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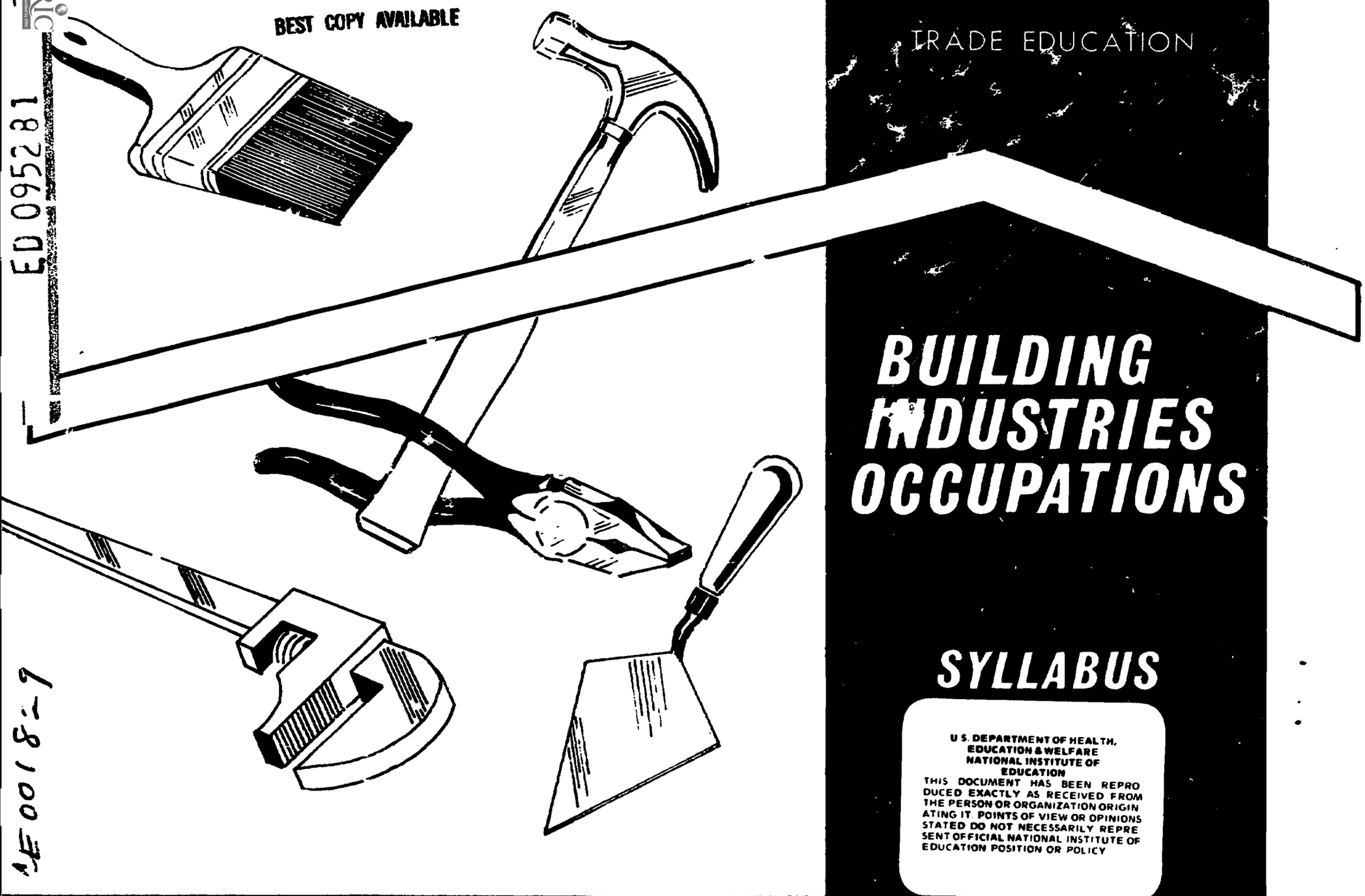
ABSTRACT

The Building Industries Occupations course is a two-year program of approximately 160 three-period teaching days per year. The required course content is designed to be effectively taught in 80 percent of the total course time, thus allowing 20 percent of the time for instruction adapted to such local conditions as employment prospects, student ability and motivation, and physical plant characteristics. Each unit is subdivided by the following trade area units: site work/carpentry (40 percent), masonry (12 percent), electricity (15 percent), plumbing (10 percent), heating (12 percent), air conditioner installation (3 percent), and painting/decorating (8 percent). The area units contain a suggested average time to be devoted to learning experiences, a content outline, performance objectives, and additional information for the teacher. The final pages contain a resource list of texts and references, films, filmstrips and transparencies organized by trade area, and a directory of sources of these materials. (BP)

TRADE EDUCATION



BUILDING INDUSTRIES OCCUPATIONS

SYLLABUS

THE UNIVERSITY OF THE STATE OF NEW YORK / THE STATE EDUCATION DEPARTMENT
BUREAU OF SECONDARY CURRICULUM DEVELOPMENT / ALBANY, NEW YORK 12224 / 1971

BUILDING INDUSTRIES OCCUPATIONS

1973 REPRINT

A Suggested Syllabus of Basic Instruction in the Trades of

CARPENTRY

MASONRY

PLUMBING

HEATING

ELECTRICITY

AIR CONDITIONING

PAINTING AND DECORATING

The University of the State of New York/The State Education Department
Bureau of Secondary Curriculum Development/Albany, New York 12224/1971

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Carl G. Benenati

FOREWORD

The course in *Building Industries Occupations* is concerned with seven of the major construction trades. Traditionally, each trade has been taught in some depth as a distinct, separate course, thus requiring an early choice by the student and restricting his field of employment. The *Building Industries Occupations* course will provide the student with basic knowledge and entry-level skills in each of the included areas, thus allowing a delayed and broadened choice of occupation.

During the summer of 1969 a curriculum writing committee composed of Allen Rowe, Ulster County BOCES, and Clinton Savoury, Putnam County BOCES, assisted and guided by Charles Stebbins, Associate, Bureau of Trade and Technical Education, prepared the course outline which was subsequently developed for publication by Joseph J. Messier, Associate in Vocational Curriculum.

The syllabus is organized in sections by trade area for more efficient use by those planning a *Building Industries Occupations* course, and in those programs utilizing a team of trade-specialist teachers. It is written in a manner calculated to aid the sole teacher of this multifaceted course formulating those areas of the course of study in which, although knowledgeable, he is not a specialist.

The content and format of this syllabus was so well accepted by occupational educators, within and without New York State, that the format was adopted for several subsequent curriculum publications, and this 1973 reprinting became necessary.

G. Earl Hay, *Supervisor*
Vocational Curriculum Unit
Bureau of Secondary Curriculum Development

Gordon E. Van Hooft, *Director*
Division of Curriculum Development

TO THE TEACHER

The *Building Industries Occupations* course is a 2-year program of approximately 160 three-period teaching days per year. The required course content is designed to be effectively taught in 80 percent of the total course time, thus allowing 20 percent of the time for instruction adapted to such local conditions as employment prospects, student ability and motivation, and physical plant characteristics. The 80 percent segment is subdivided to allot percentages of:

Site Work/Carpentry	40
Masonry	12
Electricity	15
Plumbing	10
Heating	12
Air Conditioner Installation	3
Painting/Decorating	8

The syllabus is organized in units by trade area, each unit containing a suggested average time to be devoted to those learning experiences. It is expected that some minor modification of the time allotments will be made in adapting the content to a specific teaching situation.

A three-column format is used, the first column of which is a content outline. The second column describes in performance terms the objectives of each unit of instruction. The final column suggests methods of presentation and of limiting the instruction to the scope of the course. Some of the expanded content is background or introductory information, included for use at the teacher's discretion, for motivational value, or for educating the more capable students who may wish to specialize in a particular trade.

The *Objectives* column is written to reflect this division of content. Those items titled "The student should:" are motivational, introductory, or informational in nature, or are prerequisite knowledge. Items titled *"The student should be able to:"* are required course content and are stated so that they describe a test of the student's entry-level ability.

The *Information* column identifies some additional content which should be reserved for presentation to those particular students who can benefit from the additional depth or breadth of instruction. This column also contains suggested methods of presentation which are included to stimulate and aid the teacher in devising effective methods. These suggestions should not be used in lieu of the teacher-prepared lesson plan; they should be carefully selected, adapted, or built-upon at the teacher's discretion.

The final pages of the syllabus contain a resource list of texts and references, films, filmstrips and transparencies organized by trade area, and a directory of sources of these materials.

This syllabus, like all syllabuses, presents required content in some logical progression, but not necessarily in a teaching sequence. It should serve well in guiding the individual teacher in formulating a course of study for his teaching situation, which will present the required content and such additional skills and knowledge as circumstances may warrant.

Carl G. Benenati, *Chief*
Bureau of Trade and Technical Education

Robert H. Bielefeld, *Director*
Division of Occupational Education Instruction

OBJECTIVES

In preparing this syllabus, three distinct groups of objectives were considered.

Planning

To provide to those planning a *Building Industries Occupations* course, the —
- Scope of the course
- Trade level of the course
- Student level considered necessary for probable success in the course and in the trade
- Instructor qualifications for teaching the course
- Basis on which to tentatively estimate the nature and cost of facilities, equipment, and supplies

Teaching

To provide to those implementing a *Building Industries Occupations* course, aid in —
- Establishing course content
- Establishing the scope of the course
- Forming a comprehensive method of teaching
- Establishing the depth of instruction and the level of skill to be attained

Content

To prepare the student for entry-level employment in the building construction industry by aiding the student in —
- Developing tool skills necessary for entry-level employment
- Developing an awareness of the importance of good work habits and safe procedures
- Preparing to adjust to employment conditions
- Developing the personal and social qualities necessary for success in employment, and for being a well-adjusted member of a free society

To form the basis of the student's future advancement in the industry by —
- Providing sufficient related information to enable the student to develop an attitude of self-reliance and initiative
- Providing sufficient background information to enable the student to make sound trade judgments
- Motivating the student to desire continual self-improvement

CONTENTS

SITE WORK

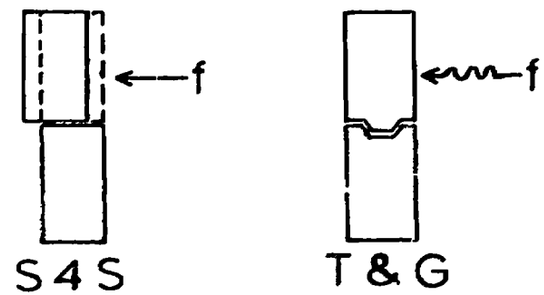
CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
I. BUILDING CODES —— Suggested Time: 1 Day		
A. Type 1. State 2. Local	The student should: Be aware of the existence of regulatory codes, understand their purposes, and be acquainted with some inherent advantages and disadvantages.	Using an *opaque projector*, display exemplary sections of a code. Relate by use of anecdote.
B. Procedure 1. Obtaining permits 2. Inspections	Be aware of the common procedures in obtaining building permits and inspections, and of the penalties for failure to comply with regulations.	The student should not be required to know code content.
II. BLUEPRINT READING —— Suggested Time: 1 Day		
A. Boundaries B. Elevations	Be sufficiently familiar with residential blueprints to be able to locate thereon the land boundaries and the position of buildings and appurtenances.	*Opaque projection* of a plot plan, preferably in conjunction with individual student copies, is an effective teaching method.
1. Contour lines	Understand the relationship of contour lines to lot topography.	
2. Bench mark 3. Construction elevations	Be acquainted with the relationship of the bench mark and construction elevations.	The student should not be required to set or to figure elevations at this point.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
III. SITE PREPARATION —— Suggested Time: 5 Days		
A. Lot lines 1. Locating corner markers 2. Setting lot lines	*The student should be able to:* Set lot lines to an accuracy of ± 1/2 inch, when given the plot plan of a quadrilateral lot, proper equipment, and preset mere stones.	
B. Clearing the site 1. Marking and protecting trees to be retained	The student should: Be acquainted with the fluorescent tapes used as markers. Understand the need to protect trees from damage to bark, limbs, and roots.	
2. Using the scrub axe 3. Using the scrub sickle 4. Using the chain saw a. Maintenance b. Safety	Demonstrate safe and proper use of site clearing tools and equipment. Understand the relationship of tree shape to direction of fall.	The teacher should be aware of the legal differences between vocational instruction and employment. He should periodically consult the current edition of *"Laws Governing Employment of Minors in New York State."*
5. Disposing of felled trees and brush	Be aware of the possibility of local prohibitions on burning as a means of disposal.	County Health Departments can provide rulings regarding areas within that county.
C. Setting primary building lines	Be aware of the necessity of maintaining at least the code minimum setback from the lot lines.	
D. Setting batter boards 1. Function of batter boards	*The student should be able to:* Build serviceable batter boards using supplied tools and materials, and emplace them properly in relation to building lines.	The student's work should be judged on the basis of *field standards* for batter boards.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
2. Construction and placement		
E. Setting final building lines	*The student should be able to:* Properly set up a builder's transit, leveling it to the inherent capabilities of the instrument.	Accuracy should be stressed. Speed is of no importance since the student is demonstrating possession of *know-how* rather than skill.
1. Builder's transit a. Proper setup and maintenance		
b. Establishing 90° and 180° angles	Make efficient use of the builder's transit in establishing angles of 180°, and of 90° left and right.	
c. Simple elevations	Make efficient use of the builder's transit in establishing an elevation above and below the bench mark.	One elevation above and one below the bench mark should demonstrate the student's ability to perform the proper arithmetical functions.
2. Triangulation	Establish an angle of 90° at the intersection of building lines by using a tape measure to obtain multiples of units 3, 4, 5.	*Overhead projection* of overlays of successively larger 3, 4, 5 triangles may be successful. Stress use of the largest practical multiple in each case.
3. Identical diagonals	Square-up the corners of a rectangle by using a tape measure to obtain diagonal measurements of ± 1/4-inch equality.	*Overhead projection* of two-color overlays of a rectangle and a *rhomboid*, each containing two diagonal lines, will demonstrate the relationship.
4. Establishing line position on batter boards	Secure building lines in their final position on the batter boards, using personally selected tools.	Emphasize unsuitability of pencil marks and nails in *retaining* the final position of the lines on the batter boards.

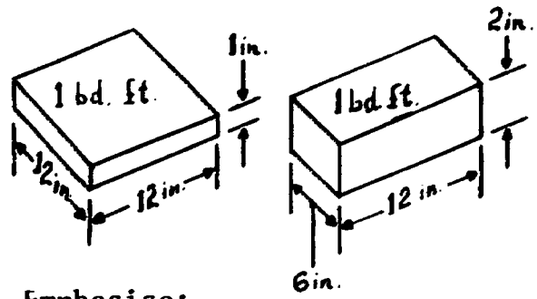
CARPENTRY

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
I. CONCRETE FORMS —— Suggested Time: 4 Days		
A. Footing		
1. Definition of footing a. What it is b. Where it is c. Why it is needed	*The student should be able to:* Identify footings as depicted in sketches, blueprints, and sectional drawings supplied to him.	The symbols for footings and for poured concrete should be learned through repeated use of blueprints and other visuals. Compare the bearing strength of several soils and rock strata.
2. Definition of pressure a. What it is b. How it is calculated	The student should: Demonstrate an understanding of pressure as weight on a surface of specified size (force per unit area). Demonstrate an understanding of area measure, as related to linear measure.	Pressure may be more easily understood by use of comparisons: A heavy, sharply-pointed knife is placed, handle down upon the palm of the hand. No injury results. However, if the same knife, evidently weighing the same, was so placed on its point the skin would be penetrated. A student steps into deep snow, sinking to his waist. The same student dons skis or snowshoes and, although now heavier, does not sink.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
3. How a footing functions	*The student should be able to:* Figure soil pressure in tons per square foot, to an accuracy of ± 5 percent, when given the size of the building, the width of the footing, and the total dead weight.	Accuracy in computing pressure is important only insofar as this exercise aids the student in understanding the function of the footing.
4. Types of footing forms a. Job built b. Prefabricated		
5. Form materials a. Plank b. Panel c. Hardware	The student should: Be acquainted with the various materials, both rough and commercially prepared, which are available for constructing footing forms.	*Opaque projection* of working drawings and jobsite photographs of the various form materials is of value.
6. Construction a. Placing components b. Maintaining dimensions	*The student should be able to:* Identify by name and function, the standard parts of a footing form as shown on a pictorial drawing.	Quality of work should be judged by field standards. Time should be appropriate to existing conditions.
c. Bracing	Build a plank footing form using personally selected tools and materials, and conforming to a supplied plan.	Cut two thin sections from the end of 1-inch S4S stock, and two from 1-inch T&G. Manipulate in an *opaque projector* to illustrate the function of a keyway.
d. Keyways	Explain the need for, and the function of, keyways.	
e. Leveling, plumbing, straightening	The student should: Be aware of the need for maintaining exact dimensions, and of building all forms level, plumb, and straight.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
7. Estimating quantities	Estimate to an accuracy of -0 to +20 percent, the materials needed to build footing forms of given dimensions.	It is important that the student acquire an insight as to the procedures used in estimating materials. It is not necessary that he, at this level, be capable of performing the functions.
	The student should:	
8. Removing the forms a. Stripping	Be aware of the reusability of most of the form materials, and thus, the need for careful removal.	
b. Cleaning for reuse c. Safety	Be aware of the hazards inherent in neglecting to immediately remove nails and neatly pile the material.	While there must be continual emphasis on safety, overemphasis can produce a negative reaction.
B. Slabs		
1. Setting form sides		
2. Reinforcement a. Why it is needed	Be aware of the low tensile strength of concrete, and the high tensile strength of steel.	Be sure that the student understands the meaning of tensile strength, coefficient of expansion, and alkaline. Use the commonplace as examples.
b. How it works c. Materials 1) Rods 2) Net	Be aware of the identical coefficient of expansion of the two materials. Be aware of the completely rust-preventative nature of the alkalines in concrete.	

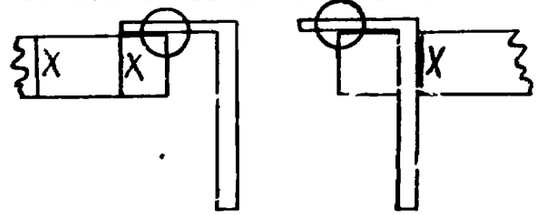
CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
3. Screeds a. Function of screeds b. Materials c. Setting d. Selecting a straight-edge e. Removing screeds	Emplace screeds to a correct height, strength, and straightness, using personally selected tools and materials. Select and prepare a usable straight-edge. Demonstrate knowledge of correct removal procedure.	The balance between required rigidity and easy removal should be emphasized.
II. LUMBER —— Suggested Time: 1 Day		
A. Dimension materials		
1. Preferred species	List the three chief species of DIM lumber, and the properties of each.	The student should understand such terms as hardness, toughness, stiffness, bending strength, and nail-holding power, and the degree to which each is possessed by the chief DIM species.
	The student should:	
2. Sizes a. Nominal b. Actual	Recognize the difference between the nominal and actual sizes of DIM lumber.	
3. Grades	Be aware of the existence of grades of lumber, the defects involved in grading, and the relationship of grade to use.	The student should understand why grading is needed, but should not be required to recognize the grade of specimen pieces.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
4. Board measure	The student should: Be aware of the difference between board measure and cubic measure. *The student should be able to:* Determine the board footage of a supplied list of DIM lumber.	Sketch several shapes containing one board foot of lumber. *Project* by either method.  Emphasize: 12 bd. ft. = 1 cu. ft.
B. Sheathing 1. Boards a. Species b. Sizes c. Types	State the three purposes of sheathing. Identify boards as being S4S, shiplap, or T&G. Properly sheath a section of deck, using supplied material and personally selected tools and fasteners.	To develop skill in use of the hammer, it is suggested that: 1) The appropriate size *box nail* be used. 2) Use of nailing-stapling *machines* be deferred.
2. Plypanels a. Sizes b. Types c. Grades	The student should: Be acquainted with the various species, sizes, types, and grades of deck sheathing panel materials, and the properties and uses of each.	
III. PLATFORM FRAMING —— Suggested Time: 15 Days		
A. Sills 1. Function of sills 2. Materials	Be acquainted with the standard materials used for sills, and the common methods of construction.	Emphasize the necessity of selecting a sill width sufficient to cover the holes in concrete block where termite block cap is not used.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
3. Installation a. Anchor bolts b. Nailing blocks	Properly secure nailing blocks in a concrete block foundation wall, using personally selected tools and materials.	
	Correctly lay out and secure sills to the nailing blocks, using personally selected tools and fasteners.	
	Correctly lay out and bore sills to be secured to an existing anchor-bolted foundation wall, using personally selected tools.	Emphasize necessity of placing each hole exactly, and boring perpendicular to the sill face. An effective teaching aid consists of two sets of two 1 x 4 boards prepared for face dowel jointing. One set is properly done; the other contains dowels and holes which are out-of-position, or off-angle.
	The student should:	
B. Girders 1. Function of girders	Understand the function of a girder as a joist support.	Transparencies and transparency masters for *overhead projection*, presenting both function and form of girders, are available from several commercial suppliers.
2. Types a. Steel b. Built-up wood	Be acquainted with the standard types of residential girders, and with the relative strengths and weaknesses of each.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
3. Fabricating a built-up beam a. Correct spacing of joints	The student should: Be aware of the necessity of placing all joints over a supporting column, and of alternating joints and solid timber to reduce lateral deflection.	Bench demonstration: Using 1/8-inch rippings of 5/4-inch pine, and 1/4-inch dowels, construct a scale, 4-member, built-up beam.
b. Correct placing of crowned material	Be aware of the necessity of placing all components so that the crowns lie in the same direction.	
c. Nails and nailing	*The student should be able to:* Assemble to field standards the supplied components of a built-up beam, using personally selected tools and fasteners.	
4. Installing the girder a. Scaffolding 1) Double post 2) Horse and plank	The student should: Be aware of such basic principles of safe scaffold construction as maintaining level and plumb, and properly cross-bracing. Be acquainted with the properties of preferred materials and fasteners.	
	The student should be able to: Properly erect a horse scaffold which will comply with section 23.19 of Industrial Code Rule 23, New York State Labor Department. Construct from supplied material, a rigid and well-braced, double-post scaffold which will conform to requirements of State Labor Department.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
b. Beam pockets	The student should: Be aware of the necessity of preventing direct contact between masonry and a wooden beam. Be acquainted with the standard methods of preventing direct foundation/beam contact.	Shop demonstration: Have students supply a dry piece of softwood (publicly check its moisture content with a meter, if possible). Place the wood on a water-soaked concrete block for several hours. Demonstrate that the moisture content has increased beyond the 20 percent decay point.
c. Temporary posts	*The student should be able to:* Select, measure, cut, and assemble with personally selected tools and fasteners, the 2 x 4 "T" posts needed to fit a described position.	
d. Body mechanics	The student should: Be aware of the hazards in placing primary strain on other than the leg and arm muscles when moving heavy objects.	Shop demonstration: Using such common items as concrete block, 50-pound boxes of nails, and 94-pound sacks of cement, demonstrate the proper manner of lifting and pushing.
5. Straightening and bracing	*The student should be able to:* Select and properly use the tools and equipment necessary for the block-and-line method of straightening and bracing a girder.	
C. Columns 1. Types a. Adjustable b. Fixed	The student should: Be acquainted with the types of columns available, and with the sizes, properties, and uses of each.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
2. Installation a. Connection to girder b. Contact with pad	*The student should be able to:* Select the required tools, and properly align, plumb, and secure in place the type column supplied.	
D. Sill header	The student should: Be acquainted with the standard on-center spacing for joists.	Printed masters and/or transparencies for *overhead projection*, which should be of assistance in teaching theory and practice of floor framing, are available from several commercial suppliers.
1. Layout for joists a. Standard b. Allowance for joist by-passing		
c. Allowance for centering plypanels	Be aware of the need to set back the first space to provide for overlapping the joists and centering plypanel decking.	Several cardboard "plypanels," scaled 1 inch = 1 foot, freely superimposed in an *opaque projector* on a joist layout of equal scale, should aid in presenting this material.
d. Doubling joists under partitions 1) Full contact 2) Spacer blocks	Be acquainted with the method of framing under partitions, of framing openings in the floor, and with the terminology involved.	
e. Framed openings 1) Trimmers 2) Headers 3) Tail joists	*The student should be able to:* Select and lay out sill headers for correct placement of joists, doublings, and framed openings as indicated on a supplied plan.	Teach use of the square in "picking-up" the layout on successive headers, in order to avoid arithmetic error. 

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
2. Installation a. Crown direction	Be aware of the necessity of setting all components "crown up."	
b. Nailing	Be aware of the temporary nature of nailing done at this point.	
E. Joists	Be acquainted with sizes, grades, and species of lumber appropriate to this use.	
1. Selection	Be aware of the need for squaring the end which contacts the header.	
2. Installation a. Crown direction	Be aware of the necessity of setting all joists "crown up."	
	The student should be able to:	
b. Straightening the header	Select and properly use the equipment necessary to straighten the headers by the block-and-line method.	
c. Nailing	Select and properly use the correct fasteners in nailing the platform framing permanently in place.	
	The student should:	
3. Ledger boards and joist hangers	Be aware of the need for ledger boards and joist hangers.	
	Be acquainted with the relative values of ledger boards and joist hangers.	Emphasize the reduced strength of the ledger board system due to the eventual splitting of the notched timbers.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
F. Bridging	Be acquainted with the purpose of bridging and the manner in which it fulfills its purpose.	
1. Function of bridging		
2. Types a. Crossmember 1) Wood 2) Metal	Be acquainted with the types of bridging, bridging materials, and the relative values of each.	Bench demonstration: Tie several hardwood dowels into a secure bundle. Demonstrate their shear resistance. Untie the bundle and break one of the dowels.
b. Solid block		Diagram the cross section of several joists tied with cross-member bridging. Show the distribution of forces acting on one joist. *Project* by either method.
3. Fabricating cross-member bridging a. Layout	Be acquainted with the use of the framing square in laying out bridging.	Bench demonstration: On chalkboard draw a cross section view of two 2 x 8 joists, 16 inches OC. Demonstrate use of the square in laying out bridging. Deliberately lay out with cut-points on the same side of stock. Show lack of fit. Discuss cause. Rework correctly, demonstrating proper fit.
b. Cutting	Be acquainted with standard methods of cutting bridging, both with handsaws and portable power saws.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to: Lay out the length and angles of bridging for a given floor, using the framing square and material supplied; build a jig for cutting the bridging with a handsaw; produce a given number of pieces in an appropriate length of time.	Shop demonstration: Build a jig and cut a number of bridging. Properly prenail and stack in "squares."
4. Installation	The student should: Be acquainted with the regulations and practice regarding the placement of bridging.	
a. Guideline	*The student should be able to:* Properly place a line to guide the installation.	
	Properly prenail bridging, using personally selected fasteners.	
b. Nailing	Properly secure the bridging in place.	Emphasize nailing only at the top of each piece, at this point. Explain when the bottoms are nailed, and why that is delayed.
G. Subflooring		
1. Aligning and bracing joists	Properly align and brace the floor joists, using personally selected tools and materials.	The student should understand the present and future difficulties which may arise from neglecting to straighten the joists before installing the subflooring.

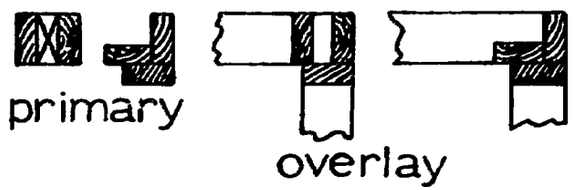
CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
2. Installation of board subfloor a. Materials b. Angled run	The student should: Be acquainted with the purposes of subflooring. Be aware of the benefits of running the boards at 45° or 30° to the header, rather than at 180°.	Bench demonstration: Construct a scale joist and header model. Use 1/2-inch brads to fasten several 1/16 x 3/4 pine rippings at 90° to the joists. Place sufficient pressure against one corner to "rack out-of-square." Remove the rippings, resquare the frame, and replace the rippings at 45° or 60° to the joists. Demonstrate the greatly increased force required for "racking."
c. Cutting and nailing	Be aware of the necessity of cutting the ends of each board to fully bear on a timber, and of "staggering" the joints.	
d. Pulling-up crowned boards	Be acquainted with the methods of straightening crowned boards.	Shop demonstration: Lay a section of shiplap or T&G, showing both the cutting and nailing methods of "pulling-up" crowned boards.
	The student should be able to: Recognize such standard subflooring materials as S4S, shiplap, and T&G.	
	Install a section of supplies subflooring, using personally selected tools and fasteners.	The student's work should be judged by field standards.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
3. Installation of plypanel subfloor		
a. Materials	Be acquainted with the properties of the types, grade, and sizes of plywood sheathing.	
	Be aware of the variety of suitable fasteners available.	
b. Joints	Be aware of the necessity of "staggering" end joints.	
	The student should be able to:	
c. Guideline	Lay out and snap a chalkline guide.	To improve hammer skill supply only *box* nails. Do not introduce stapling/nailing *machines* at this point.
d. Nailing	Emplace and correctly nail a section of plywood deck sheathing, using provided tools and materials.	
	The student should:	
H. Estimating quantities	Be acquainted with the methods of estimating quantities of materials to be needed.	Proficiency in performing the arithmetic functions involved should not necessarily be required of every student.

IV. WALL FRAMING —— Suggested Time: 7 Days

A. Shoe and plates		
1. Layout		
a. Standard stud spacings	Be aware of the necessity of maintaining standard stud spacing.	
b. First space adjustment	Be aware of the need to adjust the size of an initial space.	

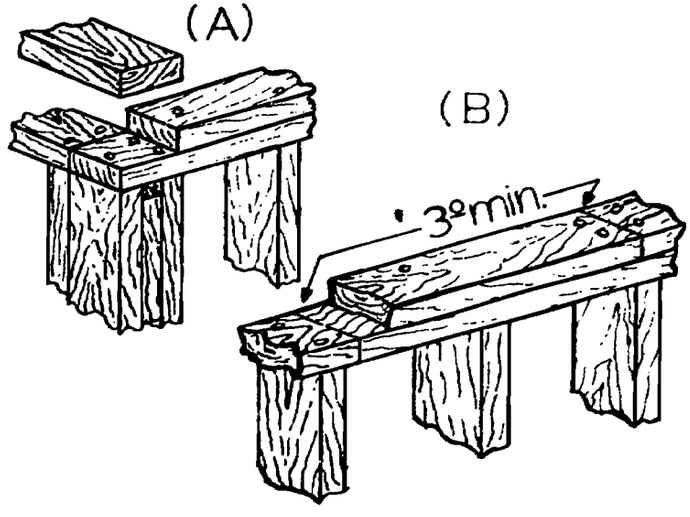
CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to: Use a framing square to lay out a section of shoe and plate for studs 16" OC, to a maximum cumulative error of ± 1/4-inch over 50 feet.	A tape measure should be used to check the layout for conformity to several 8-foot modules.
c. Corner posts 1) Function of corner posts	The student should: Be acquainted with the purpose of corner posts.	*Overhead projection* of a cross-section of different corner posts, with *overlay* of plate position should effectively demonstrate the function of corner posts.
2) Methods of assembling corner posts	Be acquainted with the several common methods of framing corner posts.	
	The student should be able to: Properly select, measure, cut, and assemble the components of a specified style corner post.	
d. Framed openings 1) Jack studs	The student should: Be acquainted with the function of jack studs and with their proper number and placement.	
2) Cripple studs	Be aware of the necessity of continuing the OC stud spacing through the cripple studs.	
	Be acquainted with the terminology involved.	
	The student should be able to: Correctly lay out a framed opening on the shoe and plate, maintaining a given R.O.	



CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
B. Studs		
1. Cutting to length a. Deriving stud length from ceiling height	*The student should be able to:* Obtain the stud length correct to ± 1/8-inch from the specified finished ceiling height.	
b. Cutting to length 1) Multiple stud jigs	Construct a jig capable of accurately cutting to length at least eight studs at one time.	
2) Safe and proper use of the portable electric saw	Cut studs to length by safe and proper use of a jig and portable electric saw.	CAUTION! *By its very nature —— light, compact, high-speed operation, restrained only by the hand of the operator —— the portable electric saw is one of the most dangerous carpentry tools. Its use by students should be only under direct and close supervision.*
2. Selection a. Separation of straight and crooked studs	The student should: Be aware of the reasons for separating the straight studs from the crooked studs, and of the lack of a standard for classification.	
b. Methods of stacking	Be acquainted with the method of stacking studs to prevent warpage and reduce moisture absorption.	Class supply of DIM lumber should be a continual demonstration of proper stacking.

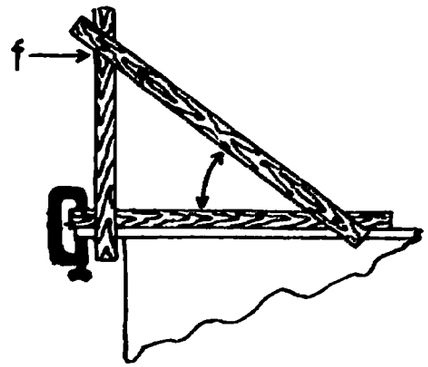
CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
C. Framed openings 1. Location a. Center to center b. Edge to edge	The student should: Be aware of the existence of two methods of dimensioning framed openings.	Masters and/or transparencies for *projection*, and residential blueprint reading texts with coordinated blueprints, are available from several commercial suppliers.
2. Size a. Blueprint schedules and specifications b. The mill book	*The student should be able to:* Determine the correct location and dimensions of a framed opening from information provided in blueprints and the local mill book.	*Opaque projection* of appropriate pages of the mill book should aid in explaining its use.
3. Lintels a. Types b. Sizes	The student should: Be acquainted with the standard methods of framing lintels, and the relative qualities of each. Be aware that lumber expands and contracts most across the width of a board, and negligibly along the grain.	Emphasize: Lintel length = R.O. + (stud thickness x number of jack studs). The teacher should be prepared to explain this characteristic of wood as an effect of its fibrous construction. Multicolor charts are available from several lumber and paper producing corporations.
D. Fabrication	*The student should be able to:* Measure and cut to an accuracy of ± 1/8-inch, and properly assemble the components of a given type lintel, using personally selected tools and fasteners.	The student should be acquainted with all of the several methods of fabricating lintels, but ability should be judged on fabrication by the method favored in the employment area.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
4. Jack studs	*The student should be able to:*	
a. Correct length	Measure and cut jack studs to an accuracy of ± 1/16-inch.	
b. Correct number	Determine from the R.O. dimensions the number of jack studs required.	Reuse of the explicatory demonstration of pressure (Carpentry, 1-A-2, Information) should aid the student in understanding the need for more surface contact of jack studs and long lintels.
	Properly install jack studs using personally selected tools and fasteners.	
5. Sills and cripple studs	Fit and install the sill and cripple studs, using personally selected tools and fasteners.	
E. Corner posts		
1. Sizes	Measure and cut to an accuracy of ± 1/16-inch, and properly assemble a specified type corner post, using personally selected materials, tools, fasteners.	
2. Fabrication		
	The student should:	
F. Estimating materials	Be acquainted with the methods of estimating the quantities of materials needed to frame the walls.	The teacher must exercise judgment regarding student ability to estimate amounts of materials. While above entry level, proficiency in estimating should be developed in those students who may profit thereby.
G. Assembling wall sections		
1. Arranging the components	Be aware of the advantages in placing all studs with crowns up.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
2. Nails and nailing	Be acquainted with the various fasteners and methods of fastening.	
3. The doubled plate a. Backset for overlap at intersecting walls	Be aware of the function of the double plate, and the proper placing of joints in relation to joints in the plate below it.	Emphasize the increased strength obtained by: (A) overlapping the double plate at corners, and (B) eliminating "knee action" by properly spacing joints in line.
b. Proper spacing of joints	*The student should be able to:* Properly fabricate a wall section from supplied components, using personally selected tools and fasteners.	
H. Erecting and bracing walls		
1. Snapping chalk guidelines	Lay out the position of the wall shoe, using either chalkbox or chalk and line, and a personally selected measuring device.	The student should be instructed in the finer points of wall erecting: Using a block of shoe material to establish the position of the inside of the wall.
2. Tacking stop blocks to box frame		

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
3. Securing brace blocks to deck	*The student should be able to:* Properly prepare a section of wall for erecting.	Raising the wall top onto blocks to provide handholds for erecting the wall.
4. Body dynamics - lifting	The student should: Be aware of the proper method of lifting heavy objects, and of the injuries probable if the proper method is not adhered to.	
5. Nails and nailing		
6. Plumbing and bracing a. Making a straightedge	Be acquainted with the methods of preparing a straightedge for plumbing walls.	Bench demonstration: Clamp a 2 x 4 - 3^{o} to the bench. Using one 16d common nail at each point, form a triangle by nailing a 2 x 4 - 4^{o} to the end of the clamped piece, and to the end of another 2 x 4 - 4^{o}. *Do not* nail the third joint. Keeping the third 2 x 4 perpendicular, move it along the clamped piece to set the "brace" at angles of 30°, 45°, and 60°, to the "shoe." Demonstrate the brace strength of each angle by placing pressure against the top of the "wall."
b. Correct angle and position of braces	Be aware of the correct angles at which braces should set. *The student should be able to:* Select and prepare to wall plumbing standards, a straightedge of specified type, using personally selected tools. Plumb a corner post or wall to the inherent accuracy of the equipment, using straightedge and carpenter's spirit level.	

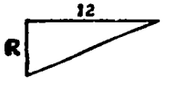
CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
I. Straightening walls		
1. Method of checking	*The student should be able to:* Use line and blocks to check straightness.	
2. Method of straightening	Straighten a wall top, using pinch bar and planks.	
J. Corner backing		
1. Function	The student should: Be aware of the need for backing all inside corners.	
2. Methods and materials	Be acquainted with the standard methods of backing inside corners.	Transparencies and transparency masters for *projecting* sketches of standard methods of backing corners are available from several commercial suppliers.
	The student should be able to: Recognize the need for backing, determine the method to be used, select the proper materials, and install the backing to field standards.	
V. SHEATHING —— Suggested Time: 2 Days		
A. Types	Recognize the common wall sheathing materials in a representative supply.	
1. Plywood		



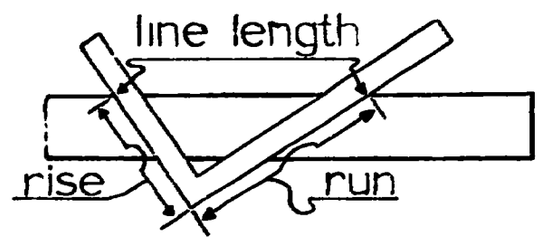
CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
2. Boards		
3. Insulating board		
	The student should:	
B. Sizes, grades, and properties	Be acquainted with the standard sizes and grades of sheathing materials.	The student should begin to retain knowledge of the available sizes, grades, and materials.
1. Tensile strength 2. Compression strength 3. Insulating value	Be sufficiently acquainted with the properties of each material to be aware of their relative advantages in use.	Relevant, commonplace comparisons should be used in explaining tensile and compression strengths.
C. Methods of application D. Nails and nailing	Be acquainted with the accepted methods of applying each sheathing material.	
E. Estimating quantities	Be acquainted with the methods of estimating needed quantities of each sheathing material.	
	The student should be able to:	
	Estimate to an accuracy of ± 10 percent, the amount of plywood/insulating board needed to sheath the walls of a given house.	The student should begin to show competency in estimating quantities of panels needed to sheath a rectangular building.
	Lay out and properly install a given type sheathing, using personally selected tools and fasteners.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
VI. SCAFFOLDING —— Suggested Time: 3 Days		
	The student should:	
A. Types	Be acquainted with the construction details of the common varieties of scaffolding.	Explain the superiority of spruce as scaffold planking.
1. Double post		
2. Single post	Be acquainted with the suitabilities of particular types of scaffolding.	
3. Wall bracket		
4. Tubular frame		Carpenter/Laborer union jurisdiction regarding tubular frame scaffolding should be mentioned.
B. Construction		
1. Base preparation	Be aware of the necessity of placing the scaffolding on firm, level ground.	
2. Assembly		
3. Plumb and level	Be aware of the critical need for maintaining plumb and level.	Demonstrate results of lateral deflection induced by out-of-plumb supports.
4. Nails and nailing	Be acquainted with the special fasteners available, especially duplex-head nails.	
5. Safety	Be acquainted with specific applications of general safety rules.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
	Construct a given type scaffold from personally selected components, using personally selected tools and equipment. The completed scaffold shall in all ways conform to Section 23.12, 23.13, and 23.20 of Industrial Code Rule 23.	A current copy of Industrial Code Rule 23 can be obtained from: State of New York Department of Labor Board of Standards and Appeals 11 North Pearl Street Albany, New York 12207
VII. CEILING JOISTS —— Suggested Time: 3 Days		
A. Layout on wall double-plate	Demonstrate those competencies acquired in installing floor joists, which are applicable to ceiling joists.	
B. Securing joists in place		
1. Crowns		
2. Nails and nailing		
C. Align and brace	Straighten the joists "by eye," and correctly tie them with materials of his own selection, or ——	
	Straighten and tie the joists, and measure, cut, and install bridging, using personally selected materials, tools, and equipment.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
VIII. ROOF FRAMING —— Suggested Time: 11 Days		
	The student should be able to:	
A. Types of roofs 1. Shed 2. Gable 3. Hip 4. Gambrel 5. Dormer 6. Combinations	Recognize, and clearly describe and sketch, the common styles of roof construction.	*Opaque projection* of photographs, sketches, plan views, and *overhead projection* of handmade or commercially available transparencies should be valuable. Pine blocks approximately 3 x 5 can be shaped to the contours of the common roof types and used as models.
B. Terminology 1. Roof a. Span b. Run	Demonstrate an understanding of terminology by correctly matching the terms to definitions or to indicated areas of a sketch.	The teacher should provide continual restatement of definition of terms as the terms are used in teaching this segment. He should, however, devise different approaches to restatement in order to prevent lack of attention due to boredom.
c. Rise d. Pitch	Figure the rise of the roof when given the span and the pitch, whether pitch is given as P = fraction or  	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
2. Rafter a. Line length b. Seat cut c. Ridge cut d. Cheek cut e. Overhang f. Projection	*The student should be able to:* Indicate on a provided sketch, the proper term for each part of a hip jack rafter.	Transparencies and transparency masters for *projection* are available from several commercial suppliers.
C. Types of rafters 1. Common 2. Hip and valley 3. Jack 4. Cripple	The student should: Be sufficiently acquainted with the four types of rafter to locate the position of each in the roof framing, and describe the inherent physical differences.	A scale roof frame containing an example of each type rafter should be a useful teaching tool.
D. The rafter square 1. Nomenclature	Be aware of the different dimensions of the body and blade of the square, and of the variety of scales thereon.	The advantages of the 12ths scale should be emphasized.
2. Using the rafter tables	Be acquainted with the tables inscribed on the square.	The seldom used board measure, brace, and octagon scales should merely be identified and explained.
	The student should be able to: Compute to an accuracy of ± 1/4-inch the line length of a common rafter, using the rafter tables and a given span and pitch.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to: Compute to an accuracy of ± 1/4-inch the line length of a hip rafter. So compute the line length of any specific jack rafter.	
E. Laying out a rafter		
1. Finding the rise and run		
2. Finding the line length a. Rafter tables b. Triangulation c. Stepping-off	Determine the line length of a rafter from a given span and pitch, using each of the three methods.	
	The student should: Be aware of the efficiency and accuracy limitations of each method.	Bench demonstration: Triangulation - Let a number on the body of the square represent the *run*, and a number on the blade represent the *rise*. Place the square on a straightedge running through these numbers, marking both arms of the square. Using the 12ths scale, measure between the marks. Consider 1 inch = 1 foot. This is the *line length* of a rafter. 

CONTENT

3. Finding the angles of cuts
   a. Ridge cut
   b. Seat cut
   c. Cheek cut

OBJECTIVES

The student should:

Be acquainted with both the rafter table, and "intersection" methods of establishing the angle of cheek cuts.

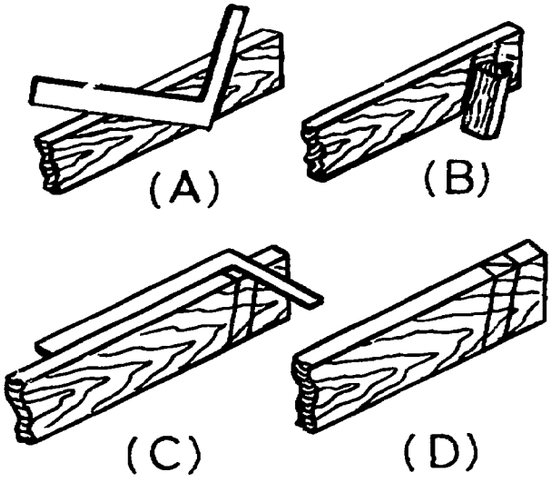
The student should be able to:

Lay out to an accuracy of ± 1/16-inch the angles of ridge cuts, seat cuts, and cheek cuts.

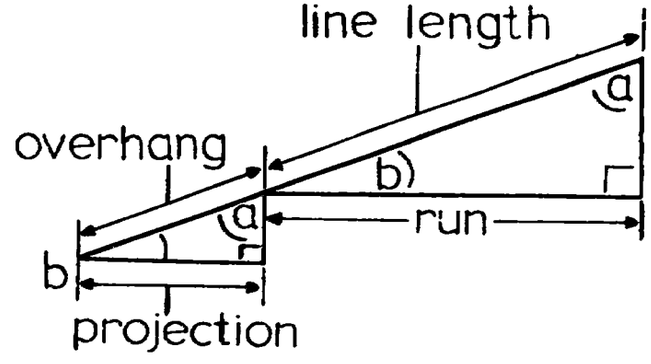
INFORMATION FOR THE TEACHER

Bench demonstration:

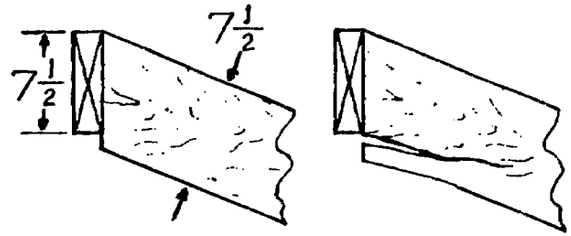
Cheek angle - On the face of a length of rafter stock, lay out the angle of the ridge cut (A). Place a piece of the same thickness "on edge" against the line. Draw a line along the opposite side of this piece (B). Square both lines across the edge of the rafter (C). Draw a diagonal between appropriate corners. This "intersection" is the correct angle for the cheek cut (D).



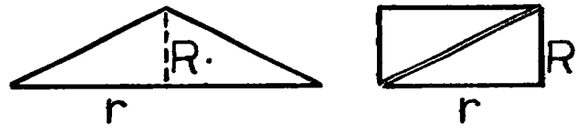
CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
4. Allowing for ridge board	Properly cut back for half the thickness of the ridgeboard ± any error in the length and/or angle of cut.	
5. Laying out the overhang	Lay out a rafter overhang which will continue the pitch to within ± 1/2-inch of specified projection.	Emphasize the relationship of the overhang/projection to rafter/run, as that of proportional triangles. Angles/cut points are constant; only lengths change.
6. Backsetting a hip rafter	Backset or relieve a hip rafter sufficiently to maintain a flat plane across the upper edges of adjacent rafters.	
F. Cutting a rafter		
1. Setting crown direction		



CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
2. Safe and proper use of the portable saw a. The job site b. The saw blade c. The electricity	The student should: Be aware of the inherently hazardous nature of portable electric saws. Be acquainted with all safety regulations regarding the portable electric saw, its power supply, and the work area. *The student should be able to:* Recognize the type saw blade required, and select, from a supply of the four common types, a properly set and sharpened blade of the correct type.	Stress the need for a clean, uncluttered, *dry* work area; correct power supply and leads; sharp, properly-set blades of the correct type; properly functioning blade guards; and secure lumber supports. Emphasize the wisdom of unfailing use of eye protectors and other safety devices.
3. Cutting and checking a pattern	Prepare the work area, check and set up the saw, and properly cut a rafter, assiduously observing all safety rules and procedures.	The student should be acquainted with job-built jigs which enable portable saws to bevel beyond 45° for making cheek cuts.
4. Cutting duplicate rafters	Make use of the prepared pattern in fabricating the additional rafters needed.	The student should not only know that rafter stock should be layed out "crown up," he should understand why. He should know that the pattern must be held on the stock so that the edges coincide at ridge cut and seat cut.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
G. Laying out a ridge board	Be aware that the ridgeboard material must be wider than the rafter stock.	Make a ridgecut on a length of DIM material. Place a block of the same material in the position of the ridgeboard, keeping the tops even. Describe the results of leaving the rafter ends partially unsupported.
1. Standard rafter spacings	Be aware that rafter layout usually follows that of the ceiling joists.	
2. Adjustment of initial space		
3. Framed openings a. Dormer b. Chimney	Be aware of the necessity of making the chimney rough opening 4 inches larger than the actual dimensions of the chimney.	
H. Fabricating a roof		
1. Securing rafters to a ridge section	Be acquainted with the method of raising sections of roof frame.	
2. Raising the section		
3. Securing rafters to the plate		
4. Plumbing and bracing the section		
5. Filling in remaining rafters	Be aware of the need to alternate sides of the ridge after emplacing no more than four successive rafters.	Explain the difficulty in removing the lateral deflection in the ridgeboard which is induced by many rafters being emplaced on one side at a time.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
6. Securing in place, the hip, jack, and cripple rafters	Lead a peer group in assembling, raising, plumbing, and bracing a section of roof frame, using personally selected tools and equipment.	
I. Cable ends		
1. Laying out stud location	Lay out stud location to an accuracy of ± 1/8-inch on 8-foot modules.	
2. Using a story-pole to measure stud lengths	Use the 2 x 4 and spirit level to obtain the lengths and cut of a number of gable studs.	Emphasize the "fool-proof" nature of this method of transmitting lengths from measurer to sawyer.
3. Nails and nailing	Stud-up a gable using personally selected tools and fasteners, maintaining the longitudinal straightness of the end rafter.	
	The student should:	
J. Collar beams	Be aware of the purposes of collar beams, and their location in the roof framing.	
1. Function		
2. Materials	Be acquainted with the materials commonly used for collar beams.	
3. Locating a. Height b. Spacing		
4. Installation	*The student should be able to:* Properly install a set of collar beams, working alone and as a team leader, using personally selected tools and equipment.	The student should be acquainted with the making and use of an "old man."

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
K. Sheathing	Correctly sketch or describe the common types of roof sheathing, and select a given type from a representative sample group.	*Opaque projection:* In estimating gable-end sheathing, cut a scale gable end from construction paper. Cut again on the rise line and join the pieces at the hypotenuses to demonstrate that a rectangle can be formed. Therefore, *run* x *Rise = area.* 
L. Estimating materials	Estimate to the degree of accuracy standard for each material, the amounts needed for the described area.	

IX. EXTERIOR FINISH —— Suggested Time: 23 Days

	The student should:
A. Cornice	Be acquainted with the common styles of cornice.
1. Types a. Open b. Box	Be acquainted with the common materials used in cornices.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
2. Building a box cornice a. Nomenclature b. Materials 1) Type 2) Quantities	Correctly identify the parts of a box cornice as shown on a furnished section drawing.	
c. Fabrication 1) Leveling and straightening 2) Rake intersection 3) Nails and nailing	Properly build a box cornice on an existing frame, using personally selected tools and the materials indicated on a supplied plan.	Rake intersection angles can be obtained by the same method used for rafter cheek cuts (Carpentry, VIII, E.3).
B. Roofing		
	The student should:	
1. Types a. Roll roofing b. Strip shingles c. Hot built-up	Be well acquainted with the weights, uses, and properties of such common materials as coated roll roofing, selvedge-edge roofing, strip shingles, and multiple-ply, hot built-up roofing.	Types a and b should be taught as part of a carpenter's and roofer's work. Type c may be so taught or merely explained as background information, at the teacher's discretion.
	Be aware of the difference between "water*proof*" and "water*shed.*"	The relationship of roof pitch to selection of materials (waterproof/watershed) should be emphasized.
2. Slater's felt a. Function b. Weights	Be acquainted with the function of slater's felt, both as temporary watershed and as undercourse with roofing materials.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
3. Drip edge a. Types 1) Metal a) Aluminum b) Galvanized iron 2) Cedar shingle	The student should: Be aware of the function of drip edge. Be acquainted with the properties of the more common types of drip edge.	The student should be made aware of the high initial cost of cedar shingle drip edge, of the need to paint galvanized iron, of the low strength and high coefficient of expansion of aluminum.
b. Methods of application c. Special tools and fasteners	*The student should be able to:* Correctly apply slater's felt. Correctly apply all common types of drip edge, using personally selected tools and fasteners.	
4. Flashing a. Materials 1) Copper 2) Aluminum	The student should: Be aware of the function of flashing, and of the properties of the two common materials.	
b. Locations 1) Valley 2) Chimney 3) Wall	Be acquainted with the common locations requiring flashing, and the shapes necessary to proper functioning in each such location.	
c. Special tools and fasteners		The teacher should avoid use in class of those sheet metal forming tools which are not generally used by carpenters in fabricating flashing.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
d. Methods of application	Be aware of the need to allow for considerable expansion and contraction of the metal.	
	The student should be able to:	
5. Applying roofing a. Layout b. Materials 1) Nails 2) Cements	Lay out and apply coated and selvedge edge roll roofing. Select the correct nails and proper cement locations for various given roofing problems.	
c. Methods of application 1) Plane surfaces	Lay out vertically and horizontally for strip shingles. Properly apply strip shingles, 5 inches to the weather.	The value of laying out from a vertical center should be emphasized. The fabrication and use of roof brackets should be taught, where pitch requires scaffolding.
2) Ridge and hip caps	Fabricate from strip shingles, and properly install ridge and hip caps.	
6. Estimating roofing quantities	Estimate to an accuracy of + 1 roll, or + 2 bundles the roofing required, given span, pitch, and roof type.	Units of purchase and the area covered thereby should be taught.
C. Window and door units		
1. Types of window a. Double hung b. Casement c. Vent d. Gliding	Identify by sight or sketch the four common window types, and state the advantages and disadvantages inherent in each.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
2. Types of doorway a. Hinged 1) Single 2) Double 3) Side light 4) Dutch b. Gliding	Identify by sight or sketch the common types of doorway.	Photographs, sketches, section drawings, and mill book pages screened by *opaque projection* should aid in fixing identification.
3. Nomenclature of units	Identify on supplied photographs or sketches such common parts as sills, head and side jambs, rails, stiles, and stop.	
4. Use of the mill book	Locate in the supplied mill book the door or window unit specified, and determine such important factors as size, cost, and included accessories.	The student should be familiar with the range of information contained in the mill book and how to find it, rather than be adept in its use.
5. Methods of installation a. Plumbing, straightening, squaring b. Nails and nailing	Install a given window/door unit to field standards of level, plumb, and square, using personally selected tools and equipment.	
D. Walls		
	The student should:	
1. Vapor barrier a. Slater's felt b. Polyethylene film	Be aware of the function of vapor barrier, and the relative efficiency of the common materials.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
2. Siding materials a. Wood 1) Shakes 2) Bevel siding 3) Vertical board, jointed 4) Board and batten b. Aluminum c. Composition	Be acquainted with the various materials currently used, and the properties of each.	
3. Methods of application a. Story pole b. Siding hook c. Nails and nailing d. Special tools and fasteners e. Corner treatment 1) Metal caps and extrusions 2) Corner boards 3) Compound bevels	Be acquainted with the methods of applying the more common siding materials. *The student should be able to:* Maintain field standards of workmanship in laying out and applying a representative section of a supplied siding material, using personally selected tools, equipment, and fasteners.	The student should be required to prove entry-level proficiency only with the materials most commonly used in his geographical area. Quality of the work, and proper procedures should be the criteria —— speed being, at this level, a negligible factor.
E. Estimating quantities	Estimate to an accuracy of ± 5 percent the amount of materials to be ordered.	While careless arithmetical work should not be ignored, the correct method rather than the correct answer is of prime importance.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
X. INTERIOR FINISH —— Suggested Time: 27 Days		
	The student should:	
A. Insulation	Be acquainted with the uses of insulation.	
1. Types a. Thermal b. Acoustic		
2. Transfer theory a. Heat b. Sound	Be aware of the means by which heat and sound are transferred.	The teacher should be prepared to explain the theory of molecular motion. Use can be made of transfer of motion from cue ball to one or many pool balls, depending on the density of grouping.
3. Materials a. Blanket and batt 1) Mineral fiber 2) Glass fiber 3) Reflective foil b. Solid and fill 1) Vegetable fiber 2) Expanded mica 3) Expanded polystyrene	Be acquainted with the common insulating materials, their properties, and relative general efficiencies.	Relate insulation type to means of transfer: reflectives/radiation, loose fibers/conduction packaged fibers/convection. The student should be alerted to the need for eye protection when working with glass fiber insulation, and of the need to avoid inhaling particles or trapping them between skin and clothing.
	The student should be able to:	
4. Application a. Fasteners 1) Nails and staples 2) Mastics	Select the proper tools, equipment, fasteners, and materials for insulating: 1) between studs, 2) between open ceiling joists, and 3) inside a small pipe duct, and —— Properly install insulation in the three specified places.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
b. Vapor barrier position	Be aware of the necessity of placing vapor barrier between the room and the insulating material.	The teacher should be prepared to explain how being wet negates the insulating ability of most materials.
B. Walls and ceilings		
1. Drywall	Be aware of the nature of gypsum board, its properties, and the sizes available.	
a. Sizes		
b. Methods of application c. Special tools and fasteners	Be acquainted with the standard methods of application and the necessary tools and fasteners.	Bench demonstration: Place on a contrasting background, a 4d blued lath nail, a 4d spiral-twisted nail, and a 1 3/8-inch annular-grooved nail. Screen together in an *opaque projector*, identifying each. Drive each nail 1-inch deep into a 2 x 4. Carefully pull the nails, emphasizing the force required for each. Repeat *projection*, showing torn wood clinging to annular-grooved nail.
d. Corner beads	*The student should be able to:* Properly install a section of drywall ceiling, using supplied gypsum board and personally selected tools and fasteners.	
e. Finishing: joints and nailheads	Properly finish the corners, joints, and nailheads.	
	The student should:	
2. Paneling	Be acquainted with the common paneling materials, and the more important properties of each.	
a. Types		
1) Board		
2) Plywood		
3) Composition		

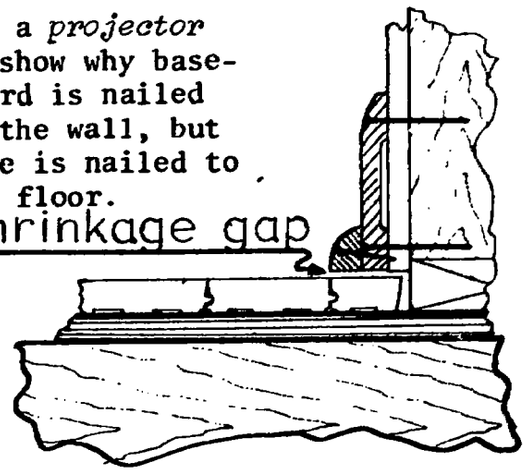
CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
b. Application 1) Methods 2) Special tools and fasteners 3) Moldings	The student should: Be acquainted with the methods of application used with the common paneling materials, and with the special tools, fasteners, and moldings required.	CAUTION! *The toxic and flammable nature of most contact cements, and the necessity of following manufacturer's instructions concerning ventilation, temperature, and sources of possible ignition, should be strongly emphasized.*
3. Estimating quantities	*The student should be able to:* Estimate to an accuracy of ± 5 percent the amount of gypsum board or sheet paneling, and to ± 10 percent the amount of board paneling, moldings, and fasteners to be ordered for a specified part of a supplied blueprint/specification.	
C. Floors		
1. Strip flooring a. Species, sizes, grades	The student should: Be acquainted with the species sizes, and grades of strip flooring in common use. Be aware of the use of softwoods as well as hardwoods for strip flooring.	
b. Special tools and fasteners	Be acquainted with the special tools and fasteners used in installing strip flooring.	The teacher should be prepared to explain *why* "cut" nails are less likely to split the flooring.

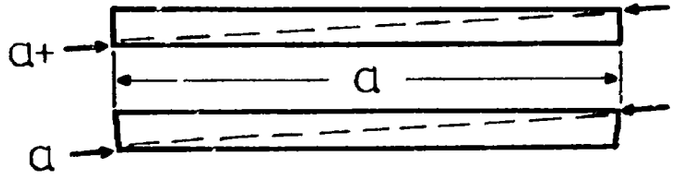
CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
c. Installation 1) Vapor barrier 2) Marking joist location	Properly install a vapor barrier, and mark the location of joists.	Bench demonstration: Make a spline. Show how it is used to reverse the direction in which strip flooring is being laid. 
3) Laying out material	Lay out material ahead of a nailer, properly cutting the ends to reduce waste. Fasten flooring by use of both hammer and nailing machine.	Clamp a length of flooring to the bench. Show how groove end will fit to tongue edge and vice-versa in changing direction 90°. Cut a rabbet across the bottom of an end of flooring to show how a 90° fit can be made.
4) Fastening final rows	Pull up to field standards of tightness, and fasten the final rows of flooring.	
5) Changing direction	Use an approved method of changing the direction of flooring by 90° and by 180°.	 
d. Sanding and finishing 1) Special tools and equipment		

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
2) Methods of sanding	Be acquainted with the process of sanding and finishing strip flooring.	
3) Methods and materials for finishing	Be aware of the variety of fillers, sealers, and finishes available.	
2. Composition flooring a. Types 1) Yard goods 2) Tiles	Be acquainted with the variety of materials available, and with the more important properties of each.	Of primary importance is an awareness of the variety of materials available and the inherent characteristics which make any one unsuitable for some uses.
b. Materials 1) Vinyl 2) Linoleum 3) Asbestos 4) Rubber 5) Cork		
c. Underlayment and vapor barrier		
d. Layout		
e. Adhesives and solvents	Be aware of the fire and health hazards inherent in some adhesives and solvents.	Students should not be required to "memorize" a list of materials - properties - adhesives - uses, but rather, taught to "check-out" these aspects before selecting a material for a specific use.
f. Special tools and equipment	Be aware of the special tools and equipment in use.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
g. Methods of cutting and laying h. Cove base	Lay out and install a section of flooring consisting of tiles of a specified material and vinyl cove base, choosing tools, adhesives, and solvents appropriate to the materials.	Student proficiency should be judged on the quality of the work, time being of little importance at this point.
3. Estimating quantities	Estimate to an accuracy of ± 10 percent the amount of strip flooring or composition tile which should be ordered for a specified installation.	
D. Trim		
1. Jambs	Select the proper tools and methods to perform the listed jobs:	
a. Straightening to required width	Straighten the parts of a stock door jamb, reducing for a stated wall thickness.	Since the edges of the jamb are beveled, the trim setback is the point of measurement for width.
b. Cutting to required size c. Assembling and bracing	Cut jamb parts to proper length, assemble the jamb, and brace square and true.	Emphasize the need for checking actual door width, jamb dado depth, and desired floor clearance before cutting jamb parts to length.
d. Setting jambs 1) Leveling the head 2) Plumbing, shimming, straightening 3) Nails and nailing	Install the jamb, straight and plumb, in its rough opening.	The effects on door function of out-of-plumb jambs should be explained.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
2. Window stool and apron a. Scribing the stool b. Finishing stool ends c. Fitting the apron d. Finishing the apron ends e. Fastening in place	Prepare and install to field standards, the stool and apron of window trim, using personally selected tools and materials.	The use of the coping saw in returning the ends of apron and stool should be mastered. The need for a brace between apron and floor when nailing stool to apron should be demonstrated.
	The student should:	
3. Casings and stops a. Styles — the mill book	Be aware of the variety of styles available, and of the usefulness of the mill book in identifying and ordering a particular style.	*Opaque projection* of pertinent pages of the mill book should be an effective method.
b. Mitered joints c. Coped joints	Be acquainted with the several tools available for more efficient and accurate mitering and coping.	The student should be proficient in use of the commercial miter box and trimmer in mitering and in preparation for coping.
	The student should be able to:	
d. Nails and nailing	Properly cut, fit, and install the casings and stops required for a specified window and door jamb, using personally selected tools and equipment.	Proper use of the nail set should be taught.
4. Baseboard and shoe a. Styles b. Installation	Properly cut, fit, and install in a specified area the required baseboard and shoe, using personally selected tools and fasteners.	Emphasize starting the installation so that the final piece will have an "open" end.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
		Use a *projector* to show why baseboard is nailed to the wall, but shoe is nailed to the floor.
		
		
5. Doors a. Type 1) Panel 2) Flush a) Solid core b) Hollow core	The student should: Be aware of the different type doors available and of the various species of wood used.	
b. Materials		
c. Fitting a door 1) Making a door jack	*The student should be able to:* Construct a simple door jack from job site scrap materials.	
2) Using the portable electric plane	Set up and safely operate the portable electric plane.	It is recommended that the student be proficient with the jointer before progressing to power planing.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
3) Back-beveling edges 4) Jamb clearance	Fit a door with 1/8-inch to 3/32-inch total side clearance, and properly back-beveled.	The need for back-beveling can be demonstrated by measuring the distance across the face of a door, and from edge to edge through its thickness. 
d. Hanging a door 1) Laying out the gains 2) Using the butt gage	Lay out gains for a correct swing of the door.	
3) Using the portable router and template	Cut gains no more than 1/64-inch oversize, and install butts in both door and jamb.	The student should be proficient with butt gage and butt chisel, before progressing to router and jig.
4) Using power screwdrivers	Hang the door, placing hinge pins without moving the screws.	Only a light hammer blow should be necessary to enable the leaves of the butts to mesh.
5) Adjusting the butts	Pack out butt leaves if necessary to properly align the door in its jamb.	
	The student should:	
6. Hardware a. Sash locks, lifts, balancers 1) Types 2) Installation	Be acquainted with the several types of sash locks and operators in common use.	The student should be able to identify common sash locks as such, and have a basic understanding of the mechanical function of sash balancers and operators.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
b. Door stops 1) Types 2) Installation	Be acquainted with such common door stops as the baseboard, floor, and hinge-pin types.	The student should be able to identify common door stops as such. Inclusion of pneumatic and hydraulic closers is at the teacher's discretion.
c. Door locks 1) Types and properties	Be acquainted with the modern types of rim lock, mortise lock, and tubular lock, as well as simple bolts and safety chains.	The student should be able to identify the common locks by type.
	Be aware of the relative usefulness of each type.	The teacher is cautioned *against* demonstrating the security weakness of a lock type.
	Be aware of the method of installing each type.	
	The student should be able to:	
2) Installation a) Locating the height b) Using templates	Lay out to a specified height, the position of a tubular lock, using supplied templates or jigs.	
c) Using the expansive bit d) Using the hole saw	Bore the required holes, using a personal choice of available tools.	Proficiency in the use of both hand and power tools should be developed.
e) Safe and proper use of chisels	Inlet the striker and plate, tight, true, and flush with the stile, using a personally selected and prepared wood chisel.	Proper sharpening and safe handling of wood chisels should be stressed.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
f) Assembling the lock set	Assemble the lock set so that all parts are correctly aligned and function freely.	Emphasize care in avoiding marring the lock finish.
g) Locating and installing the striker plate		Teach use of installed striker to locate position of striker plate on the jamb.
h) Adjusting the stops	Adjust the stops to field standards of fit.	Emphasize allowing for the finish on stops and door when setting the stops.
E. Stairs		
1. Terminology a. Rise 1) Total 2) Unit	Identify on provided appropriate sketches, all listed common terms.	Transparencies and transparency masters for *projection* are available from several commercial suppliers.
	The student should:	
b. Run 1) Total 2) Unit c. Riser d. Tread	Be acquainted with the sizes, grades, and species of materials commonly used in stair building.	
e. Stringer 1) Plain 2) Housed	Be aware of the processes involved in building both plain and housed stringers.	The student should merely see how a housed stringer differs, that he may understand the added work involved.
f. Nosing		Only a simple wall-mounted rail should be considered at this level.
g. Rail		

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
2. Building a plain stringer stairs		
	The student should be able to:	
a. Determining total rise and run	Figure the total rise and run of a stairs from a sketch containing the ceiling height and other necessary information.	
b. Determining unit rise and run	Derive the unit rise and run on a basis of stock tread sizes and 7 1/2-inches, ± 1/2-inch as the rise.	This method should prove to be more easily taught than the obsolescent "easy stairs number" method.
c. Laying out the stringer 1) Using the framing square 2) Using stair gages	Locate the crown and use the framing square to lay out the cuts on the stringer stock provided.	This procedure can be related to the "stepping-off" method of figuring rafter length. (Carpentry, VIII, E.2c)
d. Dropping the stringer	Properly allow for tread thickness.	
e. Placing the stringers f. Installing risers and treads 1) Stock tread sizes 2) Nails and nailing	Assemble the components in the proper manner using personally selected tools and fasteners; the completed stairs conforming to field standards of rigidity and workmanship.	Bench demonstration: Select some available object such as a work-bench top to serve as a "second-floor." Have the students figure a stairs to it. Use the correct figures to lay out and cut stringers. Install risers and treads, and plywood "finished floor" clamped to bench top.
g. Installing a rail 1) Establishing dimensions	Derive the length and height of rail from a supplied sketch.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
	Cut the supplied handrail to length and return the ends.	
2) Installing brackets	Properly locate and attach hardware to the rail.	Emphasize care in protecting the finish of walls, rail, and hardware, especially avoiding off-angled or burred screws.
3) Attaching the rail	Secure the rail to the wall, maintaining the correct position and angle.	

MASONRY

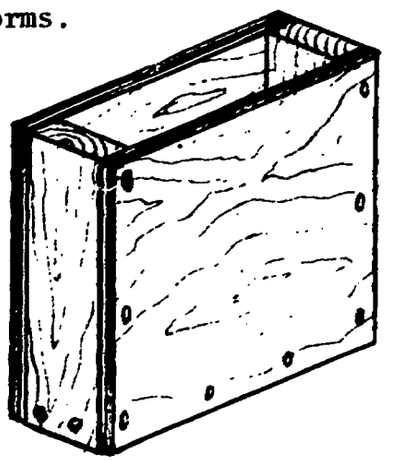
CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
I. CONCRETE — Suggested Time: 4 Days		
A. Composition	The student should:	
1. Cement a. Preparation	Be acquainted with the nature and manufacture of portland and masonry cements.	As introductory information, this material should not be subject to testing.
b. Types	Be aware of the availability of various types of cements, each possessing unique qualities which adapt it for specific uses.	It is important that the student know that there are different cements, but not that he memorize types, properties, and designations.
c. Function	*The student should be able to:* Correctly describe in simple, non-technical terms, the function of cement in concrete.	
d. Proper storage	Describe the proper methods of storing cement in various hypothetical, but typical jobsite conditions.	It is important that the student know how to store cement to prevent exposure to moisture.
2. Aggregates a. Types 1) Heavyweight 2) Lightweight	The student should: Be aware of the availability of different aggregates to meet specific weight requirements.	
b. Groups 1) Course 2) Fine	Be aware of the existence of a wide range of aggregate particle sizes, and the need for several sizes in any concrete mix.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
c. Function	Be acquainted with the function of aggregates in the mix.	
3. Water a. Purity	Be aware of the effects of oil, vegetable matter, and other impurities in the mix water.	As a "rule-of-thumb," the mix water should be chemically and mechanically as pure as drinking water.
b. Function	Be aware of the function of water in the mix.	The student should understand that water enters into the crystalline structure of the concrete, rather than evaporating, thus making it possible to "set" concrete under water.
B. Preparation		
1. Proportions of mix a. Rich b. Lean	Be acquainted with the standard proportions of the common concrete mixes.	The student should know the proportions and aggregate sizes used in the standard mixes for footings and slabs.
c. Effects of excessive water in mix d. Properties of mixes 1) Tensile strength 2) Compression strength 3) Resistance to weathering	Be aware of the change in properties of the concrete caused by changing the type of cement or proportions of the mix.	The student should not, at this point, be expected to know which mixes produce which properties, but merely that such changes are possible. Air-entraining cements should be explained.
2. Methods of mixing a. Hand mixing b. Machine mixing c. Ready mixed	Be acquainted with the methods of mixing the components of concrete.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
	Combine in correct proportion, the components of a specified amount of concrete, and mix to proper consistency using the equipment provided.	The student should experience mixing, both by hand and in mixing machines.
C. Blueprints		
1. Plan view		
2. Section view		
3. Specifications		
D. Pouring		
1. Temperature limitations	The student should:	
a. Covering	Be aware of the need to prevent concrete from freezing during the curing period.	The teacher should be prepared to explain the effects of freezing on the crystalline structure of concrete.
b. Antifreeze materials c. Type III cements d. Heating the components	Be acquainted with the methods used to prevent freezing.	The student should know that many antifreeze preparations actually accelerate the hardening of the mix rather than lower its freezing point, and that those true antifreeze materials decrease the strength of the mix when added in amounts large enough to lower the freezing point appreciably.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
2. Methods a. Chutes b. Buckets c. Wheelbarrow	The student should: Be aware of the common methods of pouring concrete on light-construction jobsites.	The student should experience moving concrete by chute and by wheelbarrow. Films, field trips to jobsites, or individual observation should suffice for understanding the use of cranes and buckets.
3. Hydration a. In air b. Under water	Be acquainted with the precautions required to prevent dilution of concrete placed under water, or loss of water in mixes placed on sand. Be aware that concrete produces heat while setting.	
4. Curing a. Maintaining temperature	Be aware that heat accelerates and cold retards curing of the mix so that concrete poured in temperatures of less than 50° F. must be protected during curing.	Emphasize the need to keep all components above freezing temperature (never heat the cement), but the mix itself below 80° F.
b. Maintaining moisture	Be aware that from 3 to 12 days is the normal span of curing time, and that the mix must be kept moist to develop full strength.	Bench demonstration: Make some rock candy. Compare its need for sufficient moisture throughout crystallization, with the need for moisture in curing concrete.
E. Uses		
1. Footings and piers a. Mixes	*The student should be able to:* Demonstrate by simple definition, and by locating on a provided sketch or blueprint, an understanding of the nature of footings and piers.	An understanding of the function of these members is prerequisite to appreciating the need for care in building them.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
b. Forms 1) Clean 2) Ready	Be aware of the need for forms to be clean, tight, and well braced, and of the ensuing problems should they not be.	
c. Reinforcement 1) Function	Be aware of the function of iron in preventing shearing of concrete.	As an oversimplification, reinforcing rods in concrete may be compared to wired glass.
2) Types	Be acquainted with the form of reinforcing commonly used for this purpose.	A brief description of the duties of the iron worker may be valuable.
	Be aware of the identical expansion coefficients of concrete and iron.	Reinforcing rods should be mentioned as *dowels* used in lieu of a keyway, as well as in use within a concrete member.
	Be aware of the rust-preventative nature of the inherently alkaline concrete.	
d. Vibrating 1) Function 2) Methods	Be aware of the need for prevention of air pockets in a pour.	Bench demonstration: Build two exceedingly tight forms.



CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
		Mix sufficient stiff, lean concrete to fill both forms. Quickly pour the 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."
e. Screeding 1) Function 2) Method	The student should: Be acquainted with the common methods of screeding.	
f. Curing	*The student should be able to:* Discern any condition of form or reinforcing which would delay a pour.	
	Vibrate and screed to produce a smooth, dense concrete.	The student should use only shovel or board tamp to work the concrete at this point.
2. Walls and columns a. Mixes b. Reinforcement c. Pouring and vibrating d. Curing	Properly use an immersion-type vibrator.	Stress the importance of vibrating while filling the form rather than after it is full, and of constantly moving the vibrator to avoid puddling the grout.
e. Finishing 1) Filling holes	Demonstrate proficiency in filling tie-rod holes and small honeycombs, using a wooden float and a stiff mixture of sand and cement.	Where appearance is important, grey and white cements can be blended to match the pour.
2) Removing form marks	Remove small projections by use of carborundum stones.	Power grinders should not be introduced at this point.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
3. Slabs a. Mixes b. Reinforcement 1) Rod 2) Net	The student should: Be aware of the use of net reinforcement in place of rods in some slab pours.	
c. Expansion joints 1) Function	Be aware of the need to provide for thermal expansion in long units of concrete.	All students should be familiar with the "tar" joints in concrete paved highways.
2) Methods and materials	Be acquainted with the methods and materials used to provide expansion joints in concrete.	The commoner materials —— asphalt, asphalt-impregnated fiberboard, vinyl —— should be introduced.
d. Pouring and vibrating e. Screeding	Be acquainted with the support forms installed by the carpenter to set the grade and guide long screeds.	Both 2 x 4 and pipe supports should be introduced.
f. Finishing 1) Wood float 2) Steel trowel 3) Machines	Be acquainted with the tools used to finish concrete, and the characteristics of the finish obtained.	Stress the selection of float or trowel finish on the basis of slipperiness, ease of cleaning, and surface density.
	The student should be able to: Impart a commercially acceptable finish to concrete —— float and trowel, hand tool and machine.	The student should be familiar with the operation of concrete finishing machines, but emphasis should be on attaining proficiency with hand tools.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
4. Damp-proofing a. Sealers b. Bituminous coatings c. Membrane d. Polyethylene spray	The student should: Be aware of the need for damp-proofing subterranean concrete structures in poorly drained soils. Be acquainted with the common damp-proofing materials, the properties of each, and the methods of application. *The student should be able to:* Properly apply two coats of asphalt-asbestos damp-proofing to a section of foundation wall.	The student should be judged on the neatness as well as the completeness of the application.
II. BLOCK CONSTRUCTION —— Suggested Time: 10 Days		
A. Types 1. Heavyweight 2. Lightweight	State, in simple terms, the criteria regulating use of the two types of masonry blocks.	Emphasize the nonload-bearing nature of lightweight blocks.
B. Shapes and sizes	Correctly identify, among provided samples, the more common shapes of block. State the dimensions of standard block shapes.	At this point, samples should be limited to stretcher, corner, jamb, and partition (solid) block.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
C. Mortar		
1. Proportions of mix	*The student should be able to:* Prepare a specified amount of mortar, the components of which will be proportioned properly for laying block walls under moderate weather conditions.	Only Type I cements should be used at this point.
2. Maintaining plasticity	Retemper mortar whose workability has decreased due to evaporation of water.	The relationship between ambient temperature and time since mixing should be the basis for deciding whether stiff mortar can be retempered or has begun to "set" and should be discarded.
D. Layout of the bond	The student should: Be acquainted with the most common styles of laying block.	Emphasis should be on the running bond since this style is most often used.
1. Running	Be aware of the method of layout used for each style.	
2. Stacking		
E. Laying block		
1. Mortar bedding a. Full bedding b. Face shell bedding c. Buttering headjoints	Be acquainted with the methods of setting the block in mortar. Be aware of the conditions under which each method should be preferable.	Full bedding is normally used only at the footing where it serves as a substitute keyway, and in columns, piers, and pilasters.
2. Applying mortar a. Spreading b. Swiping	*The student should be able to:* Apply mortar to blocks by both spreading and swiping, such bedding conforming to field standards of workmanship.	The student must become adept in use of the trowel.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
3. Running up corners a. Maintaining height b. Maintaining uniform joints c. Plumbing, leveling, straightening	Run up a corner six courses high; straight, level, and plumb, with uniform joints, whose total height shall be 48 inches, ± 1/4-inch.	Evaluation should be based on the quality of the work, time being considered only in relation to set up of the mortar.
4. Running stretcher courses a. Stringing lines 1) Line pins 2) Line clamps	The student should: Be aware of the necessity of stringing lines. Be acquainted with the common methods of attaching lines.	The student should be capable of stringing lines with commercial hardware or by improvising with nails or weights.
b. Plumbing and straightening	*The student should be able to:* Lay to field standards of plumb, level, and uniformity, four stretcher courses of at least 10 blocks length.	The student should become proficient in use of the mason's spirit level.
c. Cutting and dressing 1) Brick chisel 2) Masonry saw	Cut and dress block to length and to height, to an accuracy of ± 1/4-inch using the brick chisel, and ± 1/8-inch using the masonry saw.	Proper safety procedures in use of the masonry saw must be emphasized.
d. Setting the closure block 1) Maintaining joint size 2) Maintaining mortar bond	Set the closure blocks level and true, maintaining joint size within ± 1/8-inch of uniformity, and perfect mortar bond at all points.	Emphasize the necessity of lowering the block in as level a position as possible.
e. Setting brick ties	The student should: Be aware of the need to tie brick or stone facings to the block wall.	Bench demonstration: Make a quantity of wooden "bricks" of about 1/4-inch = 1-inch scale. Position these

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
		so as to simulate a section of brick veneer. Place sufficient weight on the top to cause the "wall" to bulge and collapse.
	The student should: Be acquainted with the more common methods of tying the facing.	Both header courses and galvanized iron ties should be introduced.
5. Patching and pointing a. Mortar consistency b. Using a backstop	Be aware of the necessity of patching and pointing before the mortar sets, of using a backstop against which the mortar can be forced, and of using fresh mortar for such repairs. Be acquainted with the method of patching and pointing where the mortar has already set.	
6. Tooling joints a. Function	Be aware of the need to increase the weather resistance of the joints.	
b. Shapes 1) V 2) Concave	*The student should be able to:* Tool joints to field standards of density and appearance.	The teacher should be prepared to discuss the unsuitability of extruded and raked joints for all but decorative purposes.
c. Method		
7. Pilasters and intersections a. Control joints 1) Wire lath 2) Tie bar 3) Calking	Demonstrate the proper method of tying intersections of nonbearing walls. Demonstrate the proper method of tying intersection of bearing walls.	The teacher should be prepared to explain why interior intersections should not be masonry bonded.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to: Properly rake-out and calk the vertical joint of exposed wall intersections.	
b. Masonry bond	Lay-up a pilaster, using a correct masonry bond.	
F. Wall openings		
1. Laying out openings	The student should: Be acquainted with the layout method of indicating openings in block walls.	The student should not be required to make the opening layout at this point, but merely to follow it accurately.
2. Laying block	Be acquainted with the methods and materials used in preparing wall openings.	
	The student should be able to:	
a. Working to set frames	Properly lay-up block against a preset frame.	Product quality, not labor time, should be the criterion for evaluating the student.
b. Jamb block	Properly lay-up with jamb block to ± 1/8-inch of each side of a wall opening.	
c. Lintels and sills 1) Steel 2) Precast concrete	Properly emplace a provided lintel of each type.	
G. Anchor bolts	Set anchor bolts to within ± 1/16-inch of specifications.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
H. Damp-proofing		
	The student should be able to:	
1. Parge coating	Properly apply two coats of concrete plaster to the block wall exterior.	Smoothness of the cove and adherence to grade specifications should be noted in evaluating work.
2. Sealers	Demonstrate a knowledge of the common sealers, their properties and the methods of applying each.	
a. Bituminous		
b. Membrane		
c. Polyfilm		
d. Polyethylene spray	Properly apply a sealer of a type indicated on provided blueprints/ specifications.	
III. BRICK VENEER —— Suggested Time: 17 Days		
A. Brick	The student should:	
1. Sizes and styles	Be aware of the variety of sizes and face textures available.	Only the locally common varieties should be introduced at this point.
2. Types	Be aware of the different rate of absorption of common brick and face brick, the effects on mortar bond, and the procedures required by these effects.	Shop demonstration: Borrow a lab scale and weights. Weight two dry common brick, a face brick, and a pre-wet common brick. Place one of the dry brick flat in 1/4-inch of water for 1 minute. Re-weigh this brick. If it has gained more than 20-grams (7/10-oz.) it was too dry to use. Lay the other three brick in fresh mortar on a well-set wall. After several minutes remove them to show mortar adhering to all except the other too-dry common brick.
a. High absorption		
b. Low absorption		

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
B. Mortar 1. Mix a. Proportions b. Methods	Be acquainted with the properties of mortar required for good brick work, and the proper proportions of the correct mix.	
2. Plasticity	be aware of the prime importance of properly plastic mortar in obtaining a good bond.	
3. Water retention		The teacher should emphasize that the mortar must have a high water retention value to properly bond even wetted high-absorption brick.
C. Laying out the bond		
	The student should be able to:	
1. Corners and ends 2. Stretcher course	Lay out an acceptable running bond for a specified section of brick veneer, said section including corner, end, a doorway, and a run of soldier course.	Instruction in other than the running bond should, at this point, be limited to *projecting* photographs or drawings and discussing the variation.
D. Laying brick 1. Mortar bedding a. Spreading b. Swiping c. Buttering	Prepare, or supervise the preparation of, masonry components needed for a specified section of brick veneer.	Preparation should include wetting brick if necessary, and placing components conveniently, as well as properly mixing the mortar.
2. Laying-up corner and end a. Maintaining level and plumb	Lay up corner or end to field standards of level, plumb, and uniformity of joint size.	The teacher should emphasize the necessity of completely filling all joints with mortar.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
b. Maintaining joint size		Mortar shrinkage is so small that cracks between brick and mortar due to shrinkage must be magnified to be seen.
3. Stringing a guideline		
	The student should be able to:	
4. Laying stretcher courses	Lay up stretcher courses to field standards of uniformity.	
a. Maintaining bond		
b. Tying in veneer		
c. Securing full mortar bond		Emphasize necessity of removing excess mortar with upward cut of the trowel to avoid cracks in the mortar bond.
d. Cutting brick		
5. Laying window sills	Lay up window sills to minimum field standards of workmanship.	
6. Finishing joints	Identify by any specified means, the four common styles in which joints are finished.	The teacher should emphasize the practical superiority of tooled joints; the esthetic value of the other styles.
a. Tooled		
b. Brushed		
c. Struck		
d. Raked	Properly finish joints in each of the styles.	
	The student should:	
E. Washing the wall	Be aware of the need to clean new brickwork of cement dust, mortar drippage, and efflorescence.	
1. Materials	Be acquainted with the materials used for washing brickwork.	
a. Brushes		

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
b. Muriatic acid c. Water	The student should: Be fully aware of the nature of muriatic acid, its properties, and its effects on various common materials.	CAUTION! *The teacher must be sure that the student recognizes "muriatic" as a commercial term for a certain concentration of powerful hydrochloric acid.* *Demonstrating the effects of HCl on samples of cloth, wood, and metal should be effective.* *To prevent spattering, always gently pour the acid into the correct amount of water.*
2. Methods		
3. Safety a Personal 1) Contact with acid 2) Acid fumes	*The student should be able to:* Properly dilute the acid to working concentration.	
b. General 1) Other people 2) Property	Demonstrate a knowledge of correct safety equipment and procedure.	The wisdom of unfailing use of hand and eye protection should be stressed.
	Demonstrate a knowledge of correct first aid procedures.	The teacher should be prepared to explain, in the most simple terms, the relationship of acid and base.
	Properly wash and rinse a section of brickwork, observing all precautions to insure the safety of his person, others in the vicinity, and nearby property.	While ventilation is necessary, wind may carry acid vapors. Drippage must be considered. Tools and other unprotected metal must not be exposed to acid droplets. Containers must be clearly labeled, safely closed, and properly stored.

PLUMBING

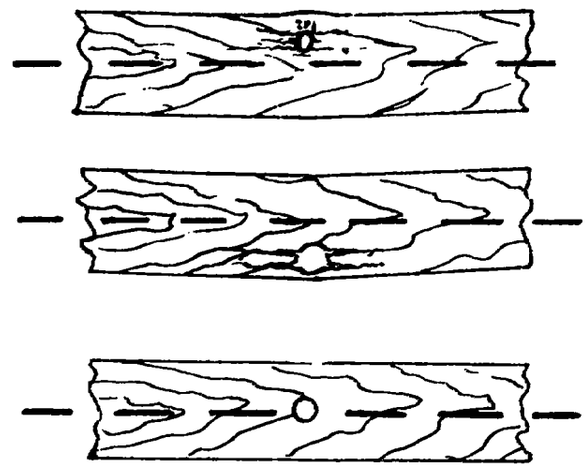
CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
I. PREPARATION — Suggested Time: 1 Day		
	The student should be able to:	
A. Blueprint reading	Demonstrate knowledge of what blueprints are, and why they are needed.	
1. Roughing a. Water supply 1) Municipal 2) Well	Demonstrate proper care of the blueprint.	
b. Waste disposal 1) Municipal 2) Septic system	Locate on a supplied blueprint: • The nature and correct position of supply and waste lines. • The location and type of common plumbing fixtures.	It is suggested that this topic be taught by repeated use of the blueprint in introducing each successive topic in this Plumbing section.
2. Fixtures a. Water supply 1) Cold 2) Hot b. Sanitary c. Bath d. Laundry 1) Washer 2) Dryer 3) Tubs		Bench demonstration: Using contrasting ink, make a *transparency* of the plumbing data on a section of blueprint. Screen the section through an *opaque projector* so that the students may attempt to locate the plumbing. Position the transparency over the blueprint to locate the plumbing. An *overhead projector* may be used if a *positive transparency* is made of the blueprint.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
B. Specifications	Be acquainted with the standard specifications format.	The student should know what information is contained in the specifications, and how to locate specific information. Proficiency in use of "specs" is not within the scope of the course.
1. Sizes		
2. Qualities	Be aware of the precedence of specifications over blueprints should they not agree.	
3. Materials		Commercially prepared texts containing sample blueprints and specifications are available.
		The screening of this material in an *opaque projector*, preferably in conjunction with individual student copies, is an effective method.
C. Codes and regulations	Be aware of the existence of plumbing codes.	The student should not be required to commit any part of a code to memory.
1. Local and State building codes		
2. Health Department regulations	Be acquainted with inspection procedures.	
	Be aware of problems ensuing from noncompliance.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
II. ROUGHING IN — Suggested Time: 22 Days		
	The student should be able to:	
A. Water supply	Recognize the common materials used for pipe and fittings.	
1. Mains a. Materials 1) Copper 2) Galvanized iron 3) Plastic	Demonstrate a basic knowledge of the properties of each material as used in plumbing. Ascertain the sizes of samples of standard pipe and fittings.	Bench demonstration: Show the effects of: • Warm nitric acid (HNO_3) on copper • Repeated bending of copper • Temperature extremes on plastic • Water-borne minerals in galvanized pipe • Any strong acid on the zinc coating of galvanized pipe
b. Fittings	Identify common fittings in a mixed sample.	
2. Branch lines a. Risers b. Compression chambers	Describe a compression chamber, where it is located, and why it is needed.	
3. Installation		
a. Threaded joints 1) Cutting iron pipe	Cut iron pipe to length to an accuracy of ± 1/8-inch, using the vise and pipe cutter supplied.	Shop demonstration: Perform the required joining operations, emphasizing the importance of:

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
2) Cutting a thread	Properly cut threads using the vise and dies supplied.	• Cutting pipe to well-squared ends • Reaming the ends of iron pipe • Using sufficient cutting oil on thread dies • Using a sealing compound on threaded joints • Using the correct type and size wrench • Removing all sulfates and oxides from both copper surfaces to be joined • Protecting adjacent surfaces from heat and flame
3) Method of joining	Make a watertight threaded joint, using personally selected tools and equipment.	
4) Tools and equipment		
b. Sweated joints 1) Cutting copper pipe	Cut copper tubing to length to an accuracy of ± 1/16-inch, using a wheel tubing-cutter.	
2) Preparing the parts	Expose the pure metal of tubing and fitting by use of emery paper and flux.	
3) Sweating the joints	Make a watertight sweat joint, using wire solder and propane or butane torch.	Screening the components in an *opaque projector* between operations will provide close inspection to all students simultaneously.
c. Cemented joints	Fit and solvent-weld watertight joints in polyvinyl chloride and polyvinyl dichloride pipe.	
d. Unions	State the purpose and use of ground-joint unions.	
4. Pipe supports a. Straps b. Hangers	Support a run of each type pipe, using personally selected pipe supports.	Shop demonstration: Support a run of each type pipe, demonstrating the proper type of support and spacing for each. Demonstrate safe use of hand and power boring tools.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
c. Notched timbers 1) Location 2) Size limitations	Have a basic understanding of the tension and compression forces in a horizontal timber, and of the effects of oversize or improperly located notches and holes.	Bench demonstration: Make a scale simulation of installed floor joists. Bore pipe runs —— some correct, some oversize or off center. Move a weight from one to another to show the effects of such holes on structural strength.



B. Waste lines

1. Soil pipe and vents a. Materials 1) Cast iron 2) Copper 3) Composition	Be acquainted with the common materials used for soil pipes, fittings, and drains.	
b. Fittings	Be acquainted with the form, function, and particular uses of common fittings.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
c. Traps	Be aware of the form, function, and proper location of traps.	Bench demonstration: Construct a sink drain of ordinary materials, except the trap which will be a laboratory type, clear glass unit. Pour water through the drain to show the function of the trap.
2. Fixture drains		
a. Materials		
1) Copper		
2) Steel		
b. Traps	Be acquainted with the specific uses of the three types of trap.	
1) S		
2) P		
3) Barrel		
3. Basement drains	Be acquainted with the purpose and function of basement drains and sump pumps.	
a. Drain tile		
b. Sump pumps		
4. Installation		
a. Leading cast iron soil pipe	Accurately cut iron soil pipe, using personally selected tools and equipment.	Demonstrate the use of the cold chisel in cutting iron soil pipe.
1) Materials		
	The student should be able to:	
2) Methods	Calk a bell-and-spigot joint watertight, using supplied packing, lead and furnace, and personally selected tools.	Emphasize safety in use of molten metals, including avoidance of inhaling lead vapors.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
b. Sweating copper c. Slip joints	*The student should be able to:* Construct a watertight and unmarred sink drain and trap, using supplied components and personally selected tools and equipment.	Require padded wrenches in assembly of bright-plated slip joints.
d. Sloping the drain	State the maximum and minimum pitch allowable in sloping drains. Demonstrate a basic understanding of why the pitch is limited.	Shop demonstration: Construct a small sluice box. Securing it at several pitches, pour in a mixture of water and small pieces of putty to demonstrate how pitch affects the washing away of solids.
C. Septic systems 1. Septic tanks a. Construction b. Materials 1) Steel 2) Precast concrete c. Function d. Placement 2. Drain field a. Function b. Location c. Construction 1) Distribution box 2) Absorption trench	The student should: Be acquainted with the construction and function of septic tanks, dry wells, and leaching beds. Be aware of the health aspects involved in locating septic systems.	The use of color *overlays* in an *overhead projector* to show the positioning of septic system components is an effective method.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
D. Gas supply		
	The student should:	
1. Pipes a. Materials	Be aware of the unsuitability of copper pipe for conducting some gases.	
b. Sizes c. Line pressure	Be aware of the effect of pipe size on gas flow.	The student should not be expected to figure gas volume delivered, or gas pressure.
d. Valves 1) Type 2) Location	Be aware of the necessity of installing a shutoff valve before each appliance.	
2. Connection a. Meter b. Appliances 1) Condensation traps 2) Flexible tubing	Be acquainted with the form, function, and location of condensation traps.	Demonstrate metal fatigue in aluminum, induced by repeated bending.
	The student should be able to:	
	Assemble a gas-tight pipe system connecting a water heater, range, and clothes dryer to the gas meter, using supplied pipe, fittings, and flexible tubing, and personally selected tools and equipment.	The quality of fitting, tightness, and general neatness of the system should be criteria for evaluation.
3. Testing	Demonstrate proper safety procedure in testing pipe lines and appliance connections.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
III. FINISHING —— Suggested Time: 3 Days		
	The student should be able to:	
A. Fixtures	Install provided plumbing fixtures to field standards of workmanship, using personally selected tools and equipment.	The necessity of installing fixtures level, plumb, and true, should be emphasized as should protecting the fixtures from damage by other workmen.
1. Installation a. Sanitary b. Bath c. Sinks and lavatories d. Laundry		
2. Connection a. Supply b. Drain	Install and connect —— watertight and with finish unmarred —— showerheads, drains, pop-up wastes, supply pipes, valves, and controls.	Emphasize protection of chrome, brass, and other visible finishes from damage by wrenches, screwdrivers, and other tools.
3. Testing		
	The student should:	
B. Water heaters	Be acquainted with the function of the hot water heater.	A description of function should be sufficient coverage of electric and water jacket heaters.
1. Types a. Gas b. Electric c. Domestic water jacket		The student should have a basic understanding of the function of a thermocouple.
	The student should be able to:	
2. Installation of gas heater a. Leveling in place b. Water connection c. Connection to meter d. Venting e. Testing	Set up, connect, and vent a gas water heater, all work being to field standards of workmanship.	The student should not be expected to "troubleshoot" malfunction in the heater mechanism. His competency should be judged on securing leaking connections, positioning the thermocouple, and adjusting the pilot flame.
	Demonstrate the accepted, safe method of testing the installation for gas and water tightness, and for proper functioning.	

HEATING

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
I. THEORY OF HEAT TRANSFER —— Suggested Time: 1 Day		
	The student should:	
A. Conduction	Be acquainted with the means by which heat travel.	The teacher should be prepared to reexplain (Carpentry, X, A.2) the molecular motion theory of heat transfer, if in his judgment, it would aid the students' understanding of this section.
1. Function		
2. Relative conductivity of common materials	Be aware of the superiority of certain materials as either thermal conductors or insulators.	Bench demonstrations of conduction/convection/radiation, and of the relative conductivity of such materials as copper, aluminum, woods, and textiles, are easily devised and quite effective.
B. Convection		
C. Radiation		
II. HEATING SYSTEMS —— Suggested Time: 12 Days		
A. Hydronic		
1. Method of distribution a. Gravity flow b. Forced flow c. One-pipe system d. Two-pipe system	Be acquainted with the systems of hot water heat.	Description of the obsolescent systems should be sufficient, that time may be devoted to fully understanding the current system.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
2. Means of distribution a. Cast iron b. Copper and aluminum	Be aware of the relative values of cast iron and copper/aluminum as radiators.	
3. Characteristics a. Efficiency b. Expense	Be aware of the effect which the system used may have on fuel consumption.	The student should view this system as expensive to install, not economically converted to air conditioning, slow to respond -- but delivering very even heat.
B. Forced warm air 1. Up flow 2. Reverse flow	Be acquainted with the systems of warm air heat, and with the specific circumstances in which each system is used.	The student should know that the position of the plenum chamber determines the type furnace, and that the reverse flow (counterflow) is designed specifically for basementless homes.
3. Characteristics	Be acquainted with the characteristics of forced warm air heat.	The student should view this type system as inexpensive, rapid-acting, compatible to central air conditioning —— and somewhat noisy, and prone to soil surfaces around registers.
C. Radiant 1. Types a. Hot water b. Electric	Be acquainted with the two common systems of radiant heat and the most common utilizations of each.	The student should be aware of the use of hot water radiant heat, usually only in slab construction.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
2. Method of distribution	Be acquainted with the construction materials compatible with specific distribution systems.	
a. Embedded coil b. Panels	Be acquainted with single or interlocking electrical radiant panels.	The student should be alerted to the unsuitability of lightweight plasters and acoustical materials as a base for electrical coil radiant heat.
3. Characteristics	Be acquainted with the characteristics of radiant heat.	The student should view this system as expensive to install and/or to operate, difficult to service or modify, completely incompatible to air conditioning —- but supplying the most even, draft-free heat, and when electrical, nearly maintenance-free and completely clean.
III. ENERGY SOURCES —— Suggested Time: 1 Day		
A. Types	Be acquainted with the standard sources of energy for heating.	
1. Coal		
2. Oil		
3. Gas		
4. Electricity		
B. Characteristics	Be acquainted with the characteristics of each energy source which make it more or less desirable for use in homes.	As background or introductory information, this instruction should not be subject to testing.
1. Efficiency		
2. Expense		

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
IV. TEMPERATURE CONTROL —— Suggested Time: 2 Days		
A. Thermostatic function 1. Bimetallic rod 2. Mercury vial	The student should: Be acquainted with the form and function of bimetallic and mercury thermostats.	Bench demonstration: Place the bimetallic element in an *opaque projector*. The class can watch as the projector lamp heat causes the element to bend and close the circuit. The demonstration can be repeated using a mercury thermostat, but due to the need to place it horizontally, the movement but not the contact will be seen.
B. Thermostat features 1. Single setting 2. Time change 3. Combination controls	Be acquainted with the various types of temperature control available. *The student should be able to:* Make an accurate sketch of the single-setting thermostat, mercury and bimetallic, and clearly describe its functioning.	At this point, the student should not be required to understand the functioning of any control except the single-setting mercury and bimetallic thermostats. It is sufficient that he know of the existence of the other types and what additional functions they perform.
V. SYSTEMS INSTALLATION —— Suggested Time: 13 Days		
A. Heater unit 1. Unpacking and placing 2. Connecting a. Transfer system 1) Pipes 2) Ducts 3) Coils	Set up a heater unit, to field standards of workmanship, including: • Removing the components from the shipping containers without marring the cabinet.	Obtain a supply of installation instruction sheets from the manufacturer of the heater unit being used. Bring the *opaque projector* into the shop (modern opaque projectors work quite well in partially lighted rooms).

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
b. Fuel supply c. Vents d. Controls	• Checking the shipment for missing or damaged parts. • Setting the heater unit in place, level, plumb, and true. • Connecting the unit to the heat transfer system, energy supply, and vents. • Installing and connecting control devices.	*Project* the schematic/pictorial drawings of the installation instructions. Have the students follow on their copies, your instructions on a segment of the work. Completely illuminate the shop and demonstrate the actual work. Return to the *projector* for instructions on the next segment.
B. Transfer systems	*The student should be able to:*	
1. Installation a. Pipes 1) Cutting 2) Preparing the joints 3) Making connections	Select, prepare, and sweat-fit the components of a copper hot water heating system, all work watertight and to field standards of workmanship.	Plumbing, II, 3.b.
b. Duct work 1) Joining 2) Hanging	Select, install, and support the components of the duct work of a forced warm air system, maintaining field standards of workmanship.	Instruction should be limited to assembly and joining of sheet metal duct components. The fabrication of the duct sections is not within the scope of this course.
c. Resistance coils 1) Joining sections 2) Securing in place	Cut, thread, and fit watertight, the components of a hot water radiant heat system. Install space strips and wire, and install interlocking grid panels to field standards of workmanship.	Plumbing, II. 3.a.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
d. Radiators and registers 1) Placement 2) Connection	Install and properly connect radiators and registers, all surfaces trued and unmarred.	
C. Testing		
1. Valves	Test all valves for proper functioning.	The student should not be expected to troubleshoot faulty equipment. At this level, it is sufficient that the student to able to determine whether or not the system is functioning properly.
2. Combustion	Check the resistance coils, or heater unit for proper functioning.	
3. Controls a. Function	Test all controls for proper functioning.	
b. Thermostat adjustment	Adjust the thermostat to maintain the required temperature.	

ELECTRICITY

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
I. ELECTRICAL THEORY —— Suggested Time: 1 Day		
	The student should:	
A. Nature of electrical energy	Be acquainted with the electron theory.	The teacher should be prepared to briefly review the electron theory if a need is indicated.
B. Production of electricity (AC)	Be acquainted with the process of producing and transmitting electricity.	A brief description of a transmission system, from generator to building weatherhead should suffice.
C. Transmission of electricity	*The student should be able to:*	
1. Conductors	Categorize common materials as insulators or conductors.	The student should know which common solids and liquids will conduct, and which will insulate. He should know that Type A extinquishing agents must never be used on electrical fires.
2. Insulators		
3. Safety	Demonstrate an awareness of the danger in ignorant or careless handling of electrical equipment.	It is imperative that the student become safety conscious.
D. Terminology	Demonstrate by any teacher specified means, a correct understanding of the common electrical terms.	It may be necessary to define the terms to aid the student's recall. The combining of terms —— kilowatt-hour, volt-ampere —— should be explained.
1. Ampere		
2. Volt		
3. Watt		

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
4. Ampacity		
5. Ground		
II. HOUSE WIRING —— Suggested Time: 36 Days		
	The student should:	
A. Regulatory Codes	Be aware of the existence of codes specifying standards for electrical installations.	The student should be aware of existence of such codes, and the necessity of compliance. He should not be required to memorize code content.
1. Type a. Underwriters b. Local		
2. Inspection procedure	Be acquainted with the procedure involved in obtaining inspection and approval of the installed system.	The problems resulting from non-compliance should be presented.
3. Application of regulations	Be aware of the regulations for: . 220 v., single-phase entrance . Locating the meter . Locating, and minimum capacity of, the distribution panel	The student should not be required to memorize code requirements. He should know that installations are regulated, and how to determine the exact requirements.
a. Service entrance 1) Entrance cable 2) Meter connection 3) Distribution panel		
b. Circuits 1) Wire gage 2) Distribution	Be aware of the relationship between circuit wire gage and the circuit total amperage, and thus, the distribution of circuits.	The student should know the amperage rating of #18 through #6 wire.
c. Switches and receptacles 1) Type	Be acquainted with the common types of switches and receptacles, and with their current ratings.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
2) Distribution	The student should: Be aware of the code specifications for locating switches and receptacles.	The student should know the maximum distance allowable between receptacles.
B. Blueprint reading		
1. Symbols 2. Wiring	*The student should be able to:* Describe the wiring of a specific medium-size one-story house, using code manuals and a provided house plan.	The student should be aware that plan locations are not necessarily exact. Door swing, tile and panel heights should be verified.
C. Service entrance	The student should: Be acquainted with the various factors governing placement of transmission wires and the service entrance.	The many advantages and the disadvantages of underground service should be explained.
1. Types a. Overhead b. Underground		
2. Measuring and cutting cable a. Tools and equipment b. Methods	*The student should be able to:* Measure and cut entrance cable to field standards of accuracy, using personally selected tools and equipment.	The high cost of entrance cable should be stressed, but not overemphasized.
3. Installing entrance cable a. Preparing cable ends	"Skin" and clean the proper amount of cable ends.	The teacher should introduce the local utility company's booklet of recommended installations and mandated procedures.
b. Running/supporting cable	Correctly support exposed cable, or pull cable through a conduit mast.	

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
c. Connecting 1) Weatherhead 2) Meter box 3) Main disconnect	Properly connect the cable to its terminals at meter box and main disconnect.	The strict observation of all regulations should be re-emphasized.
4. Installing the distribution panel	Properly install a provided distribution panel.	
	The student should:	
a. Types 1) Fuses 2) Breakers	Be acquainted with the types of panels in use.	The advantages and disadvantages of each type should be explained.
b. Grounding		The student should understand the need for proper grounding of the system.
c. Safety	Be aware of the vital importance of using only the correct type extinguisher on electrical fires.	The teacher should be prepared to explain why Type B/C extinguishers are safe for use on electrical fires.
5. Circuitry a. Layout 1) Path 2) Load 3) Location	*The student should be able to:* Lay out the circuitry for a five-room house, properly locating switches and outlets, as indicated on a supplied plan.	Layout in a framed unit is, of course, preferable to a "paper" layout.
b. Boxes 1) Types 2) Sizes 3) Methods of installation	Install boxes as indicated on a supplied plan, by fastening directly to the structure and by use of hanger bars.	Recessed units, "ganging" of boxes, and code limitations on the number of wires per box should be included.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
c. Cable 1) Tools and equipment 2) Armored	Properly prepare the structure to receive cable.	Good judgment in locating and boring the circuit path should be developed.
3) Nonmetallic		The student should be acquainted with armored cable, but emphasis should be on proficiency with nonmetallic cable.
4) Methods of installation	Pull cable through the prepared path, properly securing ends in boxes, and preparing the ends for connection.	
d. Switches and receptacles 1) Types 2) Installation	Properly install switches and receptacles as indicated on a supplied plan.	The student should be capable of installing 220-v. range and clothes dryer connections, and 3-way switches as well as 110-v. receptacles and single-pole switches.
e. Installing fixtures	Properly connect and install lighting fixtures.	Emphasize protection of the fixture and adjacent surfaces, and the use of correct lamp sizes.
f. Cover plates	Properly install cover plates of the type and finish indicated on supplied specifications.	Stress care in not marring the plate or adjacent surfaces, and in keeping the plate plumb.
6. Testing	Test the installation for proper functioning.	In case of malfunction, the student's "troubleshooting" should be limited to checking fixtures and boxes for loose or improper connections.

AIR CONDITIONER INSTALLATION

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
I. FUNCTION —— Suggested Time: 2 Days		
A. Heat transfer theory		
1. Intensity a. Fahrenheit b. Celsius c. Absolute	*The student should be able to:* Demonstrate an understanding of intensity and the difference in the measuring scales in use. Transpose intensity readings from one scale to another when provided the conversion formulas.	The teacher should be prepared to aid the student in recalling this information. The student should not be required to memorize these formulas but only to perform the required arithmetic function as indication of his comprehension of intensity measurement.
2. Quantity a. Btu b. Specific heats	Demonstrate an understanding of quantity of heat, the British thermal unit as a measurement of heat quantity, and specific heat as an indication of heat content of a material. The student should: Be acquainted with the specific heats of several common materials.	Comparison: Intensity —— One quart of water and one pint of water are both at 180°F. Quantity —— If both amounts of water are cooled to 170°F., the quart will release 20.4 Btu's of heat; the pint will release 10.2 Btu's.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
B. Refrigeration system		
1. Type	The student should: Be aware of the existence of two refrigeration systems.	The objectives of the section are concerned with conditioner installation. The student should understand the basic functioning of conditioners needed for systems installation. Adjusting or repairing malfunctioning equipment is not within the scope of the course.
a. Compression	Be sufficiently acquainted with the compression system to understand how it produces cold air.	
b. Absorption		The absorption system should be clearly explained, but emphasis should be on the more common compression system.
2. Service a. Room b. Central	Be acquainted with the differences in room conditioners and central conditioners.	
C. Controls		
1. Operation a. Manual b. Semiautomatic c. Automatic	Be acquainted with the convenience features available in temperature controls.	It is necessary at this level, only that the student know of the existence of units providing certain convenience advantages. He should not be required to understand the functioning of any but the manual control.
2. Type a. Bimetallic rod b. Mercury vial	Be acquainted with the function of the direct contact, bimetallic rod, and the mercury contact, bimetallic coil thermostats.	Heating, IV. A.

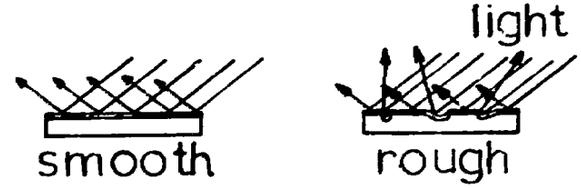
CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
II. INSTALLATION —— Suggested Time: 7 Days		
A. Room unit		
1. Location a. Direct sunlight b. Airflow obstructions	The student should: Be aware of the need to locate the unit where it will not be seriously affected by conditions which interfere with its functioning.	The student should be instructed in how these factors affect conditioner functioning.
c. Electrical supply 1) Ampacity 2) Voltage	Be acquainted with proper procedures in checking an existing electrical supply for sufficient capacity. Be aware of the advantages in placing the unit on its own separate circuit.	It is sufficient that the student understand the necessity of checking electric power, and the manner in which it is done. Proficiency in such testing is not within the scope of the course.
2. Placement a. Window frame b. Existing wall opening	Be aware of the two standard placements of room unit conditioners	Instruction should be limited to placement in double-hung windows and previously prepared wall openings, since this course is limited to new construction.
3. Installing the mounting frame and brackets, or mounting sleeve.	*The student should be able to:* Properly install a mounting sleeve in an existing wall opening, using personally selected tools and equipment. Properly install a mounting frame and brackets in a double-hung window unit, using personally selected tools and equipment.	The student should be aware of the need to pitch the mounting components 1/8-inch on 1-foot to the outside, to allow condensation to drain away from the wall.
4. Installing the unit	Properly secure the unit housing in the mounting sleeve.	Emphasize: • Move units by grasping the bottom pan —— never by the tubing or coils.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
	Secure the unit housing to the mounting frame and brackets.	• Check the clearance of refrigerant lines and wiring before placing the unit in the housing. NEVER force the unit into place.
	Properly install the unit in the housing.	
5. Installing filler boards	Measure, cut to a sealable accuracy, and install filler boards, using provided fasteners and personally selected tools.	
6. Installing locks and seals	Neatly and correctly install sash locking brackets.	The student should understand the necessity of eliminating air leaks around the installation.
	Neatly and correctly install seals at all possible air leakage points.	Emphasize care in avoiding marring the exposed finished parts of the conditioner and surrounding surfaces, and in obtaining a pleasing appearance of seals and calking.
7. Testing a. Cooling b. Ventilating c. Exhausting	Test the installed unit for proper operation of the cooling, ventilating, and exhausting functions.	The student should be able to determine if air is being cooled and moved, and if it is being moved in the correct direction. Troubleshooting a unit malfunction should be limited to obstructing all air vents to determine whether or not the thermostat is functioning.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
B. Central unit		
	The student should be able to:	
1. Furnace combination a. Installing a combination unit	Properly unpack and assemble a climate control unit, observing all the manufacturer's instructions.	Emphasize care in handling components to avoid damaging refrigerant lines and capillary tubes.
b. Installing in existing unit	Properly unpack and install in an existing forced warm air system, a precharged conditioning unit, all work to be in accordance with manufacturer's instructions.	
c. Installing controls 1) Combination thermostat 2) Single function thermostat	Install temperature controls as specified by the manufacturer.	
d. Connecting to power supply e. Installing diffuser grilles	Connect the unit to the electrical power supply observing applicable codes and regulations, and the manufacturer's instructions.	The high electrical requirements of control units should be discussed.
	The student should:	
2. Independent precharged unit a. Preparing the installation	Be aware of the increased capacity of water-cooled units.	The student should understand that the 25 percent increase in efficiency is affected by the cost of cooling water.
1) Packaged unit	Be acquainted with the several advantages of packaged units.	Seemingly evident advantages —— mechanism not exposed to weather, windows are not blocked, interior decor is not affected, thermostat is more efficiently located, noisy mechanisms are not in the room —— may not occur to the student without teacher direction.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
2) Remote cooler unit	Be acquainted with the advantages and disadvantages of remote cooler units.	Expense of installation, maintenance of exterior parts, and effect on property appearance must be balanced against estimated savings in water costs.
	The student should be able to:	
b. Installing ducts 1) Rigid 2) Flexible 3) Hangers	Install ductwork as specified on a supplied detail, all workmanship conforming to field standards.	The student should not be expected to lay out the ductwork, nor to fabricate parts. His work should be evaluated on proficiency in selecting specified components, and on tightness and neatness of installation.
c. Installing the condenser d. Installing the evaporator	Install the condenser and evaporator units in their proper places without damaging the coils, fins, coolant lines, or cabinetry.	Specifications for the concrete for mounting a remote cooling unit should be discussed. Masonry, I.E.3.
e. Installing controls	Install temperature controls as directed by the manufacturer, properly leveling in place without marring the control or adjacent surfaces.	
f. Connecting to supply lines	Connect the unit to power and water supply, and to water disposal if necessary, conforming to codes, regulations, and standards of workmanship.	Electricity, II, A.1. Plumbing II, A.3.6.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
3. Testing	*The student should be able to:* Activate the unit, and check the movement of air and the proper functioning of temperature controls.	Student troubleshooting should be limited to adjusting a properly operating thermostat, and eliminating faulty connections in water, electrical, and duct systems.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
I. PREPARING THE SURFACE —— Suggested Time: 6 Days		
	The student should:	
A. Smoothing and cleaning	Be aware that the finish cannot improve a poorly prepared surface.	Bench demonstration: Select samples having rough spots and checks. Apply paint and clear finish. Show the results. Make opaque or transparent drawings of reflective/refractive surfaces. *Project*. Explain.
1. Tools and equipment	Be aware that finishes will not adhere to wet, slippery, or loose surfaces.	
a. Hand tools	Be acquainted with the common hand tools used for preparing surfaces.	In the process of acquiring skill in use, the student should become capable of identifying and selecting such surface preparation tools as planes, scrapers, belt sanders, disc sanders, and orbital sanders.
b. Power tools	Be acquainted with the common power tools used for preparing surfaces.	
c. Coated abrasives 1) Shapes and sizes 2) Grits 3) Manufacture	Be acquainted with the variety of coated abrasives available for hand and machine use.	Compare sandpaper samples representing the variety of grit sizes and materials, by use of the *opaque projector*. Discuss the information printed on the backing. Charts, booklets, and filmstrips are available from abrasives manufacturers and their associations.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
d. Solvents	The student should: Be acquainted with the solvents available for cleaning pitch, wax, oils, and asphalt from surfaces to be finished.	Emphasize health and safety aspects. Explain Type B fire extinguishers. Paint and varnish removers should not be introduced in this course which is concerned with new work rather than repair and maintenance.
2. Methods a. Wood b. Metal c. Composition	*The student should be able to:* Safely and properly prepare for finishing, supplied surfaces containing such representative imperfections as tool marks, pencil marks, rough spots, and lumber crayon marks.	The student's work should be judged on safe and orderly procedures, and a degree of finish commensurate with the nature of the product.
B. Patching		
1. Materials a. Wood doughs b. Paste wood fillers c. Drywall cements d. Putty e. Fibrated epoxies	The student should: Be acquainted with the various materials used to fill cracks, chips, pitch pockets, and nail holes in surfaces being prepared for finishing.	
2. Tools and equipment	Be acquainted with the tools and equipment commonly used in patching defective surfaces.	The student should be instructed in the proper use of putty knives, trowels, chisels, and rough cloth.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
3. Methods of application	Effectively patch a variety of surface defects, using personally selected tools and materials.	The patch jobs should include metals and wallboard as well as wood, and range in difficulty from filling nail holes to removing pitch pockets. Patching previously finished surfaces is repair and maintenance in nature, and outside the scope of this course.

II. APPLYING THE FINISH —— Suggested Time: 11 Days

A. Stains

	The student should:	
1. Type a. Oil b. Water c. Spirit	Be aware of the availability of different types of stain, based on the nature of the pigment carrier.	
	Be acquainted with the relative advantages and disadvantages inherent to each type.	
	Be aware that species of wood vary in ability to "take" a stain.	
		Bench demonstration: Stain one piece of pine or fir with each of the three types. Show results in an *opaque projector*. Apply stripes of the three types to each piece of a collection of woods of varying "stainability," to show effects of stain type on quality. *Project.*

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
2. Application		
a. Brush b. Wipe-on	*The student should be able to:* Apply oil and spirit stains to woods of medium to good stainability, achieving a finish quality commensurate with the nature and purpose of the surface.	Proficiency in use of the less common water stains is not necessarily entry-level proficiency.
B. Clear finishes		
1. Type a. Surface b. Penetrating	Demonstrate by any teacher-selected means, an understanding of surface finish and penetrating finish.	
2. Materials a. Shellac b. Lacquer c. Varnish d. Synthetic resins e. Sealers	Demonstrate by any teacher-selected means, a basic knowledge of the properties of the common clear finish materials.	The student should know such basic properties as the effects of alcoholic beverages on shellac, the nongloss finish of sealers, and the high weather-resistance of lacquer.
3. Means of application a. Brush 1) Types	The student should: Be aware of the variety of brush sizes, and of the general and specific purpose brush shapes which are available.	Finishes should be applied with varnish/enamel, wall, and sash brushes, in sizes from 3/4-inch to 4 inches.
2) Methods	Be acquainted with the proper methods of using paint and varnish brushes.	Instruction and practice should show the false efficiency of attempted use of brushes of unsuitable size or type, and of finishing around installed hardware.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
3) Maintenance	Be acquainted with the means of maintaining brush condition.	Emphasize the need to clean brushes after use. Acquaint with vapor-type brush conditioners.
b. Spray		
1) Types	Be aware of the existence of two types of spray equipment.	The students should be instructed in the properties of pressure-feed and suction-feed.
2) Methods	Be acquainted with the proper methods of spray finishing.	Instruction and practice should begin to develop judgment of proper distance for various finishes, and a "parallel wrist."
3) Maintenance	Be acquainted with the means of routinely maintaining spray equipment.	Emphasize the need to solvent-clean spray equipment *immediately* after use.
	The student should be able to:	
	Apply clear finishes to field standards of quality, personally selecting the appropriate means of application.	
C. Paints		
	The student should:	
1. Type a. Exterior b. Interior	Be aware of the existence of specific paints for indoor and outdoor use, and of the general noninterchangeability of their natures.	The student should realize that while using interior paints outdoors is merely uneconomical, use of lead-base exterior paints indoors can be injurious to health.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
2. Surface finish a. Gloss enamel b. Semigloss c. Flat	Be aware of the existence of paints prepared to provide a specific amount of surface reflectivity.	Instruction should be given on characteristics of surface finishes —— glare, soil resistance, easy washability —— which affect the choice of paint for a given use.
3. Base material a. White lead b. TE and TLE c. Latex d. Alkyd resins e. ZnO	Be acquainted with the common paint bases, and with the outstanding properties of each.	The properties of the common paint bases —— resistance to sunlight, moisture resistance, resistance to chemical fumes, self cleaning or nonchalking —— should be clearly explained.
	The student should be able to: Demonstrate by any teacher-selected means, a basic knowledge of the variety of common paints available, their outstanding properties, and proper utilization.	The student should acquire this knowledge by repeated teacher-statement, and by use, *not* by memorization.
4. Application a. Brush 1) Types and uses	Apply paint to field standards of quality, personally selecting proper brushes and equipment.	Emphasize removal of hardware, and the covering of surfaces not to be painted.
2) Maintenance	Properly clean and store brushes after use.	
b. Roller 1) Types and uses 2) Maintenance	Apply paint to field standards of quality using roller and pan, and using pressure-feed roller. Properly clean and store equipment after use.	The relationship between roller cover material and paint type should be emphasized.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should be able to:	
c. Spray 1) Types and uses	Apply paint to field standards of quality, using teacher-selected spray equipment.	The teacher's knowledge of local employment conditions will determine whether *pressure-feed* as well as *suction-feed* equipment will be used.
2) Maintenance	Properly clean and store equipment immediately after use.	
3) Safety	Demonstrate by use thereof, and by any other teacher-designated means, an appreciation of proper safety and health precautions.	The student should know what *to* do, what *not* to do, and *why*.
D. Solvents		
	The student should:	
1. Common materials a. Alcohol b. Lacquer thinner c. Turpentine d. Mineral spirits	Be acquainted with the commonly used solvents, and with their individual properties.	The student should not be required to memorize the finish/solvent relationships, since this information is given on the container. He should be encouraged to form a habit of reading this information before opening the container.
2. Uses a. Thinning b. Cleaning	Be aware of the uses to which solvents are put.	
3. Safety a. Inhalation b. Ingestion c. Eye and skin protection	Be acquainted with general safety procedures for use of solvents.	The teacher should *know* the proper *first-aid* procedures for *each* solvent used in his course.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should:	
d. Type B fire	Be aware of the type extinguisher proper for use on volatile liquids.	The student should understand *why* the proper type should be used. He should be aware of any undesirable side effects.
	Be aware of the type extinguisher which must not be used on volatile liquids.	
	The student should be able to:	
	Demonstrate by use, and by any other teacher-designated means, an appreciation of and adherence to proper safety procedures.	
III. MATERIALS ESTIMATION —— Suggested Time: 2 Days		
A. Area measurement	Demonstrate by any teacher-designated means, an ability to estimate area to an accuracy of ± 3 percent.	Overhead projection of defined areas, with overlays lined as included square feet should be an effective method.
	The student should:	
1. Rectangles	Be aware that most triangular shapes will contain a right angle.	Reuse of Carpentry, VIII, K., may be helpful.
2. Triangles	Be aware that most irregular shapes will be composites of several regular shapes.	
	The student should be able to:	
B. Coverage	Demonstrate by any teacher-designated means, an ability to transpose area measurement to a correct number of units of finish materials.	
1. Prime coat		
2. Two-coat system		
3. Three-coat system		

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
	The student should: Be aware that the same amount of different finishes will provide different coverage. Be aware that a finish will provide different coverage on different surfaces.	Shop demonstration: Gather samples of representative materials such as fiber board, gypsum board, white pine, and plain-sawed red oak. Stripe each with various finishes. When dry, screen in the *opaque projector*, then pass among the students to show difference in coverage.
IV. MATERIALS STORAGE —— Suggested Time: 2 Days		
A. Fire prevention and control	Be aware of the fire hazards inherent in storing of finishes and solvents.	The shop facilities *must* include an amount of small storage spaces of approved construction,
1. Ignition combustion a. Proper containers b. Proper storage facilities	Be aware of the ways in which fires start.	
2. Spontaneous combustion a. Critical materials b. Proper disposal	Be acquainted with the means employed to prevent or minimize the possibility of fire.	Emphasize immediate placing of used wiping cloths in metal safety cans which *must* be emptied at the end of each school day.
3. Explosion a. Vapors control b. Eliminating sources of ignition	*The student should be able to:* Demonstrate in use, and by any other teacher-designated means, a knowledge of proper storage conditions and procedures.	Violations of safety procedure should always be immediately discussed with the violator.

CONTENT	OBJECTIVES	INFORMATION FOR THE TEACHER
B. Maintaining stock		
1. Stock rotation	The student should: Be aware of the need to use older stock first.	The student should understand *why* stock must be rotated —— settling of solids, dropping of a color from the manufacturer's line, changes in shade of a color designation over long periods of time.
2. Mixing devices a. Impellers b. Vibrators	Be acquainted with stock rotation procedures. Be acquainted with devices used to insure thorough preuse mixing of stored finishes.	
	The student should be able to: Demonstrate, by continuous use thereof, a knowledge of proper stock maintenance and preparation procedures.	

RESOURCE MATERIAL

BOOKS

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_____ *Concrete form construction.* Albany.

_____ *Framing, sheathing, and insulation.* Albany.

_____ *Hand tools and portable machinery.* Albany.

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Feirer, John L. *Cabinetmaking and millwork.* Peoria, Ill. Chas. A. Bennett Co., Inc. 1967.

_____ *Woodworking for industry.* Peoria, Ill. Chas. A. Bennett Co., Inc. 1963.

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McDonnell, Leo P. *Hand woodworking tools.* Albany. Delmar Publishers, Inc. 1962.

_____ *Portable power tools.* Albany. Delmar Publishers, Inc. 1962.

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Wilson, J.D. & Werner S.O. *Simplified stair layout.* Albany. Delmar Publishers, Inc. 1947.

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Delmar Publishers, Inc. *Bricklaying I, II, III; teacher's manual.* Albany. 1952.

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_____ *Forms for architectural concrete, T21-3.* Chicago. 1952.

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Bachmann, George K. *Pipefitters and plumbers vest pocket reference book.* Englewood Cliffs, N.J. Prentice-Hall. 1960.

Delmar Publishers, Inc. *Plumbing, vols. I, II.* Albany.

_____ *Blueprint reading and sketching — plumbing trades.* Albany. 1968.

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Oravetz, Jules Sr. *Plumbers and pipefitters library, vols. I, II, III.* Indianapolis. Theodore Audel and Co. 1968.

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Althouse, Andrew D., Turnquist, Carl H. & Bracciano, Alfred F. *Modern refrigeration and air conditioning.* Homewood, Ill. Goodheart-Willcox Co. 1968.

Anderson, Edwin P. *Home gas heating and appliance manual.* Indianapolis. Theodore Audel and Co. 1965.

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OCCUPATIONAL DESCRIPTION

These publications may be of value to the teacher of Building Industries Occupations who also is engaged in prevocational guidance or instruction.

Chronicle Guidance Publications, Inc. *Occupational briefs — construction industry.* Moravia, N.Y. The Corporation.

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Portable electric tools. Bailey Films. Series of five, 50-frame strips, color, records.

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Capacitance in AC circuits, MN-8018B, 5 min.
AC series circuits, MN-8018C, 4 min.
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Foundations and concrete, MN-6719A, 26 min.
Framing, floor joists, and walls, MN-6719B, 25 min.
Framing, rafter principles, and common rafters, MN-6719C, 15 min.
Framing, hip and valley rafters, MN-6719D, 25 min.
Interior and exterior trim, MN-6719E, 12 min.
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Threading caps and dies, MN-7831G, 14 min.
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Plan now for tomorrow. Atlanta, Ga. Chamber of Commerce, 1955, 27 min., color.
Power by which we live. General Electric Co., 23 min., color.
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Miscellaneous Sources

A house in the sun. Jones & Laughlin, 40 min., color.
Basic electricity, TF1-4144. National Audiovisual Center, 19 min., color.
Building trades: the house builder, no. 5917. Universal Education Visual Arts, 15 min., color.
Cable surface wiring, OE 377. National Audiovisual Center, 17 min., b & w.
Knowing woods and their uses, code 401984. McGraw-Hill, 13 min., b & w.
Plans approved. National Forest Products, Assoc., 28 min., color.
Roughing-in nonmetallic sheathed cable, OE 373. National Audiovisual Center, 16 min., b & w.
Structural for modern building. Armco, 15 min., color.
Three-wire service entrance, OE 374. National Audiovisual Center, 24 min., b & w.
UNICOM method of house construction. National Lumber Manufacturers' Assoc., 33 min., color.
Wood finishing, code 401924. McGraw-Hill, 16 min., b & w.

SOURCE LIST

American Technical Society
848 East 58th Street
Chicago, Illinois 60637

Armco Steel Corporation
General Office Film Library
Middletown, Ohio 45042

Bailey-Film Associates
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Los Angeles, California 90025

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809 W. Detweiller Drive
Peoria, Illinois 61614

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4865 Stenton Avenue
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Department of the Navy
Office of Information
90 Church Street
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or, local Navy recruiter.

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Jones & Laughlin Steel Corp.
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McGraw-Hill Book Co. - Webster Division
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National Audiovisual Center
National Archives and Records
Service (G.S.A.)
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National Fire Protection Assoc.
60 Battery March Street
Boston, Massachusetts 02110

National Forest Products Assoc.
1619 Massachusetts Avenue, N.W.
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National Lumber Manufacturers' Assoc.
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Dept. 6940
Troy, New York 12180

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Sears, Roebuck & Co.
Dept. 733g
925 S. Homan Avenue
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Stanley Tools Division
The Stanley Works
New Britain, Connecticut

State of New York, Dept. of Commerce
Film Library
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Albany, New York 12205

State of New York, Dept. of Labor
Division of Labor Standards
80 Centre Street
New York, New York 10013

State of New York, Division of Housing
and Community Renewal
Housing and Building Codes Bureau
393 Seventh Avenue
New York, New York 10001

Structural Clay Products Institute
1520-18th Street, N.W.
Washington, D.C. 20036

Sweet's Catalog Service
F.W. Dodge Corp.
330 West 42nd Street
New York, New York 10001

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Indianapolis, Indiana 46206

Tweedy Transparencies
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East Orange, New Jersey 07018

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Washington, D.C. 20036

U.S. Dept. of Housing and Urban Development
Washington, D.C. 20036

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

Visual Products Division
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3M Center
St. Paul, Minnesota 55110