Instructor's Resource Manual and
Lab Manual Solutions
to accompany

Building Construction: Principles, Materials, & Systems
Second Edition

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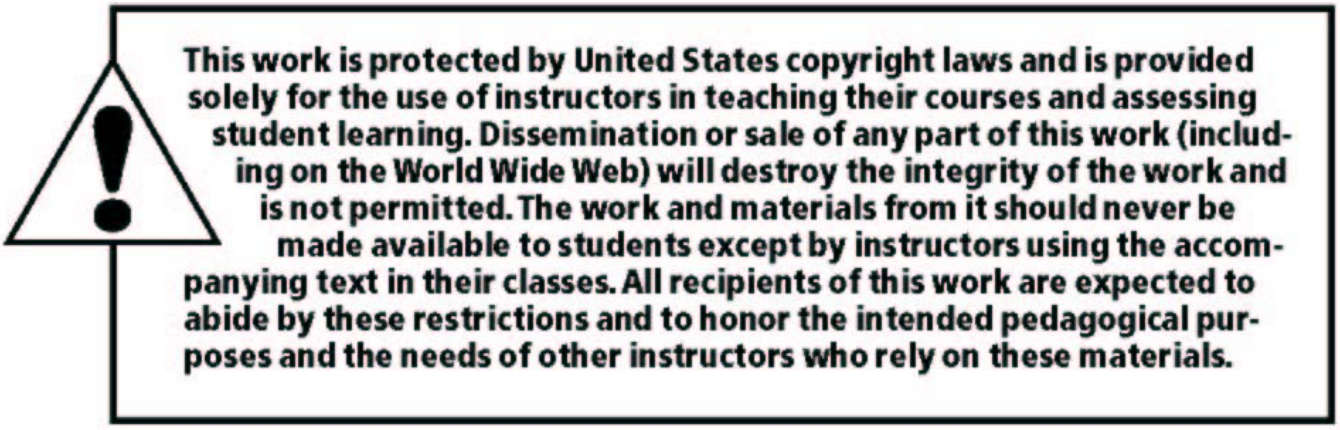

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Instructor's Resource Manual
Note: Each chapter has the following:

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Chapter 1 An Overview of Building Delivery Process

Lecture Notes

1.1 Project Delivery Phases

- Predesign
- Design phase
- Preconstruction phase
- Construction phase
- Post construction phase

1.2 Predesign phase

- Planning phase, the project is defined in terms of its function, purpose, scope, size and economics. This is the most crucial of 5 phases

1.3 Design phase

Consists of the architect, civil and structural consultants, and mechanical, electrical and plumbing and fire-protection (MEPF) consultants

Three phases of design phase

- Schematic design stage (SD) – emphasis on design with creative, conceptual and innovative concepts
- Design development stage (DD) - developing practical and pragmatic solutions
- Construction documentation stage (CD) – develop all documents required by the contractors.
- Construction drawings are dimensioned drawings that the construction team uses to build the project.
- Specifications are the technical data in writing where the drawings are graphical.
- The project manual is assembled by the architect and design team to include all specifications and other project information

1.4 CSI Masterformat and specification

- Masterformat is the organization of the specifications developed by the Construction Specifications Institute (CSI)
- Figure 1.4 = 50 Divisions

1.5 Preconstruction and Bid Negotiation

- Preconstruction phase begins after construction drawings and specifications are complete.
- This is where the construction team is selected.
- The team consists of the general contractor and a number of specialty subcontractors.
- General contractors (GC) do not perform a much of the performed work, but is responsible and liable to the owner.
- The key function of GC is overall management of construction and coordination

1.6 General Constructor and Project Delivery Methods

- Design-Bid-Build method
- Design-Negotiate-Bid method
- Construction manager as agent method
- Construction manager as at risk method

- Design-build method
- Integrated project delivery method

1.7 Design-Bid-Build method
- Competitive sealed bidding = open bidding
- Competitive sealed proposal
- Invitational Bidding = closed bidding

1.8 Construction Phase
- Shop Drawings = fabricators prepare their own drawings
- Mock Up Samples
- Other Submittals

1.9 Construction Contract Administration
- Architects Observation of Construction (what and where
- Contractor determines how (means and method) and when (sequence)
- Inspection of work
- Payment Certifications
- Change orders

1.10 Postconstruction (Project Closeout) Phase
- Substantial completion = submit all guaranties and warranties
- Certificate of Occupancy
- Final Completion Inspection
- Record Documents (As Built documents)

1.11 Design-Negotiate-Bid method
- Used when owner knows a reputable contractor
- Negotiated contract can be during design or predesign phase

1.12 Construction management Related Project Delivery method
- Construction manager as owners Agent (CMAA)
    - May advise owner of selection of design and contracting teams
- Construction Manager at Risk (CMAR)
    - Provide CM services during design phase and work as GC

1.13 Design-build method
- Owner awards the contract to one firm who designs and builds the project.

1.14 Fast track Project Scheduling
- Segmenting project to save time

1.15 The Integrated Project Delivery (IPD) Method
- The ultimate in promoting harmony, collaboration, and integrating all member of the team
- Technology for IPD = Building Information Modeling (BIM)
- BIM tools and Interoperability
- Life-cycle Nature of BIM

Chapter 1 Questions in chapter

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24	27	C	1.9	17
24	28	A	1.9	17
24	29	D	1.9	17
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24	31	A	1.9	17
24	32	A	1.9	19
24	33	D	1.12	20
24	34	B	1.13	20
24	35	E		25
24	36	B	1.15	22

Class Activities or Homework Activity

1. Simple design project, find something on campus or in a room that has a design flaw, have students work in teams or individual to decide:
   What is the problem? (i.e. doors open in wrong direction)
   Who is responsible for design? (Owner or architect or installer or manufacture?)
   How would you fix the problem?
   How would the designers fix the problem?

2. Have the students make an excel spreadsheet showing sustainable examples of materials in each of the CSI master format divisions with the following columns: Div#, Description, Example of sustainable material, website for information, picture of information, and why it is sustainable.

3. Bring a sample of a project manual and bid documents and make up questions related to that project where the students can find information. Where is the project? What are the bidding instructions? Time, Date, etc.

Special Chapter Content

- Building (Project) Program = AIA Document B141 Pg 3

- Working Drawings = used until the 20th century for what is now called construction drawings Pg 5

- Relationship between Construction Drawings and Specifications Pg 6

- Difference between Div 10 = Specialties = prefabricated items, marker boards, lockers, grills, flagpoles and Div 13 = Special Construction = site fabricated by special contractors, ice rink, swimming pools, aquariums, sound control and vibration. Pg 9

- Important Items in Div 00 (Procurement and Contracting Requirements) Pg 9

- Important Items in Div 01 (General Requirements) Pg 10

- Relationship between Architect and the General Contractor. Pg 10

- Surety bonds = a form of insurance that the contractor buys from a surety.
  Bid Bond = (Bid Surety Bond) ensures that bidder will be able to obtain performance and payment bonds
  Performance Bond = protects the owner against fault
  Payment Bond = (labor and materials bond) ensures that bills will be paid
  Pros and Cons of Bonds Pg 13

- Summary of Architects functions as construction contract administrator Pg 17

- Value Engineering = the science of obtaining balance among the cost, reliability, and performance. Pg 18

- Project Delivery Methods at a Glance Pg 24-25

End of Chapter Answer Key

Chapter 1 Questions end of chapter

Question Page #	Question #	Answer	Answer Section #	Answer Page #
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25	2	Figure 1.1	1.1	3
25	3	Figure 1.3	1.3	6
25	4	Competitive bid anyone can submit a bid, invitational bid has to be invited to submit a bid by owner		11,13,24
25	5	Figure 1.4	1.4	8
25	6	The drawing have also been called as built drawings and reflect the actual installed work on the drawings	1.10	18
25	7	CMAA May advise owner of selection of design and contracting teams, eliminates the need of the general contractor because this contractor represents the GC and hires all. CMMR Provide CM services during design phase and work as GC and CMMR	1.1	25
25	8	a. CMAA = Construction manager as agent b. CMAR = Construction manager as risk c. BIM = Building Information Modeling d. IPD = Integrated Project Delivery	1.12	25
25	9	The ability to exchange information between the virtual model and BIM model	1.15	23
25	10	IPD is a delivery process and the BIM is the technology that can assist in the integration of information though out the design and construction process.	1.15	24

Lab Solutions Manual

Assignment 1

Ch. 1: An Overview of the Building Delivery Process

Name: _____

1.1 The current edition of CSI MasterFormat, as given in the text, was introduced in 2004 and includes major changes from its earlier edition. Using the text and Google (search "History of MasterFormat"), answer the following questions:

(a) Provide the year in which MasterFormat was updated immediately prior to its current (2004) edition (called MasterFormat 2004) and the number of divisions that update contained?

In 1995, called MasterFormat 1995. It contained 16 divisions.

(b) How many divisions were used in MasterFormat 2004? 50 divisions

(c) Provide the year in which MasterFormat was first established and the number of divisions it contained.

MasterFormat was first established in 1963. It contained 16 divisions.

(d) Give two important reasons for increasing the number of MasterFormat divisions in the 2004 edition.

1. The 1995 MasterFormat had 16 divisions, originally conceived in 1963. From 1963 to the present time, buildings have changed substantially, particularly with respect to: (a) building services (such as automation, digital communication, electronic safety and security), and (b) equipment and processes used in manufacturing facilities. The 16-division MasterFormat had only three divisions to accommodate the specifications for items (a) and (b) stated above, which were: Division 14: Conveying Systems, Division 15: Mechanical, and Division 16: Electrical. In 2004 edition, these three divisions have been expanded to twenty divisions—Divisions 20 to 29 for Facilities Services and Divisions 40 to 49 for Process and Equipment.

2. Ten divisions (Divisions 30 to 39) have been assigned to Site and Infrastructure Subgroup in 2004 edition. This change was made to expand the scope of MasterFormat to include various civil engineering and site development projects such as underground utilities, roadways, waterways, and so on.

1.2 Which 2004 MasterFormat division(s) will you be concerned with if:

(a) You are a drywall subcontractor (a contractor who specializes in constructing gypsum board interior partitions)?

Division 09 Finishes

(b)	You are a supplier of demountable interior partitions?	Division 10: Specialities
(c)	You are a manufacturer of aluminum windows?	Division 08: Openings
(d)	You are a manufacturer of wood doors?	Division 08: Openings
(d)	You are a supplier of insulating materials?	Division 07: Thermal and Moisture Protection

1.3 During a routine visit to the construction site, the project architect observes that the exterior wall cladding of the building was being installed before the glazed elements (which were available at the site). The architect was concerned that this sequence of wall construction would compromise the aesthetics of the wall and discussed the issue with the general contractor, who disagreed. In your opinion, should the architect instruct the general contractor to install the glazed elements first and then construct the cladding around the glazed elements? Explain your answer.

It is fine for the architect to raise the issue with the GC during a site visit. However, due to the architect's role as a construction observer, he/she has no authority to instruct the GC as to the sequence of construction. The architect should place his/her observations and concerns on record with a copy to the owner.

1.4 You have been retained as the facilities manager for an independent school district (ISD) that administers the maintenance of a large number of existing schools and formulates policies for the construction of new ones. Because of its experience, the ISD has a short-list of general contractors who are highly professional and competent. The ISD board has requested your recommendation for the project delivery system it should adopt for the construction of a new facility. What should be your recommendation to the board? Explain.

Because the ISD, based on its experience, has a short list of qualified and competent GCs, the two design-bid-build methods (competitive sealed bid and competitive sealed proposal) of project delivery are not well suited. The more suitable project delivery methods for the ISD are:

- Design-bid-build method (invitational bidding)
- CMAR method

In the second method, the selected general contractor comes on board during the design phase to provide preconstruction services.

1.5 The margin note "Relationship Between the Architect and the General Contractor" on page 10 in the text states that the design and construction contracts are two-party contracts. Is this true of all project delivery systems? If not, name the delivery system(s) where it is not true and state your reasons.

The contract between the major participants in a project (owner, architect, GC, steel fabricator, steel erector, concrete subcontractor, plumbing subcontractor, and so on) in an integrated project delivery (IPD) method is a multiparty contract. This is because of the nature of an IPD as being a collaborative enterprise. Two-party contracts may, in an IPD, however, exist between a GC and a few minor subcontractors. These subcontractors remain outside IPD's multiparty contract.

1.6 Is a building information modeling (BIM) software a comprehensive software that can be used for all aspects of building design—architectural design, structural design, MEP design, and so on? Explain.

Separate BIM software tools, specific to each design and fabrication speciality, are used. For example a BIM software for architectural design is different from that used for structural design, which in turn is different from that used for MEP design, and so on. However, all such tools must be fully compatible with each other to provide a complete and rapid exchange of information between them and in the construction of the final model.

1.7 Building information modeling (BIM) software is a three-dimensional (3D) design and construction software. Using Google search, explain what 4D BIM is and how it differs from 3D BIM.

BIM allows visualization in 3D geometry as opposed to the 2D geometry used in commonly used drafting software. In addition to 3D geometry, a BIM contains information related to all components (and parts) of the building. It is the information content of the model that distinguishes BIM from the conventional 3D modeling software (such as Google SketchUp) or a 3D

CAD software (such as Autodesk's AutoCAD), which deal only with he geometrical aspects of the model. A BIM model contains the three dimensional geometry of the building plus all relevant information about each component and the material used in the building as needed by the GC to construct the building. Therefore, constructing a BIM model is referred to as *virtual construction*.

A BIM model that allows life cycle management of the building, i.e., records changes in the model as a function of time, recording the building's maintenance, repairs, and alterations, contains the fourth dimension—that of time. It is referred to as 4D BIM by the industry.