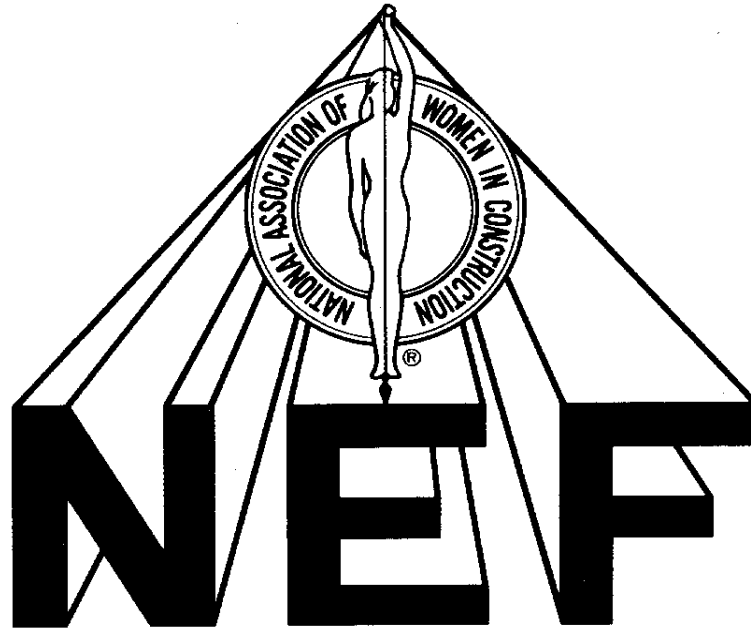


**NAWIC EDUCATION FOUNDATION**

# **BUILDING DESIGN GUIDELINES**



**P. O. Box 57069, Raleigh, North Carolina 27627  
866-277-2883 Toll Free**

**508 Merwin Road, Raleigh, North Carolina 27606**

**BUILDING DESIGN PROGRAM**

## MIDDLE/JUNIOR HIGH SCHOOL (GRADES SIX through NINE)

### CHAPTER INSTRUCTIONS AND GUIDELINES

#### I. Structure of Program

- A. The Building Design Program for students in grades six through nine shall be administered by the NAWIC Education Foundation.
- B. Participating Sponsors shall select a Building Design Program chairperson to coordinate the program.

#### II. Program Description

- A. This Building Design Program is a team-based program that encourages students to apply and integrate skills learned in math, science and communication arts classes.

#### III. Objectives

- A. To enhance awareness of Construction Industry Careers and Professions;
- B. To highlight the interrelations between math, science, technology and communication as they relate to the Construction Industry; and
- C. To foster critical thinking, problem solving and creativity.

#### IV. Design Problem

- A. Each sponsor shall be furnished with a Student Packet with a “Design Problem” included. The problem shall be generic enough to meet the needs of all areas of the United States and Canada.

#### V. Eligibility

- A. Any middle level student (grades six – nine) may participate in the Building Design Program through the sponsoring entity.  
Student may be:
  - 1. Enrolled in a Public or Private School.
  - 2. Participate in a school enrichment program (after-school or on weekends).
  - 3. Attend a Boys and Girls Club.
  - 4. Involved in scouting activities.
  - 5. Involved in any other organized educational activity.

#### VI. Fees/Supplies

- A. There will be no fee for participating.
- B. Design supplies are the responsibility of the participant or local sponsor.



## LETTER TO SCHOOL

Date:

To: Mathematics, Science and Communication Arts, Industrial Arts Instructor, State Technology Education Association Supervisor, or other Education coordinator

From: Jane WIC, Construction Industry Committee or Building Design Program Chair

Re: Building Design Program

The National Association of Women in Construction (NAWIC) \_\_\_\_\_ Chapter is sponsoring a Building Design Program for middle level students for the 2004-2005 school year and we wish to encourage you and your students to participate.

The Building Design Program is a vehicle to introduce students to the imaginative world of construction through the following objectives:

- ◆ Enhance awareness of Construction Industry Careers and Professions;
- ◆ Highlight the interrelations between math, science, technology and communication as they relate to the Construction Industry; and
- ◆ Foster critical thinking, problem solving and creativity.

As the instructor you will be supplied with instructor guidelines and your students a design problem and other resource materials.

The members of the NAWIC \_\_\_\_\_ Chapter will be here to serve as your industry “experts” to supply guest instructors and other resources you may need. The NAWIC Education Foundation believes the challenge of meeting future work force demands, requires immediate attention to the importance of educating, training, and preparing our youth for careers in the Construction Industry.

We hope you will participate in this innovative program and look forward to hearing from you. Please contact me, to schedule a meeting time to discuss the program further and plan guest lecture dates. I can be reached during the hours of \_\_\_\_\_ at \_\_\_\_\_ or via e-mail at \_\_\_\_\_.





## **SAMPLE PRESS RELEASE**

(Fill in necessary information. Please individualize this release.)

**FOR IMMEDIATE RELEASE  
MONTH, DAY, YEAR**

**FOR FURTHER INFORMATION CALL:**  
Chairperson's name and daytime phone number

### **FUTURE CONSTRUCTION INDUSTRY PROFESSIONALS BEGIN THEIR TRAINING!**

*City, State* ~ The National Association of Women in Construction (NAWIC) \_\_\_\_\_ Chapter will sponsor a Building Design Program for middle level students in the \_\_\_\_\_ (school or school district or troop, etc.). This program is administered by the NAWIC Education Foundation in an effort to create an awareness of career opportunities in the Construction Industry.

The NAWIC Education Foundation is a Texas, non-profit corporation operating to provide and promote educational opportunities and programs to benefit the Construction Industry throughout the United States and Canada.

The Construction Industry is a diverse industry with many career facets. This industry is innovative, technical and exciting. The Building Design Program is a vehicle to introduce students to the imaginative world of construction through the following objectives:

- ◆ Enhance awareness of Construction Industry Careers and Professions;
- ◆ Highlight the interrelations between math, science, technology and communication as they relate to the Construction Industry; and
- ◆ Foster critical thinking, problem solving and creativity.

The members of the \_\_\_\_\_ Chapter of NAWIC believe the challenge of meeting future workforce demands requires immediate attention to the importance of education, training and preparing our youth for careers in construction.



## QUICK REFERENCE GUIDE

1. Appoint a Building Design Program Chair. The Building Design Chair should familiarize their selves with *entire* program package and call the Regional or National Chair with any questions and/or concerns.
2. Determine budget requirement for providing supplies and/or sponsoring competition (optional).
3. Make contact with the school, mathematics, science and communication arts instructors, state supervisor of the Technology Education Association (see attached list), scouting council, activities director, etc. Send an introductory letter and the instructor and student packets. Follow up with a phone call to further promote the program.
4. Send press releases to your local newspapers and education publications to announce the program.
5. Schedule a visit to meet with the instructor. Building Design Chair and the instructor should map out the program together. Timeline the schedule of guest lecturers, construction site tours, etc. NAWIC insurance is not available for site tours. Be sure to check liability requirements of owner and/or general contractor as well as school policy.
6. Solicit and schedule guest lecturers from your chapter and the construction industry. Schedule a job site and/or construction office tour. (See note above regarding site tours.) Arrange for industry professionals to judge completed projects if having competition.
7. Visit the class to view the completed projects.
8. Invite the students and instructor to a chapter meeting or recognition night. Give gifts or awards, as the chapter feels necessary.

## TIMELINE OF ACTIVITIES

### DATE LINE (SUGGESTED)

### ACTIVITY

March – June

Contact the instructor to introduce them to the Building Design Program. Prepare the instructor for the upcoming school year.  
Attend your State Technology Education Association conference or meeting to present a workshop on the Building Design Program.

August – September

Contact the instructor to meet with them to discuss and plan the program. Gain their support. Make up a schedule for guest lecturers and class visits.

### **Remember: Enthusiasm is contagious!**

September – December

The Building Design Program is scheduled for Ten Lessons. These lessons may take ten days or ten weeks, depending upon the instructor and the added value of the NAWIC chapter. Visit the class, guest lecture, and offer support and encouragement.

- ◆ Lesson One – Student Introduction
- ◆ Lesson Two – Floor Plans
- ◆ Lesson Three – Floor Plans continued
- ◆ Lesson Four – Site Plans
- ◆ Lesson Five – Estimating
- ◆ Lesson Six – Models
- ◆ Lesson Seven – Models Continued
- ◆ Lesson Eight – Careers
- ◆ Lesson Nine – Report
- ◆ Lesson Ten – Completion

October – December

Visit the class to view final projects. Invite the students to a recognition night or a chapter meeting. This is an excellent time to give certificates and hold an award presentation.



## **The Building Design Program may be started in the fall or spring semester.**

**If it has been decided to run the Building Design Program in the spring, start here.**

January - February                      Contact the instructor to meet with them to discuss and plan the program. Gain their support. Make up a schedule for guest lecturers and class visits.

February – May                              The Building Design Program is scheduled for Ten Lessons. These lessons may take ten days or ten weeks, depending upon the instructor and the added value of the NAWIC chapter. Visit the class, guest lecture, and offer support and encouragement.

- ◆ Lesson One – Student Introduction
- ◆ Lesson Two – Floor Plans
- ◆ Lesson Three – Floor Plans continued
- ◆ Lesson Four – Site Plans
- ◆ Lesson Five – Estimating
- ◆ Lesson Six – Models
- ◆ Lesson Seven – Models Continued
- ◆ Lesson Eight – Careers
- ◆ Lesson Nine – Report
- ◆ Lesson Ten – Completion

May – June                                      Visit the class to view final projects. Invite the students to a recognition night or a chapter meeting. This is an excellent time to give certificates and hold an award presentation.

These are recommended guidelines to assist the program gain the most exposure. Your chapter can get started with as little as one class, after-school program or troop in your area. The Building Design Program also meets the second goal of the 1999-2000 NAWIC Strategic Plan: NAWIC will be the vehicle that provides more women to the construction industry by creating opportunities to participate in industry enhancement programs.



## GETTING THE WORD OUT!

There are several ways to inform the public about the Building Design Program. One very effective way is contact your local chapter of the International Technology Education Association.

By contacting this association you can send announcements about all of the NAWIC Education Foundation's k-12 programs to their member publication attend a local meeting, present at their state conference and receive a list a teachers that would be interested in participating in the Building Design program. Below is a list of State Supervisors to contact initially about the program. The State Supervisor can then direct you to the next step.

<p><b>ALABAMA</b> Bruce Baker Technology Ed/Industrial Arts Alabama Department of Education 5226 Gordon Persons Building PO Box 302101 Montgomery, AL 36130 334/242-9112 F 334/242-0234 <a href="mailto:bbaker@sdenet.alsde.edu">bbaker@sdenet.alsde.edu</a></p>	<p><b>ALASKA</b> Sue Ethelbah Vocational Education Alaska Department of Education 801 W. 10<sup>th</sup> Street, Suite 200 Juneau, AK 99801 907/465-8729 F 907/465-3240 <a href="mailto:sethelba@educ.state.ak.us">sethelba@educ.state.ak.us</a></p>	<p><b>ARIZONA</b> Richard Ralson State Supervisor Technical Education Arizona Department of Education 1535 West Jefferson Street – Bin 42 Phoenix, AZ 85007-3209 602/542-5423 F 602/542-1849 <a href="mailto:rralsti@mail1.ade.state.az.us">rralsti@mail1.ade.state.az.us</a></p>
<p><b>ARKANSAS</b> Dick Burchett, Program Manager Trade and Industrial Education Luther S. Hardin Building #3 Capitol Mall 501D Little Rock, AR 72201-1083 501/682-1271 F 501/682-1509 <a href="mailto:dburchett@worked.state.ar.us">dburchett@worked.state.ar.us</a></p>	<p><b>CALIFORNIA</b> Dennis Turner, Technology Ed State Supervisor California Dept. of Education 721 Capitol Mall, 4<sup>th</sup> Floor Sacramento, CA 95814 916/657-2446 F 916/657-2521 <a href="mailto:dturner@cde.ca.gov">dturner@cde.ca.gov</a></p>	<p><b>COLORADO</b> Dr. Jerry Atkinson, Vocational/Technical Program Manager Colorado Community College &amp; Occupational Education System 1391 N. Speer Blvd, Ste 600 Denver, CO 80204 303/595-1580 F 303/825-4295 <a href="mailto:SB_JERRYA@CCCS.CCCOES.EDU">SB_JERRYA@CCCS.CCCOES.EDU</a></p>
<p><b>CONNECTICUT</b> Gregory C. Kane, State Supervisor Technology Education Bureau of Curriculum &amp; Instructional Program Connecticut Dept. of Education 165 Capitol Avenue Hartford, CT 06106 860/566-5658 F 860/566-5623 <a href="mailto:gkane@aol.com">gkane@aol.com</a></p>	<p><b>DELEWARE</b> Clark Greene, State Supervisor Technology Education Delaware Depart of Public Instruction PO Box 1402 Dover, DE 19903 302/739-4681 F 302/739-3744 <a href="mailto:cgreenea@den.k12.state.de.us">cgreenea@den.k12.state.de.us</a></p>	<p><b>DISTRICT OF COLUMBIA</b> Dr. Cynthia M. Bell, Director Vocational Education Branch DC Public Schools 1709 3<sup>rd</sup> Street, NE Room 24 Washington, DC 2002 202/576-6308 F 202/576-7800 <a href="mailto:nrc%bell@mercury.k12.dc.us">nrc%bell@mercury.k12.dc.us</a></p>
<p><b>FLORIDA</b> Doug Wagner, State Supervisor Technology Education Florida Department of Education 325 West Gaines Street, Ste 714 Tallahassee, FL 32399-0400 850/488-1831 F 850/487-1735 <a href="mailto:wagnerd@mail.doe.state.fl.us">wagnerd@mail.doe.state.fl.us</a></p>	<p><b>GEORGIA</b> Ron Barker, State Supervisor Technology Education Georgia Department of Education Twin Towers East, Ste 1770 Atlanta, GA 30334 404/657-8316 F 404/651-8984 <a href="mailto:rbarker@doe.k12.ga.us">rbarker@doe.k12.ga.us</a></p>	<p><b>HAWAII</b> Anthony Calabrese, Education Specialist School Renewal Group 189 Lunalilo Home Road, 2<sup>nd</sup> Fl Honolulu, HI 96825 808/394-1312 F 808/394-1304 <a href="mailto:anthony_calabrese@notes.k12.hi.us">anthony_calabrese@notes.k12.hi.us</a></p>



<p><b>IDAHO</b>  Don Eshelby, State Program Manager  Trade &amp; Technology Ed  State Advisor VICA &amp; TSA  Len B. Jordon Bldg, Rm. 324  650 West State Street  PO Box 83720  Boise, ID 83720-0095  208/334-3216 F 208/334-2365  <a href="mailto:DESHELBY@VED.STATE.ID.US">DESHELBY@VED.STATE.ID.US</a></p>	<p><b>ILLINOIS</b>  Ronald Engstrom  Principal Technology Education  Consultant  Illinois State Board of Education  100 North First St., N-242  Springfield, IL 62777-001  217/782-2826 F 217/785-9210  <a href="mailto:rengstro@smtp.isbe.state.il.us">rengstro@smtp.isbe.state.il.us</a></p>	<p><b>INDIANA</b>  Gregg Steele, Technology Education  Specialist  Indiana Department of Education  State House, Rm. 229  Indianapolis, IN 46204  317/232-9184 F 317/232-9121  <a href="mailto:gsteele@ideanet.doe.state.in.us">gsteele@ideanet.doe.state.in.us</a></p>
<p><b>IOWA</b>  Mr. Myril Harrison  Technology Education Consultant  Department Iowa Department of Education  Bureau of Technical &amp; Vocational  Education  Grimes State Office Building  East 14<sup>th</sup> and Grand  Des Moines, IA 50319  515/281-3590 F 515/281-6544  <a href="mailto:mharris@ed.state.ia.us">mharris@ed.state.ia.us</a></p>	<p><b>KANSAS</b>  Craig Haugsness, Education Program  Consultant Industrial Arts/Technology Ed  Kansas Department of Education  120 East 10<sup>th</sup> Street  Topeka, KS 66612  785/296-7285 F 785/296-3523  <a href="mailto:cah@smtpgw.ksbe.state.ks.us">cah@smtpgw.ksbe.state.ks.us</a></p>	<p><b>KENTUCKY</b>  Henry Lacy, Program Consultant  Technology Education  Kentucky Department of Education  2127 Capital Plaza Tower  500 Mero Street  Frankfort, KY 40601  502/564-3472 F 502/564-7371  <a href="mailto:hlacy@kde.state.ky.us">hlacy@kde.state.ky.us</a></p>
<p><b>LOUISIANA</b>  Jerry O'Shee, Program Manager  Technology Education  Louisiana Department of Education  PO Box 94064, Rm. 333  Baton Rouge, LA 70804-9064  504/342-3609 F 504/342-7367  <a href="mailto:joshee@mail.doe.state.la.us">joshee@mail.doe.state.la.us</a></p>	<p><b>MAINE</b>  Lloyd Keast, Director Technology Ed  Maine Department of Education  State House, Station #23  Augusta, ME 04333  207/287-5854 F 207/289-5894  <a href="mailto:lloyd.keast@state.me.us">lloyd.keast@state.me.us</a></p>	<p><b>MARYLAND</b>  Kathy Chernus  Lead Specialist in Technology Ed  Maryland State Dept of Ed  Division of Career Tech 7 Adult Learning  200 W. Baltimore Street, 3<sup>rd</sup> Fl  Baltimore, MD 21201-2595  410/767-0177 F 410/333-2099  <a href="mailto:kchernus@msde.state.md.us">kchernus@msde.state.md.us</a></p>
<p><b>MASSACHUSETTS</b>  David Bouvier  Statewide Technology Education  Coordinator  Massachusetts Depart of Ed  350 Main Street  Malden, MA 02148-5023  781/388-3300 ext 278 F 781/338-3394  <a href="mailto:dbouvier@doe.mass.edu">dbouvier@doe.mass.edu</a></p>	<p><b>MICHIGAN</b>  Dr. James Levande  Contracting Consultant, Technology  Education  Office of Career &amp; Technology Ed  Michigan Department of Ed  Box 30009  Lansing, MI 48909-7509  517/373-6731 F 517/373-8776  <a href="mailto:levandej@state.mi.us">levandej@state.mi.us</a></p>	<p><b>MINNESOTA</b>  Thomas Ryerson  Tech Prep/Technology Education Specialist  Department of Children, Families and  Learning  107 Capitol Square Building  550 Cedar Street  St. Paul, MN 55101-2233  612/296-1106 F 612/296-3348  <a href="mailto:tom.ryerson@state.mn.us">tom.ryerson@state.mn.us</a></p>
<p><b>MISSISSIPPI</b>  Ms. Lynn Basham, State Supervisor  Technology Education  Mississippi Department of Education  PO Box 771  Jackson, MS 39205-0771  601/359-3482 F 601/359-6619  <a href="mailto:lbasham@mdek12.state.ms.us">lbasham@mdek12.state.ms.us</a></p>	<p><b>MISSOURI</b>  Bart Washer, State Supervisor  Industrial Technology Education  Missouri Dept of Elementary &amp;  Secondary Education  PO Box 480  205 Jefferson St.  Jefferson City, MO 65102  573/751-7764 F 573/526-4261  <a href="mailto:bwasher@mail.dese.state.mo.us">bwasher@mail.dese.state.mo.us</a></p>	<p><b>MONTANA</b>  Dr. Jody Messinger, Specialist  Industrial &amp; Technology Education  Montana Office of Public Instruction  State Capitol  106 State Capitol  PO Box 202501  Helena, MT 59620-2501  406/444-4452 F 406/444-1371  <a href="mailto:jmessinger@opi.mt.gov">jmessinger@opi.mt.gov</a></p>



<p><b>NEBRASKA</b>  Bob Phelps  Nebraska Department of Education  301 Centennial Mall South  PO Box 94987  Lincoln, NE 68509-4987  402/471-4819 F 402/471-0117  <a href="mailto:bp Phelps@nde4.nde.state.ne.us">bp Phelps@nde4.nde.state.ne.us</a></p>	<p><b>NEVADA</b>  Michael J. Raponi, Consultant  Trade &amp; Industrial Education  Nevada Department of Education  700 E. Fifth Street  Carson City, NV 89710-5096  702/687-9196 F 702/687-9114  <a href="mailto:mraponi@nsn.k12.nv.us">mraponi@nsn.k12.nv.us</a></p>	<p><b>NEW HAMPSHIRE</b>  Dr. Ed Taylor, Curriculum Supervisor  Technology Education  New Hampshire Dept of Ed  101 Pleasant Street  Concord, NH 03301  603/271-3886 F603/271-1953  <a href="mailto:etaylor@ed.state.nh.us">etaylor@ed.state.nh.us</a></p>
<p><b>NEW JERSEY</b>  Mark Wallace, Executive Director  Technology Educators Assoc. of NJ  PO Box 219 Sammis Rd  Vernon, NJ 07462  973/764-7419 F 973/764-7419  <a href="mailto:tpps26@tapnet.net">tpps26@tapnet.net</a></p>	<p><b>NEW MEXICO</b>  Karen Christopherson, State Supervisor  Technology Education  New Mexico Department of Education  300 Don Gaspar  Santa Fe, NM 87503  505/827-6665 Fax 505/827-4041  <a href="mailto:kchristopherson@sde.state.nm.us">kchristopherson@sde.state.nm.us</a></p>	<p><b>NEW YORK</b>  Eric F. Shur, Associate State Supervisor  Technology Education  New York State Dept of Education  Room 674 EBA  89 Washington Ave.  Albany, NY 12234  518/486-3659 Fax 518/473-0858  <a href="mailto:eshur@mail.nysed.gov">eshur@mail.nysed.gov</a></p>
<p><b>NORTH CAROLINA</b>  Deborah Shumate, Technology Education  Consultant  North Carolina Department of Public  Instruction  301 North Wilmington Street  Raleigh, NC 27601-2825  919/715-1715 fax 919/715-1628  <a href="mailto:dishumate@dpi.state.nc.us">dishumate@dpi.state.nc.us</a></p>	<p><b>NORTH DAKOTA</b>  Mark Wilson, State Supervisor  Technology Education  State Board for Vocation Education  Capitol Building, 15<sup>th</sup> Floor  600 East Boulevard Avenue  Bismarck, ND 58505-0610  701/328-2711 fax 328-1255  <a href="mailto:mwilson@pioneer.state.nd.us">mwilson@pioneer.state.nd.us</a></p>	<p><b>OHIO</b>  Dr. Richard A. Dieffenderfer  Consultant, Industrial Technology  Ohio State Dept of Education  65 South Front Street, Room 1005  Columbus, OH 43215-4183  614/466-2211 fax 614/728-3058  <a href="mailto:pd_dieffende@ode.ohio.gov">pd_dieffende@ode.ohio.gov</a></p>
<p><b>OKLAHOMA</b>  Mr. Lynn Hawkins  State Program Administrator  Technology Education  Oklahoma Dept of Vocational &amp; Technical  Education  1500 West. 7<sup>th</sup> Avenue  Stillwater, OK 74074-4364  405/743-5478 fax 405/743-6809  <a href="mailto:lhawk@okvotech.org">lhawk@okvotech.org</a></p>	<p><b>OREGON</b>  Fred Uecker  Industrial &amp; Engineering System  Specialist  Office of Professional Technical Ed.  Oregon Department of Education  255 Capitol Street, NE  Salem, OR 97310  503/378-3584 ext. 336 fax 503/373-7968  <a href="mailto:Ed.UECKER@state.or.us">Ed.UECKER@state.or.us</a></p>	<p><b>PENNSYLVANIA</b>  Robert Dorn  Technology Education Supervisor  Pennsylvania Department of Ed  333 Market Street, 8<sup>th</sup> Floor  Harrisburg, PA 17126-0333  717/783-6848 fax 717/787-7066  <a href="mailto:bdorn@northstar.csiu.k12.pa.us">bdorn@northstar.csiu.k12.pa.us</a></p>
<p><b>RHODE ISLAND</b>  Dr. Richard J. Kramer, Specialist,  Vocational Education Programs  Office of Workforce Development  Rhode Island Department of Elementary &amp;  Secondary Education  255 Westminster Street  Providence, RI 02903  401/222-4600 ext. 2007 fax 401/222-2537  <a href="mailto:ride1562@ride.ri.net">ride1562@ride.ri.net</a></p>	<p><b>SOUTH CAROLINA</b>  Benjamin T. Martin  Education Associate, Trade &amp; Industrial  Education  915-A Rutledge Building  1429 Senate Street  Columbia, SC 29201  803/734-3398 fax 803/734-3525  <a href="mailto:btmartin@sde.state.sc.us">btmartin@sde.state.sc.us</a></p>	<p><b>SOUTH DAKOTA</b>  George D. Rockhold  Program Representative  Department of Education and Cultural  Affairs  Division of Workforce &amp; Career Preparation  700 Governors Drive  Pierre, SD 57501-2291  605/773-4736 fax 605/773-4236  <a href="mailto:georger@deca.state.sd.us">georger@deca.state.sd.us</a></p>



<p><b>TENNESSEE</b>  Thomas A. D'Apolito  Consultant, Technology Education  Division of Vocational-Technical Education  Andrew Johnson Twr, 4<sup>th</sup> Floor  710 James Robertson Parkway  Nashville, TN 37242-0383  615/532-2844 fax 615/532-8226  <a href="mailto:tdapolito@mail.state.tn.us">tdapolito@mail.state.tn.us</a></p>	<p><b>TEXAS</b>  Richard Grimsley  Director, Technology Education  Texas Education Agency  1701 North congress Ave.  Austin, TX 78701-1494  512/463-9474 fax 512/475-3575  <a href="mailto:trgrims1@mail.tea.state.tx.us">trgrims1@mail.tea.state.tx.us</a></p>	<p><b>UTAH</b>  Jim Christensen  Technology Education specialist  Utah State Office of Education  250 East 500 South  Salt Lake City, UT 84111  801/538-7598 fax 801/538-7868  jim.christensen.usoe.k12.ut.us</p>
<p><b>VERMONT</b>  Doug Webster  Trade &amp; Industry consultant  Vermont Department of Education  120 state Street  Montpelier, VT 05602  802/828-3131 fax 802/828-3146  <a href="mailto:dwebster@doe.state.vt.us">dwebster@doe.state.vt.us</a></p>	<p><b>VIRGINIA</b>  George R. Wilcos  Principal Specialist  Technology Education Service  Virginia Department of Education  PO Box 2120  Richmond, VA 23218-2120  804/225-2839 fax 804/371-2456  <a href="mailto:gwillcox@iris.org">gwillcox@iris.org</a></p>	<p><b>WASHINGTON</b>  Ron Crawford  Supervisor Vocational Education Programs  Curriculum &amp; Professional Development  Old Capitol Building  PO Box 47400  Olympia, WA 98504-7200  360/753-5670 fax 360/753-4515  <a href="mailto:crawford@ospi.wednet.edu">crawford@ospi.wednet.edu</a></p>
<p><b>WEST VIRGINIA</b>  Ms. Alta McDaniel  Supervisor, Technology Education  West Virginia Department of Education  1900 Kanawha Blvd. Bldg 6-243-B  Charleston, WV 25305-0330  304/558-2194 fax 304-558-3946  <a href="mailto:amcdanie@access.k12.wv.us">amcdanie@access.k12.wv.us</a></p>	<p><b>WISCONSIN</b>  Kevin Miller  Technology Education Consultant  Wisconsin Department of Public  Instruction  PO Box 7841  Madison, WI 53707-7841  608/266-3551 fax 608/267-9275  <a href="mailto:millekd@mail.state.wi.us">millekd@mail.state.wi.us</a></p>	<p><b>WYOMING</b>  Dr. Alan Sheinker  Data &amp; technology Unit  Wyoming Department of Education  Hathaway Building, 2<sup>nd</sup> Floor  Cheyenne, WY 82002  907/777-6213 fax 307/777-6234  <a href="mailto:ashein@educ.state.wy.us">ashein@educ.state.wy.us</a></p>
<p><b>ALBERTA</b>  Ms. Sharon Prather  Program Manager CTS  Curriculum Branch  Alberta Education  Devonian Building, West Tower  11160 Jasper Avenue  Edmonton, Alberta TSK OL2 CANADA  403/427-2984 fax 403/422-3745</p>	<p><b>NOVA SCOTIA</b>  Eric Worden, Consultant  NS Department of Education  Industrial Arts  21 Brunswick Street  PO Box 578  Halifax, Nova Scotia B3J 2S9 CANADA  902/424-5906 fax 902/424-0613</p>	<p><b>ONTARIO</b>  Bernie Burns, Education Officer  Ministry of Education  16<sup>th</sup> floor-Mowat Block, Room 1626  Queen's Park, 900 Bay Street  Toronto, Ontario M7A 1L2 CANADA  416/325-2542 fax 416/325-2575</p>



# DESIGN BUILDING PROGRAM

## MIDDLE/JUNIOR HIGH SCHOOL (GRADES SIX through NINE)

### INSTRUCTOR GUIDELINES

#### INSTRUCTOR INTRODUCTION

The Construction Industry is a diverse industry with many career facets. This industry is innovative, technical and exciting. This building design program is a vehicle to introduce students to the imaginative world of construction through the following objectives:

**Enhance awareness of Construction Industry Careers and professions;**  
**Highlight the interrelations between math, science, technology and communication as they relate to the Construction Industry; and**  
**Foster critical thinking, problem solving and creativity.**

The application of math is key to the success of this project. The Building Design Program encourages students to apply and integrate skills learned in math, science and communication arts classes. It is appropriate for grades six through nine and is to be completed in teams of two – five students.

Most educators agree that involving the tactile sense enhances learning of abstract concepts. Scaled model building offers a “hands-on” approach for students to learn and apply abstract concepts.

#### Math Concepts

Students will learn:

- Scale - Develop an understanding of the concept of scale as it relates to the construction industry. Scale is the proportion used to determine the relationship of a representation
- Estimating – Learn the process of judging or calculating the quantity of materials, labor and equipment required for a given piece of work; make judgments as to the best use and costs of materials, labor and equipment.
- Conversion – Learn the process of changing from one unit to another and the skills used to make a scaled drawing.
- Measurement - Demonstrate the ability to measure to ¼ inch scale, which will allow the student to draw their sketches and floor plan drawings.

#### Science Concepts

Students will learn:

- Brainstorming - Use brainstorming techniques to explore a variety of floor plans and design options. No judgment is made as to the value of one option over the other until the process is complete.



Problem Solving - Analyze possible solutions and then implement the proposed solution. The solution is then evaluated to determine its appropriateness in relationship to the problem. Generally, problem solving model is:

### **INPUT - PROCESS - OUTPUT – FEEDBACK**

#### Communication Concepts

Students will learn:

- Listening - Develop listening skills and follow directions.
- Writing – Create written reports that present organized thought.
- Oral Speaking – Present their project to a larger group, and discuss their reasoning and point of view.
- Researching and Reading – Research and read materials necessary to gather information to make decisions about the project.

This project will make students knowledgeable about careers, as engineers, architects, construction managers, carpenters or other skilled crafts, by helping them become aware of the diverse construction world more clearly. Students also explore duties performed in the Construction Industry through a variety of activities in this project.

This project is designed to take a **MINIMUM** of ten class periods. The instructor is **STRONGLY ENCOURAGED** to extend that time frame in order to meet the objectives of the program, your goals for the class, as well as fulfilling the needs of the students. The average class has completed work for this program outside of the classroom and has taken up to 15 class periods.

Lesson plan guidelines begin on page fourteen (14). It is not the intent of the NAWIC Education Foundation to give the instructor detailed instruction ready lesson plans. The guidelines give the instructor an objective for the day. Further plans detailing specific objectives, instructional input, guided and independent practice is left up to the instructor's discretion. It is strongly recommended that construction industry professionals be used to supplement instruction materials.



# INSTRUCTOR LESSON PLAN GUIDELINES

## **LESSON ONE – Student Introduction**

Introduce the entire project, explaining the goals and objectives of this activity. Assign the students to construction teams of two to five students. Walk the students through the different types of activities they will be doing during the next ten-plus days. Use a Construction Industry video to help you give an overview of the construction industry and support a class discussion.

Go through the student packet and explain all of the different activities. It is suggested that you have a speaker this day to give an overview of the construction industry and help support the importance of this kind of learning activity. Make sure to explain the grading and/or project evaluation to be performed.

Students should think about selecting construction careers on which to report. See page 16.

Students are expected to record their experiences in a journal or job logbook. The journal is better known as a Job Log in the construction industry. The importance of the job log is to record daily activities on the job site. The job log becomes a permanent document in the project files. Job logs are later referred to if there is a possible legal problem or other discrepancies on the project. Recordings usually start with date, time, weather, and those present on site.

### **CRITERIA FOR JOURNALS:**

**What difficulties did the students encounter?**

**What did the students enjoy most during this activity?**

**What math did they learn about that is used in construction.**

**What technology did they learn about that is used in construction.**

**What types of communication did they learn about that is used in construction.**

**What science did they learn about that is used in construction.**

Encourage the use of the last five minutes of the period for the students to record information in their journals.

### SUGGESTIONS:

**Use a Construction Industry video for an overview of the construction industry. Videos can be ordered from the NAWIC Education Foundation at 866-277-2883 and/or e-mail [nef@airmail.net](mailto:nef@airmail.net)**

*Or*

**Use a NAWIC or other Construction Industry Professional to give a brief introduction to the construction industry this day.**



## **LESSON TWO – Floor Plans**

Discuss how to sketch a floor plan.

Students will be starting rough work (sketching) but are not expected to finish today. Introduce the scientific concept of brainstorming and problem solving.

Have students work in-groups of two - five, brainstorming different solutions to the design problem. They will remain in this group throughout the remainder of the project. Have them draw as many ideas as possible on blank pieces of paper. Remind them that there are no wrong solutions during the brainstorming process.

When rough work is completed, have them make any modifications needed and then do a finished sketch on ¼” graph paper. Hand out the graph paper and explain what a scale drawing is. Students should select their best idea and have them layout a floor plan using ¼” scale graph paper.

Keep all sketches for project documentation. Encourage the use of the last five minutes of the period for students to record information in their journals.

### **SUGGESTIONS:**

**Refer to Architectural Graphics and Building Construction Illustrated both by Frank Ching (published by Van Nostrand Reinhold New York) as a reference for a basic introduction to drawing for floor plans.**

*Or*

**Bring in NAWIC or other Construction Industry Professional/Architect/Drafter to give a lesson on drawing floor plans.**

## **LESSON THREE – Floor Plans *continued***

Take the first ten minutes of class to explain floor plan symbols and roof structures. Talk about the types of roofs and their advantages. Look on Roof Designs sheet for allowable types. Roof should have a 2’ overhang to scale.

Have students continue to work on their floor plans for the remainder of the hour. Students should draw an elevation for each wall and the floor. This will help the student visualize walls for the model.

Answer any individual questions that may come up during this time. Remind participants to include location of plumbing fixtures, cabinets, outlets, furnace and hot water heater. Keep floor plan work for project documentation.

Encourage the use of the last five minutes of the period for students to record information in their journals.



SUGGESTIONS:

**Same as above.**

### **LESSON FOUR-Site Plans**

Students should be finishing their floor plans and elevations today. Possibly, bring in a surveyor to speak on the topic of surveying.

Have them place their house outlining on the site plan. Using the site plan provided, have them locate their house in accordance within setback requirements specified on the site plan.

Take ten minutes to explain house location on site plans in relationship to local environmentalist.

SUGGESTIONS:

**Have students cut out a square or rectangular piece of colored paper representing the size of their building at the scale of the site plan. Students can easily move paper around on the site plan and discuss advantages and disadvantages of different locations.**

### **LESSON FIVE – Estimating**

Handout the **Math Worksheet** associated with this activity.

Explain the concept of square footages to students. Students will be working with estimating, calculations. Review your proposed grading/evaluation criteria for their total project.

Introduce the concept of estimating. Go through the enclosed price list for materials with the students and have them fill out the Bill of Materials.

Make sure that they show all of their calculations. Encourage the use of the last five minutes of the period for students to record information in their journals.

SUGGESTIONS:

**Estimating is the process of quantity take-off and assigning costs to that take-off. Estimators measure the cost of a construction project. Estimators take into account the amount of material it will take to complete a building, cost of labor and profit.**



## **LESSON SIX- Models**

Students should begin their models today. (Refer to *Model Construction Suggestions* in appendix)

Using the information from above, have them layout walls, roof and floor on 1/8" foam board. Account for roof selection in wall layout. They will eventually cut all parts out and assemble the house using a hot glue gun, rubber cement or Elmer's glue-all.

Encourage the use of the last five minutes of the period for students to record information in their journals. Answer any individual questions that may come up during this time. Have them explain why they selected roof type used on model.

### SUGGESTIONS:

**1/8" foam board is suggested. Different widths of foam board are acceptable as well as museum board and corrugated cardboard. Model will take several days to complete**

## **LESSON SEVEN- Models Continued**

Students continue to work on their models and/or catch up on any work they may have.

## **LESSON EIGHT- Careers**

**This is career day.** Show a video tape about the different careers associated with the building industry or take the students on a field trip to an architectural and/or engineering firm. A working construction site might be of interest, or you may wish to bring a guest speaker in your room in conjunction with the video.

Discuss the videotape with the whole class and then have students begin writing their reports on five careers found in the construction industry. Students should complete their reports outside of class and they will be due on the last day.

Encourage the use of the last five minutes of the period for students to record information in their journals.

### SUGGESTIONS:

**Bring in several Construction professionals to get a wide perspective of the Construction Industry.**  
**Videos are available for order through the NAWIC Education Foundation.**  
**Field Trip to construction-related office or tour of job site.**



## **LESSON NINE- Report**

Explain the final report that students must complete, describing their solutions and all ideas that they had. Have them explain why they chose those particular solutions.

Give them the remainder of the hour to work on this report. Tell students that they should complete their reports outside of class and that they are due on the last day.

Encourage the use of the last five minutes of the period for students to record information in their journals. Students will explain their final solution in the report.

### **SUGGESTIONS:**

**Stress the importance of the report. Construction Industry professionals typically have to explain the concept of their project through oral and written communication to a wide variety of people. These people may include: community groups, investors, city officials, owners, etc. Students should reference back to their journals to write the report.**

## **LESSON TEN- Completion**

Finish any work that has not been done before today. Tie up all loose ends and have students submit all work necessary for evaluation. Collect all materials from students and let them know when all of the projects will be graded.

### **INSTRUCTOR NOTE:**

1. At your discretion, you may have students work on any activities outside of class.
2. Your local NAWIC Chapter may assist you in obtaining speakers or tours to complement your class experience.

# Student Information Packet

Design Problem  
Math Worksheets  
Roof Design  
Model Construction Suggestions  
Construction Industry Careers



# NAWIC Education Foundation

## STUDENT INTRODUCTION

### Building Design Program

This program is designed to present the Construction Industry to you in a fun and educational manner. The Construction Industry is innovative, technical and exciting. Working in this industry requires a good knowledge of math, science and communication.

A young family has recently purchased land in a new development area in your hometown. In an attempt to save money, you have been asked to act as their architect and design a modest house for them. This house must be built for the occupancy of three family members and must include eating, sleeping, living and private bath areas.

This family would like you to make the living area of the house as large as possible but they do not want you to exceed 1,000 square feet for the entire structure. As you know, there is not much money available to build this house. Your job is to keep total costs for this project under \$50,000.

### Design Considerations

While designing for a structure like this, there are always variables that Construction Industry Professionals like you must keep in mind. The land that the family purchased is in an urban area that has a small creek running through it and lots of trees.

No one constructs a building by themselves, it takes teamwork! You will be divided into teams of two – five to complete this program. Working in a team means that everyone must rely on collaboration to accomplish their group's goals. Teams can focus on resolving problems, creatively exploring possibilities or alternatives and executing well-developed plans, among other things.

You will be evaluated on your professionalism and thoroughness in the categories listed below. When you have completed your planning, you should have the following information completed:

1. Show the location of your house on the site plan provided.  
(Appendix titled Site Plan)
2. Complete the enclosed bill of materials keeping costs to \$50,000. Include the costs for the slab foundation, floor, all walls, windows, sink, toilet, etc. (Pages 10 and 11; Wall Sections in Appendix)
3. Keep a journal (Job Logbook) of all activities conducted during activity.  
Submit neatly handwritten journal.
4. Submit a typed report of the solution you chose explaining all of your ideas. This report should not exceed two (2) typed double spaced pages.
5. Use grid paper to sketch your house and submit it when done. You should include a view of each wall and the floor.  
Scale:  $\frac{1}{4}'' = 1' - 0''$



## Building Considerations

6. a) Using the information from step 5, layout all interior and exterior walls, roof, and floor on 1/8" foam board, museum board or corrugated cardboard.  
  
b) Cut out all parts and assemble the house using rubber cement or Elmer's Glue-all. Scale: 1/4" = 1'0"  
  
c) Submit model
  
7. From the information that you learned in class select five building trades/careers needed to build your house and explain the types of duties or activities they would be doing. This report should not exceed two (2) double spaced typed pages. Submit report.

### Materials Take Off List

#### Structural Materials

	Cost	Quantity	Total
Bay window 60" x 42"	\$ 1,500	_____	_____
Picture window 60" x 42"	1000	_____	_____
Standard window			
24" x 28" double hung	100	_____	_____
24" x 36" double hung	150	_____	_____
30" x 36" double hung	200	_____	_____
Door interior	100	_____	_____
Door exterior	350	_____	_____
Interior walls			
number of linear ft _____	12	_____	_____
Exterior walls			
number of linear ft _____	42	_____	_____
(2 x 4 construction)			
number of linear ft _____	46	_____	_____
(2 x 6 construction)			
Concrete slab 4" thick 8.5 yards	45 per yd	_____	_____
Roofing			
number of square ft _____	2	_____	_____

#### Interior Build-in Items

Upper cabinets	50 linear ft	_____	_____
Lower cabinets	100 linear ft	_____	_____
(price includes cost of countertop)			
Bathroom sink	125	_____	_____
Toilet	250	_____	_____
Bath tub	500	_____	_____
Shower	300	_____	_____
Kitchen sink	200	_____	_____
Flooring			
vinyl No sq yd _____	10 sq yd	_____	_____
carpeting No sq yd _____	15 sq yd	_____	_____
Water heater	700	_____	_____
Furnace			
Used for 2" x 6" exterior walls	1500	_____	_____
Used for 2" x 4" exterior walls	2000	_____	_____
Outlets	50	_____	_____
(6 minimum required by code)			
Lighting fixtures	75	_____	_____
(3 minimum required by code)			
Building permit	20	_____	_____

Note all materials includes cost of labor

**Total Cost**

\_\_\_\_\_



### Materials Math Worksheet

(Show all work)

Estimate the number of square feet needed for the following

Bathroom	L _____ x W _____ = _____ sq ft
Utility room is separate	L _____ x W _____ = _____ sq ft
Kitchen space	L _____ x W _____ = _____ sq ft
Living space	L _____ x W _____ = _____ sq ft
Sleeping space if separate	L _____ x W _____ = _____ sq ft

Calculate final sizes based on floor plan

Bathroom	L _____ x W _____ = _____ sq ft
Utility room is separate	L _____ x W _____ = _____ sq ft
Kitchen space	L _____ x W _____ = _____ sq ft
Living space	L _____ x W _____ = _____ sq ft
Sleeping space if separate	L _____ x W _____ = _____ sq ft

Calculate total number of yards of floor covering using the floor plan

Vinyl	L _____ x W _____ = _____ sq ft
convert to number of yards	_____

Carpeting	L _____ x W _____ = _____ sq ft
convert to number of yards needed	_____

Calculate roofing based on roof selection

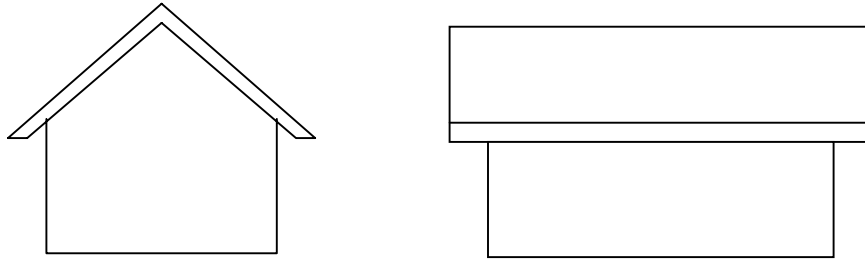
L _____ x W _____ = _____ sq ft
---------------------------------

Where appropriate use these figures in determining material costs.

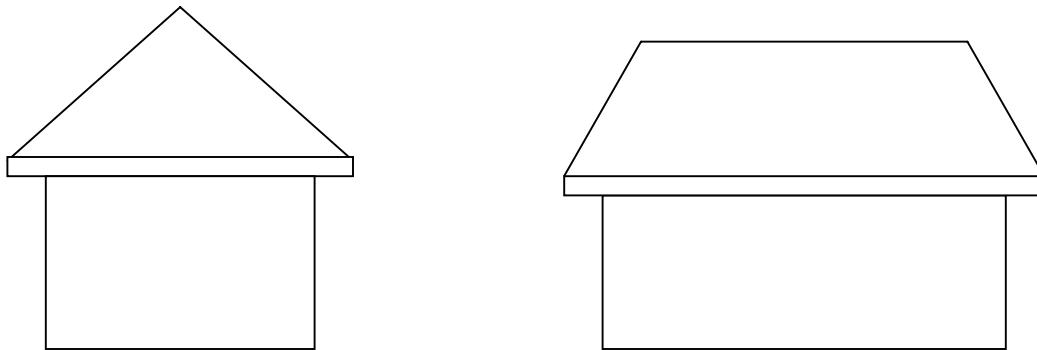


## ROOF DESIGNS

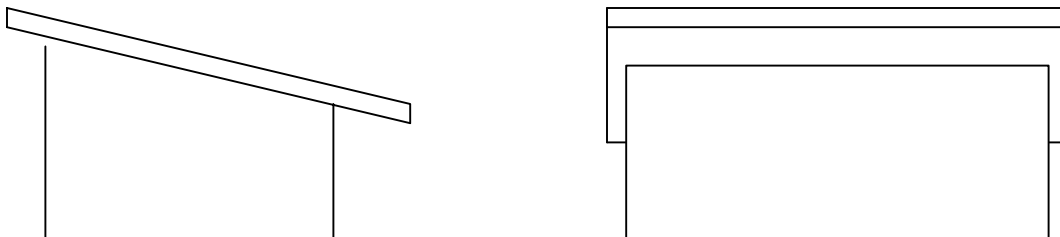
**GABLE** The gable roof is a very popular type of roof. It is easy to build, sheds water well, provides for ventilation, and is applicable to a variety of houses and shapes and design.



**HIP** The hip roof is slightly more difficult to build than a gable roof, but is still a popular choice. It does not provide for ventilation as well as some other designs and increases the chance for leakage due to the hips and valleys.



**SHED** A shed roof is similar to a flat roof, but has more pitch. It is frequently used for additions to existing structures or in combination with other roof styles. A built-up roof is generally required unless the roof has a pitch of over 3:12. (Three feet rise for each 12 feet of run.)



## MODEL CONSTRUCTION SUGGESTIONS

The model house and base will be constructed from 1/8" foam core or substitution. Any windows or doors may be either inked on the model or cut out. Interior walls are optional. Scale 1/4" = 1'-0".

### I. Supplies

- A. Model: White foam core board, 1/8" thick. Typically can be purchased at arts and crafts stores or hobby shops in 2' x 3' sheets or other sizes. The foam core board consists of core foam laminated between two sheets of paper.
- B. Model base: Foam core, 1/8" thick. Size: 3" beyond the size of the building.
- C. Adhesive: Do not use any airplane/household type cement. Use hot glue gun, rubber cement or Elmer's Glue-All for all porous materials.
- D. Clamping devices: Stick pins.
- E. Pens: Felt tip black.  
Pencils: Soft lead (2H).
- F. Cutting board: Any stiff cardboard, Masonite, or plastic material.

### II. Equipment

- A. Cutting tool: X-acto knife and blades (at least two) purchased at the same place as the foam core, or Snap blade knife, available at most hardware stores.

*Suggestion: The Snap blade knife is more economical and blade can be continuously broken off within the holder when dull.*

- B. Straight edge: Any hard material, steel, Masonite, etc. that can be used as a guide when cutting.

### III. Model Making Construction

- A. The foam core is an easy material to work with. **CAUTION** must be used as the cutting tool is extremely sharp. Always be alert to where you place your fingers and materials when cutting the foam core.
- B. Layout of the model. Fabricating the components for the model: Lay out the exterior walls. Remember considerations for roof style. Interior walls are optional. During the phase, all windows and doors should be cut out or drawn on the walls. Use a straight edge to guide cutting. Each wall and roof side should be a separate component.

## SUGGESTIONS:

1. Use your floor plan to determine the length of each wall. Scale is the same as your drawing.
2. Use your building elevation drawing to determine the height of the walls. Wall height should be at least 8'.
3. Do not lay out the roof until the walls are assembled to the base. Using paper as the initial roofing material is helpful if your roof is a complicated shape. Once you are satisfied with the shape, then you can lay out the roof on the foam core.

### C. Cutting the Foam Core

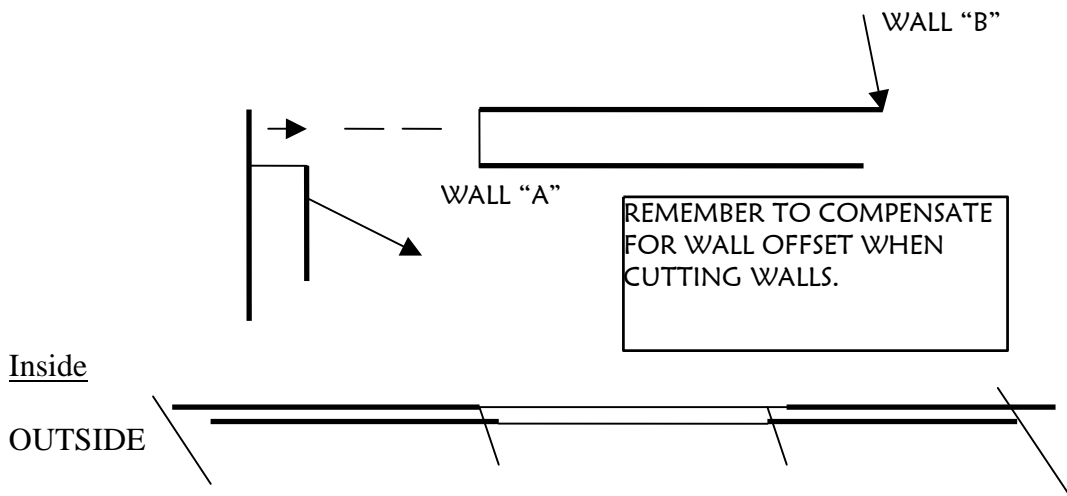
1. Set up the cutting board.
2. Model Base

The base should be no more than 3" beyond the exterior of the building. The foam core should be placed on the cutting board. With the straight edge as a guide, place the cutting tool firmly against the foam core and press down.

### 3. Building Walls

- a. Cut out each wall using the straight edge as the guide.
- b. Wall construction suggestions:

- 1) Fabricating for clean, presentable corners. Cut the walls as shown. One wall, "A" has a notch so that the thickness of wall "B" will fit into wall "A" when assembling the walls.



- 2) Windows and doors. If your decision was to cut out the windows and doors, then this hint may be followed. Slightly bevel the edge when cutting them out. The foam core material will not be visible from the outside.

#### **IV. Assembling the Model**

- A. Use a Photocopy of your floor plan as a template.
- B. Assemble each wall to the base initially with stick pins as guides until all walls are in place. Pin the walls together. If satisfied with the assembly then disassemble and glue the walls to the base and to each other. Use the stickpins to hold them in place until the glue is dry.
- C. Initially create your roof from paper until you are satisfied with its form. Use the paper as a template to cut out the roof from the foam core. Glue the roof to the walls using the stickpins as clamps until dry. Roof can be removable.

# CAREER OPPORTUNITIES CONSTRUCTION INDUSTRY PROFESSIONS

## **Building Trades, Technical & Industrial**

Masonry  
Carpentry/Cabinet making  
Lathing  
Residential Electrical Wiring  
Industrial/Commercial Electrical Wiring  
Heating Ventilating & Air Conditioning/Refrigeration  
Drafting (Architectural or Mechanical)  
Welding  
Plumbing - Residential and Commercial  
Painting  
Interior/Exterior Specialties  
Quality Assurance/Control  
Inspectors

Note: 4 years apprenticeship in field before qualifying for journeyman status. Requirements vary according to state laws. A union construction environment will typically impose more formal apprenticeship training and differences in wages.

## **Associates Degrees**

Electrical/Electronics Technology  
Civil Engineering Technology  
Computer-Aided Drafting and Design  
Construction Management/Technology  
Architectural Technology  
Structural Technology  
Landscape Designers

Career options: Drafting supervisor, computer-aided design operator, detailer, planner/scheduler, cost estimator, and surveyor, project manager of small-scale business.  
Note: Typically 2-year associate degree program.

## **Bachelor's Degree**

Civil Engineering  
Architectural Engineering (Construction Management Emphasis)  
Construction Management  
Architecture  
Safety and Industrial Management  
Landscape Architects

Career options: Construction Engineer, Estimator, field engineer, project engineer, project manager, Sales/application Engineer, Architect, Design Engineer. Note: typically 4 -5 year bachelor degree program. Programs in Construction Management vary according to university.



# CONSTRUCTION INDUSTRY CAREERS

## Construction Managers

Construction Managers assume a variety of responsibilities and positions within construction firms. They are known by a range of job titles that are often used interchangeably—for example, construction superintendent, general superintendent, project manager, general construction manager, or executive construction manager. Construction managers may be owners or salaried employees of a construction management or contracting firm, or individuals working under contract or as salaried employees for the owner, developer, contractor or management firm overseeing the construction project.

In the construction industry, managers and other professionals active in the industry general managers, project engineers, cost estimators, and others—are increasingly referred to as constructors. The term constructor refers to a broad group of professionals in construction who, through education and experience, are capable of managing, coordinating, and supervising the construction process from conceptual development through final construction on a timely and economical basis. Given designs for buildings, road, bridges, or other projects, constructors oversee the organization, scheduling, and implementation of the project to execute those designs. They are responsible for coordinating and managing people, materials, and equipment; budgets, schedule, and contracts; and the safety of employees and the public.

Generally, a contractor is a firm under contract to provide specialized construction services. On small projects such as remodeling a home, the construction contractor is usually a self-employed construction manager or skilled trade's worker who directs and oversees employees. On larger projects, construction managers working for a general contractor have overall responsibility for completing the construction in accordance with the engineer or architect's drawings and specifications and prevailing building codes. They arrange for subcontractors to perform specialized craft work or other specified construction work.

Construction managers plan, budget, and direct the construction project. They evaluate various construction methods and determine the most cost-effective plan and schedule. They determine the appropriate construction methods and schedule all required construction site activities into logical, specific steps, budgeting the time required to meet established deadlines. This may require sophisticated estimating and scheduling techniques, using computers with specialized software. Construction managers determine the labor requirements and, in some cases, supervise or monitor the hiring and dismissal of workers.

Managers direct and monitor the progress of field or site construction activities, at times through other construction supervisors. This includes the delivery and use of materials, tools, and equipment; the quality of construction, worker productivity, and safety. They are responsible for obtaining all necessary permits and licenses and, depending upon the contractual arrangements, direct or monitor compliance with building and safety codes and other regulations.

They regularly review engineering and architectural drawings and specifications to monitor progress and ensure compliance with plans and specifications. They track and



control construction costs to avoid cost overruns. Bases upon direct observation and reports by subordinate supervisors, managers may prepare daily reports of progress and requirements for labor, material, and machinery and equipment at the construction site. Construction managers meet regularly with owners, subcontractors, architects, and other design professionals to monitor and coordinate all phases of the construction project.

**Employment:** Construction managers held about 197,000 jobs in 1994. Over 85 percent were employed in the construction industry. Engineering, architectural, surveying, and construction management services firms, as well as local governments, educational institutions, and real estate developers employed others.

**Training, other qualifications and advancement:** Students interested in becoming a construction manager need a solid background in building science and management, as well as related work experience within the construction industry. They need to be able to understand contracts, plans, and specifications, and be knowledgeable about construction methods, materials, and regulations. Familiarity with computers and software programs for estimating and scheduling is important.

Over 100 colleges and universities offer 4-year degree programs in construction management or construction science. Graduates from 4-year degree programs usually are hired as assistants to project managers, field engineers, schedulers, or cost estimators.

Many individuals also attend training and educational programs sponsored by industry associations, often in collaboration with post secondary institutions. A number of 2-year colleges throughout the county offer construction management or construction technology programs.

**Architects** design buildings and other structures. The design of a building involves far more than its appearance. Buildings must also be functional, safe and economical and must suit the needs of the people who use them. Architects consider all these things when they design buildings and other structures.

Architects provide a variety of professional services to individuals and organizations planning a construction project. They may be involved in all phases of development, from the initial discussion of general ideas with the client through construction. Their duties require a number of skills-design, engineering, managerial, communication, and supervisory.

The architect and client first discuss the purposes, requirements, and budget of a project. Based on the discussions, architects may prepare a program-a report specifying the requirements the design must meet. In some cases, the architect assists in conducting feasibility and environmental impact analyses and selecting a site. The architect then prepares drawings and written information presenting ideas for the client to review. After the initial proposals are discussed and accepted, architects develop final construction plans. These plans show the building's appearance and details for its construction. Accompanying these are drawings of the structural system; air-conditioning, heating, and ventilating systems; electrical systems; plumbing; and possibly site and landscape plans. They also specify the building materials and, in some cases, the interior furnishing. In developing designs, architects follow building codes, zoning laws, fire regulations, and other ordinances, such as those that require easy access by disabled

persons. Throughout the planning stage, they make necessary changes. Although they have traditionally used pencil and paper to produce design and construction drawings, architects are increasingly turning to computer-aided design and drafting (CADD) technology for these important tasks.

Architects may also assist the client in obtaining construction bids, selecting a contractor, and negotiating the construction contract. As construction proceeds, they may be employed by the client to visit the building site to ensure that the contractor is following the design, meeting the schedule, using the specified materials, and meeting the specified standards for the quality of work. The job is not complete until all construction is finished, required tests are made, and construction costs are paid.

Architects design a variety of buildings, such as office and apartment buildings, schools, churches, factories, hospitals, houses, and airport terminals. They also design multi-building complexes such as urban centers, college campuses, industrial parks, and entire communities. In addition to designing buildings, they may advise on the selection of building sites, prepare cost analysis and land-use studies, and do long-range planning for land development.

Architects sometimes specialize in one phase of work. Some specialize in the design of one type of building—for example, hospitals, schools, or housing. Others specialize in construction management or the management of their firm and do little design work. They often work with engineers, urban planners, interior designers, landscape architects, and others.

During a training period leading up to licensure as architects, entry-level workers are called intern-architects. This training period gives them practical work experience while they prepare for the Architect Registration Examination. Typical duties may include preparing construction drawings on CADD, assisting in the design of one part of a project, or managing the production of a small project.

**Employment:** Architects held about 91,000 jobs in 1994. Most jobs were in architecture firms—the majority of which employ fewer than five workers. Nearly one-third were self-employed architects, practicing as partners, in architecture firms or on their own. A few workers for builders, real estate developers, and for government agencies responsible for housing, planning, or community development, such as the US department of defense, Interior, and Housing and Urban Development and the General Services Administration.

**Training, Other Qualifications, and Advancement:** All States require individuals to be licensed (registered) before they may call themselves architects or contract to provide architectural services. Many architecture school graduates work in the field although they are not licensed. However, a licensed architect is required to take legal responsibility for all work. Three requirements generally must be met for licensure: A professional degree in architecture, a period of practical training or internship (usually for 3 years), and passage of all sections of the Architecture Registration Examination.

In many States, the professional degree in architecture must be from one of the approximately 100 schools of architecture with programs accredited by the National Architectural Accrediting Board (NAAB). However, State architectural registration boards set their own standards, so graduation from a non NAAB-accredited program may meet the education requirements for licensure in some States. There are several types of



professional degrees in architecture. The majority of all architecture degrees are from 5-year Bachelor of Architecture programs intended for students entering from high school or with no previous architecture training. Some Schools offer a 2-year Master of Architecture program for students with a pre-professional undergraduate degree in architecture or a related area, or a 3 – r 4- year Master of Architecture program for students with a degree in another discipline. In addition, there are many combinations and variations of these degree programs.

New graduates usually begin in architecture firms, where they assist in preparing architectural documents or drawings. They also may do research on building codes and materials; or write specifications for building materials, installation criteria, the quality of finishes, and other related details. Graduates with degrees in architecture also enter related fields such as graphic, interior or industrial design; urban planning; real estate development; civil engineering; or construction management.

**Job Outlook:** Architects' employment has traditionally been affected by the level of local construction, particularly of non-institutional structures such as office buildings, shopping centers, schools, and healthcare facilities. The boom in construction of commercial office space and some other types of non-residential structure during the 1980s means there will be less construction of this type between 1994 and 2005. Nevertheless, employment growth of architects is expected to increase about as fast as the average for all occupations during this period.

The needed renovation and rehabilitation of old buildings, particularly in urban areas where space for new buildings is becoming limited is expected to provide jobs for architects and to compensate somewhat for any slowdowns in jobs related to new construction. In addition, the expected expansion of the populations under age 15 and over 65 should put the demand for public and private buildings, such as schools and healthcare facilities. The need to replace architects who retire or leave the labor force will provide many additional job openings.

**Earnings:** According to The American Institute of Architects, the median salary for intern-architects in architecture firms was \$24,700 in 1993. Licensed architects with 8 to 10 years' experience but who were not managers or principals of a firm earned a median salary of \$38,900 in 1993; and principals or partners of firms earned a median salary of \$50,000 in 1993. Partners in some large practices earned over \$110,000.

**Construction and building inspectors** examine the construction, alteration, or repair of buildings, highways, streets, sewer and water systems, dams, bridges, and other structures to ensure compliance with building codes and ordinances, zoning regulations, and contract specifications. Inspectors generally specialize in one particular type of construction work or construction trade, such as electrical work or plumbing. They make an initial inspection during the first phase of construction, and follow-up inspections throughout the construction project to monitor compliance with regulations. In areas where severe natural disasters-such as earthquakes or hurricanes-are more common, inspectors monitor compliance with additional safety regulations.

Building inspectors inspect the structural quality and general safety of buildings. Some specialize for example, in structural steel or reinforced concrete structures. Before



construction begins, plan examiners determine whether the plans for the building or other structure comply with building code regulations and are suited to the engineering and environmental demands of the building site. Inspectors visit the worksite before the foundation is poured to inspect the soil condition and positioning and depth of the footings. Later they return to the site to inspect the foundation after it has been completed. The size and type of structure and the rate of completion determine the number of other site visits they must make. Upon completion of the entire project, they make a final comprehensive inspection.

A primary concern of building inspectors is fire safety. They inspect structure's fire sprinklers, alarms, and smoke control systems, as well as fire doors and exits. In addition, inspectors may calculate fire insurance rates by assessing the type construction, building contents, adequacy of fire protection equipment, and risks posed by adjoining buildings.

An electrical inspector inspects the installation of electrical systems and equipment to ensure that they function properly and comply with electrical codes and standards. They visit work sites to inspect new and existing wiring, lighting, sound, and security systems, motors, and generating equipment. They also inspect the installation of the electrical wiring for heating and air-conditioning systems, appliances, and other components.

Elevator inspectors examine lifting and conveying devices such as elevators, escalators, moving sidewalks, lifts and hoists, inclined railways, ski lifts, and amusement rides.

Mechanical inspectors inspect the installation of the mechanical components of commercial kitchen appliances, heating and air-conditioning equipment, gasoline and butane tanks, gas and oil piping, gas-fired and oil-fired appliances. Some specialize in inspecting boilers or ventilating equipment as well.

Plumbing inspectors examine plumbing systems, including private disposal systems, water supply and distribution systems, plumbing fixtures and traps, and drain, waste, and vent lines.

Public works inspectors ensure that Federal, State and local government construction of water and sewer systems, highways, streets, bridges, and dams conforms to detailed contract specifications. They inspect excavation and fill operations, the placement of forms for concrete, concrete mixing and pouring, asphalt paving, and grading operations. They record the work and materials used so that contract payments can be calculated. Public works inspectors may

Specialize in highways, structural steel, reinforced concrete, or ditches. Others specialize in dredging operations required for bridges and dams or for harbors.

Home inspectors conduct inspections of newly built homes to check that they meet all regulatory requirements. Home inspectors are also increasingly hired by prospective homebuyers to inspect and report on the condition of a home's major systems, components, and structure. Typically, home inspectors are hired either immediately prior to a purchase offer on a home or as a contingency to a sales contract.

Construction and building inspection increasingly use computers to help them monitor the status of construction inspection activities and keep track of permits issued. Details about construction projects, building and occupancy permits, and other documentation are now generally stored on computers so that they can easily be retrieved and kept accurate and up to date.



Although inspections are primarily visual, inspectors often use tape measures, survey instruments, metering devices and test equipment such as concrete strength measures. They keep a daily log of their work, take photographs, file reports, and, if necessary, act on their findings. For example, construction inspectors notify the construction contractor, superintendent, or supervisor when they discover a code or ordinance violation or something that does not comply with the contract specifications or approved plans. If the problem is not corrected within a reasonable or specified period, government inspectors have authority to issue a “stop-work” order.

Many inspectors also investigate construction or alterations being done without proper permits. Violators of permit laws are directed to obtain permits and submit to inspection.

**Employment:** Construction and building inspectors held about 64,000 jobs in 1994. Over 50 percent worked for local governments, primarily municipal or county building departments. Employment of local government inspectors is concentrated in cities and in suburban areas undergoing rapid growth. Local governments employ large inspection staffs, including many plan examiners or inspectors who specialize in structural steel, reinforced concrete, boiler, electrical, and elevator inspection.

About 18 percent of all construction and building inspectors worked for engineering and architectural services firms, conducting inspections for a fee or on a contract basis. Most of the remaining inspectors were employed by the Federal and state governments. Many construction inspectors’ employers by the Federal Government work for the US Army Corps of Engineers or the General Services Administration. Other Federal employers include the Tennessee Valley Authority and the Departments of Agriculture, Housing and Urban Development, and Interior.

**Training, Other Qualifications, and Advancement:** Individuals who want to become construction and building inspectors should have a thorough knowledge of construction materials and practices in either a general area, like structural or heavy construction, or in a specialized area, such as electrical or plumbing systems, reinforced concrete, or structural steel. Construction or building inspectors need several years of experience as a manager, supervisor, or craft worker before becoming inspectors. Many inspectors have previously worked as carpenters, electricians, plumbers, or pipe fitters.

Employers prefer to hire inspectors who have formal training as well as experience. Employers look for persons who have studied engineering or architecture, or who have a degree from a community or junior college, with courses in construction technology, blueprint reading, mathematics, and building inspection. Courses in drafting, algebra, geometry, and English are also useful. Most employers require inspectors to have a high school diploma or equivalent even when they qualify on the basis of experience.

Certification can enhance an inspector’s opportunities for employment and advancement to more responsible positions. Most States and cities actually require some type of certification for employment. To become certified, inspectors with substantial experience and education must pass stringent examinations on code requirements, construction techniques, and materials. Many categories of certification are awarded for inspectors and plan examiners in a variety of disciplines, including the designation “CBO”, Certified Building Official.



Construction and building inspectors must be in good physical condition in order to walk and climb about construction sites. They also must have a driver's license. In addition, Federal, State and many local governments may require that inspectors pass a civil service examination.

**Job Outlook:** Employment of construction and building inspectors is expected to grow faster than the average for all occupations through the year 2005. Growing concern for public safety and improvements in the quality of construction should continue to stimulate demand for construction and building inspectors. Despite the expected employment growth, most job opening will arise from the need to replace inspectors who transfer to other occupations or who leave the labor force. Replacement needs are relatively high because construction and building inspectors tend to be older, more experienced workers who have spent years working in other occupations.

**Earnings:** The median annual salary of construction and building inspectors was \$32,000 in 1994. The middle 50 percent earned between \$25,200 and \$43,800. The lowest 10 percent earned less than, \$19,400 and the highest 10 percent earned more than \$57,500 a year. Generally, building inspectors, including plan examiners, earn the highest salaries.

## Construction Trades Occupations

**Carpenters** are involved in many different kinds of construction activity. They cut, fit, and assemble wood and other materials in the construction of buildings, highways and bridges, docks, industrial plants, boats and many other structures. Their duties vary by type of employer. A carpenter employed by a special trade employed by a general building contractor may perform many tasks, such as framing walls and partitions, putting in doors and windows, hanging kitchen cabinets, and installing paneling and tile ceilings.

Local building codes often dictate where certain materials can be used, and carpenters have to know these requirements. Each carpentry task is somewhat different, but most tasks involve the same basic steps. Working from blueprints or instructions from supervisors, carpenters first do the layout, measuring, marking, and arranging materials. They then cut and shape wood, plastic, ceiling tile, fiberglass, or drywall using hand and power tools, such as chisels, planes, saws drills, and sanders, then join the materials with nails, screws, staples, or adhesives. In the final step, they check the accuracy of their work with levels, rules, plumb bobs, and framing squares and make any necessary adjustments. When working with prefabricated components, such as stairs or wall panels, the carpenter's task is somewhat simpler because it does not require as much layout work or the cutting and assembly of as many pieces. These components are designed for easy and fast installation and can generally be installed in a single operation.

**Employment:** Carpenters, the largest group of building trades workers, held about 992,000 jobs in 1994. Four of every 5 worked for contractors who build, remodel, or repair buildings and other structures. Most of the remainder worked for manufacturing firms, government agencies, wholesale and retail establishments, and schools. About 4 of every 10 were self-employed.



**Training, Other Qualifications, and Advancement:** Carpenters learn their trade through on-the-job training and through formal training programs. Some pick up skills informally by working under the supervision of experienced workers. Many acquire skills through vocational education. Others participate in employer training programs or apprenticeships.

Most employers recommend an apprenticeship as the best way to learn carpentry. Because the number of apprenticeship programs is limited, however, only a small proportion of carpenters learn their trade through these programs. Local joint union-management committees of the United Brotherhood of Carpenters and Joiners of America and the Associated General Contractors, Inc. or the National Association of Homebuilders administer apprenticeship programs. Training programs are administered by local chapters of the Associated Builders and Contractors and by local chapters of the Associated General Contractors, Inc. These programs combine on-the-job training with related classroom instruction. Apprenticeship applicants generally must at least 17 years old and meet local requirements. For example, some union locals test an applicant's aptitude for carpentry. The length of the program, usually about 3 to 4 years, varies with the apprentice's skill.

A high school education is desirable, including courses in carpentry, shop, mechanical drawing, and general mathematics. Manual dexterity, eye-hand coordination, physical fitness, and a good sense of balance are important. The ability to solve arithmetic problems quickly and accurately also is helpful. Employers and apprenticeship committees generally view favorably training and work experience obtained in the Armed Services and the job corps.

Carpenters may advance to carpentry supervisors or general construction supervisors. Carpenters usually have greater opportunities than most other construction workers do to become general construction supervisors because they are exposed to the entire construction process. Some carpenters become independent contractors. To advance, carpenters should be able to estimate with accuracy how long a job should take to complete and its cost.

**Job Outlook:** Job opportunities for carpenters are expected to be plentiful through the year 2005, due primarily to extensive replacement needs. Well over 100,000 job openings will become available each year as carpenters transfer to other occupations or leave the labor force. The total number of job openings for carpenters each year usually is greater than for other craft occupations because the occupation is large and turnover is high.

Increased demand for carpenters will create additional job openings. Employment is expected more slowly than the average for all occupations through the year 2005. Construction activity should increase slowly in response to demand for new housing and commercial and industrial plants and the need to renovate and modernize existing structures. Opportunities for frame carpenters will be particularly good.

**Earnings:** Median weekly earnings for carpenters, excluding the self-employed, were \$424 in 1994. The middle 50 percent earned between \$315 and \$591 per week. Weekly earnings for the top 10 percent of all carpenters were more than \$785; the lowest 10 percent earned less than \$252. Earnings may be reduced on occasion because carpenters lose work time in bad weather and during recessions when jobs are unavailable.



**Electricians:** Electricity is essential for light, power, air-conditioning, and refrigeration. Electricians install, connect, test, and maintain electrical systems for a variety of purposes, including climate control, security, and communications. They also may install and maintain the electronic controls for machines in business and industry.

Electricians work with blueprints when they install electrical systems. Blueprints indicate the location of circuits, outlets, load centers, panel boards, and other equipment. Electricians must follow the National Electric Code and comply with State and local building codes when they install these systems. In factories and offices, they first place conduit (pipe or tubing) inside designated partitions, walls, or other concealed areas. They also fasten to the wall small metal or plastic boxes that will house electrical switches and outlets. They then pull insulated wires or cables through the conduit to complete circuits between these boxes. In lighter construction, such as residential, plastic-covered wire usually is used rather than conduit.

Regardless of type of wire being used, electricians connect it to circuit breakers, transformers, or other components. Twisting ends together with pliers and covering the ends with special plastic connectors joins wires. When stronger connections are required, electricians may use an electric “soldering gun” to melt metal onto the twisted wires, which they then cover with durable electrical tape. When the wiring is finished, they test the circuits for proper connections.

In addition to wiring a building’s electrical system, electricians may install coaxial or fiber optic cable for computers and other telecommunications equipment. A growing number of electricians install telephone and computer wiring and equipment. They also may connect motors to electrical power and install electronic controls for industrial equipment.

Maintenance electricians spend much of their time in preventive maintenance. They periodically inspect equipment and locate and correct problems before breakdowns occur. Electricians also may advise management whether continued operation of equipment could be hazardous. When needed, they install new electrical equipment. When breakdowns occur, they must make the necessary repairs as quickly as possible in order to minimize inconvenience. Electricians may replace items such as circuit breakers, fuses, switches, electrical and electronic components, or wire. When working with complex electronic devices, they may work with engineers, engineering technicians, or industrial machinery repairers. Electricians use hand tools such as screwdrivers, pliers, knives, and hacksaws. They also use power tools and testing equipment such as oscilloscopes, ammeters, and test lamps.

**Employment:** Electricians held about 528,000 jobs in 1994. More than half were employed in the construction industry. Others worked as maintenance electricians and were employed in virtually every industry. In addition, about 1 out of 10 electricians were self-employed.

**Training, Other Qualifications, and Advancement:** The best way to learn the electrical trade is by completing a 4- or 5-year apprenticeship program. Apprenticeship gives trainees a thorough knowledge of all aspects of the trade and generally improves their ability to find a job. Although more electricians are trained through apprenticeship than workers in other construction trades are, some still learn their skills informally on the job.



Large apprenticeship programs are usually sponsored by joint training committees made up of local unions of the International Brotherhood of Electrical Workers and local chapters of the National Electrical Contractors Association. Training may also be provided by company management committees of individual electrical contracting companies and by local chapters of the Associated Builders and Contractors and the Independent Electrical Contractors. Because of the comprehensive training received, those who complete apprenticeship programs qualify to do both maintenance and construction work.

The typical large apprenticeship program provides at least 144 hours of classroom instruction each year and 8,000 hours of on-the-job training over the course of the apprenticeship. In the classroom, apprentices learn blueprint reading, electrical theory, electronics, mathematics, electrical code requirements, and safety and first aid practices. They also receive specialized training in welding and communications and fire alarm systems. On the job, under the supervision of experienced electricians, apprentices must demonstrate mastery of the electrician's work. At first, they drill holes, set anchors, and set up conduit. Later, they measure, fabricate, and install conduit, as well as install, connect, and test wiring, outlets, and switches. They also learn to set up and draw diagrams for entire electrical systems.

Regardless of how one learns the trade, previous training is very helpful. High school courses in mathematics, electricity, electronics, mechanical drawing, science, and shop provide a good background. Special training offered in the Armed Forces and by post-secondary technical schools also is beneficial. All applicants should be in good health and have average physical strength. Agility and dexterity also are important. Good color vision is needed because workers frequently must identify electrical wires by color.

Most apprenticeship sponsors require applicants for apprentice positions to be at least 18 years old and have a high school diploma or its equivalent. For those interested in becoming maintenance electricians, a background in electronics is increasingly important because of the growing use of complex electronic controls on manufacturing equipment.

**Job Outlook:** Job opportunities for skilled electricians are expected to be good as the growth in demand outpaces the supply of workers trained in this craft. There is expected to be a shortage of skilled workers during the next decade because of the anticipated smaller pool of young workers entering training programs. Employment of electricians is expected to increase more slowly than the average for all occupations through the year 2005.

In addition to jobs created by increased demand for electrical work, many openings will occur each year as electricians transfer to other occupations, retire, or leave the labor force for other reasons. Because of their lengthy training and relatively high earnings, smaller proportions of electricians than other craft workers leave their occupation each year. The number of retirements is expected to rise, however, as more electricians reach retirement age.

**Earnings:** Median weekly earnings for full-time electricians who were not self-employed were \$574 in 1994. The middle 50 percent earned between \$415 and \$754 weekly. The lowest 10 percent earned less than \$301, while the highest 10 percent earned more than \$971 a week.



**Plumbers and Pipe fitters:** Most people are familiar with plumbers who come to their home to unclog a drain or install an appliance. In addition to these activities, however, plumbers and pipe fitters install, maintain, and repair many different types of pipe systems. For example, some systems move water to a municipal water treatment plant, and then to residential, commercial and public buildings. Others dispose of waste. Some bring in gas for stoves and furnaces. Other supply air-conditioning. Pipe systems in power plants carry the steam that powers huge turbines. Pipes also are used in manufacturing plants to move material through the production process.

Although plumbing and pipefitting sometimes are considered a single trade, workers generally specialize in one or the other. Plumbers install and repair the water, waste disposal, drainage, and gas systems in homes and commercial and industrial buildings. They also install plumbing fixtures, bathtubs, showers, sinks and toilets and appliances such as dishwashers and water heaters. Pipe fitters install and repair both high and low-pressure pipe systems that are used in manufacturing, in the generation of electricity, and in heating and cooling buildings. Some pipe fitters specialize in only one type of system. Steamfitters, for example, install pipe systems that move liquids or gases under high pressure. Sprinkler fitters install automatic fire sprinkler systems in buildings.

Plumbers and pipe fitters use many different materials and construction techniques, depending on the type of project. Residential water systems, for example, use copper, steel, and increasingly plastic pipe that can be handled and installed by one or two workers. Municipal sewerage systems, on the other hand, are made of large cast iron pipes; installation normally requires crews of pipe fitters. Despite these differences, all plumbers and pipe fitters must be able to follow building plans or blueprints and instructions from supervisors, lay out the job, and work efficiently with the materials and tools of the trade.

When construction plumbers install piping in a house, for example, they work from blueprints or drawings that show the planned location of pipes, plumbing fixtures, and appliances. They lay out the job to fit the piping into the structure of the house with the least waste of material and within the confines of the structure. They measure and mark areas where pipes will be installed and connected. They check for obstructions, such as electrical wiring, and, if necessary, plan the pipe installation around the problem.

After the piping is in place in the house, plumbers install the fixtures and appliances and connect the system to the outside water or sewer lines. Using pressure gauges, they check the system to insure that the plumbing works properly.

**Employment:** Plumbers and pipe fitters held about 375,000 jobs in 1994. About two-thirds worked for mechanical and plumbing contractors engaged in new construction, repair, modernization, or maintenance work. Other did maintenance work for a variety of industrial, commercial, and government employers. One of every 5 plumbers and pipe fitters is self-employed.

**Training, Other Qualifications, and Advancement:** Virtually all plumbers undergo some type of apprenticeship training. Many programs are administered by local union-management committees made up of members of the United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of the United States and Canada, and local employers who are members of either the Mechanical



Contractors Association of America, Inc., the National Association of Plumbing-Heating-Cooling Contractors, or the National Fire Sprinkler Association, Inc.

Nonunion training and apprenticeship programs are administered by local chapters of the Associated Builders and Contractors.

Apprenticeships, both union and nonunion, consist of 4 to 5 years of on-the-job training, in addition to at least 144 hours annually of related classroom instruction. Classroom subjects include drafting and blueprint reading, mathematics, applied physics and chemistry, safety, and local plumbing codes and regulations. On the job, apprentices first learn basic skills such as identifying grades and types of pipe, the use of the tools of the trade, and the safe unloading of materials. As apprentices gain experience, they learn how to work with various types of pipe and install different piping systems and plumbing fixtures. Apprenticeship gives trainees a thorough knowledge of all aspects of the trade. Although most plumbers are trained through apprenticeship, some still learn their skills informally on the job.

Applicants for union or nonunion apprentice jobs must be 18 years old and in good physical condition. Apprenticeship committees may require applicants to have a high school diploma or its equivalent. Armed Forces training in plumbing and pipefitting are considered very good preparation. In fact, persons with this background may be given credit for previous experience when entering a civilian apprenticeship program. Secondary or post secondary courses in shop, plumbing, general mathematics; drafting, blueprint reading, and physics also are good preparation.

**Job Outlook:** Job opportunities for skilled plumbers and pipe fitters are expected to be good as the growth in demand outpaces the supply of workers trained in this craft. Employment of plumbers and pipe fitters is expected to grow more slowly than the average for all occupations through the year 2005. However, the pool of young workers available to enter training programs will also be increasing slowly and many in that group are reluctant to seek training for jobs that may be strenuous and have uncomfortable working conditions.

**Earnings:** Median weekly earnings for plumbers and pipe fitters who were not self-employed were \$530 in 1994. The middle 50 percent earned between \$373 and \$742 weekly. The lowest 10 percent earned less than \$284; the highest 10 percent earned more than \$970 a week.

In 1993, the median hourly wage rate for maintenance pipe fitters in 160 metropolitan areas were about \$18.70. The middle 50 percent earned between about \$16.90 and \$20.90 an hour. In comparison, the average wage for non-supervisory and production workers in private industry, except farming, was \$10.80. In general, wage rates tend to be higher in the Midwest and West than in the Northeast and South.

