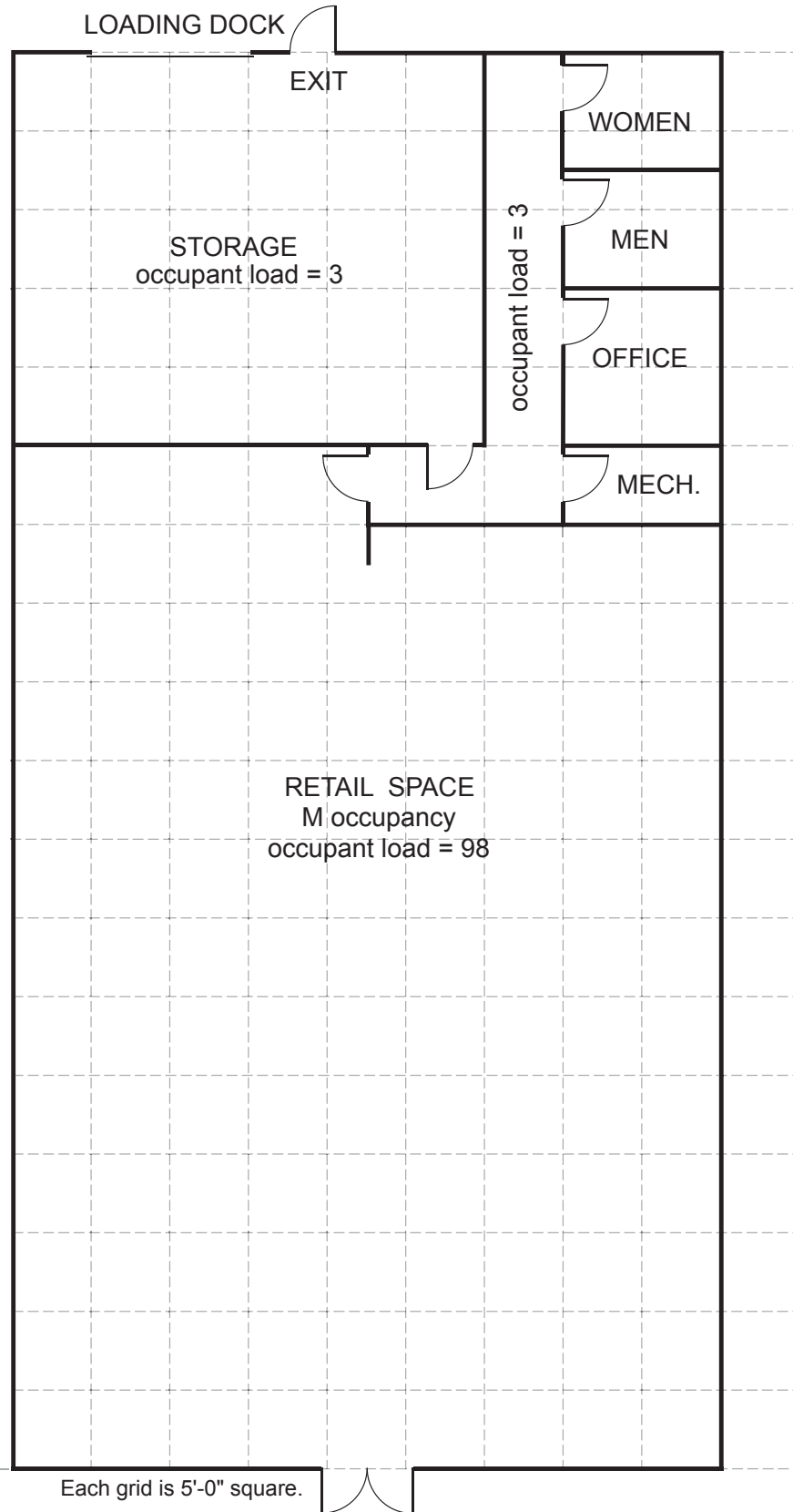
street

-  exit access
-  exit
-  exit discharge
-  public way

MINI-MALL

**Exercise 4**

Using the following diagram of a small retail space in a strip mall, locate the errors in egress planning for this space. Suggest how the errors can be corrected.

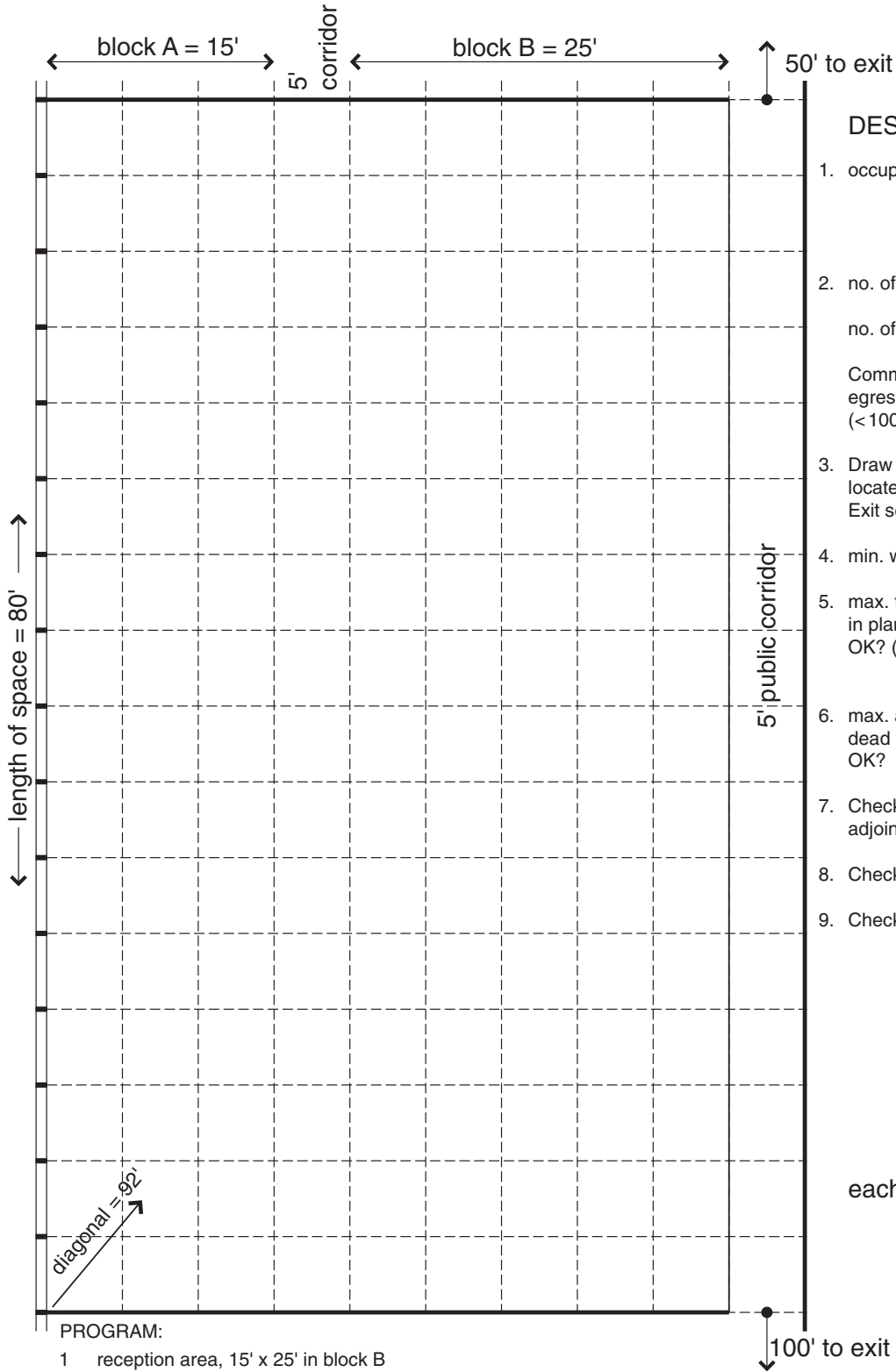




**Exercise 5**

Using the following diagram of a tenant office space, develop a preliminary space plan that satisfies the given program requirements and conforms to IBC egress requirements. For simplicity, the space plan can be developed using 5 ft (1.5 m) square blocks of space. The program tells what spaces must be on each side of the interior corridor (that is, within block A or block B).

Use the design procedure given with the diagram to check the egress provisions.



DESIGN PROCEDURE

1. occupant load = \_\_\_\_\_
2. no. of exits for suite = \_\_\_\_\_  
no. of exits for training = \_\_\_\_\_
- Common path of egress travel OK? (<100') Y N
3. Draw spaces and locate exits.  
Exit separation OK? Y N
4. min. width of exits = \_\_\_\_\_
5. max. travel distance in plan = \_\_\_\_\_  
OK? (<300') Y N
6. max. allowable dead ends = \_\_\_\_\_  
OK? Y N
7. Check exits through adjoining spaces.
8. Check door encroachment.
9. Check door swings.

PROGRAM:

- 1 reception area, 15' x 25' in block B
- 1 conference room, 15' x 25' in block B
- 1 training room, 35' x 25' in block B
- 1 workroom, 10' x 25' in block B
- 8 offices, 10' x 15' each in block A

space is sprinklered  
 training room: 15 sq. ft./person, "A" occupancy  
 all other spaces: 100 sq. ft./person, "B" occupancy

**Exercise 6**

Using the same set of architect drawings used for Exercise 2 in Ch. 19, review the plans of the egress system. Identify components of the exit access, exits, exit discharge, and the location of the public way. Try to find one or more instances where the common path of egress travel would be an issue. Calculate one or two instances of maximum egress access travel distance. Look also at exit widths, dead-end corridors, door swings, fire-rated partitions, glazing in fire-rated partitions, and stairways.

## FURTHER REFERENCES

### Websites

*American National Standards Institute:* [www.ansi.org](http://www.ansi.org)

*ASTM International:* [www.astm.org](http://www.astm.org)

*California Building Standards Commission:* [www.bsc.ca.gov](http://www.bsc.ca.gov)

*California Department of Housing and Community Development:* [www.hcd.ca.gov](http://www.hcd.ca.gov)

*International Association of Plumbing and Mechanical Officials:* [www.iapmo.org](http://www.iapmo.org)

*International Code Council:* [www.iccsafe.org](http://www.iccsafe.org)

*International Code Council Online Library:* [publicecodes.citation.com](http://publicecodes.citation.com)

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———. *International Residential Code*. Washington, DC: International Code Council.

———. *2009 IBC Handbook: Fire- and Life-Safety Provisions*. Washington, DC: International Code Council.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. According to the IBC, whether a room is required to have two exit access points or just one is primarily dependent on two factors: occupant load and
  - A. whether the building is sprinklered
  - B. maximum travel distance
  - C. common path of egress travel
  - D. occupancy group
  
2. According to the IBC, which of the following are considered parts of the means of egress?
  - I. common path of travel
  - II. exit
  - III. exit access
  - IV. public way
  - V. exit discharge
  - A. I, II, and V
  - B. II, III, and V
  - C. I, II, III, and IV
  - D. II, III, IV, and V
  
3. According the IBC, dead-end corridors in non-sprinklered buildings are limited to a maximum of
  - A. 10 ft (3048 mm)
  - B. 20 ft (6096 mm)
  - C. 30 ft (9144 mm)
  - D. 50 ft (15 240 mm)
  
4. Which of the following is an INCORRECT statement about fire-rated door assemblies?
  - A. Either hinges or rated pivots may be used.
  - B. Under some circumstances a closer is not needed.
  - C. Labeling is required for both the door and frame.
  - D. Doors may be held open with automatic-closing devices.

5. According to the IBC, which of the following is NOT an exit?
- A. a door from a stairway to the outside
  - B. a stairway in a three-story building
  - C. an exit passageway
  - D. a corridor
6. In most cases, the minimum width of a corridor serving an occupant load of 55 is
- A. 36 in (914 mm)
  - B. 42 in (1067 mm)
  - C. 44 in (1118 mm)
  - D. 48 in (1219 mm)
7. Exit routes in commercial buildings may NEVER pass through
- A. foyers
  - B. kitchens
  - C. reception rooms
  - D. work rooms
8. In a nonsprinklered building, a large conference room requires two means of egress. If the rectangular room has a diagonal dimension of 96 ft (29.26 m), what is the minimum distance required between the two egress points?
- A. 24 ft (7.32 m)
  - B. 32 ft (9.75 m)
  - C. 48 ft (14.63 m)
  - D. 64 ft (19.50 m)
9. The greatest possible distance that the occupant of a building may need to traverse before reaching an exit is called the
- A. exit passageway
  - B. common path of egress travel
  - C. dead end limit
  - D. travel distance

10. When fully open, doors cannot project into the required egress width by more than
- A. 3<sup>1</sup>/<sub>2</sub> in (89 mm)
  - B. 4 in (102 mm)
  - C. 7 in (178 mm)
  - D. 10 in (254 mm)

# 21

## SUSTAINABLE DESIGN

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### EXERCISES

#### Exercise 1

Review the various details that have been completed for the Chair Showroom during the course of the semester. Research and suggest sustainable materials that could be used for them. Select a detail and revise it to improve its sustainability.



**Exercise 2**

Research and suggest sustainable finish materials that could be used for the Chair Showroom and that would work as well as standard materials. Include the supporting structure for the finishes as well as the finishes themselves.

## FURTHER REFERENCES

### Websites

*American Society of Interior Designers*: information about sustainable design, [www.asid.org/designknowledge](http://www.asid.org/designknowledge)

*Athena Sustainable Materials Institute*: [www.athenasmi.ca](http://www.athenasmi.ca)

*Building Green*: [www.buildinggreen.com](http://www.buildinggreen.com) (subscription needed)

*Certified Forest Products Council*: [www.certifiedwood.org](http://www.certifiedwood.org)

*Consortium for Research on Renewable Industrial Materials*: [www.corrim.org](http://www.corrim.org)

*Scientific Certification Systems*: Forest Certification Program, [www.scs-certified.com/nrc](http://www.scs-certified.com/nrc)

*Forest Stewardship Council*: [www.fscus.org](http://www.fscus.org)

*Green Globes*: [www.thegbi.org](http://www.thegbi.org)

*Green Seal*: [www.greenseal.org](http://www.greenseal.org)

*Healthy Building Network*: [www.healthybuilding.net](http://www.healthybuilding.net)

*International Tropical Timber Organization*: [www.itto.int](http://www.itto.int)

*Life Cycle Assessment 101*: basics of life-cycle assessment, [www.epa.gov](http://www.epa.gov) (search for “LCA 101”)

*Pharos Project*: sustainable materials, [www.pharosproject.net](http://www.pharosproject.net)

*Rainforest Alliance*: [www.smartwood.org](http://www.smartwood.org)

*U.S. Green Building Council*: LEED and other programs, [www.usgbc.org](http://www.usgbc.org)

*Whole Building Design Guide*: [www.wbdg.org](http://www.wbdg.org)

### Books

Bonda, Penny, and Katie Sosnowchik. *Sustainable Commercial Interiors*. Hoboken, NJ: John Wiley & Sons.

Spiegel, Ross, and Dru Meadows. *Green Building Materials*. Hoboken, NJ: John Wiley & Sons.

Wilson, Alex, ed. *GreenSpec Directory*. Brattleboro, VT: BuildingGreen.

Wilson, Alex, and Mark Piepkorn. *Green Building Products: The GreenSpec Guide to Residential Building Materials*. Gabriola Island, BC: New Society Publishers.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. A building carries a rating of three globes. Under what system was it designed and certified?
  - A. Greenguard Environmental Institute
  - B. Green Building Initiative
  - C. NAHB Green Building Standard
  - D. LEED
  
2. Of the following programs, the one that is run by the Environmental Protection Agency is
  - A. LEED
  - B. Green Globes
  - C. Energy Star
  - D. the Green Building Initiative
  
3. In the LEED rating system for commercial interiors, which category is worth the most possible points?
  - A. Energy and Atmosphere
  - B. Indoor Environmental Quality
  - C. Materials and Resources
  - D. Water Efficiency
  
4. Which of the following is NOT part of a life-cycle assessment?
  - A. risk-benefit analysis
  - B. inventory analysis
  - C. impact assessment
  - D. improvement analysis
  
5. An interior designer wants to reduce the ecological impact of using wood products. Which of the following practices is LEAST certain to contribute to this goal?
  - A. using products with the FCS label
  - B. specifying that an interior be LEED certified
  - C. detailing with reclaimed wood
  - D. designing with alternative wood materials

6. In the United States, the standards that call for the lowest VOC content are those established by the
- A. Environmental Protection Agency
  - B. LEED certification requirements
  - C. state of Massachusetts
  - D. South Coast Air Quality Management District
7. An office building being designed will contain a majority of open-plan work space. Which of the following strategies could the interior designer suggest to the architect to best improve energy efficiency while meeting the needs of space planning?
- A. planning for displacement ventilation
  - B. maximizing the use of daylighting
  - C. conforming to ASHRAE Standard 90.1
  - D. requiring building commissioning
8. Gypsum wallboard is recovered from a demolished building for use as soil amendment. This is an example of a product that is
- A. renewable
  - B. post-consumer
  - C. post-industrial
  - D. recycled
9. In which year did the federal government ban the use of lead-based paint in housing?
- A. 1973
  - B. 1978
  - C. 1983
  - D. 1990
10. The design and detailing of a sustainable workstation could best be achieved by using all of the following EXCEPT
- A. specifying low VOC adhesives
  - B. using countertops of recycled material
  - C. detailing with straw particleboard
  - D. finishing with reclaimed wood

# 22

## BUILDING INVESTIGATION

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### EXERCISE

#### Exercise 1

Perform the field measurement of an interior finished space.

#### Procedure

Follow the suggested procedure for measuring spaces given in ICD Ch. 22. At least two site visits will be needed. Work in teams of two or three. At least two people are needed for accurate and easy measurement; if teams of three are used, two can measure while the third records the information.

The following checklist will help you remember the information and dimensions which need to be included in all measured drawings.

1. direction of north
2. overall length and width of spaces
3. ceiling heights, wall lengths (including alcoves and niches)
4. location of all openings with notes on where they lead
5. size of all openings
6. size and location of all trim and casings
7. direction of door swings
8. type and operation of windows
9. location of switches, outlets, and lights (horizontal and vertical position)
10. location of existing plumbing, plumbing fixtures, and gas lines/pipes
11. location and size of baseboard heating units, radiators, air supply and return, ducts, and so on

12. location of miscellaneous items such as thermostats, doorbells, window treatment hardware, intercoms, alarms, security system components, and so on
13. size and location of existing cabinetry, with information about interior configuration
14. size and location of existing appliances and other equipment, especially those to be reused
15. notes on whether dimensions are rough or to finished face of partitions

### What to Take to the Site

The following items should be brought with you to the site.

- clipboard
- paper and pens or pencils
- 25 ft (8 m) tape measure,  $\frac{3}{4}$  in (19 mm) wide (or a 100 ft (30 m) tape if the space is large)
- camera (optional)
- feet/inches calculator (optional)

### Tips

- Before you leave the site, add up the secondary dimensions. Be sure the totals equal the overall measurements you took in step 2.
- Use a sonic measuring device for large spaces or where dimensions are difficult to make with a tape measure.
- Decide on an accuracy tolerance for the type of work you will be doing. Generally, measuring walls and openings to within  $\frac{1}{4}$  in (6 mm) accuracy is sufficient and about the best you can reasonably do with a tape measure.  $\frac{1}{8}$  in (3 mm) accuracy is about the best you will ever do if you take a lot of time.
- Where dimensions are critical, make several measurements along the height of walls, door openings, and so on to determine whether the line of measurement is plumb. For example, the edge of an outside corner of a wall could be  $\frac{3}{8}$  in longer near the floor than near the ceiling due to normal construction tolerances.
- If there is a lot of detail in one area, make an enlarged sketch of just that area so that you have plenty of room to show dimensions and make notes.
- Plan on at least two trips to the site. You always forget something the first time around. Take a camera, too, especially if the site is a long way from the office or classroom.

### Final Product

One sheet with a drafted floor plan and one elevation as directed by your instructor. Draw the floor plan and elevation at a scale of  $\frac{1}{4}$  in = 1 ft 0 in (1:50) with pencil or with CAD as directed by your instructor.

## FURTHER REFERENCES

### Books and Other Publications

Friedman, Donald. *The Investigation of Buildings: A Guide for Architects, Engineers, and Owners*. New York: W. W. Norton & Company, Inc.

McDonald, Travis C. Jr. *Understanding Old Buildings: The Process of Architectural Investigation*. Washington, DC: National Park Service, U.S. Department of the Interior.

**QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE**

1. When doing a field survey of a core and shell space for a retail tenant, the LEAST important mechanical system element to determine is the
  - A. location of terminal reheat units
  - B. positions of main sprinkler supply line valves
  - C. width of supply air ducts
  - D. height of roof drain lines above the floor
  
2. Which of the following is a relatively inexpensive instrument that may be used by one person to take quick and accurate field measurements of a large interior space?
  - A. 100 ft (30 m) tape measure
  - B. sonic distance measuring device
  - C. reflectorless electronic distance measuring device
  - D. laser scanner
  
3. Who is responsible for verifying that sprinkler piping does not interfere with recessed downlights?
  - A. architect
  - B. interior designer
  - C. electrical engineer
  - D. mechanical engineer
  
4. In a rural area, a client has asked an interior designer to assemble a team to build an addition for a new bedroom and bathroom. Which of the following is NOT needed on the team?
  - A. architect
  - B. plumber
  - C. electrician
  - D. civil engineer
  
5. On an interior design project, determining where sprinkler heads will be located is the joint responsibility of the
  - A. interior designer and mechanical engineer
  - B. architect and fire protection engineer
  - C. mechanical engineer and ceiling contractor
  - D. general contractor and fire protection engineer



# 23

## LICENSURE FOR INTERIOR DESIGNERS AND ARCHITECTS

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### EXERCISES

There are no exercises (or solutions to exercises) associated with this chapter.

## FURTHER REFERENCES

### Websites

*ARE*: architect registration examination, <http://ncarb.org/ARE.aspx>

*ASID*: American Society of Interior Designers, [www.asid.org](http://www.asid.org)

*CCAC*: Committee of Canadian Architectural Councils, administered by the Royal Architectural Institute of Canada, [www.raic.org](http://www.raic.org)

*CCIDC*: California Council for Interior Design Certification, [www.ccidc.org](http://www.ccidc.org)

*ICD*: Interior Designers of Canada, [www.idcanada.org](http://www.idcanada.org)

*IDEC*: Interior Design Educators Council, [www.idec.org](http://www.idec.org)

*IDEX California*: IDEX California certification exam, [www.ccidc.org/idex.html](http://www.ccidc.org/idex.html)

*IIDA*: International Interior Design Association, [www.iida.org](http://www.iida.org)

*NCARB*: National Council of Architectural Registration Boards, [www.ncarb.org](http://www.ncarb.org)

*NCIDQ*: National Council for Interior Design Qualification, [www.ncidq.org](http://www.ncidq.org)

### Books

#### ARE Exams

Ballast, David Kent and Steven E. O'Hara. *ARE Review Manual*. Belmont, CA: Professional Publications, Inc.

Ballast, David Kent and Holly Williams Leppo. *Building Design & Construction Systems: ARE Sample Problems and Practice Exam*. Belmont, CA: Professional Publications, Inc.

———. *Building Systems: ARE Sample Problems and Practice Exam*. Belmont, CA: Professional Publications, Inc.

———. *Construction Documents & Services: ARE Sample Problems and Practice Exam*. Belmont, CA: Professional Publications, Inc.

———. *Programming, Planning & Practice: Sample Problems and Practice Exam*. Belmont, CA: Professional Publications, Inc.

Ballast, David Kent. *Schematic Design: ARE Sample Problems and Practice Exam*. Belmont, CA: Professional Publications, Inc.

Ballast, David Kent. *Site Planning & Design: ARE Sample Problems and Practice Exam*. Belmont, CA: Professional Publications, Inc.

Taher, Rima. *Structural Systems: ARE Sample Problems and Practice Exam*. Belmont, CA: Professional Publications, Inc.

#### IDEX California Exam

Ballast, David Kent. *IDEX Essentials: The Power to Pass the IDEX California® Exam*. Belmont, CA: Professional Publications, Inc.

**NCIDQ Exam**

Ballast, David Kent. *Interior Design Reference Manual: Everything You Need to Know to Pass the NCIDQ® Exam*. Belmont, CA: Professional Publications, Inc.

———. *NCIDQ® Section 1 Sample Questions and Practice Exam*. Belmont, CA: Professional Publications, Inc.

———. *NCIDQ® Section 2 Sample Questions and Practice Exam*. Belmont, CA: Professional Publications, Inc.

———. *NCIDQ® Section 3 Practice Exam for the Interior Design Practicum*. Belmont, CA: Professional Publications, Inc.

## QUESTIONS FOR EVALUATING STUDENT KNOWLEDGE

There are no questions associated with this chapter.

# APPENDIX: HANDOUTS

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HOW TO SKETCH DETAILS

COMMON ABBREVIATIONS

ISOMETRIC GRID

## HOW TO SKETCH DETAILS

This handout describes how to use sketching to help develop your interior design details so that they look like you want them to, that they perform their intended functions, and that they are developed enough to use for construction drawings.

Good detailing requires a combination of thinking and sketching. Sketching not only records and communicates your thoughts, but also serves as a critical part of the “think—sketch—revise” process. That is, you have an idea, you quickly sketch it, you look at your sketch and think some more, and then you sketch some more (either separate sketches or tracings). Throughout this process, you are not only refining your sketch, but your thinking as well. This “think—sketch—revise” process only happens with hand sketching—it doesn’t happen with CAD drawing, which is why sketching is so important.

The detailing process consists of the following steps.

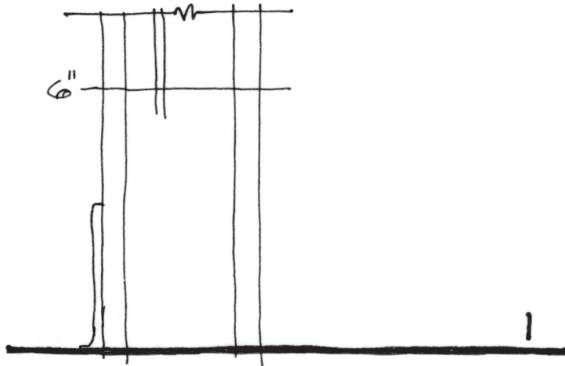
- Step 1.* Determine the design intent of the detail.
- Step 2.* Determine the constraints of the detail.
- Step 3.* Establish functional needs.
- Step 4.* Research any unknowns involving constraints and functional needs.
- Step 5.* Develop concept alternatives and then select the best.
- Step 6.* Apply constructability requirements.

Sketching should start by drawing whatever it is that you know about how you want the detail to look. This may include any or all of the detail’s shape, size, thickness, position relative to other construction, materials, or anything else. The sketches in Fig. I-3 show the development of a simple interior window sill detail.

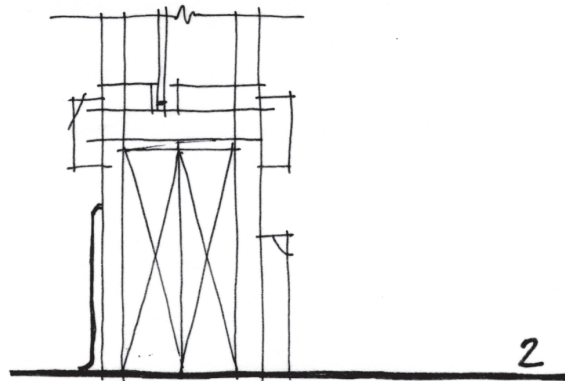
Given conditions

- Partition is 2-1/2" metal studs with 5/8" gypsum wallboard
- Outside is to have a 4" vinyl base
- Inside is to have a wood base
- Glass should be toward the outside
- Sill should be about 6" above floor
- Floor is not very level
- Window frame should be wood
- Design to be "transitional" in appearance

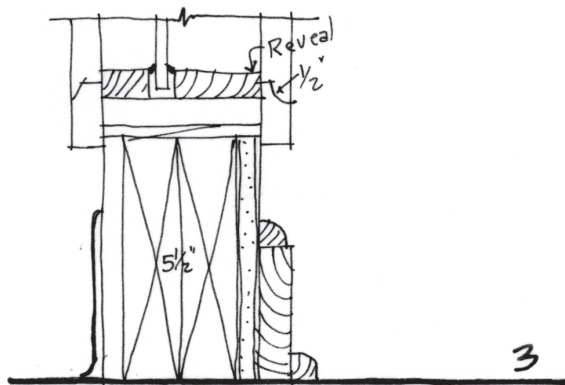
Step 1:  
Sketch what is known about the problem.



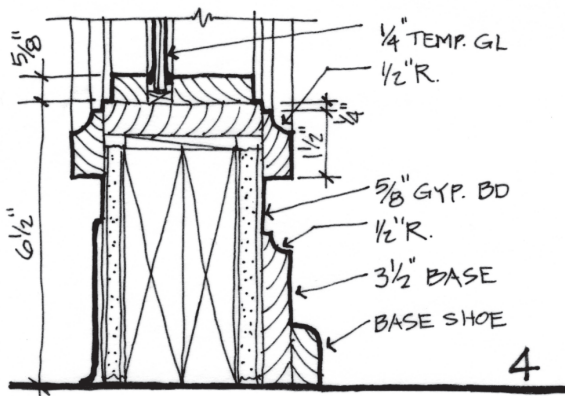
Step 2:  
Block out what you think the overall configuration will be. In this case it shows 3/4" thick trim; rough blocking to support the window frame (building a metal stud partition this short is not practical), and some beginning ideas about the shape of the trim.



Step 3:  
Some study done about what the "transitional" base should look like. This detail using a base shoe will also accommodate an uneven floor because it can bend a little as the floor rises and falls. Note made to step back the glass framing with a reveal. Note made about using a standard height of rough blocking (5-1/2"). Decision made to continue drywall on blocking.



Step 4:  
Some changes made in wood base detail. Decision made to use a standard 1/2" radius curve on all wood trim pieces. Base shoe drawn more accurately. Dimensions added and some notes added. Assuming that the detail has been coordinated in three dimensions with the jambs, it is ready for review and approval prior to being drafted manually or with CAD.



## Developing Construction Details

*Step 1.* Use a 14 in roll of cheap tracing paper, an architect's scale, and a fine point felt-tip marker. The advantage of using a felt tip for everything is that it prevents you from erasing. You should *not* erase, but trace. If you choose to use a pencil, do not use a hard, sharp point. A soft pencil or felt tip will encourage you to think in broad terms without worrying about the little details of drawings.

*Step 2.* Start with what you know. Using an appropriate scale (usually 3 in = 1 ft or half-size), draw a rough outline of the existing construction and how you think you want your detail to look. Generally, you should draw freehand, without instruments. Use the architect's scale to get you close to being to scale so that you can see the proper relationships of sizes of adjacent parts.

*Step 3.* Lay a second layer of tracing paper over the first. Trace the portions that you want to keep and redraw elements you want to change or add to. You may add notes to yourself, do little three-dimensional sketches to help you understand the detail, ask questions of your coworkers, and do research during the development process.

You may also need to create supplemental sketches. For example, you may be developing a section detail, but find that you must do some elevations and plan details in order to fully understand the design and construction implications.

*Step 4.* Repeat step 3 as many times as necessary. Some simple, standard details can be developed with just one or two sketches in a few minutes. Complex, nonstandard details that are related to many other parts of the design project may take hundreds of sketches and weeks of work to fully develop.

*Step 5.* Trace the final drawing ignoring the guidelines and other temporary lines from your previous sketches. Include dimensions and notes as necessary to fully describe your drawing.

## Things to Remember

- Start with what you know.
- Bumwad is cheap.
- Trace, don't erase.
- Your marking instrument will affect your thinking.



## COMMON ABBREVIATIONS

The following list provides common abbreviations used on construction drawings and other documents.

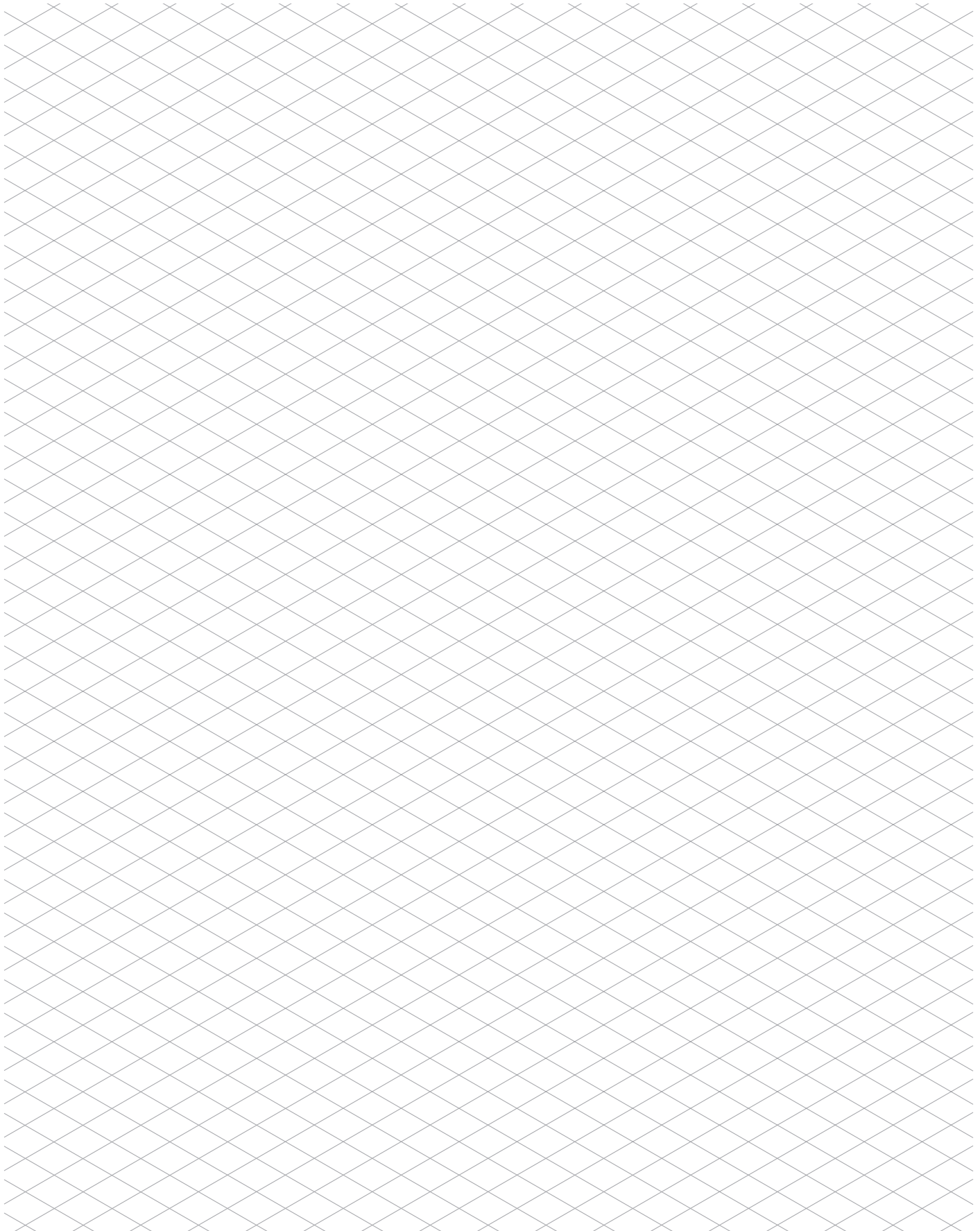
2 ×	nominal 2 in thick wood member (by any other dimension)
8/4	eight quarters (2 in) nominal hardwood member thickness
ACOUS	acoustical
AFF	above finished floor
AHU	air handling unit
ALUM	aluminum
BLDG	building
BLKG	blocking
BM	benchmark
BR	bedroom
CAB	cabinet
CARP	carpet
CER TILE	ceramic tile
CG	corner guard
CH BD	chalkboard
CL	centerline
CLG	ceiling
CLO	closet
CLR	clear
COL	column
CONC	concrete
CORR	corridor
CMU	concrete masonry unit
C to C	center to center
DBL	double
DET	detail
DF	drinking fountain
DIA	diameter
DIAM	diameter
DIFF	diffuser
DO	ditto
DW	dishwasher
EL	elevation
ELEC	electrical
ELEV	elevation or elevator
EQ	equal
EXH	exhaust

EXT	exterior
FD	floor drain
FF	finished floor
FIN FL	finished floor
FPRF	fireproofing
GFRG	glass-fiber reinforced gypsum
GI	galvanized iron
GL	glass
GLU LAM	glued laminated
GWB	gypsum wallboard
GYP BD	gypsum wallboard
HC	hollow core
HDBD	hardboard
HGT	height
HM	hollow metal
HORIZ	horizontal
HPDL	high pressure decorative laminate
HT	height
HW	hardwood
HWD	hardware or hardware device
INSUL	insulation
KD	knock down
LAV	lavatory
LIB	library
LR	living room
LTG	lighting
M	men
MAX	maximum
MECH	mechanical
MET	metal
MFG	manufacturer or manufacturing
MIN	minimum
MTL	metal
NA	not applicable
NIC	not in contract
NO	number
NON COM	noncombustible
NTS	not to scale
OC	on center
OFF	office

OPNG	opening
OPP	opposite
PART BD	particleboard
PERF	perforated
PLAS	plaster
PLY WD	plywood
PNT	paint
POL	polished
PTN	partition
QTY	quantity
R	radius or riser
REG	register
REQD	required
SA	supply air
SC	solid core
SIM	similar
SM	sheet metal
SP	space
SQ FT	square foot
SQ IN	square inch
SS	stainless steel
STL	steel
STOR	storage
T & B	top and bottom
T & G	tongue and groove
TEMP	tempered
THK	thick or thickness
TYP	typical
UL	Underwriters Laboratories
VERT	vertical
W	women
W/	with
WD	width or wood
WH	water heater
W/O	without
WP	working point

## ISOMETRIC GRID

This isometric grid can be used to help you quickly develop three-dimensional sketches and isometric details. It may be used either as an underlay, or it can be drawn on directly.



grid 1/4" apart.    6" = 1'-0": each square = 1/2"    3" = 1'-0": each square = 1"    1-1/2" = 1'-0": each square = 2"