Residential Construction
Academy

Basic Principles
for Construction
Residential Construction Academy

Basic Principles for Construction

Mark W. Huth
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**Appendix A**  

**Appendix B**  

**Glossary**  

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One of the most pressing problems confronting the building industry today is the shortage of skilled labor. It is estimated that the construction industry must recruit 200,000 to 250,000 new craft workers each year to meet future needs. This shortage is expected to continue well into the next decade because of projected job growth and a decline in the number of available workers. At the same time, the training of available labor is becoming an increasing concern throughout the country. This lack of training opportunities has resulted in a shortage of 65,000 to 80,000 skilled workers per year. The crisis is affecting all construction trades and is threatening the ability of builders to build quality homes.

These are the reasons for the creation of the innovative Residential Construction Academy Series. The Residential Construction Academy Series is the perfect way to introduce people of all ages to the building trades while guiding them in the development of essential workplace skills including carpentry, electrical, HVAC, plumbing, and facilities maintenance. The products and services offered through the Residential Construction Academy are the result of cooperative planning and rigorous joint efforts between industry and education. The program was originally conceived by the National Association of Home Builders (NAHB)—the premier association of over 200,000 member groups in the residential construction industry—and its workforce development arm, the Home Builders Institute (HBI).

Construction professionals and educators created National Standards for the Construction trades. In the summer of 2001, the NAHB, through the HBI, began the process of developing residential craft standards in five trades. They are carpentry, electrical wiring, HVAC, plumbing, and facilities maintenance. Groups of construction employers from across the country met with an independent research and measurement organization to begin the development of new craft-training Standards. The guidelines from the National Skills Standard Board were followed in developing the new standards. In addition, the process met or exceeded the American Psychological Association standards for occupational credentialing.

Then, through a partnership between HBI and Delmar Learning, learning materials—textbooks, videos, and instructor’s curriculum and teaching tools—were created to effectively teach these standards. A foundational tenet of this series is that students learn by doing. A constant focus of the Residential Construction Academy is teaching the skills needed to be successful in the Construction industry and constantly applying the learning to real-world applications.

Perhaps most exciting to learners and industry is the creation of a National Registry of students who have successfully completed courses in the Residential Construction Academy Series. This registry or transcript service provides an opportunity for easy access for verification of skills and competencies achieved. The Registry links construction industry employers and qualified potential employees together in an online database facilitating student job search and the employment of skilled workers. For more information on the Residential Construction Academy Series, visit www.residentialacademy.com
Whether an individual chooses a career as a skilled craftsperson or is striving to become a general contractor, Basic Principles for Construction provides the necessary background for understanding the construction industry and the basic skills for learning a specific trade.

Basic Principles for Construction is an outstanding resource for new and advancing construction students, or for those considering entering a construction program. This text provides a solid foundation to learn the major trade areas—carpentry, electrical wiring, HVAC, plumbing, and facilities maintenance. It introduces students to the industry—explaining how it is organized and how to successfully gain employment—and also covers the need-to-know information for the daily activities associated with working in the industry, including safety, basic math, tools, and blueprint reading.

Organization

This textbook is organized in a logical sequence that is easy to learn and teach, and is divided into five major sections:

- **Section 1: The Construction Industry** is designed to provide students with background on the industry. It introduces students to the organization and leadership structure, as well as the importance of ethics, teamwork, and effective communications with others to successfully complete a job.

- **Section 2: Safety** covers the all-important elements of safely working on a job site, including working with electricity, hazardous materials, scaffolding, ladders, and compressed air. It also covers OSHA regulations, practical housekeeping, and personal protective equipment to ensure safe work habits.

- **Section 3: Construction Math** reviews basic math skills and how to practically apply these skills on the job. Examples and practice problems are integrated into the chapters to increase student aptitude in working out various construction problems. The section concludes with a chapter on combined operations, which illustrates the necessity of having the ability to utilize several math skills in completing a single job.

- **Section 4: Tools and Fasteners** introduces students to the selection, use, and care of the various hand and power tools required to complete a job, as well as different types of fasteners. The section also includes a chapter on the basics of rigging as it applies to residential construction.

- **Section 5: Print Reading** emphasizes the elements and features of basic residential blueprints and how to accurately read them. Activities at the end of each chapter encourage students to practice their blueprint reading skills.
This innovative series was designed with input from educators and industry and informed by the curriculum and training objectives established by the Standards Committee. The following features aid learning:

**A Success Story** opens each section, providing insights, advice, and motivation from professionals working in a variety of construction trades, offering an insider's view of construction as a career.

**Features**

**Easy Aspects**

- "I'm very satisfied with the choice I made because I have a good work ethic and like what I'm doing," Leanna explains.
- "With education, you can do anything you want. It just opens doors." Leanna continues her education by taking vocational courses covering code updates and technical advances.

**Challenges**

- "I never thought I would be a construction worker. It’s a joy to be able to work and like what you’re doing. Not everyone has that privilege. Just try it.”
- "I'm not very big," states Leanna, whose 5-foot 4-inch stature makes lifting a 12-foot ladder or carrying bundles of wire difficult.
- "I'm very satisfied with the choice I made because I have a good work ethic and like what I'm doing," Leanna explains.

**Importance of Education**

- "Workers who understand the electrical pressure that causes current to flow, measured in amperes, and the voltage that causes the current to flow, measured in volts, have a basic understanding of the laws of electricity and can work safely around electrical circuits."
Caution features highlight safety issues and urgent safety reminders in working with the various tools in industry so students can avoid potential mishaps.

Examples and Practice Problems integrated into the math chapters illustrate to students, step by step, the various methods of working out construction problems. In addition, it encourages them to practice and improve their math skills.

Review Questions are designed to reinforce the information in the chapter as well as give students the opportunity to think about what has been learned and what they have accomplished.
WHY A HAZARD

Recommendation to Correct

4. Give a brief report on the accident to your class.
3. Explain what safety rules were broken to cause the accident.
2. Write a very brief description of your own, giving just the most important facts about the accident, including what caused it.
1. Explain what safety rules were broken to cause the accident and how it could have been prevented.

SAFETY HAZARDS

Visit a construction site or build this activity on conditions in your school lab. Describe each of the safety hazards you see, explain why it is a hazard, and describe what has been done to correct the hazard. Find at least five hazards that either exist or have been corrected or avoided. Make a list like the one below to record your findings.

<table>
<thead>
<tr>
<th>HAZARD</th>
<th>WHAT A HAZARD</th>
<th>RECOMMENDATION TO CORRECT</th>
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FIRE

Sketch a floor plan of your school shop or your job site, indicating where the extinguishers are located. List the classes of fires that can be extinguished with each fire extinguisher on your sketch.

MATERIAL SAFETY DATA SHEET (MSDS)

Refer to the MSDS in Figure 3–10 to answer the following questions:
1. What is the product?
2. What physical and chemical properties are known about this product?
3. What is the boiling point of this product?
4. What potential hazards are associated with the use of this product?
5. What potential hazards are associated with the disposal of this product?
6. What potential hazards are associated with the transportation of this product?
7. What potential hazards are associated with the storage of this product?

MEASURING BODY RESISTANCE

Electric shock is a form of an electric current flowing through the body. The amount of current that flows through the body is determined by the resistance of the body, the amount of voltage applied to the body, and the amount of current applied to the body. In general, the greater the voltage applied to the body, the greater the amount of current that flows through the body.

Procedure:
1. Set your digital multimeter to the resistance range.
2. Insert the red test lead into the volt/ohm jack on the digital multimeter.
3. Hold one test probe in one hand and place the other test probe between the thumb and index finger of your left hand. Record your resistance measurement.
4. Gradually increase the pressure with which you are holding the test probes. Record your resistance measurement.
5. Gradually decrease the pressure with which you are holding the test probes. Record your resistance measurement.

Analysis:
1. What happened to the resistance reading from hand to hand when you increased the pressure with which you were holding the test probes?
2. How does your resistance reading compare between hand-to-hand (dry) and hand-to-foot measurement?
3. How does your resistance reading compare between hand-to-hand (moist) and hand-to-foot measurement?
4. How does your resistance reading compare between hand-to-hand (moist) and hand-to-foot measurement when your skin was dry and your hand-to-foot measurement when your skin was wet?
5. If you were to come in contact with an electric current, would you have a better chance of surviving if the current was allowed to flow from hand to hand, or from hand to foot? Explain your reasoning.
6. How does your resistance reading compare between hand-to-hand (moist) and hand-to-foot measurement when your skin was dry and your hand-to-foot measurement when your skin was wet?

Activities complete each chapter where applicable, and are intended to provide students with a practical “hands-on” experience as it relates to the reading within the text. Everything from identification to Internet research, critical thinking, and building—these activities bring the key points of the chapter to life!

Turnkey Curriculum and Teaching Material Package

We understand that a text is only one part of a complete, turnkey educational system. We also understand that instructors want to spend their time on teaching, not preparing to teach. The Residental Construction Academy Series is committed to providing thorough curriculum and preparatory materials to aid instructors and alleviate some of those heavy preparation commitments. An integrated teaching solution is ensured with the text, Instructor’s e.resource™, and print Instructor’s Resource Guide.

e.resource™

Delmar Learning’s e.resource™ is a complete guide to classroom management. Designed as an integrated package, the e.resource offers the Instructor with many valuable tools, including PowerPoint, a Computerized Test Bank, and an Image Library, as well as the chapter outlines and answers to review questions available through the electronic version of the print Instructor’s Resource Guide.
PowerPoint

The series includes a complete set of PowerPoint Presentations providing lecture outlines that can be used to teach the course. Instructors may teach from this outline or can make changes to suit individual classroom needs.

Computerized Testbank

The Computerized Testbank contains hundreds of questions that can be used for in-class assignments, homework, quizzes, or tests. Instructors can edit the questions in the testbank, or create and save new questions.

Image Library

An Image Library offers instructors the option of creating their own classroom presentations by providing electronic versions of all line art and photos from the textbook.

Instructor’s Resource Guide

An instructor’s version of lecture outlines, the Instructor’s Resource Guide provides a step-by-step breakdown of the key points found in each chapter, along with “Teaching Tips” and correlating PPT presentation slides, creating a completely streamlined and integrated approach to teaching. Also included are answers to the Review Questions that appear at the end of each chapter. The Instructor’s Resource Guide is available in electronic and print versions.

Online Companion

The Online Companion is an excellent supplement for students that features many useful resources to support the Basic Principles for Construction book. Linked from the Student Materials section of www.residentialacademy.com, the Online Companion includes chapter quizzes, an online glossary, additional “Success Stories,” related links, and more.

The Complete Residential Construction Academy Series

Basic Principles of Construction provides a foundation for other texts within the series, which covers carpentry, electrical wiring, HVAC, plumbing, and facilities maintenance. Each title offers a complete instructor curriculum package, including accompanying videos and a CD-ROM courseware series. Programs may be credentialed by the Home Builders Institute in these trades, providing national recognition for the program. In addition, students who successfully complete one or more of the trade programs can receive a certification of completion and may be eligible to enter in the National Registry. This registry provides a direct link between students and potential employers. For applications and the latest information, visit www.residentialacademy.com

Available

Residential Construction Academy Carpentry (Order # 1-4018-1343-7)
Residential Construction Academy Electrical Principles (Order # 1-4018-1294-5)
Residential Construction Academy House Wiring (Order # 1-4018-1371-2)

Coming Soon

Fall 2004: Residential Construction Academy HVAC (Order# 1-4018-4899-0)
Fall 2004: Residential Construction Academy Plumbing (Order # 1-4018-4891-5)
Fall 2005: Residential Construction Academy Facilities Maintenance
The author of this textbook, Mark Huth, brings many years of experience in the industry to his writing—first working as a carpenter, contractor, and then a building construction teacher—and his career has allowed him to consult with hundreds of construction educators in high schools, colleges, and universities. *Basic Principles for Construction* has been shaped by his observations of the difficulties students have in studying construction, and by the outstanding programs offered at the best schools in the country. He has also authored several other successful construction titles, including *Construction Technology*, *Basic Blueprint Reading for Construction*, *Understanding Construction Drawings*, and *Practical Problems in Mathematics for Carpenters*. 
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