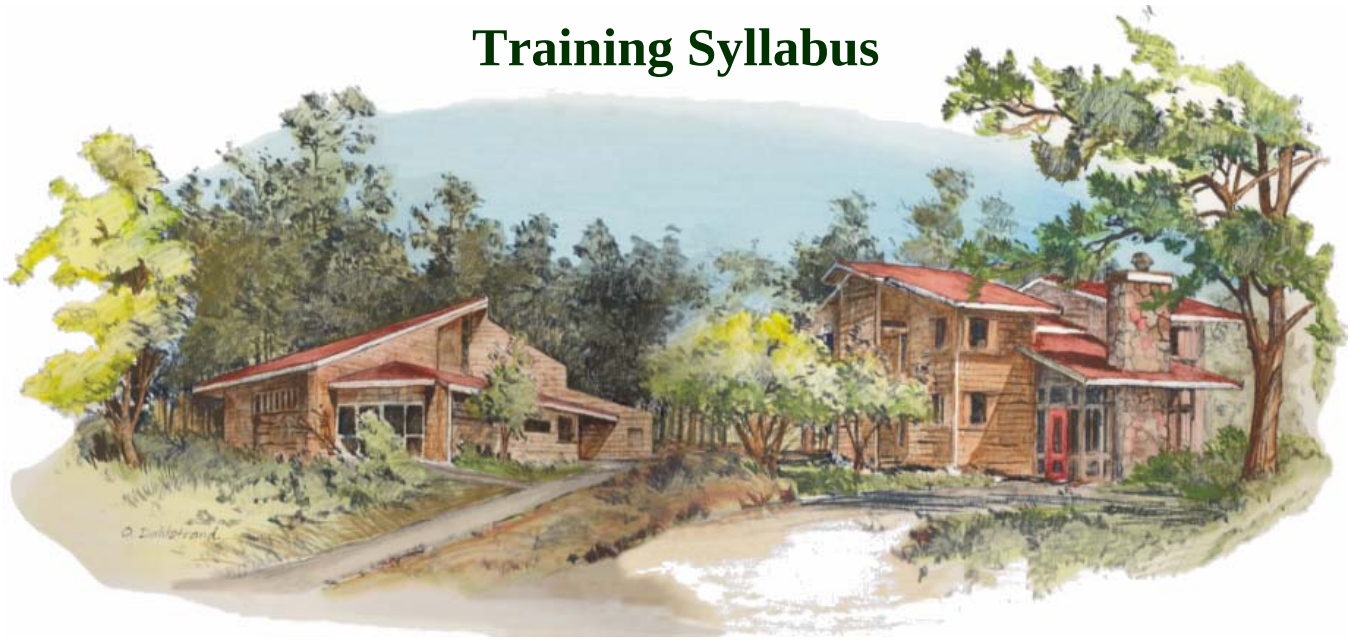
State of California . The Resources Agency . Department of Parks and Recreation

INTERMEDIATE CARPENTRY SKILLS

September 24-29, 2006

Training Syllabus



William Penn Mott Jr. Training Center

State of California

M e m o r a n d u m

Date: August 8, 2006

To: Supervisor

From: **Department of Parks and Recreation**
William Penn Mott Jr. Training Center

Subject: Employee Attendance at Formal Training
Intermediate Carpentry Skills

Am employee from your office will soon be attending the formal training program described in the attached. Please insure that the employee is fully prepared to attend the session and that the groundwork is laid for the employee's implementation of the training upon returning to work.

You can assist with capturing the full value of the training by taking the following steps:

Prior to Training

1. Make sure that **specific** employee needs are identified and, if necessary, called immediately to the attention of the Training Coordinator.
2. Review with the employee the reason for the employee's attendance.
3. Review objectives and agenda with the employee.
4. Discuss objectives and performance expected after the training.

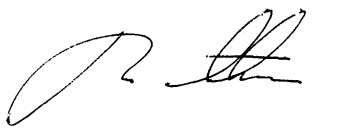
Immediately Following Attendance

1. Discuss what was learned and intended uses of the training.
2. Review the employee's assessment of the training program for its impact at the workplace and review the due date of the Post-Training Evaluation form.
3. Support the employee's use of the training at the work place.

Prior to Three Months Following Training

1. Employee after discussion with the supervisor login to the Employee Training Management System (ETMS) to complete the Post-Training Evaluation form.
2. Supervisor evaluates the effectiveness of the training on the employee's job performance and login to the ETMS to complete the Training Effectiveness Assessment form**.**

Thank you for your assistance in seeing that the full benefit of training is realized.



Broc E. Stenman
Department Training Officer

Attachment

cc: Participant

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Mission Statement
Training Office

The mission of the Training Office is to improve organizational and individual performance through consulting, collaboration, training and development.

TRAINING CENTER STAFF

Broc Stenman .....Department Training Officer
Joanne Danielson ..... Academy Coordinator
Chuck Combs.....Training Specialist
Michael Green.....Training Specialist
Dave Galanti .....Training Specialist
Michelle Gardner.....Cadet Training Officer
Connie Breakfield.....Cadet Training Officer
Pat Bost .....Assistant Program Coordinator
Pamela Yaeger .....Assistant Program Coordinator
Bill Spencer.....Assistant Program Coordinator
Summer Kincaid.....Assistant Program Coordinator
Brian Petersen .....Program Assistant

THE MISSION

of the California Department of Parks and Recreation is to provide for the health, inspiration and education of the people of California by helping to preserve the state's extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high quality outdoor recreation.

FORMAL TRAINING GUIDELINES

Welcome to formal training, an essential component in your career development.

Since 1969, our Department has been providing a continuously changing number of diverse training programs at its Training Center. The Department strives to enhance your learning and job performance with formal training of the highest quality. This fact demonstrates the commitment your Department has made to you in your service to the public. This commitment is costly and represents an important investment in you and your career. You and the Department realize a return on that investment by your positive participation and post training follow-through.

The program you will be participating in is described in this training syllabus, which outlines what you can expect from this training and what is expected of you. This syllabus details what you should do before you leave for training; what to do when you arrive; what you will be doing while in training; and, importantly, what you should be able to do when you return to your work site. Specifically:

1. SYLLABUS: The syllabus is now accessible on the Employee Training Management System (ETMS). You should print a copy of the syllabus to bring with you to class. Your copy of this syllabus is an important part of your training experience and should be brought with you to training. Read it before you arrive and review it following the program along with material you received at training.

2. PRE-TRAINING ASSIGNMENTS: Your completion of pre-training assignments is essential to the success of your training. You are responsible for all reading assignments in preparation for classroom sessions. Time will be provided during working hours to accomplish any assignments which involve either individual or group efforts and resources. (Pre-training assignments are listed in the "Training Attendance Requirements" section.)

3. TRAVEL: Arrange your travel to and from the training through your District or Office. (No reimbursement for travel expense - including per diem costs - will be approved for travel not specifically authorized in advance by the District Superintendent.) Individuals may claim reimbursement for incidental expenses

incurred as outlined in DAM 0410.6. The Training Center does not have the capability to provide transportation to/from Monterey Airport.

4. HOUSING: Housing will be assigned to you on a shared-room basis and will be available from 3 p.m. on the date of arrival to 12 noon on the date of departure. The Department provides your room and board expenses at the Training Center only. No per diem allowance will be authorized for living off-grounds. This does not preclude living off-grounds at your own expense. Please advise the Department Training Officer no later than one week before your scheduled arrival if you plan to live off-grounds. No animals are permitted in Asilomar housing. In the event of an emergency, staff must know your room assignment, therefore, you may not switch rooms without staff approval. Overnight guests are not allowed in the buildings unless registered beforehand at the front desk in Asilomar's Administration Building. Quiet hour for lodge living areas is 10 p.m.

HOUSING CANCELLATION POLICY: If you do not need lodging or must change or cancel your reservation, you must contact the Training Center at least 72 hours prior to your date of arrival. The Training Center is committed to ensuring that the reservation that has been made for you is accurate and needed.

5. MEALS: Meals will be provided, semi-cafeteria style, from dinner on the date of arrival through lunch on the date of departure. Meals will be served at 7:15 a.m. for breakfast, 12 noon for lunch, and 6 p.m. for dinner. Hot or box lunches may be provided on some days. If you require a special diet, notify the Asilomar Chef at 831-372-8016 no later than one week before your scheduled arrival.

6. OFF-GROUNDS ACCOMMODATIONS: When authorized to stay off-grounds by the Department Training Officer, the Training Center will pickup the cost of your room and meals at the current DPR Asilomar rate. If you stay off grounds and have meals on grounds, the Training Center will authorize only what the Department pays Asilomar for lodging.

7. CLOTHING: Field uniforms of “Required Uniform Items” (not including optional items) will be worn daily by all uniformed employees during formal training sessions unless specified in the Program Attendance Checklist (See “Required Uniforms Items” in the appropriate Uniform Handbook). Non-uniformed employees should wear apparel normally worn on the job. Appropriate attire includes apparel suitable for casual office dress. It does not include such items as shorts, T-shirts or tank tops (special clothing requirements for your program may be described in "Attendance Checklist" section).

Because we are on the conference grounds with many other groups, and the image we project as State Park employees is important not only during working hours but off duty hours as well, your informal sportswear should be appropriate.

8. ROOM SAFES: Recently two safes have been installed in each of the lodge rooms used by the Training Center (Live Oak, Tree Tops, and Deer Lodge). These safes are a type that allows the user to input their own combination of numbers to facilitate opening and closing. The Training Center has a master key for emergency entry. Safes are to be left in the open position when checking out of your room.

9. WEAPONS: Weapons are permitted in rooms under the following conditions. Authorized firearms and magazines stored while at the Training Center shall be in a safe condition and stored in one of the following locations: your room safe in Live Oak, Tree Tops, or Deer Lodge, one of the Training Center's safes in the Whitehead Room or secured in your vehicle.

10 ALCOHOLIC BEVERAGES: Participants shall not possess or consume alcoholic beverages in common areas (living room) while on the Asilomar Conference Grounds unless provided and hosted by Concessionaire Delaware North.

11. SMOKING: Smoking is not permitted in the Training Center or in any lodge or guest room on the Asilomar Conference Grounds.

12. TRAINING CENTER: The Training Center is located on Asilomar Conference Grounds, part of Asilomar State Beach. The Conference Grounds are operated for our Department by a concessionaire, and all lodging and food services are provided to us by employees of the concessionaire. Constant efforts are made to maintain a sound, harmonious working relationship between the Department and concessionaire. None of us can expect preferential treatment for any reason and, as a departmental employee, you will be expected to join in our continuing effort toward an effective relationship with each Asilomar concession staff member. On occasion, non-departmental groups may be staying in the same lodges. It is imperative that you represent the Department well on and off duty.

13. REGISTRATION: When you arrive at Asilomar Conference Grounds, go directly to the front desk at the Asilomar Administration Building for your room key and dining room ticket. If you require vegetarian meals, notify the front desk representative and your meal ticket will be marked accordingly.

14. COURSE LEADERS: The formal training you will attend is developed and, for the most part, conducted by experienced State Park employees in field and staff positions. Some courses will be conducted by qualified instructors from other agencies and educational institutions. Your course leaders have proven their ability and knowledge in their profession, and provide a level of expertise difficult to match.

15. TRAINING CENTER STAFF: A Training Center staff member has been assigned responsibility for your training group as well as for your training program. That staff member usually serves as a Course Leader as well as a Coordinator. During the program, you may be asked to assist Training Center staff in the logistics of your training program (organizing field trip transportation, supervising classroom breaks, etc.). Center staff will do all within their power to make your training experience pleasant and meaningful.

16. TRAINING MATERIALS: May be made available to you at both your unit and the Training Center. Handout materials issued at your unit should be brought to training for possible use. A conference binder or notebook will be issued to you at the training session for note taking and convenience in handling materials. Copies of DAM and DOM will be available to you for self-study. Bring your own pens and pencils.

17. ATTENDANCE: Regular attendance is a critical course requirement and your participation is important to the success of this training. **An absence of more than 10% of the course hours constitutes grounds for dropping a participant from the course.** The Training Center Manager may modify this requirement based upon participant knowledge level and/or the portion of the course missed. (There is a separate attendance policy for Basic Visitor Services training contained in the Participant Handbook).

18. COLLEGE CREDIT: Most training programs are accredited by Monterey Peninsula College for lower division credit. If you successfully complete an accredited program, you will receive either a letter grade or a credit/no-credit designation.

19. VEHICLES: All vehicles should be parked in the lots adjacent to the Training Center. Any questions regarding use of a State vehicle while at the Training Center should be discussed with your supervisor prior to your departure for training, or with your Program Coordinator while at the Training Center.

20. BICYCLES: If you bring your bicycle, store it in the bicycle shed next to the Training Center. Bicycles may not be brought into any building nor chained to lamp posts, trees, etc. The Training Center has a limited number of bicycles available for your use. Prior to your use, you are required to complete a safety inspection and sign a waiver which is posted in the bicycle shed.

21. MAIL: Mail forwarded to you during your time at the Center should be addressed to you in care of:

Department of Parks and Recreation
WILLIAM PENN MOTT JR. TRAINING CENTER
P. O. Box 699, Pacific Grove, CA 93950

22. CELL PHONES: As a courtesy to your fellow participants and course leaders ensure that your cell phone is turned off during classes. Participants should not be receiving or making cell phone calls during class time. Please limit those calls to your breaks.

23. FAX: The Training Center's FAX number is (831) 649-2824.

24. TELEPHONE: Limit phone calls during classroom hours to urgent business or emergencies. Anyone wishing to contact you by telephone during working hours should call the Center at (831) 649-2954. Calls after 5 p.m. or during weekends should be made to (831) 372-8016, Asilomar Conference Grounds, and the caller should tell the switchboard operator you are with a Department of Parks and Recreations training group.

25. LAUNDRY AND DRY CLEANING: May be taken care of by you at one of several local establishments. An iron is available for 24-hour checkout from the Training Center front desk.

26. RECREATION: Facilities available on grounds include a heated swimming pool, ping-pong and pool tables, and a volleyball court. The Monterey area offers horseback riding, golf, tennis, racquetball, deep sea fishing, and many historical landmarks and scenic sights to explore.

27. POST-TRAINING ASSIGNMENTS: In connection with formal training are to be completed under the direction of your supervisor. See "Program Attendance Requirements" in this syllabus.

28. COFFEE BREAK REFRESHMENTS: Will be available throughout each session at the Center. You will be asked to contribute to the "Hospitality Fund" to defray expenses. Please bring your own coffee cup.

PROGRAM ATTENDANCE CHECKLIST

To assist you in your preparation for formal training session at the William Penn Mott Jr. Training Center, the following list is provided:

_____1. Read and understand the Intermediate Carpentry Skills Program Syllabus prior to your arrival at the Training Center.

_____2. Complete the pre-training assignment.

_____3. Arrange your travel through your District Office.

_____4. Remember to bring the following with you to training:

Program Syllabus and all pre-training assignments.

Personal Safety Equipment (eye, ear, head, and hand protection). **(Eye protection is required at all times on all lab projects.)**

Coveralls or appropriate work clothing.

Foul Weather Gear (Due to the possibility of rain during the program, it is required that you bring rain gear with you).

Proper Field Uniform (not including optional items) (Review DOM 0500).

Coffee cup, calculator, pencils, pens, alarm clock.

Note: The pre-training assignment will be collected during the program orientation. Completion of the pre-training assignment and bringing the correct personal safety equipment are mandatory and will count for 20% of your program grade.

If you have questions or need assistance, call the Program Coordinator Chuck Combs: 831-649-7124 or email: chuck@parks.ca.gov. He will be happy to offer suggestions.

POST-TRAINING ASSIGNMENT

Prior to ninety days after the completion of this program, the employee and his/her supervisor should sit down and discuss the impact and assess the effectiveness this program has had on the employee. Then both the supervisor and employee should login to the Employee Training Management System (ETMS) and complete the Post-Training Evaluation form (an email will be sent to both employee and supervisor notifying them that the evaluation needs to be completed). Once you login to the ETMS, you will need to fill out the evaluation form before you will be able to do anything else.

The post-training evaluation process is intended to provide a bridge between classroom instruction and the on-the-job application of training. The information obtained through this process will assist the training participant, supervisor, and Training Center in providing a return on the investment the Department has on training.

INTERMEDIATE CARPENTRY SKILLS GROUP 34–AGENDA–September 24-29, 2006

Lead Instructor: Ken Glaspie APCs: Cairns, Whitsel, and Sturges

Sunday		
September 24		
1500-	Registration: *Check in at the Asilomar Administration Building.*	All

Special Notice: This program will be conducted at the Mott Training Center Shop Annex, 2211 Garden Road, Building C, Monterey, California. Vans are available to transport you to and from the Shop Annex and will leave the Mott Training Center promptly at 0800 daily and return after 1700. Exception as noted below in schedule.

Monday		
September 25		
0830-0930	Orientation/Registration/Expectations	Combs
0930-1100	Wood Frame Construction, Review	Glaspie
1100-1200	Blueprint Reading, Review	Moore
1200-1300	*Lunch*	
1300-1400	Task Hazard Analysis/ADA	Spencer
1400-1500	Tools & Equipment and Maintenance	Cairns
1500-1630	Floor Framing	Glaspie/Sturges
Tuesday		
September 26		
0830-1000	Wall Layout, Siding and Decking	Glaspie/Cairns
1000-1200	Wall Construction, Framing, Rough Openings	Glaspie/Cairns
1200-1300	*Lunch*	
1300-1630	Rotating Labs	All
	Doors and Windows	Sturges
	Roofs and Roof Framing	Cairns
	Maintenance Training Structure	Glaspie
Wednesday		
September 27		
0830-1200	Rotating Labs (Continued)	All
1200-1300	*Lunch*	
1300-1630	Rotating Labs (Continued)	

INTERMEDIATE CARPENTRY SKILLS GROUP 34–AGENDA–September 24-29, 2006

Lead Instructor: Ken Glaspie APCs: Cairns, Whitsel, and Sturges

Thursday
September 28

0830-1200	Rotating Labs (Continued)	All
1200-1300	*Lunch*	
1300-1500	Rotating Labs (Continued)	
1500-1630	Cleanup	

Friday
September 29

0830-0930	Assessing Building Repairs	Glaspie/Cairns
0930-1030	Examination	Combs
1030-1130	Exam Review	Combs
1130-1230	Program Summary and Evaluation	Combs
1230-	Lunch and Departure	

CARPENTRY SKILLS TRAINING PROGRAM 36 HOURS

PROGRAM OUTLINE

	TOTAL HOURS
ORIENTATION	1.5
CARPENTRY SKILL AREAS	26.0
Frame Construction	
Layout Applications	
Roofing	
Finish Carpentry (Exterior)	
CARPENTRY TOOLS	4
Hand Tools, Power Tools and Stationary Tools	
Carpentry Tool Application and Use	
Special Tools	
Tool Maintenance	
SPECIAL TOPICS	4
Building Codes	
Construction Blueprint Reading	
Safety and THA / Accessibility-ADA	
Reading a Building for Repairs	
PROGRAM SUMMARY AND EVALUATION	.5
TOTAL HOURS	36.0

INTERMEDIATE CARPENTRY SKILLS

PROGRAM ORIENTATION

Purpose: Participants will meet one another and the Program Coordinator and Instructor. The group will share expectations for the training program. In addition, program content will be reviewed and registration for Monterey Peninsula College completed.

Performance Objectives: By the close of the session the participant will

1. Review program content, procedure and evaluation processes.
2. Complete Monterey Peninsula College registration materials.
3. Adhere to all Training Center guidelines.
4. Review pre-training assignment.

CARPENTRY SKILLS AREAS

Purpose: To provide a thorough introduction to Carpentry Skills, which will enable Park Maintenance Workers to make repairs and modifications to existing park buildings and facilities.

Performance Objectives: By the close of the session the participant will

1. Identify the components of a typical wood frame building.
2. Identify common materials used in wood frame building construction.
3. Construct a wood frame wall with rough openings for door and window.
4. Correctly install a pre-hung door and aluminum frame sliding window.
5. Correctly apply roof sheeting and composition shingles.
6. Match lumber and other materials with the proper construction use.

CARPENTRY TOOLS

Purpose: To enable the Park Maintenance Worker to use a wide variety of carpentry hand and power tools in order to fulfill the responsibility of maintaining, repairing and constructing park buildings.

Performance Objectives: By the close of the session the participant will

1. Select the proper tools for carpentry projects.

2. Demonstrate the ability to maintain tools and equipment in proper working condition.

3. Demonstrate safe use of carpentry tools and equipment.

SPECIAL CARPENTRY TOPICS

Purpose: To provide the participant with the basic knowledge needed to construct and repair wood structures with minimum supervision.

Performance Objectives: By the close of the session the participant will

l. Demonstrate the ability to read construction blueprints and drawings.

2. Demonstrate an understanding of the purpose, use and requirement of building codes.

CARPENTRY PROJECT PRACTICAL

Purpose: To provide the participant with an introduction to construction techniques and an opportunity to practice acquired carpentry knowledge and skills.

Performance Objectives: By the close of the session the participant will

1. Demonstrate the ability to construct or repair small buildings.

2. Demonstrate the ability to identify and use various materials used in building construction.

ASSESSING BUILDING REPAIRS

Purpose: To provide the participant with an introduction to construction techniques and an opportunity to practice acquired carpentry knowledge and skills.

Performance Objectives: By the close of the session the participant will

1. Demonstrate the ability to "read" a building’s visual symptoms and assess the probable structural repairs needed.

2. Develop a systematic approach to making the repairs needed.

INTERMEDIATE

CARPENTRY SKILLS

WORKBOOK

INTERMEDIATE CARPENTRY SKILLS

GENERAL TOPICS

MISSION

The function of the California Department of Parks and Recreation as stated in the Public Resources Code is ".....to acquire, protect, develop, and interpret for the inspiration, use, and enjoyment of the people of the state a balanced system of areas of outstanding scenic recreational and historic importance. These areas shall be held in trust as irreplaceable portions of California's natural and historic heritage".

With the exception of acquisition, the daily routine of every park maintenance worker is summed up in the mission of the Department. Every decision made, and every action taken, by a maintenance worker affects both the resource and the visitor's enjoyment of the resource. Something as small as replacing a missing shingle on a building's roof has a direct bearing on the life of the structure and the condition of its furnishings. Additionally, if the building is historic, the type of shingle and workmanship used in the repair affect the interpretation of the structure. The personal mission of every Park Maintenance Worker must include maximizing the visitors experience and working diligently to preserve the resources entrusted to their care.

SAFETY

On every carpentry project, the maintenance worker must be alert to potential dangers the project may pose to the public, park employees, and self. It is of the utmost importance that all persons on the project site be knowledgeable in the safe and proper use of the tools and equipment they will be using. Although the project supervisor or lead person is responsible for identifying special precautions to be taken, the responsibility for a safe workplace is shared by all employees.

Safety is the single most important subject the maintenance worker must learn about the carpentry (or any other) trade. Accidents do not "just happen" -- they are caused by unsafe acts, unsafe conditions, or a combination of the two. Accidents can be prevented if safety rules are learned and followed. OSHA and CAL-OSHA (Occupational Safety and Health Act) establishes minimum standards of safety, or safety orders, for all phases of industrial activity. The General Industry Safety Orders and Construction Safety Orders apply specifically to building construction. Safety Orders should be available in your unit’s maintenance library. In California the Safety Orders are included in Title 8 of the California Administrative Code.

CODES

All work performed on facilities within the California State Park System must meet acceptable standards. Acceptable standards for Federally owned facilities are found in the Uniform Building Code and the Public Resources Code.

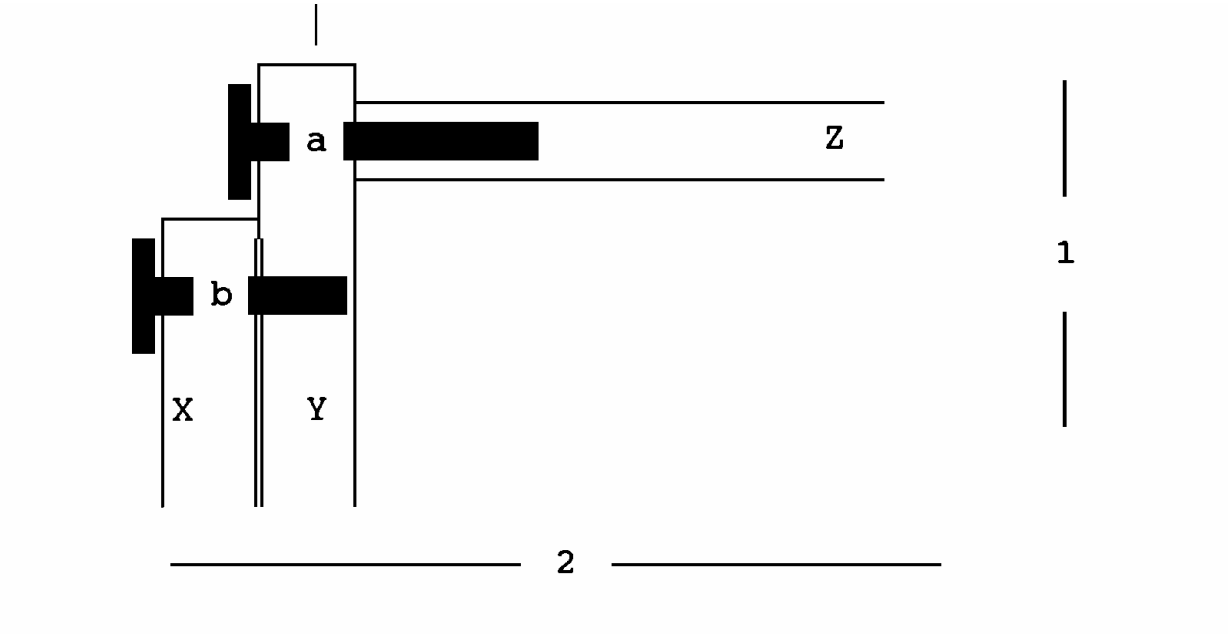
The California Building Code is Title 24 of the California Administrative Code. Title 24 is based on the Uniform Building Code and is the building standard for state owned buildings. The purpose of this code is to insure that structures are safe, accessible, and adequate for their intended use. Although there are significant differences between the two codes, Title 24 adopts many portions of the UBC by reference numbers. It is necessary to refer to both Title 24 and the Uniform Building Code whenever modifying or constructing a California State Park structure. The latest Code edition should be available in every maintenance library.

The California Public Resources Code gives the Department of Parks and Recreation responsibility for preserving California's irreplaceable natural and cultural resources. Two processes which help the maintenance worker fulfill that function are commonly referred to as "CEQA" and "5024". CEQA stands for California Environmental Quality Act and basically says that nothing will be done that will adversely affect the environment. 5024 refers to the Public Resources Code and is basically interpreted to say that nothing will be done to alter the character of historic structures.

The Department of Parks and Recreation has developed policies based on CEQA and 5024 which can be found in the Resource Management chapter of the Departmental Operations Manual. The Maintenance Chief is generally responsible to see that the CEQA or 5024 requirements have been met before work begins. When in doubt.....ask! The Public Resources Code and Departmental Operations Manual should be available in your unit’s maintenance library.

FASTENERS

To correctly use fasteners the maintenance worker must first determine the forces which will be applied to the assembly, and the direction of the grain in the wood to be fastened. Look at the illustration of the three boards below. The boards are considered to be "fastened" together because their movement is restrained by the two nails. Nail "a" is driven perpendicular to (across) the grain in board "Y" and parallel (in line) with the grain in board "Z". Nail "b" is driven perpendicular to the grain of boards "X" and "Y". If a load is placed on board Y, the board will try to shear off the restraining nails and slide out of the assembly. The nails could be described as being in "shear". Another example of shear would be if a pulling force were applied to the assembly along the direction of line #1. If a pulling force were applied in the direction of line #2, however, the force would put the restraining nails in "tension".



The correct size and number of nails will adequately fasten lumber together when the load is in shear, and when the nails are used perpendicular to the wood grain. Nails do not hold well in tension. Nails may only be used to fasten boards in tension IF the nails are driven perpendicular to the wood grain, and IF the nails are subjected to loads of less than two-thirds that allowed for nails in sheer (UBC Table 25-G). Nails driven parallel to the grain (such as nail "a" in board "Z") MUST NOT be used to hold loads in tension.

Intermediate Carpentry Skills
Study Questions/Workbook - Part 1

GENERAL TOPICS

1. The function of the California Department of Parks and Recreation is "to_____, _____, _____and _____areas of outstanding scenic recreational and historic importance.

2. _____ is the single most important subject the maintenance worker must learn about the carpentry trade.

3. What is the "mission statement" for your unit of the park system?

   _____

   _____

4. All employees are responsible for maintaining a _____workplace.

5. Accidents do not "just happen" -- they are caused by unsafe _____ or _____.

6. _____ is based on the Uniform Building Code and is the building standard for all state owned buildings.

7. _____ stands for California Environmental Quality Act and basically says that nothing will be done that will adversely affect the environment.

8. _____ basically interpreted to say that nothing will be done to alter the character of historic structures.

9. If force is applied to two boards in such a way that one board tries to slide along the other, a nail holding the two boards from moving would be in "_____".

10. If a force is applied to two boards in such a way that the boards are being pulled apart, a nail holding the boards from moving would be in "_____".

11. Nails hold best when resisting "_____" forces.

12. Nails cannot be trusted to hold in tension when they are driven into the end grain or_____ to the grain of the board.

Transfer these answers to your pre-training assignment booklet sheet 3

The woods most used for various purposes in building are as follows:

POSTS, GIRDERS, TRUSSES & HEAVY FRAMING

Dense Yellow Pine
Douglas Fir
White Oak
Larch
Spruce

LIGHT FRAMING, STUDS, JOISTS, RAFTERS

Spruce
Hemlock
Common Yellow Pine
Larch

OUTSIDE FINISH

White Pine
Cypress
Redwood
Poplar
Spruce

SHINGLES, CLAPBOARDS

Cedar
Cypress
Redwood

WINDOWS, DOORS, FRAMES

White Pine
Fir

FLOORS

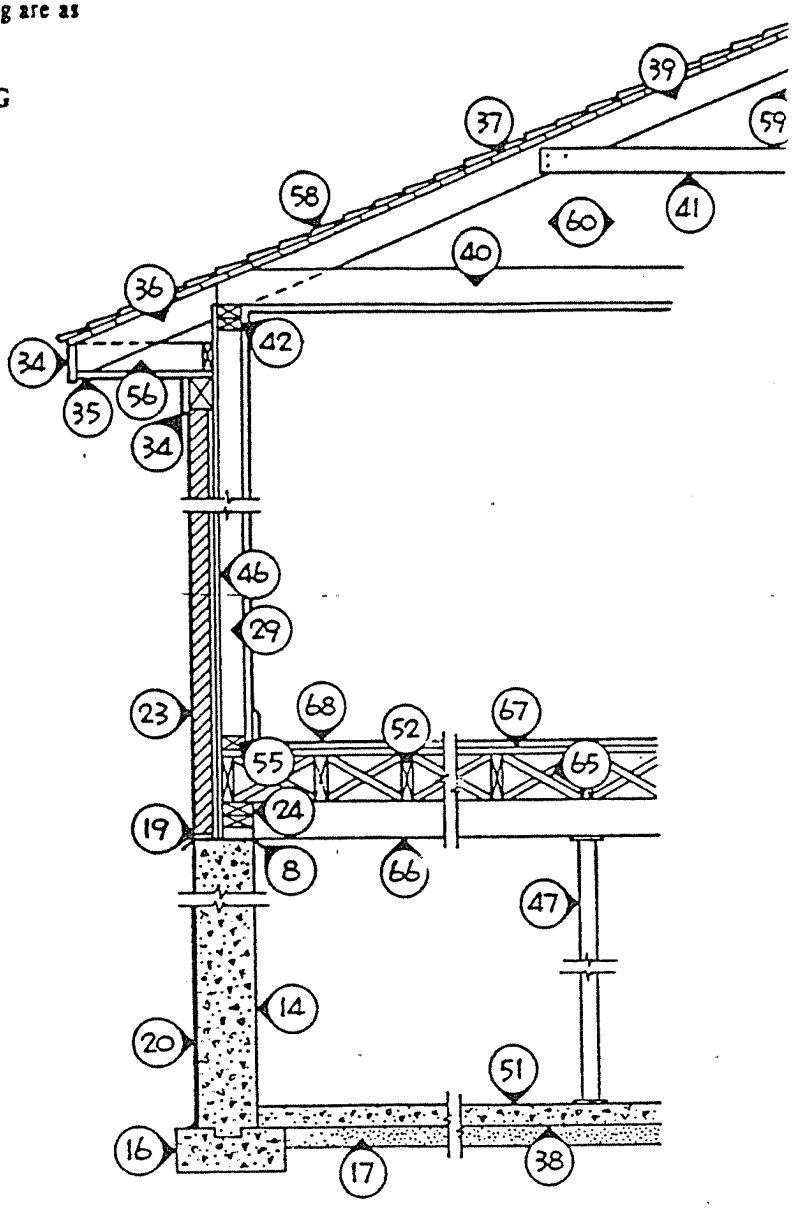
Oak
Maple
Yellow Pine
Birch
Beach

FINISH (Painted)

White Pine
Birch
Gum
Redwood
Poplar

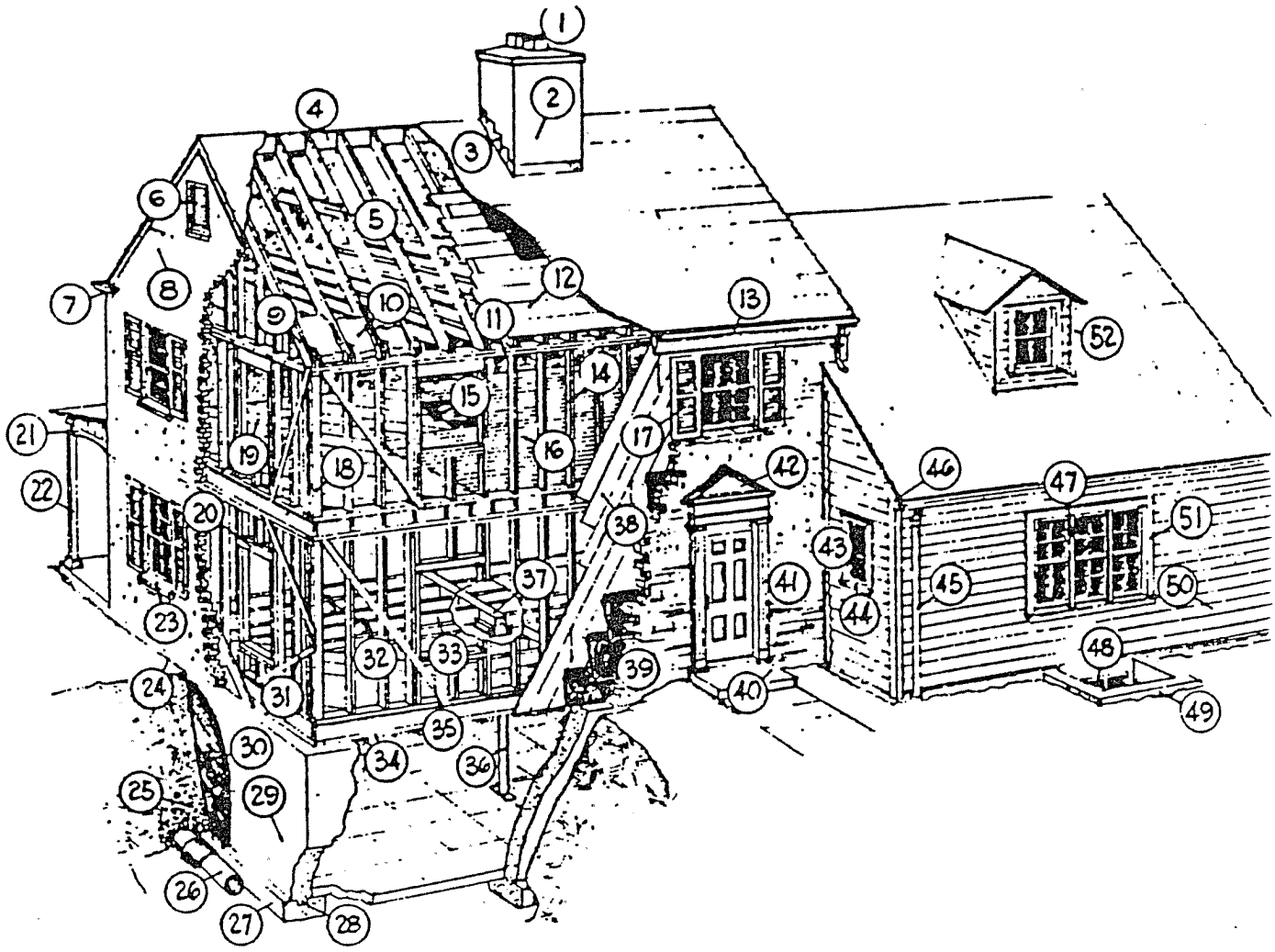
NATURAL FINISH

Oak
Chestnut
Walnut
Mahogany
White Pine
Birch
Redwood
Cedar



Typical residential terms.

8. Termite shield
14. Foundation wall
16. Foundation wall footing
17. Gravel fill
19. Weep hole
20. Waterproofing
23. Brick veneer
24. Sill
29. Studding
34. Fascia
35. Soffit
36. Rafter overhang
37. Roof boards or plywood
38. Vapor barrier
39. Rafter
40. Ceiling joist
41. Collar beam
42. Double plate
46. Diagonal sheathing or plywood
47. Basement post (lally column)
51. Concrete floor or slab
52. Floor joist
55. Sole plate
56. Lookout
58. Roofing shingles
59. Ridge
60. Attic space
65. Cross-bridging
66. Girder or beam
67. Plywood subflooring
68. Finish flooring



Typical residential terms.

1. Chimney flues or pots
2. Chimney
3. Flashing
4. Ridgeboard
5. Collar beam
6. Vent; louver
7. Cornice return
8. Brick veneer
9. End rafter
10. Insulation
11. Top double plate
12. Roof decking
13. Gutter
14. Stud
15. Flooring paper
16. Finish flooring
17. Shutter
18. Corner post
19. Subfloor
20. Lintel; header
21. Porch frieze board
22. Porch post
23. Brick sill
24. Grade line
25. Cinder or gravel fill
26. Drain tile
27. Footing
28. Keyway
29. Foundation wall
30. Waterproofing
31. Knee brace
32. Bridging
33. Floor joists
34. Sill plate
35. Corner brace
36. Steel column
37. Beam; girder
38. Wall sheathing
39. Building paper
40. Stoop
41. Trim pilaster
42. Pediment door trim
43. Double-hung window
44. Windowsill
45. Downspout
46. Rake mold
47. Mullion
48. Basement window
49. Areaway wall
50. Bevel siding
51. Wood window trim
52. Dormer

INTRODUCTION

The modern wood frame house is an economical, long lasting structure. Few, if any, materials can compare with wood framing in residential construction. To produce an efficient house, however, you must use sound construction methods and select good-quality, suitable materials.

This series of how-to sheets was developed by the American Plywood Association as an elementary guide to wood-frame construction. It is intended as a guide and help to those who have little major-construction experience. The sheets illustrate the basic steps to completing the structural shell of a house.

Each sheet, in nontechnical language, illustrates step-by-step construction of a single-story house with a concrete block foundation, plywood-and-stud walls, and plywood sheathed gable roof. Each how-to sheet covers one step of construction. Usually the most common and simplest construction methods are described, and no attempt has been made to show the wide variety of alternate methods although a few are mentioned. For illustrative purposes, an example house 24 x 48 ft. is used through the series, and terms are explained in a glossary.

American Plywood Association — A trade association representing most of the nation's manufacturers of construction plywood. The Association has three main jobs: *research* to improve plywood performance and products; *inspection and testing* to ensure plywood's consistently high quality; and *promotion and information service.*

Batten — A thin, narrow piece of board used to cover vertical joints of plywood siding.

Batter Board — A temporary framework used to assist in locating corners when laying out a foundation.

Blocking — Small wood pieces used between structural members to support panel edges.

Bottom Plate (sole plate) — The lowest horizontal member of a wall or partition which rests on the subflooring. Wall studs are nailed to the bottom plate.

Chalk Line (snap line) — A long spool-wound cord encased in a container filled with chalk. Chalk-covered string is pulled from the case, pulled taut across a surface, lifted, and snapped directly downward so that it leaves a long straight chalk mark.

Collar Beam — A horizontal tie beam in a gable roof, connecting two opposite rafters at a point considerably above the wall plate.

Course — A continuous level row of construction units, as a layer of foundation block, shingles, or plywood panels, as in subflooring or roof sheathing.

Cripple — Any part of a frame which is cut less than full length, as in cripple studs under a window opening.

d — The abbreviation for "penny" in designating nail size; for example 8d nails are 8-penny nails, 2½ in. long.

Dimension Lumber — Lumber 2 to 5 in. thick and up to 12 in. wide. Includes joists, rafters, studs, planks, girders, and posts.

Doubling — To use two like framing members nailed together, such as studs or joists, to add strength to a building.

Fascia — Horizontal board that is used as a facing.

Fascia Rafter — End rafters at the end of the rake.

Footing — The concrete (usually) base for foundation walls, posts, chimneys, etc. The footing is wider than the member it supports, and distributes the weight to the ground over a larger area to prevent settling.

Gable — The triangular portion of the end wall of a house with a pitched roof.

Gusset — A small piece of wood, plywood, or metal attached to corners or intersections of a frame to add stiffness and strength.

Header — One or more pieces of framing lumber used around openings to support free ends of floor joists, studs, or rafters.

Header Joist (ribbon or band joist) — The horizontal lumber member that is butted against ends of floor joists around the outside of the house to add support to and tie joists together.

In-line Joint — A connection made by butting two pieces of lumber, such as floor joists, end-to-end and fastening them together using an additional splice piece nailed on both sides of the joint.

Joist — One of a series of parallel framing members used to support floor or ceiling loads, and supported in turn by larger beams, girders or bearing walls, or foundation.

Kiln Dried — Wood seasoned in a humidity and temperature-controlled oven to minimize shrinkage and warping.

Lap Joint — A connection made by placing two pieces material side by side and fastening them nailing, gluing, etc.

o.c. — On center. A method of indicating the spacing of framing members by stating the measurement from the center of one member to the center of the next.

Plumb Bob — A weight attached to a line for testing perpendicular surfaces for trueness.

Rafter — One of a series of structural members of a roof, designed to support roof loads.

Rake — The overhanging part of a roof at a gable end.

Ridge Board — Central framing member at the peak, or ridge, of a roof. The roof rafters frame into it from each side.

Setback — Placing of a building a specified distance from street or property lines to comply with building codes and restrictions.

Sill (Mudsill, Sill Plate) — The lowest framing member of a structure, resting on the foundation and supporting the floor system and the uprights of the frame.

Soffit Underside of a roof overhang.

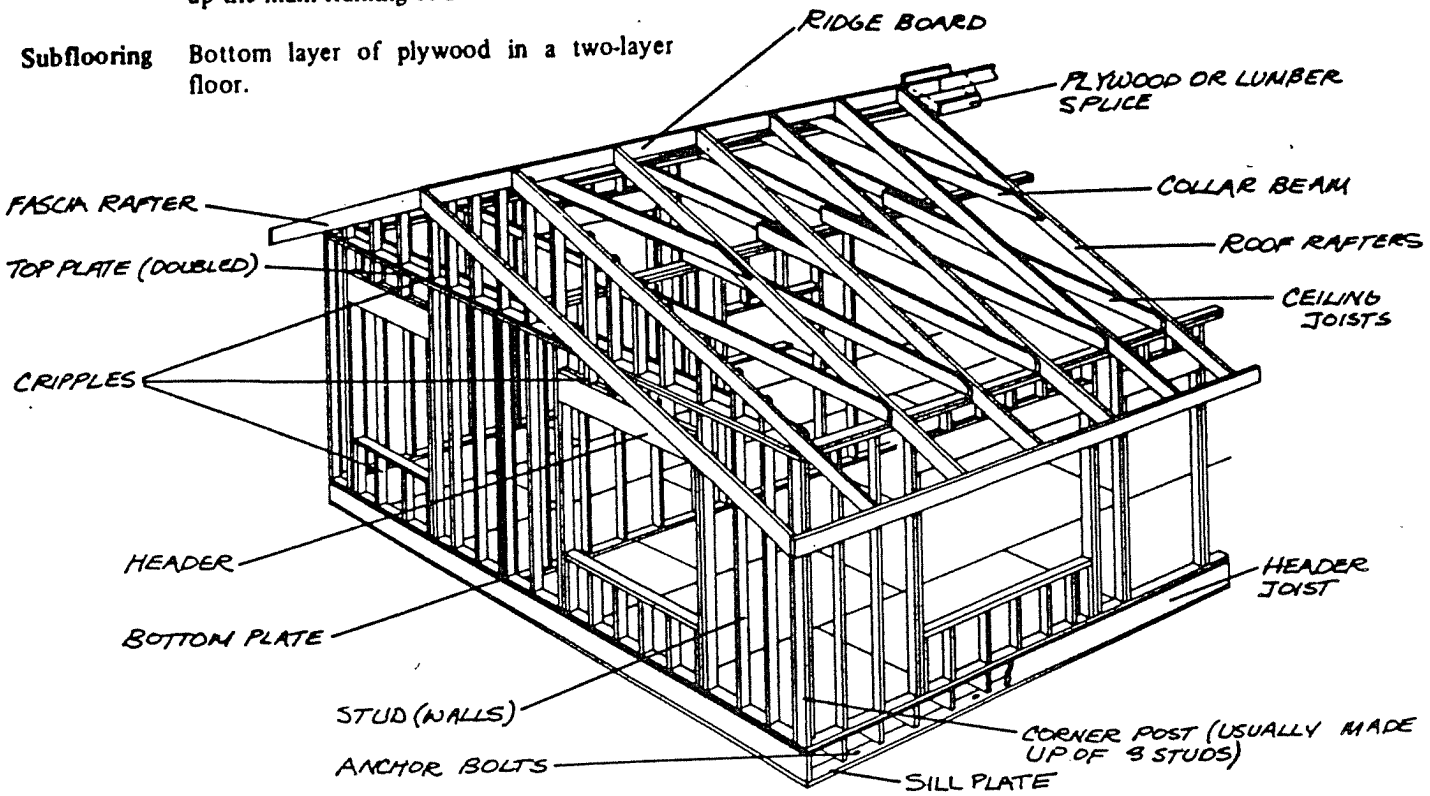
Span The distance between supports of a structural member.

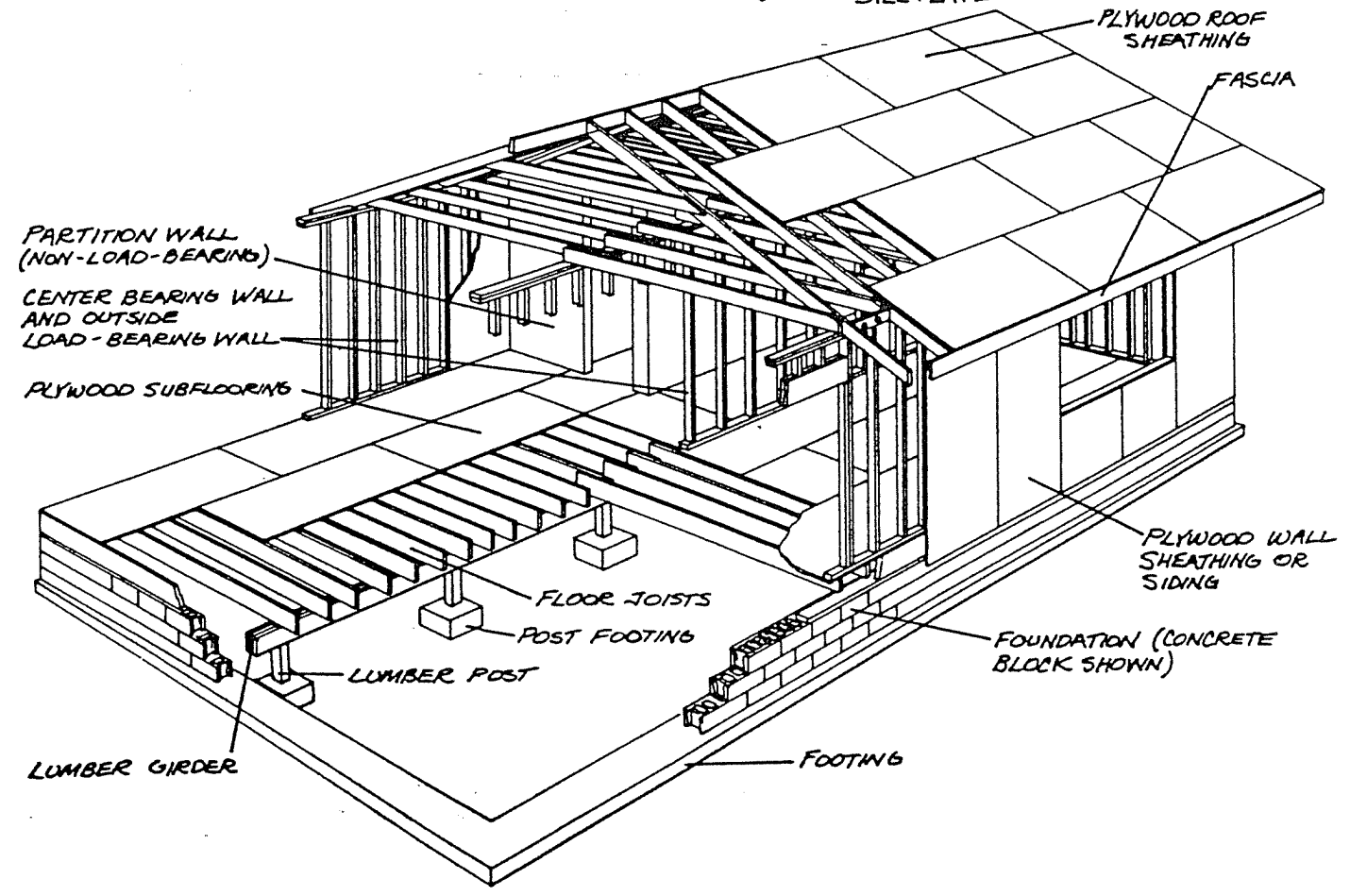
Studs (Wall) Vertical members (usually 2 x 4's) making up the main framing of a wall.

Subflooring Bottom layer of plywood in a two-layer floor.

Top Plate The uppermost horizontal member nailed to the wall or partition studs. Top plate is usually doubled with end joints offset.

Underlayment Top layer of plywood in a two-layer floor. Provides a smooth base for carpet, tile or sheet flooring.





LAYOUT THE FOUNDATION

Laying out a foundation is the critical beginning in house construction. It is a simple but extremely important process and requires careful work. If you make sure the foundation is *square* and *level*, you will find all later jobs—from rough carpentry through finish construction and installation of cabinetry—are made much easier.

1. Make sure your proposed house location on the lot complies with local regulations. If property lines are at all in question, verify location of lot-line corners by city, county, or private surveyor. Once property lines are established, it is equally vital that you review city, county, or state requirements on location of the house with respect to property lines. Most regulations require that a house be set back from the street property line a specified distance (often 25 to 30 ft.) and that sides of the house be set back from adjoining property lines (often 5 to 10 ft.). Carelessness in establishing property lines and allowable house location could result in extending a garage or future addition over a neighbor's property line, or in an infringement of local building-code regulations.

4. After corners are located and squared, drive three 2 x 4 stakes at each corner as shown in Figure 1. Locate these stakes 3 ft. to 4 ft. outside the actual foundation line. Then nail 1 x 6 batter boards horizontally so that their top edges are all level and at the same grade (see Step 6 for a method of checking their levelness). Hold a string-line across tops of opposite batter boards at two corners and using a plumb bob, adjust so that it is exactly over the tacks in the two corner stakes. Cut saw kerfs ¼ in. deep where the line touches the batter boards so that string-lines may be easily replaced if broken or disturbed.

Cut all saw kerfs the same depth since the string-line not only defines the outside edges of the foundation but will provide a reference line to ensure uniform depth of footing excavation. When you have made similar cuts in all eight batter boards and strung the four lines in position, the outside foundation lines are accurately established.

5. Next, locate the lengthwise girder location, usually on the centerline of the house. Double check your house plans for exact position since occasionally the girder will be slightly off centerline to support an interior bearing wall. To find the line, measure the correct distance from corners. Then install batter boards and locate string-line as in Step 4.

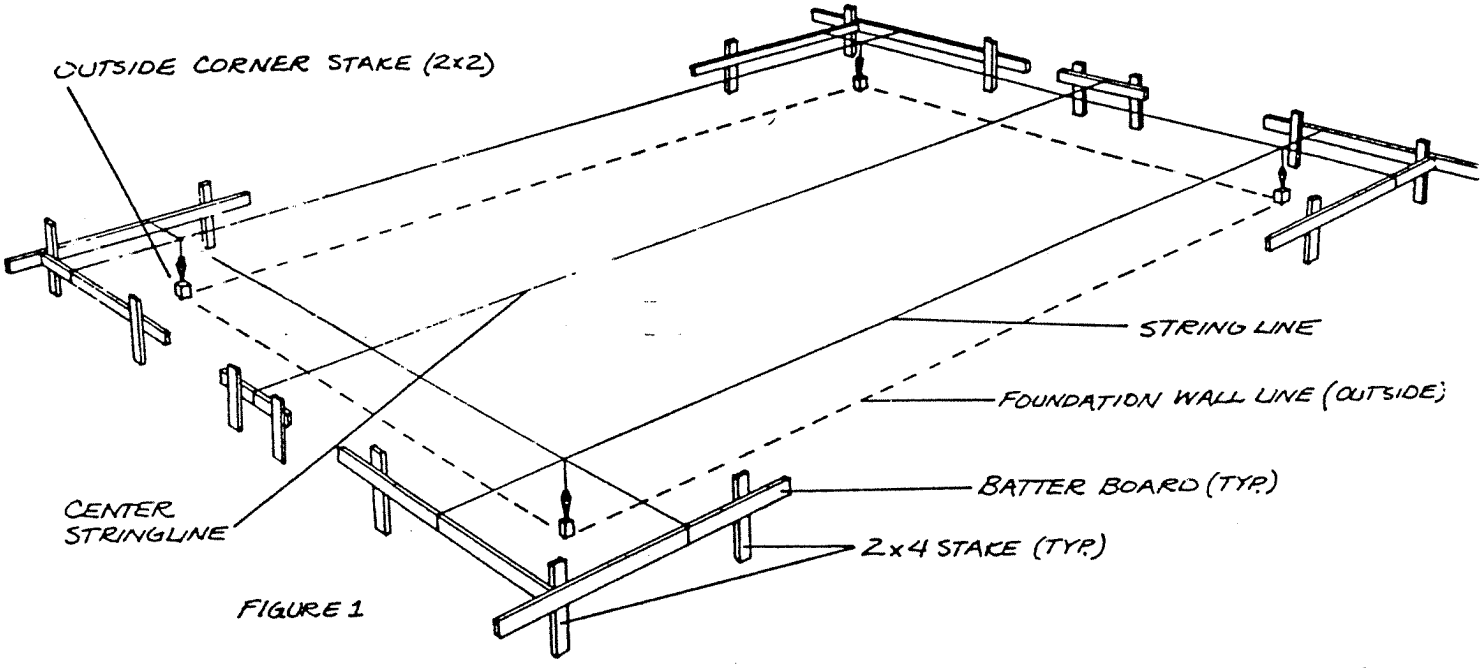


FIGURE 1

2. Set house location, based on required setbacks and other factors such as the natural drainage pattern of the lot; then level or at least rough-clear the site.

3. Lay out the outside foundation lines. Figure 1 shows the simplest method for locating these. Locate each outside corner of the house and drive small stakes into the ground. Drive tacks into tops of these stakes to indicate the outside line of the foundation wall (not footings). Next check squareness of house by measuring the diagonals, corner to corner, to see that they are equal. (If structure is rectangular, all diagonal measurements will equal.) You can check squareness of any corner by measuring down one side for 6 ft., down the other for 8 ft. The length of the diagonal line across these two end points should measure exactly 10 ft. If it doesn't, the corner isn't truly square. See Figure 2.

6. Check for foundation levelness. Remember that the top of the foundation must be level around the entire perimeter of the house. The most accurate—and simplest—way to check this is to use a surveyor's level, if you have access to and familiarity with this tool.

The next best approach is to ensure that batter boards, and thus string-lines, are all absolutely level. You can accomplish this with a 10 ft. to 14 ft. long piece of straight lumber. (Judge its straightness by sighting along the surface.) Using this straightedge in conjunction with a carpenter or masonry level, drive temporary stakes around the house perimeter, spaced a distance apart not exceeding the length of the straightedge lumber (see Figure 3). Then place one end of the straightedge on a batter board, check for exact levelness, and drive another stake to the same height. Each time a

stake is driven, the straightedge and level should be reversed end-for-end, which should ensure close accuracy in establishing the height of each stake with reference to the batter board. The final check on overall levelness comes when you level the last stake with the batter board where you began. If the straightedge is level here, then you have a level foundation base line.

During foundation excavation, the corner stakes and temporary leveling stakes will be removed. This stresses the importance of the leveled batter boards and string-line, because corners and foundation levelness must be located using the string-line.

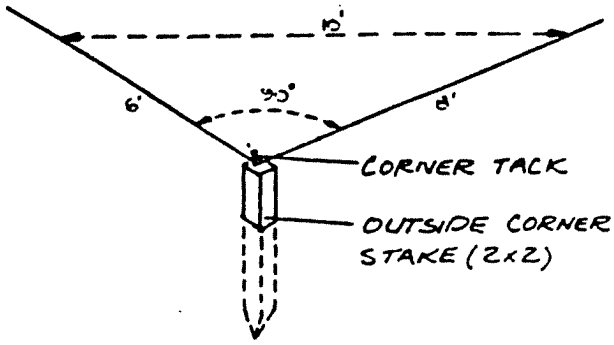


FIGURE 2

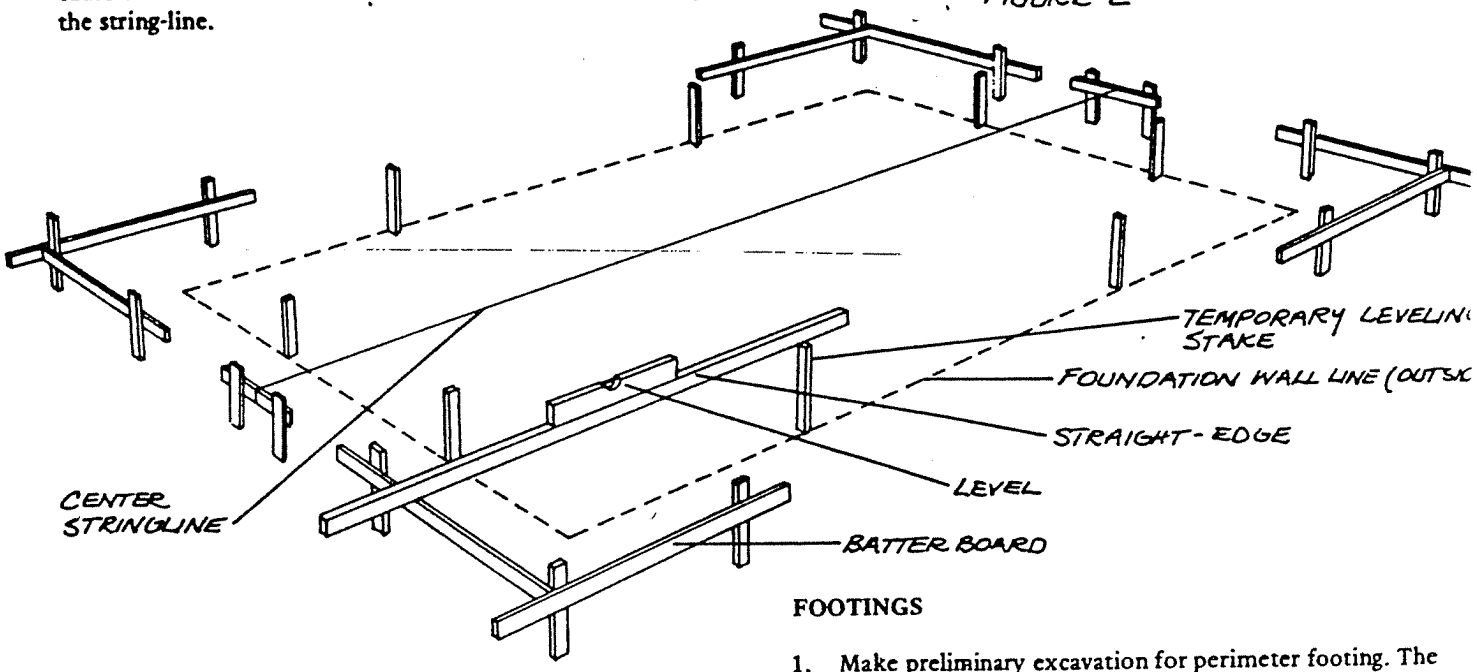


FIGURE 3

CONCRETE BLOCK FOUNDATION AND POST FOOTINGS

Poured concrete footings are most commonly used for house foundations. Footings, properly sized and constructed, prevent settling or cracking of building walls. Footings must be completely level, and must extend at least 12 in. below the frost line and at least 6 in. into undisturbed soil. These requirements dictate the depth at which you place the footings. *Do not place foundations on black top soil.*

Do not pour concrete if the temperature is expected to go below about 40° F within the first week after pour, unless you are prepared to take extensive measures to protect it.

A row of post footings will be located along the centerline of the house. These support posts and girders which, in turn, support the floor joists. Minimum height for post footings should be 8 in. above finish grade in crawl-space foundations. Post footing thickness is determined in Step 3.

FOOTINGS

1. Make preliminary excavation for perimeter footing. The amount of excavation may vary, depending on site conditions. To allow yourself adequate working space, excavate about 2 ft. beyond the outside of the wall. (If you dig too deep, fill with concrete—never soil.)

2. Using a plumb bob from the foundation layout stringline, locate outside corners of the block foundation. Measure about 4 in. beyond corner points to establish footing edge lines (see Figure 1). Outline both outside and inside perimeters of the footing with string. Dig the footing trench to required depth. Install forms of 1/2 inch APA® grade-trademarked plywood or 2 x 8's supported by 2 x 4 stakes driven into the soil about 2 ft. apart (see Figure 2). These stakes should be driven below the top of the formboards, to facilitate leveling the concrete.

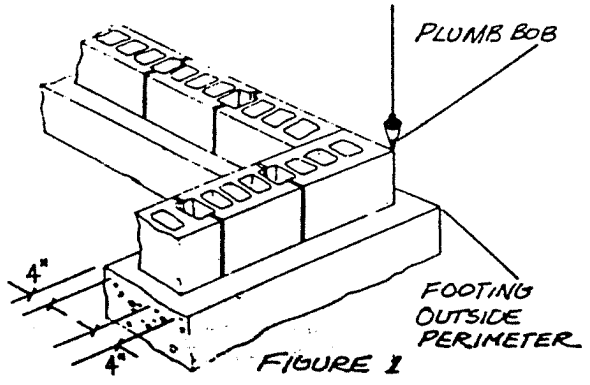


FIGURE 1

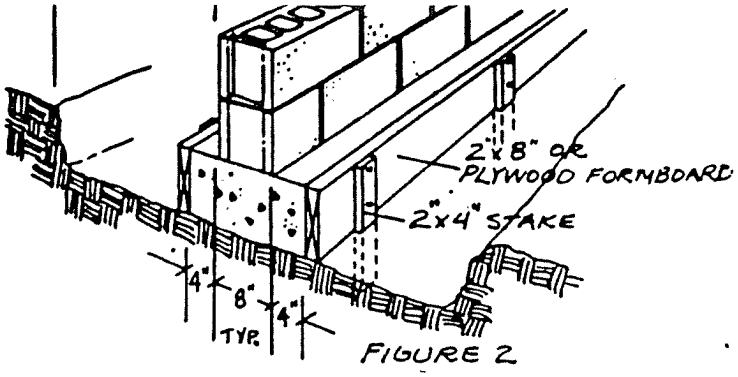


FIGURE 2

3. Using the lengthwise centerline string, mark locations for floor-supporting posts. Post spacing is specified on your house plan, as is post footing size. Post footings are generally about 20 in. square, but may vary in size depending on allowable soil pressure and post spacing. Again, check local building codes. Some require a steel rod extending out the top of the post footing to engage the post and keep it in place. The bottom of the footing should be at the same level as the perimeter footing. Height should be a minimum of 8 inches above ground in a crawl space house. Build forms of 1/2 in. APA grade-trademarked plywood and 2 x 4's. End-post footings may be poured integrally with the perimeter footings.

4. Prepare and place concrete. If ready-mix concrete is available, order a mix with at least 2000 psi 28-day strength. Or you can mix concrete on the site using a 1:3:5 mix (one part by volume of Portland cement; 3 parts clean sand; and 5 parts gravel). Use about 5 1/2 gallons of water per sack of cement if sand is wet, (6 1/4 gallons per sack if sand is dry). Mix concrete thoroughly, and place in forms in thin layers. "Spade" and tamp concrete carefully between pours to prevent air pockets. Top of footings should be smooth and level all around.

5. Cure concrete and strip forms. In warm weather, leave forms in place for three days, sprinkling daily with water so concrete will not dry too quickly. In cool weather, leave forms in place 7 days; in cold weather (below 40°), don't pour.

FOUNDATION WALL

6. As in Step 2, accurately locate outside wall corners on footings, using a plumb bob. (Block walls should be centered on footing.) String a cord tautly between corners to outline outside of block wall and mark with chalk, or use a chalk line. Lay the first course of blocks without mortar all around the perimeter to determine joint spacing and whether you will have to cut any blocks. Space blocks 3/8 in. apart (a 3/8 in. maximum joint is allowable, provided the average for the entire course is no more than 1/2 in.). Mark each joint on the foundation. Check the house plan for any required openings for crawl space vents, drains, utilities, etc.

7. Prepare mortar. Mix 2 parts masonry cement (or 1 part each of Portland cement and hydrated lime) with 4 to 6 parts of damp mortar sand. Add just enough water to make a plastic mortar that clings to the trowel and block but is not so soft that it squeezes down too much when laying block. After mixing, place mortar on a wet mortar board near where blocks will be laid.

form to ASTM C-90, Grade A. Finished height of the foundation wall should be approximately 12 in. above finish grade level. First build each corner up to full height, to establish required thickness of joints. Use corner blocks with one flat end at corners. Build corners up using a mason's level to keep blocks plumb and level. Then stretch line between corners to guide laying additional blocks. For the first course of blocks, place mortar on footings for the full width of the block. For succeeding courses, apply mortar on face shells only.

9. Set anchor bolts for sill plate. Before laying the last two courses, locate and position anchor bolts as shown on plans, or as in Figure 4 if not shown on plans. Be sure to provide at least two bolts per individual sill plate. Fill all cells in the top course, or cover with 4 in. solid masonry units, or use a wood sill plate wide enough to bear on both the inner and outer shells of the blocks. Install fiberglass sill sealer between foundation and wood sill plate.

10. After block wall is completed, wait at least 7 days before placing backfill against wall. Do not backfill until floor sheathing is installed. If a drain is provided, slope soil in crawl space toward drain.

POSTS AND GIRDERS

Posts and girders are the basic structural members that support the floor joists along the centerline of the house. Wood posts are fastened to the girder that rests upon them (see Figure 1).

Posts for an average house are generally 4 x 6 or 6 x 6 solid lumber, cut to proper length as outlined in Step 3. The girders used to support floor joists are generally built up of two or three pieces of 2x dimension lumber. If available, order kiln-dried lumber (and keep it dry) to reduce shrinkage. Your house plans will specify post spacing, girder span lengths, and lumber grades. The long dimension of the house dictates the overall length of the girder. For example, in a 48 ft. long house, three girder sections each approximately 16 ft. long will be needed (see Step 1).

Before ordering material, check local conditions to see if materials must be treated for termite protection. Also check plans to see whether a vapor barrier (a good idea in any case) must be installed in the crawl space.

1. Determine length of girder required. Overall length of the girder is determined by the length of the house. The girder must reach from inside-surface to inside-surface of the foundation wall, minus 1/2 in. clearance on each end. In the example 48 ft. house, the overall girder length is 46 ft. 7 in. (48 ft. less 16 in. to compensate for thickness of both end foundation walls and 1 in. total clearance).

2. Fabricate the girder. For the 48 ft. house, the centerline girder is best fabricated in three 16 ft. sections, with two cut to fit the required length. For built-up girder sections, use three 2 x's nailed together with 20d (4 in. long) common nails 32 in. o.c. in each of two rows, one along the top and one along the bottom of the girder. Stagger top and bottom rows of nails (see Figure 2).

3. Determine length of posts. At each post location, stretch a line from opposite sill plates. Use building twin or heavy nylon fishline, and stretch it tight to eliminate sag. Measure down from the string to the post foundation, then substract the depth of the girder from this dimension and cut post to length. If post footings have protruding lengths of reinforcing bar, drill post bottom so the post can slip over the bar.

4. Install a vapor barrier if required. Use a 6-mil-thick polyethylene film, placed to cover all ground inside the foundation, lapping edges about 6 in. Use sand or gravel to hold edges down.

5. Place the posts on post footings. If a vapor barrier has been stretched across the footings, rest posts directly on the vapor barrier. If no vapor barrier is present, use pieces of 15-pound asphalt-impregnated building felt between concrete post footing and end of post.

6. Once all posts are in place, lift girders and place them on top of posts. Girders should be cut so that butt joints fall over the center line of a supporting post (see Figure 1). Trim the two end girder sections to allow for a 1/2 in. space between foundation and girder (Figure 3). At this point it may be valuable to plumb and brace the posts and girders with 2 x 4's and stakes, until floor joists are installed.

7. Now check the level of the entire girder. Tops of all girders should be level with top of sill plates (Figure 4). Shim if necessary. Once everything is level, nail the posts to the girders. The ends of the girders that butt together should be toenailed with at least six 10d common nails. Firmly attach the girder to each post on the underside with galvanized steel framing anchors or clip angles and lag screws.

Note: The center girders may be solid lumber. If so, they should be placed so that the top of the girder is slightly above the sill plate (about 1/8 in.) to allow for shrinkage.

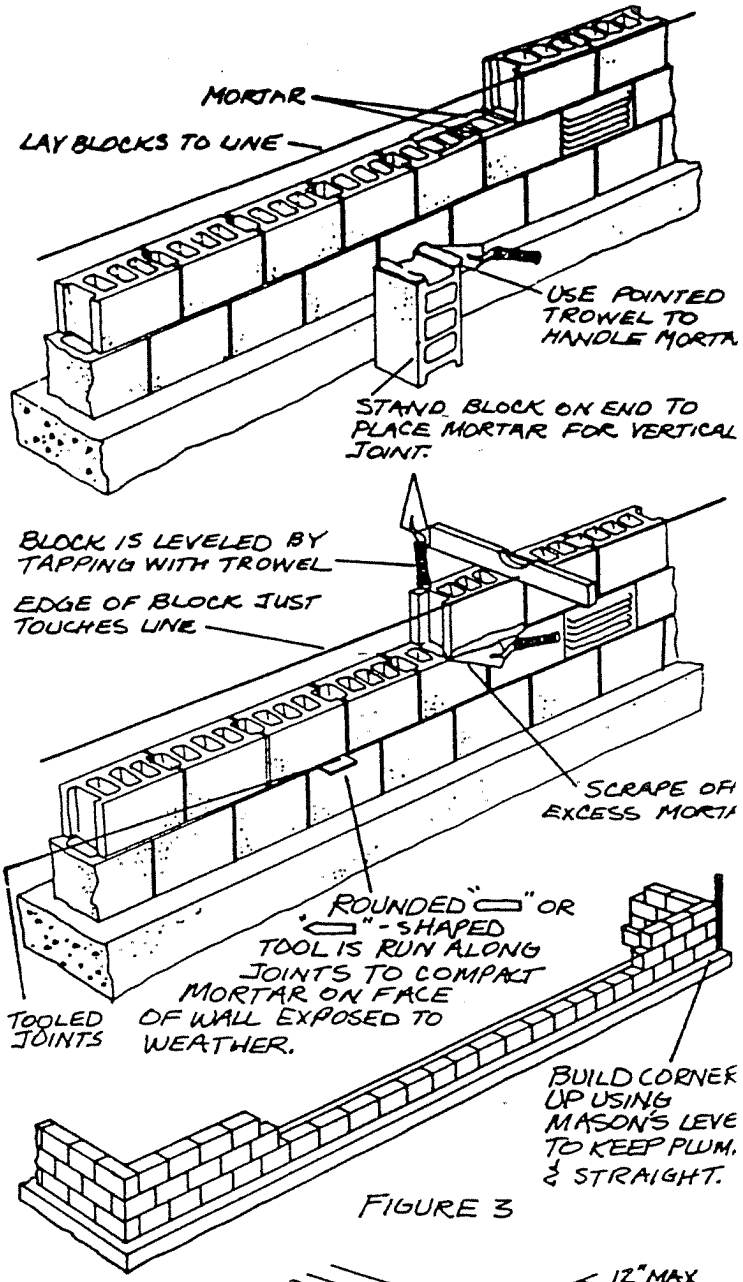


FIGURE 3

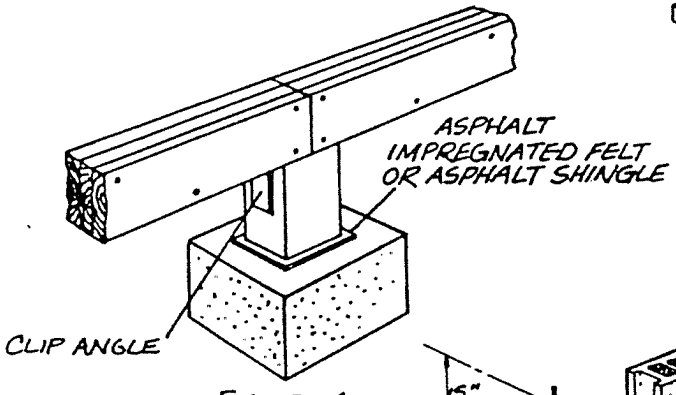


FIGURE 1

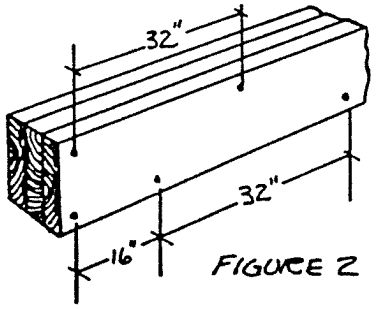


FIGURE 2

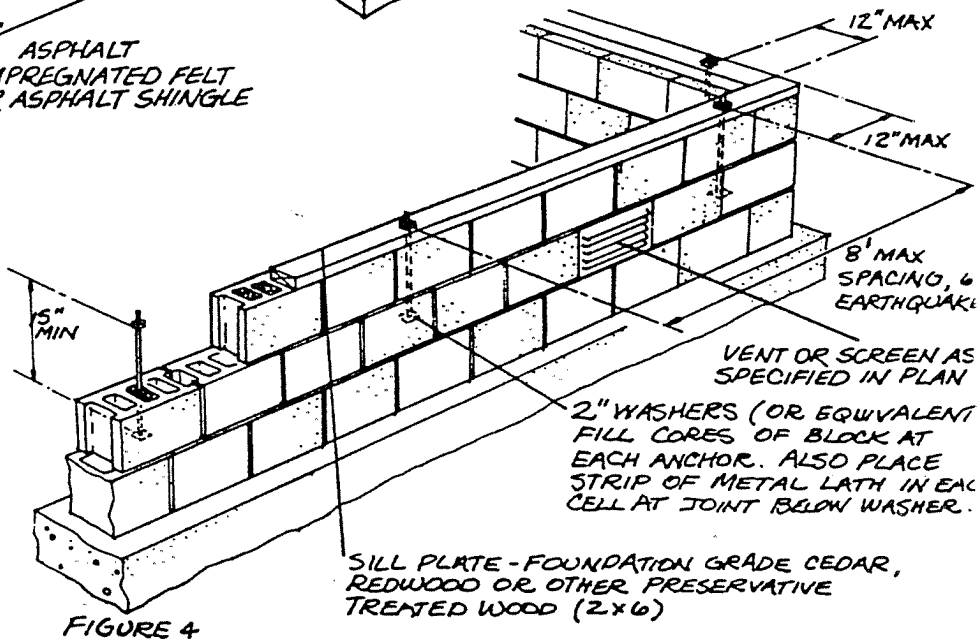


FIGURE 4

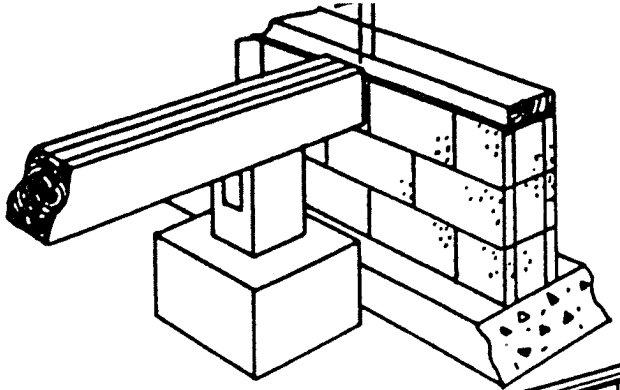


FIGURE 3

The most common spacing for joists is 16 in. o.c., and it is used in this example. Spacings of 24 in. or wider, however, may also be used.

The size of plywood subflooring panels may influence joist layout. In planning layout, remember that plywood panels are 4 by 8 ft. and panel ends must be supported on joist to provide the necessary floor stiffness.

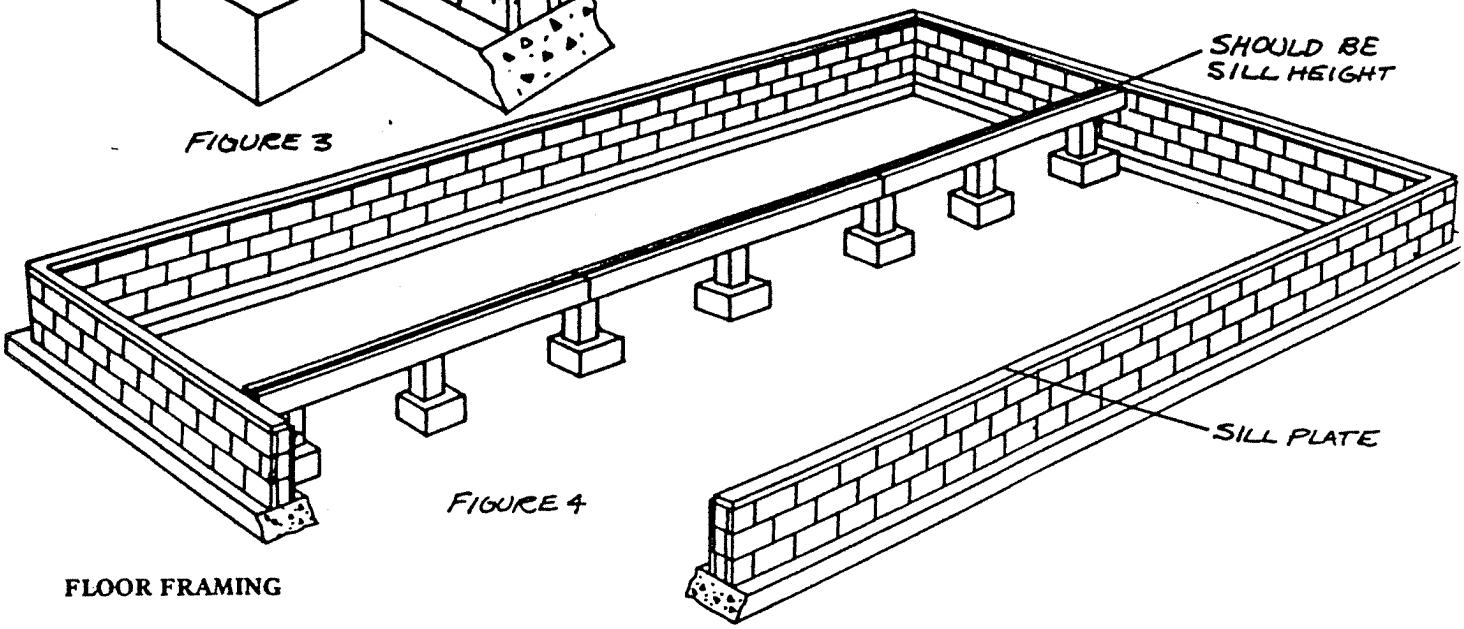


FIGURE 4

FLOOR FRAMING

See Figure 1 for an overall view of typical floor framing. Joists are the main supporting members of the floor. They rest on the sill plate at the outside end and the girder at the inner end. In residential construction, joists are generally 2x lumber placed on edge. When purchasing lumber for joists, order kiln-dried material if available to minimize shrinkage. Be sure to check your house plans for joist size and spacing and for any special lumber grade requirements.

Any joists having a slight bow edgewise should be placed so that the bow or "crown" is on top. (You can determine if a joist is crowned by sighting along the edge.) A crowned joist will tend to straighten out when subfloor and normal flo loading are applied. Also, with straight joists, the edge ha ing the largest edge knots should be placed on top because, in that position, the joists are stronger.

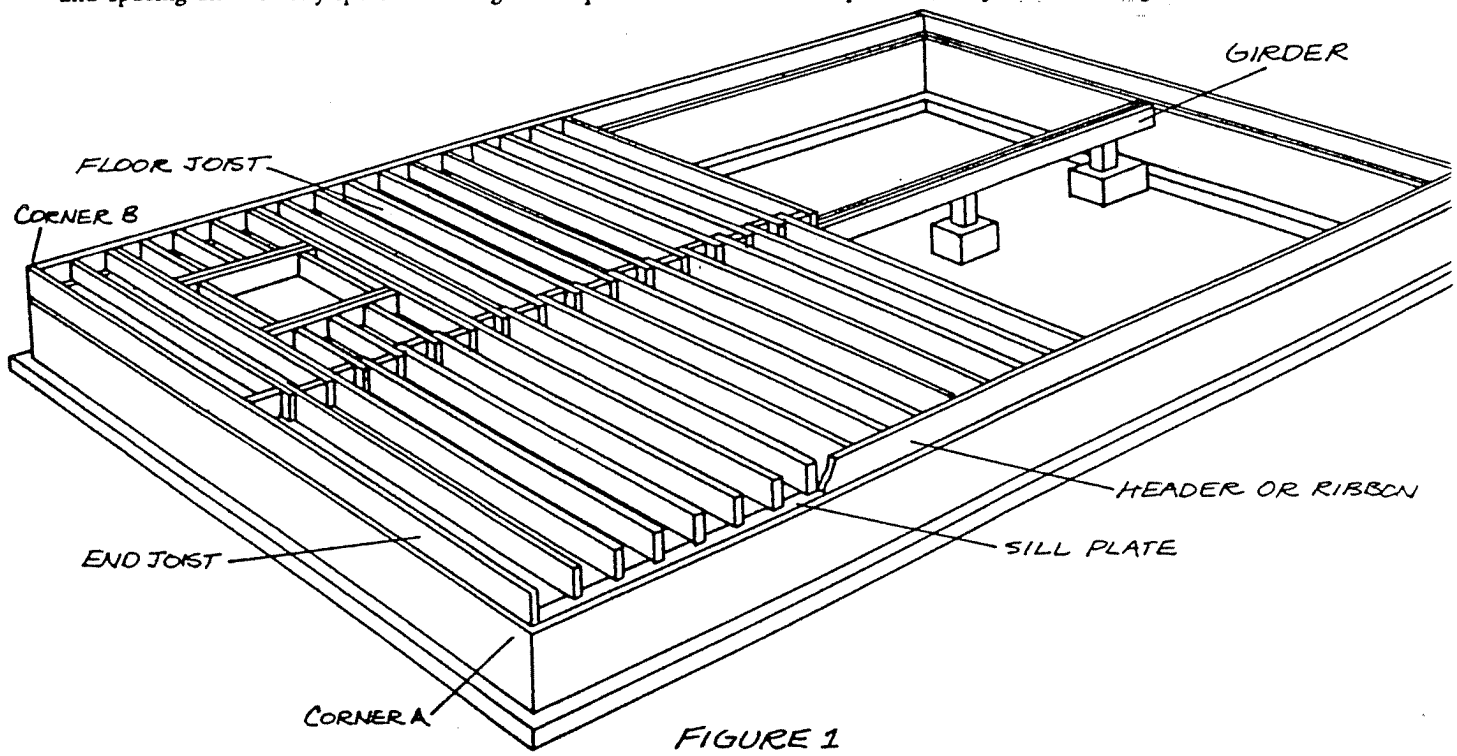


FIGURE 1

JOIST LAYOUT

1. Lay out floor-joist positions. Mark joist locations on the sill plates using two marks, one for each side of the joist (see Figure 2). Mark the end joist location on the sill, even with the outside edge of the sill. Mark the location of the first interior joist, so that spacing between joists is 13 3/4 in. (16 in. from outside of sill to centerline of first interior joist). Mark position of other joists, spacing them 16 in. o.c., continuing to the end of the house. The location of the end joist at this end of the house should also be marked on the sill.

2. Repeat this process on the opposite sill except that spacing between the end and first interior joist is 12 1/4 inches (14 1/2 inches from outside of sill to centerline of first interior joist, to allow for joist overlap at the center of the house).You must start the joist layout from the same end wall as in Step 1, so that all joists are parallel to the outside walls. Also mark joist locations on the girder, to ensure alignment of joists between the sidewalls.

3. Check the floor plan and mark on the sill plates the location of all partitions parallel to the joists. Generally, double joists are required under each partition, and the extra joists must be located and marked on the sill. A regular joist can serve as one of the "doubling" joists (see Figure 3).

4. Also mark location of any openings for crawl-space access, chimney, etc. Regular joists on each side of these openings will be placed with other regular joists, but all special framing should be left out until these regular joists are in. (When locating a floor opening, measure from its center in opposite directions to locate the inside edges. This is necessary to make sure the opening is located properly according to the plans.).

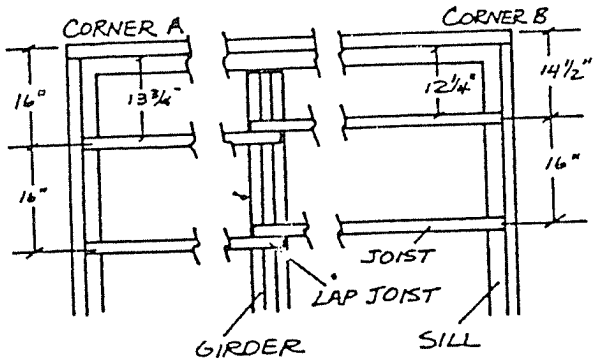


FIGURE 2

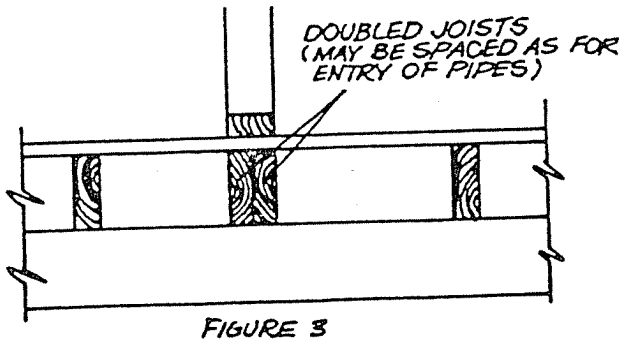


FIGURE 3

SETTING THE JOISTS

5. Select straight pieces of joist material for headers and end joists. Cut and nail them in place. Use 8d common nails and toenail from the outside lower edge of the header and end joist into the sill, spacing nails about every 16 in. Nail corner joints with three 16d common nails.

6. Using a steel square, mark vertical alignment for each joist on the inside face of header joists. Merely continue the horizontal lines on the sill to the inside face of the header.

7. Cut joists to length, if necessary. Lap of joists over center of the girder should be at least 4 in. and no more than 28 inches. Lay the joists across the sill and girder with all crown edges facing the same direction. This eliminates the need for additional checking when joists are tipped for installation.

NOTE: Floor joists can be butted over the center girder to form in-line joists (instead of being lapped) if joists are spliced with a 24 inch long piece of plywood or lumber, nailed to each joist.

8. Place joists at marks and drive two 16d common nails through the headers into the end of each floor joist. Toenail joists to the girder, using three 8d common nails for each joist. Nail lapped joists together over girder with three 10d common nails.

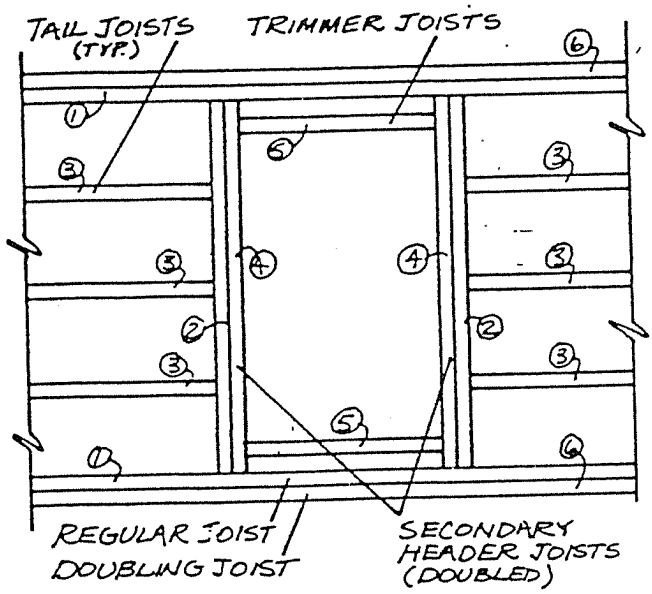


FIGURE 4
(CIRCLED FIGURES SHOW ORDER OF PLACING FRAMING)

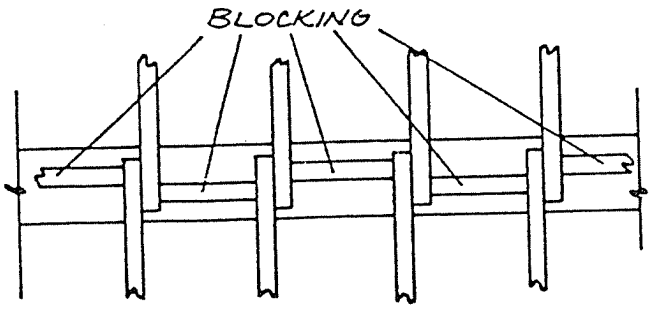


FIGURE 5

FLOOR OPENINGS

9. Frame openings in floor as shown on plans. One such opening is illustrated in Figures 1 and 4. The order of placing members is critical, if you are going to end nail the members. Order of placement is illustrated in Figure 4 for the particular opening shown. If members are placed in the order shown, all but the "trimmers" can be end-nailed.

10. An alternate method to the careful order described above, involves use of "framing anchors," specially made steel angles which will allow placement of members in a more logical, less critical order.

11. Install solid blocking between joists over the girder to help keep the joists parallel and to straighten any that tend to twist. Nail blocking on alternate sides of the girder centerline (see Figure 5). Drive two 16d nails into each end of each piece of blocking. Keep solid blocking flush with the top edges of the joists.

12. Check level of top of all joists, headers, and blocking. Shim up or trim down as needed to provide a firm, level base for plywood subflooring.

PLYWOOD SUBFLOORING

Subflooring is used over floor joists to form a working platform and base for finish flooring. In the example house, a two-layer floor system is assumed; that is, the floor is made up of plywood subflooring and a separate layer of underlayment, plus floor covering (e.g., carpet or resilient tiles), or it consists of subflooring plus hardwood. Plywood provides a smooth, solid, stable base for underlayment or wood strip or block finish flooring.

Plywood can be obtained in a number of grades and thicknesses that are suitable for use as subfloor, but C-D interior grade plywood sheathing is commonly used for this application. Panels of this grade carry an Identification Index marking on the back that give allowable spacing of joists for various thicknesses of plywood. For floor joists 16 in. o.c., for example, you can use APA® grade-trademarked C-D sheathing marked with an Identification Index of 32/16 (the 32 is allowable spacing for roof rafters in inches; the 16 is spacing for floor joists). Be sure to specify exterior glue if construction delays will entail long outside storage or exposure. (Cover and protect subflooring if possible during construction, in this case.)

When applying subflooring, place the plywood on the joists so that the C grade (the better) face is up. C-D grade plywood has C-grade veneer on the face and D-grade on the back. Space plywood panels 1/8 in. apart at edge joints and 1/16 in. apart at end joints over joists. (A copper penny is about 1/16 in. thick.) In wet or humid areas, double these spacings.

SUBFLOOR SHEATHING LAYOUT

1. Begin at the corner of the house where you began the joist layout described on page 7 1. A little time spent at this point planning ahead can save time and material in the long run. Review your plans and make trial measurement with your tape to estimate how the first row of panels will come out at the other end of the floor. To ensure proper alignment of the first row, strike a chalk line across the joists (the length of the floor area) 4 ft. 0 in. in from the outside edge of the header.

Start the first row with a full-sized 4 x 8 ft. panel set flush with the outside edge of the end joist and the long panel dimension across the joists. Use the chalk marks as a guide for alignment of the first row. Allow 1/16 in. between panel ends. Trim the end of the last panel in the first row flush with the end joist. (Any odd-sized panel sections required to fill in at the end of a row should cover two or more spans. These fill-in panels must be placed with the face grain across supports.)

If the last panel in the first row comes out 1 in. or more short of the inside edge of the end joist (due to an odd building dimension), nail a 2 x 4 "scab" (a block) to the end joist to support the panel end (see Figure 1). Then use a filler strip of scrap material as required. Remember that you can increase the panel end gaps slightly to gain length in a row. (Always maintain a minimum gap of 1/16 in. between panel ends.)

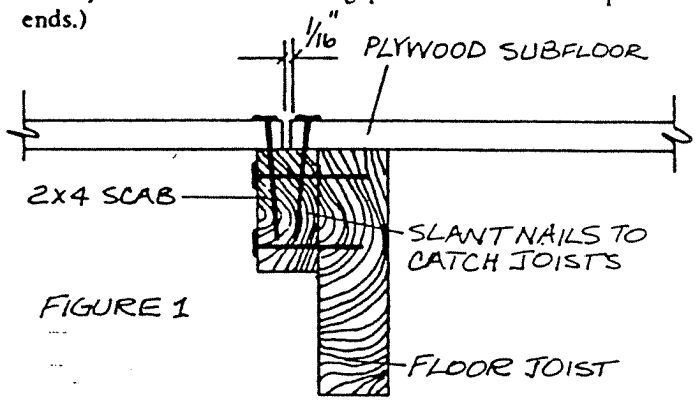


FIGURE 1

2. Lay out the remaining rows up to the place where the joists are lapped (usually at the center of the floor area). To stagger the panel joints, start the second row with a half panel (4 x 4 ft). Leave 1/8 in. gap at the panel edges (between the rows). Start the third row with a full panel once again, and so on. Trim an occasional panel end slightly, if required, as you go down the row to keep end joints roughly centered over the joists. (Usually only one panel per row need be trimmed.)

3. Since floor joists are generally lapped side-by-side over the interior girder, you will need to "step back" your panel layout somewhere near this point. Usually, house dimensions and joist overlap work out so that a joint between rows of panels falls over the joist lap area. If so, you have no problem. You will simply cut the first panel of the next row 1 1/2 inches short to allow for the lap. If, in some unusual case, this joint does not fall over the lap, it will be necessary to "scab" a 2 x 4 on the side of a joist every 8 ft., to support the end of one of the panels. (See Figure 1.)

In any case, begin the second half of the floor so that the panel joints are staggered as indicated above in Steps 1 & 2.

EXAMPLE

Some of the above points can be illustrated by the example subffloor layout in Figure 2. If you simply started from corner A and laid the first row of panels with the recommended 1/16 in. gap, you would probably need to trim the fourth panel (Panel B), since it would force the fifth one too far off centerline of joist. By figuring carefully, or by laying the fifth and sixth panels in place and measuring, you can make just the right amount of cut on only one panel in the row.

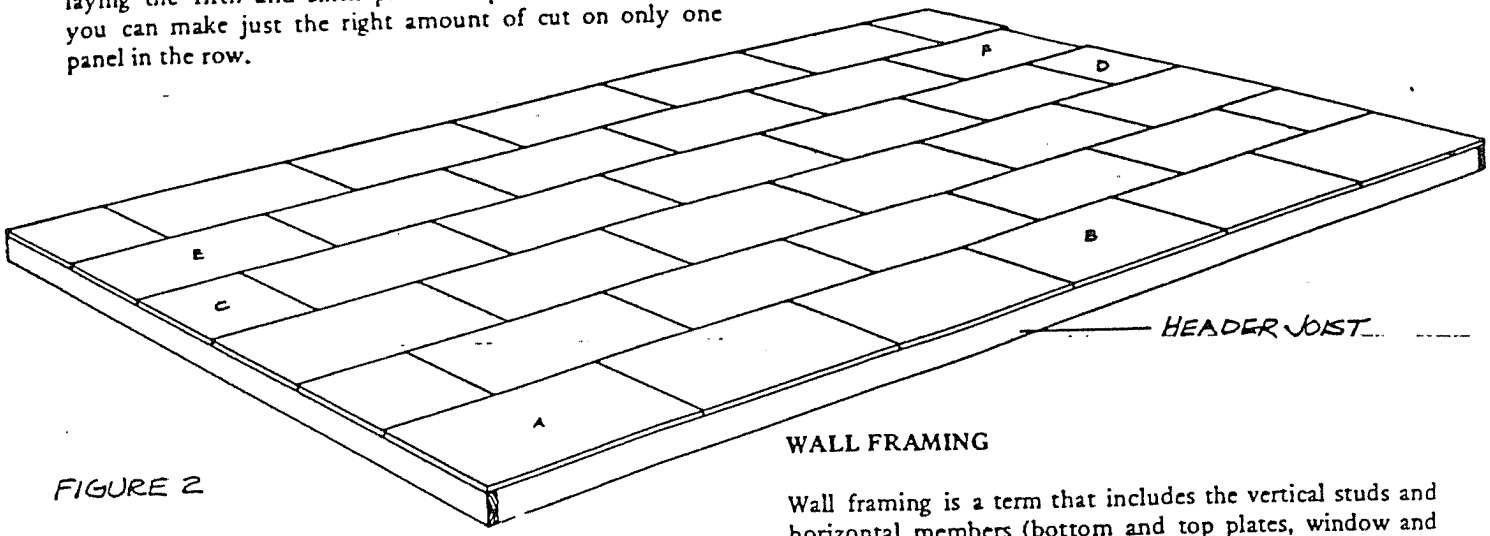


FIGURE 2

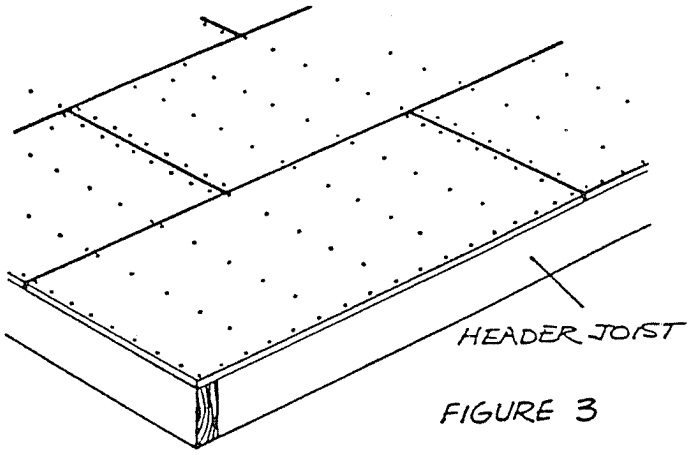


FIGURE 3

SUBFLOOR NAILING AND PLACEMENT

Nail panels in place as shown. Use 6d common nails for 1/2 in. plywood or 8d for 5/8 in. or 3/4 in. plywood. Place nails 3/8 in. from edge of plywood panel and space 6 in. apart along the outside perimeter of the house and along plywood end butt joint over interior joists. Drive nails at a slight angle to penetrate floor joists. Space nails 10 in. apart when nailing into joists under panel interior. (With these spacings, 9 nails are required across each end of each panel, 17 nails along an 8-ft. supported panel edge, and 6 nails along each interior joist. See Figure 3.)

Drive subfloor nails accurately so that they all penetrate the joists. Nails that miss joists, or angle out the side of joists, can cause floor squeaks. It is usually worthwhile to snap chalk lines on the plywood showing joist locations, to ensure that nails are driven correctly. NOTE: Take special care where the joists lap at the girder, since rows of nails must jog at that point. Where scabs are required, due to the offset at the overlapped joists over the girder, use 10d nails to attach 2 x 4 scab to the side of the joist to support the panel ends (see Figure 1). The scab should be of sufficient length to provide full support to the panel ends.

WALL FRAMING

Wall framing is a term that includes the vertical studs and horizontal members (bottom and top plates, window and door headers) of both exterior and interior walls that support the ceiling and roof. Wall framing lumber in conventional house construction is generally of 2 x 4 lumber, with the exception of headers over windows and doors in load-bearing walls, which may be 2 x 6's or larger or two or more 2 x 4's nailed together.

Before selecting or cutting wall framing materials, check house drawings to determine whether dimensions are drawn to the middle or the outside of the stud. Also check dimensions given for roughin-in door and window openings against the millwork manufacturer's installation recommendations.

Wall framing described here is called "platform construction." Wall sections are constructed flat on the subfloor then tilted up into position. Length of exterior wall sections must be determined by the number of helpers you have available to assist you in raising walls. If only two men are on hand, it may be wise to frame sections no longer than about 24 ft.

1. Lay out and mark on the subfloor, location of all exterior and interior walls. Then select 2 x 4 bottom plates for all exterior walls and cut them to length. Temporarily nail them in place (to the subfloor), with the outside edge of the 2 x 4 flush with the edge of the floor header joist. Use 8d scaffold nails, since they permit easy withdrawal. Next, position the bottom of all interior wall partitions, again tacking in place with 8d scaffold nails. By laying out all walls—both exterior and interior—you can identify all wall intersections and determine special framing required (see Figure 1).

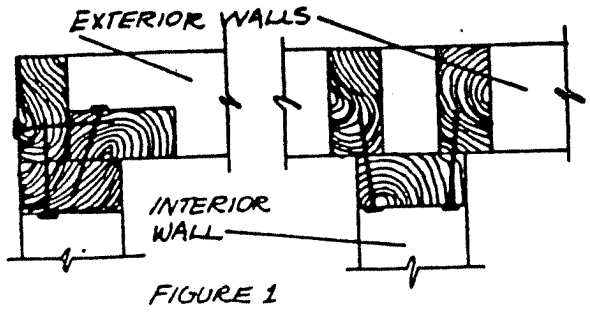


FIGURE 1

2. While bottom plates are still tacked in place, mark location of all major openings (make sure it's a rough, clear opening) on all plates. Then lay out all stud locations, which are generally 16 in. on center. Start on one exterior corner, and with a tape, measure and mark the location of each stud (Figure 2). Remember that most plywood sheathing and siding panels are 48 in. wide, so the dimension from the outside of the corner to the centerline of the first stud from that corner should be 16 in. Extra studs needed at wall intersections and those required to carry special loads at door openings should also be noted and marked.

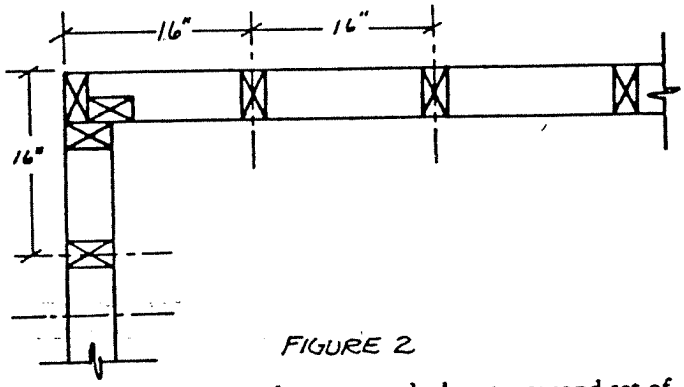


FIGURE 2

3. After all bottom plates are marked, cut a second set of plates and mark them exactly like the bottom plates. These will be the lower member of the doubled top plates.

4. Prepare to cut all wall-height stud framing members. To the floor-to-ceiling height dimension noted on your drawing, add about 1 in. for underlayment and ceiling material thickness and substract about 4 1/2 in. for three 2 x 4 place thicknesses. Measure and cut one stud to the proper length, double-check its length, and mark it as a "stud pattern." Cut all other studs to this pattern to ensure standard stud height for all exterior and interior walls. (Note: precut studs may also be used.) Then cut all cripples, jack studs, and headers, each time checking for proper length. Where several pieces of the same length are required, as in cripples, always use the same member as the pattern.

5. Assemble long-wall exterior wall sections first. Move the interior wall plates and end exterior wall plates out of the way to clear the floor for working space. (Make sure you've marked their location on both plate and subfloor for later reference.) Remove scaffold nails from exterior wall bottom plates. Tip on edge and nail in place with 16d nails driven diagonally through the plate into plywood subfloor (see Figure 3). Nailing the bottom plate to the subfloor will keep the completed wall section from sliding off the floor deck during tilt-up.) Make sure the 16d nails are not driven into the edge of the 2 x 4 where a stud will be located or into a floor joist. Move the top plate of the same wall parallel to the bottom plate, a stud-height distance apart.

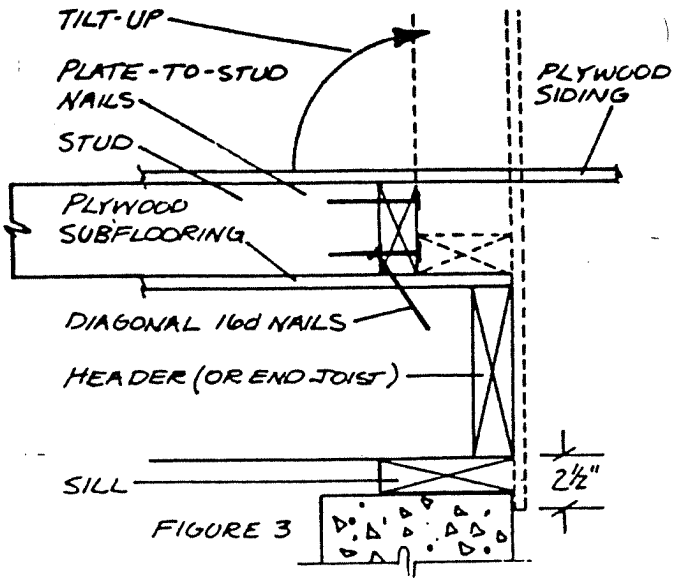


FIGURE 3

6. Locate all full-height studs and nail in place by driving nails through the bottom and top plates into the ends of the studs, two 16d nails in each plate at each stud. (You will add another top plate after the wall is erected.) Where special wall-intersection framing is required, as at corners and where interior wall will join, nail it in place. Next nail all cripples in place. Then cut and install all bottom top headers. The following sizes are recommended.

Maximum Span (ft.)	3 1/2	5	6 1/2	8
Header Size (in.)	2 x 6	2 x 8	2 x 10	2 x 12

7. Check the wall for squareness by measuring the diagonals from corner to corner. When the wall is square, the two diagonals will be exactly the same length.

8. Before tipping wall sections in place, cut several 1 x 4 or 1 x 6 diagonal braces so that, once the wall is upright, these braces can be used to attach the wall framing temporarily to the subfloor, to prevent the wall from tipping over (Figure 4).

9. Erect the wall sections; first the long walls. As you tilt the sections into place, the diagonally driven 16d nails (Figure 3) will withdraw gradually from the floor. Use 16d nails spaced 16" on center to secure the wall sections to the floor. Then build and raise the shorter end walls. Nail them to the floor and to the side walls at the corners.

10. Frame interior walls. Interior partitions are laid out exactly like exterior walls except that no sheathing or siding is attached. Interior walls should be braced diagonally during raising and, where necessary, nailed to exterior walls at their intersection. When all walls are in place, apply a second layer of top plates throughout. Make sure that butt joints in the two layers are offset, and that the doubling plates are properly lapped, to tie together all intersect walls (see Figure 5)

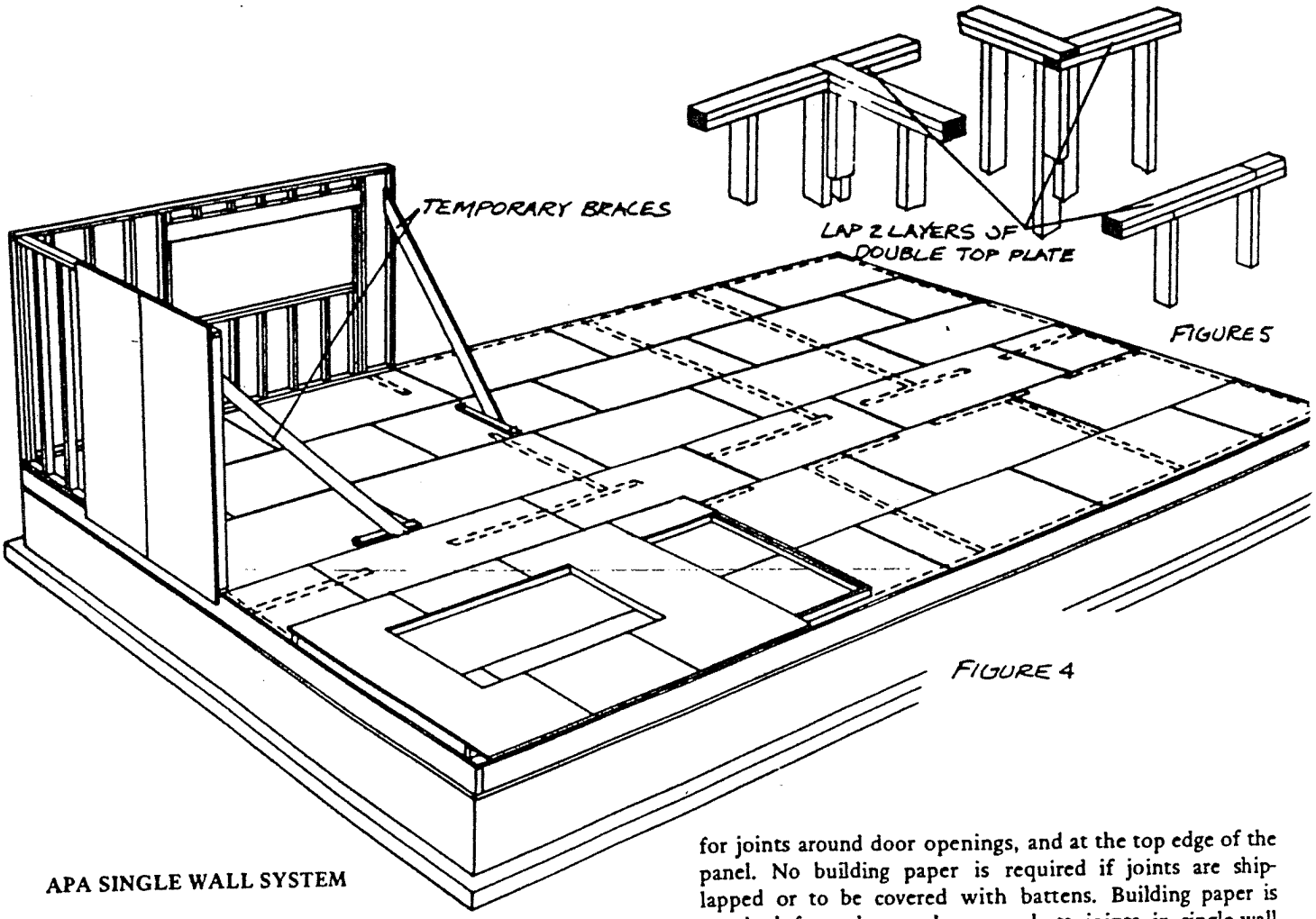


FIGURE 5

FIGURE 4

APA SINGLE WALL SYSTEM

The APA Single Wall System saves time and money. Plywood panel siding bearing the APA grade-trademark—available in a wide variety of textures and patterns is applied direct to wall framing (Figure 1), thus eliminating the costs of material and labor for installing the sheathing layer of conventional double-wall construction. Single-wall construction meets all requirements for structural performance, as a combination siding and sheathing.

APA grade-trademarked plywood siding comes in panels 3/8 to 3/4 in. thick and 4 ft. by 8,9, or 10 ft. long. (Check your lumber dealer for panel-length availability in your area.)

Normally, panels are installed vertically, with the long dimension running parallel to the studs. However, they may be installed horizontally. Allowable stud spacing is marked on the APA grade-trademark on the back.

Exterior panel may be used on studs 24 in. o.c. when applied with face grain horizontal, subject to your preference on finishing and appearance. No extra corner bracing is needed with panel siding.

Before applying plywood siding, check your house plans to see if there are any special requirements. Panel thickness may be specified, or windows may have to be attached to framing before siding is applied. The plans also may call out particular butt-joint locations or give specific details for joints around door openings, and at the top edge of the panel. No building paper is required if joints are shiplapped or to be covered with battens. Building paper is required for unbattened square butt joints in single-wall construction.

Panel the side walls first, then the shorter end walls.

1. See "Wall Framing," Steps 1 through 7, for framing of tilt-up walls; or erect 2 x 4 stud walls in place.

2. Cut siding panels to proper length. See Figure 2 for guide. In determining length, allow for 1 in. lap over top of foundation wall and 1 1/2 in. for covering the second top plate after wall tilt-up.

3. Place the first panel at one end of the wall framing section, making sure the edge of the panel is flush with the outside edge of the corner stud.

4. Apply the panel to the wall framing. Use hot-dip galvanized, aluminum, or other nonstaining nails to prevent staining of the siding from nail weathering and rusting. Use 6d box, siding, or casing nails for plywood siding 1/2 inch or less thick; use 8d nails for thicker panels. Drive nails every 6 in. along panel ends and edges, every 12 in. at intermediate supports. See Figure 3 for nailing shiplapped panels. All edges of panel siding must be backed by solid lumber framing or blocking.

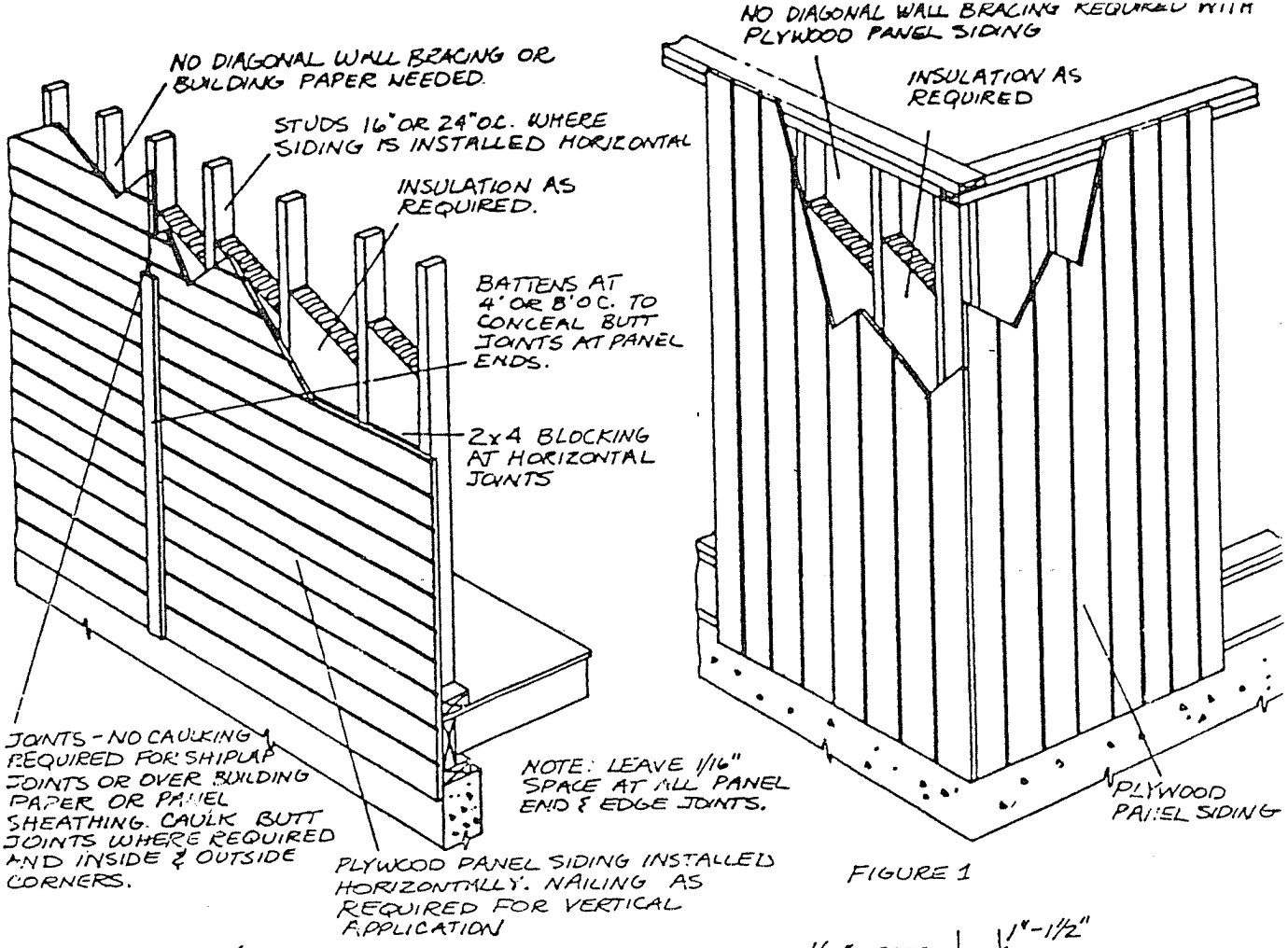


FIGURE 1

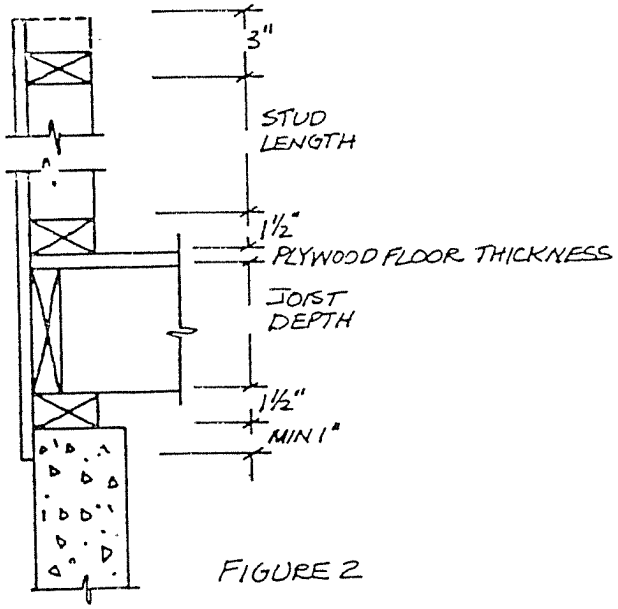


FIGURE 2

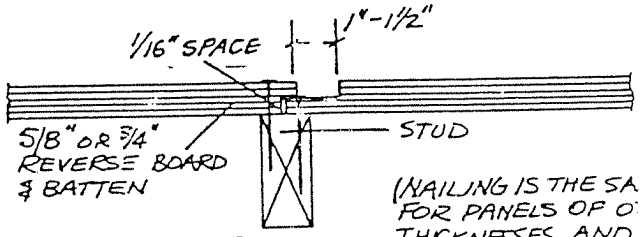


FIGURE 3

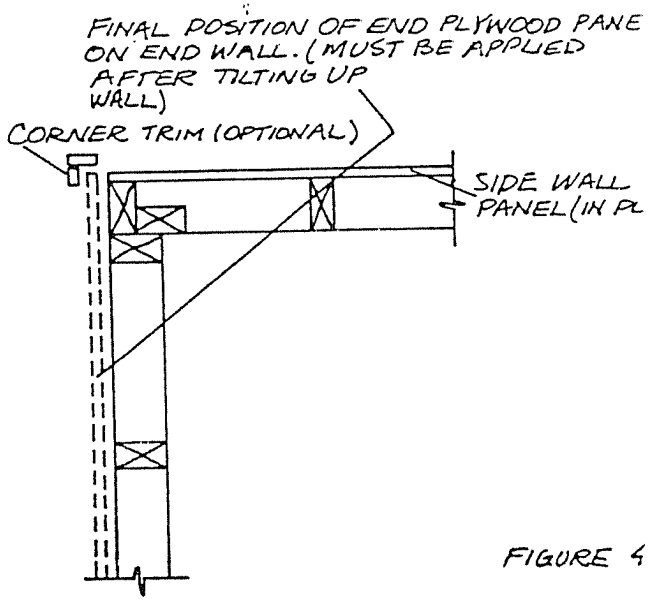


FIGURE 4

5. Apply additional panels in the same manner as above, to finish wall coverage. Remember to leave a 1/16 inch space between all ends and edges of panels. This spacing is necessary to ensure that panels will stay flat under all weather conditions.

6. Tilt the side wall into position and fasten it through the subfloor to the sill plate and header joist.

7. When both side walls are completed and in place, apply siding to shorter end walls. Place one panel at the end of each wall and temporarily tack it into position. Allow for overlap of sidewall framing and siding. See Figure 4 for help in figuring the overlap (normally about 3 1/2 in. plus panel thickness). It is usually easier to use corner trim pieces than to try to trim edges to perfect fit. Permanently fasten all remaining panels to wall framing; do not apply panel at the other end of the wall. Remove temporarily fastened panel from wall. The open framing at either end of the walls facilitates tilt-up and attachment to side walls. See Figure 4.

8. Tilt walls into position and nail to side walls at corners with 16d nails. Apply corner siding panels to complete siding application.

9. Caulk joints as required. No caulking is required for shiplapped joints or for joints backed by building paper. Caulk butt joints at all inside and outside wall corners, using any of the various high-performance polyurethane, thiokol, or silicone caulks. In some cases, a foam rod or other type of filler material may be used behind the sealant. Always follow the sealant manufacturer's instructions and recommendations.

10. Apply battens and trim strips as desired for appearance, or as shown on plans. Lap corner trim strip over siding joint as shown in Figure 4, so that there is no continuous joint through corner trim and siding. Where siding is applied with face grain across the studs, apply battens to conceal the vertical butt joints at panel ends. Block behind horizontal joint. Nails through battens must penetrate the studs at least 1 inch.

SIDING OVER SHEATHING

Conventional exterior wall covering consists of a sheathing material overlaid with siding. Plywood used in both places provides strength and stiffness, durability, and distinctive appearance.

APA® grade-trademarked C-D Interior sheathing, 3/8 in. thick, is recommended over studs spaced 16 in. o.c., although 24 in. spacing may be an acceptable alternative in some code areas. Sheathing may be applied vertically with panel face grain parallel to the studs. For extra stiffness, however, apply plywood sheathing horizontally with the face grain across the studs (face grain runs the long way of the panel). Be sure to check local building regulations first to see if horizontal joints must be blocked.

Apply sheathing to tilt-up side walls first, and erect them; then sheath shorter end walls. Before applying sheathing, check your house plans for possible special requirements. The plans may also call out special details at door openings, wall corners, and at the top edge of the panel.

SHEATHING INSTALLATION

1. See page 73,"Wall Framing," Steps 1 through 7, for framing of tilt-up walls; or erect 2 x 4 stud walls in place.

2. For vertical application, position the first plywood sheathing panel at one end of the wall framing section. Make sure the edge of the panel is flush with the outside edge of the corner stud. Allow the sheathing to overlap the top plate by 1½ in. so that the panel will cover the second top plate when installed after the wall is erected. Since most floor-to-ceiling heights are 7 ft.-6 in. to 7 ft.-9 in., the sheathing will also overlap the bottom plate. Do not trim. If sheathing is applied with face grain across the studs, be sure to make the same overlap allowances over the bottom plate.

3. Nail the sheathing to the wall frame. Use 6d box or common nails, spacing them 6 in. o.c. at panel edges and 12 in. o.c. over intermediate studs.

4. Apply the rest of the APA grade-trademarked plywood sheathing to the wall section to finish coverage. Remember to leave a 1/16 in. space between all panel ends and 1/8 in. between panel edges.

5. Tilt the wall into position and fasten the bottom plate to the floor framing with 16d nails. Fasten the overlapped sheathing to the header joist with 6d nails at 6 in. o.c.

6. When both side walls are completed and in place, apply sheathing to shorter end walls. Place one panel at end of wall framing and temporarily tack into place. Allow for overlap of side wall framing and sheathing.

Overlap will be about 3½ in. plus the sheathing thickness. Permanently fasten all remaining panels to wall framing; do not apply last panel at other end of wall. Remove temporarily fastened panel from wall. The open framing at either end of the walls allows the end-wall panels to be tilted up past the side walls.

7. Tilt walls into position and nail to side walls at corners with 16d nails. Attach bottom plate and sheathing to floor framing as in Step 5. Apply corner panels to complete sheathing installation.

8. Add a plywood filler strip, if necessary, below the sheathing to help tie the floor to the sill (see Figure 1). Nail this filler 6 in. o.c. to both header joist and sill.

SIDING INSTALLATION

9. Apply plywood siding to sheathed walls (Figure 2). Texture 1-11, 303-16 in. o.c. sidings, and other Exterior panels under 7/16 in. thick may be applied with face grain parallel to studs 16 in. o.c. Any Exterior panel may be used over studs 24 in. o.c. if face grain is across studs (subject to your preference on finishing and appearance). Use hot-dipped galvanized, aluminum or other nonstaining nails to prevent staining of the siding from nail weathering and rusting. Use 6d box, siding, or casing nails for plywood siding ½ in. or less thick; use 8d nails for thicker panels. Drive nails every 6 in. along panel ends and edges, every 12 in. at intermediate supports. Nails through battens must penetrate studs at least 1 in. or be driven through the plywood sheathing if the joint does not occur over a stud.

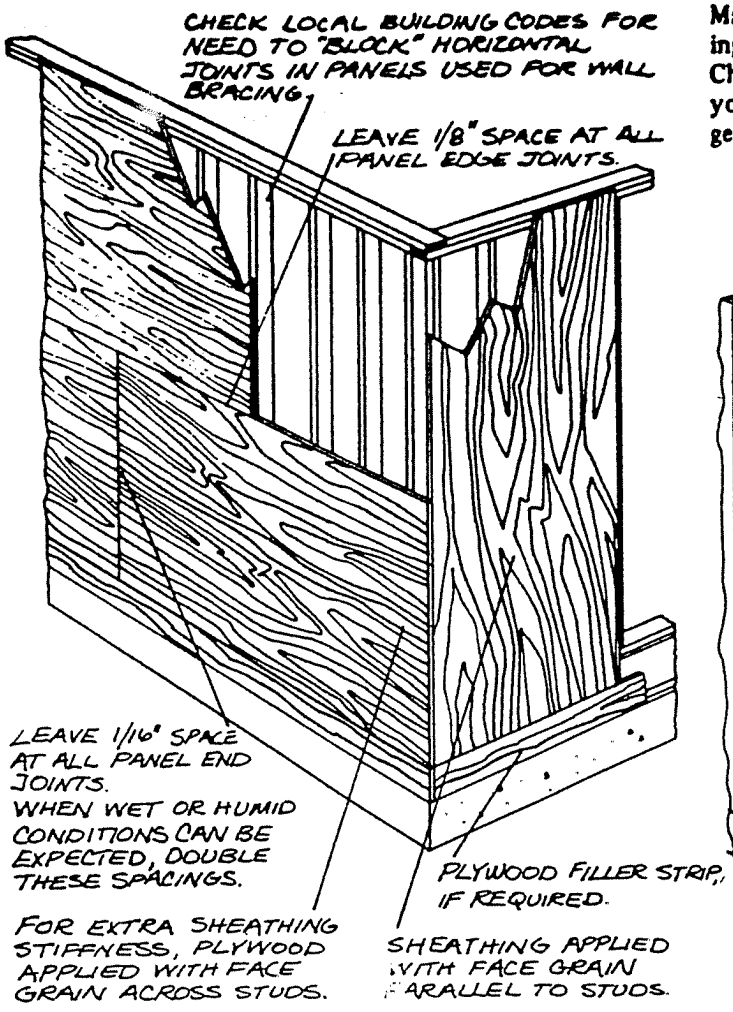


FIGURE 1

Main framing members are called joists and, like floor framing, their size is determined by spacing and length of span. Check your house plans for correct size and spacing, and your local building codes for agreement. Ceiling framing is generally of 2x lumber.

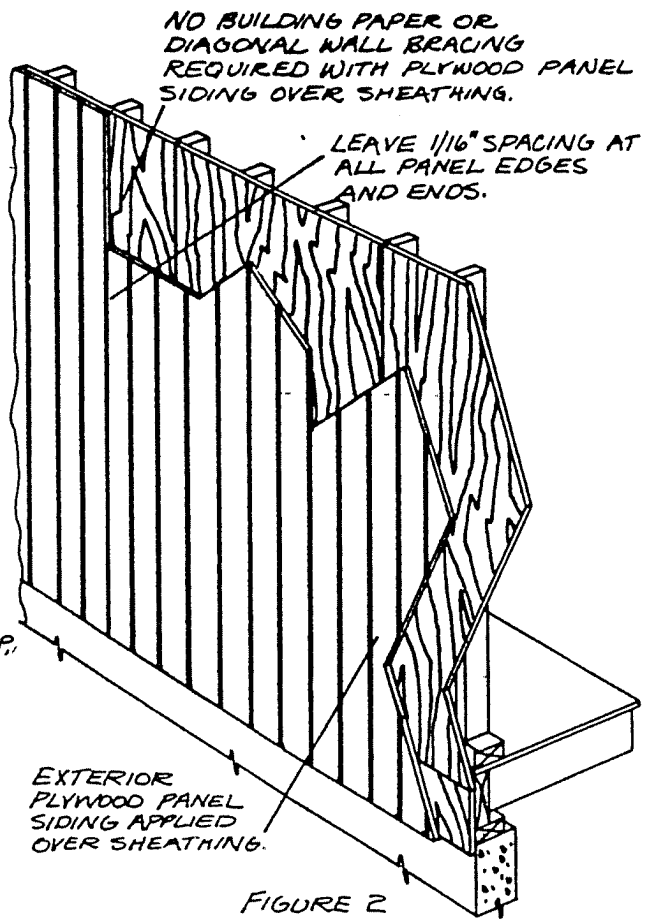


FIGURE 2

10. Leave 1/16 in. space between all ends and edges of siding panels.

11. Caulk square-edged siding butt joints with any of the various high-performance polyurethane, thiokol, or silicone caulks. In some cases, a foam rod or other type filler material may be used behind the sealant. Always follow sealant manufacturer's recommendations. No caulking is needed for ship-lapped joints or for joints covered by battens.

CEILING FRAMING

After exterior and interior walls are erected, plumbed for straightness, braced, and tied together with the second top plates, ceiling framing can be installed. Basic construction of ceiling framing is similar to that of floors, except that header joists are not included.

Ceiling framing does three things. It ties together opposite walls and roof rafters to resist the outward pressure imposed on the walls from the pitched roof. It supports the finished ceiling, and it supports either a second story, or in this example, an attic storage area.

You will want to install your ceiling framing before your roof rafters, to give you a working platform for building the roof. You should lay out both ceiling framing and roof rafters at the same time, however, since the ceiling joists must lap the roof rafters, and be securely nailed to them. Follow your house plans for location of members. It is much easier to space ceiling joists at the same spacing as roof rafters, and that is the method shown here.

With plywood sheathing and siding, and with doubled top plates, ceiling joists and roof rafters need not line up over the wall studs. In fact, wall studs are usually placed at 16 in. o.c., whereas roof rafters and ceiling joists can be placed at 24 in. o.c.

If the load-bearing interior wall is not continuous, a beam will be needed to carry the inside ends of the ceiling joists. Check your house plans to determine type, placement, and size of beam necessary to support the load. The beam may be below the ceiling joists, at the same level as the joists, or may even be above them. If it is at the same level, or abov them, it must support the joists with metal hangers.

1. Lay out the position of the ceiling joists and roof rafters in approximately the same manner as was done for floor joists, marking location of each joist and each rafter on both outside plates and the interior bearing wall. Note at this point that the two roof rafters on opposite sides of the house will frame opposite each other at the center, but that the ceiling joists will lap these rafters. The easiest method for making everything line up is to use filler blocks over the interior bearing partition, as shown in Figure 1. Then the two ceiling joists "meeting" over the center partition can be placed one on each side of the roof rafter, with the filler block occupying the space of the roof rafter at he center point.

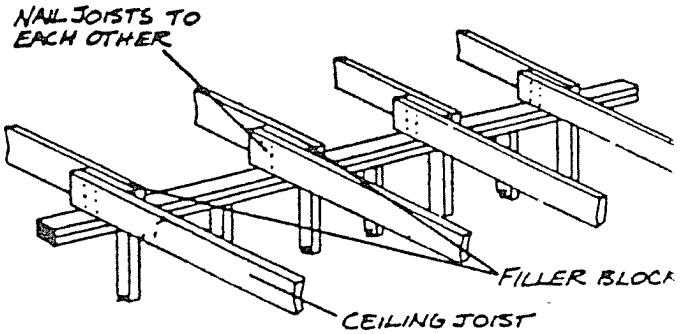


FIGURE 1

2. Begin installing ceiling rafters. Because the end rafter will be placed with its outside face flush with the outside of the wall, the ceiling joist at the end of the house will not lap its rafter (see Figures 2 and 3). For this reason, it is easier to place the end joist after the gable end has been framed. Place your first ceiling joist to lap the first interior roof rafter, which will have its centerline 24 in. from the face of the end wall. Succeeding joists (and rafters) are spaced 24 in. o.c.

3. Trim corners of ceiling joists at outer walls where they must match the rafter slope. (Your house plan will tell you the slope). If only a small amount must be removed, you may saw it off after rafters are in place.

4. Cut ceiling joists to proper length with the outer end flush with the outside of the wall and allowing for at least 4 in. overlap at the center.

5. Install ceiling joists and toenail to the top plate of the exterior walls with two 10d nails on each side. At the center lap, nail the joists to the filler block, and then toenail to the plate of the load-bearing wall or beam (Figure 4). Since the ceiling rafters are supplying the tie across the building, they must be well spiked. For a 24 ft. wide building, with ceiling joists and roof rafters both at 24 in. spacings, four 16d nails are required from each ceiling joist into the filler block. Tie together ceiling joists and the non-bearing walls that run parallel to them, as in Figure 5. As with floor framing, place ceiling joists with the crown up.

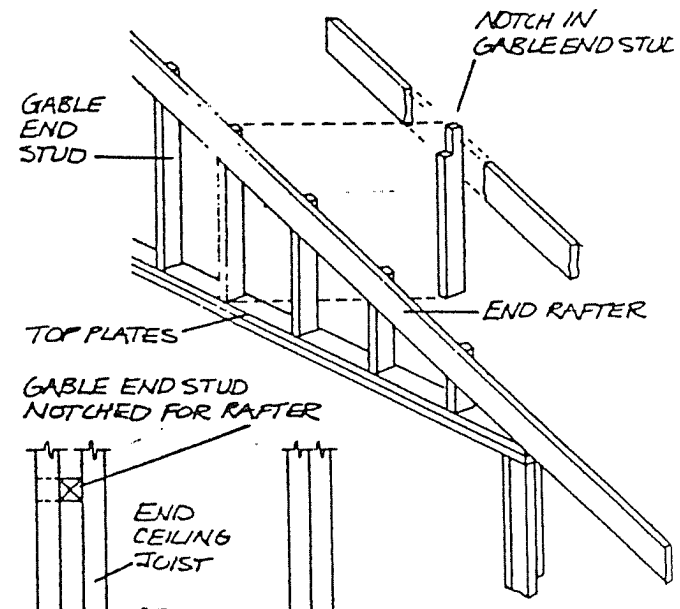


FIGURE 2

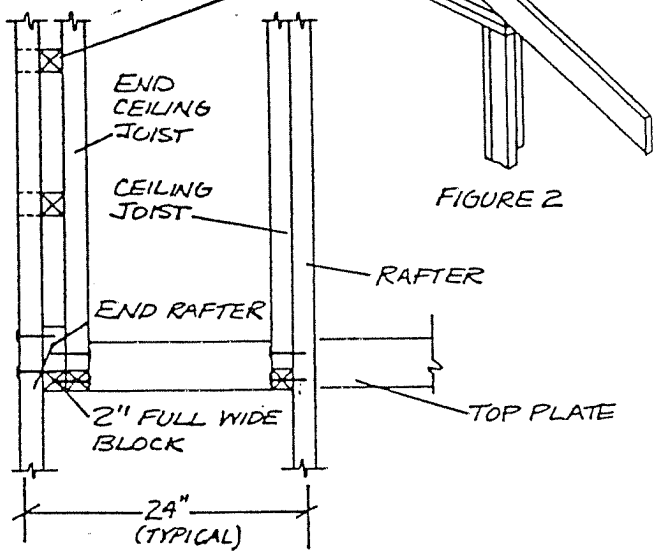


FIGURE 3

6. Cut and frame attic access in the same manner as openings in the floor. Fire regulations and building codes usually list minimum size requirements, and your house plans show locations. If the opening is small (2 to 3 ft. square), doubling of the headers and joists is not necessary.

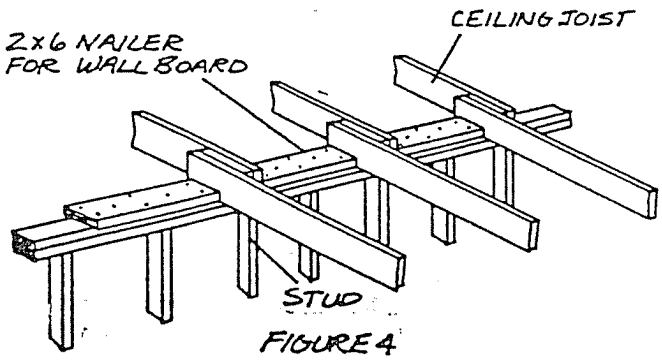


FIGURE 4

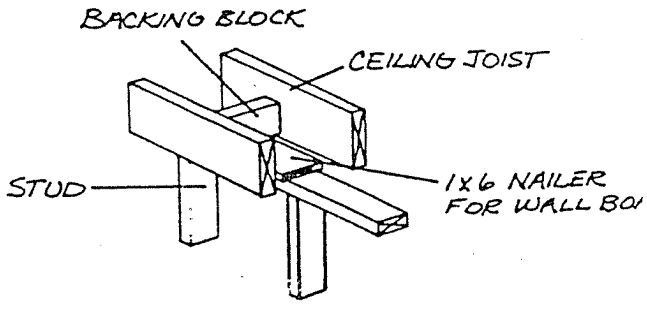


FIGURE 5

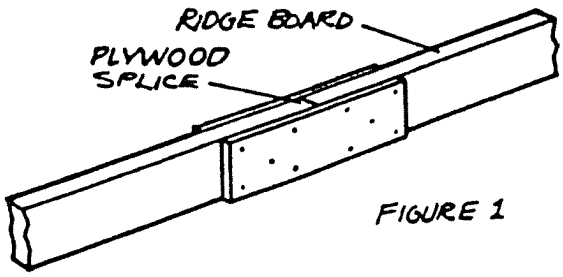


FIGURE 1

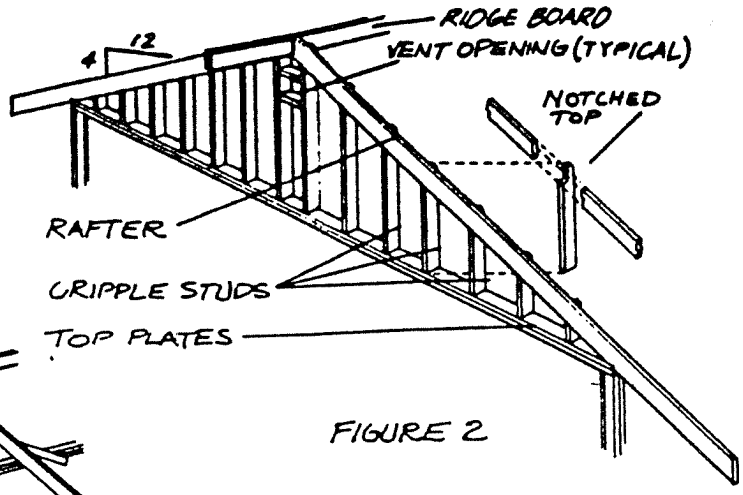


FIGURE 2

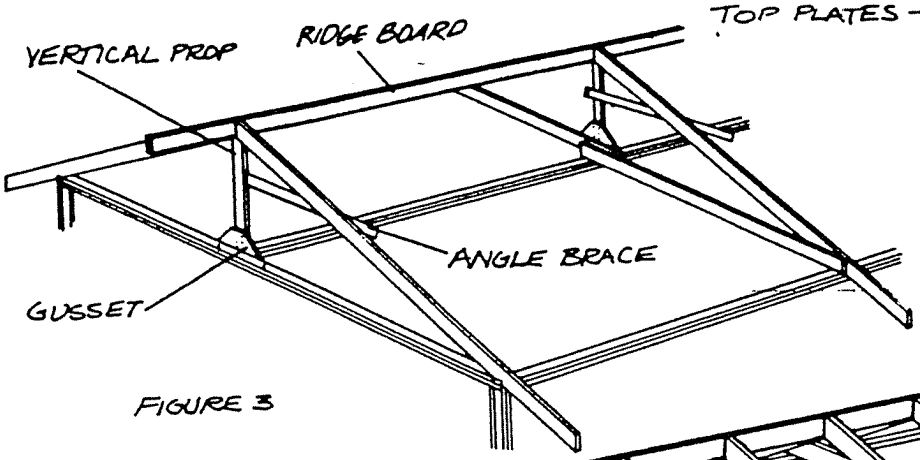


FIGURE 3

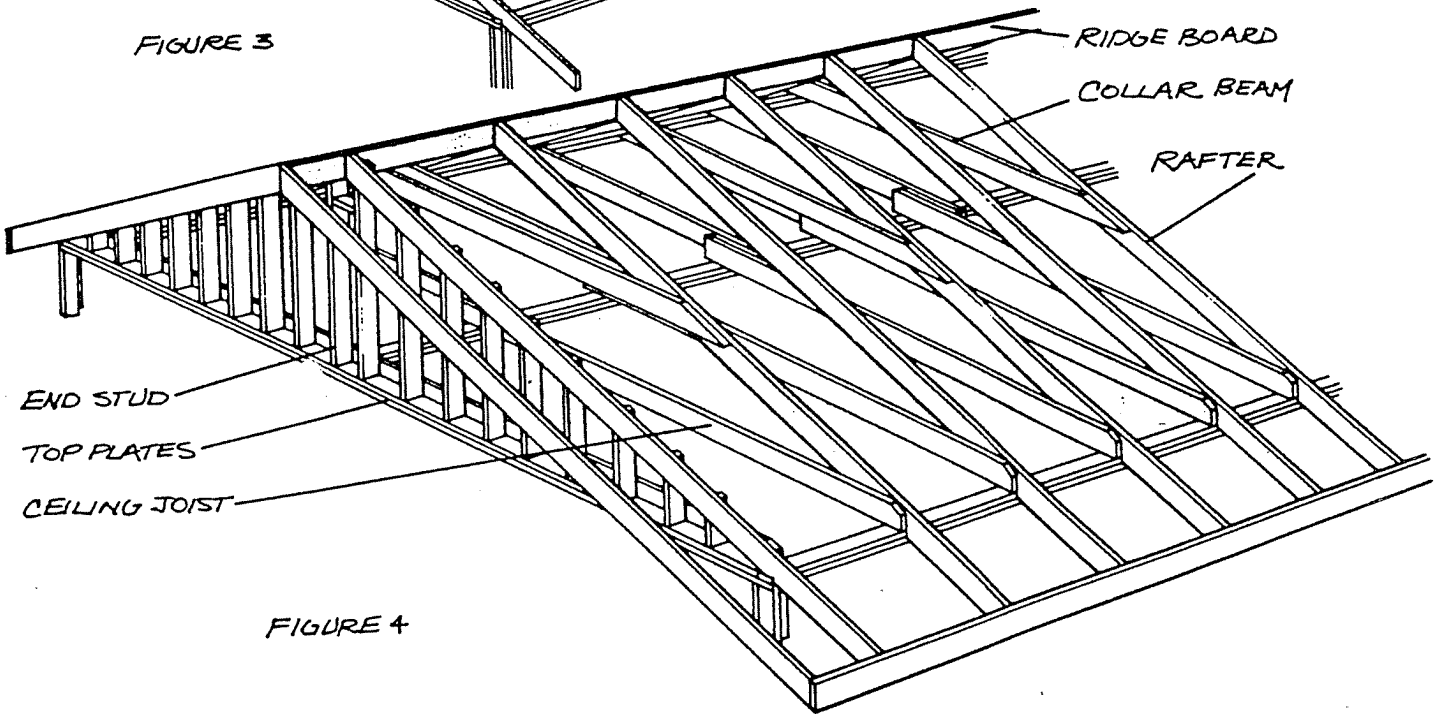


FIGURE 4

ROOF FRAMING

Roof framing is the combination of rafters, ridge board, collar beams, and cripple studs. In gable roof construction, all rafters are precut to the same length and pattern. Each pair of rafters is fastened at the top to a ridge board, commonly a 2 x 8 for 2 x 6 rafters, which provides support and a nailing area for rafter ends.

1. If not already done, mark rafter locations on the top plate of side walls. The first rafter pair will be flush with the outside edge of the end wall. Space the first interior rafter at 24 in. measured from the end of the building to the center of the rafter. All succeeding rafter locations are measured 24 in. center to center. They will be at the sides of ceiling-joist ends.

2. Next, mark rafter locations on the ridge board, allowing for specified gable overhang. To achieve required total length of ridge board, you may have to splice it (see Figure 1). Do not splice it yet, however, because it is easier to erect it in shorter sections.

3. Check your house plan for roof slope (Figure 2). For example, 4 in. of rise in 12 in. of run is common, and is usually considered minimum for asphalt or wood shingles.

4. Draw a rafter pattern full-size on the floor of the house, showing actual slope. From this drawing, length of rafters including over all: angle of cut at ridge and overhang, and location of notched seat cut (to fit on wall top plate) can be determined. Remember to include the width of the ridge board in the drawing so that rafter length will be accurate.

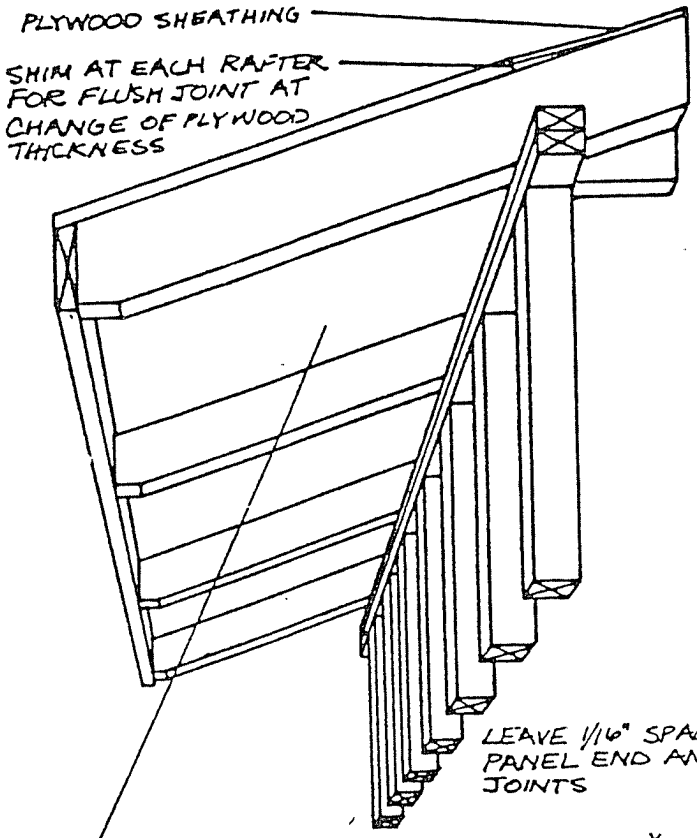


FIGURE 1
(OPEN SOFFIT)

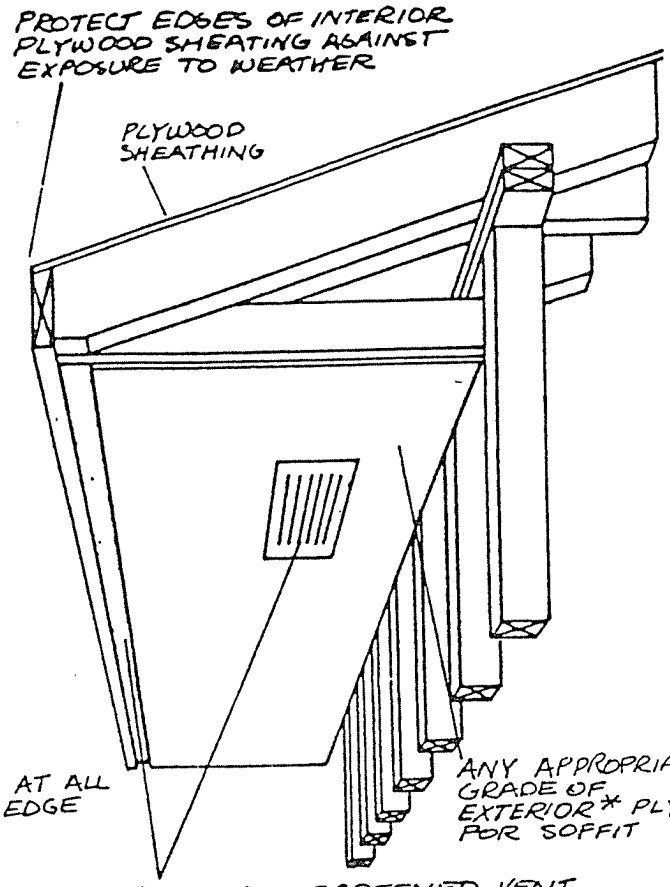


FIGURE 2
(BOXED SOFFIT)

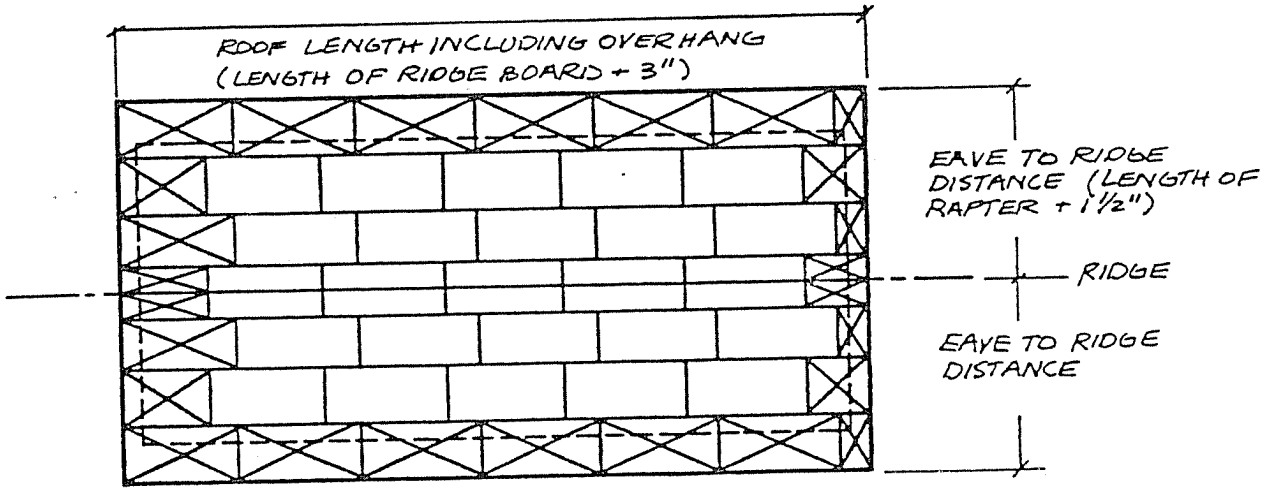


FIGURE 3
FOR "OPEN SOFFITS" ALL PANELS MARKED WITH X'S MUST BE EXT-DFPA "SOFFIT" PANELS.

5. Lay out the pair of rafters, marking top and bottom angles and seat cut location. Make the cuts and check fit by setting them up at floor level. Once a good fit is achieved, mark this set of rafters for identification and use it as a pattern for the remainder.

6. Cut remaining rafters. For a 48 ft. house with rafters spaced 24 in. o.c., you will need 24 more pairs cut to the pattern (25 total pairs). In addition, you will need two pairs of fascia rafters for the ends of the gable overhang (Figure 4). Since they cover the end of the ridge board, they must be longer than the pattern rafters by half the width of the ridge board. Fascia rafters will have the same cuts at the top and bottom as the regular rafters, but they will not have a seat cut.

Getting started with erection of the roof framing is the most complicated part of framing a house. Plan it carefully, making sure you have all materials on hand and all steps in mind before you begin. It is best to make a "dry run" at ground level. Erection procedure will be much easier if you have at least two helpers. A considerable amount of temporary bracing will be required if the job must be done with only one or two men.

7. Build temporary props of 2 x 4's to hold the rafters and ridge board in place during roof framing installation. The props should be long enough to reach from the top plate to the bottom of the ridge board, and should be fitted with a plywood gusset at the bottom; when installed the plywood gusset is nailed temporarily to the top plate or to a ceiling joist. The props are also diagonally braced from about midpoint in both directions to maintain true vertical (check with a plumb bob).

8. Move ridge board sections and rafters onto the ceiling framing. (Lay plywood panels over the ceiling joists for safer footing.) First erect the ridge board and the rafters nearest its ends, as shown in Figure 3. If the ridge of the house is longer than the individual pieces of ridge board, you'll find it easier to erect each piece separately, rather than splicing the ridge board full length first. Support the ridge board at both ends with the temporary props. Toenail the first rafter pair securely to the ridge board using at least two 8d nails on each side, then nail at wall. Install other end rafter pair in the same manner.

9. Make the ridge board joints, using plywood gussets on each side of the joint and nailing them securely to the ridge board.

10. Check the ridge board for level. Also check for straightness over the centerline of the house.

11. After full length of the ridge board is erected, put up the remaining rafters in pairs, nailing them securely in place. Check occasionally to make sure ridge board remains straight. If all rafters are cut and assembled accurately, the roof should be self-aligning.

12. Toenail the rafters to the wall plate with 10d nails, using at least two per side. Also nail the ceiling joists to the rafters. For a 24 ft. wide house, you will need four 16d nails at each lap. In high wind areas, it's a good idea to add metal-strap fasteners for extra uplift resistance.

13. Cut and install 1 x 6 collar beams at every other pair of rafters (4 ft. o.c.); see Figure 4. Nail each end with four 8d nails. Collar beams should be in the upper third of the at crawl space. Remove temporary props.

14. Square a line across the end wall plate directly below the ridge board. If a vent is to be installed, measure half its width on each side of the center mark for location of the first stud on each side. Mark positions for remaining studs at 16 in. o.c., then measure and cut studs. Notch the top end to fit under the rafter so that the stud bottom will be flush with the top plate. Cut cripple studs and headers to frame in vent opening (see Figures 2 or 4).

15. Cut and install fascia board to correct length of ridge board. Bevel the top edge to roof slope. Nail the board to rafter ends, then install fascia rafters. Fascia rafters cover the end of the ridge board (see Figure 4). Where nails will be exposed to weather, use hot-dip galvanized or other non-staining nails.

NOTE: Readymade lightweight wood roof trusses may be available at building supply dealers in lengths from 20 to 32 ft. or more. Because they span from one exterior wall to the other, with no interior bearing walls required, they allow greater flexibility in planning interior room arrangement. Trusses are most adaptable to houses with rectangular plans where the constant width requires only one type of truss.

ROOF SHEATHING

Roof sheathing, the covering over rafters or trusses, provides structural strength and rigidity, and makes a solid base for fastening the roofing material. APA® grade-trademarked sheathing is marked with an Identification Index, which tells you the recommended rafter spacing for the plywood thickness. For the example house, with 24 in. spans (distance between rafters), plywood with a marking of 24/0 is adequate. Sheathing panels with this Identification Index are available in 3/8 and 1/2 thickness.

Your house plan will show either "open soffits" (Figure 1) or "closed soffits" (Figure 2). If you have closed soffits, all of your roof sheathing can be APA grade-trademarked C-D INT grade. With open soffits, all panels to be exposed at the overhang, either along the side or at the end of the roof, must be Exterior type, and of high enough appearance grade to permit painting or staining to blend well with the rest of the house. To keep the roofing nails from showing through the underside, these exposed soffit panels must be at least 1/2 in. thick (and you'll have to consider the length of roofing nails as well). Many of the textured-finish plywoods of 1/2 in. and 5/8 in. thickness can be used with the textured side down to provide attractive open soffits.

With either open or boxed soffits, you will need a r
sheathing layout.

1. Draw your layout. It may be a freehand sketch, but should be relatively close to scale. The easiest method is to draw a simple rectangle representing half of the roof. The long side will represent the length of the ridge board. Make the short side equal to the length of your rafters, including overhangs. If you have open soffits, draw a second line (possibly dotted) inside the ends and bottom, to show the area that must be covered by Exterior plywood. Remember that this is only half of the roof, and that any cutting of panels on this side can be planned so that the cutoff portions will be useful on the other. If your eave overhang is less than 2 ft., and you have an open soffit, you may wish to start with a half-panel width of soffit plywood. Otherwise, you will probably start with a full 4 x 8 ft. section of plywood at the bottom of the roof, and work upward toward the ridge, where you may have to cut the last row of panels. Stagger panels in succeeding rows.

2. Complete your layout for the whole roof. The layout shows panel size and placement as well as sheathing panel quantities needed (See Figure 3). If your diagram should show that you will have excessive waste in cutting, you may be able to reduce scrap by slightly shortening the rafter overhang at the eave, or the gable overhang.

As shown in Figure 3, for the example house, nearly half of the panels are "soffit" panels. For such a case, rather than shimming to level up soffit and interior sheathing panels (as in Step 7), you may want to use interior sheathing panels of the same thickness as your soffit panels, even though they might then be a little thicker than the minimum required.

3. Cut panels as required, marking cutting lines first to ensure square corners.

4. Begin panel placement at corner of the roof. If you are using special soffit panels, remember to place them best or textured side down.

5. Fasten each panel in the first course (row), in turn, to the roof framing using 6d common smooth, ring shank, or spiral thread nails. Space nails 6 in. o.c. along panel ends and 12 in. o.c. at intermediate supports.

6. Leave 1/16 in. space at panel ends and 1/8 in. at edge joints. In areas of high humidity, double the spacing.

7. Apply the second course, using a soffit half panel in first (overhang) position. If the main sheathing panels are thinner than the soffit sheathing, install small shims to ease the joint transition (Figure 1).

8. Apply remaining courses as above.

NOTE: If your plans show closed soffits, the roof sheathing will be all the same grade and thickness. For applying plywood to the underside of closed soffits, use nonstaining type nails.

NAILS

On any construction job, the cost of nails used is so small, compared with their importance, that they should always be of the best quality. Sizes (length) are indicated by "penny," abbreviated as "d" (as in 8d). Length of all nails will be the same in a particular penny size, regardless of head or shank configuration. Only the diameter changes. Use nonstaining siding or casing nails to prevent siding from discoloring due to nail weathering or rusting.

NAIL SIZE AND NUMBER PER POUND

		COMMON		BOX	
Size	Length (in.)	Diameter (in.)	No. per Pound	Diameter (in.)	No. Per Pound
4d	1-1/2	.102	316	.083	473
5d	1-3/4	.102	271	.083	406
6d	2	.115	181	.102	236
7d	2-1/4	.115	161	.102	210
8d	2-1/2	.131	106	.115	145
10d	3	.148	69	.127	94
12d	3-1/4	.148	63	.127	88
16d	3-1/2	.165	49	.134	71
20d	4	.203	31	.148	52
30d	4-1/2	.220	24	.148	46
40d	5	.238	18	.165	35

COMMON AND BOX NAILS

Common and box nails are for normal building construction, particularly framing. Smooth box nails of the same penny size will have a smaller diameter than common nails. Since this smaller diameter has less tendency to split the lumber, they are recommended for most uses. You also get more box nails per pounds, as shown on the table.

SCAFFOLD NAILS

Scaffold or "double-headed" nails can save you time and trouble in many operations where the fastener must later be removed—as in scaffolding, bracing, concrete forms, and temporary fastening during framing layout.

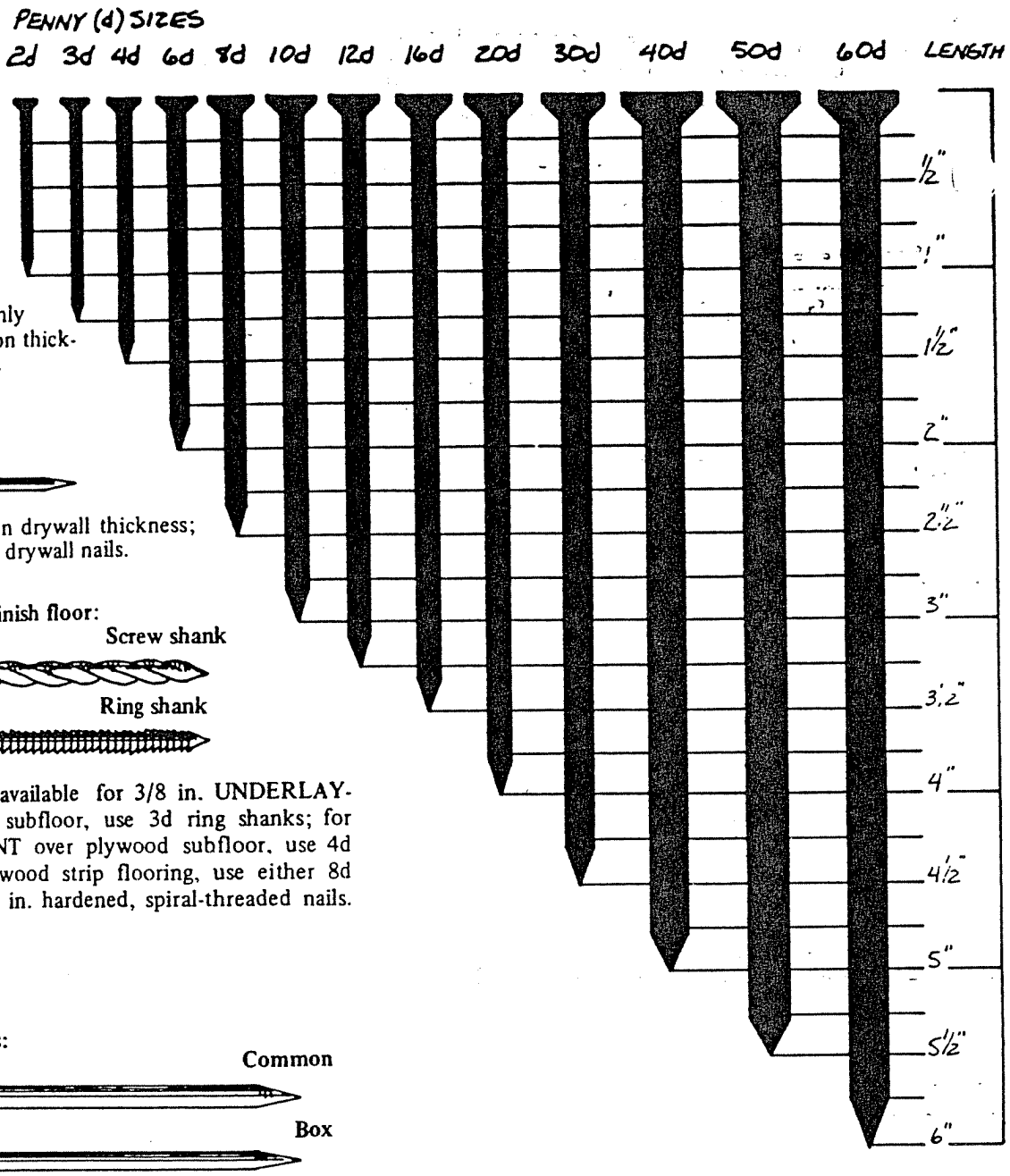
CASING AND FINISH NAILS

These are for use when you do not want large nailheads visible, such as in interior and exterior siding applications. To further reduce visibility, both may be driven deeper into the material with a nail-set and the holes filled with wood filler of matching color.

NONSTAINING NAILS

For long service and freedom from staining, use nonstaining nails. They are necessary where exterior exposure is combined with need for good appearance; for example, in siding, fascias, soffits, exterior trim, and wood decks. Galvanizing is the most common nail coating, and offers good protection against staining. Nails also are made of metals or alloys not subject to corrosion, including aluminum, bronze, and stainless steel.

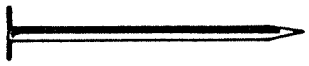
NAILS COMMONLY USED FOR RESIDENTIAL CONSTRUCTION



Roofing nails:

A special type, commonly available. Size depends on thickness of roofing material.

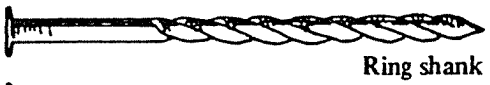
Drywall nails:



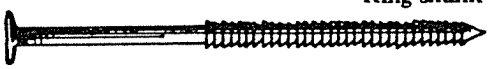
4d to 6d size depends on drywall thickness; for ½ in. drywall use 4d drywall nails.

For underlayment and finish floor:

Screw shank



Ring shank



Special nail types are available for 3/8 in. UNDERLAYMENT over plywood subfloor, use 3d ring shanks; for 5/8" UNDERLAYMENT over plywood subfloor, use 4d ring shanks. For hardwood strip flooring, use either 8d hardwood nails or 2½ in. hardened, spiral-threaded nails.

Common and box nails:

Common

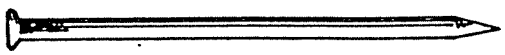
Box

16d for general framing.
8d and 10d for toenailing.
6d and 8d for subfloor, wall sheathing and roof sheathing. Size depends on thickness of plywood sheathing.

Scaffold nails:

8d and 10d most common, for scaffolds, bracing, and any temporary fastening that must be later removed.

Siding nails:

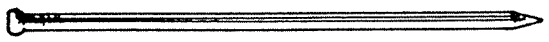


Nonstaining nails of size specified for siding thickness (usually 6d and 8d).

Casing and finish nails:

Casing

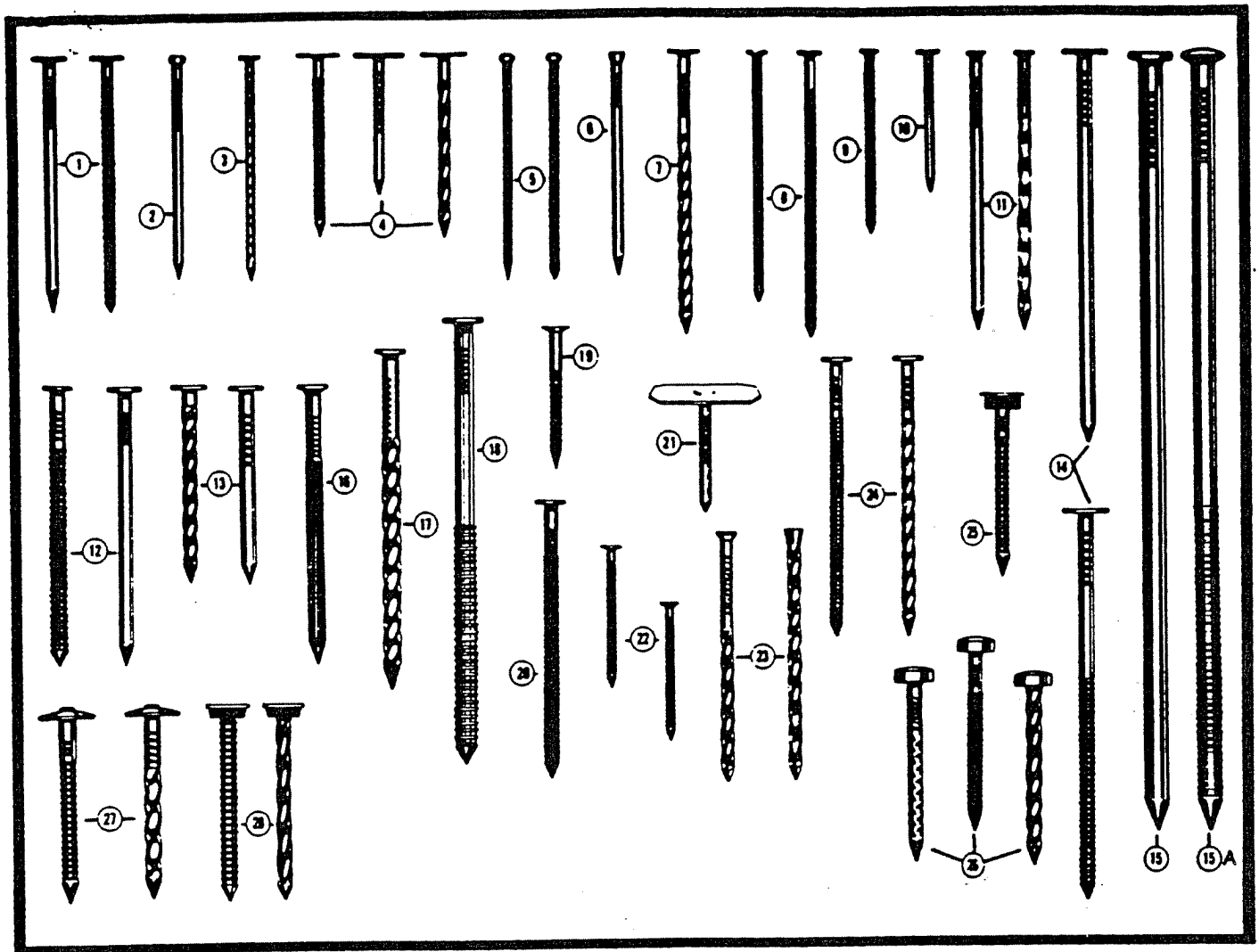
Finish



4d, 6d, and 8d most common, for exterior and interior trim and paneling where large nailheads should not show. Use casing nails for exterior siding.

DEFORMED-SHANK NAILS

A variety of deformed-shank patterns such as screw shank, ring shank, and barbed are available. These all have greater holding power than smooth nails. Often, you may use a smaller size deformed-shank nail and still do the job satisfactorily.



STORMGUARD® NAILS
FOR EXTERIOR APPLICATIONS
(Hot-dipped zinc-coated twice in molten zinc)

1. Wood Siding, Box (Plain & Anchor)
2. Finishing
3. Insulating, Plastic Siding
4. Asphalt Shingle (Anchor, Plain & Screw)
5. Cedar Shake (Plain & Anchor)
6. Casing
7. Cribber
8. "Split-Less" Wood Siding (Plain & Anchor)
9. Asbestos
10. Cedar Shingle
11. Hardboard Siding (Plain & Screw)
12. Common (Anchor & Plain)
13. Aluminum, Steel & Vinyl Siding (Screw & Plain)
14. Insulation Roof Deck (Plain & Anchor)
15. Gutter Spike (Plain)

15A. Gutter Spike (Anchor)

INTERIOR & OTHER NAILS

16. Masonry
17. Pole Barn, Truss Rafter (Screw)
18. Pole Barn (Anchor)
19. Drywall, GWB-54 Style
20. Underlayment, Plywood (Sub-floor, sheathing, etc.)
21. "Square-Cap" Roofing
22. Underlayment (Flat Head & Countersunk)
23. Spiral Flooring (Casing Head & Countersunk)
24. Pallet (Anchor & Screw)

METAL ROOFING NAILS

25. Rubber Washer (Stormguard, Anchor)
26. Compressed Lead Head (Barbed, Anchor & Screw)
27. Umbrella Head (Stormguard, Anchor & Screw)
28. Lead Washer (Stormguard, Anchor & Screw)

Penny-Wise Nail Lengths

2d ..... 1"	12d ..... 3¼"
3d ..... 1¼"	16d ..... 3½"
4d ..... 1½"	20d ..... 4"
5d ..... 1¾"	30d ..... 4½"
6d ..... 2"	40d ..... 5"
7d ..... 2¼"	50d ..... 5½"
8d ..... 2½"	60d ..... 6"
9d ..... 2¾"	70d ..... 7"
10d ..... 3"	80d ..... 8"

MATHEMATICS

TOPIC 11 – LUMBER PRODUCTS AND BOARD MEASURE

This topic is planned to help you answer the following questions:

- **How are standards for lumber and lumber products set and maintained?**
- **What are the various factors to be considered in grading lumber?**
- **How should a purchase order for lumber be made out?**
- **What is the sale of lumber based on?**
- **How can a framing square be used in calculating the board feet in a piece of lumber?**

Definition of Lumber

The term *lumber* as used in the carpentry trade refers to the manufactured product and not to the tree in its natural state. The lumber-manufacturing industry, like most other industries, is in a constant state of change. Lumber-manufacturing and marketing methods are continually being improved.

Lumber Standards

Standardization in the lumber-manufacturing industry is for the protection of the consumer and for convenience of communication within the industry. Specifications and grades of lumber are standardized by regulations of the American Lumber Standards and by trade associations, such as Western Wood Products Association and the American Plywood Association. These associations set standards that individual mills must meet to qualify for and to maintain their membership in the associations.

Factors in Grading

The factors that are considered in grading lumber are many and complex. They include species of lumber; size; grain; size and spacing of imperfections; surface texture; profile; moisture content; and so forth. Framing lumber may be "visually graded" or "machine stress" graded. Regardless of the method used, each piece of lumber is marked with a grade stamp. Also, the industry is developing a process of stamping each piece of framing lumber with span symbols. These symbols, referenced to simplified span tables, will indicate the maximum allowable spans that can be made in fabricating joists and rafters.

Purchase Orders

During your apprenticeship you should learn to make out a purchase order for lumber in accordance with the practices utilized in your own marketing area. The information in a purchase order usually includes size, species, classification, surface texture, grade, number of pieces, and length of each piece, as in the following examples:

2 x 8 Douglas fir, Joists, S4S, Standard and better, 48 pieces, 16 feet long

2 x 12 Redwood, Rough, Construction, 15/12, 20/16, 25/14 (15 twelves, 20 sixteens, 25 fourteens)

The finished size, or dressed size, of lumber is very important in detailing and in actual dimensions in construction. However, the sale of lumber is based on the rough, or "nominal," size (2 x 4, 1 x 6, 2 x 8, 3 x 12, and so forth). This nominal size is used in calculating the number of board feet contained in a piece of lumber. The price is stated as so much per board foot or so much per 1,000 board feet (Mb.f.). Lumber less than 1 inch in thickness is figured as 1 inch.

Calculation of Board Feet

The term *board measure* implies that the unit of measure for lumber is the board foot. A board foot is 1 inch thick, 12 inches wide, and 1 foot long (or any combination of factors that will give the same result). For example, 1 inch X 12 inches X 1 foot = 1 b.f., or stated as a true equation, 1 inch X $^{12}/_{12}$ inch X 1 foot = 1 b.f. The formula for calculating board feet can be stated as follows:

$$\frac{\text{Pieces} \times \text{Thickness (in.)} \times \text{Width (in.)} \times \text{length (ft.)}}{12}$$

Through the use of this formula, an order for 15 pieces of 2 x 8 each 18 feet long would be figured as follows: 15 X 2 X 8 X 18 ÷ 12 = 360 b.f. (4,320 ÷ 12 = 360).

The cancellation method used with the formula is the fastest and most practical method for you to use in the field. However, for use with an office machine, a table of constants may be worked out and used to advantage under some conditions. The carpenter's framing square has imprinted upon it an "Essex Board Measure," which can be used in calculating the number of board feet in a piece of lumber.

Intermediate Carpentry Skills
Study Questions/Workbook - Part 2

INTRODUCTION TO CONSTRUCTION

1. The most common spacing for floor joists is: _____
   a. 12 inches on center
   b. 16 inches on center
   c. 24 inches on center

2. Plywood floor panels should be spaced approximately: _____
   a. no gap between panels
   b. 1/16 inch between panels
   c. 1/8 inch between panels

3. The wall framing described in the workbook is called: _____
   a. "platform construction"
   b. "balloon construction"

4. A "fabricated" girder may be used in residential construction. _____
   The nailing schedule is:
   a. 16d sinkers, 24" on center, in two rows
   b. 20d sinkers, 32" on center, in two rows
   c. 20d common nails, 32" o.c., staggered in two rows.

5. When setting joists, the "crown" should be placed: _____
   a. up
   b. down
   c. doesn't matter

6. When setting joists, large knots should be placed: _____
   a. up
   b. down
   c. doesn't matter

7. T F Header (end) and ribbon joists are "toenailed" with 8d common nails directly to the mud sill. _____

8. T F Floor joists are "end nailed" to the header (end) joist using two 16d common nails. _____

9. T F Plywood subflooring stamped "32/16" may be used over joists spaced either 32 or 16 inches on center. _____

10. T F Plywood subfloor panels must be butted tightly together, leaving no spaces between sheets. _____

11. T F Correct layout of plywood subflooring will "stagger" the placement of panels. _____

12. The nailing schedule for plywood subflooring edges is: _____
    a. 3/8" from the edge, 6" apart
    b. 1/2" from the edge, 6" apart
    c. 3/8" from the edge, 8" apart

13. The nailing schedule for plywood interior is: _____
    a. on joist lines, 6" apart
    b. on joist lines, 8" apart
    c. on joist lines, 10" apart

14. The most common spacing wall studs is: _____
    a. 12 inches on center
    b. 16 inches on center
    c. 24 inches on center

15. Studs are "end nailed" to top and bottom plates with _____
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16. The nailing schedule for plywood single wall siding is: _____
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    c. 3/8" from the edge, 8" apart

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20. Collar beams must be installed at: _____

a. every pair of rafters
b. every other pair of rafters
c. every third pair of rafters

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22. T F "Screw shank" and "ring shank" nails are recommended when installing underlayment. _____

23. T F A 16d nail is 3-1/2" long _____

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26. A contractor purchased 36 planks to build a scaffold. The planks, of Douglas fir Selected Structural grad, were 2 inches x 10 inches x 12 feet 0 inches. The price was $326 per M. How much did the contractor pay for the planks? _____

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A list of dimensioned lumber for framing a small house includes the following:

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29. By scaling the foundation plan, a carpenter estimated that 130 linear feet of 4-inch x 6-inch girder are required. How many board feet do the girders contain? _____

a. 260 b. 280 c. 294 d. 302

30. How many board feet are contained in 18 pieces each 2 inches x 4 inches x 16 feet? _____

a. 144 b. 180 c. 188 d. 192

31. Which one of the following formulas may be used to determine the number of board feet in any piece of lumber? _____

a. Nominal size X length in feet ÷ 12 = board feet
b. Nominal size X length in feet ÷ 144 = board feet
c. $\frac{1 \text{ X } 12 \text{ X } 12}{12}$ = board feet
d. Thickness in inches X width in inches X length in feet ÷ 144 = board feet

32. A board foot is an inch thick and a foot square, or any combination of measurements that will equal this amount. Which one of the following measurements contains a board foot? _____

a. 2 inches x 6 inches x 1 foot
b. 1 foot x 4 inches x 3 inches
c. 1 inch x 6 inches x 2 feet
d. All of these

33. If an order for redwood were written for 2 inches x 8 inches rough, the word *rough* would suggest: _____

a. Nominal size
b. A resawn textured surface
c. Imperfections other than knots
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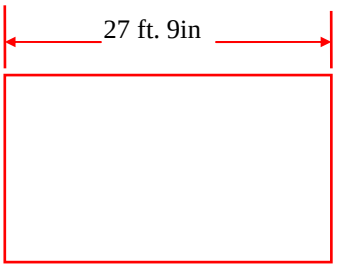
34. An exterior wall has a 7/8-inch coat of stucco and 3½-inch studs; the interior wall has ½-inch sheetrock covered with ¼-inch prefinished plywood panels. Determine what width jamb (a wood member that frames a door opening) should be ordered for the exterior door frames. _____

35. The bottom of the ceiling joists is 8 feet 1 inch above the top of the subfloor; the bottom plate and double upper plate are made of 1½-inch thick material. Determine the common stud length in inches. _____

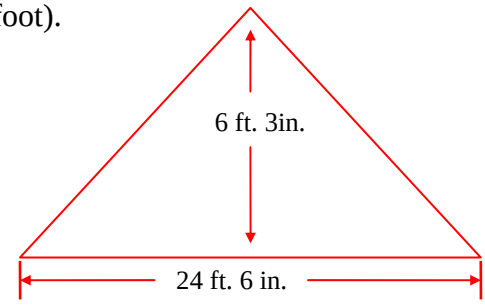
36. Determine the number of studs remaining from an original order of 312 if ¾ of the order has been used. _____

37. Determine how many 1½-inch strips can be ripped from a 6 3/8-inch wide board if each saw kerf (the width of the cut made by the blade of the saw) is 1/8 inch wide. _____

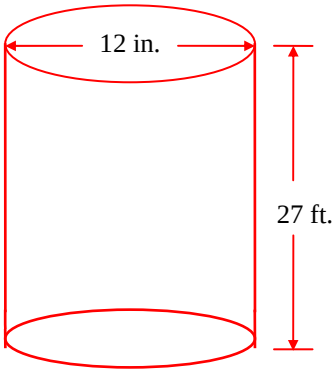
38. Find the perimeter of the figure shown below if the length is twice the width. _____



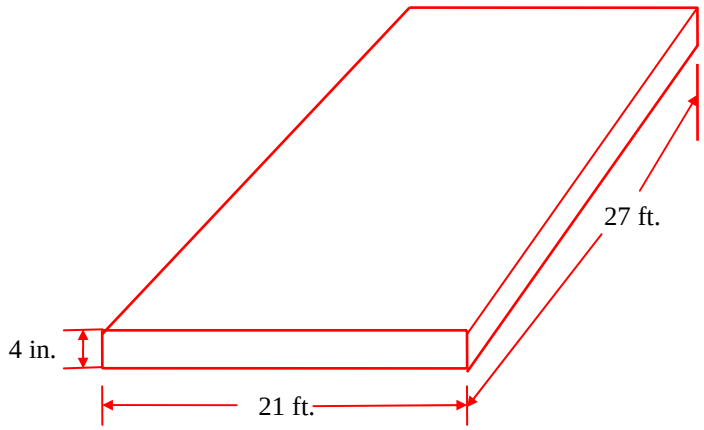
39. Determine the area of the figure shown below (to the nearest on-half square foot). _____



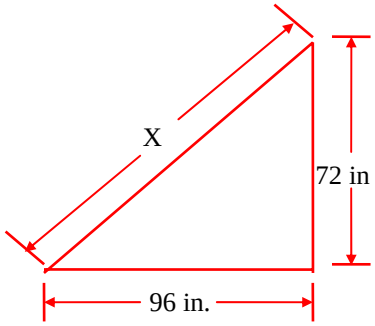
40. Determine the volume of the figure shown below (to the nearest cubic foot). _____



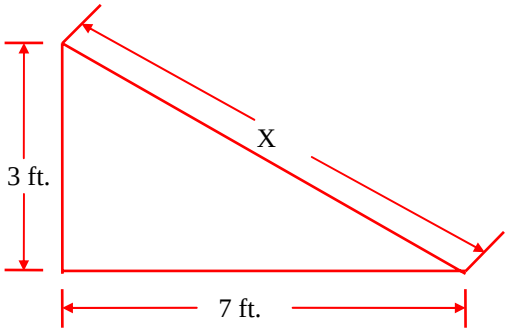
41. Calculate the volume of the figure shown below (in cubic yards). _____



42. Determine the length of X in inches in the triangle shown below. _____



43. Determine the length of X in feet in the triangle shown below. _____



Transfer these answers (1 through 43) to your pre-training assignment booklet sheet 3 through 9

INTERMEDIATE CARPENTRY SKILLS

PRE-TRAINING ASSIGNMENT BOOKLET

DUE FIRST DAY OF CLASS

SEPTEMBER 25, 2006

INTERMEDIATE CARPENTRY SKILLS

PRE-TRAINING ASSIGNMENT BOOKLET

The pre-training assignment has been developed to maximize your training experience. Completion of the pre-training assignment is mandatory and will count for 20% of your program grade. The pre-training checklist and workbook answer sheets are provided on the next nine (9) pages. These assignments will be collected by the Program Coordinator on the first day of the program.

Complete the following:

1. ❑ Discuss the Intermediate Carpentry Skills program agenda and objectives with your supervisor.

2. ❑ Make arrangements with your supervisor to demonstrate your ability to safely use the items listed under equipment on the checklist.

3. ❑ Read the course material contained in the workbook. At the end of each section you will find a series of study questions. Answer the questions on the worksheet and transfer the answers to the answer sheet.

4. ❑ Review the checklist, making sure that all items have been completed and that it has been signed by your supervisor.

If you have questions or need help, call the Program Coordinator, Chuck Combs, at (831) 649-7124. He will be happy to offer suggestions.

INTERMEDIATE CARPENTRY SKILLS
PRE-TRAINING CHECKLIST

TOOLS & EQUIPMENT

Participant has read the owners manual for, and demonstrated safe operation of, the following:

	Date Evaluated	Supervisors Initial
TABLE SAW		
RADIAL ARM SAW		
CIRCULAR SAW (Worm Drive)		
CIRCULAR SAW ("Sidewinder")		
RECIPROCATING SAW (Sawsall)		
DRILL (Portable, hand held)		

SAFETY

Participant has been instructed, and has demonstrated safe work practices in the following:

	Date Evaluated	Supervisors Initial
LIFTING AND CARRYING		
EYE/EAR/HAND PROTECTION		

ACADEMICS

	Date Evaluated	Supervisors Initial
Participant has read the syllabus and workbook		
Participant has completed the workbook study questions and answer sheets		

Participant Name: _____

Unit: _____

Supervisor Signature: _____

Name: _____

Intermediate Carpentry Skills
Study Questions/Workbook - Part 1

GENERAL TOPICS

1. The function of the California Department of Parks and Recreation is "to _____, _____, _____and _____areas of outstanding scenic recreational and historic importance.

2. _____ is the single most important subject the maintenance worker must learn about the carpentry trade.

3. What is the "mission statement" for your unit of the park system?

   _____

   _____

4. All employees are responsible for maintaining a _____workplace.

5. Accidents do not "just happen" -- they are caused by unsafe _____ or _____.

6. _____ is based on the Uniform Building Code and is the building standard for all state owned buildings.

7. _____ stands for California Environmental Quality Act and basically says that nothing will be done that will adversely affect the environment.

8. _____ basically interpreted to says that nothing will be done to alter the character of historic structures.

9. If force is applied to two boards in such a way that one board tries to slide along the other, a nail holding the two boards from moving would be in "_____".

10. If a force is applied to two boards in such a way that the boards are being pulled apart, a nail holding the boards from moving would be in "_____".

11. Nails hold best when resisting "_____" forces.

12. Nails cannot be trusted to hold in tension when they are driven into the end grain or_____ to the grain of the board.

Intermediate Carpentry Skills
Study Questions/Workbook - Part 2

INTRODUCTION TO CONSTRUCTION

1. The most common spacing for floor joists is: _____
   a. 12 inches on center
   b. 16 inches on center
   c. 24 inches on center

2. Plywood floor panels should be spaced approximately: _____
   a. no gap between panels
   b. 1/16 inch between panels
   c. 1/8 inch between panels

3. The wall framing described in the workbook is called: _____
   a. "platform construction"
   b. "balloon construction"

4. A "fabricated" girder may be used in residential construction. _____
   The nailing schedule is:
   a. 16d sinkers, 24" on center, in two rows
   b. 20d sinkers, 32" on center, in two rows
   c. 20d common nails, 32" o.c., staggered in two rows.

5. When setting joists, the "crown" should be placed: _____
   a. up
   b. down
   c. doesn't matter

6. When setting joists, large knots should be placed: _____
   a. up
   b. down
   c. doesn't matter

7. T F Header (end) and ribbon joists are "toenailed" with 8d common nails directly to the mud sill. _____

8. T F Floor joists are "end nailed" to the header (end) joist using two 16d common nails. _____

9. T F Plywood subflooring stamped "32/16" may be used over joists spaced either 32 or 16 inches on center. _____

10. T F Plywood subfloor panels must be butted tightly together, leaving no spaces between sheets. _____

11. T F Correct layout of plywood subflooring will "stagger" the placement of panels. _____

12. The nailing schedule for plywood subflooring edges is: _____
    a. 3/8" from the edge, 6" apart
    b. 1/2" from the edge, 6" apart
    c. 3/8" from the edge, 8" apart

13. The nailing schedule for plywood interior is: _____
    a. on joist lines, 6" apart
    b. on joist lines, 8" apart
    c. on joist lines, 10" apart

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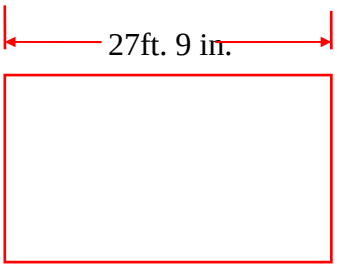

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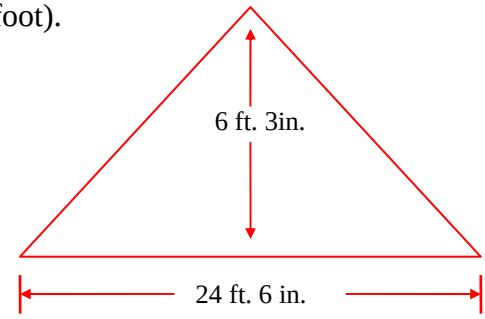

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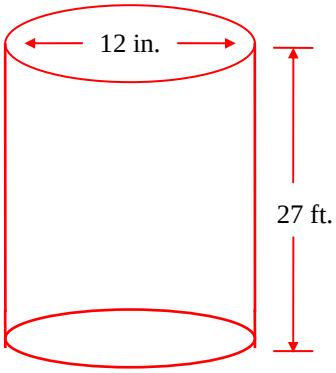

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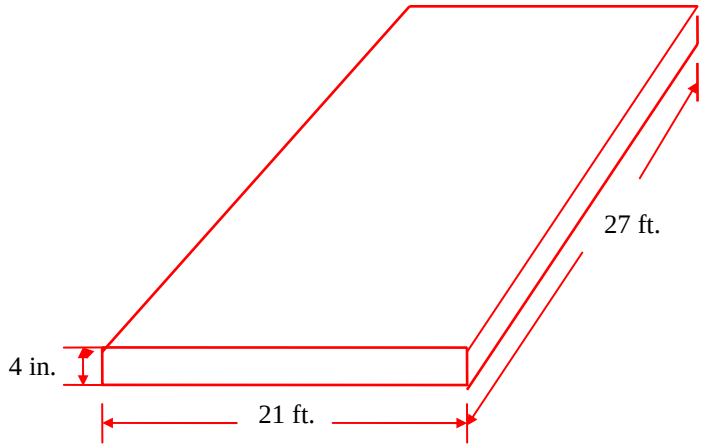

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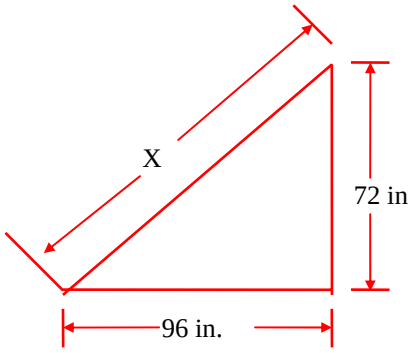

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