Chapter 1

Introduction

Content

1-1 THE CONSTRUCTION INDUSTRY

- Construction contracting is a very competitive business with a high rate of bankruptcy.

- It is essential that construction professionals have knowledge of the business and management aspects of the profession

Characteristics and Challenges of Construction

- Nature of projects:
  - Projects are unique and unrepeatable
  - Project are temporary
  - Projects are constrained by time, money, and quality
  - Projects involve many conflicting parties
  - Many decisions are made based solely on experience

Characteristics and Challenges of Construction

- Industry characteristics
  - An easy-entry industry that requires low-skill labor
  - Extremely fragmented, with many small specialties involved
  - Intense competition and high failure rates (20% of construction business fails)
  - Rapidly affected by economic recessions
  - Little R&D expenditures
  - Confidentiality and lack of information sharing
  - Slow to adopt new technologies

Characteristics and Challenges of Construction

- Increasing challenges
  - Global market competition
  - Increasing regulations (e.g., environmental and safety)
  - New advances in materials and equipment
  - Tight budget, less time, yet better quality is demanded
  - Rising costs
  - Lack of skilled resources

Reasons for Construction Company Failure

- Some major factors are:
  1. lack of capital,
  2. poor cost estimating,
  3. inadequate cost accounting, and
  4. lack of general management ability.

Construction Industry Divisions

- The major divisions of the construction industry:
  - Building construction ("vertical construction")
    - Residential, commercial, etc.
  - Heavy construction ("horizontal construction").
    - highways, airports, railroads, bridges, canals, harbors, dams, and other major public works

Other specialty divisions

- Other specialty divisions of the construction industry include:
  - Industrial construction,
  - Process plant construction,
  - Marine construction, and
  - Utility construction.

Main Players in Construction Projects

- Owners
- Design Professionals
- Construction Contractors
- Secondary Players

Owners

- Driving force behind the construction industry.

- Two basic types of owners:
  - *Public Owners*
    - Typically government agencies
  - *Private Owners*

Owners

- After determining need and deciding to build, the owner is accountable for four primary duties:

1. Developing the program and outlining the needs and requirements of the end users
2. Determining the quantity, extent, and character of the project by defining the scope of work
3. Creating the overall budget for the project, including land acquisition (if necessary), development, design, and construction costs
4. Providing the funding for the project and making periodic payments to the designers and the contractor

Design Professionals

- Two types of professional designers are engaged in the construction process:
  - Architects deal with the function, life safety issues, and aesthetics of the building.
  - Engineers deal with the systems

Design Professionals

- Primary responsibilities of the designers:
  - Assisting the owner in developing the facility program and determining end user needs and requirements
  - Advising the owner regarding the image and character of the facility and establishing broad design goals
  - Assisting the owner in selecting products to fit the program and the budget
  - Advising the owner on special and aesthetic issues and generating graphic solutions to problems
  - Developing the final building plans, construction details, and specifications

Construction Contractors

- Responsible for all construction activities.

- Constructor's job:
  - Interpret the plans and specifications and prepare cost estimates and time schedules to meet the requirements of the owner
  - Determine and implement the best construction practices, means, and methods to satisfy the owner's requirements for time, cost, and quality
  - Oversee and manage all of the construction operations into a single, safe coordinated effort

Construction Contractors

- Two types of contractors:
  - General Contractor
  - Specialist Contractor

General Contractors

- They engage in a wide range of construction activities and execute most of construction projects.
- When they enter into a contract with an owner to provide complete construction services, they are called *prime contractors.*

Specialty Contractors

- *Specialist Contractors* limit their activities to one or more construction specialties, such as:
  - Electrical work, plumbing, heating and ventilating HVAC, or earthmoving.
- They are referred as *subcontractors*
  - Because they are operating under subcontracts between themselves and the prime contractor.

Subcontractors and General Contractors

- The terms "subcontractor" and "prime contractor" are defined by the contract arrangement involved, not by the work classification of the contractors themselves.
- A specialty contractor employed by an owner to carry out a particular project might employ a general contractor to execute parts of the project.

In this situation:

- the specialty contractor becomes the prime contractor for the project and
- the general contractor becomes a subcontractor.

Secondary Players

First-Level Players

- Includes **material suppliers** and **equipment vendors.**

- This layer ***directly*** influences the outcome of a job. This level often **has contractual connections** to either the construction contractor or design professionals.

Secondary Players

Second-Level Players

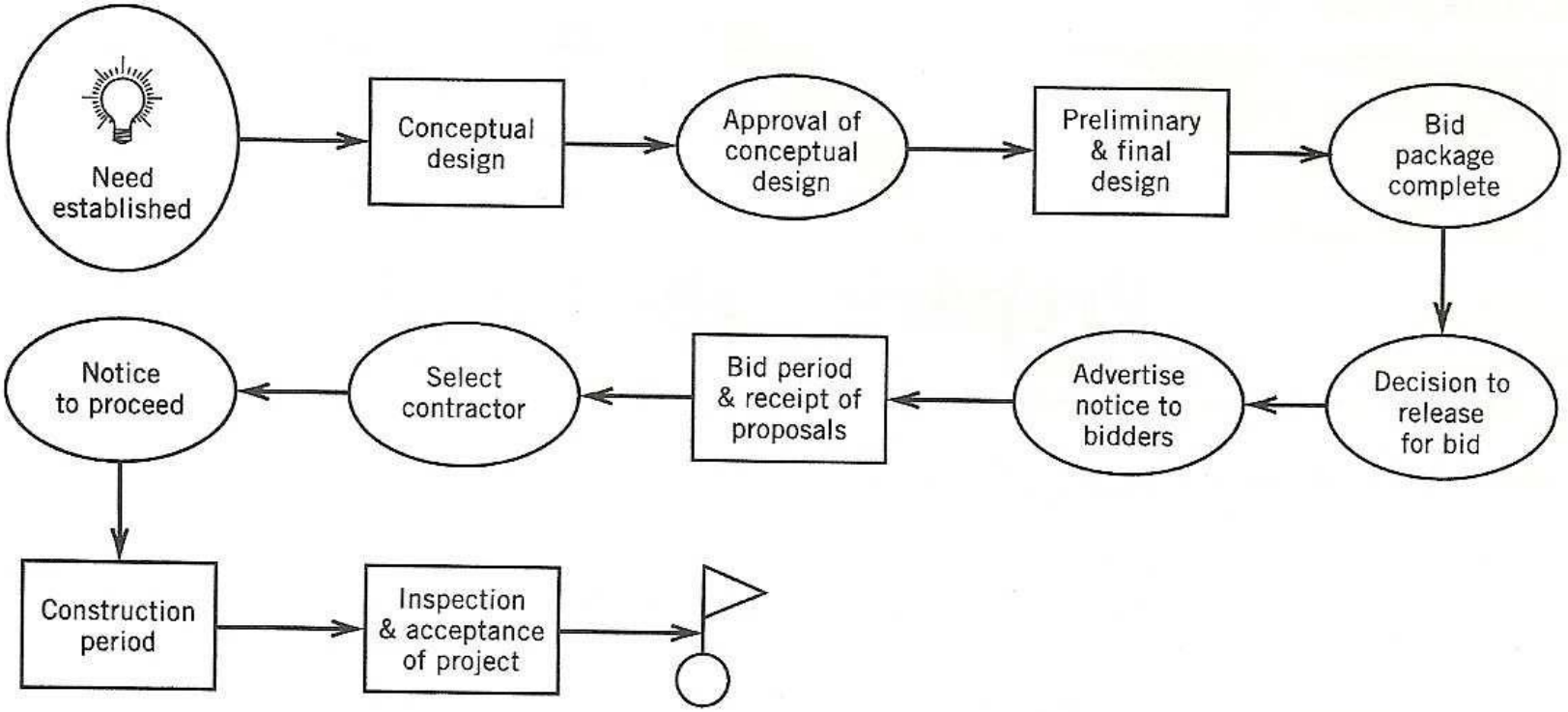
- Includes insurance companies, utility companies, bonding companies, building code officials, zoning, labor unions, and manufacturers.

- This level has no contractual connection or obligation to any of the three primary parties.

1-2 THE CONSTRUCTION PROCESS

- **Project Development and Contract Procedures**
- **How Construction Is Accomplished?**

Project Development



Contract Procedures

The major steps in the construction contracting process include (Ch. 18):

- Bid solicitation / RFP / invitation to bid
- Bid preparation
- Bid submission
- Contract award
- Contract administration

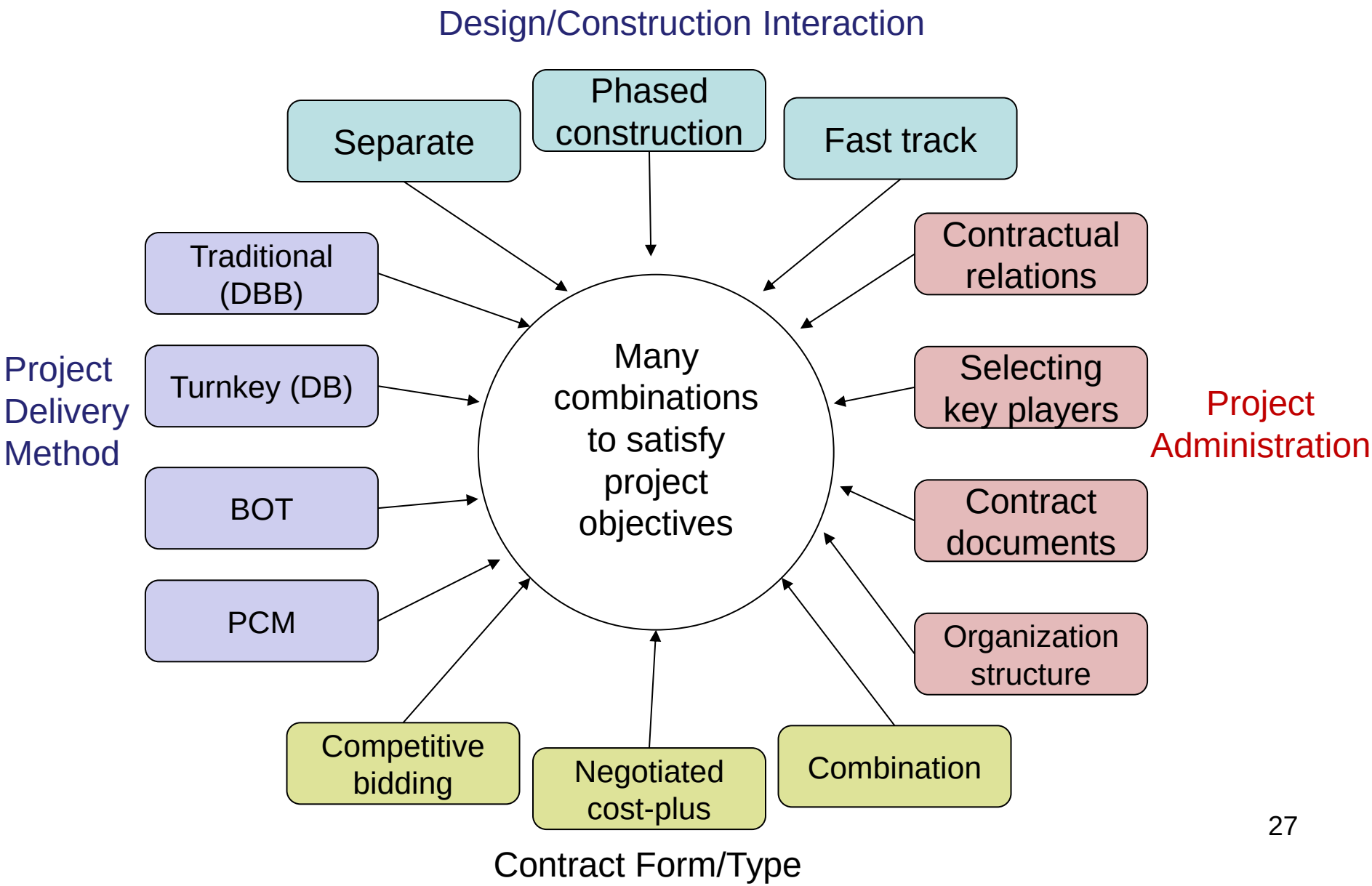
Project Development and Contract Procedures

- For major projects:
  1. Recognition of the need for the project (justification).
  2. Determination of the technical and financial feasibility of the project.
  3. Preparation of detailed plans, specifications, and cost estimates for the project.
  4. Approval by regulatory agencies. This involves ensuring compliance with:
     - Zoning regulations
     - Building codes
     - Civil defense (fire fighting system and evacuation)
     - Environmental and other regulations

Project Development and Contract Procedures

- For small projects:
  - many of previous steps may be accomplished on a very informal basis.
- For large or complex projects:
  - this process may require years to complete.

Project Contract Strategy



How Construction Is Accomplished (Project Contractual Structure)

- The main *project delivery* methods are:
  1. **Owner-Builder:** Construction employing an owner construction force
  2. **Owner-Manager:** Owner management of construction
  3. **Traditional** (Design Bid Build, DBB): Construction by a general contractor
  4. **Turn-Key:** Construction using a design/build (DB) contract
  5. Construction utilizing a **construction management contract**

1. Owner-Builder

- Construction employing an owner construction force
- Many large industrial organizations and a number of governmental agencies have their own construction forces. (Figure 1-5)
- These forces are utilized primarily for performing repair, maintenance, and alteration work.
- They are often capable of undertaking new construction projects.

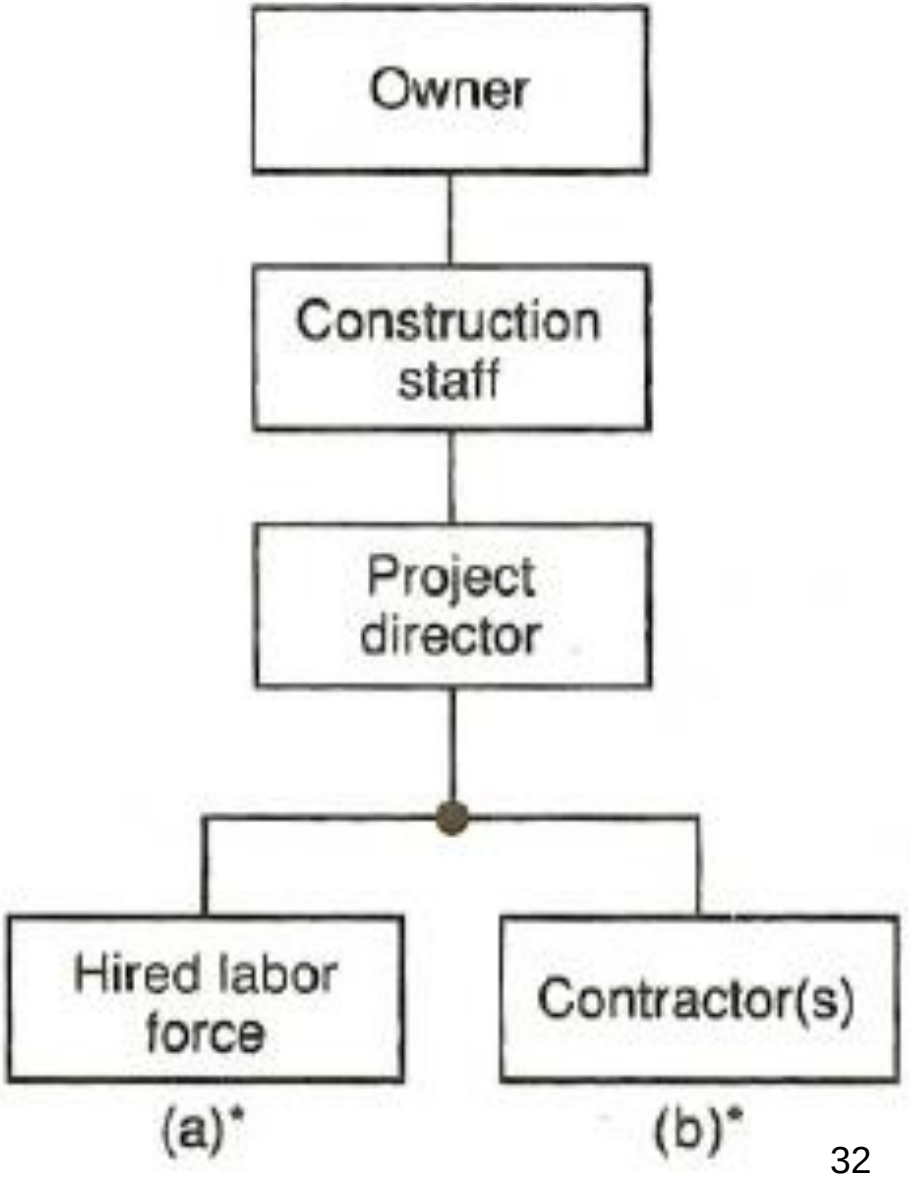
FIGURE 1–5 Construction employing owner construction forces.

- The owner acts as the general contractor on their own project, and is responsible for design and construction.
- However, the owner may choose to subcontract a substantial portion of the project to outside consultants and contractors for both design and construction, even though it retains centralized decision making to integrate all efforts in project implementation.

2. Owner management of construction

- Owners can utilize their construction staffs to manage their new construction (Figure 1-6).
- The work may be carried out by:
  - Workers hired directly by the owner (force account),
  - By specialty contractors, or
  - By a combination of these two methods

FIGURE 1–6 Owner-managed construction. [Either (a) or (b) or both may be employed.]



Advantages and Disadvantages of of Owner-Builder/Owner-Manager Structure

Advantages

- Justified when the volume of work is relatively large and relatively constant over a period of time.
- The owner-builder can employ all techniques of the design-constructor, the professional construction manager, and the traditional approach.
- Justified where the *project management* can be separated from *operational management*.

Disadvantages

- ***Time.*** Owner-builder structure, in general, requires more time.
- ***Quality Control.*** Quality is difficult to maintain in such structures.
- ***Getting Finance.*** Most lenders will not provide construction loans if the builder is an Owner-Builder. There are some very good reasons for this such as most people's lack of experience, a lack of financial control and the risk that a project will be halted due to family or other personal issues.

3. Traditional (Design-Bid-Build, DBB)

- Construction by a general contractor operating under a prime contract
- The most common method of having a facility constructed (Figure 1-7).

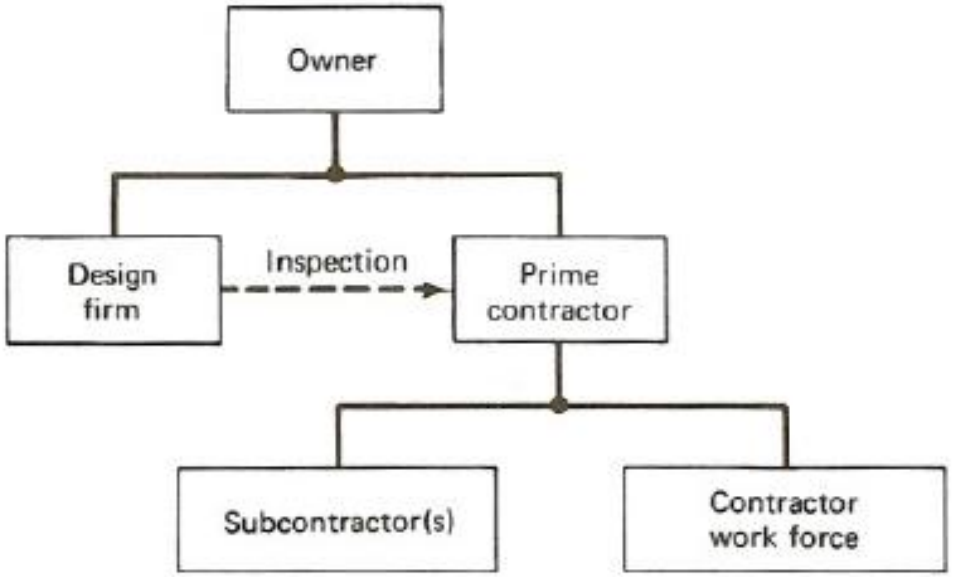


FIGURE 1–7 Construction by a general contractor.

Traditional

- This is employed for ordinary projects of moderate size and complexity.
- In this, the owner often employs a designer (an architectural/engineering or A/E firm) which prepares the detailed plans and specifications for the constructor (a general contractor).
- The general contractor is responsible for the construction itself even though the work may actually be undertaken by a number of specialty subcontractors.
- The designer may also acts on behalf of the owner to oversee the project implementation during construction.

Advantages and Disadvantages of Traditional Structure

Advantages

1. Widely accepted and historically supported.
2. Using lump-sum, the overall cost can be determined before awarding the contract.
3. Minimal involvement of the owner during construction.
4. Design-construct time can be reduced using phased construction.

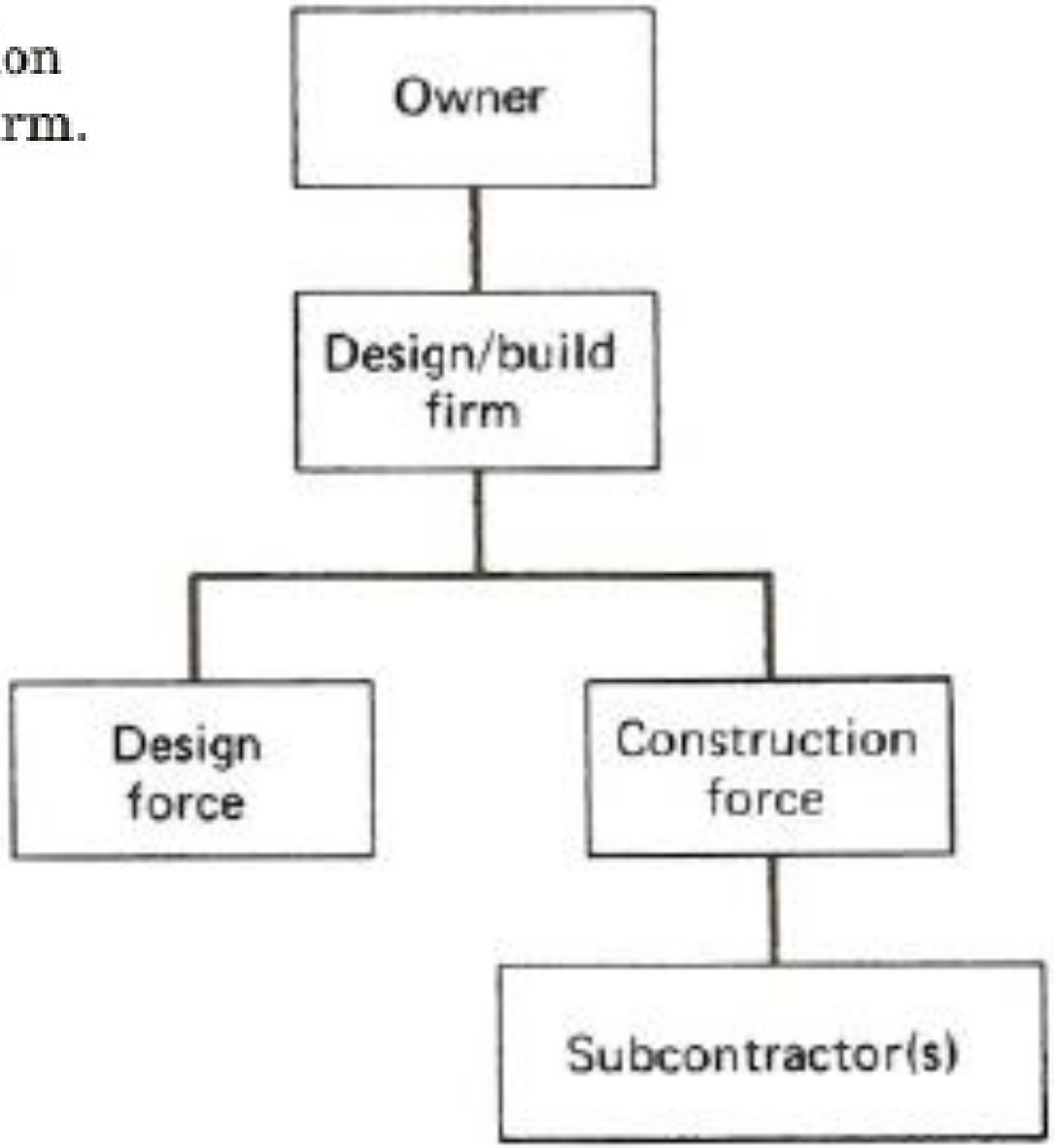
Disadvantages

1. Design may not benefit from construction expertise.
2. Overall design-construct time is usually the longest.
3. The owner and the designer are usually in an adversary position with general contractor (maximum vs. minimum quality).
4. Change orders will often end in disputes and may drive-up costs.

4. Construction using a design/build (turnkey) contract

- An owner contracts with a firm to both design and build a facility meeting certain specified (usually, performance-oriented) requirements. (Figure 1-8),
- Such contracts are usually utilized by construction firms that specialized in a particular type of construction and possess standard designs which they modify to suit the owner's needs.

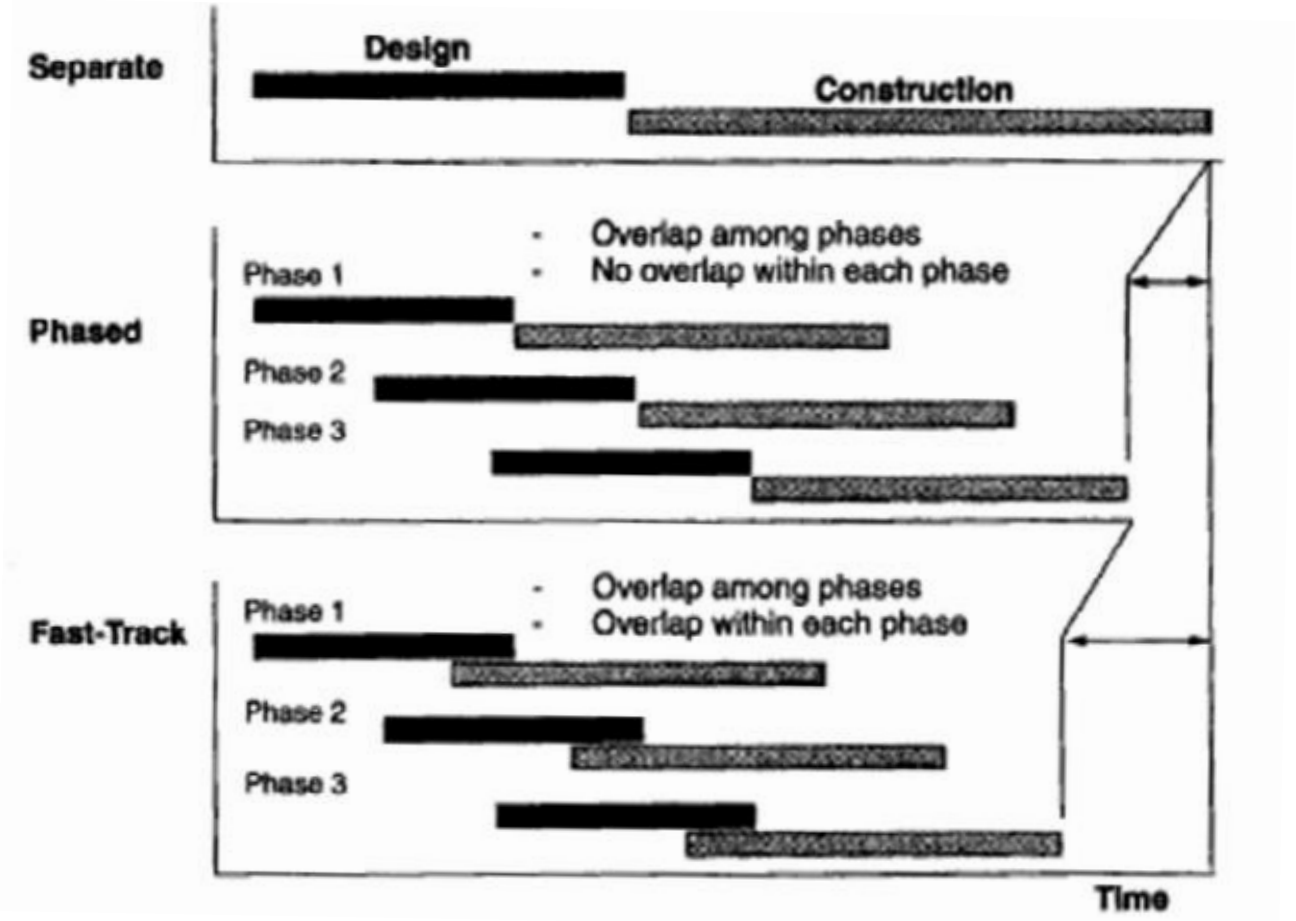
FIGURE 1–8 Construction employing a design/build firm.



- Since the same organization is both designing and building the facility,
  - Coordination problems are minimized.
  - Construction can begin before completion of final design.

- Under the ***traditional*** approach (DBB), it is also possible to begin construction before design has been completed.
  - In this case, the construction contract is normally on a cost-reimbursement basis.
  - This type of construction is referred to as *fast-track* construction.

Design/Construction Interaction



Advantages and Disadvantages of Turn-key Structure

Advantages

1. Only one contract for the owner. Design, construction, and know-how are furnished by a single organization.
2. Minimal owner coordination -dealing with a single organization.
3. Appropriate for unknowledgeable owner.
4. **Construction can begin before completion of final design.**
5. Construction expertise can be utilized during design phased construction.
6. Change orders are easy to handle.

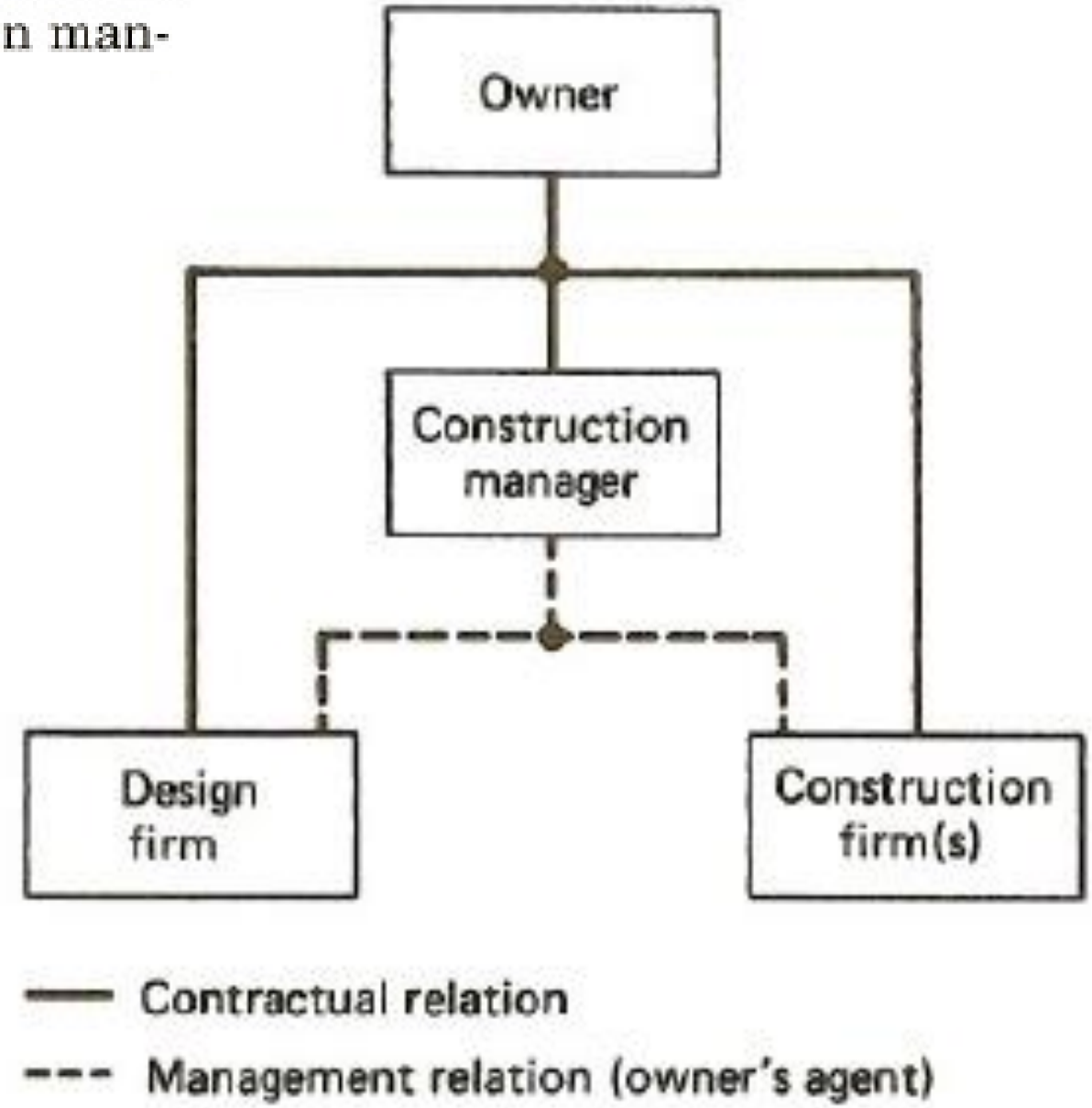
Disadvantages

1. Usually cost cannot be determined before construction.
2. If the project cost is fixed price, the overall quality and performance may be affected to ensure profit.
3. The owner may not be informed if there is a design or construction problems that may affect the schedule or the cost.

5. Construction utilizing a construction management contract

- Also known as Agency Construction Management,
- a professional *construction manager* (CM) acts as the owner's agent to direct both the design and construction of a facility.
- Three separate contracts are awarded by the owner for design, construction, and construction management of the project.

FIGURE 1–9 Construction utilizing a construction management contract.



- CM Offers potential savings in both time and cost.

- Disadvantage:
  - the construction manager (CM) typically assumes little or no financial responsibility for the project. Therefore, the cost of his/her services may outweigh any savings resulting from improved coordination between design and construction.

Advantages of Professional Construction Manager

Advantages

- Special construction skills may be utilized at all stages of the project with no conflicts of interest between the owner and the designer.
- Independent evaluation of costs, schedules, and overall construction performance, including similar evaluation for changes or modifications helps assure decisions in the best interest of the owner.
- Full-time coordination between design and the construction contractors is available.
- Minimum design-construction time can be achieved through use of phased construction.
- The professional construction manager approach allows price competition from local contractors akin to the traditional lump-sum or unit-price methods.

Disadvantages

- Construction Management contracting arrangements are often not subject to competitive bidding.
- Open-ended nature of many Construction Management contractual arrangements, which unnecessarily expose the Owner to the risk of unanticipated cost increases.

1-3 CODES AND REGULATIONS

- In general, governmental regulations for construction:
  - A. Building codes,
  - B. Zoning regulations, and
  - C. Environmental regulations

- *A. Building codes* : concerned with public safety which provide minimum design and construction standards for structural and fire safety.
- *B. Zoning regulations:* control land use, limit the size, type, and density of structures (commercial, residential, industrial)

C. *Environmental regulations*:

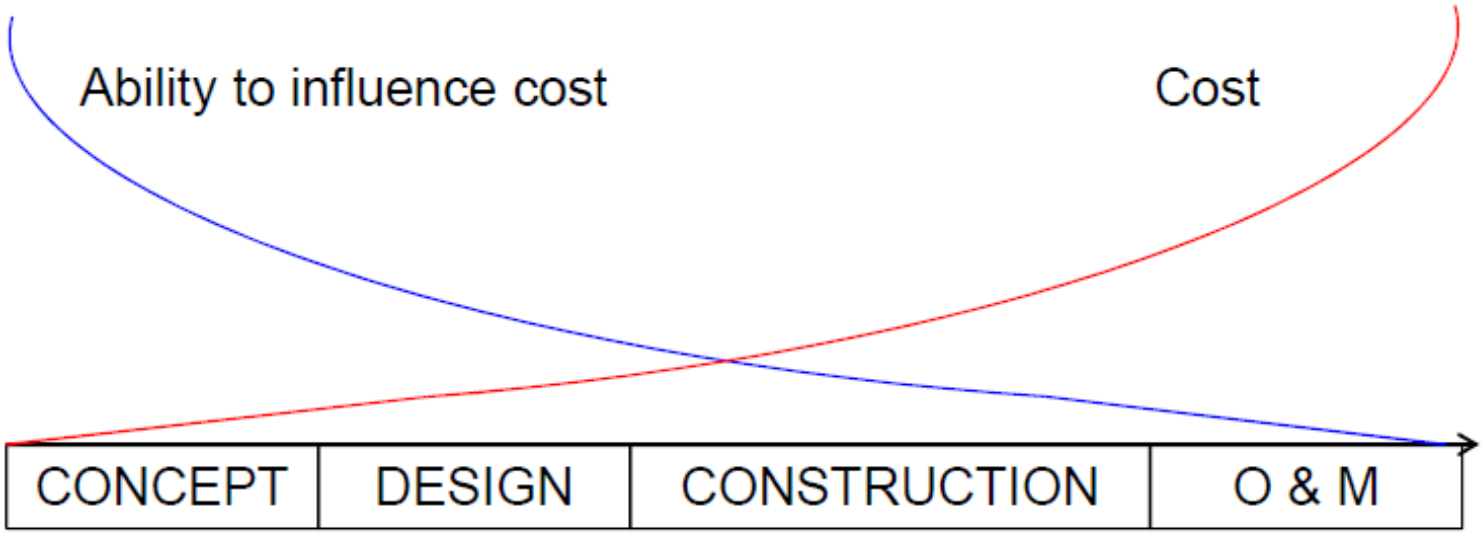
protect the public and environment by controlling such factors as:

- water usage,
- vehicular traffic,
- precipitation runoff, (rain water creek)
- waste disposal, and
- preservation of beaches and wetlands.

1-4 STATE OF THE INDUSTRY

- **Construction Productivity**
  - It will be covered in Chapter 20.
- **Reducing Construction Costs**

Reducing Construction Costs



Project Stages

Reducing Construction Costs

- Design Phase: standard material and sizes,
- Construction Phase:
  1. Good work planning (availability of labor, material and tools).
  2. Careful selection and training of workers and managers.
  3. Efficient scheduling of labor, materials, and equipment.
  4. Proper organization of work.
  5. Use of laborsaving techniques such as prefabrication and preassembly.
  6. Minimizing rework through timely quality control.
  7. Preventing accidents through good safety procedures.

1-5 CONSTRUCTION MANAGEMENT

- **Construction Management**
- **Quality control**
- **Reasons for Construction Company Failure**

Elements of Construction Management

- important responsibilities for every construction manager include:
  - workers and subcontractors,
  - equipment and construction plant,
  - material,
  - money (income, expenditure, and cash flow), and
  - time.

- Skillful construction management results in project completion on time, within budget, and as specified.
- Other important responsibilities for every construction manager could be:
  - safety,
  - worker morale,
  - public and professional relations,
  - productivity improvement,
  - Innovation.

Quality Management

- Steps must be taken to ensure that the constructed project meets the requirements established by the designer in the project plans and specifications.

Quality Management (QM)

- *Quality Management* (QM) includes such activities as:
  - specification development,
  - process control,
  - product acceptance,
  - laboratory and technician certification,
  - training, and communication.

Quality Control (QC),

- It is a part of the *Quality Management* process,
- It is primarily concerned with the process control function.
- *Quality Control* is most effective when performed by the contractor.
  - Since the contractor has the greatest control over the construction process.
- the construction contractor is primarily responsible for construction quality.

Quality Assurance (QA)

- It is inspections and tests performed by an owner's representative or government agency provide little more than spot checks
  - to verify that some particular aspect of the project meets minimum standards.