ACE MENTOR PROGRAM
ARCHITECTURE ▪ CONSTRUCTION ▪ ENGINEERING

NEW AFFILIATE RESOURCE HANDBOOK

ACE MENTOR PROGRAM
ARCHITECTURE • CONSTRUCTION • ENGINEERING

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The proper establishment of an ACE affiliate requires adherence to Federal and state laws and regulations as well as to ACE National policies. **Start-up affiliates are strongly advised to secure the services of an attorney and accountant to help in this process**. ACE Regional Directors are also available to offer guidance and assistance of a non-legal nature.

States have slightly different requirements for creating a nonprofit organization. Most state governments publish on their websites explanations of these requirements. Start-up information by state can also be located at Grantspace.org. Alternatively, a Google search for "setting up a nonprofit in [state name]" will often turn up the appropriate document. Leaders of new affiliates may wish to familiarize themselves with this information in addition to obtaining professional advice.

This chapter details the formal requirements to establish an affiliate and reviews some of the preliminary operational steps.

I. FORMATION PROCEDURES AND DOCUMENTS

Individuals or groups wishing to start an ACE affiliate should complete nine steps in the order listed below.

1. **Create a Board**

   The Board of Directors is an affiliate's governing body. To be effective and exercise proper oversight, Board members need to have a clear understanding of ACE's mission, objectives, and activities. At a minimum, the Board should have five (5) members including representatives from sponsor companies and organizations as well as a CPA and legal professional. The By-laws should clearly establish the procedure for appointing or electing Board members as well as define their terms of service.

   A list of Board members with their company affiliations should be sent to the prospective affiliate's Regional Director.

2. **Develop and Approve By-laws**

   By-laws describe and govern the operation of an affiliate. They should detail the Board's structure, including any committees, and set forth the Board's rules of operation. A sample set of ACE By-laws can be provided by the Regional Director.

   The Board must formally adopt its By-laws. A signed and dated copy of this document must be emailed to the affiliate's Regional Director. The affiliate should retain a copy of its By-laws and be prepared to make a copy available upon the request of any individual or entity.

   As a matter of good governance, affiliates should review their By-laws at least every three years and make any needed amendments. Send scanned files of any amended and properly dated set of By-laws to an ACE Regional Director.

3. **File Articles of Incorporation**

   The affiliate must incorporate itself in its home state as The ACE Mentor Program of [insert state or city name]. The name should be discussed with a Regional Director and needs to define the affiliate's intended area of operation.

   The Articles of Incorporation must be filed with the appropriate state and/or local government agency, and a scanned copy emailed to the affiliate's Regional Director. Because each state has different requirements and steps for incorporation, the ACE National Office highly recommends that an affiliate seek professional legal advice. Some states require a hard copy of the Articles of Incorporation. See this sample Articles of Incorporation.

4. **Obtain Federal Employment Identification Number (EIN)**

An affiliate must obtain a Federal Employer Identification Number (EIN) by filing a Federal Form SS-4, "Application for Employer Identification Number," with the Internal Revenue Service. The process is quick and simple.

- An online submission can be made at this section of the IRS website.
- A PDF copy can be saved with the online application.
- If an affiliate files a paper copy of the SS-4 as opposed to filing online, the IRS will mail the affiliate a letter with the EIN. Filing electronically is strongly recommended, however.
- Online submissions receive an online acceptance which should be saved as a PDF file and retained for record-keeping purposes. In addition, an affiliate should email the PDF file to its Regional Director.

5. **Execute Affiliate Agreement**

Each affiliate must execute an Affiliate Agreement at its formation. This document defines the formal relationship between ACE Mentor Program of America and the affiliate, as well as the rights and responsibilities of each entity. The Agreement clearly delineates expectations for an affiliate to be in full compliance with ACE National's requirements.

The chair of the affiliate Board or other appropriate officer must sign and date the Agreement and submit it to the affiliate's Regional Director who will transmit it to the National Office. Once the ACE President signs the Agreement, the affiliate is authorized to begin operations and to take advantage of certain benefits provided by ACE National (e.g., liability insurance). The National office will provide the affiliate a copy of the signed Agreement for its records.

An affiliate's responsibilities outlined in the Affiliate Agreement are summarized below:

Organization

- Organize affiliate as a charitable and educational nonprofit.
- With the assistance of a legal professional, draft the affiliate's Articles of Incorporation, By-laws, resolutions and any other necessary documentation and file these documents with appropriate state and local government offices as required by state regulations.
- Define the affiliate's territory.
- With the assistance of accounting and legal professionals, complete all necessary Federal, state, and local registrations and filings required of a charitable, educational, tax-exempt nonprofit corporation.

Documents

- With the advice of legal counsel, adapt the sample Articles of Incorporation and By-laws to comply with applicable state and local laws.
- Provide the ACE National Office with final executed copies of the following:
  - Affiliate Agreement
  - Articles of Incorporation
  - By-laws (signed and dated)
  - Confirmation of registration with an affiliate's state charitable unit/department
  - Confirmation (either a PDF file or hard copy) received from the IRS with the affiliate's Employer Identification Number (EIN).

6. Obtain Tax Exemption as a 501(c)(3) Nonprofit

Affiliates are eligible for inclusion under ACE's national umbrella for tax-exempt status under Section 501(c)(3) of the Internal Revenue Code. An affiliate should not file separately for its own nonprofit tax exemption.

For an affiliate to be included in the ACE's group exemption as a 501(c)(3) nonprofit, the affiliate must send the National Office, through the appropriate Regional Director, a signed statement that it agrees to be included in ACE's group exemption. Attachment B

For an affiliate to comply with IRS requirements for inclusion under ACE's group exemption, the National Office must first have the following documents on file:

- Affiliation Agreement
- Articles of Incorporation
- By-laws
- A copy of the IRS acceptance form indicating the affiliate's Employment Identification Number (EIN)
- The affiliate's legal address.
- A list of the affiliate's Board members.

Once the ACE National Office receives the signed statement requesting inclusion under ACE's group exemption, it will forward the affiliate the group exemption number that must be included on an affiliate's annual Federal tax returns. In general, if an affiliate has revenues exceeding $50,000, it must file IRS Form 990 annually. If an affiliate's revenues are less than $50,000, it must file a Form 990N (an e-postcard). An affiliate may also need to file a state tax return.

Failure to file a tax return *each year* will jeopardize an affiliate's nonprofit status and may be cause for disaffiliation from the ACE Mentor Program of America.

7. **Register in State as a Charitable Organization**

Many states, and in some cases localities, require a nonprofit to register as a charitable organization before it can solicit funds in the state. Because each state has different requirements, the advice of legal counsel is very important to understand and comply with a state's regulations. Failure to follow these requirements can result in revocation of an affiliate's nonprofit status within its state.

The Unified Registration Statement (URS) website is a useful resource to check state-by-state requirements for registering as a charity and to download a common registration statement that some states use.

Once an affiliate receives confirmation from its state approving its nonprofit status, the affiliate should carefully save this document in its records and email a scanned copy to its Regional Director.

8. **Obtain Sales Tax Exemption**

Many states provide a sales tax exemption to tax-exempt organizations.

Affiliates should check with their state regarding the procedures to obtain this exemption. It can save an affiliate money when purchasing supplies organizing special events like a scholarship breakfast.

9. **Review Insurance Coverage**

Once the National Office has approved an affiliate, it will be added to ACE National's umbrella insurance policy. Upon request, Regional Directors will provide an affiliate with a statement of insurance detailing ACE's coverage.

II. INITIAL OPERATIONAL STEPS

Regional Directors are available to assist new affiliates as they launch the operations described below. They have a wealth of experience to share.

1. **Start-up Checklist**
   After a new affiliate has completed all the steps outlined in section I above, its Regional Director will go through a start-up checklist with the affiliate leaders to ensure all required documents and information have been submitted fully and properly. Attachment A

2. **Affiliate Webpage**
   ACE National will set up on its website a page for the affiliate and also create a profile in the ACE database. The affiliate needs to designate an individual to be responsible for the website and the database. This point person will receive the affiliate's user name and password for the Behind the Scenes section of the website to administer the affiliate's database records.

3. **Board of Directors**
   The Board should meet and establish a strategy for the affiliate. Board members should undergo an orientation to understand ACE's mission and their responsibilities. All Board members must register in the ACE database.

4. **Mentors**
   Recruitment of mentors can start as soon as the affiliate is formally established. (See Chapter XX for more information about mentors.) They should be directed to register on the ACE website. The program cannot begin until the mentors are registered in the database, have passed a background check, and have completed the on-line mentor training module. For further details on the database and background check process, contact a Regional Director.

   The Behind the Scenes section of the ACE website has a full package of information relevant to mentor recruitment and training.

5. **Students**
   Student recruitment can also start. They must register through the ACE website and submit a signed Parent Consent form. Information and materials are available on the website for purposes of recruiting students.

Attachment A - Start Up Checklist

Name of Lead Contact:

Company:

Email:

Telephone:

Mailing Address of Affiliate:

Board Members:

Chair:

Vice Chair:

Treasurer:

Secretary:

Member:

Mentor Firms:

Architectural:

Engineering:

Construction:

Other:

High School(s):

Name:

Contact:

Attorney who will work with you to establish the Affiliate:

Accountant who will work with you to establish the Affiliate:

Attachment B – Affiliate Addition Letter

Date

Diana T Eidenshink
President
ACE Mentor Program of America
1501 Cherry Street
Philadelphia, PA 19102

RE: Addition to the Group Exemption Roster

Dear Diana,

The purpose to this letter is to request inclusion of our corporation under the Section 501(c)(3) of the Internal Revenue Code Group Exemption Roster held by the ACE Mentor Program of America, Inc.

A. Name of Corporation- _____

B. Mailing address- _____
_____

C. Actual address, if different from mailing address-
_____
_____

D. Federal Employer Identification Number- _____

E. Name of main contact – _____

F. Phone number - _____

This letter gives authorization to the Ace Mentor Program of America, Inc. to add ACE Mentor Program of _____ to the group exemption roster for the Section 501(c) (3) of the Internal Revenue Code. Our corporation is not a private foundation as defined under the Section 509(a) of the Internal Revenue Code. Our corporation is filed in the State of _____ as a non-profit entity.

Thank you for your consideration.

Sincerely,

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SCHOOL YEAR – SCHEDULE AT A GLANCE

Week	Date	Session Description	Mentors	Comments / Speakers
1		Program Launch	Mentor Team Leader Mentor Team Leader Mentor Team Leader	
2		Program Introduction	Mentor Team Leader Architect Mentor Contractor Mentor	
HOLIDAY BREAK				
3		Design Office Visit	Mentor Team Leader Architect Host Engineer Host	Contractor Guest
4		Analyzing Project Scope	Mentor Team Leader Architect Mentor Contractor Mentor	Subcontractor Guest
5		Site Design	Mentor Team Leader Civil Engineer Mentor Landscape Architect Mentor	Geotech Guest
6		Construction Site Visit	Mentor Team Leader Contractor Host Field Supervisor Host	Remember to wear boots!
7		Concept Design Site Planning	Mentor Team Leader Arch or Landscape Arch Guest Civil Engineer Guest	Site Contractor Guest
8		Schematic Design HVAC/Plumbing Systems Cost Estimating	Mentor Team Leader Architect Mentor Mechanical Engineer Guest	Mech. Contractor Guest
9		Mentor Feedback	Mentor Team Leader Architect Mentor Contractor Mentor	
10		Schematic Design Structural Systems Cost Estimating	Mentor Team Leader Structural Engineer Guest Contractor Mentor	Subcontractor Guest
11		Design Development Electrical/Lighting Systems Quantity Take-offs	Mentor Team Leader Electrical Engineer Guest Contractor Mentor	Elect. Contractor Guest
12		Design Development Fire Protection Systems Scheduling	Mentor Team Leader Architect Mentor Contractor Mentor	Site Supervisor Guest
13		Team Coordination	Mentor Team Leader Architect Mentor Contractor Mentor	Presentation Guest
14		Presentation Prep 1	Mentor Team Leader Architect Mentor Contractor Mentor	
15		Presentation Prep 2	Mentor Team Leader Mentor Team Leader Architect Mentor	Mock Presentations
16		**PROJECT SHOWCASE**		**Location TBD**

Mentor Team Leaders may choose to incorporate additional field trips into the schedule.

WEEK 1 – PROGRAM LAUNCH

Program Overview

Founded in 1994, the ACE (Architecture-Construction-Engineering) Mentor Program is a national not-for-profit organization with chapters throughout the United States. ACE Mentor of Eastern Iowa received affiliate designation, with the assistance of Kirkwood Community College, in 2014.

Program Mission

To engage, excite, and enlighten high school students to pursue careers in architecture, engineering, and construction through mentoring and to support their continued advancement in the industry.

As an ACE Mentor student participant, you will join a team of other students led by adult mentors who are practicing industry professionals. Opportunities presented to you will include:

- Field trips to professional offices, construction job sites, and other relevant locations.
- Discussion and performance of the same tasks completed by industry professionals.
- Practical, hands-on view of a project's everyday reality.
- Education regarding different design and construction industry careers.

ACE Mentor is now the construction industry's most respected high school mentoring program, with tens of thousands of students – and growing!

Mentor Introductions

ACE Mentors participating in this year's program will rotate with the student teams depending on that week's discussion. A listing of all participating mentors is provided in the Appendix of this handbook.

WEEK 1

Objectives:

- Student and Team Leader Introductions
- Introduce ACE Mentor Program
- Introduce CIRT Competition project
- Overview of Program goals

Mentor(s) / Speakers:

Name	Company

Action Items:

1. Understand the stated goals for the program
2. Investigate ACE careers
3. Research the “design process”

Notes:

WEEK 2 – PROGRAM INTRODUCTION

ACE Occupation Descriptions

The following is a brief description of just a few of the careers available within the design and construction industry. Each student will be asked to represent one of the professions listed below within their project team structure.

Profession	Description and Responsibilities
Project Manager	As the project manager, you are responsible for keeping your team on track, on schedule, and on budget. You will work on the team, as a member, but with additional leadership responsibilities. A good project manager listens constructively to the team members and client(s) to guide the team in achieving the team's goals.
Architect	As the architect, you are responsible for creating the overall look of the project – its aesthetics. You will lead your team in planning and designing the exterior and interior of the site building(s). When designing a building, architects must consider its function, safety, the needs of people using the building, and budget limitations.
Civil Engineer	As the civil engineer, you are responsible for the technical aspects of the site design. You will guide your team in determining the location of road(s), parking lot(s), and infrastructure. You will also assist in determining building placement. It is important for civil engineers to consider safety, functionality, and sustainability.
Contractor	As the contractor, you are responsible for the overall coordination of the project. You will assist the project manager in keeping your team on track, on schedule, and on budget. You will also lead the team in preparing the cost estimate. During the course of a project, contractors must keep in mind construction feasibility and efficiency.
Engineer	As one of the engineers, you will be responsible for the technical aspects of structural, mechanical, and electrical systems for the project. You will work with your team in the selection of systems, coordination with the overall design, and assist the contractor with budgeting. It is important for engineers to consider cost, efficiency, and sustainability.
Landscape Architect	As the landscape architect, you are responsible for the landscape surrounding the site and building(s). When creating a design, landscape architects must keep the following things in mind: function, beauty, and compatibility with the natural environment.

Profession	Description
ARCHITECTURE	Architects plan and design the exterior and interior of buildings of all kinds – from houses to offices and from airport terminals to churches. They can also create master plans for new communities, redevelopment plans for cities, or even design renovations of old buildings. Architecture mixes art with science because it involves both creating the overall look of a structure – its aesthetic – but also incorporates the development of detailed plans used to guide the construction of a building. Architects usually are involved in every phase of a building project; from its initial conception to its completion. When designing a building, architects must consider its function, safety, impact on the environment, compatibility with existing buildings, the needs of people using the building, and owner budget limitations. Skills: • Creativity, artistic ability, 3D visualization, and ability to conceptualize and understand spatial relationships • Written and oral communication skills plus knowledge of CAD software High School Preparation: • Emphasize math, art history, CAD, and studio arts classes • For Landscape Architects – environmental studies and biology College Requirements: • Either a 5-year Bachelor of Architecture or Masters of Architecture are required to become a licensed architect • Classes include: building design, structures, technology, architectural history, materials, etc. and design studios • Landscape Architecture classes include: ecology, plant and soil science, etc. Post-College Requirements: • Approximately 3-year internship under the direct supervision of a licensed architect • Successfully pass the architectural licensing exam

ACE **Careers -** ARCHITECTURE • CONSTRUCTION • ENGINEERING

Profession	Description
CONSTRUCTION MANAGER (CM)	Construction managers (CM) plan and coordinate construction projects. They may have job titles such as a construction superintendent, general superintendent, project engineer, or project manager. CMs often participate in the planning and coordination of the construction process from the conceptual development design stage through final construction. They seldom take part in the actual act of putting work in place (i.e., "swinging a hammer"). A CM oversees the organization, scheduling, budgeting, and implementation of the project to execute the design intent of a project. They are responsible for coordinating and managing contractors, materials, equipment, budgets, schedules, and contracts as well as monitoring the safety of employees, workers, and the general public. They often work with engineers, architects, and others who are involved in the construction process. Skills: • Work well under pressure, problem solving, team coordination, and plan reading • Written and oral communication skills plus knowledge of CAD software High School Preparation: • Math and science classes as well as CAD and drafting classes College Requirements: • Typically, a 4-year Bachelor's Degree in Construction Science, Construction Management, or Civil Engineering • 2-year Construction Management or Construction Technology degree • Courses include: project development, site planning, design, construction methods and materials, cost estimating, scheduling, accounting, and finance Post-College Requirements: • Gain experience in job site and office construction management activities

ACE **Careers -** ARCHITECTURE • CONSTRUCTION • ENGINEERING

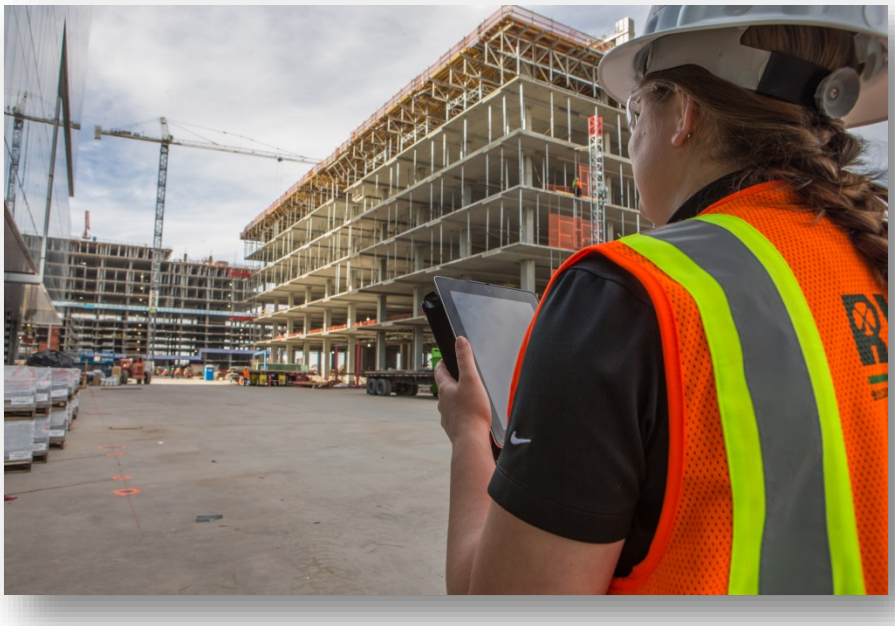
Profession	Description
ENGINEERING	Engineers play a key role in the design and construction process including the manufacture of products/materials or operation of buildings. They are often thought of as problem-solvers who figure out, for example, how to construct a bridge or improve technology. Most engineers specialize. There are more than 25 major engineering specialties; some of which have numerous subdivisions. For example, structural and transportation engineering are subdivisions of civil engineering. Skills: • Creativity, curious, analytical, and detail-oriented • Written and oral communication skills plus knowledge of CAD software High School Preparation: • Take all the math and science courses you can College Requirements: • 4-year Bachelor's Degree from an Accredited Engineering School • Not all universities offer the same types of Engineering • Normally, the first two years of school are common to all engineering programs with specialization coming in the third and fourth years (lots of math and science) Post-College Requirements: • Work as an Engineer in Training (EIT) under the direct supervision of a licensed engineer to gain experience • With experience and examinations, you can become a Professional Engineer (P.E.) allowing you to be responsible for your own work and sign/seal documents and plans • A Master's Degree is a possibility but not a requirement In addition to the standard engineering degree, many colleges offer 2 or 4-year degree programs in engineering technology. These programs prepare students for practical design and production work by focusing on various hands-on laboratory classes. This prepares students for practical design and production occupations as opposed to careers requiring more theoretical and scientific knowledge. Engineering technology graduates are not qualified to register as Professional Engineers.

Different Types of Engineering:

- **Civil** – Structures, Transportation, Water Resources, Geotechnical, Surveying Construction
- **Environmental** – Water, Waste Treatment, Recycling, etc.
- **Mechanical** – Energy, Mechanical Systems, Manufacturing, HVAC, Plumbing, Fire Protection, Automotive
- **Chemical** – Food Products, Pharmaceuticals, Plastics, Fertilizers, etc.
- **Electrical** – Electronics, Communications, Power, Controls, Instrumentation
- **Computer** – Hardware, Software
- **Industrial** – Logistics, Quality, Efficiency
- **Aerospace** – Aerodynamics, Satellites, etc.
- **Materials** – Metals, Ceramics, etc.
- **Bioengineering** – Engineering & Medicine
- **Agricultural** – Machines & Systems used in producing food and fiber
- **Mining/Geology**
- **Petroleum** – exploring, drilling, and production of oil and gas
- **Architectural**
- **Nuclear** – Nuclear power plants and fuel processing
- **Others**

"You know you are on the road to success if you would do your job and not be paid for it."

- ***Oprah Winfrey***



Project Delivery Methods

The design and construction industry varies greatly in the different project delivery methods available to complete a project from concept to completion. It is important to understand the basics of each method in order to identify roles and responsibilities of the owner, designer, and contractor.

The information below outlines, in general terms, four of the most prevalent delivery methods currently utilized within the industry. Project utilizing public funds may have restrictions on allowable delivery methods whereas projects funded with private money have no restrictions.

Delivery Method	Description
Design-Bid-Build (D-B-B)	Characteristics: • Separate contract with Architect and Contractor • Contractor is selected based on lowest cost • Most commonly understood • Linear sequence of work (longest delivery time) Primary Reason to Choose: • Owner retains full control of design • Laws are well defined • Low first cost (bidding) Disadvantages: • Owner is responsible for all project costs • Highest rate of legal issues • No utilization of contractor input
Construction Manager at Risk (CM@Risk)	Characteristics: • Separate contract with Architect and CM • CM performs as Contractor for project • CM is selected on qualifications and fees • Construction risks are transferred to Contractor • Typically open-book on costs (full disclosure to Owner) Primary Reason to Choose: • Owner retains full control of design • Contractor is involved early • Estimated costs are known prior to final design documents Disadvantages: • Owner is responsible for changes • Owner's qualification-based selection of CM • Architect under no obligation to take input from CM
	Characteristics: • Single-point of contact/responsibility for design and cost

Design-Build (D-B)	• Often the fastest delivery • Most cost effective • Requires a well-defined project scope • Timely decisions are critical to success • Administration of process is key to success Primary Reason to Choose: • Owner shares design responsibility with Design-Builder • Construction input occurs during the design process • Project scope is well defined prior to start of construction • Accelerated schedule • Typically performed with a guaranteed price from Contractor prior to completion of design Disadvantages: • Fully dependent on abilities of Design-Builder • Need up-front project definition and performance criteria • Owner needs to manage quality expectations and cost • Owner required to make early design decisions
Public-Private Partnership (3P or PPP)	Characteristics: • Still new to the U.S. but becoming more accepted • Involves a contract between a government entity and a private corporation to fund, design, and construct a project Primary Reason to Choose: • Taxpayers are relieved of initial funding obligations • Private entities are generally more efficient than public entities due to profit motivation and fewer regulations • Public entity still maintains some oversight Disadvantages: • Some risk must be taken by the public entity • Private entity efficiencies may be in conflict with public entity standard procedures • Eventually, the public entity will take over the project and must live with the results

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WEEK 2

Objectives:

- Review ACE careers
- Review project delivery methods

Mentor(s) / Speakers:

Name	Company

Action Items:

1. Identify how you view your strengths and how they will assist the team
2. Outline how your current interests might fit within an ACE career
3. Investigate LEED and sustainability in the built environment

Notes:

WEEK 3 – DESIGN OFFICE VISIT

The Built Environment

The term **built environment** is defined as "the human-made space in which people live, work, or recreate on a day-to-day basis". It encompasses places and spaces created or modified by people including buildings, parks, lakes, dams, and transportation systems.

While buildings and development provide countless benefits to society, they also have significant environmental and health impacts. This summary presents some basic facts about those impacts.

Issue	Impacting Activities Associated With Construction
Planning, Land-Use & Conservation	• Biodiversity • Re-use of existing buildings • Flooding
Energy Use, Global Warming & Climate Change	• Carbon dioxide emissions & greenhouse gases • Passive heating / cooling • Energy Use in production, transport, construct ion & operation
Pollution & Hazardous Substances	• Waste production • Pollution during manufacturing of materials & products • Recycling contaminated land
Resources, Waste & Recycling	• Mineral extraction • Waste Disposal • Water Use

? QUESTION

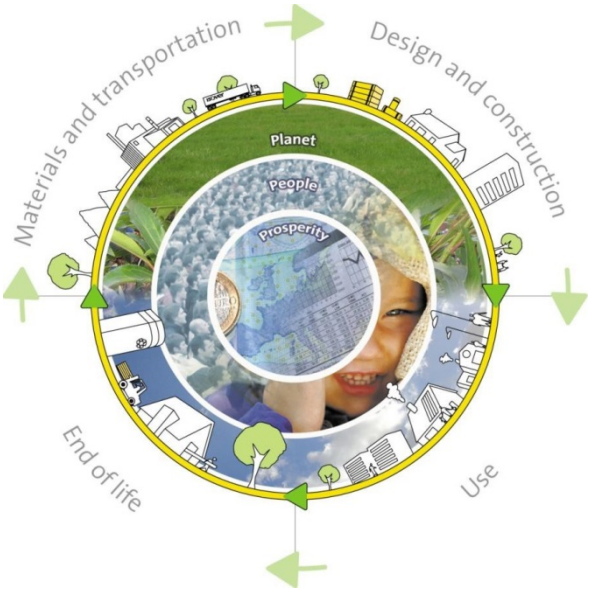
What other impacts does the built environment have on society and our standard of living?

Sustainability Concepts

Sustainable construction, also known as **green building**, aims at reducing the environmental impact of a building over its entire lifetime while also optimizing its economic possibility and the comfort and safety of its occupants.

While standard building practices are guided by short term economic considerations, sustainable construction is based on best practices which emphasize long term affordability, quality and efficiency. At each stage of the life cycle of the building, it increases comfort and quality of life, while decreasing negative environmental impacts and increasing the economic sustainability of the project. A building designed and constructed in a sustainable way minimizes the use of water, raw materials, energy, and land over the whole life cycle of the building.

Leadership in Energy and Environmental Design (LEED) consists of rating systems for the design, construction, and operation of high performance buildings, homes, and neighborhoods.



LEED-certified buildings are design to:

- Lower operating costs and increase asset value
- Reduce waste sent to landfills
- Conserve energy and water
- Be healthier and safer for occupants
- Reduce harmful greenhouse gas emissions
- Qualify for tax rebates, zoning allowances, and other incentives in hundreds of cities

Developed by the **U.S. Green Building Council (USGBC)**, LEED is intended to provide building owners and operators a concise framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions. Since its inception in 1998, the U.S. Green Building Council has grown to encompass more than 7,000 projects in the United States and 30 countries, covering over 1.5 billion square feet of development area. The hallmark of LEED is that it is an open and transparent process where the technical criteria proposed by USGBC members are publicly reviewed for approval by the almost 20,000 member organizations that currently constitute the USGBC.

The **Green Building Certification Institute (GBCI)** was established by USGBC to provide a series of exams to allow individuals to become accredited for their knowledge of the LEED rating system. This is recognized through either the LEED Accredited Professional (LEED AP) or LEED Green Associate designation. GBCI also provides third-party certification for projects pursuing LEED.

The Design & Construction Process

Although somewhat varied based on the delivery method being utilized for a project, both the design and construction teams play important roles in the building process.

Key Roles in the Design & Construction Process

Construction Managers and General Contractors plan, coordinate, and supervise construction projects from early development to completion.

Specialized or Trade Contractors perform a specific task as part of the overall project and are normally paid for services provided to the project by the originating General Contractor.

Engineers apply scientific, economic, social, and practical knowledge in order to design and build structures, machines, devices, systems, materials, and processes.

Suppliers and Vendors provide specialized equipment, materials, and products used to complete construction.

Architects provide services in connection with the design and construction of a building and the space within the site surrounding the buildings with their principal purpose human occupancy or use.

Facility Managers are responsible for the operation and maintenance of buildings once construction is complete.

Owner / Owner Representatives are responsible for making decisions and funding design and construction activities in the best interest of the building end-user.

The Design Process Defined

The steps below outline the general process during project design development with activities being performed by the architect or engineers.

Concept Design (Programming)

Early definition of project needs as required by the owner including site size, building spaces, budget, and schedule.

Schematic Design (SD)

An initial design scheme seeking to define the general project scope and conceptual design including scale and relationships between building components.

Design Development (DD)

Design refinement following SD where greater detail is provided along with a clear and coordinated description of all aspects of the architectural, mechanical, plumbing, and fire protection.

Construction Documents (CD)

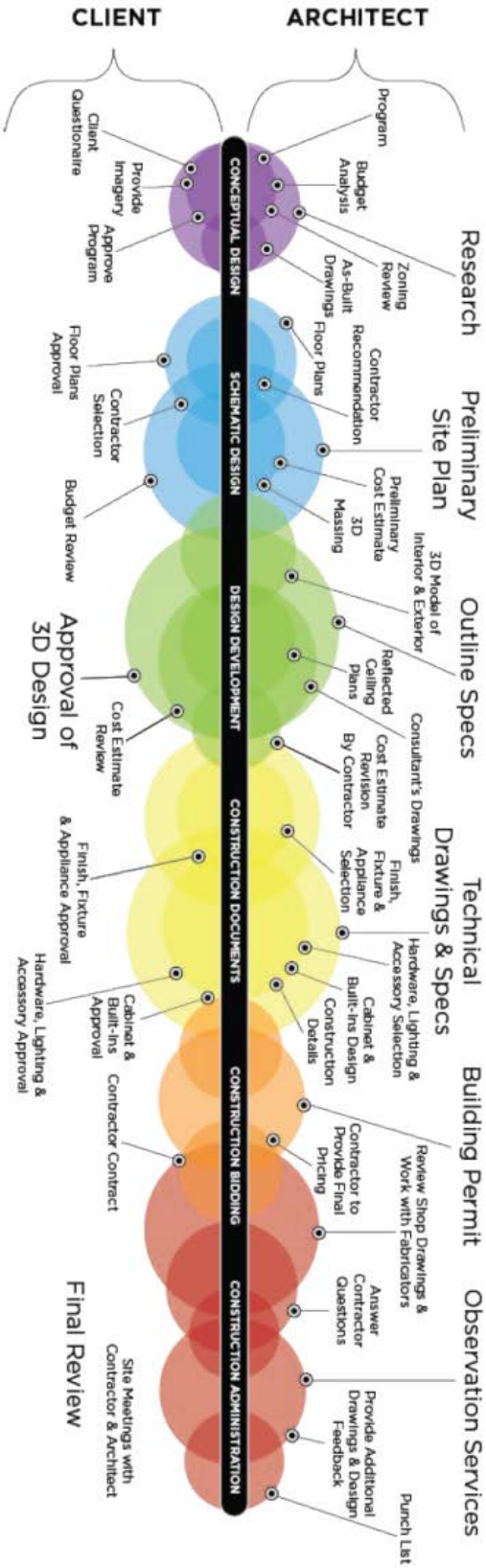
Detailed documents setting forth the requirements for the construction of the project consisting of Drawings (illustrative component) and Specifications (written requirements).

Construction Bidding

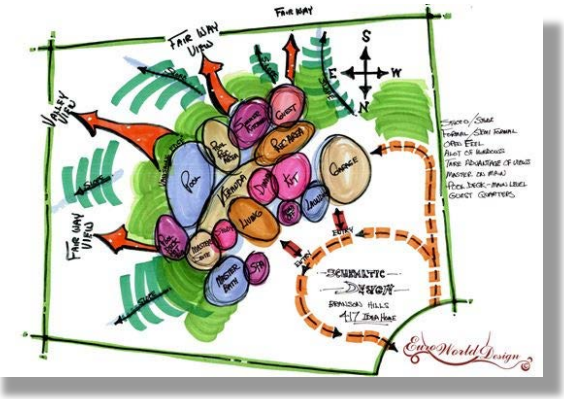
The submittal and consideration of price proposals from contractors representing the Construction Document and schedule requirements of the project.

Construction Administration (CA)

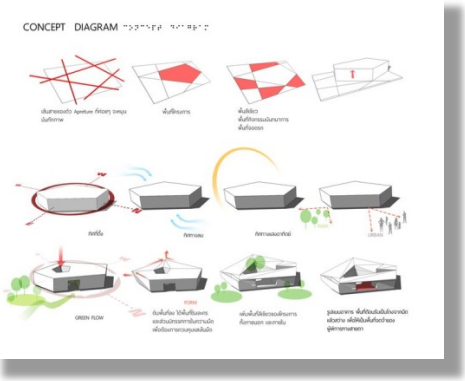
Activities performed by the design team, acting as an agent of the owner, overseeing construction to ensure conformity to the Construction Documents and industry standards.



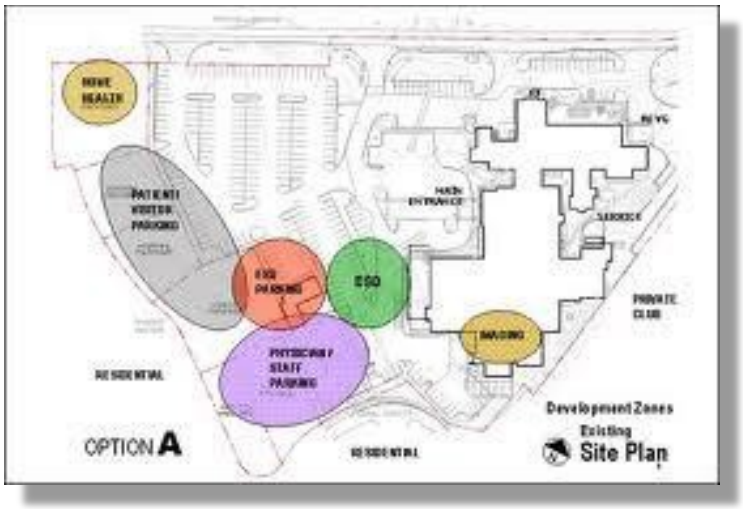
Design Communication



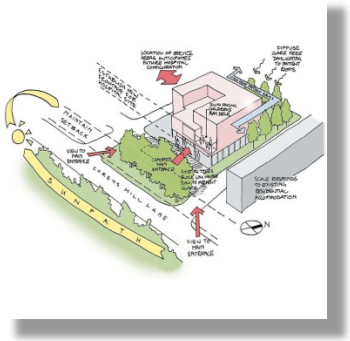
Hand Sketch Bubble Diagrams



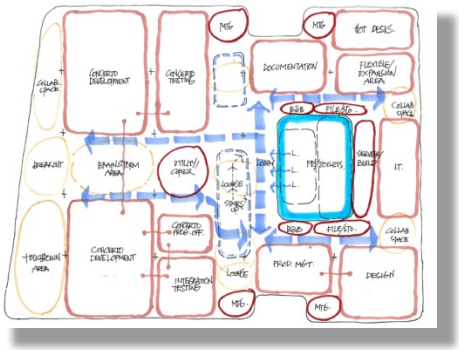
Computer-Generated Concept Diagrams



Computer-Generated Bubble Concept Diagrams

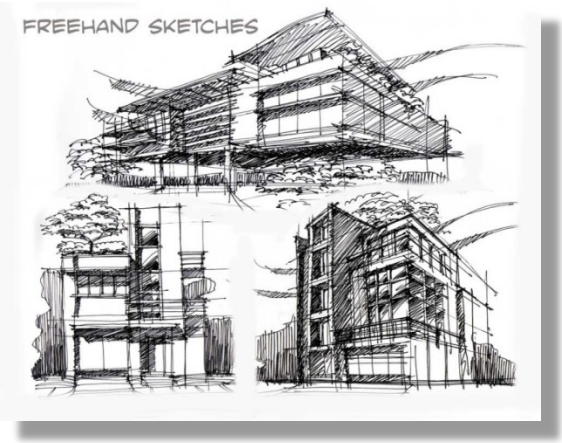


Computer-Generated 3-D Concept Diagrams



Hand-Sketch Bubble Diagrams

Hand-Sketch Site Diagrams

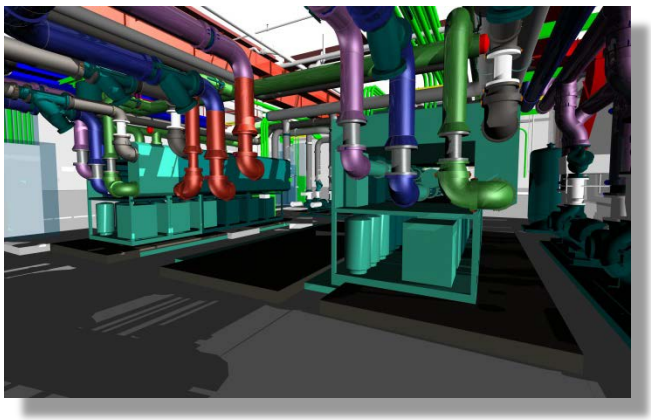


Hand-Sketch Exterior Renderings

Computer-Generated Interior Concepts

Photo-Realistic Computer Renderings

Virtual Reality Walk-Thru



Building Information Modeling – Clash Detection

WEEK 3

Objectives:

- The Built Environment
- Sustainability concepts
- Overview of the design process

Mentor(s) / Speakers:

Name	Company

Action Items:

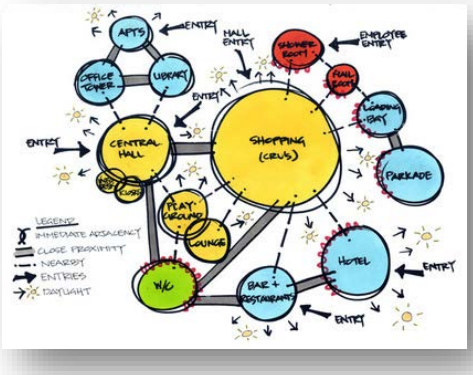
1. Select your desired role within the team
2. Investigate different communication tools and technologies for design and construction
3. Research the construction process and the different trades involved in a building project

Notes:

WEEK 4 – CONSTRUCTION COMMUNICATION

Discuss Design Office Visit & Careers

Share your thoughts and observations on the design office visit and your understanding of the design process, including:



- Conceptual Design / Programming
- Schematic Design - SDs
- Design Development - DDs
- Construction Documents - CDs
- Construction Bidding
- Construction Administration - CA

Define CIRT Competition Team Roles

As a team, discuss your preferred roles for the competition and why that is your preference. Make sure to identify:

- Why you prefer a specific role.
- How your preference fits your strengths and interests.
- If your preference is specifically aligned with your current career choice.

Team Role Choices (reference page 11 for descriptions):

- Project Manager
- Architect
- Civil Engineer
- Contractor
- Engineer
- Landscape Architect

If the team is not well represented in each of the different job descriptions, utilize your ACE Mentor to help distribute team responsibilities in an equitable manner.

Review Design and Charrette Process

Review you understanding of the design process you will be following during the completion of the CIRT competition project. Specifically:

- How the design process may vary depending on which team role you are performing.
- What type of communication tools might ultimately be needed for your specific team role in order to convey your project solution.

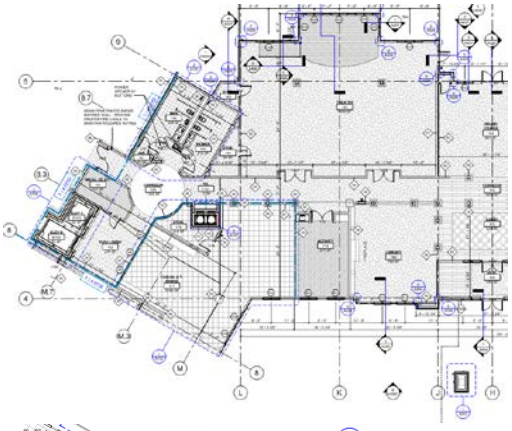
Construction Documents

Documents generated by designers intended for use by contractors are called **Construction Documents**. This can include drawings as well as written specifications outlining proposed products, materials, and quality standards. The important thing to remember is the interconnected nature of all the documents. A single drawing cannot contain everything needed to build a project so each different item often references another document for additional information. It is a collection of information with nothing able to stand alone.

Generally speaking, architectural drawings representing construction documents, would include:

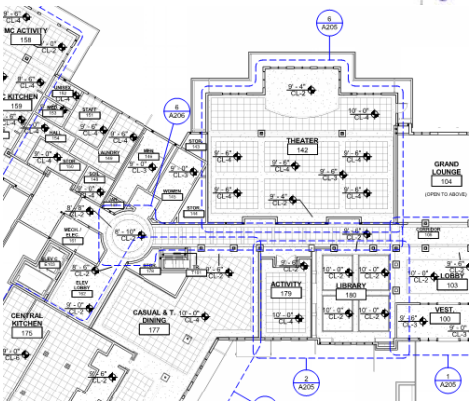
Plans
Depicts a horizontal view of the building cutting through the walls. Includes:

- Floor plans
- Enlarged plans
- Roof plans
- Finish plans
- Typically 1/8" = 1-'0" in scale



Reflected Ceiling Plans
Depicts a ceiling view looking straight up. Includes:

- Materials
- Lights
- Soffits or bulkheads
- HVAC items
- Sprinkler heads
- Typically 1/8" = 1'-0" in scale

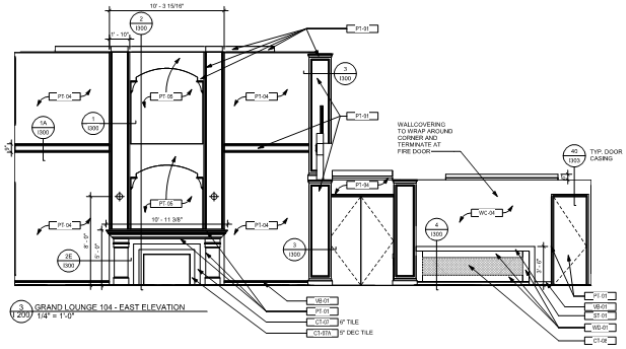


Exterior Elevations
Depicts the exterior of the building in two dimensions. Includes:

- Building height
- Materials
- Exterior features
- ALL exterior surfaces of the building should be shown
- Typically 1/8" = 1'-0" in scale

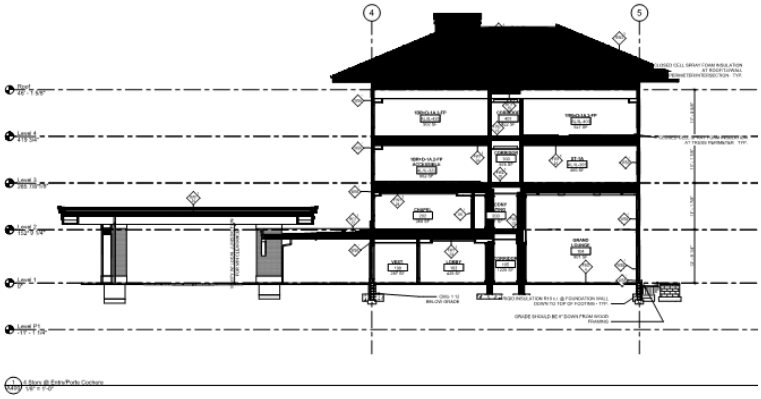
Interior Elevations
Depicts the interior of the building in two dimensions. Includes:

- Ceiling heights
- Materials
- Cabinetry
- Doors
- Windows
- Interior features
- Typically ¼” = 1’-0” in scale



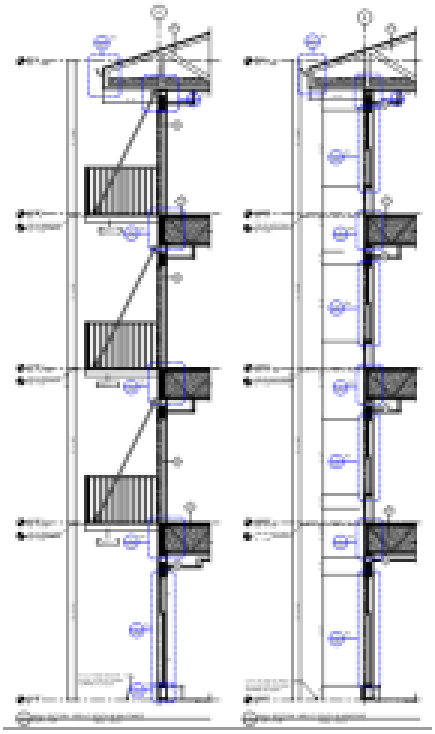
Building Sections
Depicts a two-dimensional cut-thru of the building. Includes:

- Floor-to-floor heights
- General construction of the building
- References to more detailed wall sections
- Can vary in drawing scale



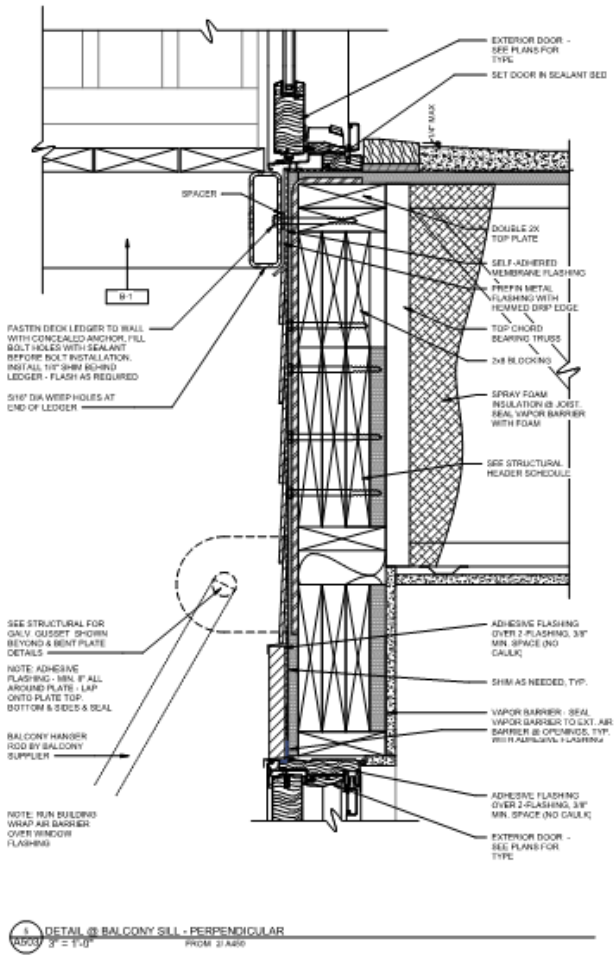
Wall Sections
Depicts a two-dimensional piece of a wall. Includes:

- Floor-to-floor heights
- General construction of the roof and floors
- Window and door heights
- Stair sections
- Elevator sections
- Cabinetry sections
- Exterior or interior features relevant to that specific part of the building
- References to more descriptive construction details
- Can be a variety of drawing scales depending on the height of the building



Details
Depicts a two-dimensional piece of the building in the highest detail provided. Details can be horizontal or vertical in nature (detailed view of a floor plan or wall section). Includes:

- Key dimensions
- Materials
- Relationship of materials to each other (specifically relating to the exterior)
- Key features specific to that part of the building
- Description of material assemblies
- Any other items needed to convey the design intent to trade contractor building the project
- Can be a variety of drawing scales but typically 1-1/2” = 1’-0” or 3” = 1’-0”



Other
Additional items typically included within a set of construction documents include:

- Life-safety code applications
- Fire-rated wall and floor assemblies
- Exiting requirements for the building
- Door and window dimension with construction detailing
- Door hardware requirements
- Tables/spreadsheets showing all interior finishes for floors, walls, and ceilings
- Again, all other information deemed necessary to constuct the building.
- <u>If required information is missing, you can be assured the contractors will ask for it at some point during construction!</u>

Construction Documents Scavenger Hunt

Instructions – In groups of two and utilizing the documents provided, answer the questions below and indicate the design discipline plan set, sheet number, and detail or note number (if applicable) where this information may be found.

Example: What should be the color of the non-potable irrigation lines?
Answer: Purple; Landscape Plans; Sheet L4; General Irrigation Note 'J'

Q 1: What is the total lot area in both square feet and acres?

Q 2: What is the maximum exit access travel distance and what is the actual maximum?

Q 3: What is the distance between grid line 'B' and the north corner of the building?

Q 4: What is the material on the inside surface of the wall cabinets in Workroom PC-1015?

Q 5: What is the wall finish material on the south wall of O.M. Exam PC-1217?

Q 6: What is the material used as the wall cap outside the upper windows on the north elevation?

Q 7: What is the type of brush seal used on a standard exam room public corridor barn door?

Q 8 What is the foundation design allowable soil bearing pressure per the geotechnical report and how far below finish grade must the exterior footings extend?

Q 9: What is used to structurally reinforce the entry canopy joists in order to support the ceiling framing?

Q 10: What is the designated fire protection occupancy for mechanical and storage rooms?

Q 11: How many type S-1 sinks are to be provided?

Q 12: What is the size of the supply air duct at heat pump 2?

Q 13: What are the designated hours of occupancy on Saturday and Sunday for the building?

Q 14: What is used to designate an emergency light fixture and/or night light?

Q 15: Who is the manufacturer of light fixture LE and what type of light is it?

WEEK 4

Objectives:

- Discuss what was learned during the design office visit
- Identify your chosen role on the project team
- Review the overall design process for your project
- Learn the different drawings used to communicate design intent to contractors

Mentor(s) / Speakers:

Name	Company

Action Items:

1. In groups of two, complete the scavenger hunt before the end of the meeting
2. Review the three different CIRT Competition challenges and be prepared, as a team, to make your selection
3. As an end user, be thinking about each different challenge and what you would want to see in a final solution

Notes:

WEEK 5 – DESIGN CHARRETTE

Identifying the Team Project

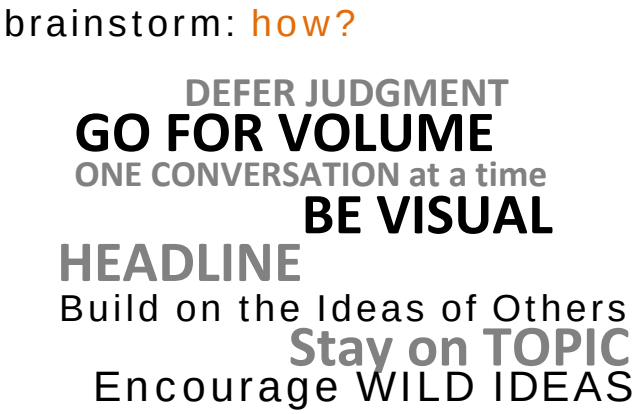
As a team, review the CIRT Competition choices and select your preferred challenge. The potential challenges are:

1. Ultra-Flexible Home
2. Envisioning an Ideal High School
3. Revitalize an Urban Block

Review the challenge descriptions from Week 1 for reference.

Concept & Site Design

The research and decision-making process identifies the needs of the building/facility allowing design to begin. Programming usually involves groups of end users gathering to discuss how they plan to use the building or what they will need from the space to make it as effective as possible.



For your chosen challenge, you must now become the end user as well as the problem-solver.

Based on your previous discussions and thoughts, you must now brainstorm your goals for the challenge and identify anything you think the design solution should contain.

After you have listed the project needs, you must now “switch hats” and brainstorm solutions for those needs.

Try to represent your ideas in a graphic manner as much as possible.

WEEK 5

Objectives:

- Select your team challenge from the three CIRT Competition options
- Begin your design process remembering to also stay in your identified team role
- Identify project needs from an end user perspective

Mentor(s) / Speakers:

Name	Company

Action Items:

1. Develop the first steps of identifying project needs and possible solutions
2. Next week's meeting is at an active construction job site
3. **You must wear long pants and closed-toed, leather shoes (preferably work boots)**
4. You **WILL NOT** be able to participate in the construction tour without the proper footwear!
5. Additional PPE (Personal Protection Equipment) will be provided (hard hats, hi-visibility vests, and safety glasses).
6. Review next week's notes prior to meeting at the job site.

Notes:

WEEK 6 – CONSTRUCTION SITE VISIT

Construction Technology

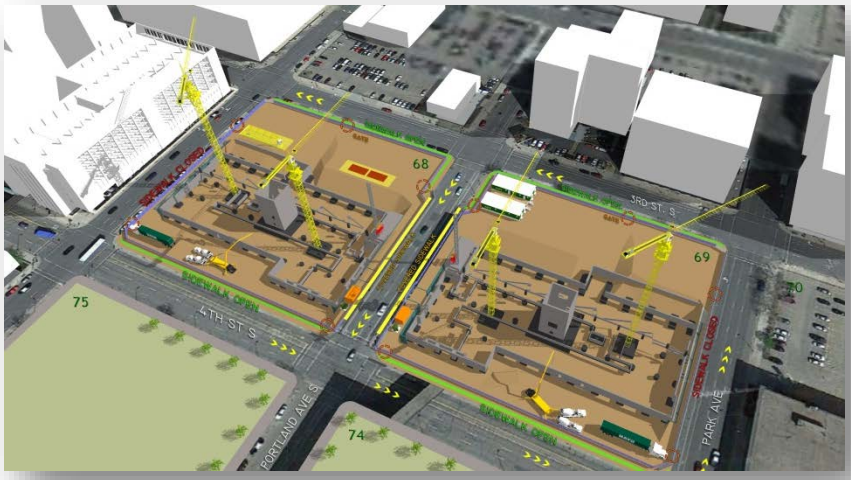
Over the last generation, the management of construction has taken a decidedly “white collar” turn. Construction managers now are most often college graduates with the role of job site superintendent also beginning to lean toward a higher level of education. The previous method of advancement based on years of experience in the trades is being replaced with an educational emphasis out of necessity: people entering the construction trades are not keeping pace with the number of people retiring.

Construction Logistics

The sophistication level of contractors has grown leaps and bounds over the last decade. Virtually constructing the building has made projects safer, limited rework, and aided in the coordination of the different trades. This collaboration and visualization begins at the earliest stages with a well thought-out site logistics plan.

A site logistics plan represents all requirements and activities anticipated on a construction job site. This may include the following:

- Job site office location
- Allowable parking
- Places for material deliveries and storage
- Trash and recyclables dumpster locations
- Vehicular circulation
- Crane placement
- Site security measures (fencing, gates, etc.)
- Off-site traffic concerns and plans to mitigate
- Erosion control measures



Well planned site logistics contribute greatly to the efficiency and safety of a construction project. No longer is this a hand sketch on a site plan. The overall layout is now often represented 3D with the same computer software programs utilized by the design team.

Safety

Pay attention to different strategies for safety on the job site. Take photos of your observations and be prepared to share next week.

Site Issues

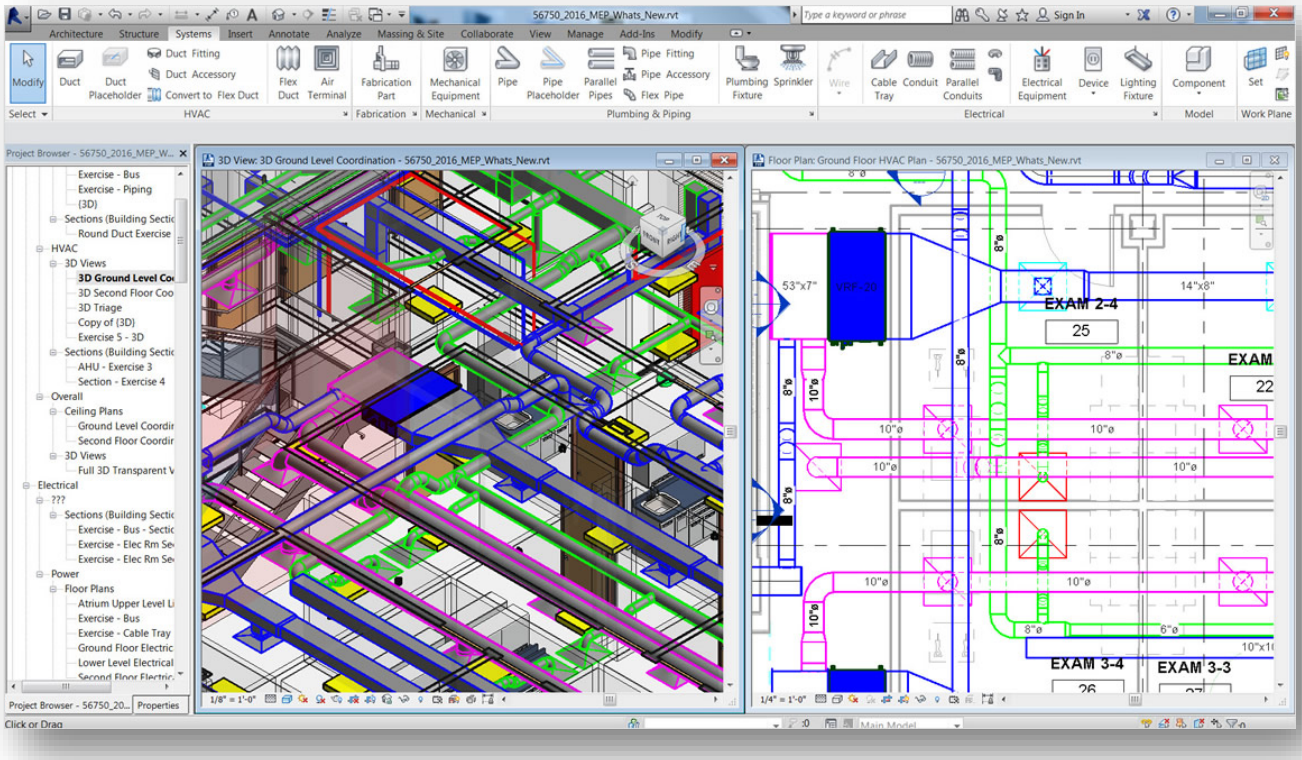
Identify what you might perceive to be difficulties relating to the property and the performance of construction on the site. Take photos of your observations and be prepared to share next week.

Trades Coordination

On-site coordination used to be “who can yell the loudest” during a meeting. Currently, active participation by all building trades is accomplished through digital coordination meetings utilizing BIM software and electronic fabrication files provided by key subcontractors. This information is compiled into a single electronic file to identify “clashes”. A clash constitutes work from multiple trades occupying the same space.

Previously, clashes were only detected after work was installed or if two foremen happened to be talking about planning the day’s work. Now, the clashes are identified months in advance and corrections are made before material ever arrives on the job site. This has led to faster installations, less rework, more prefabrication, and greater overall efficiency of labor.

After a brief review of the construction documents for the project, see if you can spot how the sequence of different construction activities are represented in reality.



WEEK 6

Objectives:

- Identify how technology has impacted management of construction processes
- Learn how proper planning leads to safer and more efficient job sites
- Tour an active construction job site and witness safety procedures

Mentor(s) / Speakers:

Name	Company

Action Items:

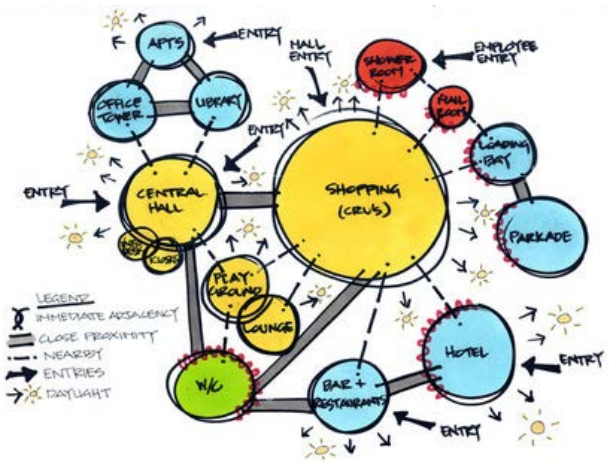
1. Identify how safety might differ on a commercial construction project versus a residential project
2. Be prepared to quiz the job site superintendent on daily responsibilities

Notes:

WEEK 7 – CONCEPT DESIGN – WORK SESSION 1

Space Programming

The research and decision-making process used to identify the needs of the building/facility and guides the design is called space programming. This involves groups of end-users gathering to discuss how they plan to use the building and what is needed to make the space as effective as possible.



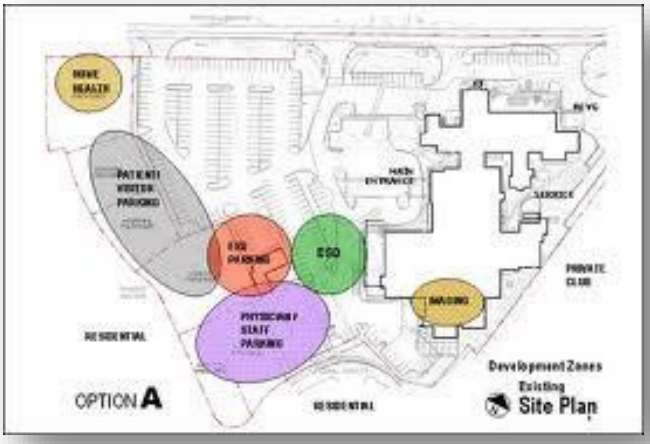
Bubble Diagrams

The relationship of the building's interior spaces to each other and the overall space program is often represented through "bubble" diagrams. These are loose sketches approximating the required square footage of the different elements of the space program whether that is single rooms or groupings of rooms. Different colors are often used to organize spaces based on their use (ex., grey = support spaces). Additionally, arrows or lines signifying a need for a space to be next to another space (ex., kitchen adjacent to the dining area) can be used to organize organizational logic.

Site Planning

Site planning involves the analysis of the site relative to zoning, code requirements, vehicular and pedestrian circulation, weather, or any other aspect of the surrounding area potentially impacting the building and its users.

After analyzing the site, the space program and associated bubble diagram is considered for best placement on the property. This could mean exposure to advantageous views, winds, sun/light, site access, existing buildings, or appropriate relationships between building entrances, parking lots, and streets.



WEEK 7

Objectives:

- Understand the program of spaces for the selected problem
- Understand how to look at the “big picture” concept first, before getting into the details
- Understand how form follows function

Mentor(s) / Speakers:

Name	Company

Action Items:

1. Create a concept diagram and layout on the site
2. Create a bubble diagram of the required building spaces
3. Begin to consider the entire building and how the concept will change your ideas

Notes:

WEEK 8 – SCHEMATIC DESIGN – WORK SESSION 2

Architectural Team

Schematic design is the first step in turning the building space program spaces and relationship to each other into a design capable of being developed into construction documents suitable for a contractor. The drawings normally contain only the essential elements needed to identify the size, shape, and height of the facility as well as the anticipated materials under consideration.

Floor Plans

A schematic floor plan will generally show walls, doors, and windows. Architects often color-code them for ease in communicating their idea to a client. This could mean a single color for the hallways and spaces outside of rooms (building entries, lobbies, etc.) while other colors represent groupings of rooms based on similar use (ex., classrooms all one color). It is always important to represent the first floor plan with some site context (sidewalks, drives, etc.) as well as its orientation on the site (north is “up” on the page).

Additionally, it is especially important for multi-story buildings to have the appropriate elements align vertically. In other words, stairwells and elevators should be stacked over each other, columns must be in the same location on each floor, and load-bearing walls should be oriented similarly.

Building Exterior

The schematic building exterior can be represented in multiple ways. Simple exterior elevations (2-D drawings of a single face of a building) can show the height, features (windows and doors), and materials. This type of drawing is most useful for anyone estimating costs since it can be used to determine quantities.

Another option includes 3-D representations of the building. There are numerous computer programs available which are incredibly useful during the design process. Their advantage is the ability to show the building from a more “real” point-of-view. You can also easily rotate the building or move to different viewpoints. The disadvantage is the inability to print out a 3-D view and use it for cost estimating. It is useful for conveying the design, but must be coupled with other ways to communicate length, width, and height.

Building Sections

One of the most useful schematic design drawings is the building section. This is an accurate depiction of the height of the building and its interior spaces. In order to properly develop the section, a designer must think about the structure of the building and its exterior design as well as the HVAC and plumbing systems. Misrepresenting the building section can lead to very costly mistakes when putting a cost estimate together for a building.

Engineering Team

Schematic design is usually one of the first opportunities for the engineering team to consider systems for a building. Civil engineers will analyze the site constraints while structural engineers will begin to investigate how the building's "skeleton" will work. It is important to have a collaborative effort between the architectural team and engineers as the selected systems can have a dramatic impact on the architecture of the building.

Site/Civil Design

Civil engineers and landscape architects need to consider storm water management on the site, vehicular and pedestrian circulation, utilities, and site topography. An improperly designed site can have severe cost repercussions while a properly designed site can greatly enhance the architectural design as well as the experience of building users and visitors.

HVAC & Plumbing Systems

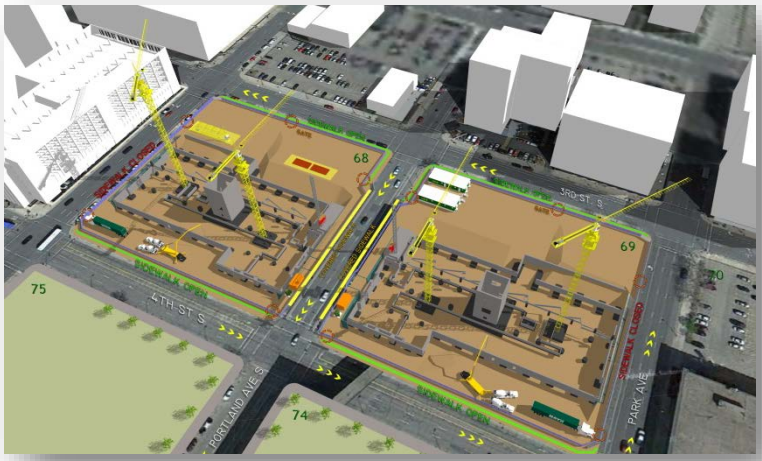
Mechanical engineers perform significant investigations during schematic design. The size and use of the building will begin to dictate what types of systems are appropriate for the facility while the exterior wall design, quantity of windows, building insulation, type of roof, site orientation, and other factors need to be understood to determine the size and performance characteristics of the mechanical systems.

Of all the support systems within a building, the HVAC system will generally have the biggest space impact on the facility design. This includes dedicated mechanical rooms and space above ceilings or in walls. It is extremely important to coordinate mechanical and structural systems as early in the design process as possible due to their impact on the building architecture.

Construction Team

The earliest stages of design offer an opportunity for a contractor to have the most influence on the constructability and cost of a project. It is also the phase of a project where the design is the most fluid and changes can happen rapidly. Active listening is important to understand the basic needs of the building program with a focus on required design elements versus ones outside of the program parameters.

Site Organization
As the building and site design start to evolve, the organization of the site needs to be considered for the construction phase. Truck access, material storage, job site offices, etc. all need to be considered and planned out. A limited site can add construction costs which must be anticipated in advance in order to appropriately develop a cost estimate.



Project Schedule
As the scope of the project is defined, a rough construction schedule can be outlined. Limited detail for the project will limit the detail in the estimate. However, it is never too early to being thinking of the project in “chunks” of time. This can be as simple as design, site construction, and building construction blocks of time.

Cost Estimate
The concept design portion of a project is a time to ask questions as you try to anticipate where the design might be headed. This might involve the number of stories on a building, approximate square footage, types of spaces within the building, or the size of the property. Again, everything is fluid at this point but, the more a project is understood by the construction team, the easier it is to forecast costs before the drawings are complete.

WEEK 8

Objectives:

- Understand the items needed for schematic design deliverables
- Develop communication between the design and construction teams
- Understand how design can impact how a building is constructed

Mentor(s) / Speakers:

Name	Company

Action Items:

1. Develop a site plan and preliminary building floor plan
2. Identify the building size and height
3. Review the impact building systems will have on the building architecture

Notes:

WEEK 9 – MENTOR FEEDBACK

Present the early design concepts and ideas for mentor comment. Be prepared to provide logic to support your design decisions and demonstrate team unity for your progress.

Notes:

WEEK 9

Objectives:

- Presentation and communication skills supporting design progress
- Team collaboration
- Acceptance of constructive criticism to support design evolution

Mentor(s) / Speakers:

Name	Company

Action Items:

1. Incorporation of feedback and commentary into design progress
2. Revise the project direction (if needed) to finalize schematic design
3. Joint team sign-off in order to proceed to more detailed design

Notes:

WEEK 10 – SCHEMATIC DESIGN - WORK SESSION 3

Architect Team

It is important to solidify the project design for the engineering and construction teams to make progress on their work. An ever-changing floor plan severely limits the ability of others to make valid contributions toward a final solution. Possibly the hardest thing for an architect to do is to know when the design meets the requirements of the project enough to stop designing. Every design change has a ripple effect on others and prevents them from being efficient in their efforts.

Design is an evolving process involving the input of others; especially the ones paying for the building. Each design decision has an impact on cost, durability, appearance, and function. Since an architect is normally designing for someone else, it is important to spend time listening and reacting to the input of others. An architect rarely gets unrestricted ability to design whatever they, themselves, want.

Finalize Plans
Review the project requirements and be ready to “lock down” the design.

Exterior Material Selection
Begin discussions relating to exterior material selections. This process involves the evaluation of the building and its context within a neighborhood as well as consideration of the project needs and aesthetic desires of the users. Materials serve both a practical and aesthetic function and their selection should take both aspects into consideration.

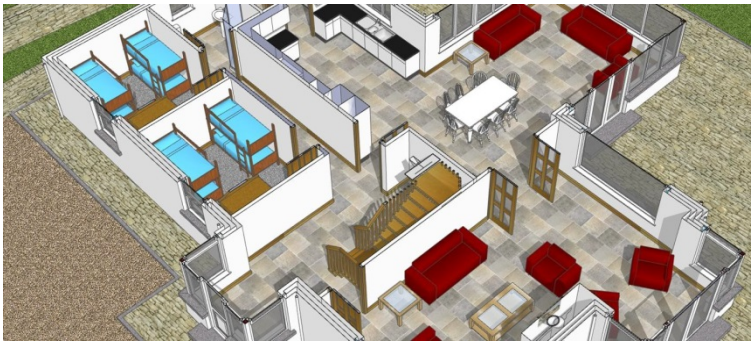
It is important to note the dramatic difference between residential and commercial construction materials. Code requirements will dictate some aspects of available selection while durability is another primary driver. While there is some overlap between acceptable materials, careful consideration is needed to ensure a selected material is appropriate for the intended use.

Residential Examples

Function	Exterior Components	Materials
• Enclosure/Protection • Thermal Comfort • Living/Breathing • Appearance • Sustainability/Green • Durability • Cost	• Wall Materials • Mechanical Items • Windows • Doors • Hardscape • Landscape • Roof	• Wood • Metals • Concrete • Masonry/Brick • Siding (Vinyl or Cement Board) • Stucco • Paints/Coatings

Interior Material Selection

Begin discussions relating to interior material selections. This process involves the evaluation of the building use and aesthetic desires of the users. Materials serve both a practical and aesthetic function and their selection should take both aspects into consideration. Interior wear-and-tear is much different than exterior weather durability.



Residential Examples

Function	Exterior Components	Materials
• Protection • Thermal Comfort • Acoustics • Living/Breathing • Appearance • Sustainability/Green • Craftsmanship • Sense of "Home" • Durability • Cost	• Wall Materials • Flooring • Ceilings • Doors • Windows/Glazing • Natural Daylight • Cabinets/Countertops • Baseboards • Trim • Furniture • Fireplaces • Stairs/Railings • Light Fixtures	• Wood • Metals • Concrete • Brick/Masonry • Stone • Plastics • Tile/Ceramics • Composites • Carpets • Vinyl Flooring • Paints/Coatings • Fabrics

Engineering Team

While the systems for a building may have been selected during early design, it is generally not possible to refine the design beyond performance characteristics in a narrative form. However, once a floor plan is defined, it is now possible to begin defining the actual design for the specific facility. For example:

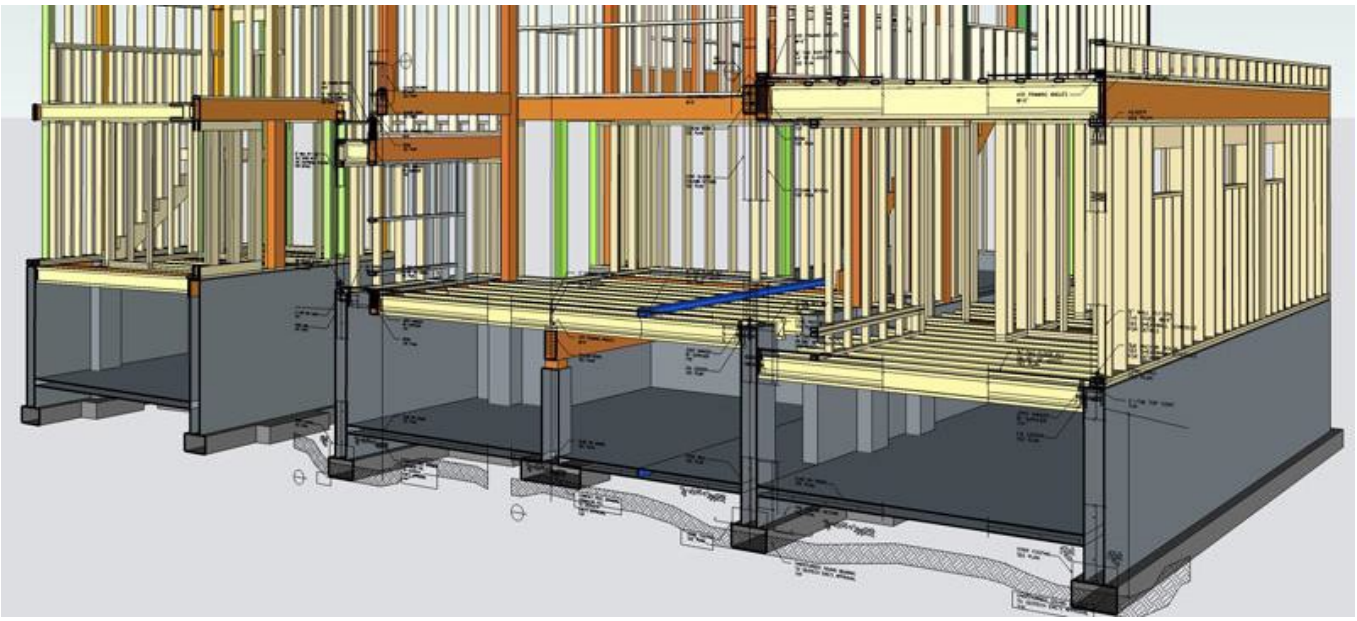
- Structural – foundation and framing systems
- HVAC – mechanical rooms and duct routing
- Plumbing – roof drainage and vertical risers

Refine HVAC & Plumbing Systems

Coordination is paramount to ensure the selected systems and their space (both vertical and horizontal) requirements are accounted for. Horizontal piping often must slope. The longer the run, the more vertical space it needs.

Structural System

Structural system design can begin with a final schematic floor plan. Minor floor plan revisions might be needed for system efficiency and cost effectiveness.



Structure Materials / Fundamentals

Function	Components	Materials
• Must Stand • Support • Reinforcement • Deflection • Rigidity • Strength • Loads (Dead/Live) • Loads (Wind/Water) • Stresses • Analysis • Parallels in Nature	• Floors • Walls • Roofs • Foundations	• Wood • Metal • Concrete • CMU • Steel • Reinforcing Steel/Rebar • Masonry/Brick • Composites

Construction Team

A final schematic design deliverable (site plan, floor plan, building sections, and exterior elevations) allow a detailed cost estimate to be performed. Depending on the level of detail available, there are two primary systems for completing a cost estimate. These are:

1. MasterFormat – quantity-based estimate of materials following the Construction Specifications Institute (CSI) MasterFormat groupings (ex., Division 03 Concrete, Division 04 Masonry, Division 05 Metals, etc.)
2. UniFormat – systems or assembly-based estimate supplementing the MasterFormat groupings (ex., A Substructure, B Shell, C Interiors, D Services, etc.)

Unit Price Estimating

UniFormat is typically more applicable at early design since it is not dependent on exact material quantities but relies more on areas of assemblies (ex., exterior wall square footage, floor plan area, etc.). MasterFormat organization is used for detailed project specifications and is generally utilized when detailed drawings are available. *A more detailed outline showing how the two systems differ is included in the Appendix.*

A cost estimate is exactly that. An *estimate* of the final costs for a project developed before the final construction documents are available. Very few people want to spend money on a design without at least some knowledge of what the design might cost. Unfortunately, the level of accuracy is then dependent on the skill of the estimator. When a cost estimate is developed dramatically impacts how you proceed.

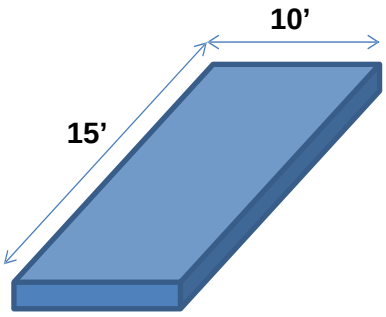
The basics of cost estimate development include the following criteria:

1. How accurate are you trying to be? (guess, “within the ballpark”, system/assembly, or detailed)
2. What components do you know? (quantities, units, material prices, labor unit costs, etc.)
3. Are the drawings detailed enough for you to determine quantities? (LF=linear foot, SF=square foot, SY=square yard, EA=each, CY=cubic yards)

Understanding these criteria will define how an estimate is developed and communicated to everyone else on the team.

Estimating Quantities

- **LF (linear foot)**
- EA (each)
- SF (square foot)
- SY (square yard)
- CY (cubic yard)

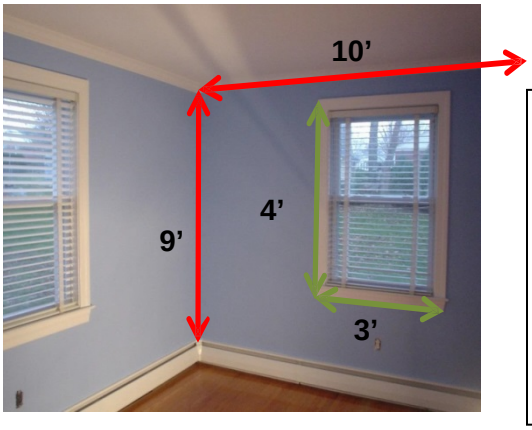


Linear Foot quantity
15’ + 10’ + 15’ + 10’ = 50 LF

- LF (linear foot)
- **EA (each) - COUNT**
- SF (square foot)
- SY (square yard)
- CY (cubic yard)

6 Total

- LF (linear foot)
- EA (each) - COUNT
- **SF (square foot)**
- SY (square yard)
- CY (cubic yard)

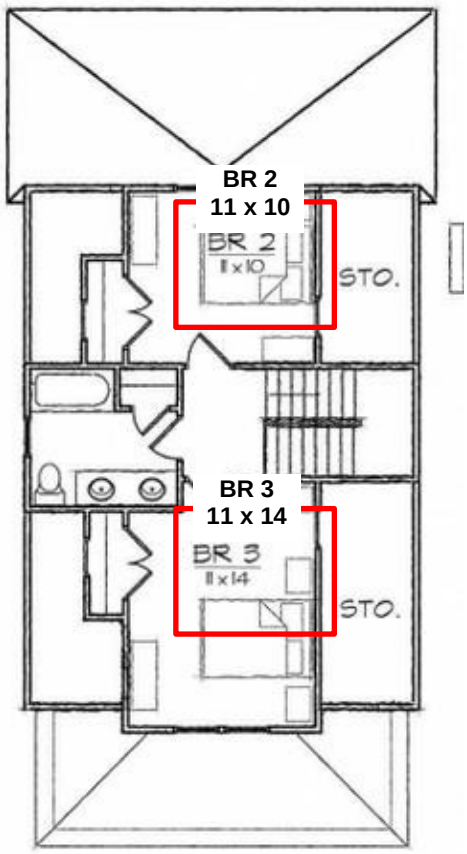


Wall Area
9’ x 10’ = 90 SF

Window Area
4’ x 3’ = 12 SF

Paintable Area
90 SF – 12 SF = 78 SF

- LF (linear foot)
- EA (each) - COUNT
- SF (square foot)
- **SY (square yard)**
- CY (cubic yard)

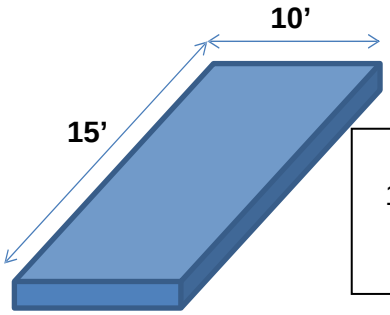


Bedroom 2
11’ x 10’ = 110 SF

Bedroom 3
11’ x 14’ = 154 SF

Square Yard Quantity
(110 SF + 154 SF) / **9** = 29.3 SY

- LF (linear foot)
- EA (each) - COUNT
- SF (square foot)
- SY (square yard)
- **CY (cubic yard)**



Cubic Yard quantity
15’ x 10’ x 0.333’ = 49.99 CF

49.99 CF / **27** = 1.85 CY

Estimating Cost

Simply multiply quantity and unit price.

1.85 CY x **$150.00/CY** = $277.50

WEEK 10

Objectives:

- Finalize floor plan
- Develop exterior design options with material selections
- Evaluate structural system options
- Evaluate interior finishes
- Identify building system performance needs

Mentor(s) / Speakers:

Name	Company

Action Items:

1. Perform quantity take-offs to begin cost estimate
2. Review format options for cost estimate
3. Research material costs

Notes:

WEEK 11 – DESIGN DEVELOPMENT - WORK SESSION 4

Architect Team

Begin to document your design and decision-making process. As additional detail is added to the design, it is important to maintain a clear vision of how you arrived at your current solution. Part of this is to maintain clarity; the other part is to enable communication of your process to others.

Code Review
Document all research to-date relating to building code requirements or limitations, municipal/city requirements which might differ from the building code, site/property requirements (flood plain, setbacks, etc.), and any other information requiring compliance by the final design solution.

Design Coordination
Methodically review the progress of all design elements to ensure proper coordination. Examples might include:

- Are exterior windows on the elevations properly represented on the floor plans?
- Do the exterior elevations match the building sections?
- Are mechanical or electrical space needs accurately shown on the floor plans and elevations?

Engineering Team

Review the architectural progress and ensure the needs of the different building systems (structural, mechanical, etc.) are accommodated and coordinated. It is paramount for the engineering team to proactively engage during architectural design to prevent unnecessary changes when the different design needs are not incorporated into the end solution.

Electrical & Lighting Systems
Discuss specific electrical and lighting needs with the architectural team. Every building has different requirements for both aesthetics and practical aspects of a design. This can mean equipment power, special lighting controls, or exterior lighting; document any code or special requirements for future reference in the final project presentation.

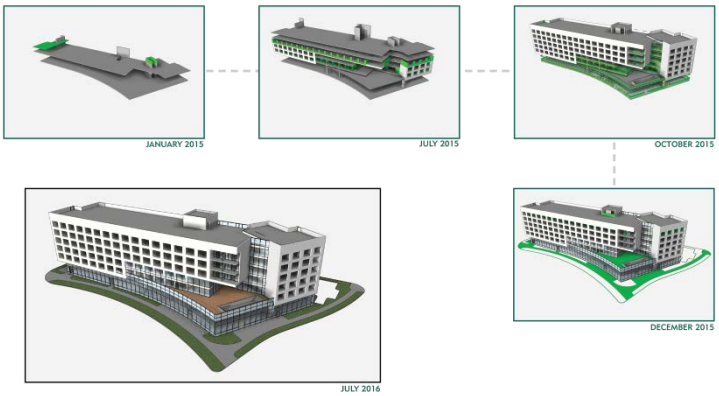
Refine HVAC, Plumbing, Civil, & Structural Design
As mentioned previously, review the architectural and site design progress for accurate coordination with the equipment and system requirements of the different design disciplines.

Construction Team

Review cost estimate progress with the entire design team. It is best to verbally outline any assumptions being made for input by the architectural and engineering teams. They can also provide clarity or direction when certain aspects of the design have been discussed but not yet documented. It is important to maintain a line of communication at all times to minimize drastic variations between the design direction and the development of project costs.

Scheduling
As a team, discuss the project scope of work. There are many aspects that go into the development of an overall project schedule. These can include:

- Design durations
- City approvals
- Site preparations
- Demolition (if needed)
- Off-site improvements
- Site and building construction
- Weather conditions
- Owner equipment set-up
- Move-in



The level of detail in a schedule generally matches the level of design progress. The further along the design, the more accurate the scope of work and methods of construction can be determined.

Phasing
Larger projects may require the phasing of work in order to maintain the most progressive schedule. Oftentimes, certain components of a building take longer to fabricate and deliver than the construction work preceding them. An example might be precast concrete exterior walls. The site preparations and footing construction may happen relatively quickly. It is not efficient for the job site to be "shut down" while waiting for the arrival of the wall panels. Your choice is to either delay the start of construction to avoid a stoppage in work or order the wall panels before the construction documents are 100% complete.

Phasing is an important discussion between the design and construction teams. This conversation will often dictate how the designers produce their documents. The entire team must understand the project schedule objectives as early in the process as possible.

Construction Execution Processes
Refer back to your construction site visit and think about all of the items needed to complete a project which are "indirect" costs. Indirect means it is a cost needed to complete the project but is not tangible. Examples include: project supervision, safety items, forms needed to install concrete, tools, etc. A significant portion of every project involves the cost of labor and materials not represented within the design documents but needed to complete the project.

WEEK 11

Objectives:

- Coordinate all aspects of the design within the drawings
- Discuss required design elements which will not be reflected in the final drawings
- As a team, review the strategies for construction execution

Mentor(s) / Speakers:

Name	Company

Action Items:

1. Document your design-making process
2. Research code or other requirements outside of your control

Notes:

WEEK 12 – DESIGN DEVELOPMENT - WORK SESSION 5

Architect Team

Continue team coordination and process documentation. Identify how you will communicate your design solution to people unfamiliar with the project. Remember, a picture is worth a thousand words!

Drawing Development
Strategically select the best ways to graphically represent your design solution. It is important to creatively communicate your solution. Research your available tools and technology and compare with examples you may find on the internet.

Design Coordination
Finalize your coordination of the different design disciplines. All effort should now be toward your final presentation materials.

Engineering Team

Develop ways to present the engineering design solutions for the project. This can be drawings, narratives, or different forms of graphic representation to communicate intent.

Fire Protection & Low Voltage Systems
These are the final systems for consideration in your design. Reference the code for your fire protection system needs while also reviewing technological advancements in the use of low voltage systems for your building design needs.

Design Coordination
Finalize your coordination of the different design disciplines. All effort should now be toward your final presentation materials.

Construction Team

You should have a working cost estimate with all scope items represented. You can always revise the unit costs or quantities, but it is important to, at least, have everything included as a line item within the estimate. This is the easiest way to review the costs with the design team and their drawings.

Design Coordination
Continue to discuss the design relative to its impact on construction costs.

Permitting and Commissioning Processes
Review the city ordinances for the required permitting processes. Be sure to incorporate this into your construction schedule.

Also, one of the final steps in a project is verification of proper system operations (commissioning). This entails operating and testing the HVAC and electrical systems prior to turning the building over to the owner. This activity should also be incorporated into the construction schedule.

WEEK 12

Objectives:

- Finalize the design process documentation
- Decide how to best represent your design graphically
- Finalize design coordination and refine project cost estimates

Mentor(s) / Speakers:

Name	Company

Action Items:

1. Research graphic representation styles
2. Finalize narratives for any important design aspects difficult to show on a drawing
3. Finalize cost estimate quantities and research costs

Notes:

WEEK 13 – TEAM COORDINATION - WORK SESSION 6

Project Team Activities

All efforts should now be geared toward your final project presentation. Challenge yourselves to critically review your design and how you have chosen to present it. If something doesn't make sense to your team, it is guaranteed it will not make sense to the people you are presenting to.

Final activities:

Design Refinement

Design Coordination

Systems Review

Cost Estimate Development

Project Schedule Development

Final Considerations:

WEEK 13

Objectives:

- "Lock-down" your presentation graphic needs
- Coordinate all aspects of the information you will be presenting
- Begin to consider your presentation organization

Mentor(s) / Speakers:

Name	Company

Action Items:

1. Finalize presentation for review with mentors
2. Back-check all information for accuracy and coordination
3. Refine how you will present your design process

Notes:

WEEK 14 – PRESENTATION PREP 1

Making a Better Presentation

Review your draft presentation and identify anything you would like to "do over". The Project Showcase is your chance to demonstrate all the hard work you have put in over the last few months. Take some time to look through these tips for your visual presentation.

Presentation Design

- Don't overload your slides with too much text or data.
- FOCUS. In general, less is more. A few powerful slides are more effective than many bland slides.
- Let the picture or graphic tell the story. Avoid text whenever possible.
- Type key words into you presentation notes area to use when presenting. Those key words might also be part of the information being presented on that slide.
- Number your slides and give them a title.
- Prepare a team logo for your presentation.
- Add your team logo to each slide to develop a presentation theme.
- Proofread everything including visuals and numbers!
- Keep similar topics together.
- Strive for similar line lengths for text.

Visual Elements

- A bold font is recommended for subtitles. The title default size is 44.
- Use clear, simple visuals. Don't confuse the audience.
- Maintain a consistent orientation if showing multiple drawings (i.e., north is always up).
- Use contract: light on dark or dark on light. The audience must be able to quickly identify your information. If things are hard to read, they will not be listening to you.
- Graphics should make a key concept clearer.
- Place graphics in a similar location on each slide.

Text

- Font size must be large enough to be easily read. Size 28 to 34 with a bold font is recommended.
- It is distracting if you use too wide a variety of fonts.
- Limit yourself to no more than 5 bullet points per slide. Overuse of text is a common mistake.

Completion and Readiness Checklist

Use this simple checklist to list all the required deliverables for your presentation. Assign a different person on your team the responsibility for each item to make sure things get done.

Complete	Deliverable	Responsible
☐		
☐		
☐		
☐		
☐		
☐		
☐		
☐		
☐		

Define the Presenter ROLES

On the day of the presentation, each team member will play a specific role. Summarize here who is assigned to each role.

Role	**Person**

ACE MENTOR PROGRAM
ARCHITECTURE • CONSTRUCTION • ENGINEERING

Objectives:

- Finalize you presentation information requirements
- Plan you presentation outline and topics
- Identify who will speak to what topics

Mentor(s) / Speakers:

Name	Company

Action Items:

1. Research your part within the overall presentation and learn your material
2. Review your materials and identify shortcomings
3. Agree, as a team, what you will wear for the presentation

Notes:

WEEK 15 – PRESENTATION PREP 2

Validate Submittal Requirements with Presentation

Juror considerations for your design concepts, renderings, etc. and how you address the following components of the design process:

Question A:
Define and/or describe the problems and challenges you faced when originally considering the design challenge.

Question B:
Thoroughly describe your design process, in writing and through visuals (e.g., sketches, renderings, stepped process, before/after, budgets, timelines, etc.) which specifically and realistically meet the precise or exact nature of the challenge and/or the client goals/needs.

Question C:
Explain how your design approach is an appropriate, innovative solution that realistically responds to the precise design competition problem. Explain how your design is different from other approaches or processes, if such is the case; and/or meets budgetary constraints, timeline issues, or other challenges.

Question D:
Describe any social, ecological, or otherwise beneficial qualities of your design solution. For example, is it a universal design? How so? Is it environmentally friendly? Does it use cost-effective or recyclable materials?

Question E:
Describe and/or demonstrate what you learned from this competition.

Evaluation Criteria

The following design and construction aspects will be jury evaluation criteria and should explain, where appropriate:

- Site selection and its context (built and/or natural)
- Constructability (structural challenges, materials, textures, colors, etc.)
- Strategy for sustainability
- Surrounding landscape/external spaces
- Life and activities, in and around the building, including the qualities of enclosed spaces showing furniture, fittings, and finishes (where needed or appropriate to the selected challenge).

More important than the actual design solution are the methods and processes used to arrive at a solution. Fundamentally, the spirit of this competition is one of design and construction.

Final Presentation Planning

The following are suggestions and things to keep in mind as you begin the planning process for your presentation. Great ideas are often ignored when a presentation is not thoughtfully produced and doesn't take the audience into consideration. The ability to speak in front of an audience could be one of your best assets in your career.

- **Don't abuse the use of visual aids** – Whatever your visuals may be, keep them simple and don't put too many words with them. The audience isn't there to read your presentation; they are there to listen to you present.

- **Communicate your process** – Your visual aids and presentation should explain your thinking and process for reaching the final solution. The journey is just as important as the destination.

- **Look at your audience** – If you ever wondered where you should be looking when presenting, the answer is right in front of you. Try to make eye contact with numerous people throughout the room.

- **Show your personality** – It doesn't matter if you are presenting to a corporate crowd or to senior citizens, you need to show some character when presenting. Focus on appropriate hand gestures, inflection in your voice, or thoughtful pauses. Everything about your presentation should highlight you as an individual while also capturing the interest of your audience.

- **Make them laugh** – Although you want to educate the audience, you need to make them laugh as well. In essence, laughter can keep the audience alert and they'll learn more from you than someone who just lectures. An engaged audience will remember both you and your information.

- **Talk to your audience, not at them** – People hate it when they get talked at, so don't do it. You need to interact with your audience and create a conversation. An easy way to do this is to ask them questions as well as letting them ask you questions. If you have finished part of your presentation pause and ask them if they have any questions or would like to hear more about a particular subject.

- **Be honest** – A lot of people present to the audience what they want to hear, instead of what they need to hear. Make sure you tell the truth even if they don't want to hear. They will respect you for that and it will make you more human. Identifying your struggles during the project is not a weakness. It only builds credibility into your solution.

- **Be professional** – Plan to wear, at a minimum, business casual attire (khakis and polo) for your presentation but make sure to coordinate your plan with the entire team. If someone wants to wear a suit but some team members do not have one, then no one should wear one. People will take you more seriously when they aren't staring at your ripped jeans.

- **Everyone and everything should have a role** – Plan your presentation so your information is relevant. Superficial "filler" material will not enhance the presentation and will distract your audience. Likewise, all members of the team should speak to a topic they are comfortable with and knowledgeable in.

- **Don't over prepare** – You need to be prepared enough to know what you are going to talk about but make sure your presentation flows naturally instead of sounding memorized.

- **Show some movement** – Make sure you use hand gestures and move around a bit (not too much) when speaking. Remember, no one likes watching a stiff. People are more engaged with a dynamic speaker.

- **Watch what you say** – You usually don't notice when you say "umm", "ah", "like", "you know", or any other useless word frequently, but the audience does. Some members of the audience will probably count how many times you say useless words. Silent pauses are fine. You don't need to fill the void with useless words.

- **Differentiate yourself** – If you don't do something unique compared to all other presenters the audience has heard, they won't remember you.

WEEK 15

Objectives:

- Final presentation preparation
- Ensure your presentation addresses the evaluation questions and criteria
- Do not leave without everyone understanding their role in the presentation

Mentor(s) / Speakers:

Name	Company

Action Items:

1. Practice, Practice, Practice

Notes:

WEEK 16 – PROJECT SHOWCASE

Team Presentation - Notes

Mentor Feedback - Notes

APPENDIX

References & Resources

The following information is provided as a resource to support this handbook and is not intended to be comprehensive but simply a basic guide.

Websites

American Institute of Architects
https://www.aia.org/

Engineering Careers Overview
https://www.allaboutcareers.com/careers/industry/engineering

Construction Manager Career Overview
https://collegegrad.com/careers/construction-managers

LEED (Leadership in Energy and Environmental Design) Guide:
https://new.usgbc.org/leed

Using Engineering and Architectural Scales:
https://www.usfa.fema.gov/downloads/pdf/nfa/engineer-architect-scales.pdf

MasterFormat versus UniFormat Estimating

There are two primary methods for assembling a detailed construction cost estimate. One is based on the pieces and parts of a building – (MasterFormat) while the other is focused on the assembly of the parts, or systems, of a building (UniFormat). Both are outlined to show their organizational differences.

MasterFormat (parts-based estimating approach)

Group / Subgroup	Division	Description
Procurement & Contracting Requirements	00	Procurement & Contracting Requirements
General Requirements	01	General Requirements
Facility Construction	02	Existing Conditions
	03	Concrete
	04	Masonry
	05	Metals
	06	Wood, Plastics, & Composites
	07	Thermal & Moisture Protection
	08	Openings
	09	Finishes
	10	Specialties
	11	Equipment
	12	Furnishings
	13	Special Construction
	14	Conveying Equipment
	15 – 19	Reserved for future expansion
Facility Services	20	Reserved for future expansion
	21	Fire Suppression
	22	Plumbing
	23	Heating, Ventilating, & Air Conditioning (HVAC)
	24	Reserved for future expansion
	25	Integrated Automation
	26	Electrical
	27	Communications (low voltage)
	28	Electronic Safety & Security
	29	Reserved for future expansion
Site & Infrastructure	30	Reserved for future expansion
	31	Earthwork
	32	Exterior Improvements
	33	Utilities
	34	Transportation
	35	Waterway & Marine Construction
	36 – 39	Reserved for future expansion
Process Equipment	40	Process Interconnections
	41	Material Processing & Handling Equipment
	42	Process Heating, Cooling, & Drying Equipment
	43	Process Gas & Liquid Handling, Purification, & Storage Equipment
	44	Pollution & Waste Control Equipment
	45	Industry-Specific Manufacturing Equipment
	46	Water & Wastewater Equipment
	47	Reserved for future expansion
	48	Electrical Power Generation
	49	Reserved for future expansion

UniFormat (systems-based estimating approach)

Level 1 Major Group Elements	Level 2 Group Elements	Level 3 Individual Elements
A SUBSTRUCTURE	A10 Foundations	A1010 Standard Foundations A1020 Special Foundations A1030 Slab-on-Grade
	A20 Basement Construction	A2010 Basement Excavation A2020 Basement Walls
B SHELL	B10 Superstructure	B1010 Floor Construction B1020 Roof Construction
	B20 Exterior Enclosure	B2010 Exterior Walls B2020 Exterior Windows B2030 Exterior Doors
	B30 Roofing	B3010 Roof Coverings B3020 Roof Openings
C INTERIORS	C10 Interior Construction	C1010 Partitions C1020 Interior Doors C1030 Fittings
	C20 Stairs	C2010 Stair Construction C2020 Stair Finishes
	C30 Interior Finishes	C3010 Wall Finishes C3020 Floor Finishes C3030 Ceiling Finishes
D SERVICES	D10 Conveying	D1010 Elevator & Lifts D1020 Escalators & Moving Walks D1090 Other Conveying Systems
	D20 Plumbing	D2010 Plumbing Fixtures D2020 Domestic Water Distribution D2030 Sanitary Waste D2040 Rain Water Drainage D2090 Other Plumbing Systems
	D30 HVAC	D3010 Energy Supply D3020 Heat Generating Systems D3030 Cooling Generating Systems D3040 Distribution Systems D3050 Terminal & Package Units D3060 Controls & Instrumentation D3070 Systems Testing & Balancing D3090 Other HVAC Systems & Equipment
	D40 Fire Protection	D4010 Sprinklers D4020 Standpipes D4030 Fire Protection Specialties D4090 Other Fire Protection Systems
	D50 Electrical	D5010 Electrical Service & Distribution D5020 Lighting & Branch Wiring D5030 Communications & Security D5040 Lighting Fixtures & Components D5050 Security Systems D5060 Data / Communications D5070 Fire Alarm System D5090 Other Electrical Systems
E EQUIPMENT & FURNISHINGS	E10 Equipment	E1010 Commercial Equipment E1020 Institutional Equipment E1030 Vehicular Equipment E1040 Medical Equipment E1090 Other Equipment
	E20 Furnishings	E2010 Fixed Furnishings E2020 Movable Furnishings

UniFormat (continued)

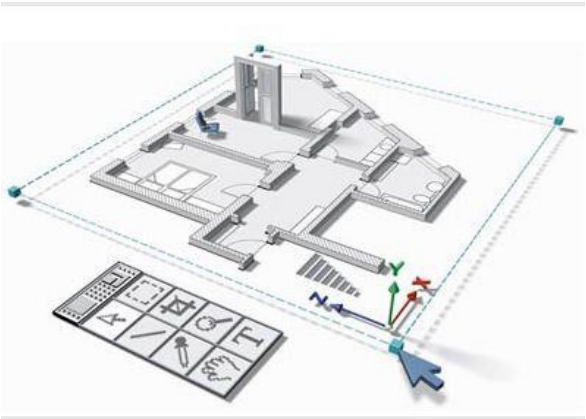
F	SPECIAL CONSTRUCTION & DEMOLITION	F10	Special Construction	F1010 F1020 F1030 F1040 F1050	Special Structures Integrated Construction Special Construction Systems Special Facilities Special Controls & Instrumentation
		F20	Selective Building Demolition	F2010 F2020	Building Elements Demolition Hazardous Components Abatement
G	BUILDING SITEWORK	G10	Site Preparation & Grading	G1010 G1020 G1030 G1040 G1050 G1060	Site Clearing & Grubbing Site Demolition & Relocations Site Earthwork Hazardous Waste Remediation Site Dewatering Site Shoring
		G20	Site Improvement	G2010 G2020 G2030 G2040 G2050 G2060	Roadways Parking Lots Pedestrian Paving Landscaping Site Retaining Walls Other Site Improvements
		G30	Site Mechanical Utilities	G3010 G3020 G3030 G3090	Water Supply Sanitary Sewer Storm Sewer Other Site Mechanical Utilities
		G40	Site Electrical Utilities	G4010 G4020 G4030 G4090	Electrical Distribution Site Lighting Site Communications & Security Other Site Electrical Utilities
		G50	Other Site Construction	G5010 G5090	Service & Pedestrian Tunnels Other Site Systems
X	INDIRECT CONSTRUCTION COSTS	X10	General Requirements	X1010 X1020 X1030 X1040 X1050 X1060 X1070 X1090	Field Management Field Office & Supplies Maintenance & Housekeeping Temporary Utilities Temporary Controls & Safety Security Construction Aids, Equip., & Tools Other Contractual Requirements
		X20	Testing & Quality Control	X2010 X2020 X2030	Soil Testing / Survey Construction Testing Quality Control
		X30	Project Management	X3010	Project Manager Time
		X40	Weather Conditions	X4010 X4020 X4030 X4040	Winter Heating Fuel & Equipment Building Enclosures Snow Removal Other Misc. Weather Conditions
		X50	Insurance, Bonds, & Taxes	X5010 X5020 X5030	General Liability & Other Insurance Performance & Payment Bonds Sales & Use Taxes
Y	FEES & OVERHEAD	Y10	Fees & Overhead	Y1010	Construction Fee
				Y1020	Construction Overhead

Residential Construction

Building a house requires a lot of planning, support, and resources. The steps listed below outline the fundamentals aspects of residential construction.

STEP ONE – FLOOR PLANS

The first step to every house starts with a floor plan. A solid plan helps the building process run smoothly as well as helping determine quantity and types of materials to be used during construction. The entire plan set must reflect local code requirements as well as all aspects of the house needed to ensure construction reflecting the design intent.



STEP TWO – FOUNDATION

The foundation is the most essential component of the house because it supports and outlines the entire house; forming the base for everything else you build. Although the foundation is important, it is typically not seen from the outside because it is nearly completely underground. The foundation is typically concrete poured in footings and a foundation wall after the excavation of the house outline and required depths for frost protection.

STEP THREE – FRAMING

Once the foundation has been installed, the rest of the house can begin to take shape. Typically, wood floor joists are attached to the foundation. A sub-floor is attached to the floor joist and wood studs are installed on top of the sub-flooring. Openings for windows and doors are framed in each wall based on the floor plan. After walls are complete, framing for the roof is attached to the top of the walls.

STEP FOUR – SHEATHING (WALLS & ROOF)

After the wall and roof framing are finished, it is important to completely enclose the entire house to protect it from outside weather conditions. This will allow interior finishes to begin as soon as possible. Wood sheathing (typically 4 x 8 sheets of plywood or OSB) is connected to the wall and roof framing to enclose the house.

STEP FIVE – ROOFING

After sheathing is completed at the roof, roofing paper installed over the sheathing followed by shingles. Colder climates will also require an ice/water membrane along the bottom portion of the roof slope. This provides a watertight enclosure at the top of the house. The next step is to provide a watertight enclosure at the exterior walls so interior finishes can start.

STEP SIX – EXTERIOR FINISHES & FAÇADE

After completion of sheathing at all exterior walls, a water barrier house wrap is installed and returned at all window and door openings to seal the interior of the house from the elements. Interior finishes can now start while the exterior finish/ façade can also begin. This can include brick, stone, siding, etc. Once the exterior finish is installed, final touch ups are made and the exterior is complete.

STEP SEVEN – MECHANICAL & ELECTRICAL

While the exterior is being finished, you can install electrical wiring through the wood framing for outlets and fixtures. Water and sanitary/vent piping for plumbing and air supply ducts for HVAC systems are installed through wood wall framing as well. Once all the wiring and piping inside the walls are complete, an inspector will verify compliance with code before insulation and drywall can be installed.

STEP EIGHT – INSULATION

Insulation is a major contributor in house comfort and energy-efficiency in all seasons. Insulation is installed between wood stud framing after all the wiring and piping has been inspected. Expandable spray insulation is applied in between joints around window and door openings to prevent outside air infiltration and inside air escaping. Good insulation and sealing makes heating and cooling your home less expensive in the long run.

STEP NINE – INTERIOR WALLS

Once wiring, piping, and insulation are complete, you can then begin drywall and inside the house. Cold/northern climates require a vapor barrier on the inside (warm) side of the wall while warm/southern climates require the vapor barrier on the outside (warm) side of the wall. Local codes will identify placement requirements.

STEP TEN – INTERIOR FINISHES

Drywall is complete. Now paint, carpet, tile, wood flooring, wood trim, base and wall cabinets, countertops, light fixtures, plumbing fixtures, and appliances can be installed. Typically, you are just over half-way complete with your house when you begin the interior finishes.

STEP ELEVEN – INSPECTIONS

Throughout the construction process and especially towards the end, the house will need to be inspected. There are standard building codes and rules new residential construction must adhere to in order to pass inspection. Anything that is not in compliance to the codes must be repaired or even replaced in some cases. Inspections include foundations, framing, mechanical, electrical, plumbing, and exterior.

STEP TWELVE – LANDSCAPING

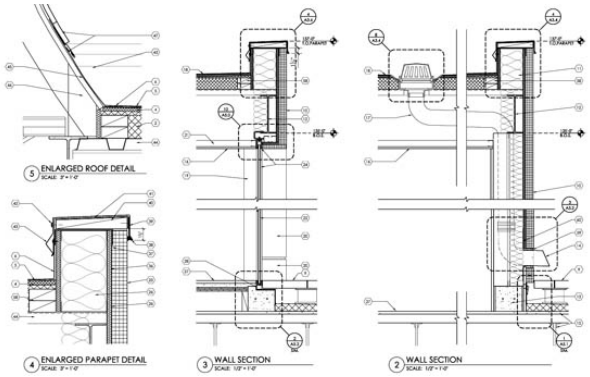
The house is nearly complete and landscaping will be the final touch. Adding trees, shrubs, flower, planting beds, mulch, pavers, sod, etc. around the house will add to the design of the house and provide an environment that compliments its look and feel. For new construction, there are often requirements for the planting of new trees. This is also part of the job of an inspector.

Commercial Construction

Commercial construction can include small retail buildings, apartments, office buildings, warehouses, grocery stores, schools, and anything not identified as a single-family house. Code and local zoning requirements are varied and can be very complicated. The steps listed below outline the fundamentals aspects of basic commercial construction.

STEP ONE – CONSTRUCTION DOCUMENTS

Drawing requirements for commercial construction are much more intense than residential projects. Part of this is mandated by codes and other regulations. But the main reason is the varying complexity of these projects and the wide assortment of construction methods utilized by architects and contractors.



STEP TWO – MASS GRADING

Depending on the size of the project and associated site work, mass grading for a project can constitute weeks of work with massive amounts of earth moving. This portion of the project is especially dependent on the quality of the soil and its bearing capacity for the heavy loads the building will transfer to the earth.

STEP THREE – SITE UTILITIES

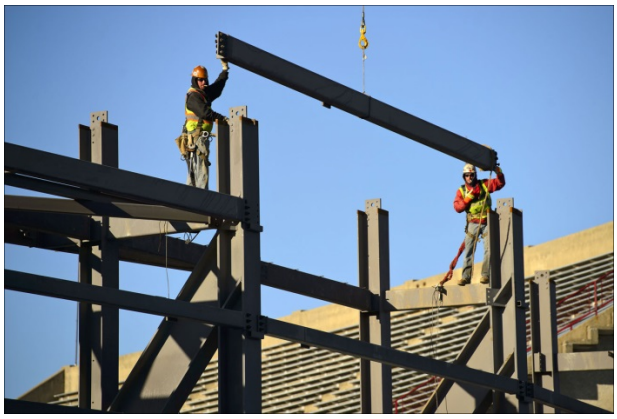
Utilities can include electrical, gas, sanitary sewer, storm sewer, and telecommunications. The type of building and its needs can dramatically affect the utility work. Public utilities (typically sanitary and storm sewer) are two of the biggest variables when considering rainwater management and the depth below the surface of the existing utilities surrounding the site.

STEP FOUR – FOOTINGS & FOUNDATIONS

Once mass grading is complete and the building pad is prepared, excavation for footings can commence. The requirements for footing depth are mandated by local codes while the size of each footing is dictated by the structural engineer based on the geotechnical report for the site.

STEP FIVE – STRUCTURE

The structure of the building can be wood, steel, or concrete. The type of structure designed for the building varies based on the type of building and its use, overall square footage and height, number of stories, fire protection requirements, and desired performance by the building owner. Additionally, anticipated weather (winter) can also impact what structural system is used.



STEP SIX – EXTERIOR ENCLOSURE

Enclosing the exterior of the building is an important milestone. Some interior work can proceed prior to this event, but any interior finishes must typically wait so weather-related impacts are minimized or eliminated. An exterior enclosure can be precast concrete, metal or wood studs with sheathing, or a metal skin over framing. Window installation follows shortly and completes the enclosure.

STEP SEVEN – ROOFING

Another aspect of the enclosure is the roof. Numerous systems exist with their installation method, lifespan, and weather susceptibility during installation being ways to evaluate the appropriate one to use. Systems can be shingles, metal roofing, or a membrane of various compositions.

STEP EIGHT – CONCRETE SLABS

Pouring concrete slabs for the interior of commercial buildings is highly beneficial for interior overhead work. Weather can impact when the slab is poured but oftentimes the slab con be installed prior to the entire enclosure being completed.

STEP NINE – ABOVE-CEILING WORK

Rough-in work for mechanical and electrical systems begins with the largest elements being installed, typically overhead. This work must be coordinated between each trade as well as with the building structure, interior walls, and ceiling finishes. This work can generally begin prior to the building being weather-tight.

STEP TEN – EXTERIOR FINISHES

There are numerous options for commercial exterior finishes ranging from brick, concrete block, metal panels, fiber-cement siding, vinyl siding, precast concrete, or troweled on cement finishes. All depend on a complex system to ensure weather-tightness for the building. The overall systems are much more elaborate than most residential construction.

STEP ELEVEN – WINDOW SYSTEMS

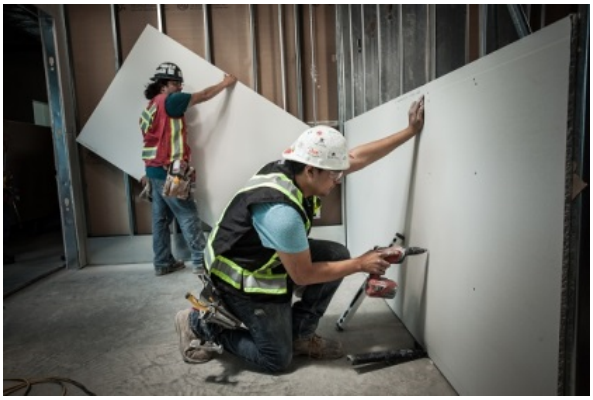
Window systems for commercial construction are much more varied than residential systems. Curtainwalls are nearly full glass systems and encompass the entire exterior enclosure. The two prime varieties are aluminum storefront or aluminum curtainwall. Smaller commercial projects can utilize residential windows, but this is usually for larger multifamily housing projects.

STEP TWELVE – IN-WALL CONSTRUCTION

Interior wall construction generally coincides with the above-ceiling rough-ins. Once walls are in place, in-wall work commences ahead of the drywall installation. Inspections of both overhead and in-wall work are required prior to ceiling or drywall install. In-wall construction can consist of electrical, mechanical, plumbing, medical gases, and low voltage.

STEP THIRTEEN – DRYWALL

Drywall can be simply walls or possibly ceiling work as well. There are a variety of types of drywall depending on the requirements for fire safety or moisture. There are also different methods for finishing the drywall which impact cost and appearance. A level 5 finish is the highest grade and provides a nearly monolithic look but at the highest cost premium.



STEP FOURTEEN – INTERIOR FINISHES

Commercial construction interior finishes are only limited by the imagination of the designer. These finishes cannot proceed until a building is weathertight. Additionally, some finishes need the building HVAC systems to be functional to control humidity for a proper installation. Codes will also impact what products are acceptable based on the fire rating requirements of the building use.

STEP FIFTEEN – LANDSCAPING

The final step is finish grading and landscaping. This can include irrigation systems and very ornate landscaping. Local codes often dictate minimum requirements but the aesthetic desires of the building owner will often far surpass those design standards.

Mentor / Guest Speaker Contact Info

Name	Company	Focus	Email