



أكاديمية الطاقة والمياه ENERGY & WATER ACADEMY

# Build Your Future in construction

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NCCER Module 00100



## Build Your Future in Construction p. 1

#### **Course Objectives**

Successful completion of this module prepares you to :



- 1. Describe the construction industry.
  - Define construction and summarize the current and future outlook for jobs.
  - Identify some of construction's more prominent contributions in history.
- 2. Explain the benefits of a construction career.
  - Recognize and describe how construction careers make a difference in the community.
  - Describe the financial and professional benefits of pursuing a construction career.



## Build Your Future in Construction p. 1

#### **Course Objectives**



- 3. Describe the typical career path for craft professionals.
  - Describe industry sectors and the progression path for construction careers.

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- Identify different construction careers and the types of skills they require.
- 4. Identify ways to pursue a career in the construction industry.
  - Explain the benefits of career and technical education programs.
  - Describe the advantages of craft training programs and their relationship with apprenticeships.
  - Summarize the path to a construction career through community colleges and universities.



## **1.0.0 Overview of the Construction Industry** p. 2

The construction industry employs millions of skilled individuals working in trades that offer rewarding jobs, excellent benefits, and great opportunities to have a positive impact on society and the world.



Whatever your skills or interests, construction has a place for everyone.

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### **1.1.0 What is Construction?** p. 2

Construction includes the creation of residential and commercial buildings, roads, bridges, dams, industrial facilities, and more.





### 1.1.0 What is Construction? p. 2

It also includes lesser- known activities related to designing, managing, planning, repairing, maintaining, and even demolishing these structures.



# Construction is both an **art** and a **science** and involves individuals skilled in a particular craft/trade.

While craft professionals must rely on their technical knowledge, they often combine it with creativity and artistic skills.

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### 1.1.1 State of the industry p. 3

The construction market in KSA is steadily growing.

The Saudi Arabian construction market is expected to witness significant growth and offer lucrative potential due to its Vision 2030, NTP 2020, and several ongoing reforms to diversify away from oil.

Saudi Arabia's Vision 2030, along with a significant investment in housing and infrastructure development promoted across the country by local authorities, is revitalizing the construction industry and generating interest in a growing number of international players.



**NEOM : Saudi ambition** 

# **1.1.2 Growing Demand for**

# Skilled Craft Professionals p. 3

Opportunities abound for individuals entering the construction field.

There are not enough skilled craft professionals to meet the industry's existing or anticipated demands in the coming years.

Construction companies are trying to hire and train individuals immediately for the projected future growth in construction.



This means there are great jobs available and they can earn a good income while they are being trained.



#### **Myth: People in Construction Are Unskilled**

In reality, craft professionals perform extremely detailed, specialized work that requires a high level of expertise gained through years of training, both in the classroom and on the job.

Many professionals must also earn specialized licenses, credentials, and/ or certifications that prove their expertise.







Myth: Construction Employees Make Minimum Wage Salaries range from 4,230 SAR to 28,600 SAR (actual maximum salary is higher).

#### **Myth: Construction Does Not Use Technology**

- Computers, mobile apps, tablets
- Drones
- Robots
- Simulators
- Software













- Computers, mobile apps, tablets
   Allow workers to share data, collabo- rate, and communicate more quickly.
- Drones
  - Survey job sites and identify potential hazards in risky or hard-to- see areas.
- Robots
  - Lift and move heavy objects on job sites.







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# **1.1.3 Common Construction Industry Myths** p. 4

#### • Simulators

Create realistic sensations of heights, stress, and hazards, allowing trainees and craft professionals to experience what it feels like to operate equipment and practice safety procedures before actually doing so on the job.



• Software

Create and update construction designs easily and seamlessly.





#### **Myth: Construction is Dangerous**

Jobs involving heavy machinery, power tools, and large components have inherent risks.



Working in construction is safer than ever before due to many factors:

- Higher government safety standards.
- More emphasis on safety in training
- Improved technology
- Safety matters in winning bids

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# **1.1.3 Common Construction Industry Myths** p. 6

• Higher government safety standards.

Formation of the Occupational Safety and Health Administration (OSHA) in 1971. Protective equipment requirements and dedicated safety managers on job sites are two of the most influential reasons for safer work environments.



• More emphasis on safety in training

Many injuries can be avoided if craft professionals are well-trained and understand the proper procedures.





# **1.1.3 Common Construction Industry Myths** p. 6

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Improved technology
 Digital technology has enabled construction companies to work more safely and efficiently.



 Safety matters in winning bids Construction company's safety records are a major factor in winning bids and being selected for projects.





Myth: Construction is Bad for the Environment Construction companies are attempting to reduce impacts on the environment by recycling materials, installing renewable energy sources, and using green construction, which involves creating structures that adhere to sustainability principles.





# **1.1.3 Common Construction Industry Myths** p. 7

Examples of construction practices that are good for the environment:

- Preassembly of structures off site, which allows for more material reuse.
- Wind power technologies, which use wind to generate energy.
- Solar panels, which harness sunlight to provide energy.
- Water reclamation











### **1.2.0 History of Construction** p. 7

Construction had its start thousands of years ago

Great Pyramid of Giza in Egypt



**Great Wall of China** 



Machu Picchu in Peru

Imagine the many aspects of work that were required to bring these structures to completion.

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Tall buildings in Riyadh KSA



# **1.2.1 Famous Construction Examples** p. 8

All the famous and iconic man-made structures around the world would not be here today without the skilled people who built them.

- *Eiffel Tower, in Paris, France* Made of wrought iron in the late 1800s
- Empire State Building, in New York The world's tallest building upon its completion in 1931.
- Golden Gate Bridge, in San Francisco, CA The longest suspension bridge in the world upon its completion in 1937.
- Hoover Dam, on the Nevada/Arizona
- Burj Khalifa, in Dubai, United Arab Emirates The tallest artificial structure in the world at 2,7'22 feet.











# **1.2.2 Important Construction**

# Innovations and Inventions p. 8

Examples of the construction industry's important innovations and inventions:

- Personal protective equipment (PPE) Designed to prevent or reduce injuries on a job site.
- Computer-aided design (CAD) CAD, a more automated approach to sketching twodimensional or three-dimensional designs.
- Building information modeling (BIM) virtual pictures of the construction











#### • Virtual reality (VR)

Like CAD and BIM, virtual reality takes what used to be paper drawings and information and allows users to visualize a structure before it is created.



VR provides a 3D model of a construction site and allows users to directly immerse themselves into the virtual space.



### 1.0.0 Section Review p. 9

1. A major reason for the project shortage of trained craft professionals

is .....

- a. construction salaries are too low
- b. technology has eliminated many construction careers
- c. demand for construction projects is declining
- d. the retirement of Baby Boomers

2. During the 19th century, many structures could be built faster due to the invention of .....

- a. hand tools
- b. steam-powered machinery
- c. self-healing concrete
- d. virtual reality



There are limitless opportunities for career mobility and advancement, plus the financial benefits that come from an industry filled with high-paying occupations.

With so many specialties from which to choose, the benefits of a career in construction are many.



# 2.1.0 Making a Difference p. 10

In many ways, the state of a society's infrastructure depends on the skills and expertise of craft professionals.

Craft professionals make a lasting difference in the world.



Craft professionals who work in construction take pride in being part of something greater than their individual contributions.





### 2.1.1 Providing Essential Services p. 10

#### These services are possible because of skilled individuals who installed













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During natural disasters or other catastrophes, craft professionals often act as first responder to restore essential services and rebuild structures in a timely manner to minimizing the impact of these emergencies.







# 2.1.2 Working to Help the Environment p. 10

The professionals who work in the industry are making positive differences for the environment.

Employing different building techniques.

Installing devices and systems that help businesses and homeowners conserve energy, reduce environmental impacts, and save money.







Construction careers can provide competitive salaries, a debt-free start, and financial security.



With the sizeable shortage of construction professionals, the increasing demand for craft professionals has resulted in rising salaries and enticing benefits designed to attract talented individuals.



### 2.2.1 Competitive Salaries p. 11



The salaries shown do not include overtime, bonuses, or other incentives.

When these are combined, the overall benefits of construction jobs are even higher.



### 2.2.2 Starting Out Debt-Free p. 11





Skilled craft training is available through technical schools, community colleges, associations, or contractor programs.

These programs are shorter and far less expensive per year than the cost of attending a university



costs.

With craft training programs, trainees learn both on the job and in the classroom under the instruction of experienced craft professionals.

Craft training typically follows an Earn as You Learn model, which allows trainees to earn wages for their work in the field with pay increases as their skills advance.









Construction careers typically offer clear paths to advancement and craft professionals have excellent opportunities to progress in their careers.

Many construction jobs begin with individuals learning how to use their tools.

As they become proficient and develop their expertise, they can obtain additional licenses and certifications to increase their chances for promotion.







 During disasters, craft professionals are considered first responders because they perform work to restore essential services and structures.
 a. True
 b. False

2. A major benefit of craft training is that .....

- a. you have no financial responsibilities until you finish training
- b. you are able to earn while you learn
- c. you eventually make enough to pay off your training debt
- d. you have your apprenticeship after one year of training



3. One reason construction careers provide craft professionals with mobility is .....

a. subcontractors often give company automobiles to employees.

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- b. most craft professionals must travel due to the lack of work.
- c. their skills are often in demand everywhere.
- d. most good contractors demand that their employees travel long distances



Individuals can choose from a large variety of construction jobs, many of which offer great opportunity for advancement and earning.



# 3.1.0 Construction Industry Sectors p. 14

The construction industry comprises four primary sectors. Each **sector** includes specific types of construction, materials, equipment, and skills.

- Residential
- Commercial
- Industrial
- Heavy civil/infrastructure





A category of construction distinguished by specific types of work, materials, equipment, and skills. The four sectors of construction are residential, commercial, industrial, and heavy civil/infrastructure.


#### Residential

Includes design, construction, and maintenance of single-family homes, multi-family homes such as apartment buildings, public housing developments, and even separate garages and sheds.

#### • Commercial

Includes design, construction, and maintenance of schools, government buildings, medical facilities, hotels, sports arenas and stadiums, shopping centers, and large office buildings.



Al Nakhla residential compound **Al Riyadh** 



Ministry of Interior Al Riyadh



#### • Industrial

Includes construction of public works such as manufacturing plants, oil refineries, electrical generating plants, chemical processing plants, and large mills.



Acwa Power

### • Heavy civil/infrastructure

Oftenreferredtoashorizontalconstruction,thissectorincludesprofessionalswhobuildbridges,roadways, airports, tunnels, and dams.



King Khalid International Airport **Al Riyadh** 



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### Contractor

Oversees many parts of a construction project, including resource management, budgeting, code adherence, quality assurance, and construction materials.

### **Project Owner**

The initiator of the project who usually finances the building endeavor.

### Subcontractor / Speciality Contractor

Typically employs craft professionals who have specialized skills needed to complete a particular part of the construction project (e.g. HVAC, electrical, plumbing).



#### **Crew Leader**

Also called foreman, this supervisory role oversees a crew of craft professionals. It is the crew leader's job to make sure that work is completed correctly and on time. Crew leaders are responsible for the safety and work of those under them.

### Site Superintendent

Manages day- to-day activities on a construction site and supervises work performed by the subcontractors.

#### **Project Manager**

Oversees the planning and delivery of construction projects on time and within budget.

One of the biggest benefits of pursuing a construction career is the variety of available jobs.

Depending on your personal interests, professional goals, and desire to learn, construction offers great opportunities for practically everyone willing to learn and develop their skills.









# **3.2.1 Carpenter** p. 16

Carpenters construct, repair, and install building frameworks and structures made from wood and other materials.

Carpenters are involved in many kinds of construction from the restoration of historic buildings to the construction of homes, commercial buildings, and more.



### **Examples of carpentry specializations include:**

• Rough carpenter

Does the framing, formwork, and other structural work.

• Finish carpenter

Puts finishing touches on structures after they are almost fully built. Most of the visible wood inside of homes and buildings is placed there by finish carpenters.



# 3.2.1 Carpenter p. 16

To be **successful**, a **carpenter** should possess the following **skills**:

- Physically fit
- Sense of balance
- Good eye-hand coordination
- Detail oriented



- Ability to read blueprints and follow instructions for installing certain products
- Basic math skills (to calculate sizes and amounts of materials accurately)
- Good problem-solving skills



# 3.2.2 Electrician p. 17

Electricians install and maintain the electrical and power systems for homes, businesses, and factories.

In large factories, electricians usually do maintenance work that is more complex.

These kinds of electricians may repair motors, transformers, generators, and electronic controllers on machine tools and industrial robots.





They also advise management regarding electrical hazards.



# 3.2.2 Electrician p. 18

### To be **successful**, an **electrician** should possess the following **skills**:

- Physically fit
- Good color vision (to recognize electrical wires by color)
- Detail-oriented
- Good math skills
- Good problem-solving skills
- Customer service skills
- Skilled with hands





Welders join metals together using a high-intensity electrical arc at temperatures between 6,000°F and 10,000°F.

By joining metal together, welders create a variety of structures, including buildings, ships, bridges, automobiles, and other smaller items.

They also cut steel using oxyfuel, air carbon-arc, or plasma- arc equipment.



A strong focus on precision and safety is key for success in this craft.





Examples of welding specializations include:

#### • Pipe welder

As the name implies, pipe welders construct and repair sections of pipe and related components.



#### • Stainless steel welder

Uses either TIG welding, spot welding, or MIG welding to join stainless steel metals. The method used typically depends on the qualities of the stainless steel being welded.





Examples of welding specializations include:

• Weld inspector

Assures the quality of existing welds by using high-tech testing methods.

Underwater welder

While wearing full underwater diving gear, this professional performs different types of welding using a power source supplied through cables and hoses connected to welding equipment.

Robotic welder

Programs robots and computer-controlled machines to perform welding











To be **successful**, a **welder** should possess the following **skills**:

- Detail-oriented
- Hand-eye coordination
- Physically fit
- Strength in reading two- and threedimensional drawings
- Basic understanding of electricity





# 3.2.4 Pipefitter p. 19

Pipefitters install, assemble, fabricate, maintain, and repair mechanical piping systems.

They work with many kinds of pipe in manufacturing, commercial, and industrial settings such as chemical plants, oil refineries, food processing plants, and paper mills.



They work with piping systems that carry water, gases, liquid chemicals, solids, and fuels.

Pipefitters need to have a good understanding of blueprints, basic math, welding, pipe bending, fittings, and valves.



# 3.2.4 Pipefitter p. 20

To be **successful**, a **pipefitter** should possess the following **skills**:

- Mechanical abilities
- Physical fitness
- Problem-solving skills
- Mathematical skills, particularly in geometry
- Ability to measure, cut, thread, and assemble pipe
- Ability to sketch piping systems





Heavy equipment operators drive and control heavy construction equipment to move construction materials, dirt, and other heavy objects at construction sites, large mills, mining operations, and distribution centers.



On large construction sites, heavy equipment may be used to clear, grade, and lift equipment prior to and during the construction of roads, buildings, bridges, airports, and power generation facilities.





# 3.2.5 Heavy Equipment Operator p. 21

To be **successful**, a **heavy equipment operator** should possess the following **skills**:

- Physical strength
- Good sense of balance
- Hand-eye-foot coordination
- Mechanical skills





### 3.2.6 Crane Operator p. 22

Crane operators use state-of-the-art machinery to hoist heavy construction materials above and around a job site.

Professional crane operators are regularly tasked with using trigonometry and physics equations to calculate maximum load size based on the configuration of the crane and load.





### 3.2.6 Crane Operator p. 22

To be **successful**, a **crane operator** should possess the following **skills**:

- Endurance
- Agility
- Physical coordination
- Good sense of balance
- Ability to judge distance
- Hand-eye-foot coordination
- Good math skills
- Comfortable with technology



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### **3.2.7 Ironworker** p. 23

Ironworkers place and install iron or steel beams, columns, and other construction materials to form and reinforce structures.



# Contrary to the name, ironworkers primarily work with steel and are often referred to as *structural ironworkers*.



### **3.2.7 Ironworker** p. 23

To be **successful**, an **ironworker** should possess the following **skills**:

- Physical fitness
- Agility
- Good sense of balance
- Hand-eye coordination
- Ability to work at heights
- Mechanical skills
- Math skills
- Problem-solving skills







# 3.2.8 HVAC Technician p. 23

HVAC technicians install, maintain, and repair heating, ventilation, and air conditioning systems.

HVAC work includes both mechanical and electronic systems such as motors, pumps, fans, thermostats, and computerized switches that control systems in residential, commercial, and industrial structures.



Technicians can also specialize in specific equipment, such as water-based heating systems, or commercial refrigeration.



### 3.2.8 HVAC Technician p. 24

To be **successful**, an **HVAC technician** should possess the following **skills**:

- Good hand-eye coordination
- Mechanical aptitude
- Basic math skills
- Good problem-solving skills





# 3.2.9 Project Manager p. 24

Project managers are essential to completing construction projects on time and on budget.

Their duties include planning, coordinating, budgeting, and supervising projects from beginning to end.

They typically prepare cost estimates, explain project contracts to other professionals, manage personnel, resolve project issues, and ensure that projects adhere to safety codes and regulations.



Project managers usually spend most of their time on site, where they monitor projects and ensure construction activities stay on schedule.



To be **successful**, a **project manager** should possess the following **skills**:

- Good oral and written communication skills
- Ability to make sound decisions
- Business acumen
- Ability to manage time and oversee multiple ongoing activities
- Strong customer service skills
- Good leadership skills





# 3.0.0 Section Review p. 25

 Which construction sector includes schools, government buildings, hotels, and shopping centers?

 a. Residential
 b. Commercial
 c. Public
 d. Industrial

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2. The construction role that typically reports to the project owner is the ......

- a. superintendent
- b. foreman
- c. subcontractor
- d. contractor



# 3.0.0 Section Review p. 25

- 3. To start your career path in most construction crafts, you generally need a .....
  - 3. high school diploma or equivalent
  - 4. bachelor's degree
  - 5. master's degree
  - 6. state permit
- 4. The construction craft professional regularly tasked with using trigonometry and physics equations to calculate maximum load sizes is the.....
  - a. heavy equipment operator
  - b. ironworker
  - c. crane operator
  - d. pipefitter



# 4.0.0 Starting Your Construction Career p. 26

After earning your high school diploma or equivalent, choose which training path works best for you.

Available training options include:

- Technical school
- Apprenticeship program
- Community college or university
- Industry training program





# 4.1.0 Career and Technical Education p. 26

Classes are generally offered at high schools and technical education centers.

CTE programs place an emphasis on career readiness and hands-on learning.



These programs emphasize the following approaches

• Real-life application

Being able to practice skills learned has been shown to increase students' retention and understanding.





# 4.1.0 Career and Technical Education p. 27

#### **Teaching nontechnical skills**

Having a combination of craft-specific technical skills along with other important but nontechnical skills increases a student's employability.

Some of these nontechnical skills include effective communication, time management, attention to detail, critical thinking, and a customer service attitude.





### 4.1.0 Career and Technical Education p. 27

#### **Career exploration**

By learning about careers early on, and from teachers with industry experience, students can discover their own strengths and interests, find a career that fits their passions, and set a path to achieve their goals.



After completing CTE classes, students generally have the qualifications needed to progress to one of these next steps:

- Industry apprenticeship
- Community college
- University degree

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# 4.2.0 Craft Training and Apprenticeships p. 28

The craft training and apprenticeship approach enables students to learn skills from experienced construction professionals.

A craft training or apprenticeship program features a split between learning in the classroom and on the job.

There are five components to an apprenticeship that are also included in craft training:

- Business involvement
- Structured OJL
- Related instruction
- Rewards for skill gains
- Nationally recognized credentials





# 4.3.0 Community Colleges and Universities p. 29

More and more colleges and universities offer constructionrelated degree programs.

These institutions offer a variety of academic degrees.



Community colleges usually provide two-year programs and offer associate degrees, while four-year universities are more often used for bachelor's degrees and beyond.



# 4.3.1 Community College p. 29

- Community colleges often collaborate with contractors and construction companies by helping facilitate their training programs.
- Rather than teach employees in-house, these companies can send trainees to a community college.
- Earning an associate degree from a community college allows you to receive college credit as well as industry-recognized certifications and credentials upon graduation.



Options for the next steps include:

- Industry apprenticeship
- Entry-level job
- University degree



An increased number of four-year universities offer degree programs in construction-related areas such as design, construction management, estimating, human resources, architecture, engineering, and safety.



King Abdulaziz University **Al Riyadh** 

A big advantage of a college degree is that it may allow you to move up the construction career ladder more quickly after gaining initial experience in your craft.



### 4.0.0 Section Review p. 30

1. CTE programs place an emphasis on preparing students for construction careers through ......

- a. hands-on learning
- b. lectures and quizzes
- c. virtual lessons
- d. group projects
- Depending on the particular craft, an apprenticeship or craft training program can generally be completed in .......
   a. six months
   b. two to four years
   c. six to eight years
   d. ten years


## 4.0.0 Section Review p. 30

3. Earning a construction degree guarantees you will be offered a construction job upon graduation

a. True b. False тсс





## End of module 00100 TCC ... Build Your Future in Construction