

Core Curriculum: *Introductory Craft Skills*

Trainee Guide
Fifth Edition



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Core Curriculum

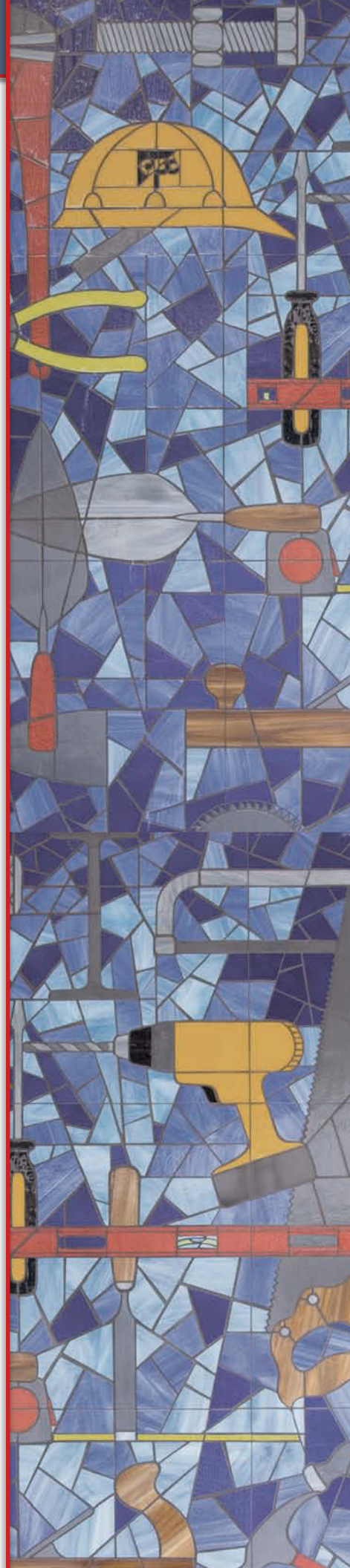
Introductory Craft Skills

Trainee Guide
Fifth Edition



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Preface

To the Trainee

Welcome to the world of construction! Construction is one of the largest industries, offering excellent opportunities for high earnings, career advancement, and business ownership.

Work in construction offers a great variety of career opportunities. People with many different talents and educational backgrounds—skilled craftspersons, managers, supervisors, and superintendents—find job opportunities in construction and related fields. As you will learn throughout your training, many other industries depend upon the work you will do in construction. From houses and office buildings to factories, roads, and bridges—*everything* begins with construction.

New with *Core Curriculum: Introductory Craft Skills*

NCCER and Pearson are pleased to present the fifth edition of *Core Curriculum: Introductory Craft Skills*. This full-color textbook includes nine modules for building foundation skills in construction. NCCER has enhanced the *Core Curriculum* to appeal to an international market. There are new features to show how construction impacts countries around the world.

We are also excited to provide a revised “Basic Safety (Construction Site Safety Orientation)” module that now aligns to OSHA’s 10-hour program. This means that instructors who are OSHA-500 certified are able to issue 10-hour OSHA cards to their students who successfully complete the module. Combined with an NCCER credential, the OSHA 10-hour card will show employers a credible and valuable training record. While aligning to the OSHA-based standards of the United States, this module enhances safety practices and discusses how these can change state-to-state and country-to-country. Also, the successful completion of this module will award a Construction Site Safety Orientation credential.

We keep math “real” for students in this edition of “Introduction to Construction Math” by emphasizing application over theory-related exercises. By keeping math “real,” the language of math is much easier to understand. As a companion piece to this module, a workbook is also available for instructors to use to supplement classroom activities.

The “Introduction to Basic Rigging” module includes basic safety requirements for working around rigging and cranes, and rigging equipment identification. This module has been reduced in size and hours. It is an elective, and as such is not

required for successful completion of the *Core Curriculum*.

“Basic Communication Skills” now includes content on nonverbal communication, and explains the importance of electronic messaging in the construction industry. “Introduction to Material Handling” now presents the basics of knot tying, as knots are critical with any material handling.

We invite you to visit the NCCER website at www.nccer.org for information on the latest product releases and training, as well as online versions of the *Cornerstone* magazine and Pearson’s NCCER product catalog.

Your feedback is welcome. You may email your comments to curriculum@nccer.org or send general comments and inquiries to info@nccer.org.

NCCER Standardized Curricula

NCCER is a not-for-profit 501(c)(3) education foundation established in 1995 by the world’s largest and most progressive construction companies and national construction associations. It was founded to address the severe workforce shortage facing the industry and to develop a standardized training process and curricula. Today, NCCER is supported by hundreds of leading construction and maintenance companies, manufacturers, and national associations. The NCCER Standardized Curricula was developed by NCCER in partnership with Pearson Education, Inc., the world’s largest educational publisher.

Some features of the NCCER Standardized Curricula are as follows:

- An industry-proven record of success
- Curricula developed by the industry for the industry
- National standardization providing portability of learned job skills and educational credits
- Compliance with Office of Apprenticeship requirements for related classroom training (*CFR* 29:29)
- Well-illustrated, up-to-date, and practical information

NCCER also maintains a Registry that provides transcripts, certificates, and wallet cards to individuals who have successfully completed a level of training within a craft in the NCCER Standardized Curricula. *Training programs must be delivered by an NCCER Accredited Training Sponsor in order to receive these credentials.*

Special Features

In an effort to provide a comprehensive user-friendly training resource, we have incorporated many different features for your use. Whether you are a visual or hands-on learner, this book will provide you with the proper tools to get started in the construction industry.

Introduction

This page is found at the beginning of each module and lists the Objectives, Performance Tasks, and Trade Terms for that module. The Objectives list the skills and knowledge you will need in order to complete the module successfully. The Performance Tasks give you an opportunity to apply your knowledge to real-world tasks. The list of Trade Terms identifies important terms you will need to know by the end of the module.

00104-15
INTRODUCTION TO POWER TOOLS

Objectives

When you have completed this module, you will be able to do the following:

1. Identify and explain how to use various types of power drills and impact wrenches.
 - a. Identify and explain how to use common power drills and bits.
 - b. Identify and explain how to use a hammer drill.
 - c. Identify and explain how to use pneumatic drills and impact wrenches.
2. Identify and explain how to use various types of power saws.
 - a. Identify and explain how to use a circular saw.
 - b. Identify and explain how to use saber and reciprocating saws.
 - c. Identify and explain how to use a portable band saw.
 - d. Identify and explain how to use miter and cutoff saws.
3. Identify and explain how to use various grinders and grinder attachments.
 - a. Identify and explain how to use various types of grinders.
 - b. Identify and explain how to use various grinder accessories and attachments.
4. Identify and explain how to use miscellaneous power tools.
 - a. Identify and explain how to use pneumatic and powder-actuated fastening tools.
 - b. Identify and explain how to use pavement breakers.
 - c. Identify and explain the uses of hydraulic jacks.

Performance Tasks

Under supervision of your instructor, you should be able to do the following:

1. Safely and properly demonstrate the use of three of the following tools:
 - Electric drill
 - Hammer drill or rotary hammer
 - Circular saw
 - Reciprocating saw
 - Portable band saw
 - Miter or cutoff saw
 - Portable or bench grinder
 - Pneumatic nail gun
 - Pavement breaker

Trade Terms

| | | | |
|--------------------------|---------------------|-------------------------|------------------------|
| Abrasive | Chuck key | Ground fault circuit | Revolutions per minute |
| Alternating current (AC) | Countersink | interrupter (GFCI) | (rpm) |
| Arbor | Direct current (DC) | Ground fault protection | Ring test |
| Auger bit | Forstner bit | Keel | Stank |
| Cartridge | Get | Masonry bit | Trigger lock |
| Chuck | | Reciprocating | |

Industry Recognized Credentials

If you are training through an NCCER-accredited sponsor, you may be eligible for credentials from NCCER's Registry. The ID number for this module is 00104-15. Note that this module may have been used in other NCCER curricula and may apply to other level completions. Contact NCCER's Registry at 888.622.3720 or go to www.nccer.org for more information.

Special Features

Features present technical tips and professional practices from the construction industry. These features often include real-life scenarios similar to those you might encounter on the job site.

Bowline Trivia

Some people use this saying to help them remember how to tie a bowline: "The rabbit comes out of his hole, around a tree, and back into the hole."

Notes, Cautions, and Warnings

Safety features are set off from the main text in highlighted boxes and organized into three categories based on the potential danger of the issue being addressed. Notes simply provide additional information on the topic area. Cautions alert you of a danger that does not present potential injury but may cause damage to equipment. Warnings stress a potentially dangerous situation that may cause injury to you or a co-worker.

NOTE Nameplates must be posted on each handling device. The nameplate must include the capacity of the device, the appropriate weight, and any instructional information.

CAUTION It is essential to note the revision designation on a construction drawing. Otherwise, you may be using an outdated drawing.

WARNING! Saw teeth are very sharp. Use gloves and do not handle the saw teeth with bare hands. When cutting with a saw, ensure that your fingers remain clear of the teeth at all times.

Color Illustrations and Photographs

Color illustrations and photographs are used throughout each module to provide vivid detail. These figures highlight important concepts from the text and provide clarity for complex instructions. Each figure is denoted in the text in *italic type* for easy reference.



00103-15_F31.EPS

Figure 31 Marking a cutting line.

Around the World

The Around the World features introduce trainees to a global construction perspective, emphasizing similarities and differences in standards, codes, and practices from country to country.

Around the World Metrics and Tools

It is important to know whether the hardware and tools you are working with are metric or Imperial. A proper fit will be unattainable if you try to use an Imperial tool on a metric part. For example, if an Imperial socket is used on a metric bolt, it may tear the points off the bolt head or nut.

Going Green

Going Green looks at ways to preserve the environment, save energy, and make good choices regarding the health of the planet. Through the introduction of new construction practices and products, you will see how the “greening of the world” has already taken root.

Reducing Your Carbon Footprint

Many companies are taking part in the paperless movement. They reduce their environmental impact by reducing the amount of paper they use. Using email helps to reduce the amount of paper used, and there are even postscripts on emails that asking you to reconsider printing the email unless necessary.

Did You Know?

The Did You Know? features introduce historical tidbits or modern information about the construction industry. Interesting and sometimes surprising facts about construction are also presented.

Did You Know? How Blueprints Started

The process for making blueprints was developed in 1842 by an English astronomer named Sir John F. Herschel. The method involved coating a paper with a special chemical. After the coating dried, an original hand drawing was placed on top of the paper. Both papers were then covered with a piece of glass and set in the sunlight for about an hour. The coated paper was developed much like

Trade Terms

Each module presents a list of Trade Terms that are discussed within the text, defined in the Glossary at the end of the module, and reinforced with a Trade Terms Quiz. These terms are denoted in the text with **bold blue type** upon their first occurrence. To make searches for key information easier, a comprehensive Glossary of Trade Terms from all modules is found at the back of this book.

1.1.0 Slings

During a rigging operation, the **load** being lifted or moved must be connected to the apparatus, such as a crane, that will provide the power for movement. The connector—the link between the load and the apparatus—is often a sling made of synthetic, chain, or **wire rope** materials. This section focuses on three types of slings:

Review Questions

Review Questions are provided to reinforce the knowledge you have gained. This makes them a useful tool for measuring what you have learned.

Review Questions

- Identification tags for slings must include the _____.
 - type of protective pads to use
 - type of damage sustained during use
 - color of the tattle-tail
 - manufacturer's name or trademark
- The type of wire rope core that is susceptible to heat damage at relatively low temperatures is the _____.
 - fiber core
 - strand core
 - independent wire rope core
 - metallic link supporting core
- Synthetic slings must be inspected _____.
 - once every month
 - visually at the start of each work week
 - before every use
 - once wear or damage becomes apparent
- An alloy steel chain sling must be removed from service if there is evidence that _____.
 - the sling is damaged
 - the sling is stretched
 - the sling is twisted
 - the sling is bent
- Chain hoists are able to lift heavy loads by utilizing a _____.
 - rope and pulley system
 - rigger's strength
 - stationary counterweight
 - gear system
- Before attempting to lift a load with a chain hoist, make sure that the _____.
 - hoist is secured to a come-along
 - load is properly balanced
 - tag lines are properly anchored
 - tackle is connected to its power source
- A hitch configuration that allows slings to be connected to the same load without using a spreader beam is a _____.
 - double-wrap hitch
 - choker hitch
 - bridle hitch
 - basket hitch
- To make the connection operation of that is

Section Review

The Section Review features helpful additional resources and review questions related to the objectives in each section of the module.

Additional Resources

Materials Handling Handbook, The American Society of Mechanical Engineers (ASME) and The International Material Management Society (IMMS), Raymond A. Kulwiec, Editor-in-Chief. 1985. New York, NY: Wiley-Interscience.

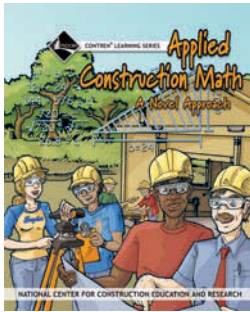
Manufacturing Facilities Design & Material Handling, Matthew P. Stevens, Fred E. Meyers. 2013. West Lafayette, IN: Purdue University Press.

1.0.0 Section Review

- For material handling tasks, it is just as important to be mentally fit as it is to be _____.
 - physically fit
 - physically aggressive
 - closely supervised
 - over 200 pounds
- Which of the following is a type of knot that is often used to join the ends of two ropes in non-critical, low-strain applications?
 - Bowline
 - Clove hitch
 - Hall hitch
 - Square knot

Core Curriculum Companions

Enhance your training with these great supplemental *Core* companions. The following resources can be used alone or in combination with the *Core Curriculum*. Visit our online catalog at www.nccer.org or contact your Pearson Sales Representative to purchase any of these items to supplement your learning.



Applied Construction Math

Paperback Trainee Guide: ISBN 0-13-227298-9

Applied Construction Math: A Novel Approach features a story that students can relate to and math skills they never thought they could grasp. Its innovative style motivates students to follow the lessons by associating math with events they may encounter in their real lives. Students will see that learning math can be something as exciting as building a new house as they follow along with Mr. Whyte and his construction class as they build the perfect house.

Thirteen chapters teach basic math skills including the following topics:

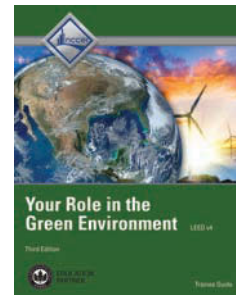
- Division
- Decimals/Percentages
- Reading Measurements
- Calculating Area
- Powers of Ten
- Linear Measure, Angles, Volumes,
- Pressure and Slopes
- Solving for Unknowns
- Square Inches, Feet, and Yards
- Volume



Tools for Success: Critical Skills for the Construction Industry 3/E

Paperback Trainee Guide: ISBN 0-13-610649-8

The *Tools for Success* workbook includes classroom activities to help students navigate their way through intangible workplace issues such as conflict resolution, diversity, problem-solving, professionalism, and proper communications techniques.



Your Role in the Green Environment 3/E

Paperback Trainee Guide: ISBN 0-13-294863-X

Geared to entry-level craft workers or to anyone wishing to learn more about green building, this module provides fundamental instruction in the green environment, green construction practices, and green building rating systems.

NCCER is also a United States Green Building Council Education Partner, and, as such, is committed to enhancing the ongoing development of building industry professionals.

NCCERconnect: An Interactive Online Course

Ideal for blended or distance education, NCCERconnect is a unique web-based supplement in the form of an electronic book that provides a range of visual, auditory, and interactive elements to enhance your training. It can be used in a variety of settings such as self-study, blended/distance education, or in the traditional classroom environment! It's the perfect way to review content from a class you may have missed or to practice at your own pace.

Features:

- **Online Lectures** – Each ebook module features a written summary of key content accompanied by an optional Audio Summary so if you need a refresher, this tool is always available.
- **Video Presentations** – Throughout, you'll find dynamic video presentations that demonstrate difficult skills and concepts! Of special note are the safe/unsafe scenarios shot on a live construction site testing your knowledge of the four 'high hazards' presented in the Basic Safety module.
- **Personalization Tools** – With the "highlighter" and "notes" options you can easily personalize your own NCCERconnect ebook to keep track of

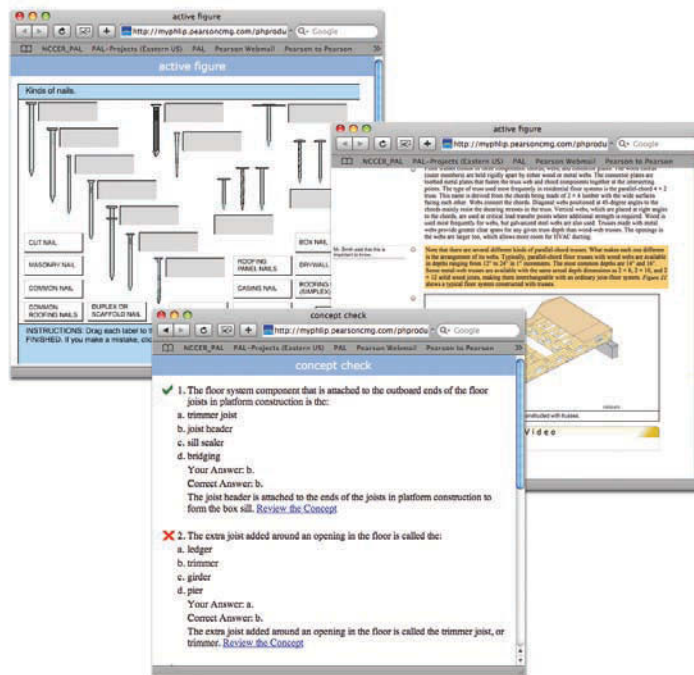
important information or create your own study guide.

- **Review Quizzes** – Short multiple-choice concept check quizzes at the end of each module section act as the ideal study tool and provide immediate feedback. Additionally, you'll find fill-in-the-blank trade terms quizzes, applied math questions, and comprehension questions at the end of each module.
- **Active Figures** – Interactive exercises bring key concepts to life, including animation in the Introduction to Construction Drawings module that will help you make the mental transition from a flat, 2-dimensional plan to a 3-dimensional finished structure.

Visit www.nccerconnect.com to view a demo.

NCCERconnect is available with:

- Core Curriculum*
- Carpentry Levels 1-4*
- Construction Technology*
- Electrical Levels 1-4*
- Electronic Systems Technician Levels 1-4*
- HEO Levels 1-2*
- HVAC Levels 1-4*
- Plumbing Levels 1-4*
- Welding Levels 1-4*
- Your Role in the Green Environment*



NCCER Standardized Curricula

NCCER's training programs comprise more than 80 construction, maintenance, pipeline, and utility areas and include skills assessments, safety training, and management education.

Boilermaking
Cabinetmaking
Carpentry
Concrete Finishing
Construction Craft Laborer
Construction Technology
Core Curriculum:
 Introductory Craft Skills
Drywall
Electrical
Electronic Systems Technician
Heating, Ventilating, and
Air Conditioning
Heavy Equipment Operations
Highway/Heavy Construction
Hydroblasting
Industrial Coating and Lining
 Application Specialist
Industrial Maintenance Electrical
 and Instrumentation Technician
Industrial Maintenance
Mechanic
Instrumentation
Insulating
Ironworking
Masonry
Millwright
Mobile Crane Operations
Painting
Painting, Industrial
Pipefitting
Pipelayer
Plumbing
Reinforcing Ironwork
Rigging
Scaffolding
Sheet Metal
Signal Person
Site Layout
Sprinkler Fitting
Tower Crane Operator
Welding

Maritime

Maritime Industry Fundamentals
Maritime Pipefitting
Maritime Structural Fitter

Green/Sustainable Construction

Building Auditor
Fundamentals of Weatherization
Introduction to Weatherization
Sustainable Construction
 Supervisor
Weatherization Crew Chief
Weatherization Technician
Your Role in the Green
 Environment

Energy

Alternative Energy
Introduction to the Power Industry
Introduction to Solar Photovoltaics
Introduction to Wind Energy
Power Industry Fundamentals
Power Generation Maintenance
 Electrician
Power Generation I&C
 Maintenance Technician
Power Generation Maintenance
 Mechanic
Power Line Worker
Power Line Worker: Distribution
Power Line Worker: Substation
Power Line Worker: Transmission
Solar Photovoltaic Systems Installer
Wind Turbine Maintenance
 Technician

Pipeline

Control Center Operations, Liquid
Corrosion Control
Electrical and Instrumentation
Field Operations, Liquid
Field Operations, Gas
Maintenance
Mechanical

Safety

Field Safety
Safety Orientation
Safety Technology

Supplemental Titles

Applied Construction Math
Tools for Success

Management

Fundamentals of Crew Leadership
Project Management
Project Supervision

Spanish Titles

Acabado de concreto: nivel uno
Aislamiento: nivel uno
Albañilería: nivel uno
Andamios
Carpintería:
 Formas para carpintería, nivel tres
Currículo básico: habilidades
 introductorias del oficio
Electricidad: nivel uno
Herrería: nivel uno
Herrería de refuerzo: nivel uno
Instalación de rociadores: nivel uno
Instalación de tuberías: nivel uno
Instrumentación: nivel uno, nivel
 dos, nivel tres, nivel cuatro
Orientación de seguridad
Paneles de yeso: nivel uno
Seguridad de campo

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KBR Industrial Services

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Maintenance & Construction Technology
Alliance
River Valley Technical Center
The Shaw Group, Inc.
The Southern Company
Starcon
TIC - The Industrial Company

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NCCER Partners

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GSSC – Gulf States Shipbuilders Consortium
ISN
Manufacturing Institute
Mason Contractors Association of America
Merit Contractors Association of Canada
NACE International
National Association of Minority Contractors
National Association of Women in Construction
National Insulation Association
National Technical Honor Society
National Utility Contractors Association
NAWIC Education Foundation
North American Crane Bureau
North American Technician Excellence
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SkillsUSA®
Steel Erectors Association of America
U.S. Army Corps of Engineers
University of Florida, M. E. Rinker School of
Building Construction
Women Construction Owners & Executives,
USA



Contents

Module One

Basic Safety (Construction Site Safety Orientation)

This module complies with OSHA-10 training requirements. It explains the safety obligations of workers, supervisors, and managers to ensure a safe workplace. Discusses the causes and results of accidents and the impact of accident costs. Reviews the role of company policies and OSHA regulations. Introduces common job-site hazards and identifies proper protections. Defines safe work procedures, proper use of personal protective equipment, and how to safely work with hazardous chemicals. Identifies other potential construction hazards, including hazardous material exposures, welding and cutting hazards, and confined spaces. (Module ID 00101-15; 12.5 Hours)

Module Two

Introduction to Construction Math

Reviews basic mathematical functions such as adding, subtracting, dividing, and multiplying. Defines whole numbers, fractions, and decimals, and explains their applications to the construction trades. Explains how to use and read various length measurement tools, including standard and metric rulers and tape measures, and the architect's and engineer's scales. Explains decimal-fraction conversions and the metric system, using practical examples. Also reviews basic geometry as applied to common shapes and forms. (Module ID 00102-15; 10 Hours)

Module Three

Introduction to Hand Tools

Introduces trainees to hand tools that are widely used in the construction industry, such as hammers, saws, levels, pullers, and clamps. Explains the specific applications of each tool and shows how to use them properly. Also discusses important safety and maintenance issues related to hand tools. (Module ID 00103-15; 10 Hours)

Module Four

Introduction to Power Tools

Provides detailed descriptions of commonly used power tools, such as drills, saws, grinders, and sanders. Reviews applications of these tools, proper use, safety, and maintenance. Many illustrations show power tools used in on-the-job settings. (Module ID 00104-15; 10 Hours)

Module Five

Introduction to Construction Drawings

Familiarizes trainees with basic terms for construction drawings, components, and symbols. Explains the different types of drawings (civil, architectural, structural, mechanical, plumbing/piping, electrical, and fire protection) and instructs trainees on how to interpret and use drawing dimensions. A set of four oversized drawings is included. (Module ID 00105-15; 10 Hours)

Module Six

Introduction to Basic Rigging (Elective)

Provides basic information related to rigging and rigging hardware, such as slings, rigging hitches, and hoists. Emphasizes safe working habits in the vicinity of rigging operations. (Module ID 00106-15; 7.5 Hours)

Module Seven

Basic Communication Skills

Provides trainees with techniques for communicating effectively with co-workers and supervisors. Includes practical examples that emphasize the importance of verbal and written information and instructions on the job. Also discusses effective telephone and email communication skills. (Module ID 00107-15; 7.5 Hours)

Module Eight

Basic Employability Skills

Introduces trainees to critical thinking and problem-solving skills. Reviews effective relationship skills, effective self-presentation, and key workplace issues such as sexual harassment, stress, and substance abuse. Also presents information on computer systems and their industry applications. (Module ID 00108-15; 7.5 Hours)

Module Nine

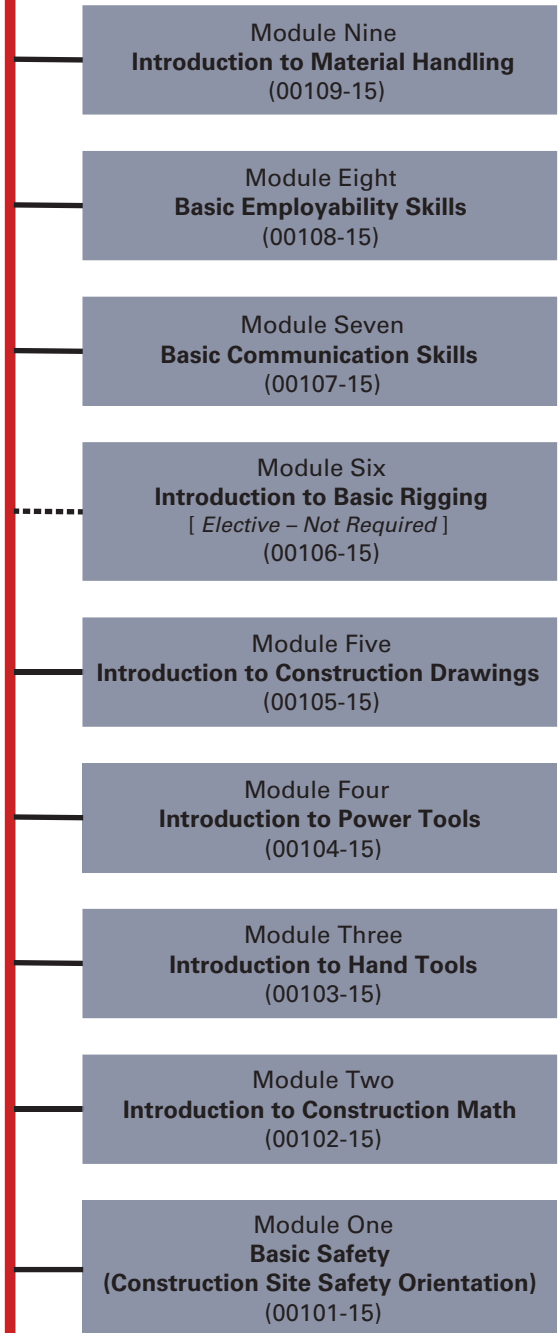
Introduction to Material Handling

Recognizes hazards associated with material handling and explains proper techniques and procedures. Introduces material handling equipment, and identifies appropriate equipment for common job-site tasks. (Module ID 00109-15; 5 Hours)

Glossary

Index

Core Curriculum: Introductory Craft Skills



This course map shows all of the modules in the *Core Curriculum*. The suggested training order begins at the bottom and proceeds up. Skill levels increase as you advance on the course map. The local Training Program Sponsor may adjust the training order.

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00101-15

Basic Safety (Construction Site Safety Orientation)



OVERVIEW

Work at construction and industrial job sites can be hazardous. Most job-site incidents are caused by at-risk behavior, poor planning, lack of training, or failure to recognize the hazards. To help prevent incidents, every company must have a proactive safety program. Safety must be incorporated into all phases of the job and involve employees at every level, including management.

Module One

Trainees with successful module completions may be eligible for credentialing through the NCCER Registry. To learn more, go to www.nccer.org or contact us at 1.888.622.3720. Our website has information on the latest product releases and training, as well as online versions of our *Cornerstone* magazine and Pearson's product catalog.

Your feedback is welcome. You may email your comments to curriculum@nccer.org, send general comments and inquiries to info@nccer.org, or fill in the User Update form at the back of this module.

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Objectives

When you have completed this module, you will be able to do the following:

1. Describe the importance of safety, the causes of workplace incidents, and the process of hazard recognition and control.
 - a. Define incidents and the significant costs associated with them.
 - b. Identify the common causes of incidents and their related consequences.
 - c. Describe the processes related to hazard recognition and control, including the Hazard Communication (HAZCOM) Standard and the provisions of a safety data sheet (SDS).
2. Describe the safe work requirements for elevated work, including fall protection guidelines.
 - a. Identify and describe various fall hazards.
 - b. Identify and describe equipment and methods used in fall prevention and fall arrest.
 - c. Identify and describe the safe use of ladders and stairs.
 - d. Identify and describe the safe use of scaffolds.
3. Identify and explain how to avoid struck-by hazards.
 - a. Identify and explain how to avoid struck-by and caught-in-between hazards.
 - b. Identify and explain how to avoid caught-in and caught-between hazards.
4. Identify common energy-related hazards and explain how to avoid them.
 - a. Describe basic job-site electrical safety guidelines.
 - b. Explain the importance of lockout/tagout and describe basic procedures.
5. Identify and describe the proper use of personal protective equipment (PPE).
 - a. Identify and describe the basic use of PPE used to protect workers from bodily injury.
 - b. Identify potential respiratory hazards and the basic respirators used to protect workers against those hazards.
6. Identify and describe other specific job-site safety hazards.
 - a. Identify various exposure hazards commonly found on job sites.
 - b. Identify hazards associated with environmental extremes.
 - c. Identify hazards associated with hot work.
 - d. Identify fire hazards and describe basic firefighting procedures.
 - e. Identify confined spaces and describe the related safety considerations.

Performance Tasks

Under the supervision of your instructor, you should be able to do the following:

1. Properly set up and climb/descend an extension ladder, demonstrating proper three-point contact.
2. Inspect the following PPE items and determine if they are safe to use:
 - Eye protection
 - Hearing protection
 - Hard hat
 - Gloves
 - Fall arrest harnesses
 - Lanyards
 - Connecting devices
 - Approved footwear
3. Properly don, fit, and remove the following PPE items:
 - Eye protection
 - Hearing protection
 - Hard hat
 - Gloves
 - Fall arrest harness
4. Inspect a typical power cord and GFCI to ensure their serviceability.

Trade Terms

| | | |
|---|--|-------------------------|
| Accident | Hazard communication standard (HAZCOM) | Qualified person |
| Arc welding | Hydraulic | Respirator |
| Brazing | Incident | Safety culture |
| Combustible | Lanyards | Safety data sheet (SDS) |
| Competent person | Lockout/tagout (LOTO) | Scaffold |
| Confined spaces | Management system | Shielding |
| Cross-bracing | Maximum intended load | Shoring |
| Excavation | Midrail | Signaler |
| Flammable | Occupational Safety and Health Administration (OSHA) | Six-foot rule |
| Flash burn | Permit-required confined space | Spoil |
| Flash point | Personal protective equipment (PPE) | Toeboard |
| Ground | Planked | Top rail |
| Ground fault | Pneumatic | Trench |
| Ground fault circuit interrupter (GFCI) | Proximity work | Welding curtain |
| Guarded | | Wind sock |
| Hand line | | |

Industry Recognized Credentials

If you are training through an NCCER-accredited sponsor, you may be eligible for credentials from NCCER's Registry. The ID number for this module is 00101-15. Note that this module may have been used in other NCCER curricula and may apply to other level completions. Contact NCCER's Registry at 888.622.3720 or go to www.nccer.org for more information.

Note

The successful completion of this module will award a Construction Site Safety Orientation credential.

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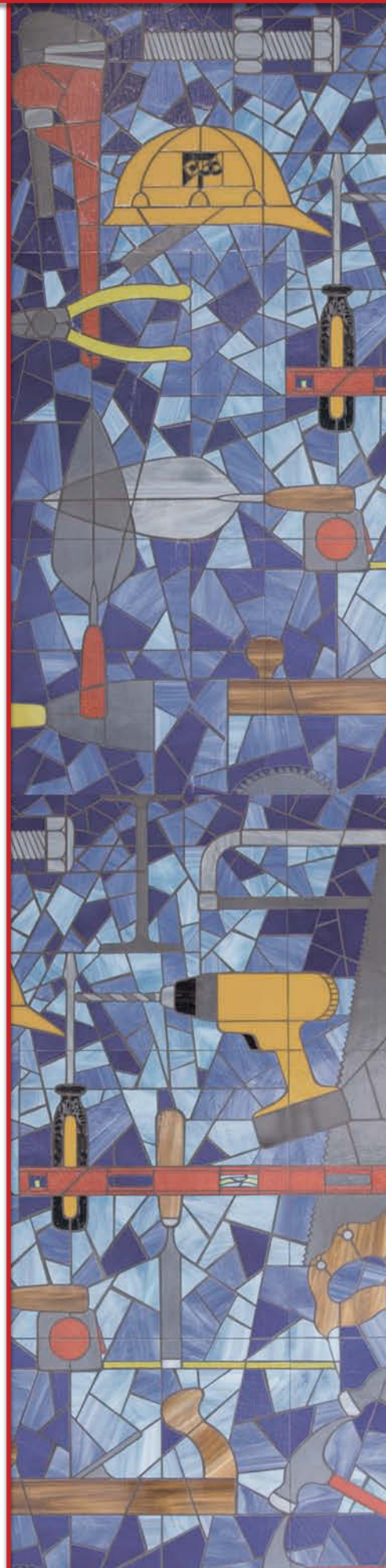
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SECTION ONE

1.0.0 SAFETY AND HAZARD RECOGNITION

Objectives

Describe the importance of safety, the causes of workplace incidents and accidents, and the process of hazard recognition and control.

- Define incidents and accidents and the significant costs associated with them.
- Identify the common causes of incidents and accidents and their related consequences.
- Describe the processes related to hazard recognition and control, including the Hazard Communication (HAZCOM) Standard and the provisions of a Safety Data Sheet (SDS).

Trade Terms

Accident: According to the US Occupational Safety and Health Administration (OSHA), an unplanned event that results in personal injury and/or property damage.

Combustible: Capable of easily igniting and rapidly burning; used to describe a fuel with a flash point at, or above, 100°F (38°C).

Competent person: A person who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Confined space: A work area large enough for a person to work, but arranged in such a way that an employee must physically enter the space to perform work. A confined space has a limited or restricted means of entry and exit. It is not designed for continuous work. Tanks, vessels, silos, pits, vaults, and hoppers are examples of confined spaces. Also see *permit-required confined space*.

Flammable: Capable of easily igniting and rapidly burning; used to describe a fuel with a flash point below 100°F (38°C).

Ground fault: Incidental grounding of a conducting electrical wire.

Hazard Communication (HAZCOM) Standard: The Occupational Safety and Health Administration standard that requires contractors to educate employees about hazardous chemicals on the job site and how to work with them safely.

Hydraulic: Powered by fluid under pressure.

Incident: Per the US Occupational Safety and Health Administration (OSHA), an unplanned event that does not result in personal injury but may result in property damage or is worthy of recording.

Management system: The organization of a company's management, including reporting procedures, supervisory responsibility, and administration.

Occupational Safety and Health Administration (OSHA): An agency of the US Department of Labor. Also refers to the Occupational Safety and Health Act of 1970, a law that applies to more than 111 million workers and 7 million job sites in the United States.

Personal protective equipment (PPE): Equipment or clothing designed to prevent or reduce injuries.

Pneumatic: Powered by air pressure, such as a pneumatic tool.

Respirator: A device that provides clean, filtered air for breathing, no matter what is in the surrounding air.

Safety culture: The culture created when the whole company sees the value of a safe work environment.

Safety data sheet (SDS): A document that must accompany any hazardous substance. The SDS identifies the substance and gives the exposure limits, the physical and chemical characteristics, the kind of hazard it presents, precautions for safe handling and use, and specific control measures.

Trench: A narrow excavation made below the surface of the ground that is generally deeper than it is wide, with a maximum width of 15 feet (4.6m). Also see *excavation*.

When you take a job, you have an obligation to your employer, co-workers, family, and yourself to work safely. You also have an obligation to make sure anyone you work with is working safely. Your employer is likewise obliged to maintain a safe workplace for all employees. The ultimate responsibility for on-the-job safety, however, rests with you; safety is part of everyone's job. In this module, you will learn to ensure your safety, and that of the people you work with, by obeying the following rules:

- Follow safe work practices and procedures, both regulatory and corporate.
- Inspect safety equipment before use.
- Use safety equipment properly.

To take full advantage of the wide variety of training, job, and career opportunities the construction industry offers, you must first understand the importance of safety. Successful completion of this module will be your first step toward achieving this goal. Later modules offer more detailed explanations of safety procedures, along with opportunities to practice them.

On a typical job site, there are often many workers from many trades in one place. These workers are all performing different tasks and operations. As a result, the job site is constantly changing and hazards are continually emerging. These hazards can jeopardize your safety. Your employer should make every effort to plan safety into each job and to provide a safe and healthful job site. Ultimately, however, your safety is in your own hands.

Safety training is provided to make you aware that hazards exist all around you every day. The time you spend learning and practicing safety procedures can save your life and the lives of others.

Safety is a learned behavior and attitude. It is a way of working that must be incorporated into the company as a culture. A **safety culture** is created when all the workers at a job site or in an organization see the value of a safe work environment and support it through their actions. Creating and maintaining a safety culture is an ongoing process that includes a sound safety structure and attitude, and relates to organizations as well as individuals. Everyone in the company, from management to laborers, must be responsible for safety every day they come to work.

There are many benefits to having a safety culture. Companies with strong safety cultures usually have the following characteristics:

- Fewer at-risk behaviors
- Lower **incident** and **accident** rates
- Less turnover
- Lower absenteeism
- Higher productivity

Did You Know?

Safety First

Safety training is required for all activities. Never operate tools, machinery, or equipment without prior training. Always refer to the manufacturer's instructions.

A strong safety culture can also improve a company's safety record, which leads to winning more bids and keeping workers employed. Contractors with poor safety records are sometimes excluded from bidding, so good safety performance is essential. Factors that contribute to a strong safety culture include the following:

- Embracing safety as a core value
- Strong leadership
- Establishing and enforcing high standards of performance
- The commitment and involvement of all employees
- Effective communication and commonly understood and agreed-upon goals
- Using the workplace as a learning environment
- Encouraging workers to have a questioning attitude and empowering them to stop work when faced with potential hazards.
- Good organizational learning and responsiveness to change
- Providing timely response to safety issues and concerns
- Continually monitoring performance
- Positive reinforcement when proper safety practices are demonstrated by employees

Around the World

GOST

While OSHA serves to protect workers by setting safety standards in the United States, other systems are used internationally. One such set of technical standards used on a regional basis is known as GOST. GOST standards are more far-reaching than OSHA standards, as they cover a much broader range of topics than worker safety alone. The first set of GOST standards were published in 1968 as state standards for the former Soviet Union. After the Soviet Union was dismantled, GOST became a regional standard used by many previous members of the Soviet Union. Although countries may also have some standards of their own, countries such as Belarus, Moldova, Armenia, and Ukraine continue to use GOST standards as well. The standards are no longer administered by Russia, however. Today, the standards are administered by the Euro-Asian Council for Standardization, Metrology and Certification (EASC).



1.1.0 Incidents and Accidents

Incidents and accidents can occur at any job site. Both at-risk behavior and poor working conditions can cause these undesirable events. You can help prevent such events by using safe work habits, understanding what causes them, and learning how to prevent them.

The terms *incident* and *accident* are often used interchangeably. However, according to the US **Occupational Safety and Health Administration (OSHA)**, an incident is an unplanned event that may or may not result in property damage. However, an incident is worthy of being documented so that steps can be taken to prevent it from recurring. When an incident occurs, no personal injury has occurred.

An accident is defined as an unplanned event that results in personal injury and/or property damage. Therefore, an event that results in property damage alone could be considered an incident or an accident. If personal injury or a fatality has occurred, the event is definitely an accident.

There are varying opinions on the use of these two terms, however. The US National Safety Council defines an incident as an unplanned, undesired event that adversely affects the completion of a task. In this definition, there is no mention of injury or property damage. Other safety organizations across the globe are likely to have their own definitions of these terms as well, or may use completely different terms.

The most important thing to understand is that both incidents and accidents are undesirable events that have a negative effect on both projects and workers. Do not be surprised when you hear the terms used interchangeably by other workers. The definitions provided by OSHA are used here to provide context for these terms as they are used throughout this module.

The lessons you will learn in this module will help you work safely. You will be able to spot and avoid hazardous conditions on the job site. By following safety procedures, you will help keep your workplace free from incidents and accidents, and protect yourself and others from injury or even death.

1.1.1 Incident and Accident Categories

Incidents and accidents are often categorized by their severity and impact, as follows:

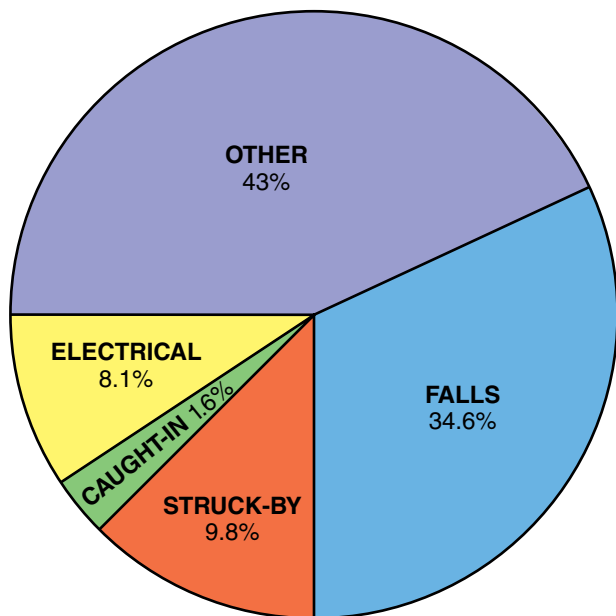
- *Near-miss* – An unplanned event in which no one was injured and no damage to property occurred, but during which either could have happened. Near-miss incidents are warnings that should always be reported rather than overlooked or taken lightly.
- *Property damage* – An unplanned event that results in damage to tools, materials, or equipment, but no personal injuries.
- *Minor injuries* – Personnel may have received minor cuts, bruises, or strains, but the injured workers returned to full duty on their next regularly scheduled work shift.
- *Serious or disabling injuries* – Personnel received injuries that resulted in temporary or permanent disability. Included in this category would be lost-time incidents, restricted-duty or restricted-motion cases, and those that resulted in partial or total disability.
- *Fatalities* – Deaths resulting from unplanned events.

Studies have shown that for every serious or disabling injury, there were 10 injuries of a less serious nature and 30 property damage incidents. A further study showed that 600 near-miss incidents occurred for every serious or disabling injury.

There are four leading causes of death in construction work. These are often referred to as the “big four”, the “fatal four”, or the “focus four”. They include falls; struck-by hazards; caught-in or caught-between hazards; and electrical hazards (*Figure 1*). Deaths from falls far exceed all other causes.

Here are explanations of the four leading hazard groups:

- Falls from elevation are incidents involving failure of, failure to provide, or failure to use appropriate fall protection.
- Struck-by accidents involve unsafe operation of equipment, machinery, and vehicles, as well as improper handling of materials, such as through unsafe rigging operations.
- Caught-in or caught-between accidents involve unsafe operation of equipment, machinery, and vehicles, as well as improper safety procedures at **trench** sites and in other **confined spaces**.
- Electrical shock accidents involve contact with overhead wires; use of defective tools; failure to disconnect power source before repairs; or improper **ground fault** protection.



SOURCE: US OSHA, 2013

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Figure 1 The four high-hazard areas.

1.1.2 Costs

Incidents and accidents cost billions of dollars each year and cause much needless suffering. The National Safety Council estimates that the organized safety movement has saved more than 4.2 million lives since it began in 1913. This section examines why incidents and accidents happen and how you can help prevent them.

Accidents that result in injury or death can have a lasting effect not only on the victims, but on their families, co-workers, and employers. An injured worker who is disabled by an accident faces potentially huge medical bills. On top of those expenses, the worker's family faces loss of the income they rely on. It's convenient to think that insurance will take care of the costs, but it may not. Workers who are injured because they violated established safety rules may have their insurance claims denied and may be dismissed from the company because of the violation. A worker who is injured in a fall because he or she was not using fall protection could be refused

compensation. How these issues are handled varies dramatically among companies and countries.

Employers and co-workers can be affected because many contract awards are based, in part, on a company's safety record. Therefore, incidents and accidents can also result in the loss of future jobs, which affects the company's financial position. This can mean layoffs, hiring freezes, or inability to purchase new equipment or tools. In this way, these events affect not only injured employees and their families, but everyone on the job site.

1.2.0 Incident and Accident Causes

When an incident or accident occurs on the job site, it can often be attributed to one of the following causes:

- Failure to communicate
- At-risk work habits
- Alcohol or drug abuse
- Lack of skill
- Intentional acts
- Unsafe acts
- Rationalizing risks
- Unsafe conditions
- Housekeeping
- **Management system** failure

Each of these causes is discussed further in the sections that follow.

1.2.1 Failure to Communicate

Many incidents happen because of a lack of communication. For example, you may learn how to do things one way on one job, but what happens when you go to a new job site? You need to communicate with the people at the new job site to find out whether they do things the way you have learned to do them. If you do not communicate clearly, incidents can happen. Remember that different people, companies, and job sites do things in different ways.

Making assumptions about what other workers know and what they will do can cause incidents.

The Fatal Four

Out of 3,945 worker fatalities in US private industry during the 2012 calendar year, 775, or 19.6 percent, were in construction. The leading causes of worker deaths on construction sites were falls, followed by struck-by-object, electrocution, and caught-in/between. These fatal four were responsible for nearly three out of five (56 percent) construction worker deaths in 2012 reports, as reported by the US Bureau of Labor Statistics. Eliminating the fatal four would save the lives of 435 workers in America every year.

Half-Measures

Most workers who die from falls are wearing harnesses but failed to tie off properly. Always follow the manufacturer's instructions when wearing a harness. Know and follow your company's safety procedures when working on roofs, ladders, and other elevated locations and make sure you have an adequate anchor point at all times.

Don't assume, for example, that all workers understand what you are saying; some workers have limited language skills, especially outside of their native language. Also, don't use terms or jargon that other people may not understand.

CAUTION

Never assume anything. It never hurts to ask questions, but disaster can result if you don't ask. For example, do not assume that an electrical power source is turned off. First ask whether the power is turned off, then check it yourself to be completely safe.

All work sites have specific markings and signs to identify hazards and provide emergency information (Figure 2). Learn to recognize these types of signs:

- Informational
- Safety
- Caution
- Danger
- Temporary warnings

Informational markings or signs provide general information. These signs are blue. The following are considered informational signs:

- No Admittance
- No Trespassing
- For Employees Only

Toolbox Talks

Toolbox talks are one way to effectively keep all workers aware and informed of safety issues and guidelines. Toolbox talks are 5- to 10-minute meetings that review specific health and safety topics. These are very common at construction sites of all types.



INFORMATION SIGN



SAFETY SIGN



CAUTION SIGN



DANGER SIGN

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Figure 2 Communication tags and signs.

Safety signs give general instructions and suggestions about safety measures. The background on these signs is white; most have a green panel with white letters. These signs tell you where to find such important areas as the following:

- First-aid stations
- Emergency eye-wash stations
- Evacuation routes
- **Safety Data Sheet (SDS)** stations
- Exits (usually have white letters on a red field)

Caution markings or signs tell you about potential hazards or warn against unsafe acts. When you see a caution sign, protect yourself against a possible hazard. Caution signs are yellow and have a black panel with yellow letters. They may give you the following information:

- Hearing and eye protection are required
- **Respirators** are required
- Smoking is not allowed

Danger markings or signs tell you that an immediate hazard exists and that you must take certain precautions to avoid an incident. Danger signs are red, black, and white. They may indicate the presence of the following:

- Defective equipment
- **Flammable** liquids and compressed gases
- Safety barriers and barricades
- Emergency stop button
- High voltage

Safety tags are temporary warnings of immediate and potential hazards. They are not designed to replace signs or to serve as permanent means of protection. Learn to recognize the standard incident and accident prevention signs and tags (*Table 1*).

1.2.2 At-Risk Work Habits

Some examples of at-risk work habits are procrastination, carelessness, and horseplay. Procrastination (putting things off) is a common cause of incidents. For example, delaying the repair, inspection, or cleaning of equipment and tools can cause incidents and even accidents. If you try to push machines and equipment beyond their operating capacities, you risk injuring yourself and your co-workers.

Machines, power tools, and even a pair of pliers can hurt you if you don't use them safely. It is your responsibility to be careful; tools and machines don't know the difference between wood or steel, and flesh and bone.

Work habits and work attitudes are closely related. If you resist taking orders, you may also resist listening to warnings. If you let yourself be easily distracted, you won't be able to concentrate. If you aren't concentrating, you could cause a significant problem.

Your safety is affected not only by how you do your work, but also by how you act on the job site. This is why most companies have strict policies for employee behavior. Horseplay and other inappropriate behavior are forbidden. Workers who engage in such behavior on the job site may be fired.

These strict policies are provided for the worker's protection. There are many hazards on construction sites. Each person's behavior—at work, on a break, or at lunch—must follow the principles of safety.

A person pulling a practical joke on a co-worker could consider it just having fun, but in fact, it could cause the co-worker serious, even fatal, injury. If you horse around on the job, play pranks, or don't concentrate on what you are doing, you are showing a poor work attitude that can lead to a serious incident.

Table 1 Tags and Signs

| Basic Stock (background) | Safety Colors (ink) | Message(s) |
|--------------------------|--|--------------------------------|
| White | Red panel with white or gray letters | Do Not Operate Do Not Start |
| White | Black square with a red oval and white letters | Danger Unsafe Do Not Use |
| Yellow | Black square with yellow letters | Caution |
| White | Black square with white letters | Out of Order Do Not Use |
| Yellow | Red/magenta (purple) panel with black letters and a radiation symbol | Radiation Hazard |
| White | Fluorescent orange square with black letters and a biohazard symbol | Biological Hazard |

