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AUTHOR Thomas, John C.
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ABSTRACT

One of 11 guides which can be used as a resource for junior high school teachers in implementing the exploration phase of career education, the guide allows students an opportunity to learn about the construction cluster and their own personal aptitudes and attitudes. The first unit of the guide provides an overview of the construction industry, trends and outlooks, training opportunities, and organized labor. The remaining six units deal with six job classifications within the construction industry: design and planning, carpentry, masonry, electricity, metal, and finishing. The guide contains units on each of these areas along with suggestions for teaching them in the laboratory situation. Each unit specifies a unit purpose and performance objectives and includes: (1) a brief description of unit content, (2) teaching-learning activities, (3) evaluation techniques, and (4) suggested resources. Related instructional materials include reference lists, audiovisual aids, charts, transparency masters, diagrams, and forms. The appendix offers planning and evaluation materials, a dictionary of occupational titles, training for construction jobs, resource utilization, and addresses of publishers and distributors. (MW)

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EXPLORING CAREERS
IN
CONSTRUCTION :
A GUIDE FOR TEACHERS

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Prepared by
John C. Thomas
Curriculum Specialist
July 1974

Curriculum Development Center
Vocational Education
University of Kentucky
Lexington, Kentucky 40506

"The antithesis between technical and liberal education is fallacious. There can be no adequate technical education which is not liberal, and no liberal education which is not technical; that is no education which does not impart both technique and intellectual vision. In simpler language education should turn out the pupil with something he knows well and can do well."

Alfred North Whitehead

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Paul D. Eads, Business, Montgomery County Junior High School

Ron Lewis, Industrial Arts, Bowling Green Junior High School

Thomas J. Osborne, Industrial Arts, Bath County High School

Bryan Thompson, Industrial Arts, Hebron Middle School

John VanHoose, Industrial Arts, Johnson Central High School

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PREFACE

Career education may be described as a program of systematic educational experiences which prepares students for economic independence and personal fulfillment. Such a program should focus on the development of knowledge, general and specific abilities, and the awareness of the values of a work-oriented society; assisting all individuals--at all educational levels and ages--to interact with the economic sector.

Career education includes vocational training, but it is more than this. It aims toward developing the total individual; i.e. an individual able to perform all of his life roles with the skill, knowledge, and understanding necessary for success in all of these roles. It aims at developing the self-motivating and self-fulfilled individual who is a constructive force in the maintenance and improvement of the social body of which he is a part.

To meet the needs of individuals of all educational levels and ages, five phases of career education need to be implemented: awareness, orientation, exploration, preparation, and adult and continuing education.

Career awareness, emphasized early in the career development program, is to lead the individual in developing certain fundamental attitudes toward himself, toward other people, and toward work. Career orientation and exploration--emphasized in the middle school years--provides appropriate educational experiences which enable the individual to become familiar with the economic system and which allow the individual to explore various occupational clusters, to obtain initial work experience, and to integrate work values into his personal value system. The career exploration phase places equal emphasis on exploration of specific occupational clusters and on the relevancy of academic subject matter to career goals. During the

preparation phase, which may begin at grade ten or later, the individual narrows his choices of careers and prepares to enter the labor market or to continue his education. The purposes of adult and continuing education are to assist in the individual's advancement and to help adults in discovering, analyzing, and preparing for new careers.

Accepting the philosophy underlying career education probably means change for the educator and the educational system; it certainly means additional planning and organizing. Adopting this new concept could mean adding totally new programs, changing present programs, training new personnel, and/or developing new courses of study.

To say that education must change is one thing; implementing that change is something else. This guide, "Exploring Careers in Construction," is one of eleven such guides (including "Orientation to the World of Work," an introduction to all the guides) which can be used as a resource for teachers in implementing the exploration phase of career education in the middle/junior high school.

The following are suggestions for implementing this guide:

- (1) It can be used as one of the eleven guides as resource material for a series of mini-courses or activity courses, each dealing with a separate occupational area or cluster.
- (2) It can be used as a resource to integrate career exploration activities into the existing curriculum.

In either option, this career exploration cluster guide can provide a valuable resource for student exploration of the Construction cluster.

INTRODUCTION

Purpose of the Guide

Through construction, man physically reshapes his world. It all begins with an idea. Architects, engineers, and others produce the plans for the construction project, and a host of other construction tradesmen contribute their expertise to make the plan a reality.

The purpose of this guide is to allow students an opportunity to learn enough about the construction cluster and his own personal aptitudes and attitudes to be able to relate himself either positively or negatively to the construction cluster in terms of his career choice.

Characteristics of this Construction Cluster Guide

The first unit included in this guide provides the students an opportunity to develop an overview of the construction cluster. This unit includes construction trends and outlooks, training opportunities, and organized labor and other units designed to be taught in a classroom situation. Although construction jobs can be classified in many different ways, for the purposes of this guide the construction industry has been divided into six areas: design and planning, carpentry, masonry, electricity, metal, and finishing. The guide contains units on each of these areas along with suggestions for teaching them in the laboratory situation.

Rationale for Developing Approaches and Activities

The identification of an approach which best fits the needs of students in a local educational area, system, or school is of utmost importance. In determining various approaches and activities, consider the following points:

1. The Learning Environment Extends Far Beyond the Walls of Classrooms In A School System.

Some things are best learned in a classroom. Others are learned best outside of the classroom and school. The use of community resources--business, industry, government--may be used for exploration purposes. Community resources include human resources and informational material from various organizations.

2. Organize The Strategy, Information, And Activities To Meet The Needs Of Your Students.

What are students like? How do they learn? What do they need? These are questions that need to be analyzed in developing an educational program for students. Use the objectives, the content, and the activities, not as ends in themselves but as means of reaching an end. Make full use of educational options for indeed students are different.

In developing teaching-learning activities, keep in mind that at least four major areas should exist: (1) a personal inventory relating to the construction cluster, (2) occupational information concerning the cluster, (3) educational information relating to the cluster, and (4) hands-on experiences to help students determine his aptitude for the cluster. There is no one right way to approach these, and certainly they have not been sequenced in any order of priority.

Organization - Teacher

Every teacher is faced with many variables in a specific teaching situation. Variables might include items such as facilities, class size,

teaching methods, class time, availability of educational resources, budget and others.

To determine the extent of student activities at the middle school level, many of these previously mentioned variables must be analyzed by teachers and others involved with the career education programs.

In the beginning it would be best to review all performance objectives for a given unit. Then, with a review of the suggested learning activities, the available resources, and local conditions, a decision can be made as to how the objectives presented in this guide can be integrated into a career education program.

All performance objectives are listed for the convenience of the teacher. However, the teacher may choose some of the objectives that are listed in the guide, perhaps omit others, or develop new ones.

The scheduling of activities must be flexible, but also have direction. Listed below are the major breakdowns of the classroom and laboratory units.

CONSTRUCTION

- | | |
|-------------------------------|----------------------------|
| 1. Exploration--Classroom | 2. Exploration--Laboratory |
| a. Definition of Construction | a. Design and Planning |
| b. Occupational Report | b. Carpentry |
| c. Self Awareness | c. Masonry |
| d. Getting Along on the Job | d. Electrical |
| e. Organized Labor | e. Metal |
| f. Trends and Outlooks | f. Finishing |
| g. Opportunities for training | |

*See example of time sheet and multiple activity line chart, pp.

Sequencing of units, proportion of time spent on a unit, continuity of

content, integration of units into existing disciplines, and instructional method are but a few of the aspects that must be dealt with in developing an efficient and effective career education program in construction.

Organization--Teacher and Administrator

Educational programs operate within a total educational system. Objectives, projections, costs, and other pertinent information are items that administrators and teachers must be concerned with.

Questions that relate to what it is going to take in terms of time, manpower, facilities, and materials to develop and/or continue a program are extremely important. Many resources will have to be utilized in arriving at an answer to these questions. The following information is outlined to provide the teacher and administrator with a planning framework.

A. STATISTICAL INFORMATION

1. Student flow
2. Cluster arrangement
3. Length of cluster

B. EQUIPMENT REQUIREMENTS

1. Furniture
2. Machine tools
3. Hand tools

C. FACILITIES REQUIREMENTS

1. Existing junior high industrial arts program
2. Existing classroom space available
3. Construction required

D. MATERIAL REQUIREMENTS

1. Lumber
 - a. quantity
 - b. specifications
2. Other Materials

- a. metals
- b. paper
- c. plastic

E. INSTRUCTOR REQUIREMENTS

- 1. Instructor qualifications
- 2. Instructor availability
- 3. Instructor required
- 4. Instructor pre-service requirements

F. COST ANALYSIS

- 1. Start-up costs (if program is new)
- 2. Cost of changing present course
- 3. Off-site cost comparison

- a. other schools
- b. mobile units

UNIT ONE

CONSTRUCTION CLUSTER EXPLORATION

(Classroom Activities)

UNIT PURPOSE: To provide classroom experiences in exploring construction for topics, titles, occupational report, definition of construction, self awareness, getting along on the job, organized labor, trends and outlooks and opportunities for training.

PERFORMANCE OBJECTIVES: The student will be able to:

- I. Identify and utilize available resources to gather information in report form about selected occupational characteristics and work attitudes.
- II. Describe types of structures and the procedures used in constructing them.
- III. List his own personal interests, achievements, activities, and goals as they might relate to the construction cluster.
- IV. Identify functions of the owner, architect, contractor, supervisor, and worker as they relate to a construction project.
- V. Describe the organizational structure of the unions in the construction industry and describe key words associated with unions.
- VI. Identify and list factors that have affected construction in the past and also describe future trends for construction.
- VII. Describe the methods by which tradesmen by the construction industry acquire an education necessary for the trade.

I. The student will be able to identify and utilize available resources to gather information in report form about selected occupational characteristics and work attitudes.

A. Suggested Content

1. Job identification

a. Title

b. DOT number

2. Distinctive or significant characteristics of the job

a. Location

b. Physical setting

c. Supervision

d. Union jurisdiction

e. Hazards

3. What the typical worker does

a. Operations

b. Tasks

(1) Timing

(2) Importance

(3) Routine

(4) Complexity

c. Responsibilities

(1) Other people or employees

(2) Property

(3) Funds

4. Materials and equipment used by the worker

a. Materials

(1) Wood

(2) Metals

(3) Plastic

(4) Paper

5. How the job is performed

a. Nature of operations

- (1) Cutting
- (2) Installing
- (3) Driving
- (4) Handling

6. Required personal attributes

a. Experience

b. Training

c. Physical strength

- (1) Lifting
- (2) Carrying
- (3) Pushing
- (4) Pulling

d. Coordination

- (1) Climbing
- (2) Balancing

e. Mental capabilities

- (1) Mathematics skills
- (2) Communication skills

f. Aptitudes

g. Social skills

7. Trends and outlooks

a. Factors affecting construction (See objective VI, page 21.)

8. Opportunities for training (See objective VII, page 27.)

a. Organizations

b. Location

c. Length of time

9. Life style

a. Income

b. Job mobility

- c. Fringe benefits
10. Misinformation about occupations
- a. Occupational stereotypes
 - b. Societal status ranking
 - c. Outdated facts

B. Suggested Teaching-Learning Activities

1. Have the student collect information for an occupational report on construction in notebook form. This activity might continue throughout the construction cluster endeavor.
2. Study want ads in newspaper and collect ads that relate to construction occupations.
3. View filmstrips or films about construction occupations.
4. List three methods of grouping construction occupations. (Let students decide upon the methods.)
5. Compare and/or contrast the significant characteristics of a brick mason with those of an architect.
6. Do all the occupations in Column A relate in the same way to the characteristics listed in Column B?

COLUMN A

Designer, planner
Carpenter
Brick mason
Electrician
Plumber
Finisher

COLUMN B

Motivation
Physical characteristics
Creativity
Social interaction
Integrity
Conscientiousness

C. Suggested Evaluation

1. Evaluate the student report.

D. Suggested Resources

1. Books
 - a. Modern Carpentry, pp. 451-454
 - b. The World of Construction, pp. 1-29

2. Films

- a. "Build a Better Life"
- b. "Careers: Construction"
- c. "Careers in Carpentry"
- d. "Careers in Construction"
- e. "Careers in the Building Trades"

3. Filmstrip

- a. "Construction Worker"

II. The student will be able to describe types of structures and the procedures used in constructing them.

A. Suggested Content

1. Construction

- a. The construction industry is an organization of people utilizing materials and operating equipment to design, construct, maintain, and remodel the following:
 - (1) Homes
 - (2) Apartments
 - (3) Factories
 - (4) Dams
 - (5) Bridges
 - (6) Locks
 - (7) Highway
 - (8) Sewer systems
 - (9) Pipelines
 - (10) Other structures
- b. Employment in the construction industry totals more than three million workers.
 - (1) Construction totals one-third of the nation's skilled labor force.
 - (2) Continued growth is indicated for the next decade.
- c. The construction industry is the largest single industry in the United States.
 - (1) It represents many diverse areas.
 - (2) There are 800,000 contractors and subcontractors; many of them are small businesses.
 - (3) The output of units built in 1971 totaled an all-time record of 2,080,000
 - (4) Construction accounts for 10% of GNP (gross national product.)
- d. Tradition construction
 - (1) Construction, as stated most frequently, means on-site activities.
 - (2) Men, materials, and equipment are all brought to a site and the construction process begins.
- e. Industrialized construction
 - (1) Manufacturing techniques are utilized in a factory setting to build a house or components of a house. The finished products are then transported to the site.

- (2) Industrialized housing and modular housing are terms that represent the manufacturing aspect of construction.
 - (3) Industrialized production methods are on the increase throughout the country.
2. Preparation, production, distribution, and service-- the construction process
 - a. Preparation phase
 - (1) Land acquisitions
 - (2) Planning
 - (3) Zoning amendments
 - b. Participants in the preparation phase
 - (1) Developers
 - (2) Land owner
 - (3) Lawyers
 - (4) Real estate brokers
 - (5) Architects and engineers
 - (6) Surveyor
 - (7) Planners and consultants
3. Production phase of the construction process
 - a. Production phase
 - (1) Site preparation
 - (2) Financing
 - (3) Construction
 - b. Participants in the production phase
 - (1) Developer
 - (2) FHA, VA, or private mortgage insurance co.
 - (3) Contractor
 - (4) Subcontractors
 - (5) Craftsmen
 - (6) Material manufacturers and distributors
 - (7) Building code officials
4. Distribution phase of the construction process
 - a. Distribution phase
 - (1) Sale
 - (2) Resale
 - b. Participants in the distribution phase
 - (1) Real estate brokers

- (2) Lawyers
- (3) Lending institutions
- (4) Title companies

5. Service phase of the construction process

a. Service phase

- (1) Maintenance
- (2) Repairs
- (3) Improvements and additions

b. Participants in the service phase

- (1) Owner
- (2) Maintenance firms
- (3) Insurance companies
- (4) Repairmen, craftsmen, and their union
- (5) Contractors
- (6) Subcontractors
- (7) Material manufacturers and distributors

B. Suggested Teaching-Learning Activities

1. Prepare a list of construction projects that are in progress in your community at the present time.
2. Discuss industrialized housing. Are there examples in your community?
3. Define gross national product and discuss the 10% figure stated in the content.
4. Prepare a chart that visually represents the groups that are dependent upon the construction industry. (Example: building supply firms, realtors, etc.)
5. Discuss the four phases of construction.
6. Project the need for housing and other construction in your locality over the next 10 years.
7. Discuss the charts "Total National Employment by Industries," (page 36), and "Total National Employment by Occupation," (page 37.)

C. Suggested Evaluation

1. Have the student describe construction and list the various phases and approaches used in the construction industry.

D. Suggested Resources

1. Article

- a. "A New Industry Gets Off the Ground."

2. Books

- a. Architecture, pp. 1-24
- b. The World of Construction, pp. 38-44, 200-205, 405-432

3. Booklets

- a. "Construction a Man's Work"
- b. "Hands to Build America"
- c. "Young People's Guide to Home Building"

4. Films

- a. "Building a Harbor"
- b. "Building a House"
- c. "Building a Skyscraper"
- d. "The Builders"
- e. "To Build a Future"

5. Slide and Tape

- a. "Hands to Build America"

6. Transparency Masters

- a. "Total National Employment by Industries," page 36
- b. "Total National Employment by Occupation," page 37

III. The student will list his own personal interests, achievements, activities, and goals as they might relate to the construction cluster.

A. Suggested Content

1. Personal profile

a. Interests (Do any relate to construction?)

b. Outstanding achievements

c. Activities he enjoys:

(1) In school

(2) Out of school

d. Health record

e. Values

2. Scholastic record

a. Subjects liked

b. Subjects disliked

3. Occupational interest matrix

a. Occupational interest before construction activities

b. Occupational interest upon completion of construction cluster

	Before Completion of Exploration Activities	After Completion of Exploration Activities
	I = Interested N = Not Interested X = No Knowledge	
Brick Mason		
Carpenter		
Designer or Planner		
Electrician		
Finisher		
Metal Related Plumber		

4. Tests

a. Interest

- (1) Strong
- (2) Ohio Vocational Interest Study
- (3) Kuder Preference
- (4) Clark's

b. Attitude

- (1) Purdue Attitude Inventories
- (2) Allport Study of Values
- (3) Rotor's

c. Aptitude

- (1) Differential Aptitude Test
- (2) GATB (General Aptitude Test Battery)

B. Suggested Teaching-Learning Activities

1. Examine the occupational descriptions pgs. 204-223, and complete the following statement and explain why "If I were in construction I would like to be-----"
2. Discuss or debate the topic: "What Does It Take to be Satisfied and/or Successful in a Career?" (See transparency on page 38.)
3. Discuss how students interpret personal worth.
4. Discuss the new orientation to work.
5. Take appropriate tests and discuss results in terms of the construction cluster.
6. Complete "Interest Matrix," p. 39, before exploration activities and also upon completion of exploration activities. Interest is based upon awareness.
7. Discuss the following terms and their meanings:
 - a. Self-realization (Knowledge of one's own needs and goals)
 - b. Judgment (A hand maiden to self-realization)
 - c. Decisiveness (Willingness and promptness to act)
 - d. Energy (Not a clock watcher)
 - e. Ability to think things through (Being thorough)
 - f. Willingness to commit oneself (Standing up and being counted)

- g. Intelligence (Almost an assumed virtue)
- h. Courage (Facing difficulty and danger without fear)
- i. Ability to take it (Self-confidence in the outcome your decision)*

C. Suggested Evaluation

- 1. Have the student complete the occupational interest matrix on page 39 and appropriate tests.

D. Suggested Resources

1. Booklet

- a. "The Importance of Being Different"

2. Books

- a. All About You
- b. Discovering Yourself

3. Films

- a. "Act Your Age"
- b. "Cabbages to Kings and Various Things"
- c. "Choosing Your Career"
- d. "Four for the Future"
- e. "Perception"
- f. "Sit Down, Shut Up or Get Out" (teacher viewing only)

4. Filmstrip

- a. "Getting to Know Me"
- b. "It's Your Future"

5. Posters

- a. "Student Attitude Builders"

* Adapted from a speech "10 Yardsticks to Success" by E. Mandell deWindt, President of Eston Yale & Towne Inc.

6. Student Materials
 - a. "Interest Matrix," p. 39
7. Tape Cassettes and Film Loops
 - a. "People Who Make Things"
8. Transparency Master
 - a. "What Does It Take to be Satisfied and Successful in a Career?" p. 38

IV. The student will identify functions of the owner, architect, contractor, supervisor, and worker as they relate to a construction project.

A. Suggested Content

1. Communication among participants

- a. Provides information for scheduling labor
- b. Provides information for scheduling materials

2. Participants and their functions

a. Owner

- (1) Pays all costs of construction
- (2) Selects architect
- (3) Selects contractor

b. Architect

- (1) Owner's technical representative
- (2) Designer, planner, interpreter

c. Contractor

- (1) Hires and fires
- (2) Schedules work, trades, and men

d. Supervisor

- (1) Designates work tasks and organization
- (2) Monitors progress and reports to superior

e. Worker

- (1) Performs work tasks
- (2) Works according to directions and plans

B. Suggested Teaching-Learning Activities

1. Make a list of guidelines for getting along with people.

- a. Don't gossip.
- b. Be a good listener.
- c. Avoid being rude.
- d. Treat co-worker as you would wish to be treated.

2. Make posters to illustrate points in #1.

3. Have group sessions and discuss the following:
 - a. Maintaining open lines of communication
 - (1) Up the ladder
 - (2) Down the ladder
 - b. Giving credit where credit is due
 - c. Admitting mistakes
 - d. Being able to understand different points of view
 - e. Making a contractor money
 - f. Losing money for a contractor
 - g. Losing a job because of a communication problem and not a lack of skill proficiency
4. Invite a personnel manager to speak to the class.
5. Have a VICA or AIAA student member talk to the class about leadership qualities.
6. List the owner, architect, contractor, supervisor, and worker on a chart. Have the class discuss how each of the five groups might respond to the following topics:
 - a. Desire for Work
 - b. Adaptability
 - c. Dignity of Work Well Done
 - d. Pride in Accomplishment
 - e. Value of Cooperation
 - f. Responsibility
 - g. Dependability
7. Have guest speakers representing various aspects for the construction industry.
8. Organize a student work force to include all five occupations previously listed. Set up situations requiring action from the various parties.
9. Simulate communication methods representative of the five participant groups mentioned in the content outline.

10. Discuss how willpower helps in getting certain jobs completed. (See "Miracle Drug - Willpower," p. 40)
11. Discuss the time it takes to make various kinds of decisions in construction. (See "Decision Making" and "Being Effective," pp. 41-42.)

C. Suggested Evaluation

1. Have the student identify the functions of the owner, architect, contractor, supervisor, and worker and also list the reasons why communication between groups is so important in the construction industry.

D. Suggested Resources

1. Books

- a. A Good Worker
- b. How to Get Along with Others
- c. Occupational Outlook Handbook
- d. Succeeding in the World of Work
- e. The World of Construction, pp. 94-106

2. Films

- a. "Your Job: You and Your Boss"

3. Filmstrip

- a. "Compassion for People"

4. Transparency Masters

- a. "Miracle Drug - Willpower," page 40
- b. "Decision Making," page 41
- c. "Being Effective," page 42

V. The student will describe the organizational structure of the unions in the construction industry and describe key words associated with unions.

A. Suggested Content

1. Types of unions

a. Craft and trade unions

- (1) Craft
- (2) Trade
- (3) Occupation

b. Industrial

- (1) All workers in the same industry
(Example: steel industry)

c. Organization of unions

- (1) American Federal of Labor - 1880's
- (2) Samuel Gompers - first president
- (3) Craft and trade union basis

d. Committee for industrial organization

- (1) Industrial organization method 1935
- (2) John L. Lewis - first president

e. Merger discussions of A.F.L. - C.I.O. - early 1955

- (1) A.F.L. President - George Meany
- (2) C.I.O. President - Walter Reuther

f. A.F.L. - C.I.O. merger effected in December 1955

- (1) Present labor federation
- (2) President - George Meany

2. Construction industry

a. Union breakdown

- (1) 10,000 local unions
- (2) 476 Building trade councils
- (3) 17 National unions

B. Suggested Teaching-Learning Activities

1. Talk to local union leaders.

Examples of questions:

- a. How much does it cost to join a union?
 - b. How much are the dues and how are they collected?
 - c. Does the union hold regular meetings?
 - d. What does the union do for its members?
2. Stage a collective bargaining session.
 3. Collect newspaper articles about union activities.
 4. Define and discuss the following terms:
 - a. Trade or craft union industrial union
 - b. American Federation of Labor
 - c. Congress of Industrial Organization
 - d. Strike
 - e. Closed shop
 - f. Union shop
 - g. Boycott
 - h. Open shop
 - i. Job steward
 - j. Bargaining
 - k. Seniority
 - l. Grievance
 - m. Arbitration
 - n. Contract
 5. Identify these people:
 - a. John L. Lewis
 - b. Samuel Gompers
 - c. Walter Reuther
 - d. George Meany

6. Debate advantages and disadvantages of organized labor on construction projects.

C. Suggested Evaluation

1. Have the student describe the organization of unions and list and describe key words associated with unions.

D. Suggested Resources

1. Booklets

- a. "Collective Bargaining - Democracy on the Job"
- b. "Facts Worth Knowing About the IBEW"
- c. "History and Structure of the IBEW"
- d. "Labor, Champion of Public Education"

2. Books

- a. A History of Labor in America
- b. A Historical Perspective of Industry, Chapter 8
- c. The Human Shape of Work
- d. The Job Revolution
- e. The Labor Story
- f. The Now Employee

3. Films

- a. "Growth of the Labor Movement"

4. Resource Persons

- a. Local labor representative
- b. Union leader

VI. The student will identify and list factors that have in the past affected construction and given variable factors, will also describe future outlooks for construction.

A. Suggested Content

1. Leisure time

- a. The work week in many countries is still six days long.
- b. In 1929 only 5% of the work force worked five days per week.
- c. In 1969 some firms moved to a four-day work week.
- d. The shifting of legal holidays to Monday provides a minimum of five three-day work weeks.
- e. The average hours worked per week in the private sectors are projected to decrease from a 1969 figure of 38.3 hours to a 1990 figure of 36 hours.
- f. Many individuals work at two jobs which results in very little leisure time.

2. Leisure homes (homes away from home)

- a. Occupied leisure units totaled 63,445,192 in 1970.
- b. A total of 4.6% of the United States population owns a second home.
- c. Lakes, mountain areas, ocean fronts, and many other geographic locations are sites of second homes.

3. Personal income

- a. More money to spend
 - (1) Average spending per person in 1972 was \$3,300.
 - (2) Projected average spending per person in 1990 will be \$6,000 (based on 1972 dollars).
- b. More affluent people
 - (1) More than half the families of the United States will be earning the equivalent of \$15,000 of today's dollars by 1990.

4. Natural resource crisis

- a. Concern for use of resources

- (1) Surging residential construction creates huge demands for lumber and plywood.
- (2) Forests in the United States total 754 million acres
- (3) Commercial forests total 500 million acres of the above figure.
- (4) Lumber is in short supply.
- (5) Harvesting timber is an environmental issue.
- (6) Mining mineral ore is an environmental concern.

b. Use of substitute materials

- (1) Plastic plumbing
- (2) Houses made of tin cans
- (3) House frames made of metal
- (4) Fiberglass modules

c. Quantity of materials required for every individual in the United States annually

- (1) 1,300 pounds of steel
- (2) 23 pounds of copper
- (3) 16 pounds of lead
- (4) 3.5 tons of stone, sand, gravel
- (5) 500 pounds of cement
- (6) 400 pounds of clay
- (7) 200 pounds of salt
- (8) 100 pounds of phosphate rock

5. Political climate

- a. Availability of money
- b. Interest rates
- c. Emphasis on housing (Housing Act of 1968)
- d. Federally sponsored programs (Operation Breakthrough)
- e. Direction of federal agencies--U.S. Dept. of Housing and Urban Development

6. Industrialized housing

- a. Skills
 - (1) Changes in the traditional skill levels of many construction workers
 - (2) Increased requirements for specialist workers (electrical, sanitary work, heating, ventilation)
- b. Industrialized housing: The wave of the future

- (1) On a collision course with conventional housing
 - (2) A hand-crafted house pricing many individuals out of the market
 - (3) Team approach
 - (4) Restrictive codes vs. systems
 - (5) Wood building systems
 - (6) Concrete building systems
 - (7) Metal building systems
 - (8) Making systems adapt to human needs
 - (9) Mechanical and electrical subsystems
 - (10) Handling components on-site
 - (11) Project management: a matter of coordination
 - (12) Utility cores and panels
 - (13) New state housing laws: the effects
 - (14) Marketing emotion in house design
 - (15) Creating neighborhood atmosphere for modulars
 - (16) Modulars vs. mobile homes
- c. Industrialized housing as a system
- (1) Rationalization
 - (2) Mechanization
 - (3) Intensive use of prefabricated elements
 - (4) Repetition
 - (5) Continuity
- d. Types of industrialized systems
- (1) The closed system, which has its own modules and designs and in which the components are not interchangeable with other systems
 - (2) The open system, which has interchangeable components
- e. Conditions of work
- (1) Better sanitary conditions and welfare facilities
 - (2) More regular working hours
 - (3) Improved safety provisions
 - (4) Protection against adverse climatic conditions
- f. Consumer needs - prefabrication
- (1) Prefabrication has two principal appeals for the consumer:
 - Lower prices
 - Better quality (in comparison with equivalent structures produced by conventional construction methods)
 - (2) Prefabrication has possible drawbacks:

- The mobile home look (the extreme form of pre-fabrication)
- Monotony of design
- Lack of variety and flexibility

7. Metrication - a shift to the metric system

- a. Conversion should take place in a planned 10-year period.
- b. Most construction groups would not voluntarily change, but would under the direction of the federal government.
- c. Coordination between construction industries would be a big problem.
- d. The system would improve international trade of building components and materials.
- e. Problems would be created in the repair and remodeling of home and apartments already built in this country.

8. Changing nature of work

a. General changes

- (1) Occupational opportunities and requirements continuing to change
- (2) The rate of change accelerating
- (3) Larger percentages of workers changing jobs more often
- (4) Work force becoming more mobile
- (5) Geographic locations of specialized industries continuing to change

b. Changes in construction

- (1) Utilization of systems building concept
- (2) Industrialized housing increasing
- (3) People no longer able to afford a hand crafted (stick built) house
- (4) Certain traditions being shattered
- (5) Types of skills needed in construction changing
- (6) Commonly accepted differences between carpenter, plumbers, and electricians blurred
- (7) Controlled working conditions
- (8) Multitude of fastening devices other than nails and a hammer
- (9) Use of synthetic materials
- (10) Plastic plumbing (codes will not accept it although it has been used in some locations since the 1930's)
- (11) New state laws that eliminate artificial barriers

B. Suggested Teaching-Learning Activities

1. Discuss the following question:
 - a. What do you suppose would happen if the work week of most workers went to 3 days or 30 hours per week?
2. The student will complete the following sentence:
 - a. If I were going to build a vacation house, I would build it.....
3. Make a list that represents an increased standard of living in the community. (See "A Growing Home-owner Army," "Disposable Personal Income Per Capita," and "Homes Are Up in Value," pp. 43-45.)
4. Describe how the natural resource crisis might affect construction in the local community and the state.
5. Debate the issues of industrialized housing vs. conventional housing.
6. Conduct a survey to find the number of prefabricated houses in the community.
7. Invite speakers to discuss the local codes which control local types of housing developments.
8. Conduct a round table discussion on metrification and the construction industry.
9. Discuss the changes in the nature of construction work.

C. Suggested Evaluation

1. Have the student present a report on future outlooks for construction based on an analysis of past and present trends affecting construction.

D. Suggested Resources

1. Articles
 - a. "Building for the Future"
 - b. "Industrialized Housing Portrait"
 - c. "Industrialized Modular Housing"
 - d. "Industry in 1990..."

- e. "Finance"
 - f. "The America of 1990"
 - g. "Using Energy Efficiently"
2. Books
- a. 4 Days, 40 Hours
 - b. Future Shock
 - c. Learning for Tomorrow
 - d. Man Incorporated
 - e. Overskill
 - f. The Job Revolution
3. Booklets
- a. "Breaking the Credential Barrier"
 - b. "Digest of Seminars - INBEX"
 - c. "HUD International Brief"
 - d. "Occupational Education Faces the Future"
 - e. "The Housing Issue"
4. Films
- a. "Go Metric"
 - b. "Discover...Why Metrics"
 - c. "The Metric System"
 - d. "Thinking Metric"
5. Transparency Masters
- a. "A Growing Home-owner Army," page 43
 - b. "Disposable Personal Income Per Capita," page 44
 - c. "Average Value and Rent of Homes," page 45

VII. The student will be able to describe the method by which tradesmen in construction industry acquire an education necessary for the trade.

A. Suggested Content

1. Apprenticeship training
 - a. Requirements for each trade area
 - b. Occupational employment in each trade area
 - c. Qualifications and training for each trade area
 - d. Employment opportunities and trends by trade area
2. High school education
 - a. Occupational employment
 - c. Qualifications and training
 - c. Employment opportunities and trends
3. Junior college, vocational technical schools, and technical institutes
 - a. Occupational employment
 - b. Qualifications and training
 - c. Employment opportunities and trends
4. College of university education
 - a. Occupational employment
 - b. Qualifications and training
 - c. Employment opportunities and trends

B. Suggested Teaching-Learning Activities

1. Have students investigate a post-high school educational program that is currently of interest to them.
2. Invite a counselor from a vocational technical school to discuss points to be considered in planning for vocational technical training.
3. Invite a college admissions official to discuss points to be considered in planning for higher education.

4. Have two students debate: "Is College Really Necessary For Certain Jobs?"
5. Discuss the reasons one might want to continue his or her education after high school:
 - a. Working environment
 - b. Advancement possibilities
 - c. Salaries
 - d. Job opportunities
 - e. Job satisfaction
6. Follow the content outline and list one job in each of the four categories and list the qualifications, training, and trends for that job. (See page 27.)

C. Suggested Evaluation

1. Have the student list various construction occupations and also describe the education and training required for such occupations.

D. Suggested Resources

1. Articles

- a. "Building New Carpenters"
- b. "Expanding Job Opportunities"
- c. "From Reject to Recruit"
- d. "Street Skills in the World of Work"
- e. "Stronger Foundation for Construction Laborers"

2. Books

- a. Learning for Tomorrow
- b. Modern Carpentry

3. Booklets

- a. "Construction: Opportunities Unlimited"

4. Film

- a. "Craftsmanship Through Apprenticeship"

SUPPORTIVE MATERIAL FOR UNIT ONE

REFERENCE LIST FOR UNIT ONE

ARTICLES

1. "The America of 1990," U.S. News and World Report, February 14, 1972, pp. 42-44
2. "Building for the Future," Manpower
3. "Building New Carpenters," Manpower, October 1971, pp. 13-18
4. "Expanding Job Opportunities," Manpower Report to the President, 1972, pp. 21-22
5. "Finance," Automation in Housing, February, 1974, pp. 24-27
6. "From Reject to Recruit," Manpower, July 1970, pp. 8-10
7. "Industrialized Housing Portrait," Automation in Housing, January 1974, pp. 23-86
8. "Industry in 1990," Industry Week, February 21, 1974, pp. 45-48
9. "A New Industry Gets Off the Ground," Industry Week, February 14, 1972, pp. 27-32
10. "Street Skills in the World of Work," Manpower, February 1974, pp. 23
11. "Stronger Foundation for Construction Laborers," Manpower February 1971, pp. 18-20
12. "Using Energy Efficiently," Exxon USA, First Quarter 1974, pp. 13-15

BOOKS

1. A Good Worker by Joan Henderson, Mafex Associates
2. All About You by William Menninger, Science Research Associates
3. Architecture by William P. Spence, McKnight and McKnight Publishing Company, 1972
4. Carpentry in Residential Construction by Stanley Badzinsky, Prentice Hall, 1972
5. Discovering Yourself by Marjorie Cosgrove and Irma Unruh, Science Research Associates
6. Future Shock by Alvin Toffler, Random House, Inc.
7. Fundamentals of Carpentry by Durbahn and Sundberg, American Technological Society

7. A Historical Perspective of Industry by Joseph Luetkemeyer (Editor), American Council of Industrial Arts Teacher Education
8. A History of Labor in America by Foster Dulles, Thos. Crowell Publishing Company
9. How to Get Along With Others by Bernice Neugarten, Science Research Associates
10. The Human Shape of Work by Peter Berger (Editor), MacMillan Co.
11. The Job Revolution by Judson Gooding, Walker and Company
12. The Labor Story by Arleine Sustin, Coward-McCann Company
13. Learning for Tomorrow by Alvin Toffler, Random House, Inc.
14. Man Incorporated by Carl Kaufman, Doubleday
15. Modern Carpentry by Willis Wagner, Goodheart-Willcox Publishing Co.
16. The Non-Employer by David Nadler, Gulf Publishing Company
17. Occupational Outlook Handbook by U.S. Department of Labor
18. Overskill by Eugene Schwartz, Ballantine Books
19. Succeeding in the World of Work by Grady Kimbrell and Ben Vineyard, McKnight and McKnight Publishing Company
20. Vocational and Practical Arts Education by Roy Roberts, Harper and Row
21. Woodworking Technology by Hammond, Donnelly, Harrod, Rayner. McKnight and McKnight Publishing Co.
22. The World of Construction by Donald Lux and Willis Ray, McKnight and McKnight Publishing Company
23. 4 Days, 40 Hours, Edited by Rive Poor, Bursk and Poor Publishing

BOOKLETS

1. "Breaking the Credentials Barrier," by S.M. Miller, Ford Foundation.
2. "Building America," Manpower and Training Committee of the Associated General Contractors of America.
3. "Collective Bargaining - Democracy on the Job," AFL-CIO

BOOKLETS - (Cont'd)

4. "Construction, A Man's Work," The Associated General Contractors of America
5. "Construction: Opportunities Unlimited," Manpower and Training Committee of the Associated General Contractors of America
6. "Digest of Seminars - INBEX," Industrialized Building Exposition and Congress, Inc., Cahners Publishing Company Inc.
7. "Facts Worth Knowing About the IBEW," International Brotherhood of Electrical Workers
8. "Hands to Build America," National Association of Home Builders
9. "History and Structure of the IBEW," International Brotherhood of Electrical Workers
10. "The Housing Issue," National Forest Products Association
11. "HUD International Brief," by U.S. Department of Housing and Urban Development. Office of Public Affairs.
12. "The Importance of Being Different," by Julius Stratton, Ford Foundation.
13. "Labor, Champion of Public Education," American Federation of Labor and Congress of Industrial Organizations.
14. "Occupational Education Faces the Future," by Myron Lieberman, City University of New York
15. "Young Peoples Guide to Home Building," National Association of Home Builders.

FILMS

1. "Act Your Age," Coronet Films (Perspective Films)
2. "The Builders," International Union of Operating Engineers
3. "Build a Better Life," National Association of Home Builders (Manpower Division)
4. "Building a Harbor," Aims Instructional Media Services, Inc.
5. "Building a House," Aims Instructional Media Services, Inc.
6. "Building a Skyscraper," Aims Instructional Media Services, Inc.

FILMS - (Cont'd)

7. "Cabbages to Kings and Various Things," Bowmar Films
8. "Careers in Carpentry," United Brotherhood of Carpenters
9. "Careers: Construction," Doubleday Multimedia
10. "Careers in the Building Trades," Perspective Films
11. "Careers in Construction," Stanley Bowmar Company, Inc.
12. "Choosing Your Career," Guidance Associates.
13. "Craftsmanship Through Apprenticeship," United Brotherhood of Carpenters.
14. "Discover...Why Metrics," Swani Publishing Company
15. "Four for the Future," Automation House
16. "Go Metric," Eye Gate Films
17. "Growth and the Labor Movement," Harcourt, Brace, and World
18. "The Metric System," NBC Educational Enterprises, Inc.
19. "Perception," Appleton-Century-Croft Film Library
20. "Sit Down, Shut Up or Get Out," NBC Educational Enterprises
21. "Thinking Metric," Eye Gate Films
22. "To Build a Future," Associated General Contractors of America
23. "Your Job? You and Your Boss," Coronet Films (Perspective Films)

FILMSTRIPS

1. "Compassion for People," Bowmar
2. "Construction Worker," McGraw-Hill Films
3. "Getting to Know Me," Eye Gate House.
4. "It's Your Future," Eye Gate House

POSTER

1. "Student Attitude Builders," Career's Inc.

TAPE CASSETTE AND FILM LOOP

1. "People Who Make Things," Guidance Associates

SLIDE AND TAPE

1. "Hands to Build America," National Association of Home Builders
(Manpower Division)

Addresses of publishers and distributors can be found in the Appendix.

TOTAL NATIONAL EMPLOYMENT BY INDUSTRIES
1960-1975

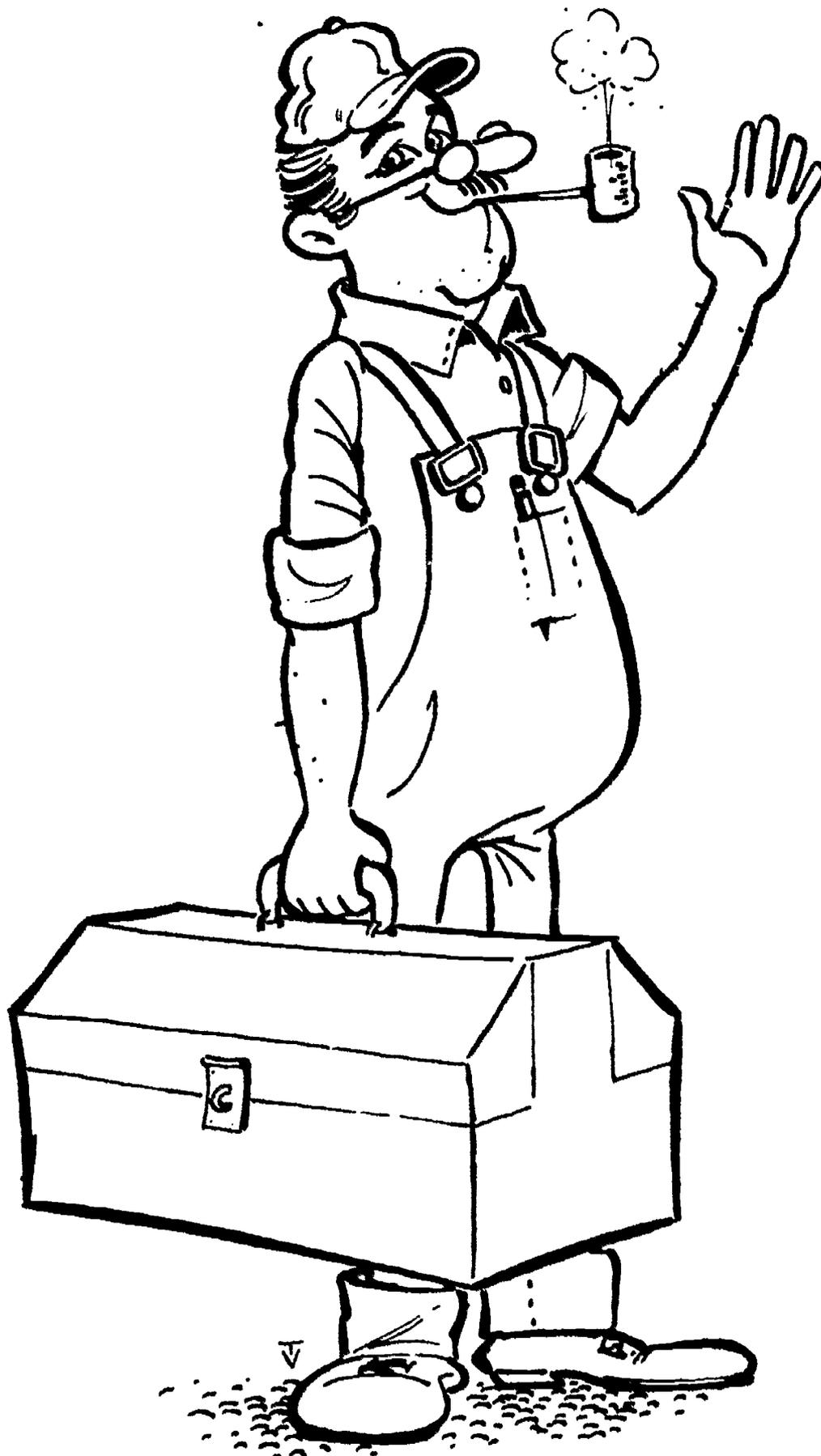
CONSTRUCTION INDUSTRY	1960 4,068,000	1975 5,675,000	
<hr/>			
NATIONAL EMPLOYMENT OF WAGE AND SALARY WORKERS	1960	1966	1975
<hr/>			
CONTRACT CONSTRUCTION	2,885,000	3,292,000	4,190,000
GENERAL BUILDING CONSTRUCTION	908,400	1,047,300	1,200,000
HEAVY CONSTRUCTION	585,700	673,900	995,000
SPECIAL TRADE CONTRACTORS	1,390,700	1,570,000	1,995,000
<hr/>			

TOTAL NATIONAL EMPLOYMENT BY OCCUPATION

1960-1975

CONSTRUCTION CRAFTSMEN	1960 2,554,000	1975 3,102,000
CARPENTERS	832,000	900,000
BRICKMASONS, STONEMASONS, AND TILE SETTERS	186,000	228,000
CEMENT, CONCRETE FINISHERS	46,000	75,000
ELECTRICIANS	360,000	450,000
EXCAVATING, GRADING, & ROAD MACHINERY OPERATORS	245,000	335,000
PAINTERS AND PAPERHANGERS	416,000	455,000
PLASTERERS	50,000	61,000
PLUMBERS AND PIPEFITTERS	304,000	425,000
ROOFERS AND SLATERS	50,000	69,000
STRUCTURAL METALWORKERS	65,000	105,000

WHAT DOES IT TAKE TO BE SATISFIED
OR SUCCESSFUL IN A CAREER?



CURRICULUM DEVELOPMENT CENTER
KENTUCKY

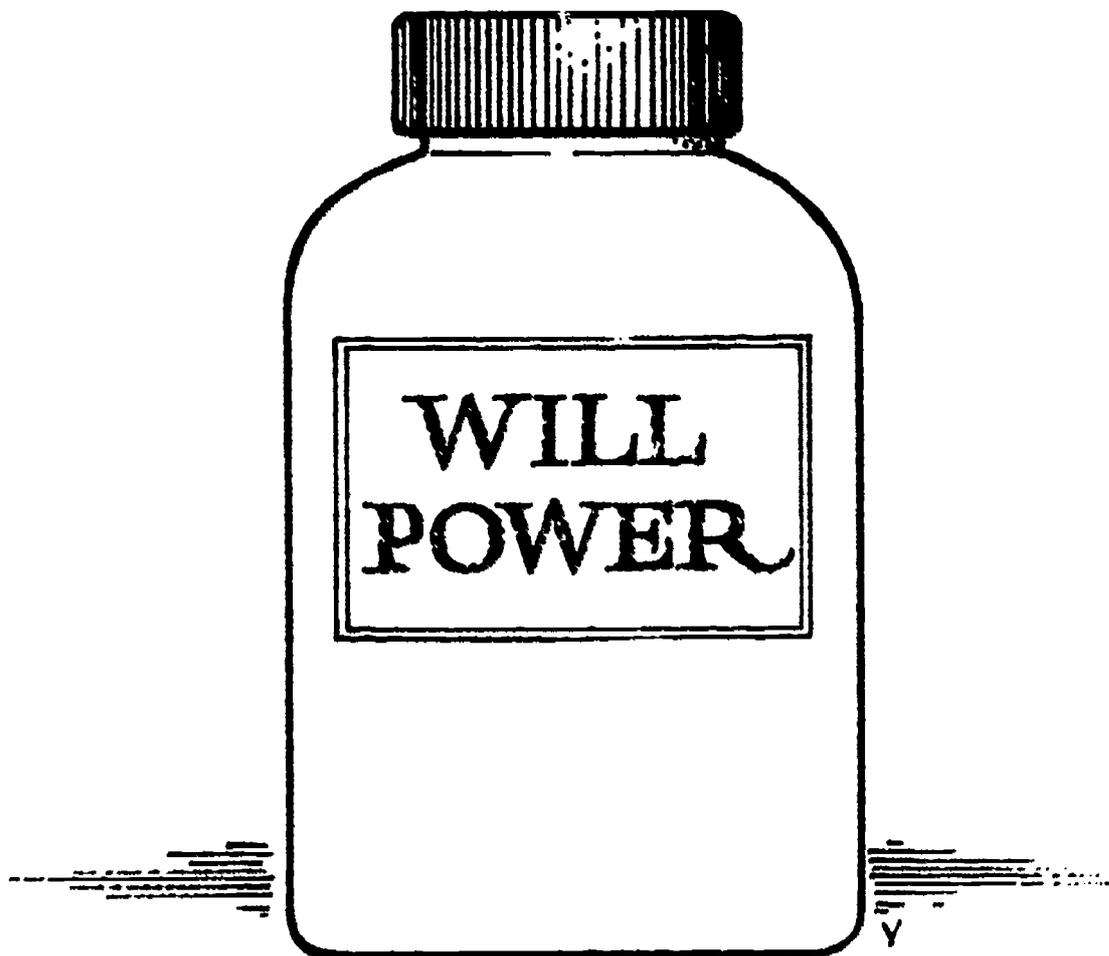
T. VANTRIESE

INTEREST MATRIX

	BEFORE COMPLETION OF EXPLORATION ACTIVITIES	AFTER COMPLETION OF EXPLORATION ACTIVITIES
	I = INTERESTED N = NOT INTERESTED X = NO KNOWLEDGE	
BRICK MASON		
CARPENTER		
DESIGNER OR PLANNER		
ELECTRICIAN		
FINISHER		
METAL RELATED - PLUMBER		

Miracle Drug

WE DON'T MAKE IT



ONLY YOU CAN PRODUCE IT!



CURRICULUM DEVELOPMENT CENTER
KENTUCKY

T. VANTRERSE

DECISION MAKING

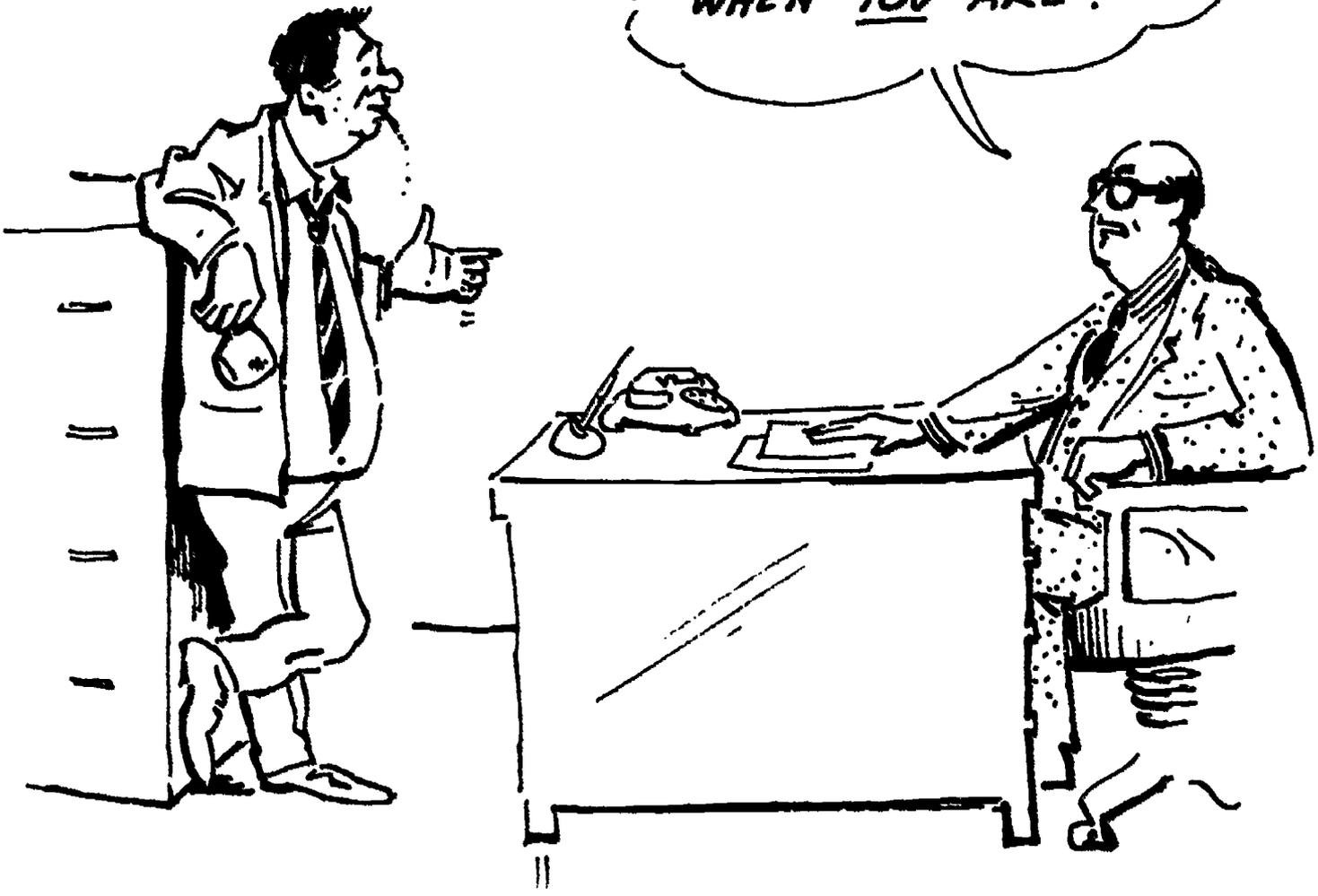
LOOK BUSTER, LET ME
TALK TO SOMEONE
WHO CAN MAKE A
DECISION! TIME MEANS
MONEY AND I WANT
ACTION!



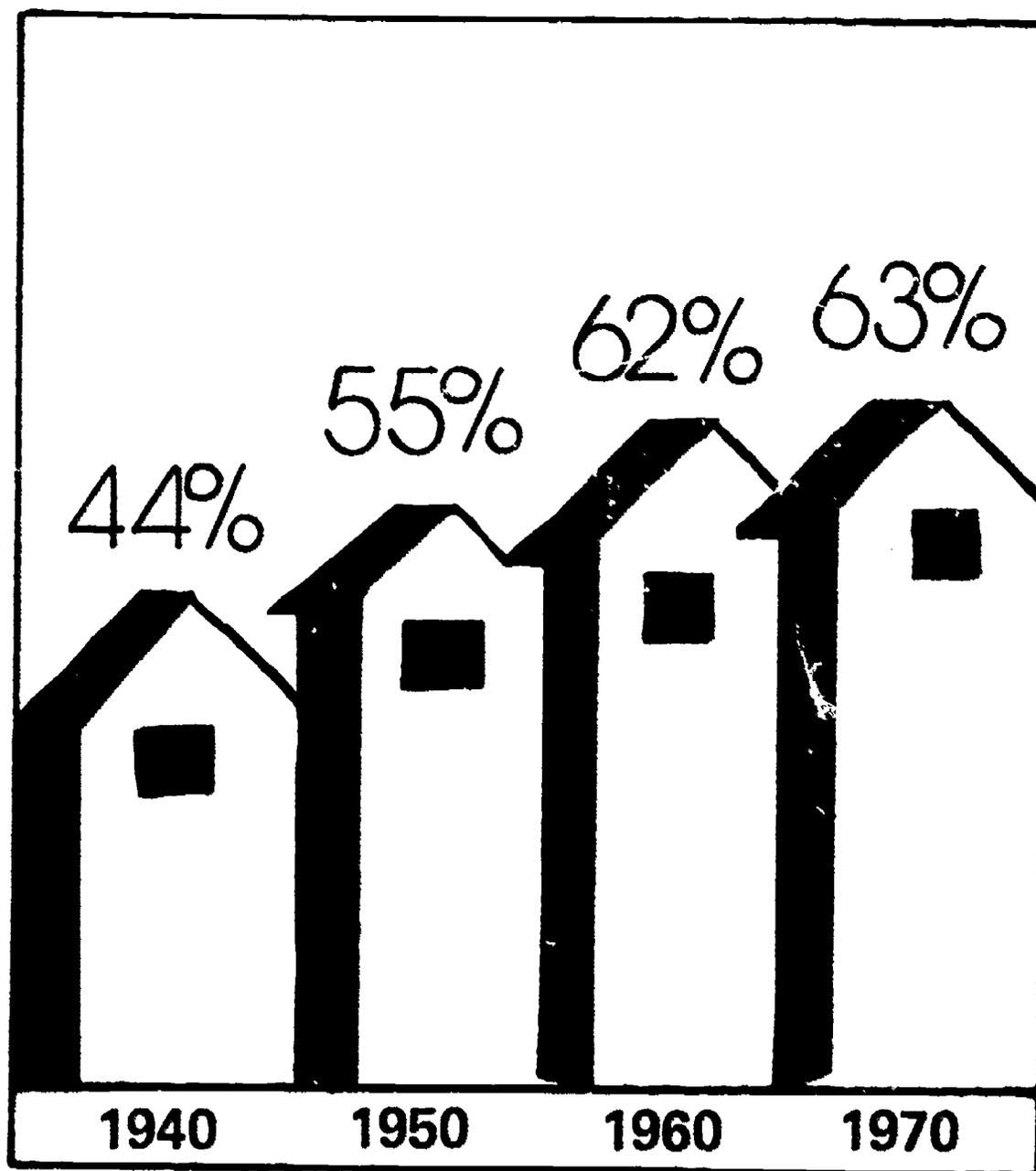
BEING EFFECTIVE

SAY BOSS, ISN'T IT ABOUT TIME I GOT A RAISE ?

YOUR NEXT RAISE IS EFFECTIVE WHEN YOU ARE !

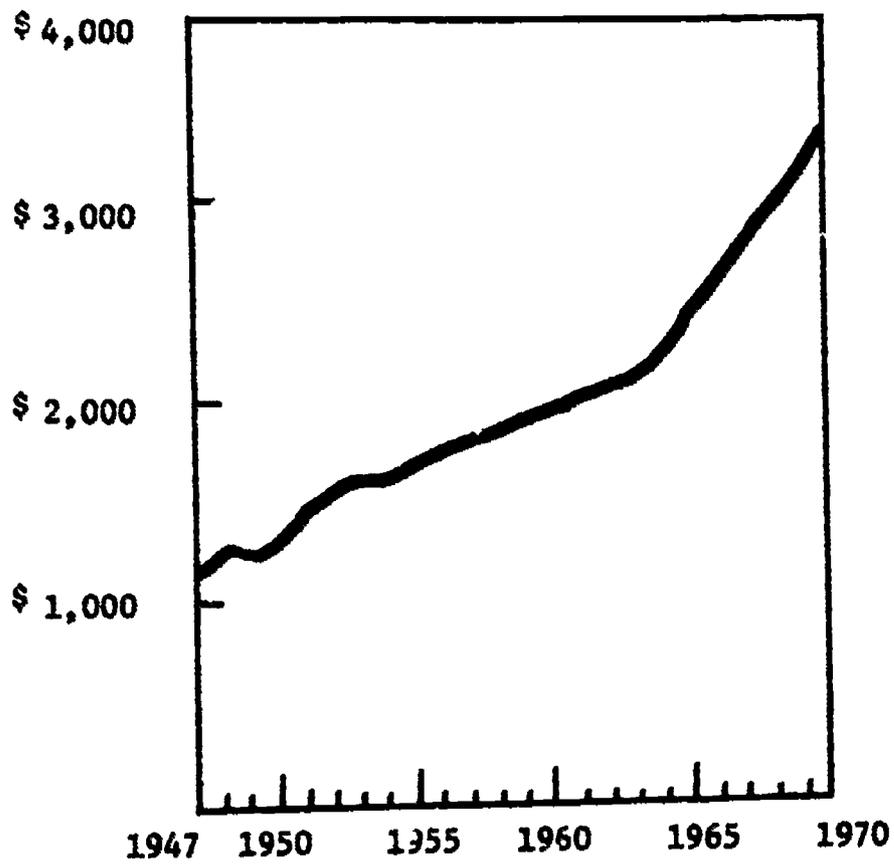


A GROWING HOME-OWNER ARMY



Source: Our Homes, U.S. Department of Commerce, Bureau of the Census.

DISPOSABLE PERSONAL INCOME PER CAPITA



HOMES ARE UP IN VALUE



Housing costs much more than it used to. Everyone is aware of price increases in both rent and the purchase price of a house. The census shows just how much the value of our shelter changes from decade to decade.

The median value of all owner-occupied homes in the United States was about \$17,100 in the 1970 census. In 1960, it was just under \$12,000. The average rent paid in 1970 by people who rent their homes was \$89 a month, compared with \$58 in 1960.

Many people had houses worth much more than \$17,100, of course. In fact, more than 3 million were counted that were valued at \$35,000 or more. But there were nearly 7 million valued at less than \$10,000.

Houses are generally more valuable in cities and nearby areas than in rural areas. The average 1970 value of owner-occupied houses was \$19,000 in metropolitan areas, compared to \$12,100 in non-metropolitan areas. By regions, houses are most valuable in the West. The 1970 average value of owner-occupied homes in the western States was \$20,500. In the Northeast, it was \$19,400; in the North Central States, \$16,700; and in the South, \$13,500.

**EACH YEAR OUR HOUSES
HAVE BEEN INCREASING
IN THEIR VALUE.**

Source: Our Homes, U.S. Department of Commerce, Bureau of the Census.

45/46

UNIT TWO
LABORATORY ACTIVITIES
IN
DESIGN AND PLANNING

UNIT PURPOSE: To provide students with an understanding of the importance of design and planning and of being able to communicate in the standardized graphic language of the construction field.

PERFORMANCE OBJECTIVES: The student will be able to:

- I. Locate and identify five different types of lines on a drawing, note the use of each, and sketch a rough drawing of an object.
- II. List the design considerations that relate to construction.
- III. Read and interpret plan information, identify the major operations of a city or county planning department, and briefly describe the information needed by an architect in order to draw a set of plans.
- IV. Determine the cost of a house by the square foot method using local averages in their calculations.
- V. Identify certain structural styles.
- VI. Identify, list, and draw common components used in residential construction.
- VII. Draw a scaled plan of a structure.

I. The student will locate and identify five different types of lines on a drawing, note the use of each, and sketch a rough drawing of an object.

A. Suggested Content

1. Viewing an object

- a. Front view
- b. Right side
- c. Left side
- d. Top
- e. Bottom
- f. Rear

2. Lines

a. Visible or object lines

- (1) Straight
- (2) Irregular

b. Center lines

c. Extension lines

d. Dimension lines

3. Planes

a. Visible line represents a plane

4. Scales

a. Architect's scale

- (1) $1/4'' = 1$ foot
- (2) $1\ 1/2'' = 1$ foot
- (3) Full scale

b. Engineer's scale

B. Suggested Teaching-Learning Activities

1. Draw the front, top, and end view of a structure.

2. Have the student draw each of the six views of an object.
3. Discuss the following terms: (relate to construction)
 - a. Design
 - b. Form
 - c. Creativity
 - d. Function
 - e. Plan
 - f. Structure
 - g. Surface texture
 - h. Contemporary
4. Make a scaled measuring device. (See "Scale," page 72.)
5. Draw an object to the same scale as the device listed in the previous activity.

C. Suggested Evaluation

1. Have the student identify four types of lines used in drawings.
2. Have the student draw six correct views of an object.
3. Have the student make an elevation sketch.

D. Suggested Resources

1. Books
 - a. Applied Drawing and Design, Units 1, 2, 5, & 7
 - b. Basic Technical Drawing
 - c. Drafting, Unit 1, 2, & 3 (page 1-39)
 - d. Orthographic Projection Simplified, (page 1-22)
 - e. The World of Construction, lab manual, (page 57-71), text, (page 83-86)
2. Transparency Master
 - a. "Scale," p. 72

II. The student will list the design considerations that relate to construction.

A. Suggested Content

1. Example of design in construction
 - a. Past
 - (1) Fort
 - (2) Early houses
 - (3) Store fronts
 - b. Present
 - (1) Houses
 - (2) Skyscrapers
 - (3) Restaurants
2. Use of materials in a design
 - a. Wood
 - b. Metals
 - c. Plastics
 - d. Glass
 - e. Stone
3. Design
 - a. Traditional
 - b. Contemporary
4. Exterior design
 - a. Layout of the interior
 - b. Non added-on decoration
5. Interior design
 - a. Relationship to exterior design
 - b. Modular options
6. Idea to reality
 - a. Louis Sullivan's "Form Follows Function"

7. Meeting needs

- a. Individual
- b. Community
- c. Societal

B. Suggested Teaching-Learning Activities

1. Discuss the following quote from Sullivan:

"Statically words have little significance, as you may assure yourself by consulting any dictionary; but, when once they are treated dynamically and pictorially, their power to convey thought increases enormously; still, let it always be understood that the powers are not in the words so much as in the mind and heart of him who uses them as his instrument."

- 2. Show and discuss transparency master "Design Continuum," page 73.
- 3. Make bulletin board display with structural design as the theme.
- 4. Discuss the late Frank Lloyd Wright's mile-high Illinois design project.
- 5. Debate good construction design vs. bad construction design.
- 6. Collect and identify various architectural designs and examples of past and present designs.
- 7. Give each student a metal coat hanger and a pair of pliers. Have him:
 - a. Take it apart.
 - b. Make something from the existing wire other than a coat hanger
 - c. Explain and demonstrate the new function of the metal wire.
- 8. Obtain a picture of the "Barcelona Chair" and discuss reasons why good design lasts.
- 9. List design characteristics that are present in buildings that have been constructed since 1970. Observe new construction and see if trends can be identified.
- 10. Design is always present in construction work. Cite examples.
- 11. Add lines and/or shading to make recognizable shapes or abstractions from the given geometric outlines. (See "Design Shapes," page 74.)

12. Discuss the phrase "Form follows Function."
13. Answer the question, "Can you tell what a house looks like inside as a result of just looking at it from the outside?"
14. Identify a problem and follow it through the four phases listed on design and planning chart. (See page 75.)
15. Discuss who decides as to which needs are met in constructing a building. (See Meeting Needs on page 52)

C. Suggested Evaluation

1. Have the student list design distinctions of construction and describe the various types of construction design continuum.

D. Suggested Resources

1. Books

- a. A Designer's Notebook, p. 1-44
- b. Design Textbook, p. 16-50
- c. 48 Design Ideas in Textured Plywood
- d. Kindergarten Chats and Other Writings
- e. Masters of Modern Architecture
- f. World of Construction, lab manual, p. 26-56

2. Transparency Masters

- a. "Design Continuum," p. 73
- b. "Design Shapes," p. 74
- c. "Design and Planning Chart," p. 75

III. The student will read and interpret plan information, identify the major operations of a city or county planning department, and briefly describe the information needed by an architect in order to draw a set of plans.

A. Suggested Content

1. Plan interpretation

- a. Structure location on the site
- b. Framed openings
- c. Plumbing locations
- d. Electrical service entrance, panel, outlets, circuits
- e. Chimney
- f. Heating and air conditioning facilities
- g. Traffic patterns (people walking)

2. City planning department

- a. A city plans for its growth and development.
- b. Information is collected and analyzed.
- c. Base maps for a city are maintained and updated.
- d. Zoning requirements are established and enforced.
- e. Certain skills are required to plan a city.
- f. Cities produce a master plan.

3. Before an architect can begin to develop the final drawings, there are many things he must know. From the owner he must find the following things:

- a. Number of rooms needed
- b. Size of each room
- c. Number of people occupying building
- d. Amount of light needed
- e. Layout of rooms
- f. The kind of material to be used for the walls of the building

- g. Roof style
- h. Storage space needed
- i. Whether a basement is needed
- j. Money available for construction
- k. The size of the plot and the contour of the plot
- l. Geographic influence
- m. Recreational and personal needs
- n. Luxury vs. necessity

B. Suggested Teaching-Learning Activities

1. Prepare scale drawing of floor plan and include electrical, heating, and traffic information.
2. Make survey of individuals in community who read and interpret plans as a part of their work.
3. Interview person who reads and interprets plans, and report to class the findings of the interview.
4. Obtain a set of prints and locate specific features of the structure.
5. Discuss towns that have been completely preplanned. Examples would include Reston, Virginia; Brasilia, Brazil, South America.
6. Develop a list of features for a house you would like to build.
7. Discuss reasons why architects are necessary.

C. Suggested Evaluation

1. Have the student identify in writing, from a set of drawings, the roof type, plumbing locations, traffic pattern, and framed openings.
2. Have the student list the major operations of a city or county planning department.
3. Have the student make a list of questions an architect might ask an owner.

D. Suggested Resources

1. Books

- a. General Drafting, p. 228 - 233
- b. Drafting, p. 84 - 88
- c. Applied Drawing and Design, Unit 12
- d. World of Construction, p. 519 - 547

IV. The student will determine the cost of a house by the square foot method using local averages in their calculations.

A. Suggested Content

1. Materials

a. Wood in a typical family home

- (1) Lumber 12,000 Bd. ft.
- (2) Plywood 5,000 Sq. ft.

b. Cost calculations of wood

- (1) Lumber (priced by board foot)
- (2) Plywood (priced per square foot)

2. Labor

a. Man hours

b. Equipment operated by the hour

c. Prevailing local conditions

d. Social Security insurance

e. Workmen's compensation

f. Unemployment insurance

3. Equipment

a. Purchase

b. Rental

c. Repairs

4. Land

a. Type

- (1) Urban (priced per square foot)
- (2) Suburban (priced per lot)
- (3) Rural (priced per acre)

b. Cost

- (1) 1958 to 1973 (average price of land in the U.S. increased 7 percent annually)
- (2) 1958 to 1973 (average consumer price index increased 2.7 percent annually)

c. Land-people ratio in the United States

- (1) Eleven acres per person
- (2) Five acres per person (excluding Alaska and government owned land)
- (3) If the whole present population of the world, 3.7 billion people were put inside the U.S. borders, the resulting density would be not much greater than that of England today.
- (4) Most urbanized state--New Jersey
- (5) The United States is not running out of land--

--The twenty largest metropolitan area, which contain 32 percent of the total population, take up less than 2 percent of the land.¹

B. Suggested Teaching-Learning Activities

1. Figure the total square feet of a given house.
2. Find out the cost of a square foot of construction in your community.
3. Calculate the cost of the house in activity number one.
4. Invite a speaker from a lumber business to talk about the large increases in the cost of lumber.
5. Discuss the question, "How does the land-people ratio of an area affect the kind of construction located in that area?"
6. Discuss land/people ratio and average value of homes as this changes from state to state. (See "Average Value and Rent of Homes," p. 76.)
7. Invite a local contractor or architect to talk about the methods used in calculating the cost of a house.

C. Suggested Evaluation

1. Have the student determine the cost of a house.

D. Suggested Resources

1. Article

- a. "Land: The Boom That Really Hurts"

¹ "Land: The Boom That Really Hurts" Fortune. July 1973

2. Books

a. Architecture, pages 320 - 327

b. World of Construction, pages 107 - 113

3. Booklet

a. "The Young Peoples Guide to Home Building"

4. Transparency Master

a. "The Average Value and Rent of Homes," p. 76

V. The student will identify certain structural styles.

A. Suggested Content

1. Individuality

- a. Elements that give residential or business structures individuality
- b. Use of materials
- c. Surrounding structures (individuality restricted through codes)

2. Ticky- tacky Boxes

- a. Look as if they have been coughed up by a huge machine

3. General layout of floor plan

- a. Rectangle
- b. U-shaped
- c. L-shaped

4. Types of houses

- a. Single story
- b. 1 1/2 story
- c. 2 story
- d. Bi-level
- e. Tri-level
- f. A-frame

5. Enviornmental considerations

- a. Bringing the outdoors in
 - (1) Window walls
 - (2) Decks
 - (3) Patios
- b. Bringing the indoors out
 - (1) Plants
 - (2) Window walls

B. Suggested Teaching-Learning Activities

1. Discuss the following questions:
 - a. What would happen if all houses in a town were built exactly the same?
2. Discuss the relationship of floor plans to roof styles.
3. List the different types of windows and how they relate to the overall design of the house.
4. Tour the local geographic area and identify different structural styles of houses.
5. Divide class into small groups.
 - a. Each group should generate a list of advantages and disadvantages for the following types of architecture. (See the following transparency masters:)
 - (1) "A-frame," p. 77
 - (2) "Bi-level," p.78
 - (3) "1 1/2 and 2 story," p.79
 - (4) "Single story," p. 80
 - (5) "Tri-level," p.81
 - b. Have each group report their findings to the class.
 - c. Compare lists and hold class discussion.

C. Suggested Evaluation

1. Have the student identify certain structural styles.

D. Suggested Resources

1. Transparency Masters

- a. "A-frame," p. 77
- b. "Bi-level," p. 78
- c. "1 1/2 and 2 story," p.79
- d. "Single story," p. 80
- e. "Tri-level," p.81

VI. The student will identify, list, and draw common components used in residential construction.

A. Suggested Content

1. Foundation

- a. Poured concrete
- b. Concrete block
- c. Treated wood

2. Floors

- a. Floor joists
- b. Subfloor
 - (1) Plywood
 - (2) Particle board

3. Walls

- a. Exterior
- b. Interior

4. Openings

- a. Doors
- b. Windows
- c. Vents

5. Roof

- a. Flat
- b. Shed
- c. Gable
- d. Hip
- e. A-frame

6. Panel Jig

- a. Wall panel
- b. Floor panel
- c. Truss

B. Suggested Teaching-Learning Activities

1. Discuss the basic components of a house using "Components in a House," p. 82
2. Draw various shapes of floor plans. See "Floor Plans," p.83.
3. Discuss fabricated wall section.
4. Discuss the different roof types using "Roof Types," p. 84.
5. Discuss the advantages of using roof trusses. See "Roof Trusses," p. 85.
6. Frame an opening in a wall section.
7. Invite a speaker who has been employed in the planning phase of construction to discuss the following:
 - a. Dignity and value of occupations in design and planning
 - b. Jobs in the community related to design and planning
 - c. Seasonal adjustments for jobs in design and planning
 - d. Glamour jobs in the design and planning segment of the construction industry

C. Suggested Evaluation

1. Have the student list different structural styles used in residential construction.

D. Suggested Resources

1. Books

- a. Carpentry in Residential Construction, p. 25-32
- b. Fundamentals of Carpentry, p. 108-163
- c. Modern Carpentry, p. 111-156
- d. Woodworking Technology, p. 334-357

2. Booklets

- a. "A New Look at Wood Framing"
- b. "The Plywood 'How To' Book"

3. Transparency Masters

- a. "Components in a House," p. 82
- b. "Roof Types," p. 84
- c. "Roof Trusses," p. 85
- d. "Floor Plans," p. 83

.....

VII. The student will draw a scaled plan of a structure.

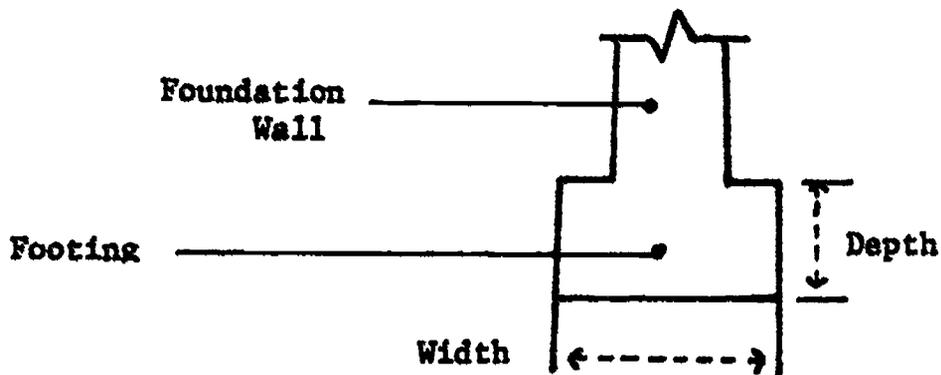
A. Suggested Content

1. Floor plan

- a. Graph paper (1/4" x 1/4")
- b. Scale to be used if a model is built:
 - (1) 1 1/2" = 1 foot
- c. Scale used with most residential plans:
 - (1) 1/4" = 1 foot
- d. Decide minimum, average, and maximum length and/or spans

2. Foundation

- a. Relationship to floor plan
- b. Size of foundation wall
 - (1) Concrete block width
 - 6", 8", 12"
 - (2) Poured concrete width
 - 8", 10", 12"
- c. Size of the footer
 - (1) Width
 - 16", 20", 24"
 - (2) Depth
 - 8", 10", 12"



3. Elevation

a. Points of reference

- (1) Ground level line
- (2) Floor level line
- (3) Window and door line

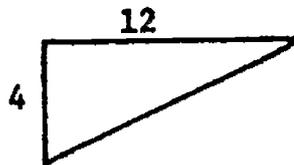
--Top of windows and doors will be 6'8"

4. Ceiling line from floor line

a. Feet from floor line

5. Ridge line

- a. Top of roof will be determined by slope of the roof
- b. Roof slope or pitch



(A 4-12 pitch indicates 4 inches of rise for every 12 inches of run)

6. Jig panel

- a. 16 inches on center
- b. 24 inches on center
- c. 4 feet on center

B. Suggested Teaching-Learning Activities

1. Draw floor plan.
2. Draw foundation.
3. Draw elevation.
4. Draw jig panel.
5. Prepare list of materials.

c. Suggested Resources

1. Books

- a. Carpentry in Residential Construction, p. 25-32
- b. Fundamentals of Carpentry, p. 108-160
- c. Modern Carpentry, p. 111-156

d. Woodworking Technology, p. 334-357

2. Booklets

a. "A New Look at Wood"

b. "The Plywood 'How To' Book"

3. Transparency Masters

a. "Components in a House," p. 82

b. "Roof Types," p. 84

c. "Roof Trusses," p. 85

d. "Floor Plans," p. 83

67/68

SUPPORTIVE MATERIAL FOR UNIT ONE

69/70

REFERENCE LIST FOR UNIT TWO

BOOKS

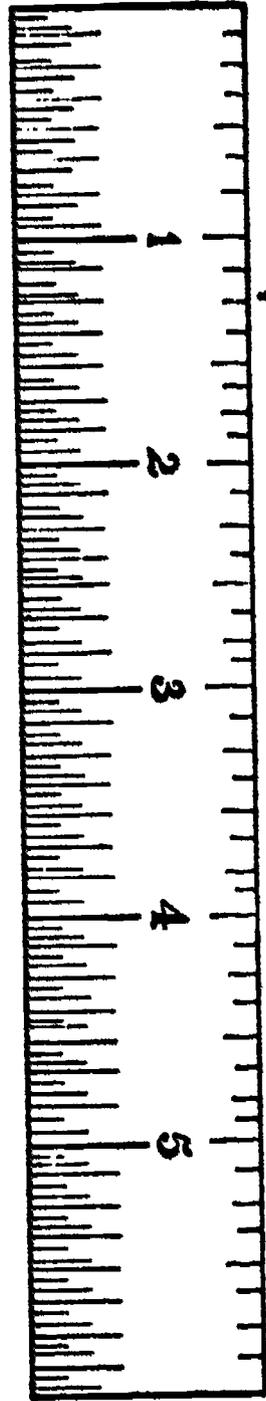
1. Applied Drawing and Design by Everett Scrogin and William Bettencourt, McKnight and McKnight
2. Architecture by William Spence, McKnight and McKnight
3. Basic Technical Drawing by Henry Spencer, Macmillan Publishing Co.
4. Carpentry in Residential Construction by Stanley Badzinski
Prentice Hall
5. A Designer's Notebook by Arthur Anderson, McKnight and McKnight
6. Drafting by Walter Brown, Goodheart-Willcox
7. Fundamentals of Carpentry, Vol. 2 by Walter Durbahn and Elmer Sundberg, American Technical Society
8. Masters of Modern Architecture by John Peter, Bonanza Publishing Co.
9. Modern Carpentry by Willis Wagner, Goodheart-Willcox
10. Orthographic Projection Simplified by Charles Quinlan, McKnight and McKnight
11. A Testament by Frank L. Wright, Bramhall House Publishers
12. Woodworking Technology by Donnelly, Hammond, Harrod and Rayner, McKnight and McKnight
13. The World of Construction by Donald Lux and Willis Ray, McKnight and McKnight

BOOKLETS

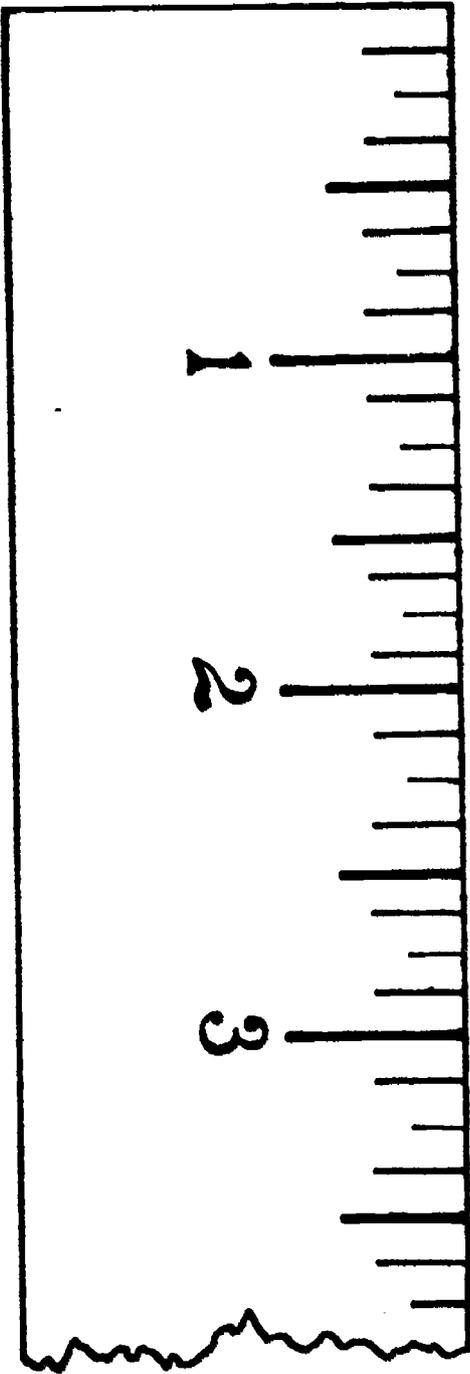
1. "A New Look at Framing," Western Wood Products Association
2. "The Plywood 'How To' Book," American Plywood Association
3. "The Young Peoples Guide to Home Building," National Association of Home Builders

Addresses of publishers and distributors can be found in the Appendix.

SCALE



RULE 1" = 1"

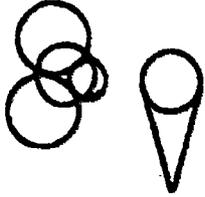
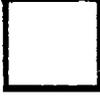


SCALE 1 1/2" = 1"

DESIGN CONTINUUM

	PAST	PRESENT	FUTURE
DESIGN	Traditional	Contemporary	Experimental
CONSTRUCTION	Conventional	Modular	Industrialized Housing
MANUFACTURING	Single craftsman	Mass Production	Automated Factories
TRANSPORTATION	Horse and Buggy	Automobile	Automated Transit Systems

DESIGN SHAPES

EXAMPLE 			
			
			
			

DESIGN AND PLANNING

**IDENTIFICATION
OF
PROBLEM**

**DEVELOP
PRELIMINARY
SKETCHES**

**STUDY
SKETCHES**

**COMPLETE
DRAWING**

AVERAGE VALUE AND RENT OF HOMES

(Median rent also was highest in the West—\$106. Figures for the other regions were: Northeast, \$92; North Central States, \$89; and the South, \$71.)

Hawaii has the most valuable housing of any State. The average value of an owner-occupied home in Hawaii in 1970 was \$35,200. Connecticut was second with an average value of \$25,500. Alaska had the highest average rent figure, \$172; with Nevada in second place at \$124 month. A table follows with average values for owner-occupied housing and for rent paid, by States:

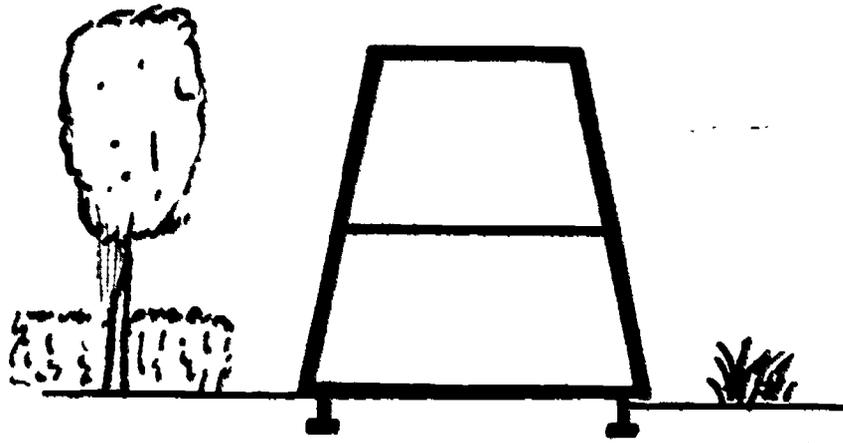


WHO PAYS THE HIGHEST RENT IN THE U.S.A.?

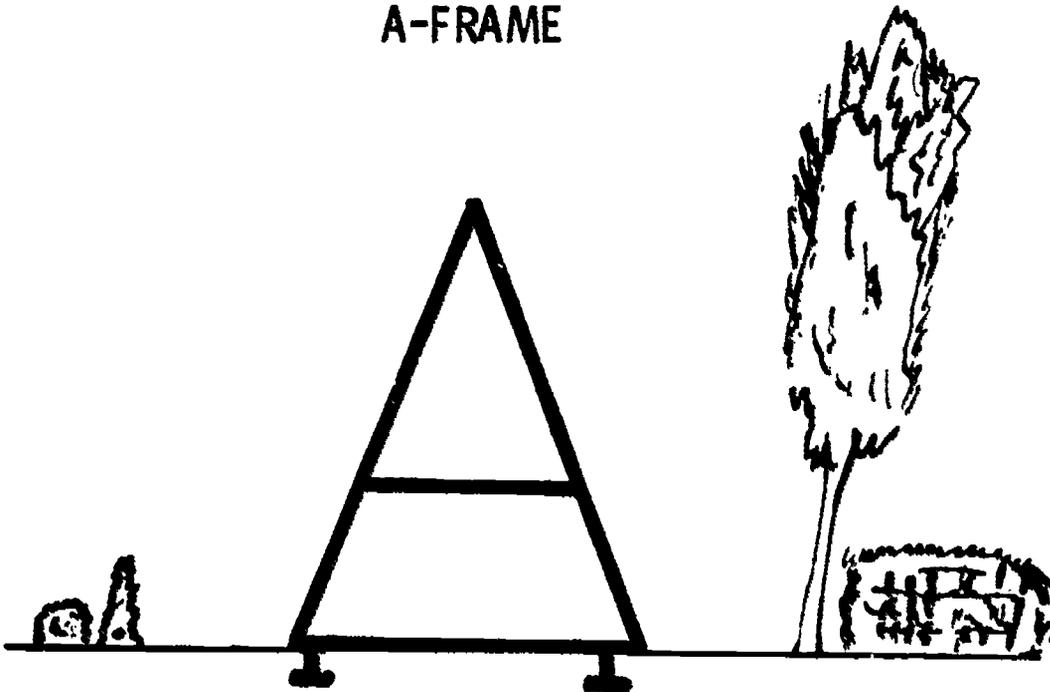
State	AVERAGE VALUE		AVERAGE RENT	
	1970	1960	1970	1960
Alabama	\$12,300	\$ 8,600	\$ 48	\$ 32
Alaska	23,100	9,100	172	110
Arizona	16,400	11,100	92	59
Arkansas	10,600	6,700	53	34
California	23,100	15,100	114	69
Colorado	17,400	12,300	97	64
Connecticut	25,500	16,700	106	59
Delaware	17,200	12,400	90	62
District of Columbia	21,400	15,400	111	75
Florida	15,100	11,800	93	60
Georgia	14,700	9,500	66	37
Hawaii	35,200	20,900	121	64
Idaho	14,100	10,600	70	51
Illinois	19,900	14,700	108	72
Indiana	13,800	10,200	83	56
Iowa	13,900	9,900	78	54
Kansas	12,200	9,300	75	55
Kentucky	12,600	8,800	64	42
Louisiana	14,700	10,700	63	44
Maine	13,000	8,800	69	46
Maryland	18,800	11,900	111	66
Massachusetts	20,800	13,800	90	55
Michigan	17,600	12,000	94	63
Minnesota	18,100	12,800	102	60
Mississippi	11,300	7,900	47	30
Missouri	14,400	10,900	75	52
Montana	14,200	10,900	72	54
Nebraska	12,500	9,400	78	56
Nevada	22,600	15,200	124	77
New Hampshire	16,500	10,700	80	46
New Jersey	23,500	15,600	112	68
New Mexico	13,100	10,700	72	58
New York	22,600	15,300	96	64
North Carolina	13,000	8,000	59	37
North Dakota	13,000	9,800	78	58
Ohio	17,700	13,400	84	61
Oklahoma	11,200	7,900	64	45
Oregon	15,500	10,500	87	56
Pennsylvania	13,700	10,200	74	51
Rhode Island	18,300	12,300	65	41
South Carolina	13,200	7,500	50	32
South Dakota	11,400	8,800	70	52
Tennessee	12,500	8,300	62	39
Texas	12,100	8,800	77	51
Utah	16,900	12,600	81	57
Vermont	16,500	9,700	76	43
Virginia	17,200	10,800	93	54
Washington	18,600	11,700	95	58
West Virginia	11,400	7,600	53	36
Wisconsin	17,300	12,600	91	63
Wyoming	15,400	12,300	73	58

Source: Our Homes, U.S. Department of Commerce, Bureau of the Census.

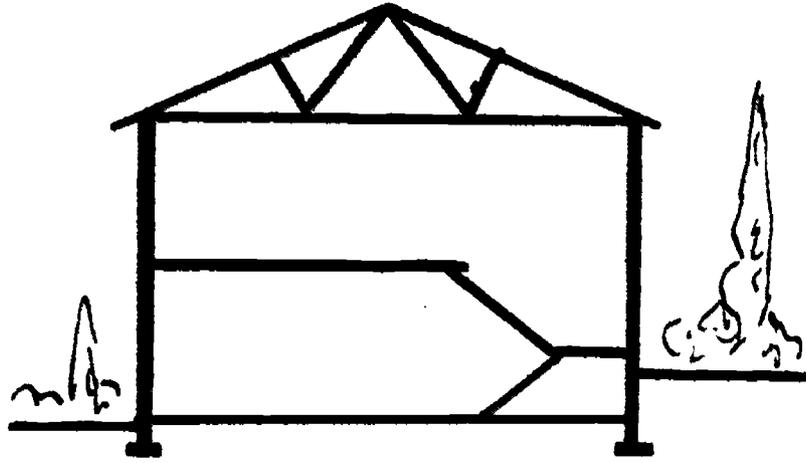
TRUNCATED A-FRAME



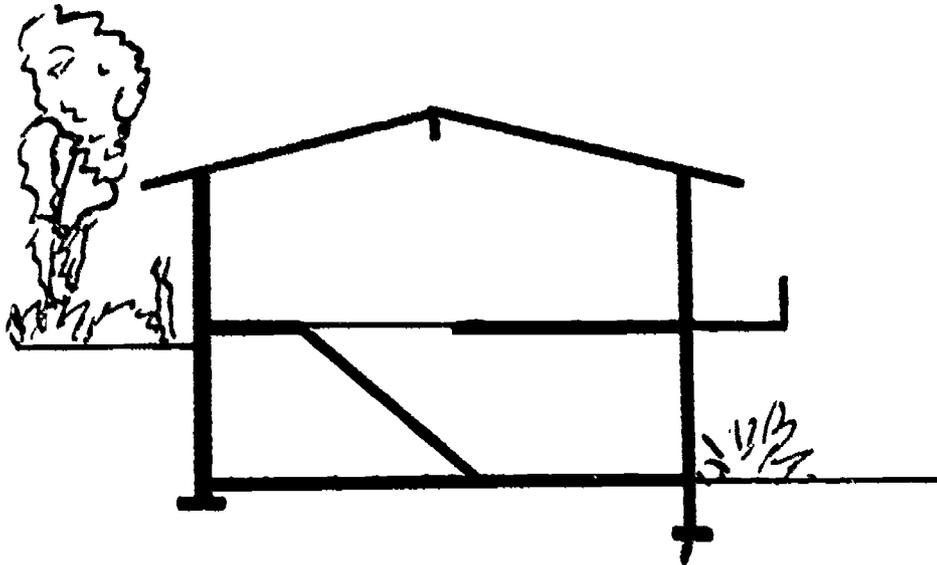
A-FRAME



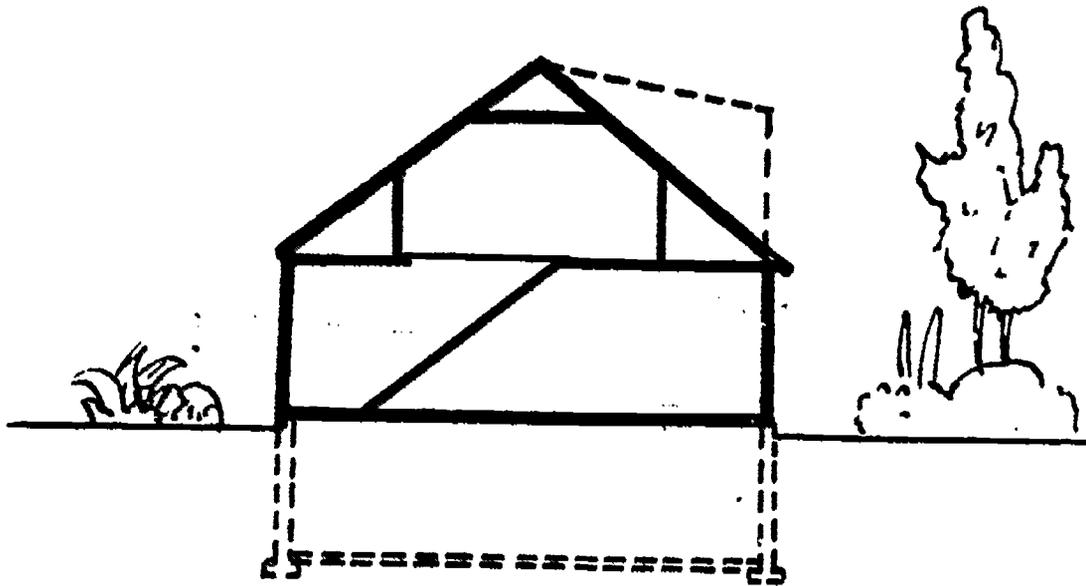
BI-LEVEL



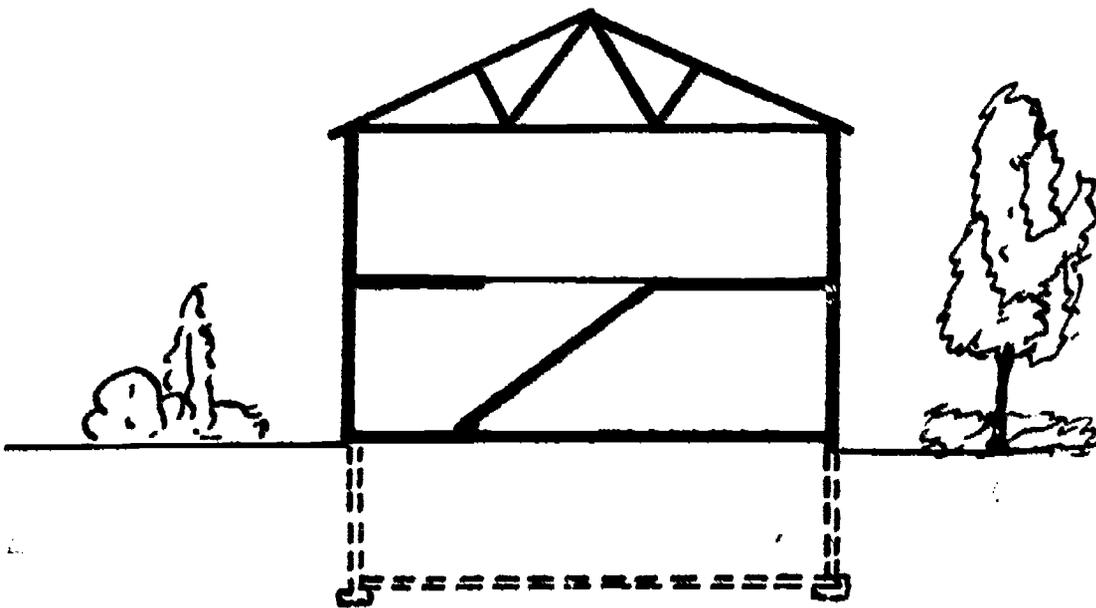
BI-LEVEL



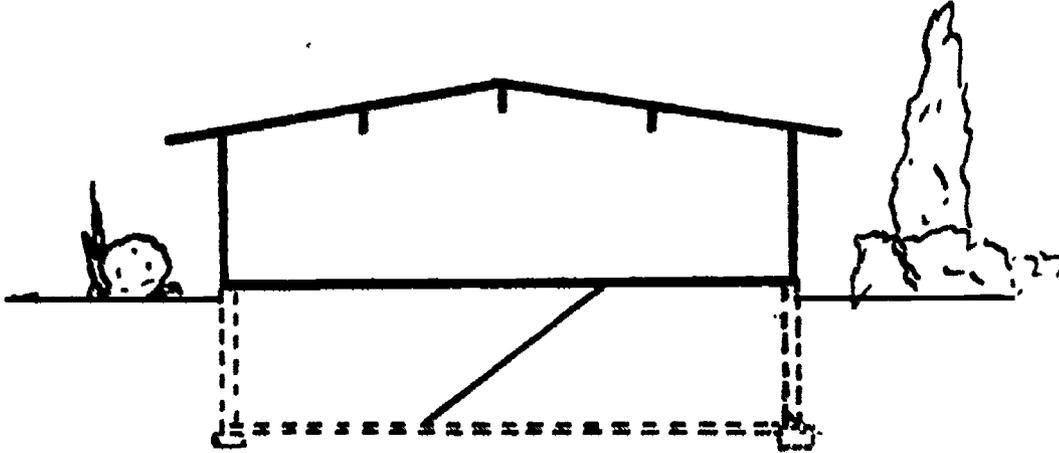
1 1/2 STORY



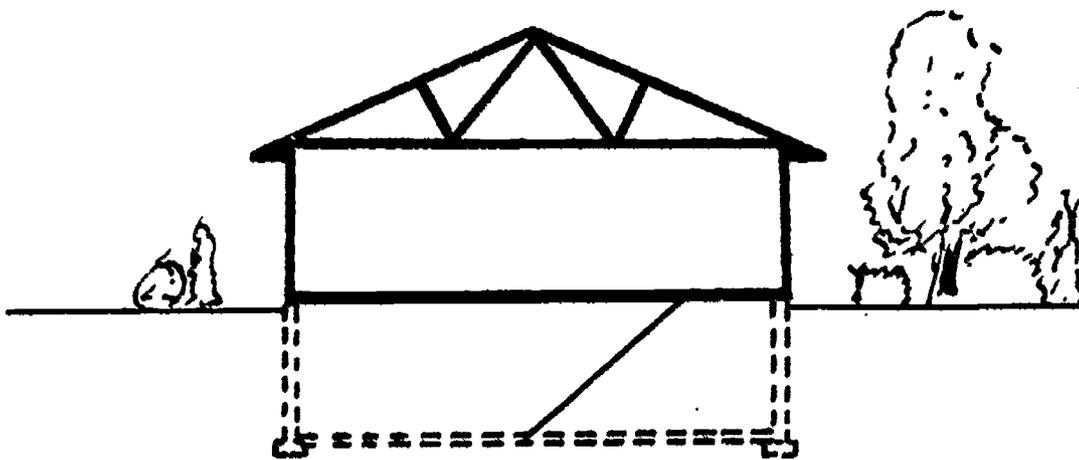
2 STORY



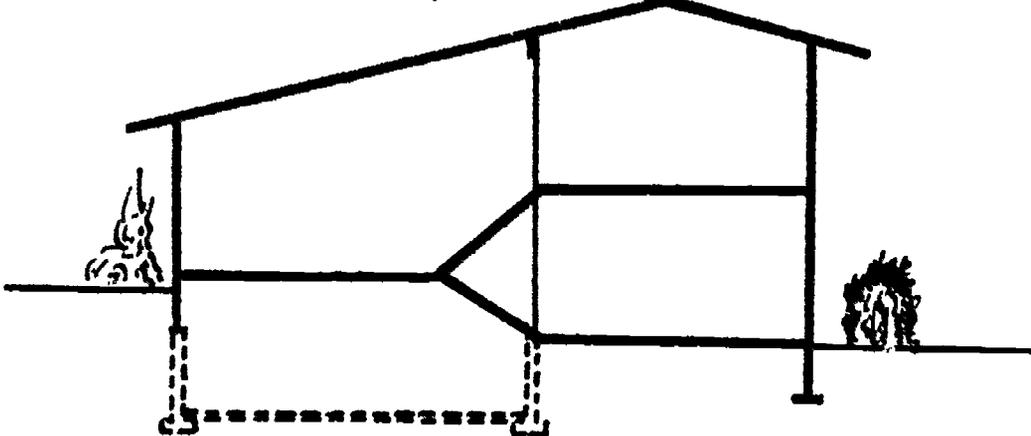
SINGLE STORY
(Open Ceiling)



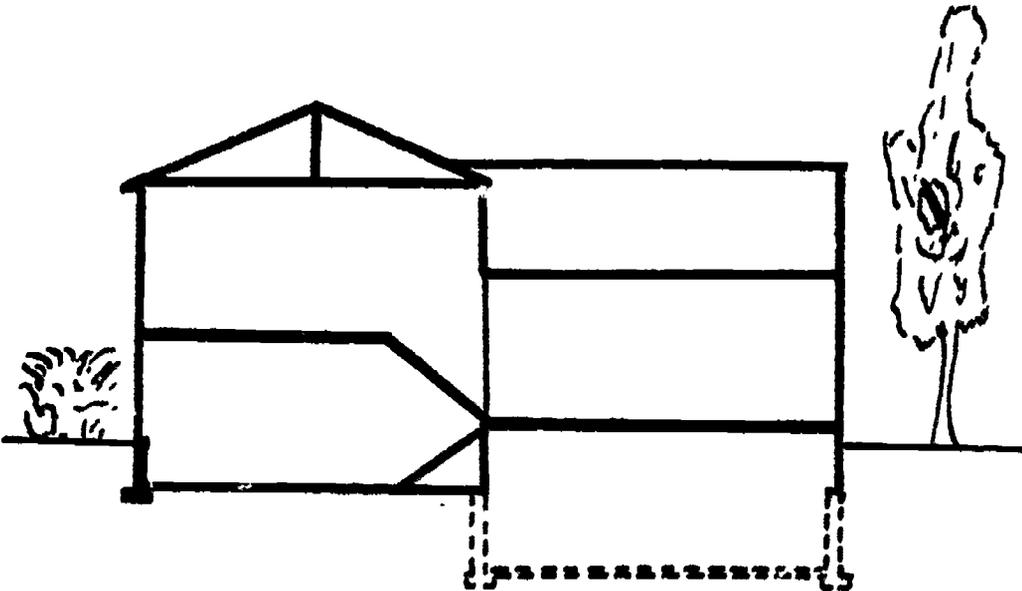
SINGLE STORY



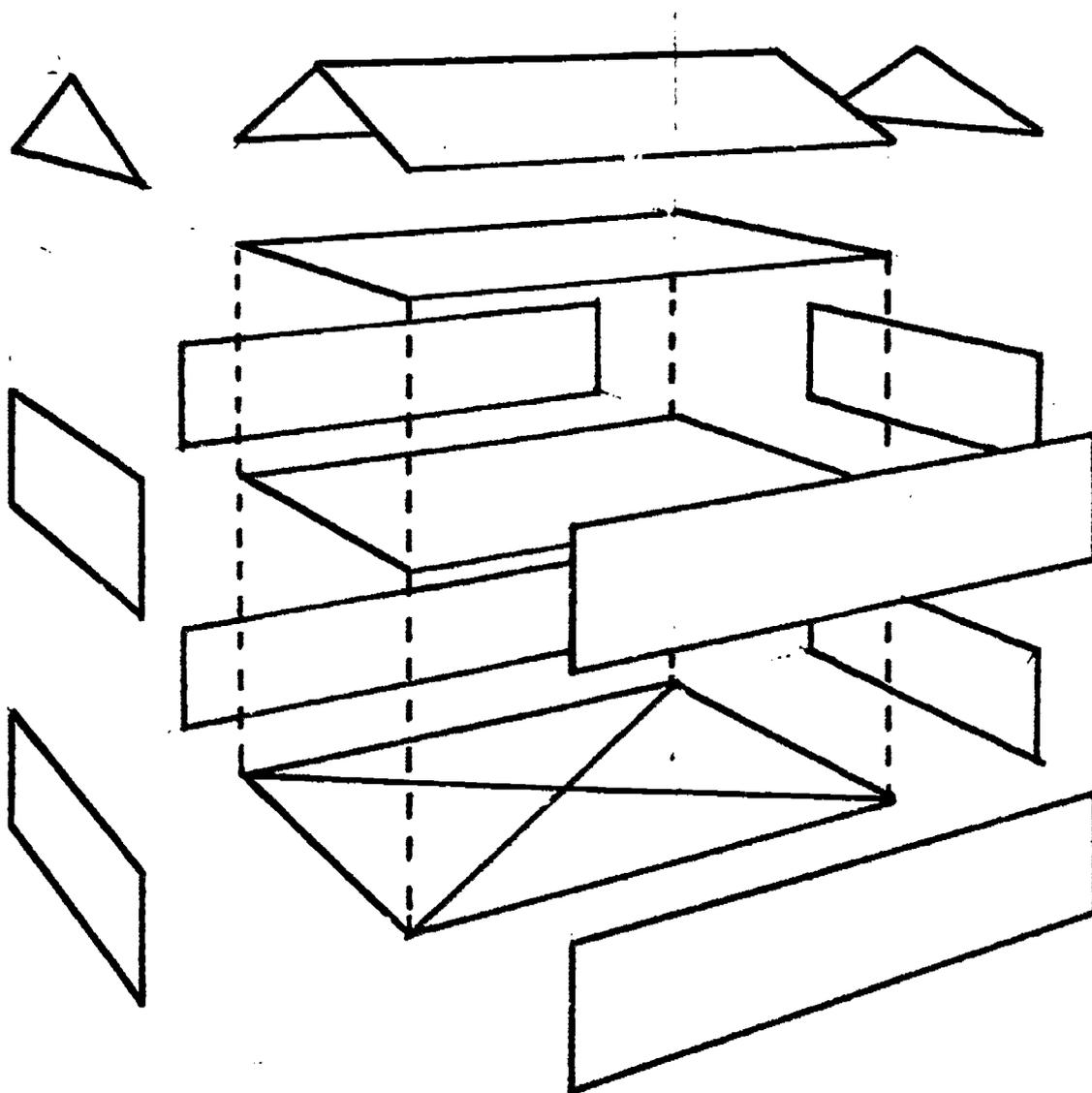
TRI-LEVEL
(Open Ceiling)



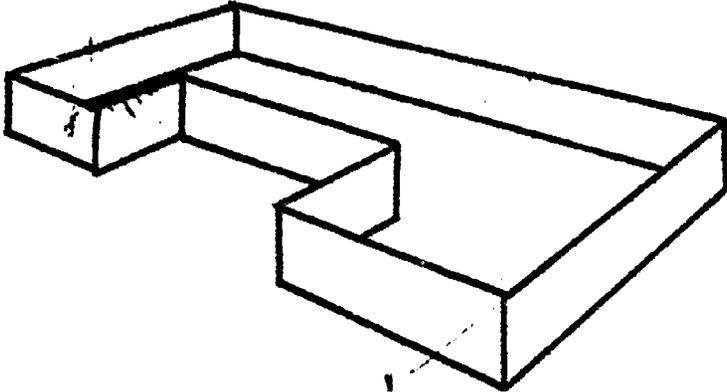
TRI-LEVEL



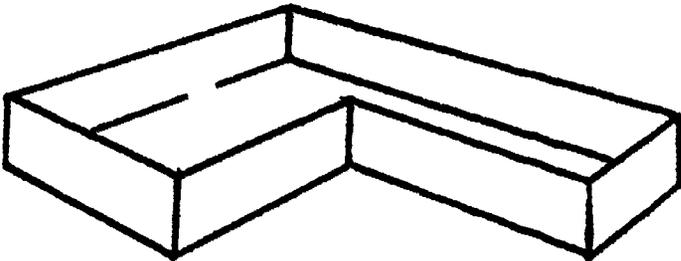
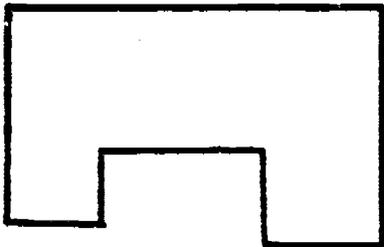
COMPONENTS IN A HOUSE



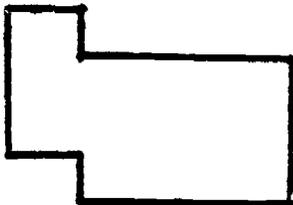
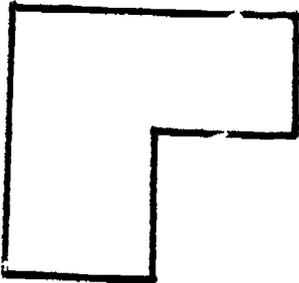
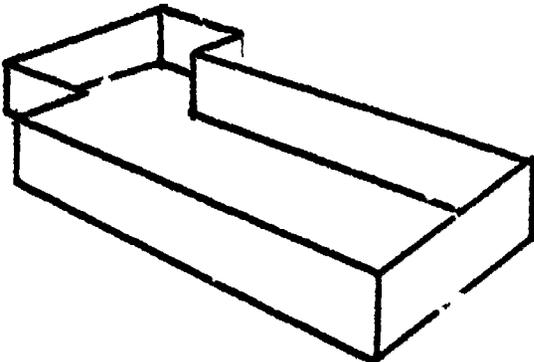
FLOOR PLANS



U-SHAPED

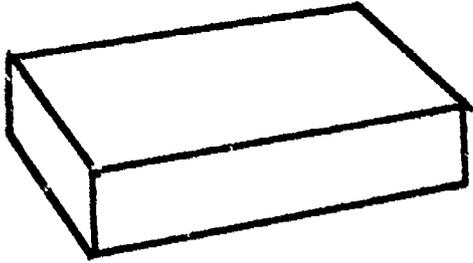


L-SHAPED

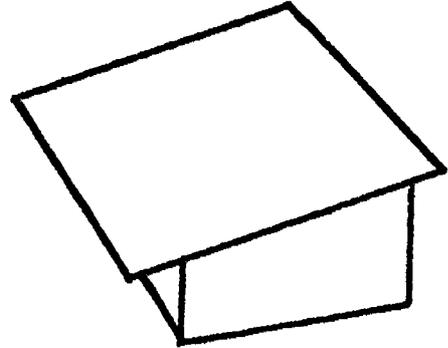


RECTANGLES

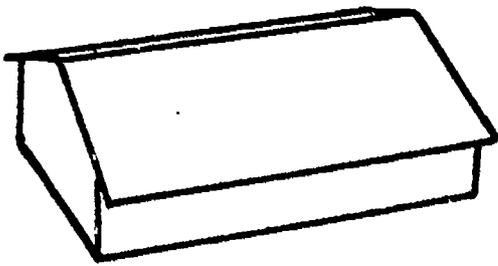
ROOF TYPES



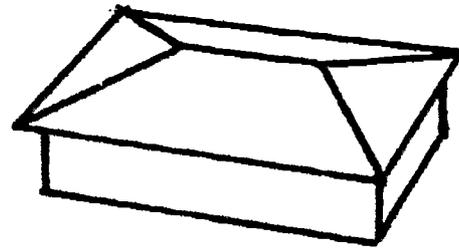
FLAT



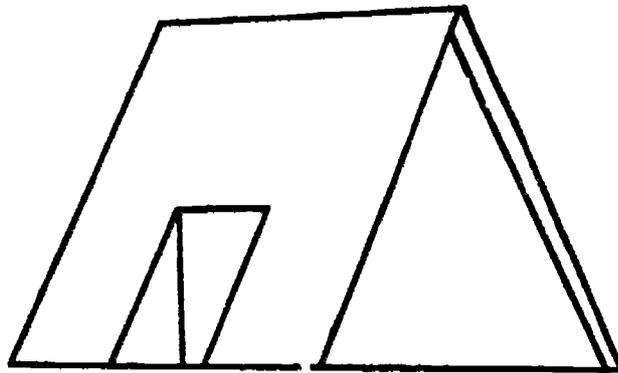
SHED



LOW SLOPE GABLE

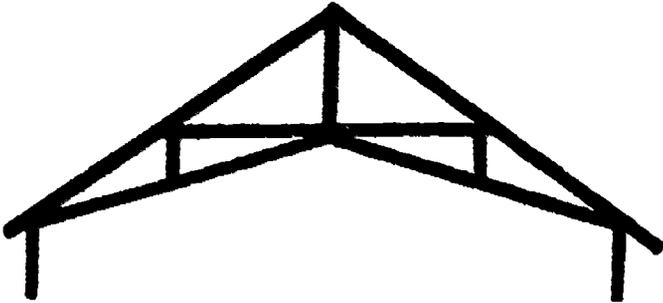
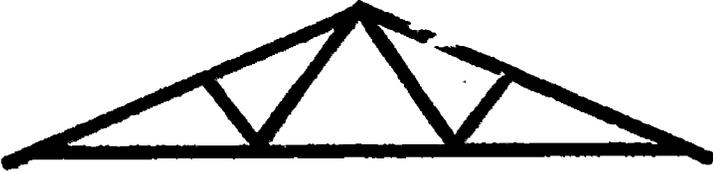


LOW SLOPE HIP



A-FRAME

ROOF TRUSSES



UNIT THREE

CARPENTRY

UNIT PURPOSE: To provide students an opportunity to complete tasks related to a construction project including planning, measuring and laying out of materials, methods of cutting and fitting, and fastening and assembly techniques.

PERFORMANCE OBJECTIVES: The student will be able to:

- I. Select and properly use layout tools, cutting tools, and fastening devices while constructing a project.
- II. Construct a panel jig.
- III. Describe the purpose and use of footings and foundation walls.
- IV. Describe the function and use of floor components.
- V. Fasten structural members together to form a vertical wall panel.
- VI. Construct a roof to cover a project.

NOTE: The types of projects selected will vary in relation to facilities, tools and machines, community resources, teacher experience, and teacher-student ratio, and budget capabilities.

Examples of projects might include:

House	Highway
Tunnel	Storage Units
Garden Tools Storage Space	Bridge
Clubhouse	Tower Fort
Deck	

Some students may want to build a structure by themselves, others may want to build a portion of a project (assembly component), others may want to complete a scaled down structure, and still others may want to form a group to work on a larger project. Knowledge and attitudes about safety should be learned as they apply to each activity. Career information should be integrated into the activities at appropriate intervals.

I. The student will select and properly use layout tools, cutting tools, and fastening devices while constructing a project.

A. Suggested Content

1. Layout

a. Marking devices

(1) Pencil

--Plain

--Carpenter

(2) Crayon

(3) Chalk

(4) Soap Stone

(5) Scribe

(6) Scratch awl

b. Marking instruments

(1) Compass

(2) Dividers

(3) Trammel points

c. Tools used in layout

(1) Framing square

(2) Combination square

(3) Sliding T-Bevel

(4) Tri-square

(5) Level

(6) Marking gauge

(7) Plumb bob

d. Straight line tools

(1) Straight edge

(2) Mason's line

(3) Chalk box and line

(4) Line level

e. Measuring systems

(1) Foot-pound

(2) Meter-liter

f. Measuring devices

(1) Bench rule

(2) Push-pull rule

(3) Folding wood rule

- (4) Framing square
- (5) Tri-square
- (6) Steel tape

2. Cutting

a. Saws

- (1) Rip saw
- (2) Cross cut saw
- (3) Back saw
- (4) Hack saw
- (5) Key hole saw
- (6) Coping saw

b. Knives

- (1) Utility
- (2) Stencil
- (3) Sloyd

c. Miter Box

- (1) 90 degree cuts
- (2) 45 degree cuts

3. Fastening (rough framing)

a. Hand nailing

- (1) Common
- (2) Box

b. Gun tacker

c. Penumatic tacker

d. Hammer tacker

e. Brad and stapler nailer

f. Electric tacker

g. Adhesives

h. Panel clips

4. Fastening (finish work)

a. Hand nailing

- (1) Box

- (2) Casing
- (3) Finish
- (4) Brad

b. Tackers

c. Staplers

d. Adhesives

e. Joints

- (1) Butt
- (2) Tongue & groove
- (3) Spline
- (4) Half lap
- (5) Scarf
- (6) Finger
- (7) Doweled
- (8) Mortise and tenon
- (9) Rabbet
- (10) Lock
- (11) Dovetail
- (12) Dado
- (13) Bawd or stopped dado
- (14) Miter
- (15) Splined miter

B. Suggested Teaching-Learning Activities

1. Determine thickness of lumber to be used in the project.
2. Determine and measure the various lengths of lumber to be used in the project.
3. Determine width of pieces to be used in the project.
4. Use marking and layout tools to layout and mark all pieces that will be used in the project. See "Layout Tools," and "Layout and Measuring Tools," pgs. 113-114, also "Dovetail Saw with Miter Box," p. 115.
5. Cut materials to length using hand saws or miter box.
6. Select proper type and size fasteners for assembling or constructing project.
7. Use proper fasteners and driving devices in order to fasten components of the project together.
8. Have a contest among students to see who can most effectively drive nails into scrap lumber. The following conditions must be taken into account:

- a. Type of hammer (weight)
 - b. Kind of wood (hardwood or softwood)
 - c. Size of nail (appropriate to thickness and type of wood)
 - d. Without bends (nail must be driven straight into the wood)
 - e. Nailhead flush with surface of wood (dents around nailhead are to be avoided)
9. Invite a speaker to talk about the use of adhesives, pneumatic tackers, and panel clips in connecting pieces of wood together.
 10. Discuss why certain current layout tools would be obsolete if the metric system was used 100% of the time in construction.
 11. Construct various woodworking joints. See "Woodworking Joints," page 116.

C. Suggested Evaluation

1. Evaluate the student's ability to properly layout tools, cutting tools, and fastening devices.

D. Suggested Resources

1. Books

- a. Modern Carpentry, p. 8-23
- b. Technical Woodworking, p. 112-134
- c. Woodworking Technology, p. 75-90

2. Booklets

- a. "Power Hand Tools"
- b. "Wood Gluing - Some Basic Principles and Techniques"

3. Films

- a. "ABC of Hand Tools"
- b. "Craftsman"
- c. "Hand Saws"
- d. "Hand Tools for Woodworking"

- e. "Laying out and Forming Flywood"
 - f. "Measuring and Squaring"
 - g. "Using Screws and Nails"
 - h. "Woodworking Series: Handtool Operations"
4. Filmstrip
- a. "Tools and Materials for Building a House"
5. Transparency Masters
- a. "Layout Tools," p. 113
 - b. "Layout and Measuring Tools," p. 114
 - c. "Dovetail Saw with Miter Box," p.115
 - d. "Woodworking Joints," p. 116

II. The student will construct a panel jig.

A. Suggested Content

1. Function of panel jigs
 - a. Wall panel construction
 - b. Floor panel construction
 - c. Roof truss construction
2. Size of building Jig
 - a. Height of wall
 - b. Width of floor panel
 - c. Roof pitch and span
3. Modular dimensions
 - a. 16 inches
 - b. 24 inches
 - c. 48 inches
4. Placement of stops
 - a. Complete length of components
 - b. Located at random intervals

B. Suggested Teaching-Learning Activities

1. Cut a piece of 1/2 inch plywood 16 inches wide and 20 inches long.
2. Draw outer perimeter of the panel on plywood.
3. Nail strips of wood to plywood to stops.
4. Invite speaker to discuss the many uses of panel construction.
5. Discuss the problems of modular dimensioning in inches as it relates to a change-over to metric measurement system.
6. Use scaled components and construct a wall panel using a panel jig. (See Transparency Master, "A-Frame Panel Truss Jig," page 117.)

7. Discuss the procedure for cutting a large quantity of lumber (4,000 - 2 x 4's) to the same length.

C. Suggested Evaluation

1. Evaluate the student's construction of a panel jig.

D. Suggested Resources

1. Books

- a. Carpentry in Residential Construction, pages 110 - 114
- b. Fundamentals of Carpentry, pages 179 - 185
- c. Modern Carpentry, pages 140 - 147

2. Booklets

- a. "Industrialized Modular Housing"
- b. "Mod 24 Building Guide"
- c. "A New Look At Wood Framing"
- d. "The Plywood 'How To' Book"
- e. "Swift Modular Systems, Incorporated"
- f. "Wickes Homes of the 70's"

2. Transparency Master

- a. "A-Frame Panel Truss Jig," p. 117

III. The student will describe the purpose and use of footings and foundation walls.

A. Suggested Content

1. Footing

a. Purpose

- (1) Supporting foundation wall
- (2) Supporting posts

b. Size

- (1) Physical size of footing
- (2) Physical size of foundation wall

2. Foundation wall

a. Purpose

b. Size

c. Material used

- (1) Concrete block
- (2) Poured concrete
- (3) Treated timbers

3. Skids

a. Utility buildings

b. Storage sheds

B. Suggested Teaching-Learning Activities

1. Visit a construction site that provides a view of the foundation.
2. Discuss the problems of a finished foundation that is incorrect in terms of dimensions listed on the set of prints.
3. Try the activity as illustrated in transparency master "Function of a Footer," page 118.
4. Sketch the foundation of a house.
5. Discuss why the height of the finished floor must be a certain distance above ground level. (Usually, about 18")

C. Suggested Evaluation

1. Have the student describe the purpose and use of footings and foundation walls.

D. Suggested Resources

1. Books

- a. Carpentry in Residential Construction, pages 1 - 24
- b. Fundamentals of Carpentry, pages 50 - 104
- c. Modern Carpentry, pages 87 - 110

2. Booklet

- a. "Here's the All-Weather Wood Foundation"

3. Transparency Master

- a. "Function of a Footer," p. 118

IV. The student will describe the function and use of floor components.

A. Suggested Content

1. Sill plate

- a. Bolted to top portion of foundation wall
- b. Located at least 8 inches above ground

2. Girder

- a. A large beam (horizontal member) that supports other smaller members (floor joists)
- b. Types
 - (1) Solid
 - (2) Built-up (2 pieces)
 - (3) Built-up (3 pieces)

3. Beams (metal)

- a. Types
 - (1) H-beams
 - (2) I-beams
 - (3) Channel

4. Columns of posts

- a. Function
 - (1) Supports girders or beams
- b. Types
 - (1) Lally column (steel tube)
 - (2) Concrete-filled lally column

5. Floor joists

- a. Function
 - (1) Supports the load of the room they span
- b. Types
 - (1) 2" x 6"
 - (2) 2" x 8"
 - (3) 2" x 10"
 - (4) 2" x 12"

c. Spacing

- (1) 12 inches on center
- (2) 16 inches on center

6. Bridging

a. Function

- (1) Acts as reinforcement for the joist
- (2) Serves to distribute a concentrated load over several joists

b. Types

- (1) 1 inch x 3 inch wooden bridging
- (2) Metal bridging
- (3) Solid wooden bridging

7. Subflooring

a. Function

- (1) Adds support to structure
- (2) Provides underlayment for finished floor
- (3) Serves as a safe platform for workmen framing side walls

b. Types

- (1) Wooden boards
 - Laid at right angle to joist
 - Laid diagonally to joists (obsolete in some areas)
- (2) Plywood
- (3) Plank
- (4) Particle or chip board

B. Suggested Teaching-Learning Activities

1. Determine size of floor components.
2. Cut materials to proper length for floor panel.
3. Utilize panel jig in assembling floor panel.
4. Calculate the number of 4 feet x 8 feet sheets of plywood necessary for covering 1400 square feet of floor space.
5. Discuss how 2 x 12's are fastened together to make girders.

6. Complete a rough sketch detailing what supports girders, sills, floor joists, subflooring, and finished flooring. (Example: the foundation wall supports the sill.)
7. Discuss and demonstrate the value of bridging.
8. Collect samples of many different types of flooring materials. Discuss the workers who install each type.
9. Discuss and demonstrate the relationship between the size of girders and the distance they span.
10. Construct a short section of a wood floor which will include sills, joists, headers, sub-flooring, sole plates, and studs.

C. Suggested Evaluation

1. Have the student describe the function of floor components and construct a portion of a floor frame.
2. See appendix for total evaluation form, pages 194 - 202.

D. Suggested Resources

1. Books

- a. Architecture, pages 131 - 166
- b. Carpentry in Residential Construction, pages 38 - 80
- c. Fundamentals of Carpentry, pages 105 - 135
- d. Modern Carpentry, pages 111 - 134
- e. Woodworking Technology, pages 341 - 345

2. Booklets

- a. "Everything You Wanted to Know About Plywood"
- b. "Here's the All Weather Wood Foundation System"
- c. "Mod 24 Building Guide"
- d. "A New Look at Wood Framing"
- e. "The Plywood 'How To' Book"

3. Films

- a. "How We Build Things"

- b. "Lumber - Where Does Lumber Come From?"
- c. "Plywood - How Do They Make Plywood?"
- d. "The Story of Building a House"

V. The student will fasten structural members together to form a vertical wall panel.

A. Suggested Content

1. Sole plate
 - a. Size
2. Studs
 - a. Nominal size
 - b. Actual size
 - c. Length increments
 - d. Grade classification
3. Top plates
 - a. Top plate is doubled after erection of wall
4. Wall bracing
 - a. Adds rigidity to frame work
 - b. Applies to exterior walls
5. Header
 - a. Carries the weight of the ceiling and roof across door and window openings
 - b. Size of the lumber used in the header depends on the width of the opening
6. Door Opening
 - a. Rough opening for door
 - (1) Trimmer stud
 - (2) Header
7. Window openings
 - a. Trimmer stud
 - b. Header
 - c. Rough sill
 - d. Cripple stud

8. Sheathing
 - a. Plywood
 - b. Wood boards
 - c. Fiberboard

B. Suggested Teaching-Learning Activities

1. Assemble wall components in panel jig and construct exterior wall panels with openings located in correct position.
2. Assemble components in panel jig and construct interior wall panels.
3. Visit building site and observe the stick-built method of construction.
4. Discuss why housing have openings other than doors.
5. Construct a wall panel with no bracing. Discuss various bracing methods
6. Invite a speaker to discuss the use of tackers, staplers, and adhesives in relation to securing sheathing.
7. Investigate the sizes (both nominal and actual) of lumber and find out if they have changed in the past ten years.
8. Investigate the use of metal framing members. (aluminum and steel)
9. Find the standard heights of door openings.
10. Apply exterior finish to vertical wall panel.
11. Discuss the function of headers.

C. Suggested Evaluation

1. Evaluate the student's work in fastening structural members together to form a wall panel.
2. See appendix for total evaluation form.

D. Suggested Resources

1. Books
 - a. Carpentry in Residential Construction, pages 81 - 118

- b. Framing, Sheathing and Insulation
- c. Fundamentals of Carpentry, pages 105 - 222
- d. Modern Carpentry, pages 135 - 156
- e. Woodworking Technology, pages 346 - 349

2. Booklets

- a. "Catalog of Handy Plans"
- b. "Everything You Wanted to Know About Plywood"
- c. "Mod 24 Building Guide"
- d. "A New Look at Wood Framing"
- e. "The Plywood 'How To' Book"

VI. The student will construct a roof to cover a project.

A. Suggested Content

1. Types

- a. Flat
- b. Shed
- c. Gable
- d. Hip

2. Joist and rafter framing

- a. Ridge board
- b. Rafters
- c. Collar beams

3. Beam and plank framing

- a. Post
- b. Ridge beam
- c. Roof beam
- d. Plank structural roof

4. Trussed rafters

- a. Chord
 - (1) Top
 - (2) Bottom
- b. Webs
 - (1) Tension
 - (2) Compression
- c. Plywood gusset
 - (1) Nails
 - (2) Glue
- d. Truss clips
 - (1) Holes for nailing
 - (2) Protruding metal bites

5. Spacing of trusses

- a. 16 inches on center
- b. 24 inches on center

B. Suggested Teaching-Learning Activities

1. Hold a sheet of paper along one end and lift it from a flat surface such as a table. (See "Strength of Paper," page 119 figure A) Describe the supporting strength of the paper. Now, roll the sheet into a semicircle and hold it along one edge. Place a penny on it. (See figure B, page 119.) Describe the supporting strength of the paper. Finally, fold accordion pleats with the sheet of paper. (See figure C, page 119.) Describe the supporting strength of the paper.
2. Measure, cut, and assemble components to form a truss assembly.
3. Discuss the advantages of various types of molds.
4. Calculate the cost for roofing a specified area, given the local cost per square.
5. Experiment with a conventional rafter frame and trussed rafters to see which will hold the most weight.
6. Identify the components that make up the cornice.
7. Invite a speaker to talk about gussets and truss clips.
8. Review drawings of trussed rafters in the Unicom Manual by the National Lumber Manufacturers Association.
9. Take field trips and identify various roof styles.
10. Visit lumber yards and examine the various types of roofing materials.
11. Discuss the advantages and disadvantages of various roofing materials.
12. Describe the working conditions of a roofer.

C. Suggested Evaluation

1. Evaluate the student's work in covering (roof) a structure or a portion of a structure.
2. See appendix for total evaluation form. See pages 194 - 202.

D. Suggested Resources

1. Books

- a. Architectural Graphic Standards
- b. Architecture, pages 219 - 221
- c. Carpentry in Residential Construction, pages 119 - 176
- d. Fundamentals of Carpentry, pages 223 - 331
- e. Modern Carpentry, pages 157 - 214
- f. Woodworking Technology, pages 350 - 356

2. Transparency Master

- a. "Strength of Paper," p.119

SUPPORTIVE MATERIAL FOR UNIT THREE

REFERENCE LIST FOR UNIT THREE

BOOKS

1. Architectural Graphic Standards by Ramsey and Sleeper, John Wiley & Sons
2. Architecture by William Spence, McKnight & McKnight Publishing Company
3. Carpentry in Residential Construction by Stanley Badzinski Jr., Prentice-Hall Inc.
4. Framing, Sheathing and Insulation by Raymond Jones Sr., Delmar Publishers Inc.
5. Fundamentals of Carpentry by Walter Durbahn and Elmer Sundberg, American Technical Society
6. Modern Carpentry by Willis Wagner, The Goodheart-Willcox Co., Inc.
7. Technical Woodworking by Chris Groneman and Everett Glazener, McGraw-Hill Publications in Industrial Education
8. Unicom Manual, National Lumber Manufacturers Association
9. Woodworking Technology by Donnelly, Hammond, Harrod and Rayner, McKnight & McKnight Publishing Company

BOOKLETS

1. "The All-Weather Wood Foundation System," National Forests Products Association
2. "Catalog of Handy Plans," American Plywood Association
3. "Everything You Wanted to Know About Plywood," American Plywood Association
4. "Here's the All-Weather Wood Foundation," American Plywood Association
5. "Industrialized Modular Housing," Industrialized Modular Housing, General Electric Company
6. "Mod 24 Building Guide," American Plywood Association
7. "A New Look at Wood Framing," Western Wood Products Association
8. "The Plywood 'How To' Book," American Plywood Association

9. "Power Hand Tools," General Services Administration
10. "Swift Modular Systems, Incorporated," Swift Industries, Inc.
11. "Wickes Homes of the 70's," The Wickes Corporation
12. "Wood Gluing - Some Basic Principles and Techniques,"
Franklin Glue Company

FILMS

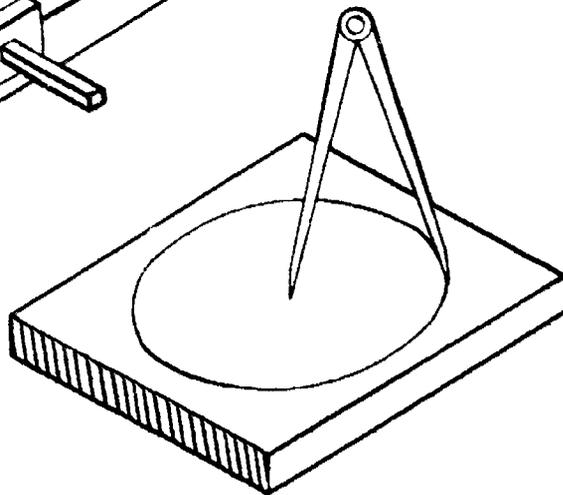
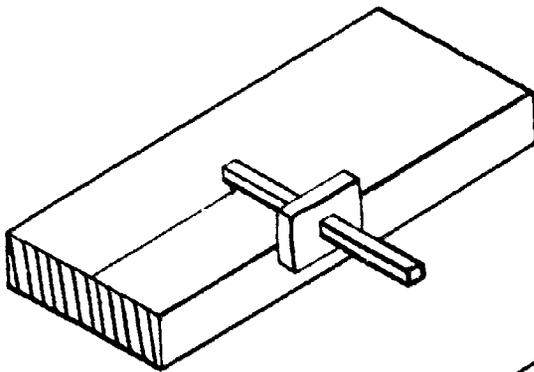
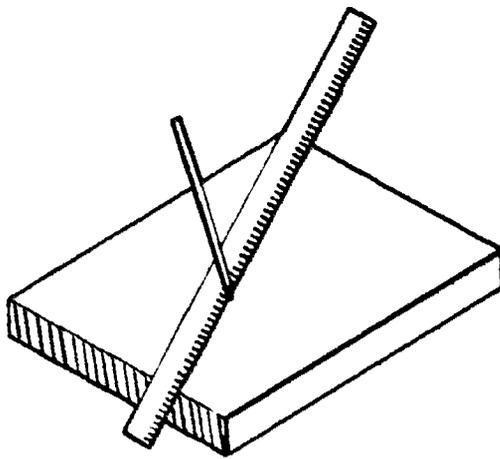
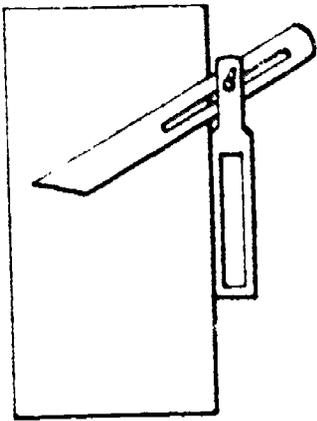
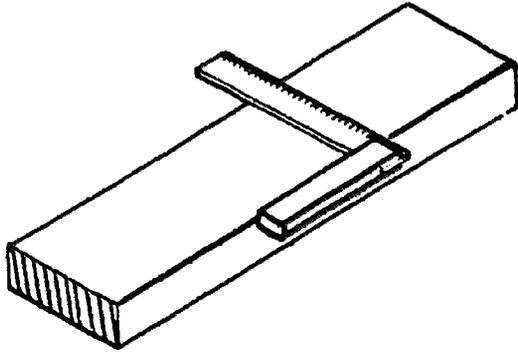
1. "ABC of Hand Tools," General Motors
2. "Craftsmen," Barr Films
3. "Hand Saws," McGraw-Hill Films
4. "Hand Tools for Woodworking," Bailey Films
5. "How We Build Things," Eye Gate House Inc.
6. "Laying Out and Forming Plywood," University of Illinois
7. "Lumber - Where Does It Come From?" NBC Educational Enterprises
8. "Measuring and Squaring," McGraw-Hill Films
9. "Plywood - How Do They Make Plywood?" NBC Educational Enterprises
10. "The Story of Building a Home," Eye Gate House Inc.
11. "Using Screws and Nails," McGraw-Hill Films
12. "Woodworking Series: Handtool Operations," Valiant Instructional
Materials Corporation

FILMSTRIPS

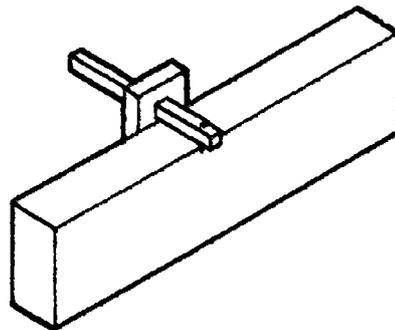
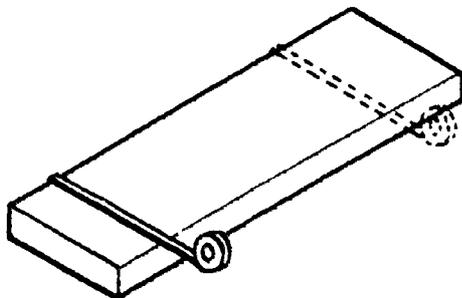
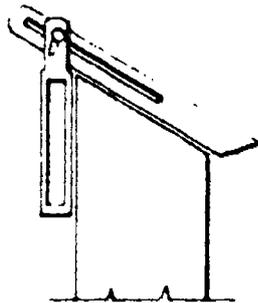
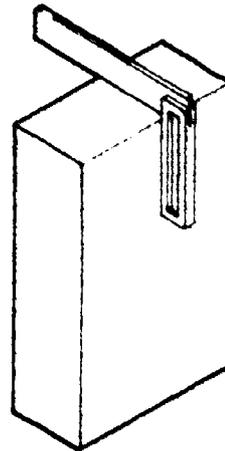
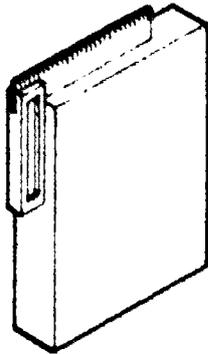
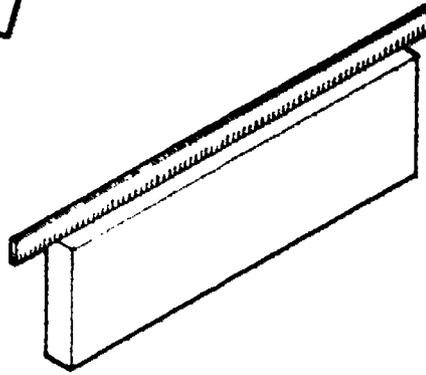
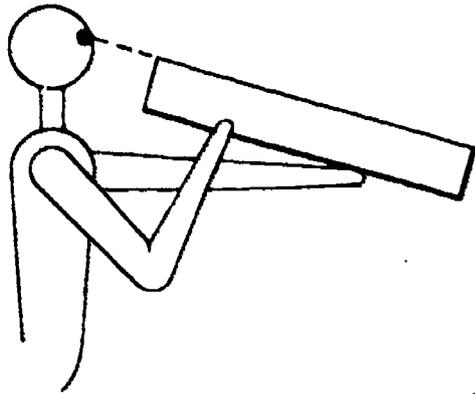
1. "Tools and Materials for Building a House," Encyclopedia
Britannica

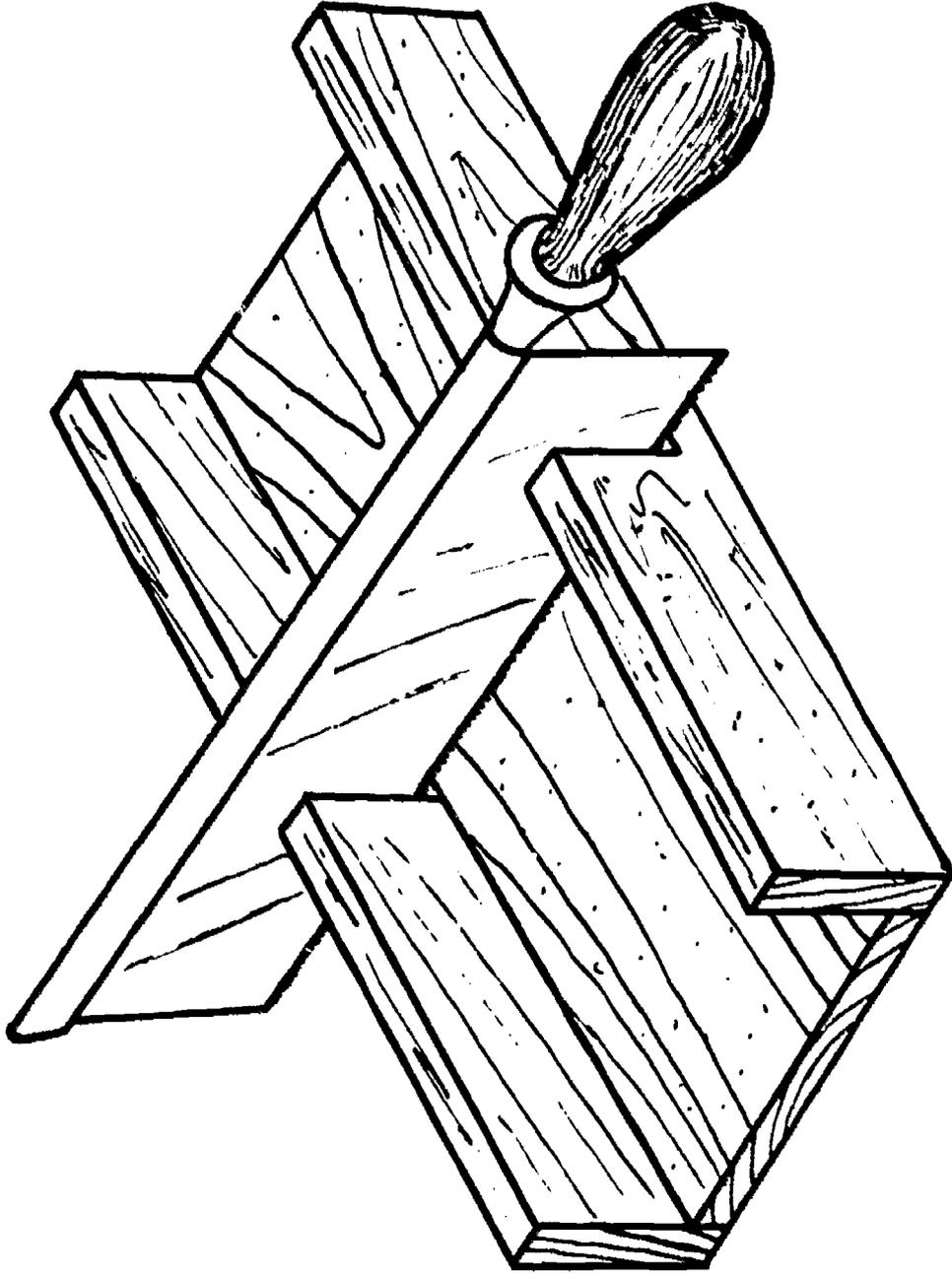
Addresses of publishers and distributors can be found in the Appendix.

LAYOUT TOOLS



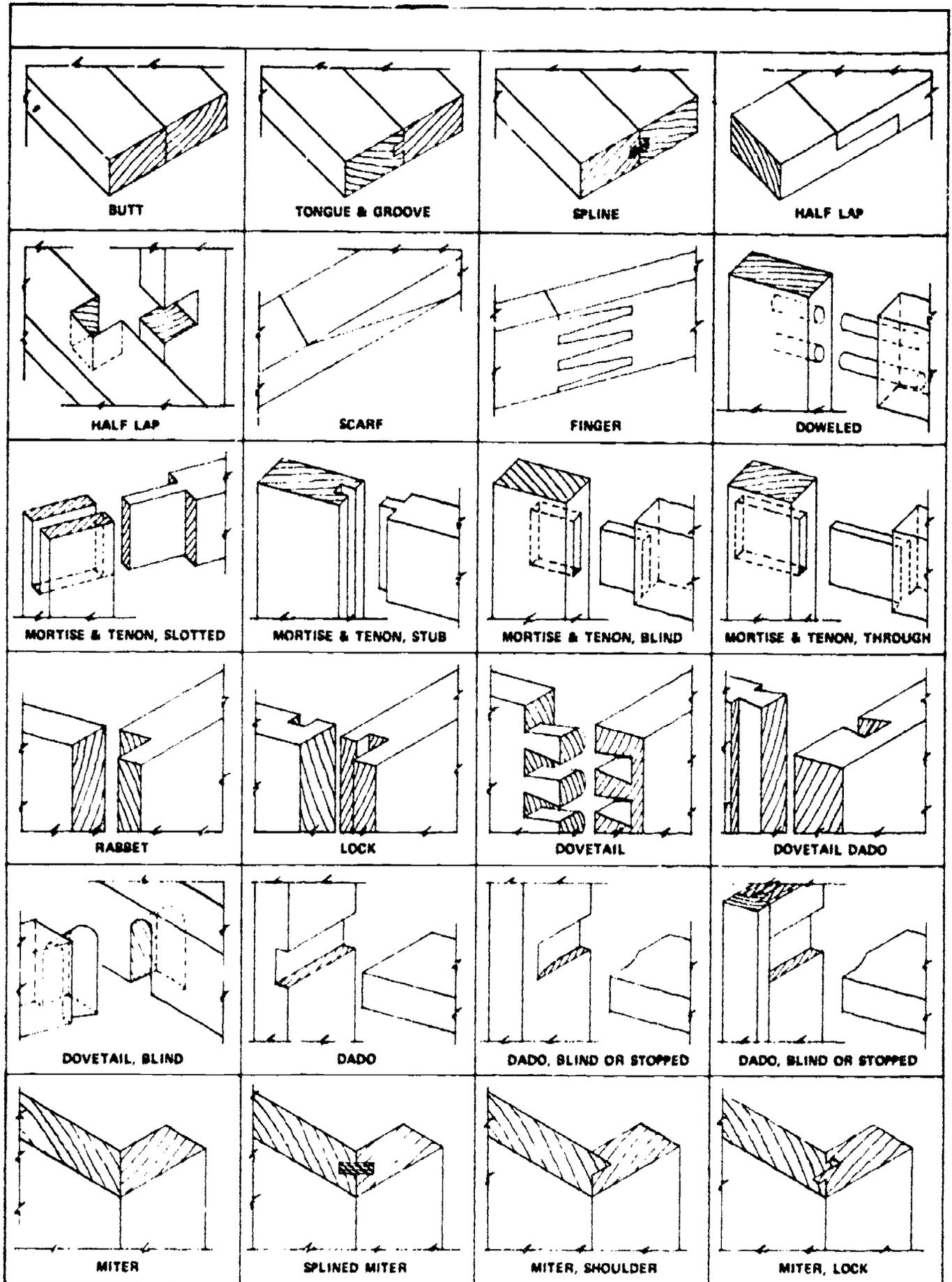
LAYOUT AND MEASURING TOOLS



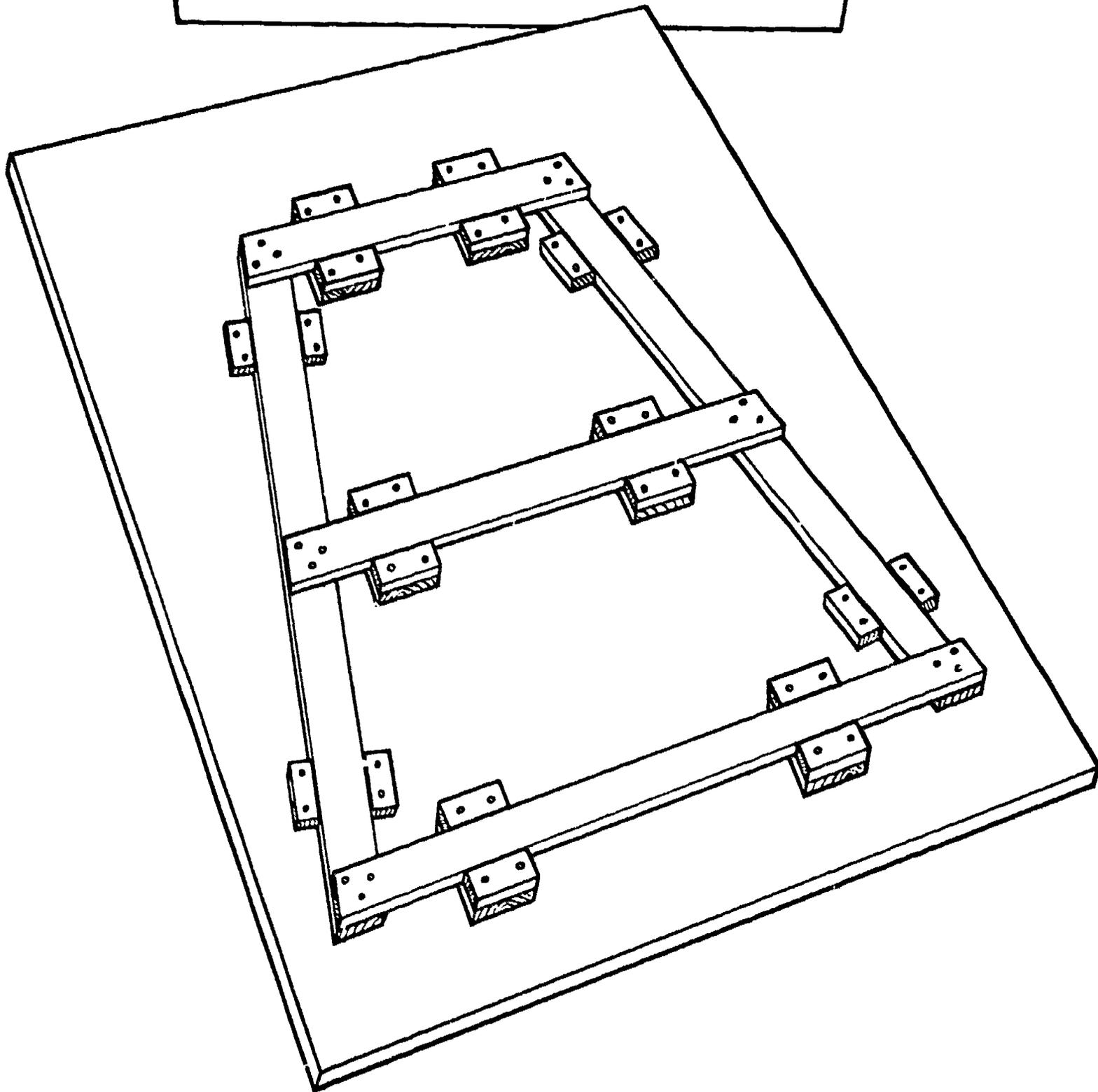


DOVETAIL SAW WITH MITER BOX

WOODWORKING JOINTS

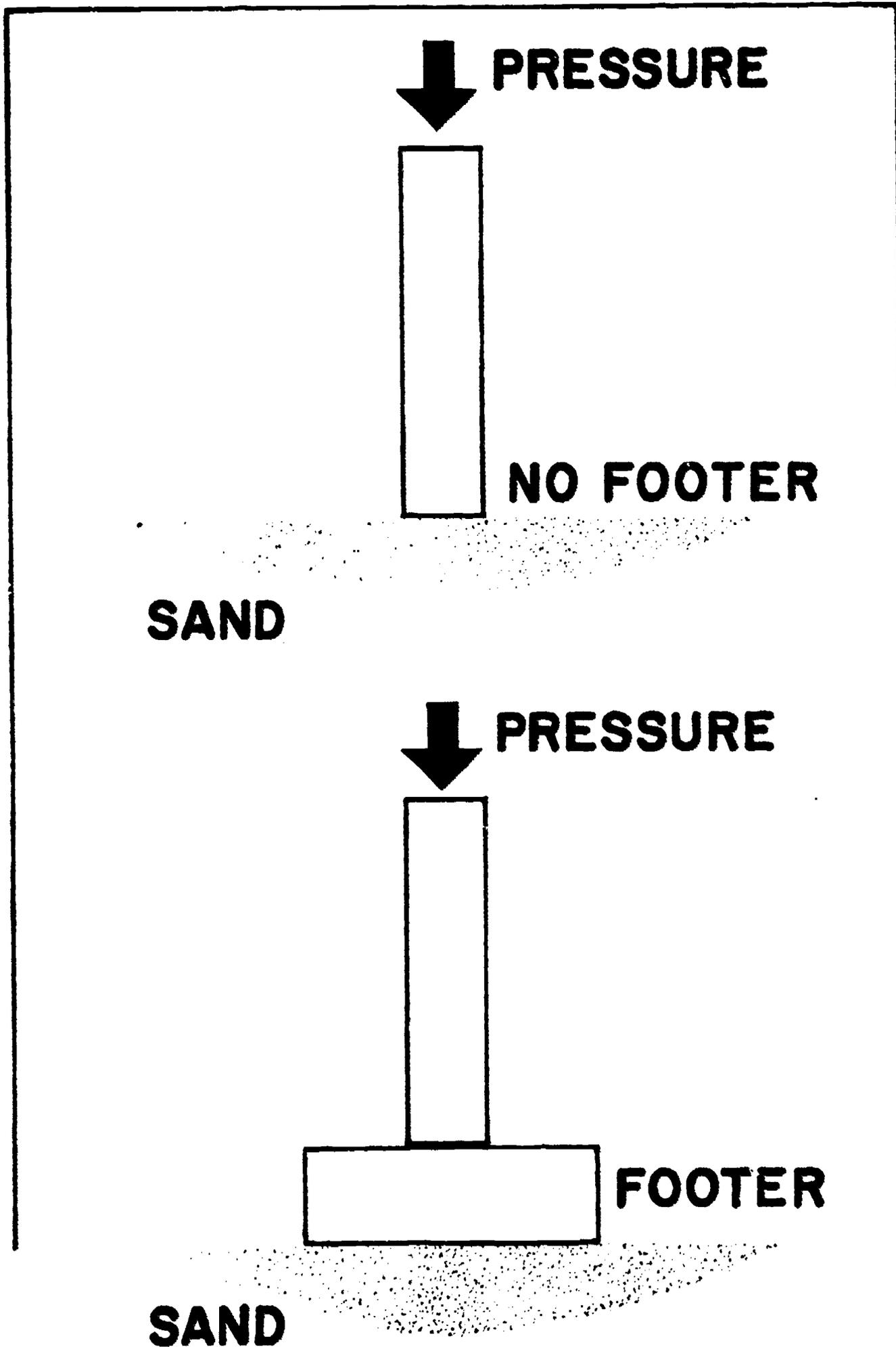


A-FRAME PANEL TRUSS JIG



T. VANTREESE, C. D. C., KENTUCKY

FUNCTIONS OF A FOOTER



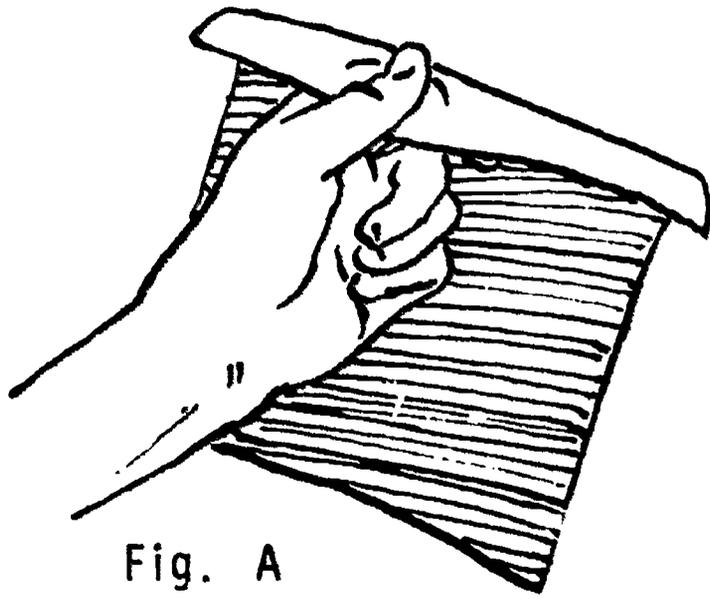


Fig. A

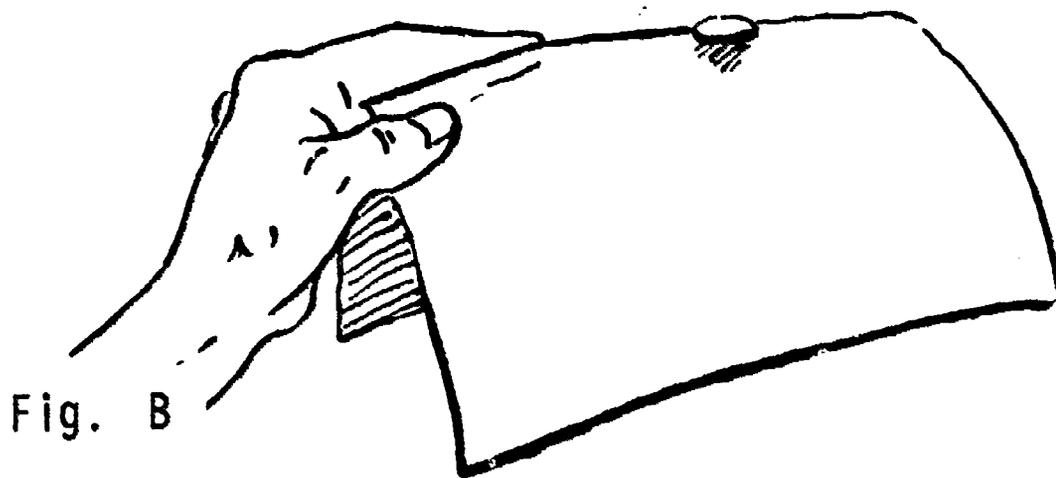


Fig. B

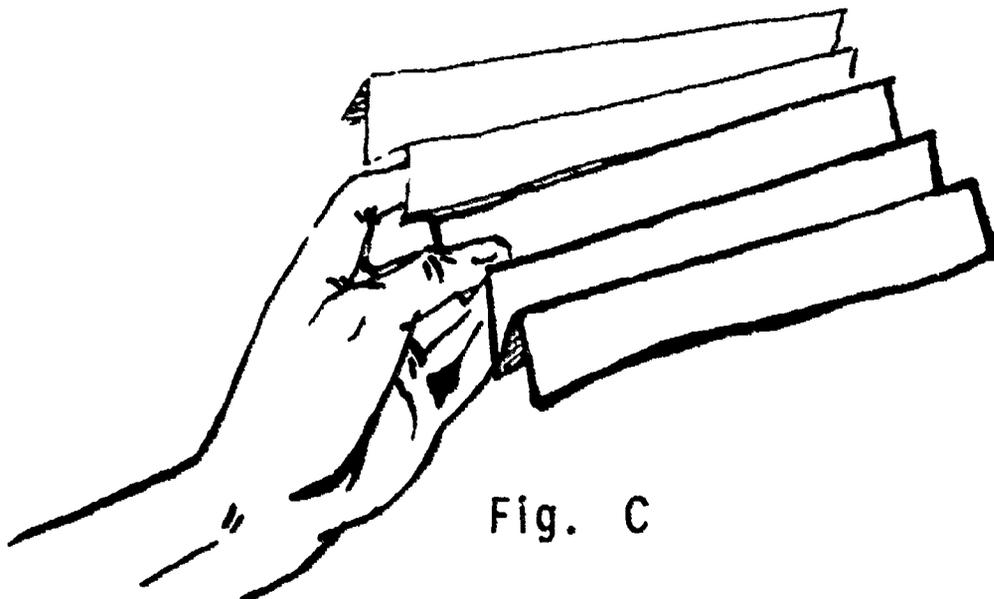


Fig. C

STRENGTH OF PAPER

UNIT FOUR

MASONRY

UNIT PURPOSE: To provide students experiences with brick, concrete and gypsum products and activities relating to masonry careers.

PERFORMANCE OBJECTIVE: The student will be able to describe the characteristics of concrete, concrete block, brick and gypsum and the use of each type in the construction industry.

- I. The student will be able to describe the characteristics of concrete, concrete block, brick and gypsum and the use of each type in the construction industry.

A. Suggested Content

1. Concrete

a. Concrete invented by the Romans.

b. Composition

(1) Cements

- Portland
- Aluminums
- Masonry
- White

(2) Aggregates

- Coarse sand
- Stone
 - crushed
 - washed gravel
- Shale
- Slag
- Vermiculite

(3) Water

c. Mixing

- (1) Hand mixing
- (2) Machine mixing
- (3) Ready mixed

d. Proportions

(1) Generally 1:2:4:8

- Part cement
- Parts sand
- Parts stone
- Parts water

e. Transporting concrete

- (1) Moving
- (2) Unloading
- (3) Placing

f. Blueprints

- (1) Plan view
- (2) Section view
- (3) Specifications

g. Uses

- (1) Footings
- (2) Piers
- (3) Walls
- (4) Columns
- (5) Slabs

2. Block construction

a. Types

- (1) Heavyweight
- (2) Lightweight

b. Shapes and sizes

c. Mortar

- (1) Proportions
- (2) Maintaining plasticity

c. Layout of bond

- (1) Running
- (2) Stacking

3. Brick veneer construction

a. Sizes and styles

b. Types

- (1) High absorption
- (2) Low absorption

c. Mortar

- (1) Mix

c. Laying brick

- (1) Maintaining level and plumb
- (2) How the amount of mortar affects this

e. Washing the wall

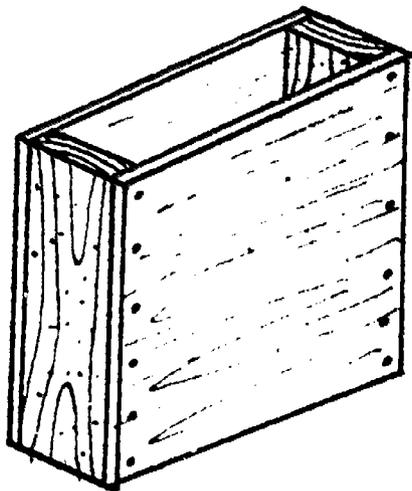
4. Gypsum

- a. Limestone mortar discovered by the Egyptians and used in the pyramids
- b. Products
 - (1) Plasters
 - (2) Wallboards
 - (3) Joint fillers
 - (4) Gypsum tiles
- c. Characteristics of gypsum products
 - (1) Cost
 - (2) Appearance
 - (3) Durability
 - (4) Workability
 - (5) Fire resistance
 - (6) Handling limitations

B. Suggested Teaching-Learning Activities

1. Visit a ready-mix concrete plant. Find out:
 - a. Source of aggregates
 - b. Handling of materials
 - c. Size of truck-mounted mixers
 - d. Distance truck can travel without extra charge
 - e. How concrete is sold
 - f. How much a bag of cement weighs
2. Construct a display board for the classroom. Procure raw materials for Portland cement and attach them to the board and label each.
3. Discuss the terms cement and concrete. Which is correct, a cement sidewalk or a concrete sidewalk?
4. Work in groups and lay out, square, and plumb a 20" x 24" hollow brick pier 5 courses high using 9 bricks per course. Mortar may or may not be used. Perform activity out of doors if possible.
5. Describe the function of expansion joints.
6. Discuss the most famous foundation blunder "Leaning Tower of Pisa." The tower is 14 feet off perpendicular.

7. Experiment with different concrete fasteners. Be able to identify each.
8. Observe construction projects and describe the use of brick, concrete, and concrete block.
9. Discuss the issue of ready-mix concrete vs. mixed-on-the-site concrete for a small project.
10. Observe the placement of concrete on an actual job site. List safety precautions taken by the workmen.
11. Invite speaker who works with brick and/or concrete to talk about recent working techniques. Prepare three questions, each on a 3" x 5" card for the speaker to answer.
12. Discuss basement leaks in concrete block walls.
13. Collect, catalog, and display samples of clay products.
14. BENCH DEMONSTRATION (Build two forms)



Mix sufficient stiff, lean concrete to fill both forms. Quickly pour mix into one form, screeding the top. Carefully fill the second form tamping and vibrating as you pour. Screed the top. When concrete is sufficiently set remove the forms to show the presence and lack of "honeycomb."

15. Discuss the dignity and value of occupations related to masonry.
16. Make surveys of jobs in the community that relate to masonry.
17. Describe any changes related to masonry occupations which are a result of different seasons of a year.
18. Examine glamour jobs related to masonry.
19. Write a paper on "Why we need masons."
20. Interview a mason about his job and then report back to the class.
21. Collect manufacturers' catalogs and samples, if possible, to show the wide variety of sizes, colors, and textures of brick.
22. List the sizes of concrete and cinder block units.
23. Identify basic hand tools used in concrete block construction.
24. Invite speaker to talk about surface bonding of concrete block (No mortar used)
25. Trace the use of gypsum. Include the following in your findings:
 - a. Egypt (Pyramid of Cheops - 3700 B.C.)
 - b. Mesopotamia
 - c. Greece
 - d. Paris, France (plaster of Paris - 19th century)
26. List the uses of gypsum in the construction industry.

C. Suggested Evaluation

1. Have the student describe the characteristics of concrete, concrete block, brick, and gypsum, and the use of each type of material in the construction industry. Also, evaluate the hands-on activities.

D. Suggested Resources

1. See pages 131-132 for a complete list of resources.

SUPPORTIVE MATERIAL FOR UNIT FOUR

REFERENCE LIST FOR UNIT

FOUR

ASSOCIATIONS

1. Brick Institute of America
2. Gypsum Association
3. International Masonry Institute
4. National Concrete Masonry Association

BOOKS

1. American Concrete Institute Journal, American Concrete Institute
2. The Art of Bricklaying, by Ray J. Edgar, Charles Bennett Publishers
3. Bricklaying Skill and Practice, by Ralph Dalzell and Gilbert Townsend, American Technical Society
4. Concrete Construction, Concrete Construction Publication, Inc.

BOOKLETS

1. "The Bricklayer and His Union," International Masonry Institute
2. "Bricklaying--A Career Opportunity in America's Building Industry," Brick Institute of America
3. "Cement Making in the West," Permanent Cement Company
4. "Cement Masons Manual for Residential Construction," Portland Cement Association
5. "Employment Outlook for Cement Masons, Lathers, and Plasterers," Portland Cement Association
6. "Facts and Fancies about Bricklaying," International Masonry Institute
7. "How to Make Concrete and How to Use It," Portland Cement Association
8. "Kaiser Cement--Types and Uses," Kaiser Cement
9. "Kaiser Gypsum Ceilings," Kaiser Gypsum
10. "Occupational Outlook Report: Bricklayers, Stonemasons, Marble Setters, Tile Setters, Terazzo Workers," U.S. Department of Labor

11. "Occupational Outlook Report: Cement Masons, Plasterers, Lathers," U.S. Department of Labor
12. "Surface Bonding Cement," W.R. Bonsal Company
13. "This is the Gypsum Association," Gypsum Association

FILMS

1. "Bricklayers," Sterling Educational Films
2. "Building for Safety," Underwriters Laboratories,
3. "Cement Masons," Sterling Educational Films
4. "Concepts in Concrete," Ideal Cement Company
5. "Futures in Concrete," Ideal Cement Company
6. "Inside Story of Concrete," U.S. Army Corps of Engineers
7. "Man and Masonry," Structural Clay Products
8. "New Dimensions in Concrete," Ideal Cement Company
9. "New Horizons in Plastering," Vermiculite Institute

SLIDES

1. "Story of Structural Slate," Vermont Structural Slate Company

Addresses of publishers and distributors can be found in the Appendix.

**PP. 133-134 WERE MISSING FROM THE DOCUMENT THAT WAS
SUBMITTED TO ERIC DOCUMENT REPRODUCTION SERVICE.**

UNIT FIVE

ELECTRICITY

UNIT PURPOSE: To provide students with background information in electricity and experiences with schematic drawings, circuits, and electrical devices; also to provide career-related activities.

PERFORMANCE OBJECTIVES: The student will be able to:

- I. Explain the types of electrical energy and their applications.
- II. Describe the functions of the electrician in the construction cluster and perform simple electrical skills.

- I. The student will be able to explain the types of electrical energy and their applications.

A. Suggested Content

1. Types of electrical energy

a. Thermoelectric

- (1) Electricity produced by coupling dissimilar metals and applying heat to the coupling
- (2) Used in motors to monitor overheating

b. Photoelectric

- (1) Electricity produced by exposing photoelectric cells to sunlight
- (2) Used in light meters in cameras, etc.

c. Chemical

- (1) Electricity produced by submerging electrodes in a chemical electrolyte
- (2) Used in storage batteries

d. Mechanical

- (1) Electricity produced by the movement of a magnet in conjunction with a wire coil
- (2) The major source of electrical energy

--Hydroelectricity

-dams

--Fuel burning

-coal

-oil

-gas

--Atomic energy

2. Experimental sources of electricity

Note: Students may find interesting current articles on research and new careers resulting from need to find energy which does not deplete natural resources.

a. Solar energy

- (1) Using the sun's energy
- (2) Will not deplete natural resources

b. Geothermal energy

- (1) Using heat from the earth
- (2) Will not deplete natural resources

B. Suggested Teaching-Learning Activities

1. Showing transparency master "Sources of Electrical Energy," p.147 , discuss the types of electricity and their applications.
2. Showing transparency master "Electron Theory," p. 148 , discuss the movement of electrons in the mechanical production of electricity.
3. Discuss why electricity is the basic requirement for economic development.
4. Conduct a survey to locate generating plants serving your local area.
5. Discuss blackouts and the resulting effects.
6. List some of the illuminous effects of electricity.
7. List, describe, and experiment with chemical effects of electricity.
8. List and experiment with magnetic effects of electricity.
9. List some of the thermal effects of electricity.
10. Discuss "Power Systems," p. 149.

C. Suggested Evaluation

1. Have the students explain the types of electrical energy and their applications.

D. Suggested Resources

1. See pages 145-146 for complete references for Unit Five.
2. Transparency Masters
 - a. "Sources of Electrical Energy," p.147
 - b. "Electron Theory," p. 148
 - c. "Power Systems," p. 149

II. Describe the functions of the electrician in the construction cluster and perform simple electrical skills.

A. Suggested Content

1. Electrical terminology

- a. Electricity - Electrons in motion. The motion is called current. The force that causes the current is called voltage.
- b. Ohm - Unit used to measure electrical resistance.
- c. Electric Circuit - The complete path from wall outlet (source of power) through a wire, through the device using the power, back through the wire and to the wall outlet.
- d. Short Circuit or "Short" - The path of an electric current other than the intended one. A low resistance path, usually accidental, between line wires or between live parts in electrical devices allowing excessive current to flow.
- e. Open Circuit or "Open" - A break or gap that stops current flow.
- f. Conductor - A wire through which electricity flows. Examples of good conductors are copper, silver, and aluminum.
- g. Insulator - A material which tends to prevent the flow of current. Examples are glass, rubber, porcelain and bakelite.
- h. Volt - A unit of measure of electrical pressure that causes current to flow. Electrical pressure measured in volts can be compared to water pressure measured in pounds per square inch. Volts are measured by a voltmeter.
- i. Ampere - An expression of the rate of flow of electrons in a conductor. This can be compared to the rate of flow of water in a pipe (gpm). Amperes are measured by an ammeter.
- j. Watt - A unit of electrical power or rate of use of electrical energy. If one ampere is moved by the force of one volt, one watt is used.
- k. Kilowatt Hour - One thousand watts used one hour.

- l. Resistance - The property of a material that opposes the flow of current. It is expressed in the unit ohm and is measured by an ohmmeter.
- m. Switch - A device to open and close a circuit.
- n. Circuit Breaker - A switch which automatically opens with excessive current to protect the circuit and connected equipment.
- o. Fuse - A device containing a strip of metal which melts and opens the circuit when excessive current flows.
- p. Transformer - A device for stepping up or down the voltage of an electric circuit.

2. Functions of the electrician in construction.

- a. Reads blueprints
- b. Installs conduit
 - (1) Measures and bends pipes
 - (2) Installs wire boxes
 - (3) Clips conduit to structural supports
- c. Installs wiring
 - (1) Forces wire through conduit system
 - (2) Strips insulation to expose conductor
 - (3) Wires switches and duplex receptacles
 - (4) Directs wire heaters, exhaust fans, etc.
- d. Installs fuse box
- e. Installs ground rod
- f. Connects to main service

B. Suggested Teaching-Learning Activities

1. Construct a simple circuit for a light with switch.
 - a. Sketch a simple circuit including the following:
 - Power source (use a standard classroom battery)
 - Conductors
 - Switch
 - Lamp
 - b. Develop equipment and tool list.

- c. Wire the circuit.
 - d. Have the teacher evaluate the circuit.
 - e. Observe the operation of the circuit.
2. Construct a simple doorbell circuit.
 - a. Sketch the doorbell circuit.
 - b. Develop equipment and tool list. (Use a standard classroom battery.)
 - c. Wire the circuit.
 - d. Have the teacher evaluate the circuit.
 - e. Observe the operation of the circuit, especially how the clapper is controlled by the opening and closing of the circuit.
3. Categorize common materials as insulators or conductors.
4. Create a list of the danger factors that exist as a result of individual ignorance or carelessness in handling electrical equipment. (Example: the use of an outlet that has not been grounded.)
5. List the kinds of electrical appliances found in a typical house.
6. Discuss the reasons for having 220 volt circuits.
7. Discuss the value of occupations related to electricity.
8. Make surveys of jobs in the community that relate to electricity.
9. Describe any changes related to electrical occupations which are a result of different seasons of a year. (Example: ice in winter.)
10. Briefly examine glamour jobs related to electricity.
11. Write a paper on "Why we need electricians"
12. Interview an electrician about his job and then report back to the class.
13. Measure the voltage and amperage of a simple circuit with appropriate meter.

14. Measure the resistance of various substances with ohmmeter.
(Use wood, wire, resistors, variable capacitors and other items as substances.)

C. Suggested Evaluation

1. Have the students list the function of the electrician.
2. Evaluate the students sketches and projects.

D. Suggested Resources

1. See pages 145 - 146 for complete reference list for Unit Five.

SUPPORTIVE MATERIAL FOR UNIT FIVE

REFERENCE LIST FOR UNIT FIVE

BOOKS

1. Electrical Construction Wiring by Walter Alerich,, American Technical Society
2. Electrical Principles and Practices by James Adams, McGraw-Hill Publishing Company
3. Electrical Wiring: Residential by Ray Mullin, Delmar Publishers
4. House Wiring by Roland Palmquist, ITT Educational Material
5. House Wiring Simplified by Floyd Mix, Goodheart-Willcox Company
6. Practical Electrical Wiring by H.P. Richter, McGraw-Hill Publishing Company
7. Principles of Electricity by Cornetet, McKnight and McKnight Publishing Company
8. Understanding Electricity and Electronics by Buban and Schmitt, McGraw-Hill Publishing Company

BOOKLETS

1. International Brotherhood of Electrical Workers
 - "Fact Book"
 - "This is the IBEW"
 - "When You Join the IBEW"
 - "Facts Worth Knowing About the IBEW"
 - "These Things We Believe"
 - "Council on Industrial Relations"
 - "The Electrical Workers Story"
 - "History & Structure of the IBEW"
2. "Simplified Electric Wiring Handbook," Sears, Roebuck and Company

FILM LOOPS

1. "Connecting Wires in an Outlet Box," Valiant Instructional Materials Corporation
2. "Electricians," Sterling Educational Films
3. "Installing a Convenience Outlet," Valiant Instructional Materials Corporation

4. "The Third Wire Can Save Your Life," Valiant Instructional Materials Corporation
5. "Trouble Shooting a Bell Circuit," Valiant Instructional Materials Corporation

FILMS

1. "Basic Electricity," ITT Educational Films
2. "Electrician," Baker & Taylor

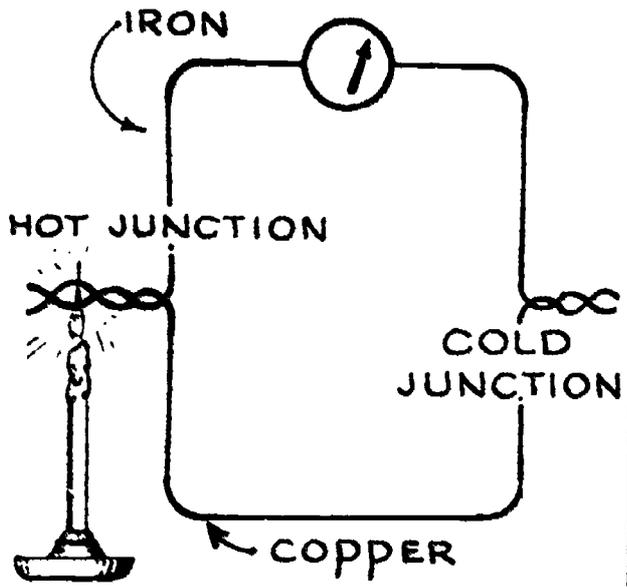
WORKBOOK

1. "The McKnight Power Experimenter - Electrical Control," McKnight & McKnight Publishing Company

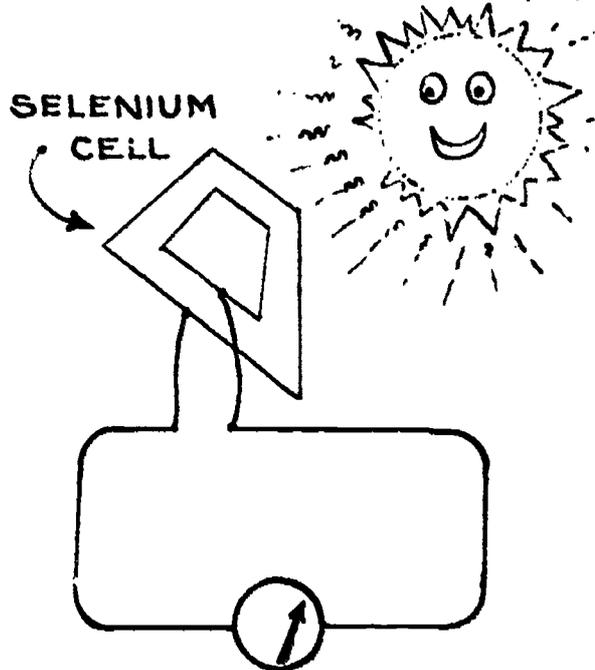
Addresses of publishers and distributors can be found in the Appendix.

Sources of Electrical ENERGY

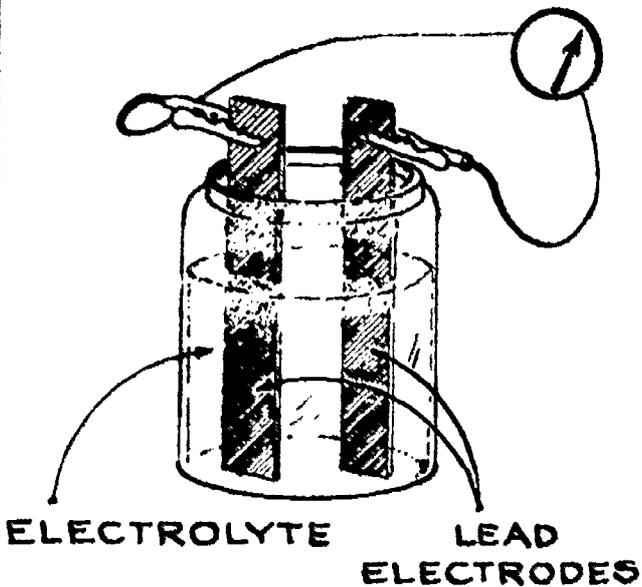
THERMOELECTRIC



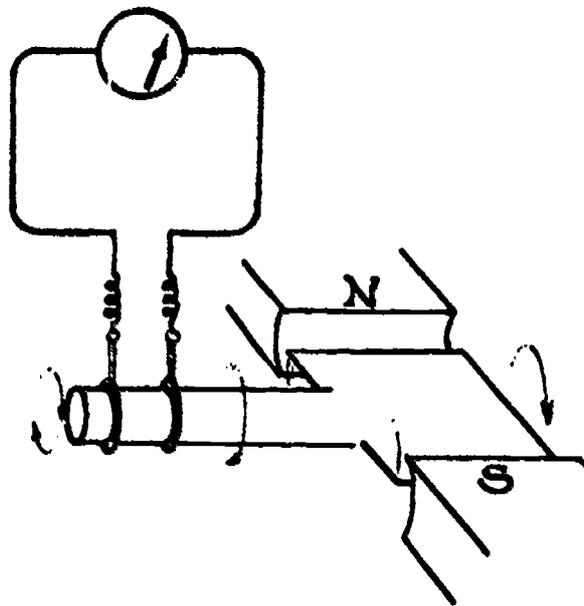
PHOTOELECTRIC



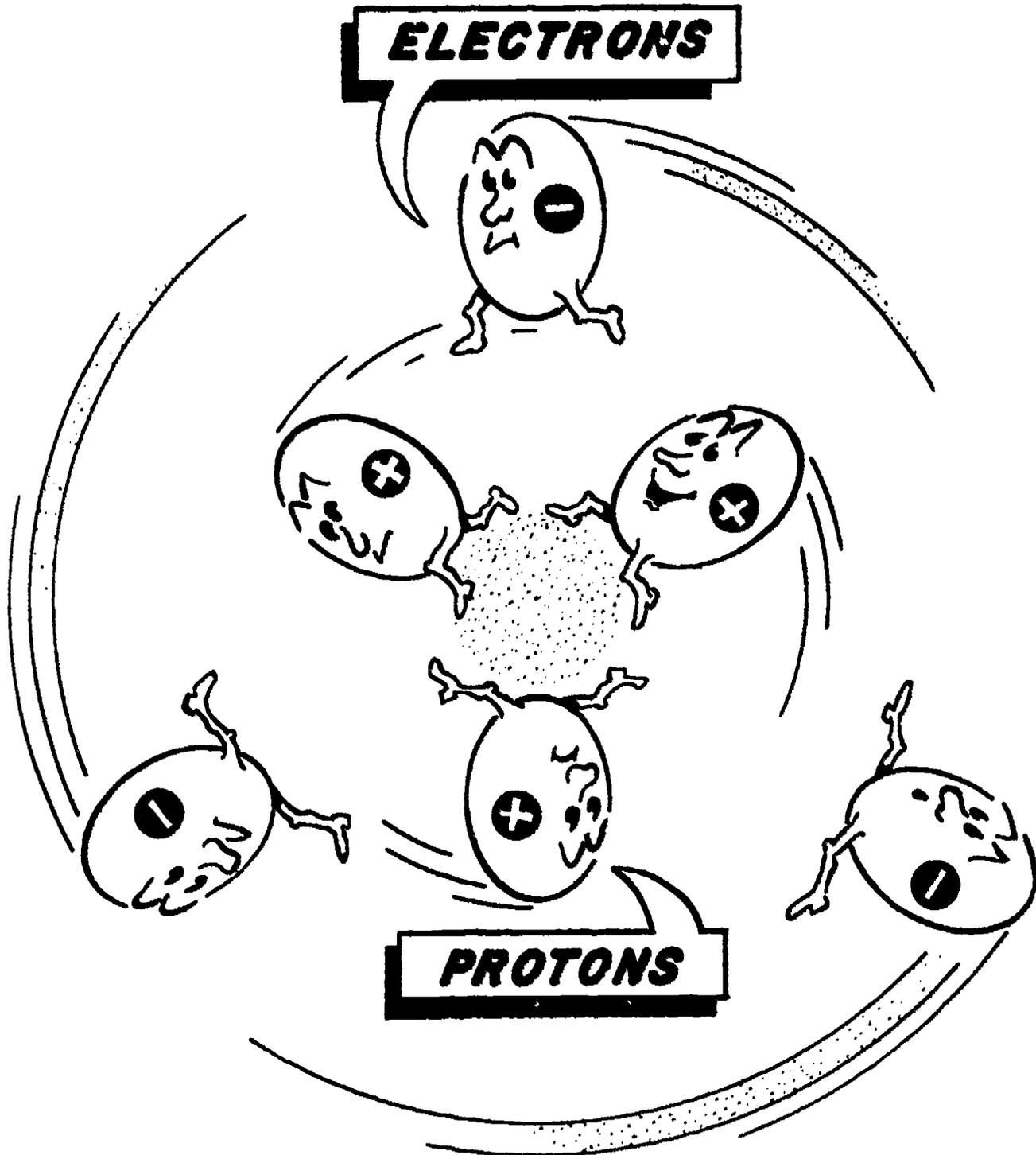
CHEMICAL



MECHANICAL

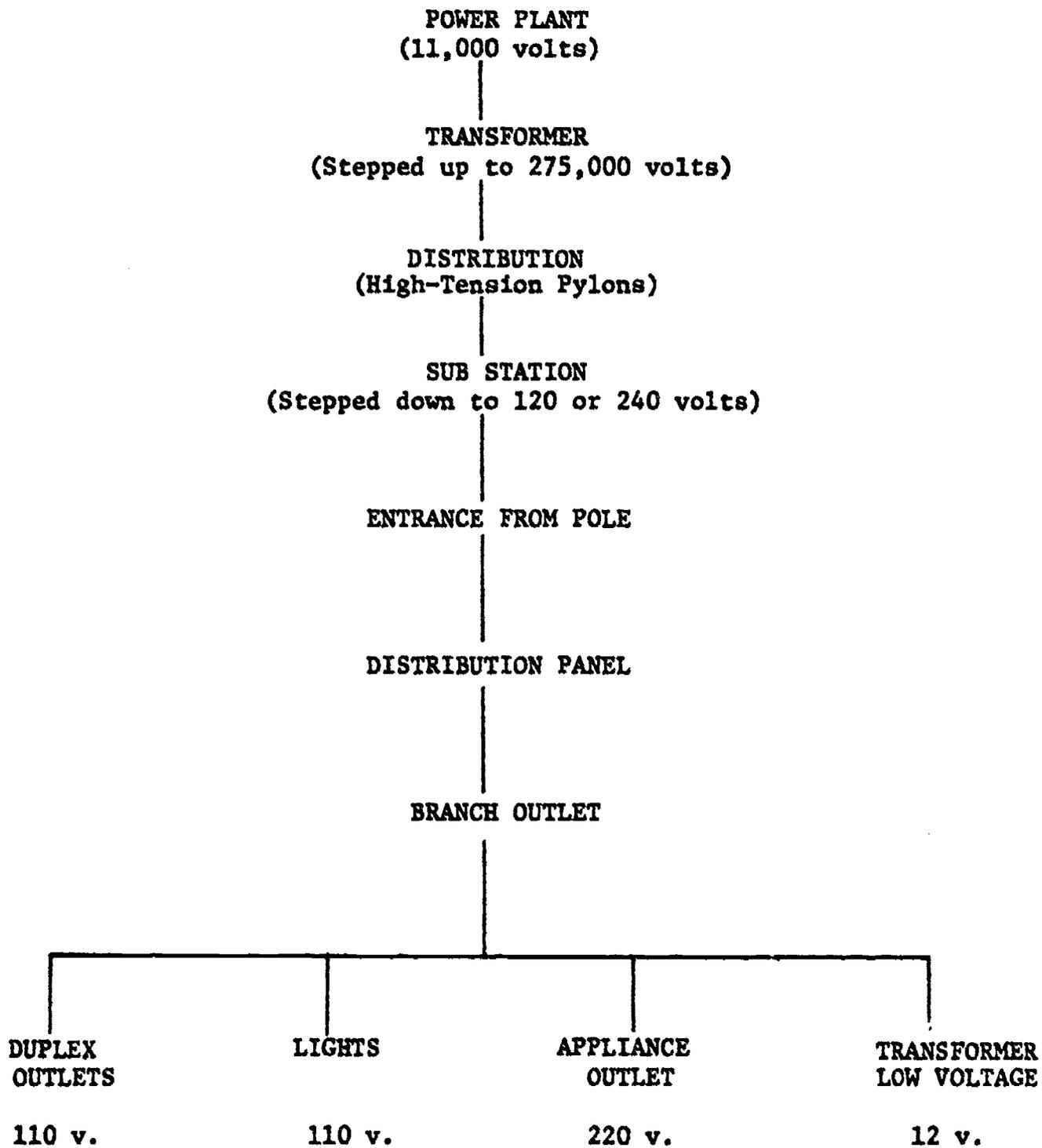


ELECTRON THEORY.....



ATOMS = ELECTRONS & PROTONS

POWER SYSTEMS



UNIT SIX

METALS

UNIT PURPOSE: To provide students experiences related to plumbing, structural metals, and sheet metals; also experiences in cutting and assembling metals.

PERFORMANCE OBJECTIVE: The student will be able to describe the activities performed by plumbers and iron workers.

I. The student will be able to describe the activities performed by plumbers and iron workers.

A. Suggested Content

1. Plumbing

a. Materials

- (1) Copper
- (2) Galvanized iron
- (3) Plastic

b. Fixtures

- (1) Water supply

- cold
 - hot

- (2) Bath
- (3) Laundry

- washer
 - tubs

- (4) Sanitary

c. Codes

- (1) Local
- (2) State
- (3) Health department regulations

2. Structural metals

a. Steel superstructures

- (1) Rigging and handling
- (2) Setting support steel
- (3) Connecting steel members
- (4) Plumbing and bracing

b. Aluminum framing

- (1) Floor system
- (2) Exterior walls
- (3) Interior partitions
- (4) Electrical installations
- (5) Plumbing installations

3. Sheet metal

a. Duct work for air conditioning

- (1) Rigid
- (2) Flexible
- (3) Hangers

b. Drip edge

- (1) Aluminum
- (2) Galvanized iron

c. Flashing

- (1) Material
 - Copper
 - Aluminum
- (2) Location
 - Valley
 - Chimney
 - Wall

B. Suggested Teaching-Learning Activities

1. Collect samples of plastic, cast iron, galvanized iron and copper. Describe the characteristics of each.
2. Discuss how water is supplied to homes and businesses.
3. Make a survey of jobs in the community that relate to metals.
4. Discuss the danger factor of working on high rise steel super-structures.
5. Trace the use of plastic pipe for plumbing purposes.
6. Discuss the working conditions of structural-iron workers.
7. Collect information about the three types of iron workers (structural, ornamental-iron, and reinforcing iron workers).
8. Visit construction site and observe the installation of drip edge and flashing.
9. Fasten pieces of plastic and cast iron pipe together.
10. Invite speakers to talk about the handling and transporting of steel that is used in large construction projects.

11. Identify different types of metals and their uses in residential construction.
12. Fabricate a section of duct work used in the air conditioning system.
13. Investigate the type of steel that weathers to a deep russet color which never requires painting.
14. List some of the advantages of using aluminum in a construction project.
15. Visit construction sites and observe the activities performed by the plumber and the iron worker.
16. Trace the prevalence of basic plumbing in residential structures. (See "Basic Plumbing in Most 1970 Homes," page 161.)

C. Suggested Evaluation

1. Have the student describe activities performed by plumbers and iron workers.

D. Suggested Resources

1. See pages 159 - 160 for a complete reference list for Unit Six.
2. Transparency Master
 - a. "Basic Plumbing in Most 1970 Homes" page 161.

SUPPORTIVE MATERIALS FOR UNIT SIX

157/158

REFERENCE LIST FOR UNIT

SIX

BOOK

1. How To Design and Install Plumbing by Matthias, Smith and Holland, American Technical Society

BOOKLETS

1. "Aluminum Building System," Alcoa Building Industries
2. "Aluminum in Architecture," Alcoa Building Industries
3. "Architectural Aluminum Report: Fabrication of Aluminum," Alcoa Building Industries
4. "Basic Facts About U.S. Steel," United States Steel Corporation
5. "Careers in Sheet Metal - The Day You Choose a New Hat," Alcoa Building Industries
6. "Designs of the Times," Kaiser Steel
7. "Journey of Discovery with Mark Steel," American Iron & Steel Inst.
8. "Mark Steel Fights Pollution," American Iron & Steel Institute
9. "The One-Leaf-Book Story of Steel," United States Steel Corporation
10. "The One-Leaf-Book Story of Environment and Industry," United States Steel Corporation
11. "Recommendations for Selection and Admission of Apprentices," National Training Fund
12. "Sheet Metal Workers and Apprenticeship Training," National Training Fund

FILM LOOPS AND FILMS

1. "Air-Conditioning and Refrigeration Mechanics," Sterling Films
2. "Jobs in the Sheet Metal Trades," Sterling Films
3. "Opportunities in Welding," Sterling Films
4. "Plumber and Pipefitters," Sterling Films

5. "Sheet Metal Workers," Sterling Films
6. "Weld--Oxygen and Arc Cutters," Sterling Films

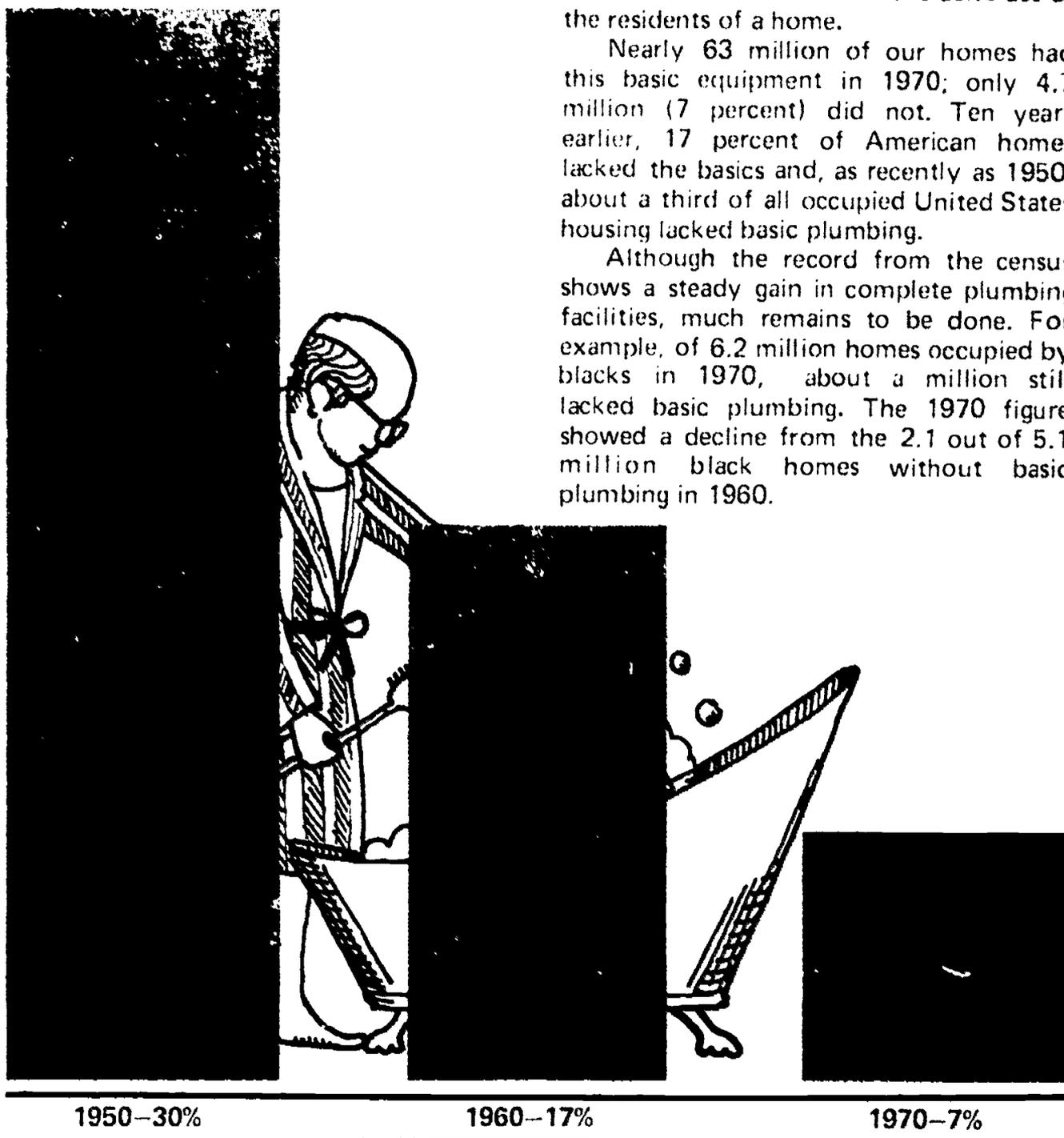
OCCUPATIONAL OUTLOOK REPORT SERIES

1. Air-Conditioning and Heating Mechanics. Bulletin 1550-3
2. Iron and Steel Industry Occupations. Bulletin 1550-110
3. Plumbers and Pipefitters, Asbestos and Insulating Workers.
Bulletin 1550-63
4. Sheetmetal Workers and Roofers. Bulletin 1550-78
5. Structural and Other Iron Workers, Elevator Constructors.
Bulletin 1550-85
6. Welders, Oxygen and Arc Cutters. Bulletin 1550-94

*Addresses of publishers and distributors can be found in the Appendix.

BASIC PLUMBING IN MOST 1970 HOMES

HOUSES WITHOUT INDOOR PLUMBING



Basic plumbing, important because of its convenience and contribution to good health, was in more homes than ever by 1970, the census showed. Basic plumbing is hot and cold piped water, a flush toilet, and a bathtub or shower for the exclusive use of the residents of a home.

Nearly 63 million of our homes had this basic equipment in 1970; only 4.7 million (7 percent) did not. Ten years earlier, 17 percent of American homes lacked the basics and, as recently as 1950, about a third of all occupied United States housing lacked basic plumbing.

Although the record from the census shows a steady gain in complete plumbing facilities, much remains to be done. For example, of 6.2 million homes occupied by blacks in 1970, about a million still lacked basic plumbing. The 1970 figure showed a decline from the 2.1 out of 5.1 million black homes without basic plumbing in 1960.

Source: Our Homes, U.S. Department of Commerce, Bureau of the Census.

UNIT SEVEN

FINISHING

UNIT PURPOSE: To provide the student with background information concerning the finishing phase of construction work and also experiences in identifying and applying finish to various surfaces.

PERFORMANCE OBJECTIVE: The student will apply a finish to various surfaces and explore the various aspects of finishing as they relate to careers.

I. The student will apply a finish to various surfaces and explore the various aspects of finishing as they relate to careers.

A. Suggested Content

1. Construction components requiring finishes

- a. Exteriors
- b. Interior walls
- c. Floors
- d. Ceilings
- e. Woodwork
- f. Hardware
- g. Doors
- h. Windows

2. Functions of various coatings

- a. Decoration
- b. Sanitation
- c. Economy
- d. Codes for safety
- e. Preservation
- f. Lighting effects
- g. Heating effects

3. Types of various coatings

a. Paints

- (1) Oil
- (2) Latex
- (3) Metallic
- (4) Alkyd

b. Wallpaper

- (1) Cloth
- (2) Paper
- (3) Vinyl

- c. Varnish
 - (1) Resin
 - (2) Synthetic
 - d. Enamels
 - e. Shellac
 - f. Lacquers
 - g. Stains
 - h. Filler
4. Properties and characteristics of various coatings
- a. Covering power
 - b. Application
 - c. Cost
 - d. Drying conditions
 - e. Weather resistance
 - f. Workability
 - g. Thinner to be used
5. Preparing the surface
- a. Smoothing and cleaning
 - (1) Tools and equipment
 - Hand tools
 - Power tools
 - Coated abrasives
 - Shapes and sizes
 - Grit
 - Solvents
 - (2) Methods
 - Woods
 - Metal
 - Composition

6. Patching

a. Materials

- (1) Putty
- (2) Cements
- (3) Paste wood fillers
- (4) Fibrated epoxies

b. Tools

- (1) Putty knives
- (2) Towels
- (3) Chissels

c. Equipment

d. Methods of application

- (1) Brush
- (2) Wipe-on

7. Applying the finish

a. Stains

- (1) Types
- (2) Application

b. Clear finishes

(1) Types

- Surface
- Penetrating

(2) Materials

- Sealers
- Lacquer
- Varnish
- Shellac

(3) Means of application

- Brush
- Spray

8. Paints

a. Types

- (1) Interior
- (2) Exterior

b. Surface finish

- (1) Gloss enamel
- (2) Semigloss
- (3) Flat

c. Base materials

- (1) White lead
- (2) Latex
- (3) Alkyd resins

d. Application

- (1) Brush
- (2) Roller
- (3) Spray

9. Solvents

a. Common materials

- (1) Lacquer thinner
- (2) Mineral spirits
- (3) Turpentine
- (4) Alcohol

b. Uses

- (1) Thinning
- (2) Cleaning

c. Safety

- (1) Ingestion
- (2) Inhalation
- (3) Eye and skin protection

B. Suggested Teaching-Learning Activities

1. Discuss the dignity and value of occupations related to finishing.
2. Make surveys of jobs in the community that relate to finishing.
3. Describe any changes related to finishing occupations which are a result of different seasons of a year.
4. Examine glamour jobs related to finishing.
5. Write a paper on "Why do we need finishers?"
6. Students will interview a finisher about his job and then report back to the class.

7. Obtain samples of various coatings.
8. Visit a paint store.
9. Apply finish to project or structure.
10. Make up sample coatings using various applications methods.
11. Visit a building site and observe a structure before any finish work is started.
12. Sketch various types of casings and moldings. (See "Shapes of Molding," page 175.)
13. Recognize 6, 8, 10, 12 foot lengths as they relate to casings and moldings.
14. Collect and examine samples of countertop material.
15. Invite speakers to talk about the various characteristics of finishes.
16. List safety precautions concerning the storage, handling, and use of various finishing materials.
17. Visit a furniture store and examine the finishes of various pieces of furniture.
18. Select the proper solvent and clean brushes that have been used in applying a specific finish.
19. Calculate the amount of paint needed to cover a specified area.
20. Patch and refinish a previously finished piece of wood.
21. Discuss the advantages and disadvantages of various finishes.
22. Experiment with various fasteners and determine which type best accommodates application of a finish. (See "Assembly and Filling Techniques," page 176).

D. Suggested Resources

1. See pages 173 - 174 for complete reference list for Unit Seven.
2. Transparency Masters
 - a. "Shapes of Molding," p. 175
 - b. "Assembly and Filling Techniques," p. 176

SUPPORTIVE MATERIALS FOR UNIT SEVEN

171/172

REFERENCE LIST FOR UNIT SEVEN

ASSOCIATIONS

1. Brotherhood of Painters and Allied Trades
2. Federation of Societies for Paint Technology
3. Gypsum Drywall Contractors International
4. National Paint, Varnish, and Lacquer Association
5. Paint Industry Education Bureau
6. Painting and Decorating Contractors of America
7. Plaster Information Center

BOOKS

1. Carpentry in Commercial Construction by Stanley Badzinski, Prentice-Hall Inc.
2. Carpentry in Residential Construction by Stanley Badzinski, Prentice-Hall Inc.
3. Fundamentals of Carpentry by Walter Durbahn and Elmer Sundberg, American Technical Society
4. Modern Carpentry by Willis Wagner, Goodheart-Willcox
5. Woodworking Technology by Hammond, Donnelly, Harrod and Rayner, McKnight and McKnight Publishing Company

BOOKLETS

1. "Finishing Wood," E.I. DuPont Company
2. "National Apprenticeship and Training Standards for Painters and Decorating and Drywall Taping," U.S. Department of Labor
3. "Opportunity in the Painting, Decorating and Coating Trade," National Joint Painting and Decorating Apprenticeship Training Committee
4. "This is Our Union," International Brotherhood of Painters and Allied Trades, AFL-CIO

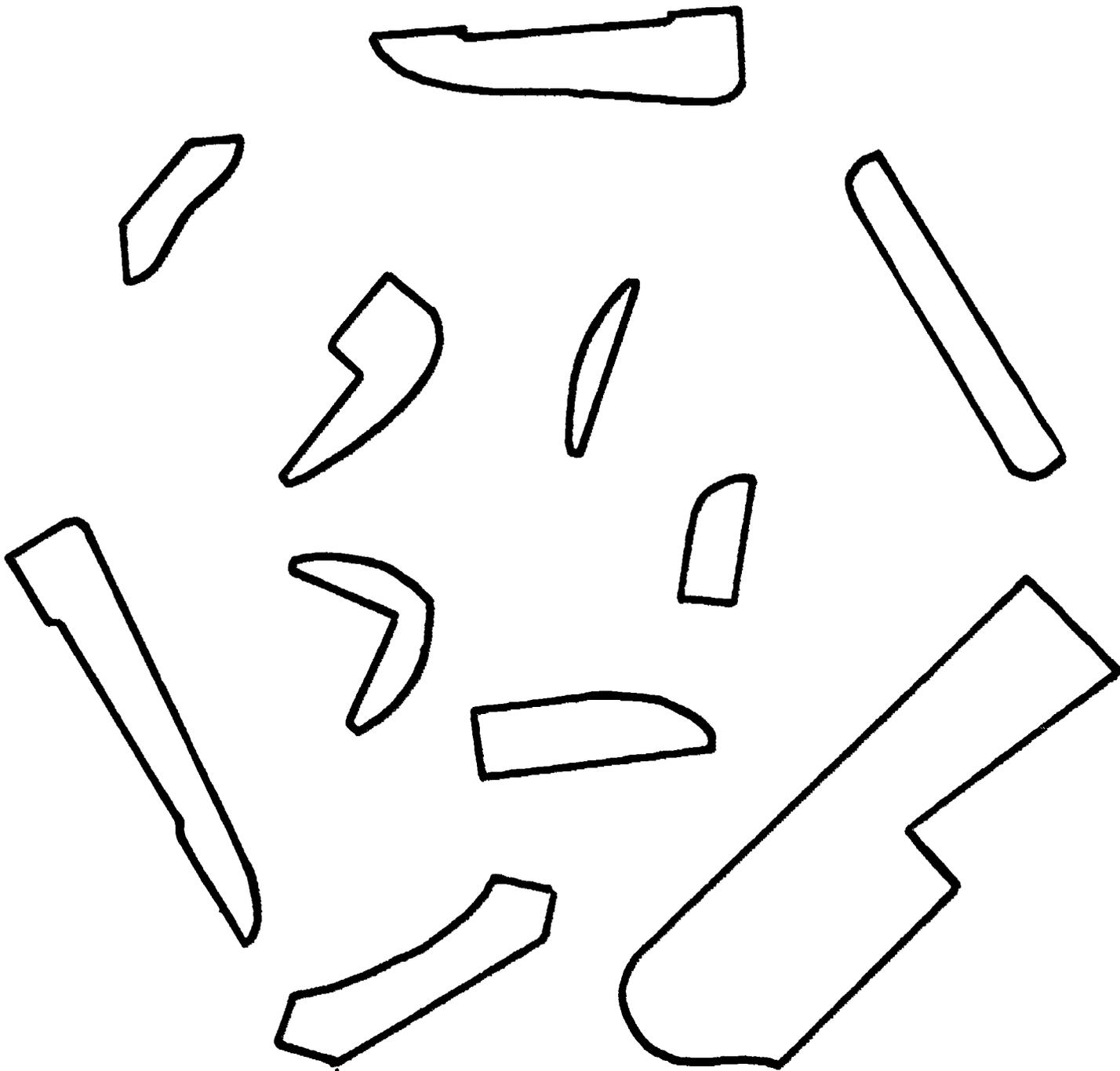
FILMSTRIPS

1. "Bleaching, Staining, Filling," Greystone Films

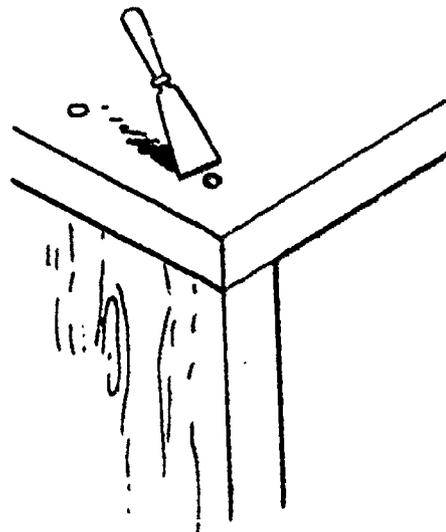
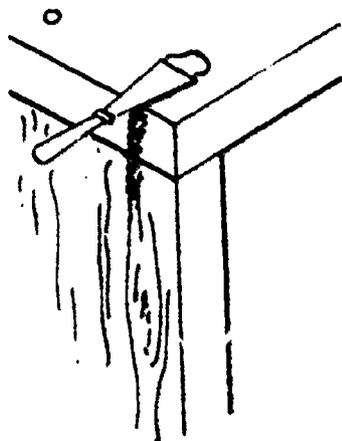
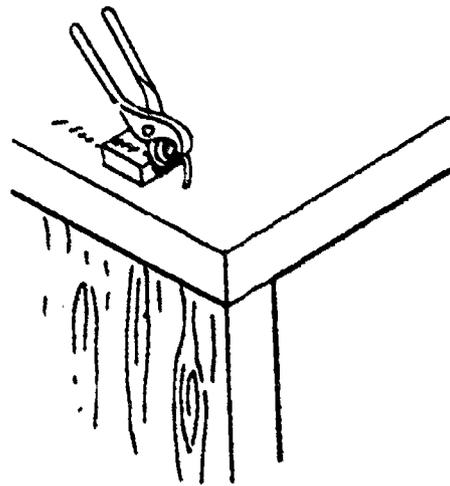
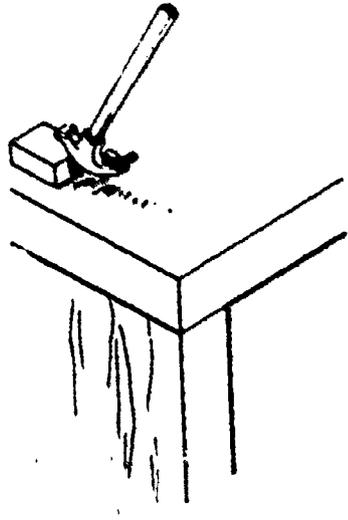
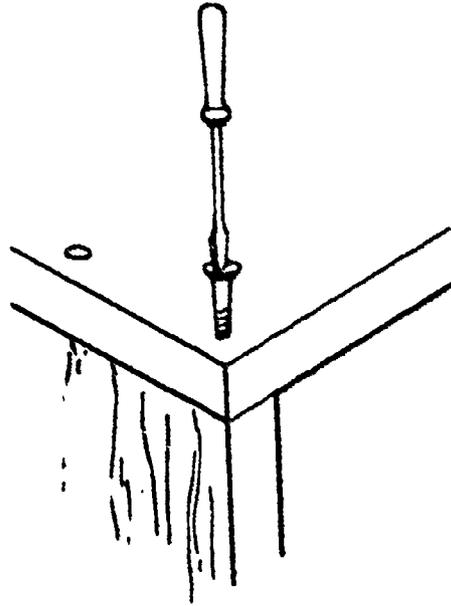
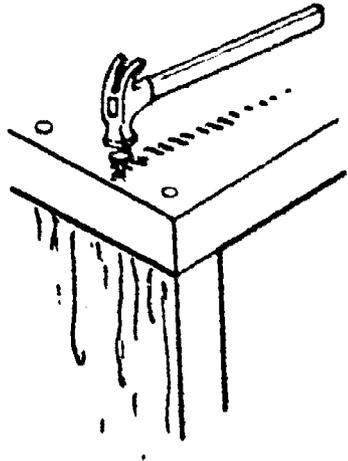
2. "Hand Sanding," Greystone Films
3. "Painters and Paperhangers," Sterling Educational Films
4. "Penetrating Finish," Greystone Films
5. "Repairing Wood Surfaces," Greystone Films
6. "Sanding by Machine," Greystone Films
7. "Shellac Finish," Greystone Films
8. "Special Finishes and Paint," Greystone Films
9. "Varnish Finish," Greystone Films

Addresses of publishers and distributors can be found in the appendix.

SHAPES OF MOLDING



ASSEMBLY AND FILLING TECHNIQUES



APPENDIX

171/178

ADDRESSES OF PUBLISHERS AND DISTRIBUTORS

Addresses of Publishers and Distributors

AIMS Instructional Media
P.O. Box 1010
Hollywood, California 90028

Alcoa Building Industries
535 Two Allegheny Center
Pittsburgh, Pennsylvania 15212

American Concrete Institute
P.O. Box 4754, Redford Station
Detroit, Michigan 48219

American Council on Industrial
Arts
Teacher Education
c/o Ervin A. Dennis
Department of Graphic Communication
University of Wisconsin - Stout
Menomonie, Wisconsin 54751

American Federation of Labor and
(AFL-CIO)
Congress of Industrial Organizations
815 16th Street, N.W.
Washington, D.C. 20006

American Industrial Arts Association
1201 16th Street, N.W.
Washington, D.C. 20036

American Iron and Steel Institute
150 E. 42nd Street
New York, New York 10017

American Plywood Association
1119 A Street
Tacoma, Washington 98401

American Technical Society
848 E. 58th Street
Chicago, Illinois 60637

American Vocational Association
1510 H Street, N.W.
Washington, D.C. 20005

Appleton-Century-Croft Film
Library, Educational Div.
440 Park Avenue South
New York, New York 10016

Arco Publishing
219 Park Avenue South
New York, New York 10003

Asphalt and Vinyl Asbestos
Tile Institute
101 Park Avenue
New York, New York 10017

Associated General Contractors
1957 E Street, N.W.
Washington, D.C. 20006

American Foundation on Automa-
tion and Employment
Automation House
49 E. 68th Street
New York, New York 10021

Automation in Housing
330 W. Adams Street
Chicago, Illinois 60606
Exxon U.S.A.

Bailey Films Association
11559 Santa Monica Blvd.
Los Angeles, California 10025

Baker & Taylor
Box 230
Mokenca, Illinois 60954

Ballantine Books, Inc.
101 Fifth Avenue
New York, New York 10003

Arthur Barr Productions, Inc.
P.O. Box 7-C
Pasadena, California 91104

Bonanza Publishing
George Braziller, Inc.
215 Park Avenue South
New York, New York 10016

Bocomar Films
P.O. Box 2552
Glendale, California 91201

Bramhall House Publishers
Dist. by Clarkson N. Potter, Inc.
23 E. 67th Street
New York, New York 10021

Brick Institute of America
1750 Old Meadow Road
McLean, Virginia 22101

Bricklayers, Masons, and Plasters'
International Union of America
815 16th Street, N.W.
Washington, D.C. 20006

Brotherhood of Painter, Decorators
and Paper Hangers of America
217-19 North Sixth Street
Lafayette, Indiana 47901

Brotherhood of Painters and Allied
Trades
United Union Building
1750 New York Avenue
Washington, D.C. 20006

Bursk & Poar Publishing
66 Martin Street
Cambridge, Massachusetts

Cahners Publishing Co.
89 Franklin Street
Boston, Massachusetts 02110

Career's Inc.
P.O. Box 135
Largo, Florida 33540

Charles Bennett Co.
809 W. Detweiller Drive
Peoria, Illinois

City University of New York
535 E. 80th Street
New York, New York 10021

Concrete Construction Publi-
cations, Inc.
Box 555
Elmhurst, Illinois

Contracting Plasters' and
Lathers' International Asso.
20 E Street, N.W.
Washington, D.C. 20001

Coward-McCann Company and
Geoghegan, Inc.
200 Madison
New York, New York 10016

Thomas Crowell Publishing Co.
666 5th Avenue
New York, New York 10019

Delmar Publishers
P.O. Box 5087
Albany, New York 12205

Doubleday Multimedia
P.O. Box 11607
Santa Ana, California 92705

E.I. DuPont Company
Advertising Department
Refinish Section N-2504
Wilmington, Delaware 19898

Encyclopedia Britannica
425 N. Michigan Avenue
Chicago, Illinois 60611

Eye Gate House Inc.
146-01 Archer Avenue
Jamaica, New York 11435

Federation of Societies for
Paint Technology
121 South Borad Street
Philadelphia, Pennsylvania
19107

Ford Foundation
Office of Reports
320 E. 43rd Street
New York, New York 10017

Franklin Glue Company
2020 Bruck Street
Columbus, Ohio 43207

General Electric Company
Industrialized Modular Housing
3198 Chestnut Street
Philadelphia, Pennsylvania 19101

General Motors Film Library
Public Relations Staff
Detroit, Michigan 48202

General Services Administration
Washington, D.C. 20405

Goodheart-Willcox Co., Inc.
123 W. Taft Drive
South Holland, Illinois 60473

Greystone Films
41 Washington Avenue
Pleasantville, New York 10570

Guidance Associates
P.O. Box 5
Pleasantville, New York 10570

Gulf Publishing Company
Book Division
Box 2608
Houston, Texas 77001

Gypsum Association
201 North Wells Street
Chicago, Illinois 60606

Gypsum Drywall Contractors
International
2010 Massachusetts Avenue, N.W.
Suite 600
Washington, D.C. 20036

Harcourt, Brace & World
757 3rd Avenue
New York, New York 10017

Harper & Row
10 E. 53rd Street
New York, New York 10022

ITT Educational Publications
4300 W. 62nd Street
Indianapolis, Indiana 46206

Ideal Cement Company
Ideal Basic Industires
821 17th Street
Denver, Colorado 80262

Industry Week
Penton Publishing Company
Penton Plaza
Cleveland, Ohio 44114

International Association of
Heat and Frost Insulators
and Asbestos Workers
1300 Connecticut Avenue, N.W.
Washington, D.C. 20036

International Brotherhood of
Boilermakers, Iron Ship-
builders, Blacksmiths,
Forgers and Helpers
Eight at State Avenue
Kansas City, Kansas 66101

International Brotherhood of
Electrical Workers
1200 15th Street, N.W.
Washington, D.C. 20005

International Brotherhood of
Painters and Allied Trades
AFL-CIO
United Unions Building
1750 New York Avenue, N.W.
Washington, D.C. 20006

International Masonry Institute
823 15th Street, N.W.
Washington, D.C. 20005

International Union of Operating
Engineers
1125 17th Street, N.W.
Washington, D.C. 20036

John Wiley & Sons, Inc.
605 Third Avenue
New York, New York 10016

Kaiser Cement
300 Lakeside Drive
Oakland, California 94604

Kaiser Gypsum
(See above address)

Kaiser Steel
300 Lakeside Drive
Oakland, California 94604

Laborers' International Union
of North America
905 16th Street, N.W.
Washington, D.C. 20006

M.I.T. Press
28 Carlton Street
Cambridge, Massachusetts 02142

MacMillan Publishing
866 Third Avenue
New York, New York 10022

Mafex Associates, Inc.
Box 519
Johnstown, Pennsylvania 15907

McGrath Publishing Company
Manpower Press
821 15th Street, N.W.
Washington, D.C. 20005

McGraw-Hill Co.
Community College Division
330 W. 42nd Street
New York, New York 10036

McGraw-Hill Films
1221 Avenue of Americas
New York, New York 10020

McKnight & McKnight Publishing Co.
Bloomington, Illinois 61701

NBC Educational Enterprises
30 Rockefeller Plaza
Room 1040
New York, New York 10020

National Association of Home-
builders
1625 L Street, N.W.
Washington, D.C. 20036

National Association of Plumbing,
Heating, Cooling Contractors
1016 20th Street, N.W.
Washington, D.C. 20036

National Bureau for Lathing and
Plastering
938 K Street, N.W.
Washington, D.C. 20001

National Concrete Masonry Asso.
1800 N. Kent Street
Arlington, Virginia 22209

National Forests Products Asso.
1619 Massachusetts Avenue
Washington, D.C. 20036

National Joint Painting and
Decorating Apprenticeship
Training Committee
1925 K Street, N.W.
Suite 207
Washington, D.C.

National Lumber Manufacturing Asso.
1619 Massachusetts Avenue, N.W.
Washington, D.C. 20036

National Paint, Varnish, and
Lacquer Association
1500 Rhode Island Avenue, N.W.
Washington, D.C. 20005

National Roofing Contractors Asso.
1515 N. Harlem Avenue
Oak Park, Illinois 60302

National Terrazzo and Mosaic Asso.
716 Church Street
Alexandria, Virginia 22314

National Training Fund
1900 L Street, N.W.
Suite 405
Washington, D.C. 20036

Occupational Outlook Series
Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Paint Industry Education Bureau
1500 Rhode Island Avenue, N.W.
Washington, D.C. 20005

Painting and Decorating Contractors
of America
2625 W. Peterson Avenue
Chicago, Illinois 60659

Penguin Books, Inc.
7110 Ambassador Road
Baltimore, Maryland 21207

Permanent Cement Company
Kaiser Center
300 Lakeside Drive
Oakland, California 94604

Perspective Films
Coronet Instructional Materials
65 E. South Water Street
Chicago, Illinois 60601

Plaster Information Center
1060 Minnesota Avenue
San Jose, California 95125

Portland Cement Association
33 W. Grand Avenue
Chicago, Illinois 60610

Prentice-Hall, Inc.
Englewood Cliffs, New Jersey

Random House, Inc.
201 E. 50th Street
New York, New York 10022

School Shop
416 Longshore Drive
Ann Arbor, Michigan 48107

Science Research Association
259 E. Erie Street
Chicago, Illinois 60611

Sears, Roebuck & Company
Sears Tower
Chicago, Illinois 60684

Sheet Metal and Air Conditioning
Contractors' National Asso., Inc.
1611 N. Kent Street
Arlington, Virginia 22209

Sheet Metal Workers' International
Association
1000 Connecticut Avenue, N.W.
Washington, D.C. 20036

Sterling Educational Films
241 E. 34th Street
New York, New York 10016

Structural Clay Products Institute
1750 Old Meadow Road
McLean, Virginia 22101

Structures Publishing
P.O. Box 423
Farmington, Michigan 48024

Swani Publishing Company
Box 248
Roscoe, Illinois 61703

Swift Industries Inc.
241 Curry Hollow Road
Pittsburgh, Pennsylvania 15236

Syracuse University Press
Box 8, University Station
Syracuse, New York 13210

Tile Contractors' Association
of America
112 North Alfred Street
Alexandria, Virginia 22314

Underwriters' Laboratories
207 E. Ohio Street
Chicago, Illinois 60611

United Brotherhood of Carpenters
and Joiners of America
101 Constitution Avenue, N.W.
Washington, D.C. 20001

U.S. Army Corps of Engineers
Public Affairs Office
Office of the Chief of Engineers
Washington, D.C. 20314

U.S. Department of Housing and
Urban Development
Washington, D.C. 20410

U.S. Department of Labor
U.S. Government Printing Office
Manpower Administration
Washington, D.C. 20402

U.S. News and World Report
2300 N Street
Washington, D.C. 20037

U.S. Steel Corporation
71 Broadway Street
New York, New York 10006

University of Illinois Press
Urbana, Illinois 61801

Valiant Instructional Materials
Corporation
415 N. Camden Drive
Beverly Hills, California 90210

Van Nostrand Reinhold Company
450 W. 33rd Street
New York, New York 10016

Vermiculite Institute
(Defunct)

Vermont Structural Slate Co.
3 Prospect Street
Fair Haven, Vermont 05743

W.R. Bonsal Company
P.O. Box 38
Lilesville, North Carolina 28091

Walker & Company
750 5th Avenue
New York, New York 10019

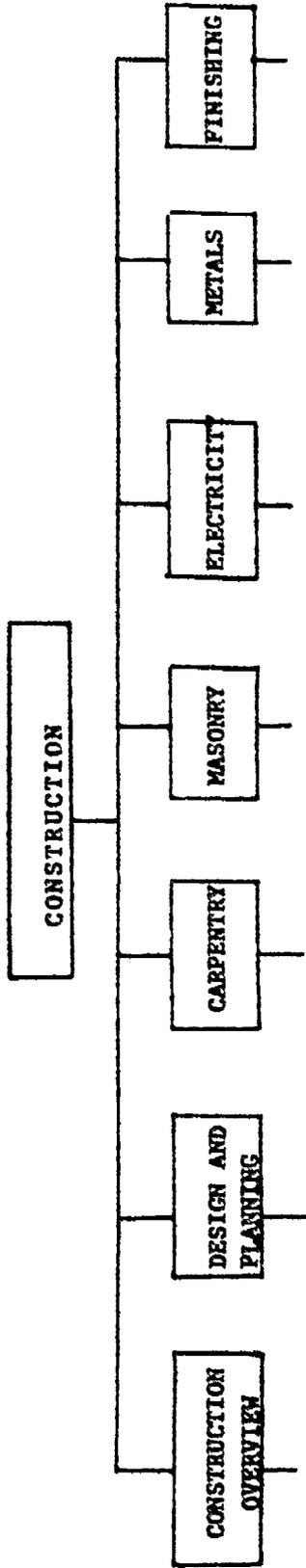
Western Wood Products Association
Yeon Building
Portland, Oregon 97204

w. kes Corporation
Manufactured Housing Division
Divisional Offices
P.O. Box 198
805 South Hull Road
Mason, Michigan 48854

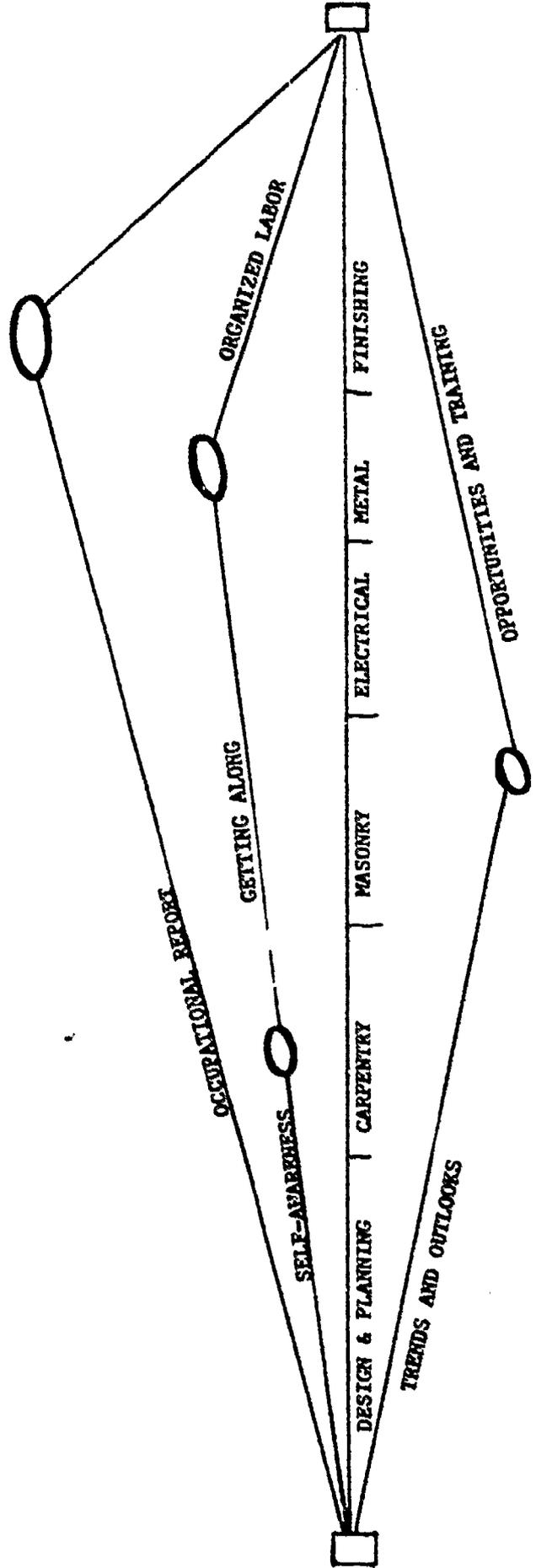
PLANNING MATERIALS

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IMPLEMENTING CAREER EDUCATION



MULTIPLE ACTIVITIES



EVALUATION MATERIALS

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STRUCTURE EVALUATION

OBJECTIVE: The outline may be used as a guide in planning and constructing a structure.

CONTENT:

A. Design and Planning Phase

1. Planning

- a. Sketches
- b. Drawings

2. Design

- a. Functional
- b. Efficient use of resources
- c. Use of materials
- d. Appearance
- e. Proportion and balance
- f. Careers

B. Construction Phase

1. Carpentry

- a. Safety
- b. Layout
- c. Cutting
- d. Correction of mistakes
- e. Accuracy of work
- f. Assembly skills
- g. Initiative
- h. Career awareness
- i. Proper dimensions

2. Masonry

- a. Safety
- b. Use of tools
- c. Skills (minimal)
- d. Initiative
- e. Career awareness

3. Electricity

- a. Safety
- b. Use of tools
- c. Skills (minimal)
- d. Initiative
- e. Career awareness

4. Metals

- a. Safety
- b. Use of tools
- c. Skills (minimal)
- d. Initiative
- e. Career awareness

5. Finishing

- a. Safety
- b. Use of tools
- c. Skills (minimal)
- d. Initiative
- e. Career awareness

CONSTRUCTION DEVELOPMENT SCHEDULE

STRUCTURE: _____ DATE BEGUN: _____ DATE COMPLETED: _____ DEVELOPER: _____

ESTIMATED TIME FOR COMPLETION: _____ CLASS: _____

Part No.	Name	Size	Quantity	Unit Cost	Total Cost
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Cost of Materials _____
 No. of Hrs. Consumed _____
 Labor Cost/Hour _____
 Total Labor Cost _____
 Total Project Cost _____

APPROVED: _____ DATE: _____
 EVALUATION: _____



RATING SCALE

No Evidence
 Poor
 Below Average
 Average
 Good
 Excellent
 5 4 3 2 1 0

A. Design and Planning Phase

1. Planning

- a. Are working drawings and sketches complete and orderly? 5 4 3 2 1 0
- b. Does plan of procedure follow a logical order? 5 4 3 2 1 0

2. Design

- a. Would the structure (if built full scale) serve an intended purpose? 5 4 3 2 1 0
- b. Does it represent efficient use human and natural resources? 5 4 3 2 1 0
- c. Were characteristics of materials observed? 5 4 3 2 1 0
- d. Does it look right; is it interesting? 5 4 3 2 1 0
- e. Does it exhibit good proportion and balance? 5 4 3 2 1 0
- f. Has the student exhibited an awareness of careers of Design and Planning in construction? 5 4 3 2 1 0

B. Construction Phase

1. Carpentry

- a. Were safety precautions observed? 5 4 3 2 1 0
- b. Were layout tools used properly? 5 4 3 2 1 0
- c. Were cutting tools used properly? 5 4 3 2 1 0
- d. How well were any mistakes rectified? 5 4 3 2 1 0
- e. Did students work carefully and accurately? 5 4 3 2 1 0
- f. Were minimal skills in assembly exhibited? 5 4 3 2 1 0
- g. Did students show initiative and resourcefulness? . . . 5 4 3 2 1 0

- h. Has the student exhibited an awareness of careers relating to carpentry? 5 4 3 2 1 0
- i. Do dimensions of the project correspond with drawings? 5 4 3 2 1 0

2. Masonry

- a. Were safety precautions observed? 5 4 3 2 1 0
- b. Were tools used properly? 5 4 3 2 1 0
- c. Were minimal skills exhibited? 5 4 3 2 1 0
- d. Did the student show initiative resourcefulness? . . 5 4 3 2 1 0
- e. Has the student exhibited an awareness of careers relating to Masonry? 5 4 3 2 1 0

3. Electricity

- a. Were safety precautions observed? 5 4 3 2 1 0
- b. Were tools used properly? 5 4 3 2 1 0
- c. Were minimal skills exhibited? 5 4 3 2 1 0
- d. Did the student show initiative resourcefulness? . . . 5 4 3 2 1 0
- e. Has the student exhibited an awareness of careers relating to Electricity? 5 4 3 2 1 0

4. Metals

- a. Were safety precautions observed? 5 4 3 2 1 0
- b. Were tools used properly? 5 4 3 2 1 0
- c. Were minimal skills exhibited? 5 4 3 2 1 0
- d. Did the student show initiative resourcefulness? . . 5 4 3 2 1 0
- e. Has the student exhibited an awareness of careers relating to Metals? 5 4 3 2 1 0

5. Finishing

- a. Were safety precautions observed? 5 4 3 2 1 0
- b. Were tools used properly? 5 4 3 2 1 0

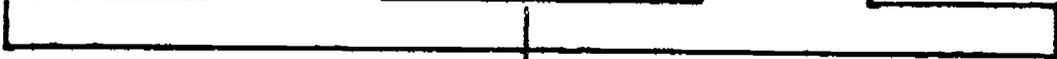
PROJECT



SMALL GROUP PROJECT

INDIVIDUAL PROJECT

CLASS PROJECT



STATEMENT OF PROBLEM
SKETCHES AND DRAWINGS
CONSTRUCTION
CAREER IMPLICATIONS
EVALUATION

Building Component

Vacation Retreat
House

Factory

Dock

Bridge

Fort

Dam

Deck

Tunnel

DICTIONARY OF OCCUPATIONAL TITLES

JOB DESCRIPTIONS

201/202

Design and Planning - Engineers, Planners, Designers, and Technicians of all kinds function in the areas of materials and design to provide a flow of information from the theoretical to the practical. The following is a listing of job descriptions of some of the more obvious areas in the design and planning phase of construction.

1. **Architect** - (D.O.T. 001.081) - Designs and oversees the construction of buildings and other structures. Manages services necessary for construction. Consults with client to determine size and space requirements, calculates information regarding cost, design, materials, equipment, and estimations of time. Prepare sketches for client. Works with contractor at the job site. Writes specifications, and prepares scale and full-size drawings. May specialize in a particular type of architecture such as churches, office buildings, etc.
2. **Architectural Draftsman** - (D.O.T. 001.281) - Plans architectural and structural features of structures. Uses drafting instruments to sketch designs and other detail work. Makes computation concerning strength of material, beams, trusses, and other building components. Estimates quantities of material needed for project and computes cost.
3. **Civil Engineer** - (D.O.T. 005.081) - Performs a variety of engineering work in designs, planning and overseeing construction and maintenance of structures and projects such as roads, railroads, airports, bridges, harbors, channels, dams, irrigation projects, pipelines, water and sewage systems, and power plants.
4. **Construction Engineer** - (D.O.T. 005.081) - Plans and designs details of structures such as buildings, bridges, waterworks, drainage systems, and utility tunnels and oversees their erection. Designs details of structure and writes materials and construction specifications. Estimates materials and labor costs. Oversees digging of excavations of building foundations and raising of super-structures. Oversees erection of machinery, apparatus, towers, and hoists for handling of steel, concrete, and stone. Conducts tests of materials and machinery. May be designated according to project engineered as Building Construction Engineer, Chimney Engineer, Civil Engineer, or Field Civil Engineer, Pipe-Line Construction.
5. **Draftsman, Civil** - (D.O.T. 005.281) - Drafts detailed construction drawings, topographical profiles, and related maps and specification sheets used in planning and construction of highways, rivers, and harbor improvements, flood control, drainage, and other civil engineering projects. Plots maps and charts showing profiles and cross sections, drafts detailed drawings of structures and installations. May accompany survey crew in field to locate grading markers or to collect data required for revision of construction drawings. May be designated as Draftsman, Commercial (D.O.T. 017.281); Draftsman, Design; Draftsman, Electrical (D.O.T. 003.281); Draftsman, Heating and Ventilating (D.O.T. 017.281); Draftsman, Landscape, (D.O.T. 019.281); and Draftsman, Map (D.O.T. 017.281).

6. Electrical Engineer - (D.O.T. 003.081) - Performs a variety of engineering work in designing, planning, and overseeing manufacture, construction, installation, operation, and maintenance of electrical or electronic components, equipment, systems, facilities, and machinery used in generation, transmission, distribution, and utilization of electrical energy for domestic, commercial, and industrial consumption. May be designated as Electrical Engineer, Power (D.O.T. 003.087); Distribution Engineer, Inductive-Coordination Engineer, Plant Engineer, Electrical; Protection Engineer; System-Planning Engineer; Transmission Engineer; Electrical-Equipment Engineer; and Signal Engineer.

7. Estimator - A technician working for a contractor in estimating for bids or doing materials take-off from architectural plans.

8. Illuminating Engineer - (D.O.T. 003.081) - Designs lighting equipment and systems. Plans installation of lighting systems for buildings, streets, tunnels, fields and outdoor display. Oversees spacing, mounting, and size of equipment to adequately light objects to be seen and supervise installation.

9. Safety Engineer - (D.O.T. 012.081) - Applies knowledge of industrial processes, mechanics, chemistry, psychology and industrial health and safety laws to prevent or correct injurious environmental conditions and minimize effects of human traits which create hazards to life and property or reduce worker morale and efficiency.

10. Surveyor - (D.O.T. 018.188) - Surveys earth's surface and oversees engineering survey party engaged in determining exact location and measurement of points, elevations, lines, areas, and contours of earth's surface to secure data used for construction, mapmaking, land valuation, mining, or other purposes.

A. CARPENTRY - From the time ground is broken until painters and decorators move out so the tenant can move in, you will find carpenters and associated workers on the job site. Carpenters set shoring in tunnels, trenches, and open excavations. They build and install wooden forms to provide working access above the ground level. They erect structures using wooden materials that form foundations, floors, walls, partitions, and roofs. They install roofing and siding materials. They install windows and door units, interior wall coverings, trim and molding. The finish carpenter fabricates and installs cabinets, counters, fixtures, and other finish work. After the structure is completed, carpenters maintain, repair and remodel. When the structure is no longer useful and is demolished, you will find carpenters in the wrecking crew.

It is generally agreed by all training authorities that the carpenter trade is best learned by serving a four-year apprenticeship under the guidance of Journeymen Carpenters on the job site and backed up by related courses in the classroom. Many individuals with outstanding aptitude for this work can shorten the time of apprenticeship by demonstrating their abilities on the job and passing certified tests given by Journeymen in an organization. Others may work in such specialized areas that they can open their own company or business and not have to depend upon formalized and certified training for Journeyman recognition.

It is quite obvious that many of the woodcraft job titles and work tasks overlap many times. The area of the country and tradition sometimes play an important part in the complete definition of what a particular worker will perform. The following is a general presentation of what you may expect of some of the more common job classifications.

1. Carpenter Foreman - (D.O.T. 860.131) - Supervises and manages activities of workers engaged in construction, installation, and repair of wooden structures and fixtures. Has knowledge of blueprints, layouts, selects materials, determines sequence of activities, assigns workers, inspects work performed by subcontractors. May make cost and time estimates. Usually employed by a contractor or establishment and is in direct contact with workers on construction site. Requires great deal of experience in the particular type of construction he is involved in. Generally has spent quite some time as a worker actually performing tasks required and has the ability to supervise people. Depending on type of construction, may be in charge of large number of people and many dollars worth of material and equipment. May be working or non-working, depending upon company policy.

2. Cofferdam - Construction Foreman - (D.O.T. 860.131) - Has direct contact with carpenters actually involved in construction of cofferdam in area of dam site. Works from blueprints to determine materials, equipment, job assignments, and any other coordination necessary to

assure proper sequencing of operations. Usually has charge of pile-driving and shoring. Must have considerable experience and knowledge of blueprints, materials, methods and be able to handle people.

3. Form - Building Foreman - (D.O.T. 860.131) - Supervises carpenters and expediting of materials required for construction of wooden forms to mold concrete. May work in shop or directly on job site. Requires vast experience in material characteristics and methods of assembly. Must be able to read blueprints and have enough imagination to be able to instruct carpenters how to construct forms. May lay out with rule, tape, plumb, level and transit.

4. Timbering Foreman - (D.O.T. 860.131) - Supervises and coordinates activities of rough carpenters engaged in construction or installation of structures or shoring with heavy planks or posts (timbers). May be in charge of workers driving piling or doing shoring activities. Requires knowledge of pile driving equipment and mechanical properties of material. Usually has considerable experience on heavy construction involving earth moving and concrete.

5. Carpenter - Labor Foreman - (D.O.T. 860.131) - Supervises and coordinates activities of workers engaged in supplying materials to workers who construct, erect, install and repair wooden structures and fixtures. Directs work crew to strip forms and dismantle wooden structures. Supervises workers engaged in pouring concrete. Usually employed by contractor or establishment large enough to warrant a foreman for carpenters and another for laborers. Usually reads blueprints to determine proper sequencing of worker and material operations.

6. Carpenter - Construction - (D.O.T. 860.131) - Constructs, erects installs and repairs wooden structures and fixtures. Highly knowledgeable and skilled in use of hand and power tools. May perform work in shop or on construction site. Studies blueprints, sketches, or building plans and follows verbal instructions to carry out the necessary operations. Usually specializes in some particular type of construction. May be self-employed but usually employed by contractor or establishment. May work as member of crew or individually. Selects lumber and other materials, shapes materials to prescribed measurements. Assembles cut and shaped materials, verifies trueness of structure, erects framework for structures. Constructs concrete forms, erects scaffolding, and may weld metal parts to steel members. May be designated according to construction specialization.

7. Carpenter, Maintenance - (D.O.T. 860.281) - Constructs and repairs structural woodwork and equipment in an establishment, or as self-employed, working from blueprints, drawings or verbal instructions. Builds, repairs, and installs counters, cabinets, benches, partitions, floors, doors, building framework, and trim. Replaces ceiling tile, floor tile, and sheet plastic wall coverings, window shades, or Venetian blinds. Uses hand tools and power tools required. Work is usually neat and well done. Depending on the type of work done, may become involved in repair jobs which require skills of other trades such as glazing or painting.

8. Carpenter, Hotel - (D.O.T. 860.131) - Repairs fixtures, doors, windows, elevators, ceilings, doors, and remodels as required. Work must be high quality and neat appearing. May become involved in some heavy structural work but usually repairs broken or worn pieces.

9. Carpenter, Mill - (D.O.T. 860.131) - Works from blueprints, sketches, or verbal instructions to select materials, construct, and install cabinets, counters, decorative store fronts, and furniture. Usually works in a shop and sets up and operates a variety of woodworking machines to surface, cut, and shape lumber, and to fabricate parts for wood products, such as doors, door and window frames. Many are self-employed and others work for contractors or establishments. May make cost and time estimates required for contract bidding.

10. Carpenter, House - (D.O.T. 860.131) - Constructs and sets forms for foundation, builds structural skeleton, sheetrocks, decks, lays shingles, sometimes builds cabinets, and does decorative woodwork inside and outside. Works primarily with hand tools and some power tools in order to shape materials to required sizes. May be self-employed or be employed by contractor. Sometimes specializes in a particular phase of house construction such as Framing Carpenter, Sheetrocker, or Shingle Layer.

11. Carpenter, Finish - (D.O.T. 860.131) - Installs molding and sets trim. Panels walls and partitions. May lay out and construct cabinets, counters, and decorative wooden structures. Workmanship must be of high quality. Hangs prefabricated door and window units, sets locks, installs weather stripping. May specialize in one or more types of construction such as Door Hanger, Garage-Door Hanger, Hardwood-Floor Layer, Jalousie Installer, or Stair Builder.

12. Carpenter, Bridge - (D.O.T. 860.381) - Constructs, erects, installs, and repairs bridges, trestles, and tunnel supports. For further information, see TRANSPORTATION.

13. Carpenter, Acoustical - (D.O.T. 860.381) - Mounts acoustical tile to walls and ceilings of residential and commercial buildings. Installs metal tile lathing.

14. Carpenter, Building-Insulating - (D.O.T. 860.131) - Removes sections of walls, roofs, and floors, or cuts apertures in structures to facilitate installation of insulating materials.

15. Carpenter, Form Builder - (D.O.T. 860.781) - Works in shop or on construction site constructing wooden forms for molding concrete. Studies blueprints or follows verbal instructions to determine size and shape of forms. Uses hand tools and power tools.

16. Carpenter, Form Setter - (D.O.T. 860.781) - Installs forms on construction site and provides necessary supports and braces so forms will not shift when concrete is poured.

17. Carpenter, Rough - (D.O.T. 860.781) - Builds rough wooden structures, such as concrete forms, scaffolds, tunnel and sewer supports and temporary frame shelters, according to sketches or verbal instructions
18. Carpenter, Packing - (D.O.T. 920. 884) - Fabricates wooden crates or boxes using woodworking hand tools and power tools, and packs machinery, vehicles, or other large or odd shaped products. Reads blueprints, shipping notices, and inspects product to determine size and shape of container.
19. Asbestos - Shingle Roofer - Measures, cuts, and nails into place asbestos siding products.
20. Axman - Pile Trimming and Capping - See Laborer - Pile Driving, Ground Work (No. 34.)
21. Batterboard Setter - (D.O.T. 851.884) - Positions batterboards (horizontal boards used in construction to indicate desired levels and for attaching string to mark grades) to indicate direction of out or power shovel or trenching machine. Determines height of batterboard from engineering data. May signal equipment operator to correct discrepancies.
22. Laborer, Carpenter - (D.O.T. 860.887) - Assists carpenter to build wooden structures. Selects and saws lumber to specified size. Holds lumber in position for nailing by carpenter. Nails sheeting to studs after structure has been framed. Cleans used lumber and wooden and metal forms. Removes shoring and bracing from forms, and dismantles and stacks them. Oils metal forms. Conveys materials and tools about job site.
23. Carpenter Helper, Hardwood Flooring - (D.O.T. 860.781) - Assists in laying hardwood flooring on subfloor surface.
24. Laborer, Pile Driving, Ground Work - (D.O.T. 850.887) - Assists Pile Driving Leadsman to erect piles and sheet piling for use in building structural foundations, retaining walls, and cofferdams. Cleans piling, using shovel or ax. Trims and points wooden piles or sheeting and tapers butt of wooden poles to fit piledriver hammer, using adz or ax.

B. MASONRY - Bricklayers are craftsmen who know how to mix and spread different kinds of mortar, read blueprints, and handle different types of masonry units. Masonry work consists of exterior and interior walls, floors, patios, walks and columns.

Marble setters, tilesetters, and terrazzo workers cover exterior and interior surfaces with marble, tile, or terrazzo.

Concrete finishers and cement masons work with the many construction projects made of concrete.

The National Joint Bricklaying Apprenticeship and Training Committee recommend the completion of a 3-year apprenticeship program as the best way to learn bricklaying. Many workers in this trade have acquired bricklaying skills informally by working as helpers or hod carriers, observing or being taught by experienced bricklayers. Many of these persons have gained additional knowledge of their trade by taking trade school courses.

Marble setters, tilesetters, terrazzo workers and cement masons usually learn the trade by working in a 3-year apprenticeship program. A substantial portion of these workers, however, have acquired their skills informally by working as helpers, observing or being taught by experienced craftsmen.

1. Bricklayer - (D.O.T. 861. 381) - Lays building materials, such as brick, structural tile, and concrete cinder, glass, gypsum, and terra cotta block (except stone) to construct or repair walls, partitions, arches, sewers, and other structures. May be designated according to material used, such as Block Setter - Gypsum, Cinder-Block Mason, Concrete-Block Mason, Hollow-Tile-Partition Erector, Plaster-Block Layer, and Terra-Cotta Mason.
2. Bricklayer, Refractory Brick - (D.O.T. 861. 381) - Lays firebrick and refractory tile to build, rebuild, reline, or patch steam boilers, furnaces, converters, cupolas, ladles, and soaking pit. Spreads or sprays refractories over exposed bricks to protect them against deterioration by heat. May replace bolts, brackets, and heating elements, weld cracks or holes in shell. May be designated according to structure worked on, such as Bessemer-Bottom Maker, Coke-Oven Mason, Lip and Gate Builder, Open-Hearth Door-Liner, and Vessel Liner.
3. Chimney Builder, Brick - (D.O.T. 861. 381) - Lays brick or tile to construct industrial smokestacks or chimneys of unusual heights. Attaches rigging and tackle to chimney to support scaffolding.
4. Marble Setter - (D.O.T. 861. 381) - Cuts, tools, and sets marble slabs in floors and walls of buildings and repairs and polishes slabs previously set in buildings. Trims, faces, and cuts marble to specified size, using power sawing, cutting, and facing equipment and handtools. Drills holes in slab, spreads mortar, sets slab in position, fills joints, cleans and bevels cracks or chips on slabs.

5. Permistone Man - (D.O.T. 861. 781) - Casts artificial stone and applies it over surfaces of structures to provide decorative coating. Nails tar paper and lath, mixes and spreads mortar, and installs precast permastone.

6. Soft-Tile Setter - (D.O.T. 861. 781) - Applies decorative steel, aluminum, and plastic tile to walls and cabinets. Brushes waterproof compound, spreads adhesive, positions tile, removes excess cement. May be designated according to the type of tile applied, such as Metal Tile Setter or Plastic Tile Setter.

7. Stonemason - (D.O.T. 861. 781) - Builds stone structures, such as piers, walls, and abutments, or lays walks, curbstones, or special types of masonry, such as alberene. Shapes stone, spreads mortar, aligns stone. May be designated according to masonry work performed, such as Alberene Stone Setter, Artificial Stone Setter, Curb Setter, Flagsetter, Granite Setter, or Gutter-Mouth Cutter.

8. Terrazzo Worker - (D.O.T. 861. 781) - Applies cement, sand, pigment, and marble chips to floors, stairways, and cabinet fixtures to attain durable and decorative surfacing according to specifications. Spreads roofing paper, spreads mixture of sand, cement, and water over surface with trowel to form terrazzo base. Cuts metal division strips, spreads mixture of marble chips, cement, pigment, and water over terrazzo base to form finished surface. Scatters marble chips, pushes roller surface, allows surface to dry, and pushes electric-powered surfacing machine over floor to grind and polish terrazzo surface. May be designated according to specific operations, such as Artificial Marble Worker, Terrazzo Finisher, or Terrazzo Polisher.

9. Tile Setter - (D.O.T. 861. 781) - Applies tile to walls, floor, ceiling, promenade roof decks. Examines blueprints, measures and cuts metal lath, tacks lath to wall, spreads plaster base over lath, cuts and shapes tile with tile cutters and biters. Tile Fitter, Tile Layer, Tile Man, or Tile Mason are other job titles.

10. Tuck Pointer - (D.O.T. 861. 884) - Repairs and finishes mortar joints between stones or bricks of masonry wall. Removes mortar from joints and trowels new mortar into joints.

11. Hod Carrier - (D.O.T. 869. 887) - Supplies bricklayer, plasterer or stonemason with bricks, concrete, mortar, or plaster, using hod. Cleans excess mortar from finished work, using brush or scraping tool. May mix mortar and concrete by hand or by use of mixing machine.

12. Plasterer - (D.O.T. 842. 781) - Applies coats of plaster to interior walls, ceilings, and partitions of buildings to produce finished surface, according to blueprints, architect's drawings, or oral instructions. Directs workers to mix plaster to desired consistency, spreads plaster, applies scratch brown or finish coats. May be designated by specialized methods, such as Ornamental Plaster Sticker, Plasterer Finish, Plasterer Rough, Plasterer, Spray Gun, Plasterer Molding.

13. Cement Mason - (D.O.T. 844. 884) - Smooths and finishes surfaces of poured concrete floors, walls, sidewalks, or curbs to specified textures, using handtools, including floats, trowels, and screeds. May be designated as Cement Finisher, Cement Paver, Concrete Finisher, Concrete Floater.

14. Stucco Mason - (D.O.T. 842. 381) - Applies waterproof, decorative covering of portland or gypsum plaster to outside of building surfaces. Erects scaffolds. Decorates final or finish coat by marking it with sand or with brush and trowel, or by spattering it with small stones.

C. ELECTRICAL CONSTRUCTION - Construction electricians lay out, assemble, install and test electrical systems. These systems provide heat, light, power, air conditioning, and refrigeration in residences, office buildings, factories, hospitals, schools, and other structures. Construction electricians also install and connect electrical machinery, electronic equipment, controls, and signal and communications systems. The construction electrician must know and follow National Electrical Code regulations, and in addition, must fulfill state, county, and municipal regulations. The electrician furnishes his own handtools such as pliers, screwdrivers, brace and bits, knives, hacksaws, and other tools. Many construction electricians go into business for themselves. As they expand their activities, they may employ other workers and become contractors. In most large urban areas, a master electrician's license is required to engage in an electrical contracting business.

1. Electrician - (D.O.T. 824.281) - Plans layout and installs and repairs wiring, electrical fixtures, apparatus, and control equipment. Plans new or modified installations to minimize waste of materials, provides access for future maintenance and avoids unsightly, hazardous and unreliable wiring consistent with specifications and local electrical code. Prepares sketches showing location of all wiring and equipment or follows diagrams or blueprints prepared by others, insuring that concealed wiring is installed before completion of future walls, ceilings, and flooring. Measures, cuts, bends, threads, assembles, and installs electrical conduit. Splices wiring to fixtures and equipment. Tests continuity of circuit to insure electrical compatibility and safety of all components, using standard instruments such as ohmmeter, battery, buzzer, or oscilloscope. May be required to hold a license.

2. Electrician, Cable Splicing - (D.O.T. 829.381) - Splices underground or submarine multiple conductor cables used in telephone and telegraph communication and electric-power transmission systems. Climbs utility poles or towers, or descends into sewers and underground vaults where cables are located.

3. Cable Puller - (D.O.T. 829.884) - Pulls lead-sheathed electrical cables for communication, signal, and power system through ducts. Pushes long, flexible, steel ribbon or rods through ducts. Attaches iron wire to rod or ribbon and pulls wire through duct. Attaches wire to cable and pulls cable through duct by hand or using winch. May pull ball or mandrel through duct to insure clear passage.

4. Calibrator - (D.O.T. 710,884) - Performs any combination of tasks involved in calibrating control instruments, such as thermostats, timing and pressure-regulating devices. Sets controls to regulate current flow, timing cycle, pressure, or temperature. Positions dial plate of controls at reference point and adjusts calibration screw so that contact points open and close at specified temperature or pressure.
5. Conduit Man - (D.O.T. 869.381) - Builds and repairs concrete underground vaults and manholes and installs ducts to provide installation and maintenance facilities for underground power cables. Installs sheeting, shoring, and bracing for excavation. Builds wooden forms and erects steel reinforcing. Directs workers engaged in pouring concrete into forms, and removes forms after concrete has set.
6. Construction Checker - (D.O.T. 821.387) - Inspects and prepares reports concerned with construction and maintenance of electrical powerline projects. Inspects pole installation to insure compliance with specifications.
7. Electrician, Power House - (D.O.T. 820 281) - Repairs and maintains electrical equipment in generating station or powerhouse. Tests defective equipment to determine cause of malfunction or failure using voltmeters, ammeters, and related electrical testing apparatus.
8. Electrician, Substation - (D.O.T. 820.281) - Inspects, tests, and maintains substation electrical equipment such as oil circuit breakers and transformers.
9. Equipment Installer - (D.O.T. 829.381) - Installs electronic control panels and mechanical equipment, such as motor generator units, battery charges, utility reels, and darkroom equipment. Bolts and screws control panels and assembled operating units to framework. Connects electrical wiring and cables. Installs lighting fixtures, outlets, switches, wall boxes, and terminal boards.
10. Lineman - (D.O.T. 821.381) - Erects wood poles and prefabricate light duty metal towers, cable, and related equipment to construct transmission and distribution power lines used to conduct electrical energy between generating stations, substations, and consumers.
11. Groundman - (D.O.T. 821.887) - Performs a variety of tasks on ground to aid in erection of utility poles and installation and repair of overhead powerlines and communication lines.
12. Electric Distribution Checker - (D.O.T. 824.281) - Inspects and tests electric distribution equipment and wiring outside and within buildings to verify conformance of installation and building code specifications or to determine feasibility of increasing electrical load.
13. Air-Conditioning Installer, Domestic - (D.O.T. 827.884) - Installs domestic air-conditioning units, usually ranging from 1/2 to two-ton capacity, in private residences and small business establishments. Install existing wiring and fuses on customer's premises to insure adequate power supply for operating air conditioner. Assembles unit window support and installs air conditioner. May change filter, lubricate machine, replace fan motor or

fan belt, and make minor adjustments.

14. Air-Conditioning Mechanic, Commercial - (D.O.T. 637.281) - See
Plumber - Pipe Fitter.

D. METALS - Plumbers, Pipefitters, Sheetmetal Workers, and Millwrights, are craftsmen who plan, install, and make operational; the plumbing, ductwork, and machinery in various structures. Each craftsman relates to his specific trade.

1. Pipe Fitter I - (D.O.T. 862.381) - Lays out, fabricates, assembles, installs, and maintains piping and piping systems, fixtures, and equipment for steam, hot water, heating, cooling, lubricating and industrial processing systems on the basis of knowledge of system operation and study of building plans or working drawings. Selects type and size of pipe and related materials, inspects worksites, plans sequence of installation. Installs and maintains refrigeration and air conditioning systems, including compressors, pumps, meters, pneumatic and hydraulic controls and piping. May be designated according to the system installed as Pipefitter, Ammonis; Pipe Fitter, Gas Pipe; Pipe Fitter, Plastic Pipe; Pipe Fitter, Soft Copper.

2. Pipe Fitter II - (D.O.T. 862.381) - A term applied to a Laborer, Plumbing; Mucker, Cofferdam; or Pipe-Layer Helper when assisting in the installation of well-point pumps and in setting well-point pipe into sand or loose earth to provide subsoil drainage systems for excavation work below ground water level.

3. Boilermaker I - (D.O.T. 805.281) - Assembles and analyzes defects in and repairs boilers, pressure vessels, tanks, and vats in the field. Sets up rigging or signals crane operator to lift parts to specified position. Bolts or arc-welds structures and sections together. Assists in testing assembled vessels by pumping water or gas under specified pressure into vessel.

4. Boilermaker II - (D.O.T. 805.281) - Lays out, fabricates, and welds boilers, pressure vessels, or parts in boiler shop. May install and expand boiler tubes.

5. Boilermaker III - (D.O.T. 805.781) - Assembles boilers, tanks, vats, and pressure vessels using handtools and power tools. Bolts or screws accessories such as manholes, handholes, fans, gages, and valves to vessel using handtools and power wrenches.

6. Plumber - (D.O.T. 862.381) - Assembles, installs and repairs pipes, fittings, and fixtures of heating, water, and drainage systems. Studies building plans and working drawings to determine work aids required and sequence of installations. Assembles and installs valves, pipe fittings, and pipes composed of metals, such as iron, steel, brass, and lead, and nonmetals such as glass, vitrified clay and plastic using handtools and power tools.

7. Structural-Steel Worker - (D.O.T. 801.781) - Performs any combination of the following duties to raise, place and unite girders, columns, and other structural-steel members to form completed structures or structure frameworks, working as a member of a crew. Sets up hoisting equipment, fastens steel members to cable of hoist using chain, cable, or rope. Signals worker operating hoisting equipment to lift and place steel member. Guides member

with tag line or rides on member to guide it as it is hoisted into position. Forces members into final position, using turnbuckles, crowbars, jacks, and handtools. Bolts aligned members to keep them in position until they can be permanently riveted or welded in place. Catches hot rivets in bucket and inserts them in rivet holes using tongs. Bucks up rivets while pneumatic riveter uses airhammer to form heads on rivets. May specialize in erecting or repairing specific types of structures and be designated accordingly as Bridge-Maintenance Man; Chimney Builder, Reinforced Concrete; Scaffold Builder, Metal; or Structural-Steel Equipment Erector.

8. Rigger - (D.O.T. 921. 280) - Assembles rigging to lift and moves equipment or material. Selects cables, ropes, pulleys, winches, blocks, and sheaves according to weight and size of load to be moved. Attaches pulley and blocks to fixed overhead structures, such as beams, ceilings, and gin pole booms with bolts and clamps. Attaches load with grappling devices such as loops, wires, ropes, and chains to crane hook. Splices rope and wire cables to make or repair slings and cable.

9. Riveter, Hydraulic - (D.O.T. 800.782) - Operates hydraulic riveting machine to rivet steel plate sections together. Selects dies according to size of rivet and type of head to be formed. Starts machine and adjusts valve to regulate pressure according to size of rivet.

10. Riveter, Pneumatics - (D.O.T. 800. 884) - Rivets together parts such as structures, plates and castings, pneumatic hammer. Places die against shank of rivet and presses trigger to pound and shape head of rivet shank.

11. Reinforcing-Iron Worker - (D.O.T. 801. 884) - Positions and secures steel bars in concrete forms to reinforce concrete. Determines numbers, sizes, shapes, and locations of reinforcing rods from blueprints, sketches, or oral instructions. Selects and places rods in forms, spacing and fastening them together, using wire and pliers. Cuts bars to required lengths, using hacksaw, bar cutters, or acetylene torch. May bend steel rods with handtools or rodbending machine.

12. Reinforcing-Steel Worker, Wire Mesh - (D.O.T. 859. 887) - Measures, cuts, bends, and fastens mesh used for reinforcing concrete on embankments and concrete road surfaces. May set redwood expansion joints for concrete paving.

13. Sheet-Metal Worker - (D.O.T. 804. 281) - Fabricates, assembles, installs, and repairs sheet metal products and equipment, such as control boxes, drainpipes, ventilators, and furnace casings, according to job order or blueprints. Selects gage and type of sheet metal according to product being fabricated and knowledge of metal. Sets up and operates fabricating machines, such as shears and brakes, and straightens sheet metal. Shapes metal over anvils, blocks, or forms using hammer. Sets up and operates soldering and welding equipment to join together sheet metal parts. May be designated according to type of metal used as: Coppersmith, Tinsmith, or according to type of activity as Fabricator,

Special Items; Product-Development Man; Roofer, Metal; Sheet-Metal Installer; Sheet-Metal Worker, Maintenance; Shop Mechanic I; or Model Maker, Sheet Metal.

14. Assembler Unit - (D.O.T. 706. 884) - Assembles custom built metal products such as doors, windows, window screens, and metal orders, diagram, or layout. Bolts, rivets, crimps, or spot welds parts of window and door frames and attaches hardware, such as locks, hinges, and molding using power screwdriver, nut runner, arbor press, portable or stationary riveter, and spotwelding machine. May cut glass to specified size.

15. Duct Installer - (D.O.T. 304. 884) - Installs prefabricated sheet metal ducts used for heating and air conditioning purposes. Assembles sections of sheetmetal duct according to specifications, using slip joints or metal screws. Cuts holes in ceiling and walls as required and makes holes and bends in metal to accommodate installation.

16. Ornamental Iron Worker - (D.O.T. 809. 381) - Installs prefabricated ornamental ironwork, other than structural ironwork, such as metal window and door frames, motor driven and automatic power doors, metal trim and paneling and aluminum curtain-wall frames. Welds brackets to lintels, sills, columns, and other structural framework. Drills holes in metal, concrete and masonry structure using portable power drills, air-hammer, and handtools. Installs equipment such as motor driven or automatic doors. May be designated according to equipment installed or material worked as Ornamental Bronze Worker, Metal-Sash Setter, Ornamental Rail Installer, Steel-Door Setter, or Steel-Sash Erector.

17. Welder, Arc - (D.O.T. 810. 884) - Welds metal parts together as specified by layout, diagram, work order, or oral instructions using electric arc welding equipment. Turns knobs on welding unit to desired amperage. Obtains specified electrode, connects cables from welding unit, starts power, strikes arc, and guides electrode. May be required to pass tests, such as Navy, Coast Guard, American Society of Mechanical Engineers, or American Bureau of Ships.

18. Welder, Atomic - (D.O.T. 810. 884) - Welds metal parts using equipment which introduces hydrogen gas into electric arc formed between two tungsten electrodes to increase arc temperature and to shield weld area to prevent oxidation.

19. Welder, Gas-Shielded - (D.O.T. 810. 884) - Welds metal using equipment which introduces shield of inert or noncombustible gas such as helium, argon, carbon dioxide, or nitrogen, around electric arc between electrode and workpiece to prevent oxidation. May be designated a Welder, Heliarc; or Tungsten Welder, Inert Gas.

20. Welder, Hand, Submerged Arc - (D.O.T. 810. 884) - Welds metal parts, using handgun or crawler type gun which blows layer of powdered flux over workpiece to shield arc.

21. Welder, Gas - (D.O.T. 811. 884) - Welds metal parts together as specified by layout, welding diagram, or work order using gas welding equipment. Positions parts in jigs or fixtures and obtains specified equipment. May be required to pass tests such as Navy, Coast Guard, American Society of Mechanical Engineers, or America Bureau of Ships.

22. Welder, Combination - (D.O.T. 812. 884) - Welds metal parts together according to layouts, blueprints, or work orders, using both gas welding or brazing and any combination of arc welding processes. May position and clamp together components of fabricated metal products preparatory to welding, but does not perform layout, fitting and aligning.

23. Welder - Fitter - (D.O.T. 819. 381) - Positions, fits, and welds fabricated, cast and forges components to assemble structural forms, such as machinery frames, tanks, pressure vessels, furnace shells, and building and bridge parts according to blueprints and knowledge of welding characteristics of metal. Selects equipment and plans layout, assembly, and welding, applying knowledge of geometry, physical properties of metal, effect of heat, allowances for thickness, machining weld shrinkage and welding techniques. May be designated as Welder, Tack; Welder, Structural Repair; Welder - Fitter, Arc; Welder - Fitter, Gas.

24. Millwright - (D.O.T. 638. 281) - Installs machinery and equipment according to layout plans, blueprints and other drawings using hoists, lift trucks, handtools, and power tools. Reads blueprints and schematic drawings to determine work procedures. Dismantles, moves, assembles, and installs machinery and equipment such as shafting, conveyors, and tram rails.

E. FINISHING - The beautification and protection of the exteriors and interiors of buildings and other structures constitutes a large portion of the finishing segment of the construction industry. Many people are involved in new construction. However, a substantial number repair, alter, or modernize current structures.

Many painters specialize in applying certain kinds of coating--plastic, vinyl, architectural coating effect, marbling, etc.

Glaziers cut, fit, and install plate glass, ordinary window glass, mirrors, and special kinds of glass panels.

1. Cabinetmaker - (D.O.T. 660.280) - Constructs and repairs wooden articles, such as store fixtures, cabinets, and furniture. Sets up and operates such woodworking machines as power saw, jointer, mortiser, planer, tenoner, molder, and shaper to cut and shape parts. May be designated as Millman, or Cabinetmaker, Maintenance, or Carpenter, Bench.

2. Carpet Layer - (D.O.T. 299.381) - Lays carpet and rugs. Lays out and cuts carpeting to size, using floor sketches. Sews sections of carpeting together by hand. Cuts and trims carpet to fit along wall edges, openings, and projections.

3. Floorlayer - (D.O.T. 864.781) - Applies blocks, strips or sheets of shock-absorbing, sound-deadening, or decorative covering to floors, walls, and cabinets. Spreads adhesive cement over floor and lays covering on floor following guidelines. May be designated as Asphalt-Tile-Floor Layer, Cork-Tile-Floor Layer, Linoleum Floor Layer, Linoleum-Tile-Floor Layer, or Rubber-Tile-Floor Layer.

4. Glazier - (D.O.T. 865.781) - Installs glass in windows, sky-lights, store fronts, and display cases, or on surfaces, such as building fronts, interior walls, ceilings, and tabletops. May install metal window and door frames into which glass panes are to be fitted. May assemble and install metal framed glass enclosures for showers. May be designated as Shower Enclosure Installer, Glazier, Structural Glass or Plate-Glass Installer.

5. Glazier, Stained-Glass - (D.O.T. 779.381) - Selects and cuts colored glass for use in stained-glass windows in churches, memorials, and in residences. May assemble and cement sections of stained-glass.

6. Insulation Worker - (D.O.T. 863.884) - Applies insulating material to exposed surfaces of equipment such as boilers, tanks, hot-or-cold air ducts or pipes, and steam generators. May cover pipe with felt which is bound with wire, or gauze which is covered with plaster of Paris. May be designated as Blanket-Insulation Worker, Block-Insulation Worker, Corkboard-Insulation Worker, Prefabricated-Pipe-Insulation Worker or Asbestos Worker.

7. Insulation Installer - (D.O.T. 863.884) - Fastens sheets, bat, blanket, and similar types of building insulation to walls, floors, ceilings, and partitions to prevent or reduce passage of heat, cold or sound. Fastens insulation to joists, rafters, studs or furring strips. May fasten furring strips to walls, ceilings, or partitions to provide nailing base for insulation.
8. Insulation Hoseman - (D.O.T. 863.884) - Blows insulating material into spaces within walls, floors, and ceiling, using hose attached to blower to insulate buildings.
9. Metal Sprayer, Corrosion Prevention - (D.O.T. 843.782) - Controls portable flame spray equipment to spray corrosion-resistant coating such as zinc or aluminum. Cleans and roughens surface of object with blast of abrasive-laden compressed air (sandblast). May spray or brush paint or apply sealing material on coated surface for decoration or further protection. May flame-spray non-metallic objects such as glass or plastics.
10. Painter - (D.O.T. 840.781) - Applies coats of paint, varnish, stains, enamels, or lacquers to decorate and protect surfaces. Paints surfaces using brushes, spray gun, or paint rollers. Creates special effects by applying paint with cloth, brush, sponge, or fingers. May be designated as Painter, Interior Finish; Painter, Maintenance, Calciminer or Varnisher.
11. Painter, Rough - (D.O.T. 840.884) - Applies paint, varnish or enamel to exteriors and interiors of industrial plants or other structures such as barns, sheds, highway guard rails, and fences. May specialize in painting gas storage tanks which require working from swing scaffolds, high above ground.
12. Painter, Structural Steel - (D.O.T. 840.884) - Paints structural steel framework of buildings, girders, cables of bridges and other structural steel.
13. Paperhanger - (D.O.T. 841.781) - Cover interior walls and ceilings of rooms with decorative wall paper or fabric. May remove old paper using water or chemical remover and scraper.

TRAINING FOR CONSTRUCTION JOBS

**CONSTRUCTION JOBS FOR WHICH
APPRENTICESHIP TRAINING IS AVAILABLE**

Occupational Employment (Nationwide Figure-1968)	Qualifications and Training	Employment Opportunities and Trends
Asbestos and Insulating Worker (22,000)	Usually applicant must be at least 18 years old. Most learn through 4-year apprenticeship. Examination required on completion of apprenticeship program.	Several hundred openings annually. Moderate employment increase.
Bricklayer (175,000)	Usually applicant must be at least 17 years old. Can be learned on the job, but 3-yr. apprenticeship recommended.	Several thousand openings each year. Moderate rise in employment.
Carpenter (869,000)	Usually applicant must be at least 17. Some learn skills informally on the job, but 4-year apprenticeship recommended.	Moderate increase in employment. Many openings each year in this very large occupation.
Cement Mason (60,000)	Usually applicant must be at least 18 years old. Can be learned on the job, but 3-year apprenticeship recommended.	Many openings each year. Rapid increase in employment.
Electrician (Construction) (185,000)	A 4-year apprenticeship recommended, but possible to learn trade through job experience.	Several thousand job opportunities each year. Very rapid employment increase.
Floor Covering Installer (37,000)	Usually applicant must be at least 17. Many learn skills on the job, but a 3-or 4-yr. apprenticeship recommended.	Several hundred openings yearly. Moderate increase in employment.

<p>Glazier (9,000)</p>	<p>Many learn trade informally but 3-year apprenticeship recommended.</p>	<p>Very favorable long-range outlook for this small occupation. Very rapid employment increase.</p>
<p>Lather (30,000)</p>	<p>Usually applicant must be at least 16 years old. A minimum 2-year apprenticeship recommended, though many learn trade informally.</p>	<p>About 1,000 openings annually. Moderate increase in employment.</p>
<p>Painter or Paperhanger (430,000)</p>	<p>Usually applicants must be at least 16. Many acquire skill informally through on-the-job experience, but 3-year apprenticeship recommended.</p>	<p>Many thousands of openings each year. Moderate increase in employment.</p>
<p>Plasterer (40,000)</p>	<p>Usually applicants must be at least 17. A 3-or 4-year apprenticeship recommended. Many learn on the job.</p>	<p>More than a thousand openings each year. Moderate increase in employment.</p>
<p>Plumber or Pipefitter (330,000)</p>	<p>Usually applicants must be at least 16. A 5-year apprenticeship recommended, but many learn on the job. Trade or correspondence courses can be useful training aids.</p>	<p>Several thousand openings each year. Rapid increase in employment.</p>
<p>Rofer (55,000)</p>	<p>Applicants must be at least 18. Many learn informally through on-the-job experience, but 3-year apprenticeship recommended.</p>	<p>A few thousand openings annually. Rapid increase in employment.</p>
<p>Sheet-Metal Worker (50,000)</p>	<p>A 4-year apprenticeship recommended, though many learn through years of on-the-job experience. Trade or correspondence school courses helpful.</p>	<p>Very rapid increase in employment. A few thousand openings annually.</p>
<p>Stonemason, Marble Setter, and Tile Setter. (30,000)</p>	<p>Usually applicants must be at least 17. Many learn trade informally through on-the-job experience, but 3-year apprenticeship recommended.</p>	<p>Several hundred openings yearly. Moderate growth in employment.</p>

**Structural-
Ornamental-, and
Reinforcing-Iron
Worker
(75,000)**

**Usually applicants must be at
least 18. A 3-year apprentice-
ship recommended.**

**A few thousand open-
ings annually.
Rapid increase in
employment.**

Source: U.S. Department of Labor, Bureau of Statistics

**JOBS FOR WHICH A
HIGH SCHOOL EDUCATION
IS PREFERRED, BUT NOT ESSENTIAL**

Occupational Employment (Nationwide Figure - 1968)	Qualifications and Training	Employment Opportunities and Trends
Asbestos and Insulating Worker (22,000)	Usually applicant must be at least 18 years old. Most learn through 4-year apprenticeship. Examination required on completion of apprenticeship program.	Several hundred openings annually. Moderate employment increase.
Boilermaking Worker (25,000)	Boilermakers often learn trade through 4-year apprenticeship; layout men and fitup men usually acquire skills on the job.	About a thousand openings annually. Moderate employment growth.
Bricklayer (175,000)	Usually applicant must be at least 17 years old. Can be learned on the job, but 3-yr. apprenticeship recommended.	Several thousand openings each year. Moderate rise in employment.
Carpenter (869,000)	Usually applicant must be at least 17. Some learn skills informally on the job, but 4-year apprenticeship recommended.	Moderate increase in employment. Many openings each year in this very large occupation.
Cement Mason (60,000)	Usually applicant must be at least 18. Can be learned on the job, but 3-year apprenticeship recommended.	Many openings each year. Rapid increase in employment.
Construction Laborer or Hod Carrier (75,000)	Little formal training required. Usually must be at least 18 years old and in good physical condition.	Slow increase in employment. However, many thousands of openings each year, especially for replacement.

Electrician (Maintenance) (240,000)	Skills learned either through apprenticeship (usually 4 years or on the job). Courses in math and basic science helpful.	Several thousand openings annually. Moderate employment increase.
Floor Covering Installer (37,000)	Usually applicant must be at least 17. Many learn skills on the job, but a 3-or 4-year apprenticeship recommended.	Several hundred openings yearly. Moderate increase in employment.
Lather (30,000)	Usually applicant must be at least 16 years old. A minimum 2-year apprenticeship recommended, though many learn trade informally.	About 1,000 openings annually. Moderate increase in employment.
Millwright (75,000)	Skill acquired either through apprenticeship (usually 4 years) or training on the job.) Courses in science, math, and mechanical drawing useful.	A few thousand openings yearly. Slow increase in employment.
Painter or Paperhanger (430,000)	Usually applicants must be at least 16. Many acquire skill informally through on-the-job experience, but 3-year apprenticeship recommended.	Many thousands of openings each year. Moderate increase in employment.
Plasterer (40,000)	Usually applicants must be at least 17. A 3-or 4-year apprenticeship recommended. Many learn on the job.	More than a thousand openings each year. Moderate increase in employment.
Plumber of Pipelifter (330,000)	Usually applicants must be at least 16. A 5-year apprenticeship recommended, but many learn on the job. Trade or correspondence courses can be useful training aids.	Several thousand openings each year. Rapid increase in employment.
Roofer (55,000)	Applicants must be at least 18. Many learn informally through on-the-job experience, but 3-year apprenticeship recommended.	A few thousand openings annually. Rapid increase in employment.
Stonemason, Marble Setter, and Tile Setter (30,000)	Usually applicants must be at least 17. Many learn trade informally through on-the-job experience, but 3-year apprenticeship recommended.	Several hundred openings yearly. Moderate growth in employment.

Structural,
Ornamental, and
Reinforcing Iron
Worker
(75,000)

Usually applicants must be at
least 18. A 3-year apprentice-
ship recommended.

A few thousand
openings annually.
Rapid increase in
employment.

Source: U.S. Department of Labor, Bureau of Statistics

**JOBS FOR WHICH A
HIGH SCHOOL EDUCATION
IS GENERALLY REQUIRED**

Occupational Employment (Nationwide Figure - 1968)	Qualifications and Training	Employment Opportunities and Trends
Air-Conditioning Refrigeration or Heating Mechanic (100,000)	Most begin as helpers and learn on the job.	Most job openings will be for air-conditioning and refrigeration mechanics. Very rapid employment increase.
Electrician (Construction) (185,000)	A 4-year apprenticeship recommended, but possible to learn trade through job experience.	Several thousand job opportunities each year. Very rapid employment increase.
Elevator (Constructor) (14,500)	Must be at least 18 and in good physical condition. Requires about 2 years experience on the job, plus related classroom instruction.	About 500 openings yearly in this small occupation. Slow employment increase.
Foreman (1,444,000)	Usually must be about 45 years of age and have spent years learning skills on the job. Ability to motivate employees, command respect, and get along with people especially helpful.	Many thousands of job openings annually. Employment expected to increase moderately through 1970's.
Glazier (9,000)	Many learn trade informally, but 3-year apprenticeship recommended.	Very favorable long-range outlook for this small occupation. Very rapid increase in employment.
Operating Engineer (Construction) (285,000)	Many learn through informal training and experience, but 3-year apprenticeship recommended.	Very favorable employment outlook. Very rapid increase in employment.
Real Estate Salesman or Broker (225,000)	License necessary; requirements include passing a written test on regulations affecting real estate transactions.	Several thousand openings yearly. Increasing opportunities for women. Moderate employment rise in employment.

Sheet-Metal Worker
(50,000)

A 4-year apprenticeship recommended, though many learn through years of on-the-job experience. Trade or correspondence school courses helpful.

Very rapid increase in employment. A few thousand openings annually.

Source: U.S. Department of Labor, Bureau of Statistics

**JOBS FOR WHICH
JUNIOR COLLEGE,
TECHNICAL INSTITUTE, OR
OTHER SPECIALIZED TRAINING
IS USUALLY REQUIRED**

**Occupational
Employment
(Nationwide
Figures - 1968)**

**Qualifications
and
Training**

**Employment
Opportunities
and Trends**

**Draftsman
(295,000)**

Post-secondary school technical training usually required (junior college, technical institute, area vocational school, correspondence school, etc) also 3-or 4-year apprenticeship.

Favorable employment prospects. Best prospects for those with post-high school training. Employment expected to rise rapidly.

**Surveyor
(45,000)**

Usually special training following high school plus training on job. For some specialities, a college degree required.

Good employment prospects through the 1970's. Rapid employment growth anticipated.

**Technician
(Construction)**

Technical training after high school usually required. Some training on-the-job.

Employment opportunities are expected to be very good. Demand will be strongest for graduates of technical training programs.

Source: U.S. Department of Labor, Bureau of Statistics

**JOBS FOR WHICH A
COLLEGE EDUCATION
IS USUALLY REQUIRED**

**Occupational
Employment
(Nationwide
Figures - 1968)**

**Qualifications
and
Training**

**Employment
Opportunities
and Trends**

**Architect
(34,000)**

License required. Usually earned by a 5-year course leading to a bachelor of architecture degree, followed by 3 years experience.

Good employment prospects in this rapidly growing field.

**Engineer
(Construction)**

Bachelor's degree in engineering.

Very good employment opportunities in this large and fast growing profession.

**Urban Planner
(7,000)**

Master's degree in urban planning desirable. For some jobs bachelor's degree in urban planning or related fields is sufficient.

Very good employment prospects. Shortage of qualified planners in this relatively small but very rapidly growing field.

Source: U.S. Department of Labor, Bureau of Statistics

RESOURCE UTILIZATION

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RESOURCE UTILIZATION

METHODS

Occupational Resource Center

Local Occupations

Local Business Establishments

Types of Occupational Information

Sources of Occupational Information

Construction Speaking Bureau

Field Trips

DOCUMENTS AND ORGANIZATIONS

Books

Occupational Outlook Series

Periodicals

Unions

OCCUPATIONAL RESOURCE CENTER

A. Location

1. Within the classroom or laboratory
2. Accessible to all students

B. Reasons for Resource Center

1. Increasing variety of resources (periodicals and industrial booklets)
2. Knowledge explosion (expectations of students)
3. To keep occupational information up-to-date
4. To accommodate different levels of inquiry within a class
5. To provide material for scrapbooks

C. Procurement

1. Survey of local businesses for periodicals
2. Survey of parents (periodicals that would be of interest to the class)
3. Organizations that would subscribe to periodicals for use in the classroom

D. Inventory

1. Collect material that has been on the shelf for four months and store until clippings are needed.
2. Prepare label for cover of each periodical with the class name and the teacher's name.

COMMUNITY RESOURCES

Local Occupations

Work goes on in every community, and for career education activities local occupations are the most readily accessible for observation and examination. Many occupational patterns exist, but people earn a living in similar fashions in communities across the country.

A system of gathering information about local occupations and people in those occupations will benefit the whole school system.. Many teachers could use the information, and potential advisory committee members might be identified from such a system. The yellow pages of the telephone directory, the local Chamber of Commerce publications, or a questionnaire may be utilized for obtaining occupational information.

A resource person from a particular occupation can add dramatically to information that has been collected. The resource person should be made aware of the educational level of the students in the class, and the class should be prepared for the visit. It would be beneficial to the speaker to have an outline of the speech desired by the teacher.

Local Business Establishments

Business establishments such as lumber yards, hardware stores, concrete mix plants, and other similar concerns will serve as valuable sites for field trips.

Initial contact with the business should be made by the teacher to discuss details of a possible visit, to explain activities the students are involved in, and to determine the kinds of processes or the phases of the business that would be most beneficial for the students.

Again, it is extremely important that the students be involved in

activities relating to the visit prior to the visit.

Types of Occupational Information

There are several types of occupational information which must be taken into consideration when visiting businesses and individuals in the various occupations, including the following:

1. Job classification
2. Unemployment labor statistics
3. Employer job descriptions
4. Local hiring practices
5. National, state, regional, and community industrial and business patterns
6. Job mobility statistics
7. Union policies
8. Effects of technological change on job requirements
9. Manpower needs of region and state
10. Available labor supply

Sources of Occupational Information

Reliable occupational information is not always easily accessible or readily available. The kinds of information needed in many instances can be obtained by combining the inputs of various agencies at different levels.

Possible sources of desired occupational information include the following:

1. United States Department of Labor
2. State Department of Labor
3. Local Employment Security Offices
4. Trade Associations and Publications
5. Industrial Development Commissions

6. Professional Organizations
7. United States Office of Education
8. Publisher Manpower Studies
9. Welfare Agencies
10. Chambers of Commerce
11. Youth Commission
12. Occupational Training Information System
(Statewide manpower information system)
13. Published Research Studies
14. Community Surveys

Construction Speakers' Bureau

A Construction Speakers' Bureau can serve many functions. The chief advantage of a resource speaker is having a new face in the classroom who can answer students' questions immediately with information that is current and localized.

Speakers are not to be used as substitutes for handbooks, pamphlets or catalogs. Outside speakers, however, can enrich and improve the quality of information utilized by students while exploring construction industries.

Individuals in construction need to understand the efforts of the school, and a speakers' bureau provides an excellent opportunity for a two-way exchange of ideas.

The key to this approach is finding people who are involved with and can talk about topics related to construction. Some speakers may use slides or charts while others will just talk about what they do. Remember, it is not necessary for the presentor to be a professional speaker, but he does need to be a skilled tradesman.

CONSTRUCTION SPEAKERS' BUREAU

Name:

Business:

Phone:

Description of topic or topics you would feel comfortable speaking about:

Length of presentation: _____

Will a fee be required? NO _____ **YES** _____ **Amount** _____

Equipment you will need:

Please indicate names of other persons who might be interested in participating in the Construction Speakers' Bureau:

(Teacher's name)

(School Address)

(School Phone)

FIELD TRIPS

There are certain occupations which do not lend themselves to realistic simulation in the school. In these instances, field trips can be used to facilitate career education efforts.

There certainly are other reasons why field trips are important. Hoppock states the real value of field trips as he points out:

One can read about working conditions; one can recognize and acknowledge them intellectually; one can even memorize them and retain them long enough to pass an examination. But the student who has actually seen them, and heard them, felt them and smelled them, has learned them emotionally as well as intellectually.¹

In selecting field trip sites keep the following in mind:

1. Don't overlook the obvious in favor of the spectacular.
2. Check potential sites to see if they are appropriate for the age and the maturity of the group.
3. Involve counselors, teachers, and students in the selection of possible sites.
4. Get approval from the school administration. Include:

Teacher's name
Date of request
Name of group
Number
Destination
Purpose
Date of trip
Departing and returning times
Mode of transportation
Written approval

¹Robert Hoppock, "Occupational Information," 3rd ed. (New York: The McGraw Hill Book Co. Inc., 1967) p. 248.

5. Discuss with students

Reading material assigned prior to trip.
Questions that can be asked during the visit.
Outline procedures to be followed:
--safety precautions
--clothing
--conduct

6. Post trip activities

News release
Thank-ycu letter
Evaluation of class

DOCUMENTS AND ORGANIZATIONS

BOOKS

Architectural Practice, Cowgill, C.H. and B.J. Small, Van Nostrand Reinhold Company

Architecture and Color, Faulkner, W., John Wiley & Sons Publishing Company

Chemistry of Building Materials, Diamant, R.M.E., Cahners Books

Exterior Design in Architecture, Ashihara, Yashinobu, Van Nostrand Reinhold Company

Functional Drafting for Today, Fuller, Don, Cahners Books

General Architectural Drawing, Wyatt, William E., Charles A. Bennett Company

Heating, Ventilation & Air Conditioning Plant, Mulholland, J.R., Cahners Books

Homes/Today & Tomorrow, Sherwood, Ruth F., Charles A. Bennett Company

Housing Crisis U.S.A., Fried, John P., Penguin Books, Inc.

How-To Book of Carpentry, DeCristoforo, R.J., Arco Publishing Company

How to Build Cabinets for the Modern Kitchen, Stevenson, R.P., Arco Publishing Company

How to Use Tools, Morgan, Alfred P., Arco Publishing Company

Industrialized Builders Handbook, Lytle, R.J., Structures Publishing Company

Industrialized Building Systems for Housing, Dietz, A.G.H. and L.S. Cutler, MIT Press

Materials of Construction, Smith, R.C., McGraw-Hill Book Company

Millwork--Principles and Practices, Lloyd, William B., Cahners Books

Modern Masonry Panel Construction Systems, Svec, J.J. and P.E. Jeffers, Cahners Books

Modern Power Tool Woodworking, DeCristoforo, R.J. Arco Publishing Company

Modular Housing in the Real, Reidelbach, Jr. J.A., Cahners Books

Points and Coatings Handbook, Banov, Abel, Structures Publishing Company

Remodeling Rooms: Walls, Floors, Ceilings, Day, Richard, Arco Publishing Company

Remodeling Your Kitchen or Bathroom, Salm, Walter G., Arco Publishing Company

Theory & Design of Wood & Fiber Composite Materials, Jayne, Benjamin A., Syracuse University Press

Townscape, Cullen, Gordon, Van Nostrand Reinhold Company

OCCUPATIONAL OUTLOOK SERIES

Dictionary of Occupational Titles, 3rd edition, 1965, Superintendent of Documents, U.S. Government Printing Office, \$7.75

Occupational Outlook Handbook, 1972-73 edition, Bureau of Labor Statistics, \$6.25

Selected Characteristics of Occupations by Worker Traits and Physical Strength, Supplement 2 to the Dictionary of Occupational Titles, 3rd edition, Superintendent of Documents, U.S. Government Printing Office, \$1.50

Suffix Codes for Jobs Defined in the Dictionary of Occupational Titles, 3rd edition., 1967, USuperintendent of Documents, U.S. Government Printing Office, \$2.00

Training Manual for the Dictionary of Occupational Titles, 3rd edition, 1965, Superintendent of Documents, U.S. Government Printing Office, 35¢

Vocational Education and Occupations, U.S. Office of Education, U.S. Employment Service, \$2.25

Relating General Educational Development to Career Planning, 1971 Superintendent of Documents, U.S. Government Printing Office, 50¢

Handbook for Analyzing Jobs, 1972, Superintendent of Documents, U.S. Government Printing Office, \$2.50

PERIODICALS

American Vocational Journal, American Vocational Association

Man/Society/Technology, American Industrial Arts Association

School Shop, Industrial-Technical Education

UNIONS

Asphalt and Vinyl Asbestos Tile Institute

Brotherhood of Painter, Decorators and Paper Hangers of America

Bricklayers, Masons, and Plasters' International Union of America

Contracting Plasters' and Lathers' International Association

International Association of Heat and Frost Insulators and Asbestos Workers

International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers

International Brotherhood of Electrical Workers

Laborers' International Union of North America

National Association of Plumbing, Heating, Cooling Contractors

National Bureau for Lathing and Plastering

National Roofing Contractors Association

National Terrazzo and Mosaic Association

Sheet Metal and Air Conditioning Contractors' National Association, Inc.

Sheet Metal Workers' International Association

Structural Clay Products Institute

Tile Contractors' Association of America

United Brotherhood of Carpenters and Joiners of America