



مدیریت پروژه‌های صنعت ساخت (ساختمانی، زیرساختی و صنعتی)

فصل دوم: مدیریت ساخت
تاریخچه، ساختار و اصول مدیریت ساخت

ارائه دهنده:

سید محمدرضا علوی پور

(PhD, PMP, CMIT)

دانشگاه Illinois Tech آمریکا

What we will learn?

- ☐ The history of general project management
- ☐ The history of construction management
- ☐ Two of well-known construction organizations
- ☐ Construction educational offerings
- ☐ Construction management certifications
- ☐ Construction management standards & best practices
- ☐ Project management definition
- ☐ Construction management definition
- ☐ Evaluating construction project success
- ☐ Construction project phases
- ☐ Project delivery
- ☐ Construction manager's duties and responsibilities
- ☐ Construction management organizations
- ☐ Do you have the right stuff?
- ☐ CM roadmap related to this section

PROJECT DELIVERY

Project delivery method (PDM)

- ❑ The owner's initial plan on **how to deliver the project** is called the project delivery method (PDM).
- ❑ As briefly stated by Gibson and Walewski:

[...] a project delivery method [...] defines the relationships, roles, and responsibilities of project team members and the sequence of activities required to complete a project

(Gibson and Walewski 2001; p.1)

Prepared by Alavipour
DO NOT DISTRIBUTE

Project delivery terminology

- ❑ **Language** used to describe project delivery often **lacks consistency**.
- ❑ Therefore, the terms project delivery, procurement, and contracting are sometimes **used interchangeably**.
- ❑ To **limit confusion** on this topic, we will refer to **project delivery** as the act of achieving project objectives, to
 1. Procurement as the act of **purchasing external services and materials** necessary to deliver a project, and
 2. Contracting as the act of establishing a **contract for services and materials**.

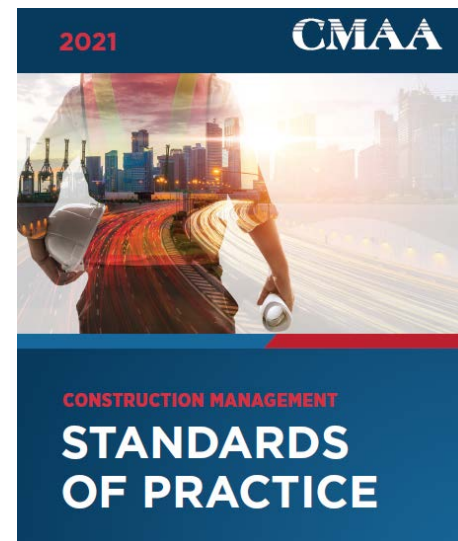
Project delivery terminology

- ❑ Similarly, **different ways to deliver projects** can be interchangeably called *project delivery methods, systems, routes, approaches, or strategies*.
- ❑ Although we consider the words “methods,” “systems,” “routes,” and “strategies” as equivalent when used in reference to project delivery, “delivery method” will be used throughout the course.

Prepared by Dr. Alavipour
DO NOT DISTRIBUTE

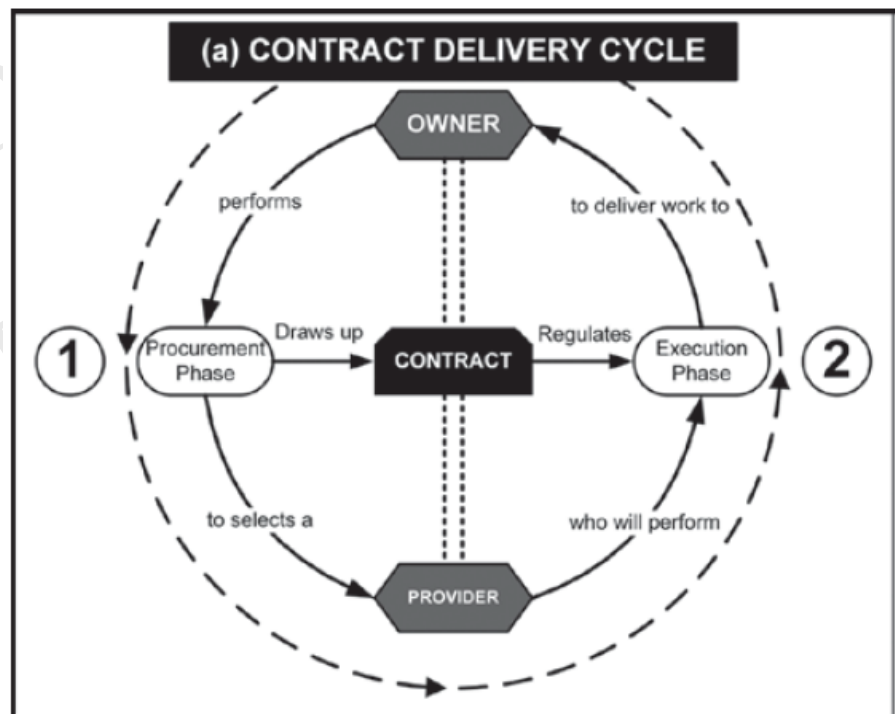
Introduction

An agency or owner uses a *project delivery method* as a strategy for a construction project's legal agreements with one or more entities/parties to organize the design, construction, operations, and maintenance services from conception to occupancy. The construction process is a complex undertaking that involves many different activities and people in its planning and execution. A construction project can organize these tasks and the roles/responsibilities of the owner, designer, CM, contractor(s), subcontractor(s), vendors, and suppliers in many ways.



Contract delivery cycle

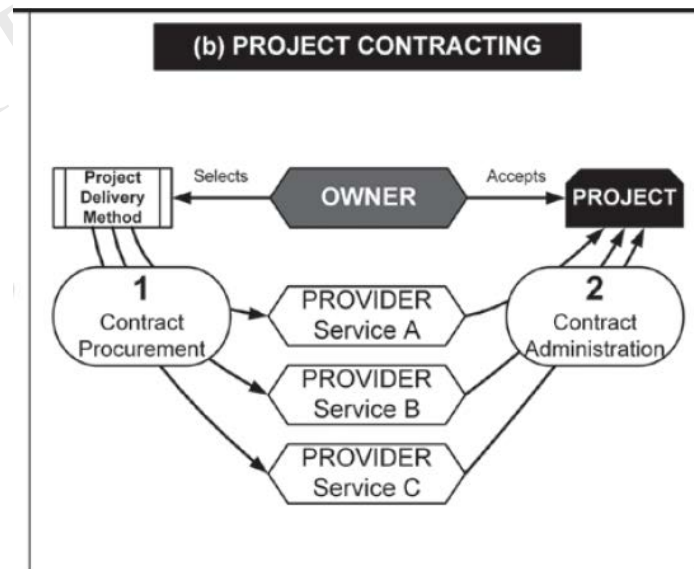
- ❑ **Most built environment** projects are instead delivered through **several contracts** for services, each following a similar **contract delivery cycle** to that shown in Figure a.



Project contracting

❑ **Contracting out** may occur in different ways, but it usually involves procuring external expertise for the project,

which can be represented as a **cycle** that is repeated as many times as **needed to deliver the whole project**, as shown in Figure b.



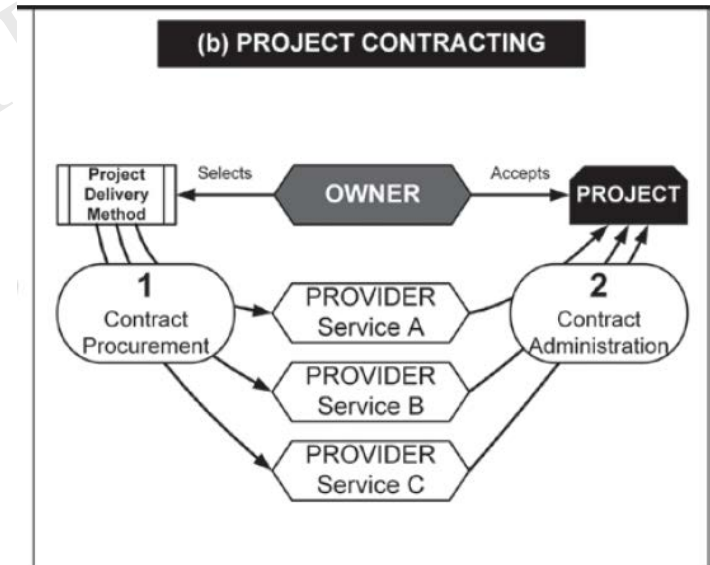
Project contracting

❑ The **selected PDM** will dictate if each iteration will occur

1. Sequentially or
2. Concurrently

to other iterations.

❖ **Concurrency** increases the need for **coordination** among contracted providers.



PDM decisions

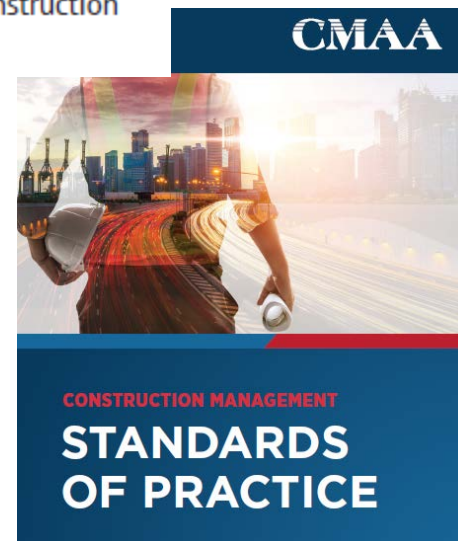
- ❑ Project delivery is becoming increasingly important as **new ways** to deliver and finance **construction projects** have been introduced, experimented with, and modified.
- ❑ This section
 1. Introduces **vocabulary** used by industry practitioners to discuss project delivery
 2. Describes **many common project delivery methods** used in the industry

Prepared by Dr. Alavipour
DO NOT DISTRIBUTE

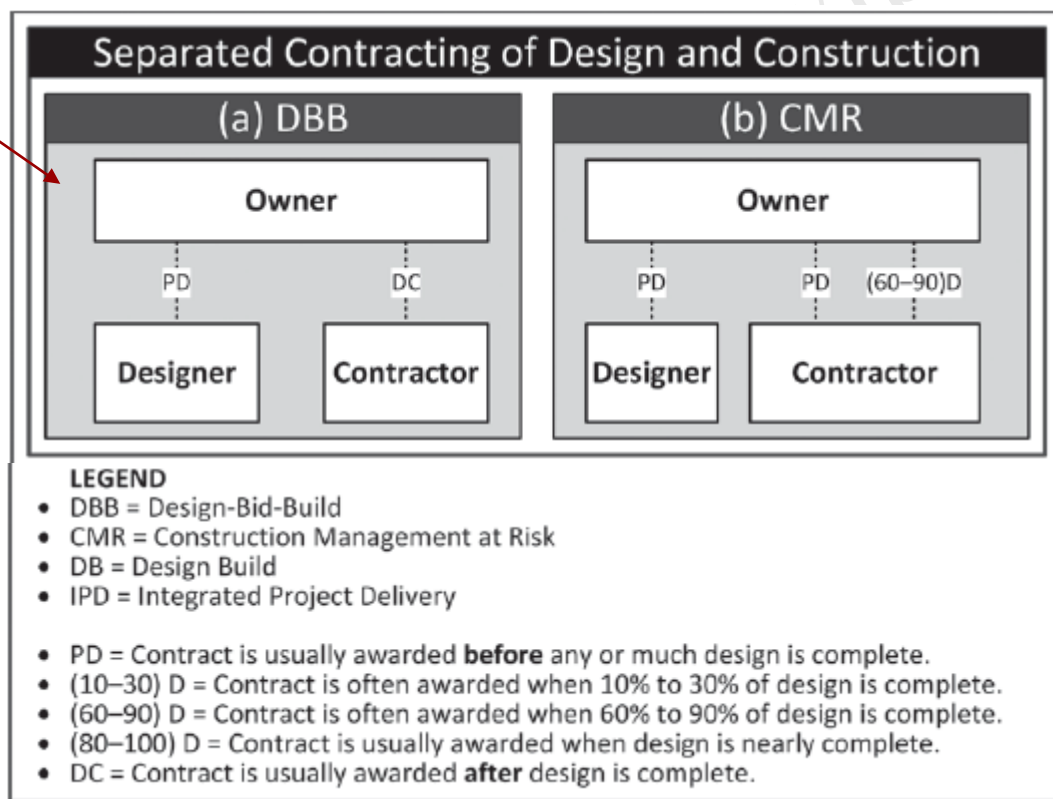
Approaches

Many approaches exist to deliver a successful project, but it is possible to reduce the number of methods to several basic delivery forms by defining who has responsibility for construction performance, i.e., the actual delivery of the project. These include:

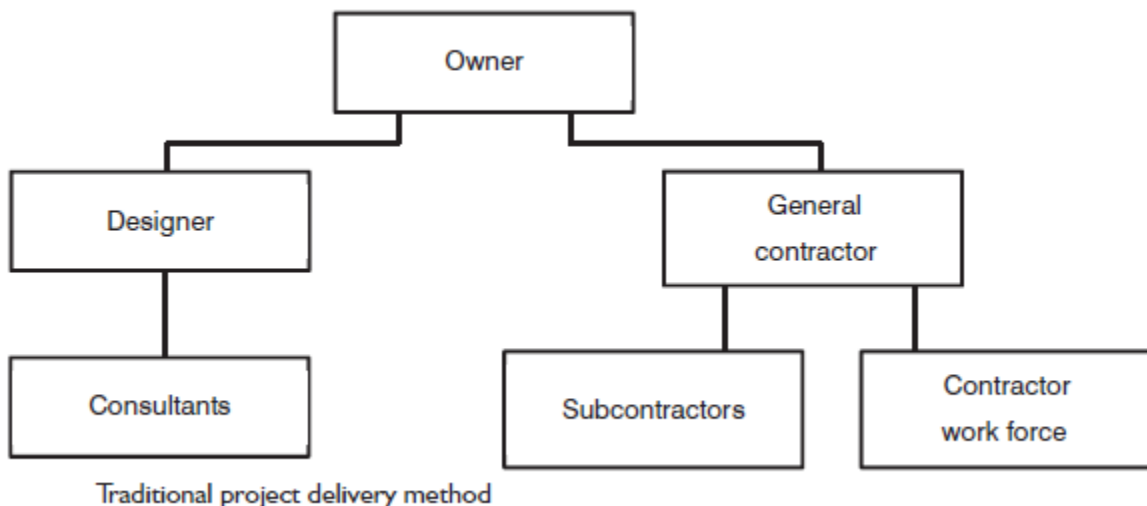
- » **Traditional Approach or Design-Bid-Build (D-B-B)**
- » **Multiple-Prime Contracting (Multi-Prime)**
- » **Construction Management at-risk (CMAR)** – also referred to as CM/independent contractor, CM/GC, or CM guaranteed maximum price (GMP)
- » **Design-Build (D-B)** – traditional or progressive
- » **Other Methods:** Engineering, Procurement, Construction (EPC); Engineering, Procurement, Construction Management (EPCM); Integrated Project Delivery (IPD); Job Order Contracting (JOC)



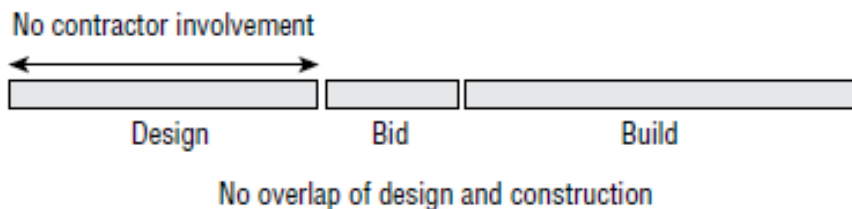
Separated contracting of design and construction



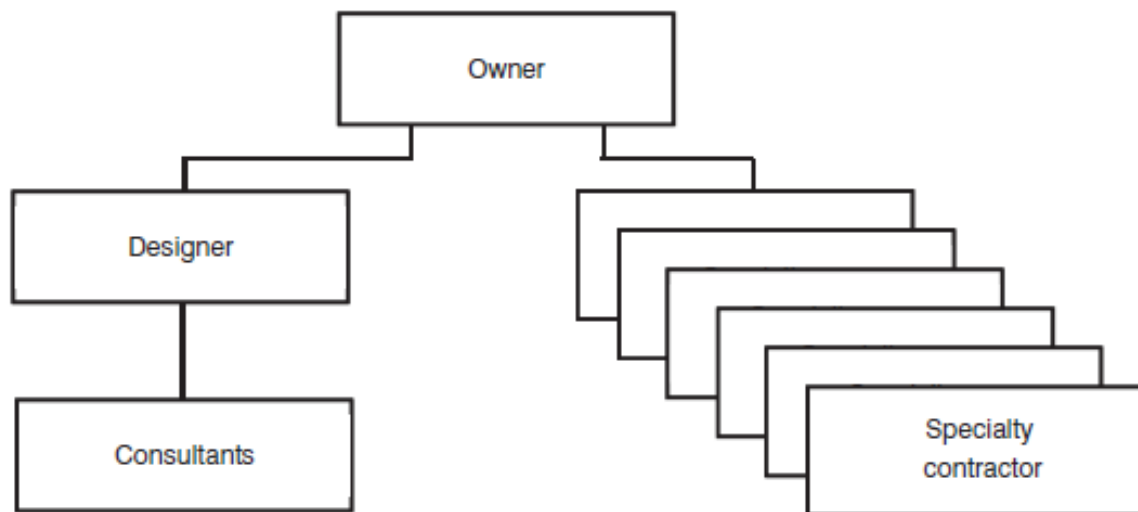
Separated contracting of design and construction: DBB example



Design-Bid-Build Linear Approach



Separated contracting of design and construction: DBB example

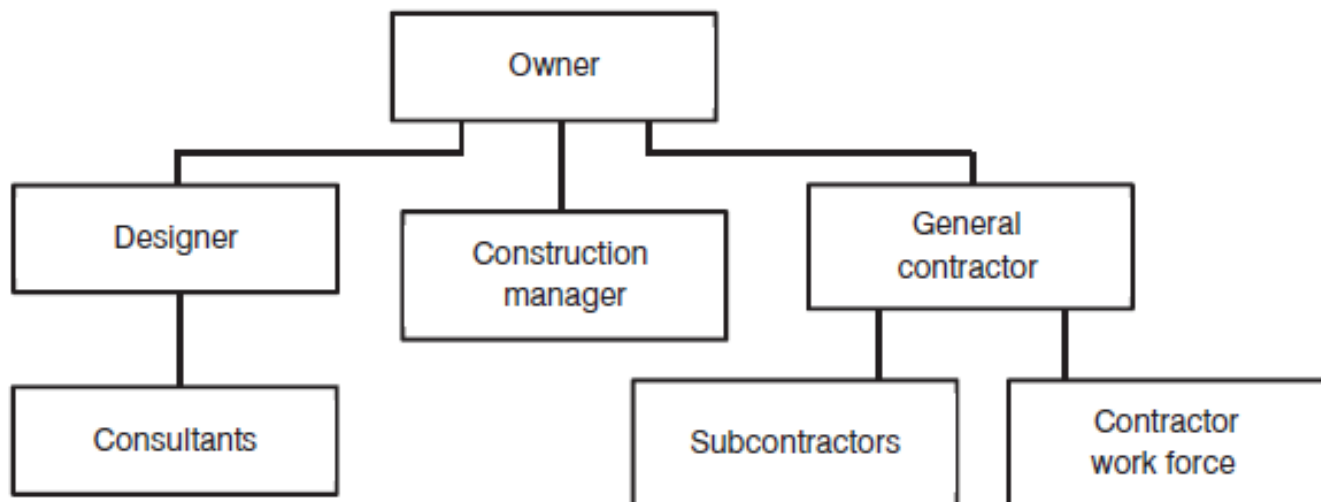


Traditional project delivery method with multiple prime contractors

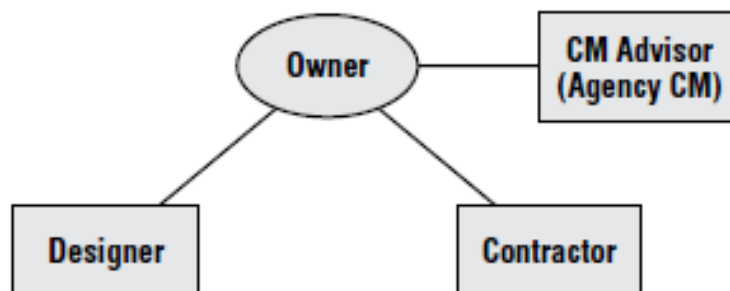
multiple prime

A contracting methodology in which the owner bypasses the use of a general contractor and enters into multiple separate contracts with trade or specialty contractors for the various sections of the work associated with the project, such as concrete, framing, mechanical, and electrical work. Each of the specialty contractors involved becomes a prime contractor on the project.

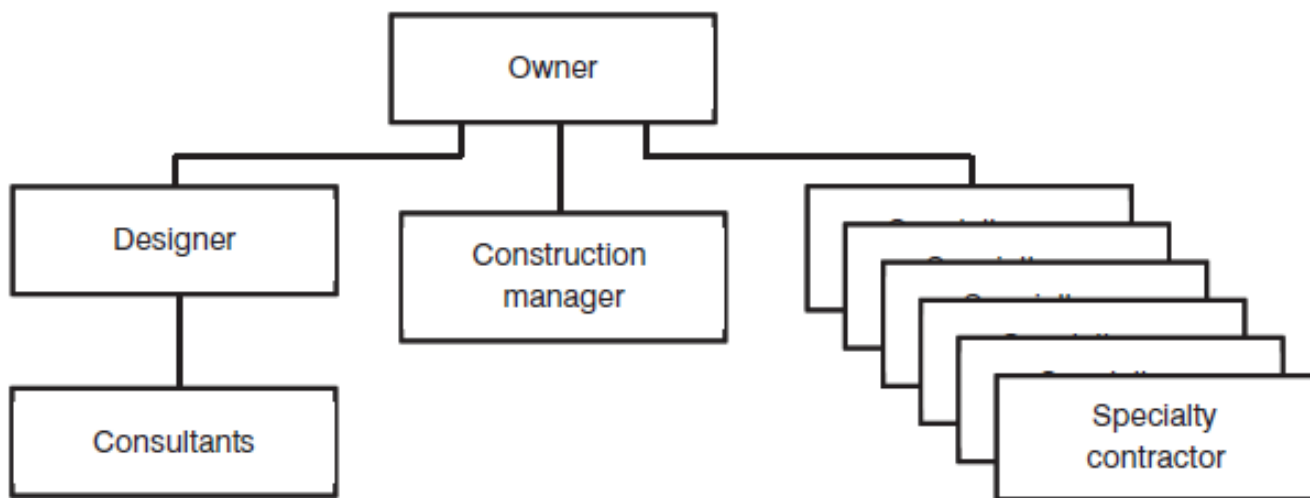
Separated contracting of design and construction: DBB example



Agency construction management project delivery method with general contractor

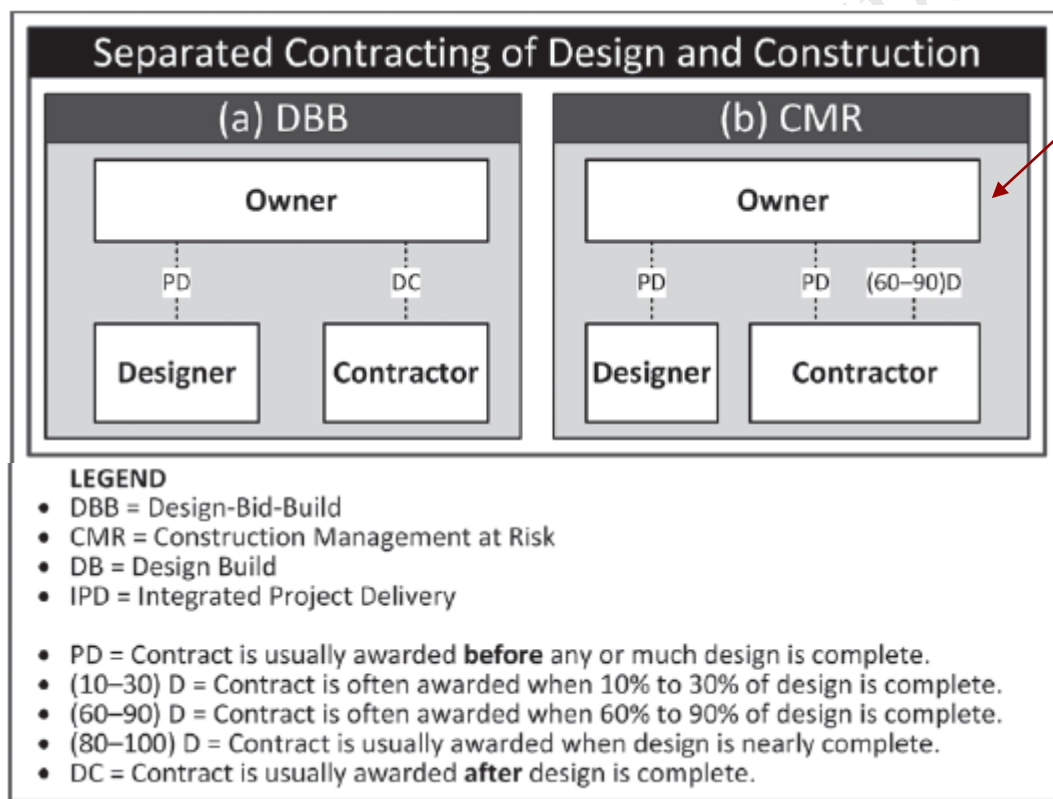


Separated contracting of design and construction: DBB example

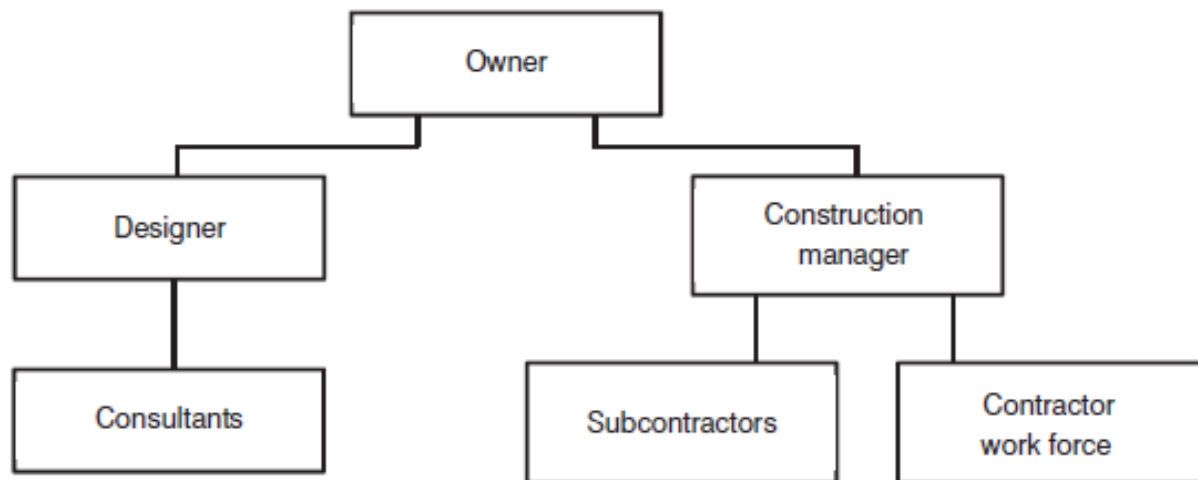


Agency construction manager project delivery method with multiple prime contractors

Separated contracting of design and construction



Separated contracting of design and construction: Construction management at risk (CMR)



Construction manager-at-risk project delivery method

Prepared by
DO NOT DISTRIBUTE

Separated contracting of design and construction: Construction management at risk (CMR)

- ❑ Under CMR, the owner contracts **separately for design and construction** services, which is similar to DBB, as shown in Figure b.
- ❑ However, the **timing is different** because the CMR is usually retained early on to allow early contractor involvement, which means the **CMR will have** an opportunity to review and comment on the **design** before it is finalized.

Prepared by Dr. Alavipour
DO NOT DISTRIBUTE

Separated contracting of design and construction: Construction management at risk (CMR)

❑ **CMR** evolved from the common use of **agency construction managers in DBB**.

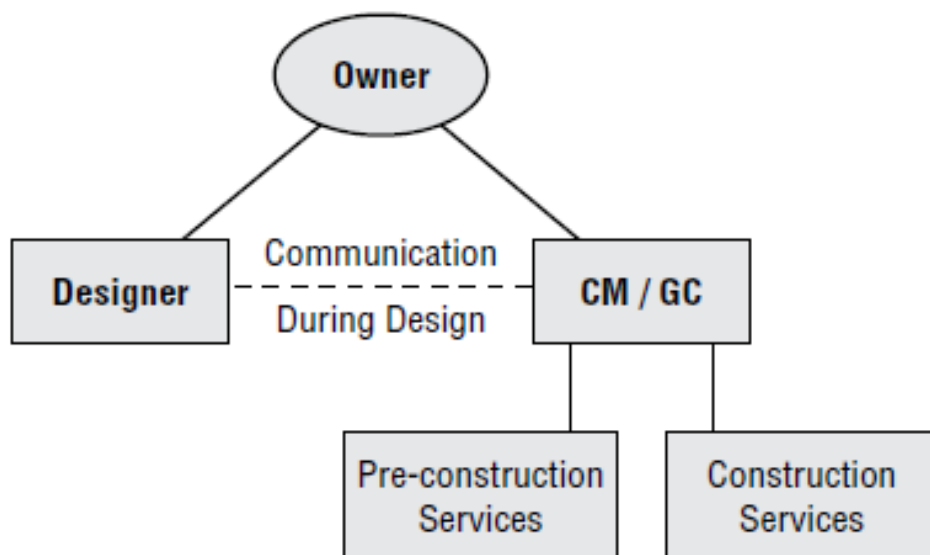
❑ Whereas **an ACM is simply** a consultant to the owner,

a CMR, as defined by the *Construction Management Association of America* (CMAA), is a firm that

[...] acts as [a] consultant to the owner in the predesign and design phases, but as the legal equivalent of a general contractor during the construction phase. When a CM is bound to a price, either fixed or a GMP, the most fundamental character of the relationship is changed.

(CMAA 2017)

Separated contracting of design and construction: Construction management at risk (CMR)



at-risk CM

A project delivery method where the construction manager acts as a consultant to the owner in the development and design phases but as the equivalent of a general contractor during the construction phase.

Separated contracting of design and construction: Construction management at risk (CMR) example

CMR example

A developer is planning a new high-rise tower to include underground parking, retail at ground level, and an upper-story hotel and apartments. Operators for the retail and hotel spaces have not yet been identified. This is the largest project to date for this developer, so their management prefers to retain some control over the design. Still, time is money, so the developer would like to overlap the design and construction activities without waiting for a hotel operator to decide details on that portion of the building. Therefore, the developer decides to use a CMR approach, where an architect and builder are selected early on and work together to further the design to a level of detail that can be priced.

- This owner does not have in-house design expertise, so they hire an architecture firm (the provider of design services) that will help understand what they are getting and work collaboratively with the builder to further the design to a level of definition that can be priced. They then continue to work collaboratively to complete the design and assist the builder during the construction.
- Soon after the designer is selected, the owner selects and hires a builder under an ACM contract (the provider of construction management services). This builder will work collaboratively with the designer to further the design to a level of definition that the builder can price.
- Once the architectural and structural design reaches around 60% completion, the owner and builder reach a price agreement on the structural scope and sign a contract that locks the price of the structure and establishes prices for the envelope, building systems, and finishes. Prices for the remaining scope items are tentative and frequently called allowances. The builder is now acting as a CMR and can move forward to finalize the structural design and begin the construction, which they will self-perform.

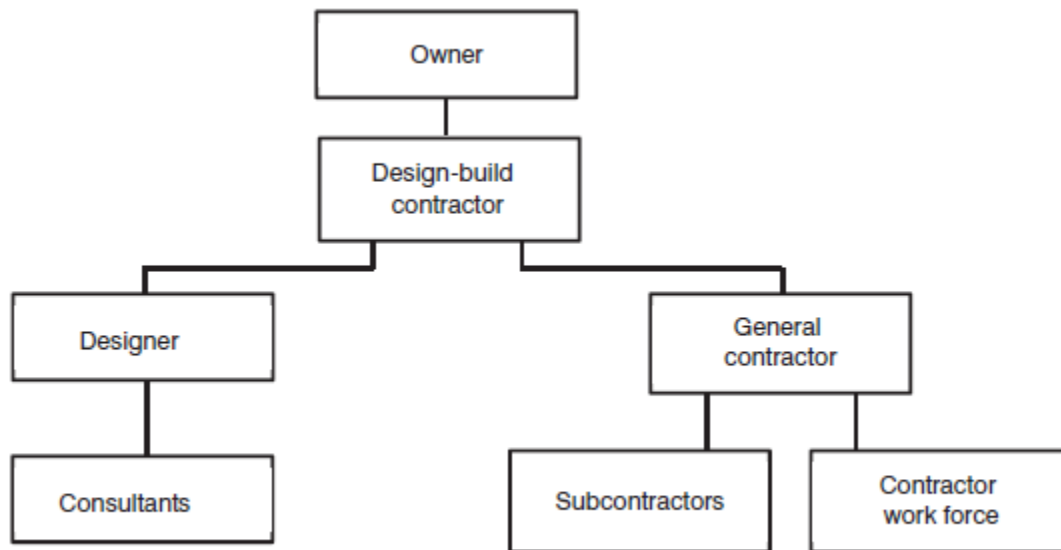
Separated contracting of design and construction: Construction management at risk (CMR) example

- Once the remaining design packages reach about 90% completion, the owner and builder reevaluate the allowances and adjust them upward or downward depending on the new available information. As soon as the owner and builder reach an agreement on each scope item, they lock the price. Once the price is locked, the builder can move forward by either self-performing or contracting out each of these scope items.

Combined contracting of design and construction: Design-build (DB)

- ❑ Under DB, the owner enters into a **single contract** with an entity that will design and build the project.
 - ❖ Thus, this contract will **combine design and construction** services.
- ❑ Acting as the **single point of responsibility** with the owner, the design-builder could be either
 1. Joint venture (JV) of firms or
 2. Individual firm that will subcontract out some of the services.
- ❑ For **large projects**, it is common that **several construction firms** will **joint-venture** by jointly constituting a **new company** that will be **dissolved** once the **project is completed**.

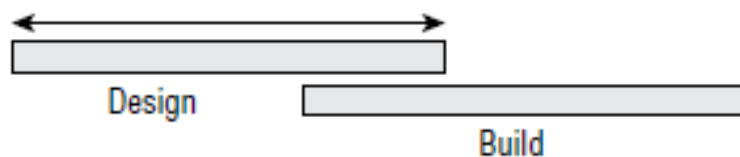
Combined contracting of design and construction: Design-build (DB)



Design-build project delivery method

Design-Build Integrated Approach

Extensive contractor involvement



Overlapped design and construction

Combined contracting of design and construction: Design-build (DB)

- ❑ For **most projects**, it is common for a general contractor to act as the **design-builder** while hiring a **design firm** to provide **design services**.
- ❑ Firms may be requested to **list their consultants and/or subcontractors** as part of the **qualification submittal**.
- ❑ **Under any approach**, the line of communication between the **owner and the design consultants or subcontractors** goes through the **design-builder** once the project price is set.

Combined contracting of design and construction: Design-build (DB)

❑ Among owners, **DB** has become popular due to **several advantages over DBB**, including

1. Having a single point of responsibility for design and construction,
2. Accelerated delivery,
3. Increased collaboration between designer and builder, and
4. Incentives for innovation.

Still, the timing of design–build contracts may vary significantly.

Combined contracting of design and construction: Design-build (DB)

- ❑ In the rest of this section, the **three most common DB** variations will be discussed.
- ❑ **One variation of DB** is the engineering, procurement, and construction (EPC) method that is **mostly used in the industrial and utility sectors**.
- ❖ Moreover, delivering a project through EPC usually provides a **more turnkey experience** for the owner.

The term “turnkey” has an equivalent meaning to “produce and deliver”.

One example of a turnkey contract is the construction of a residential property or building.

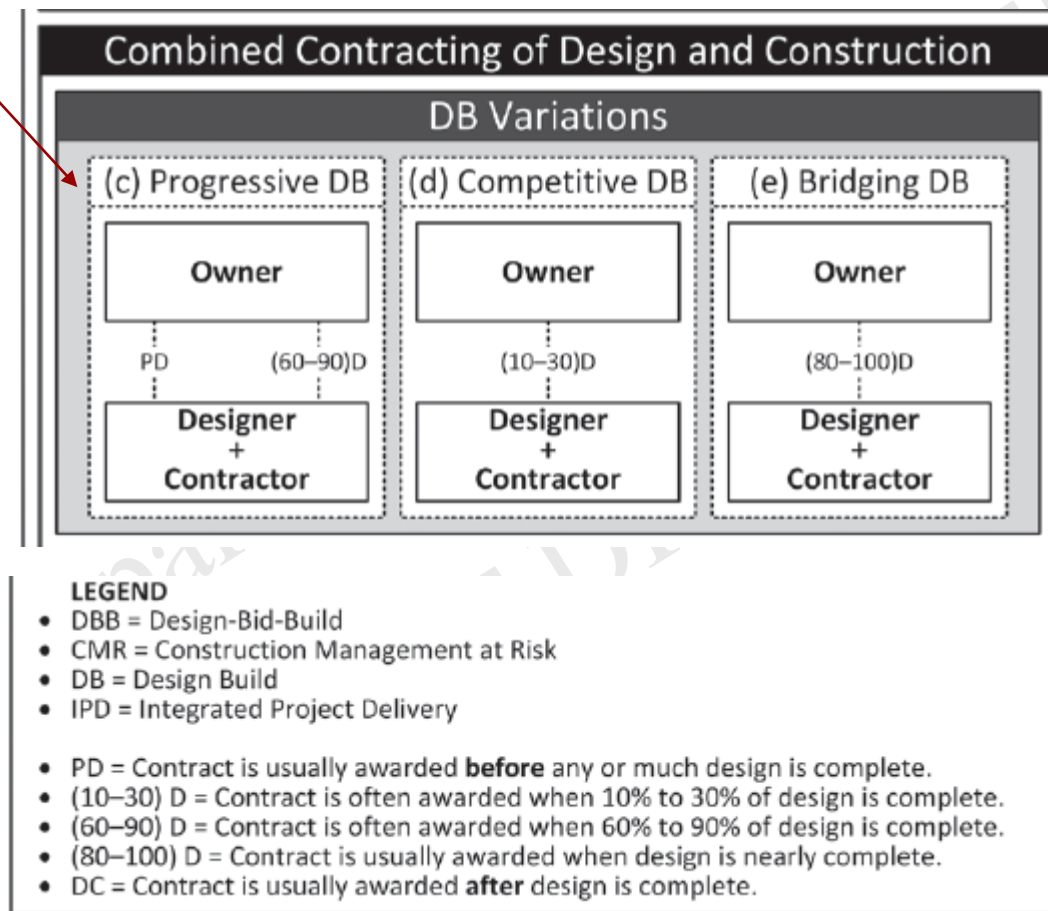
The contract is responsible to build the entire home in accordance with the plans and turn over the key of the house to the client.

In engineering, a turnkey contract could be for the building of a processing plant or production facility.

In technology, a turnkey contract is a type of contract where the service provider must deliver a fully functional network or system to the client.

As you can see, the common thread here is that the project is completed and the end result is delivered to the client.

Combined contracting of design and construction



Combined contracting of design and construction: Progressive DB

- ❑ Under PDB, the contract is awarded **early on**.
- ❑ First, the **owner** selects an **entity to act** as the design-builder.
 - ❖ Since **little to no design is available**,
the selection is **prevalently** based on **qualifications**.
- ❑ The **DB entity** will work **jointly with all parties**, including its design consultants and the owner,
to **evolve the design** to the point that it can be priced.
- ❑ At this point, a **new contract** can be signed between the owner and the design-builder, as shown in Figure c.
- ❑ To this end, **PDB's two-step nature** makes it similar to CMR.
- ❑ PDB is the **most recent variation of DB** and was **introduced** to **overcome** some of the **issues with price-competitive DB**, including claims.

progressive design-build

A qualifications-based design-build application where the design-builder is selected primarily on qualifications, followed by a process whereby the owner then progresses toward a design and contract price with the delivery team.

Combined contracting of design and construction: Progressive DB

Today there is an evolved application of design-build identified as *Progressive Design-Build* where the owner and the design-builder engage even earlier, before any design or pricing has been established by the owner. This approach has become quite popular with very large, complex projects such as the \$2.4 billion San Francisco Airport Terminal 1 Redevelopment project, where the owner wants to take full advantage of the multidisciplinary team and its expertise at the earliest stages of project planning. You can access the Progressive Design-Build Primer published by the Design-Build Institute of America at <https://dbia.org/wp-content/uploads/2018/05/Primer-Progressive-Design-Build.pdf>.

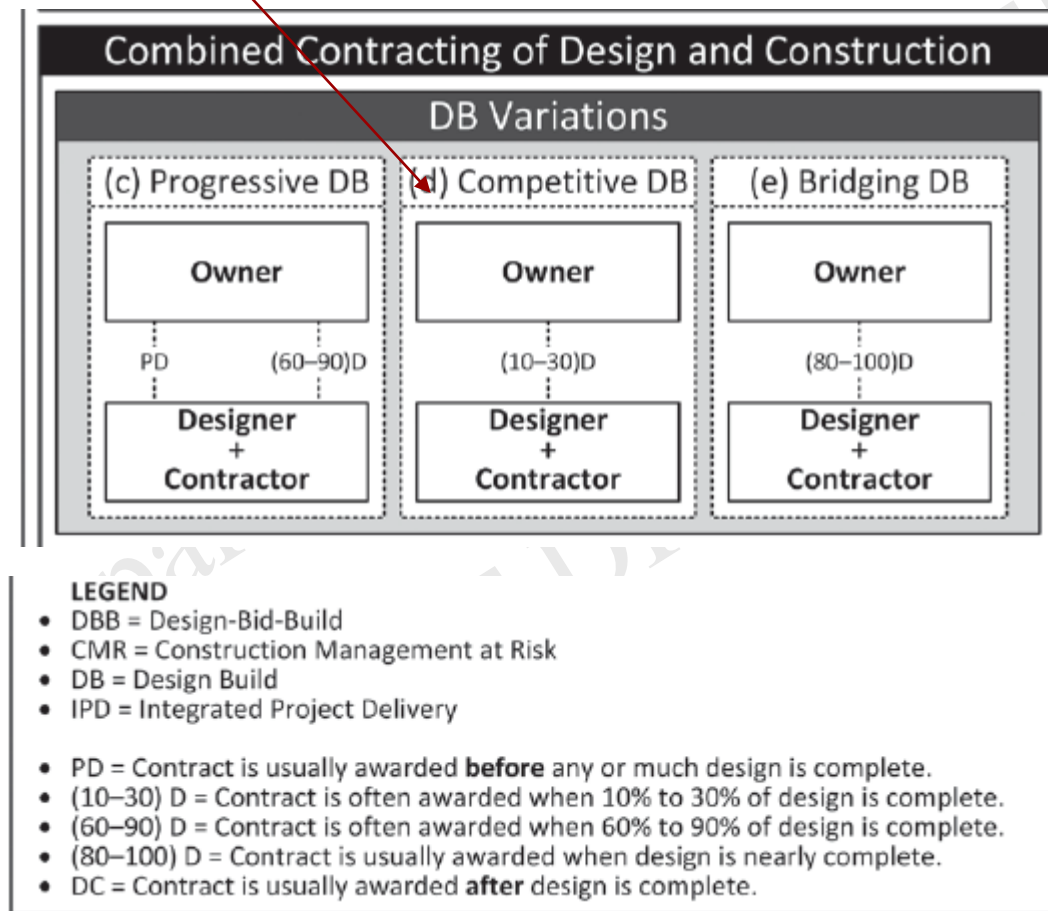
NOTE

Combined contracting of design and construction: Progressive DB

NOTE

Approximately 54 percent of all design-build projects are led by contractors. Construction managers who have a desire to participate on design-build projects should be knowledgeable regarding the design process and enjoy working with architects in a team environment.

Combined contracting of design and construction



Combined contracting of design and construction: Competitive DB

- ❑ Under CDB, the **design–build contract** is awarded once a **portion of design** is completed by the owner.
- ❑ A **common level of design definition** to award a CDB would be between **10% and 30% design completion**, as shown in Figure d.
- ❑ First, the **owner designs** the project with in-house staff or enters into a first contract with a design firm
that will produce a **preliminary design package** to be used as the **basis for identifying the project's scope**.

Combined contracting of design and construction: Competitive DB

- ❑ Since some design is available, the **owner will use** this design information to convey what they want to **competing firms**.
- ❑ Moreover, the **availability of some designs** allows potential design-builders to price the project and, therefore, the **selection also incorporates** a price competition aspect.
- ❑ Sometimes, **competing firms are requested** to take this early design and move it forward enough to provide the **owner with an understanding** of where the project will be **aiming if a certain firm is selected**.

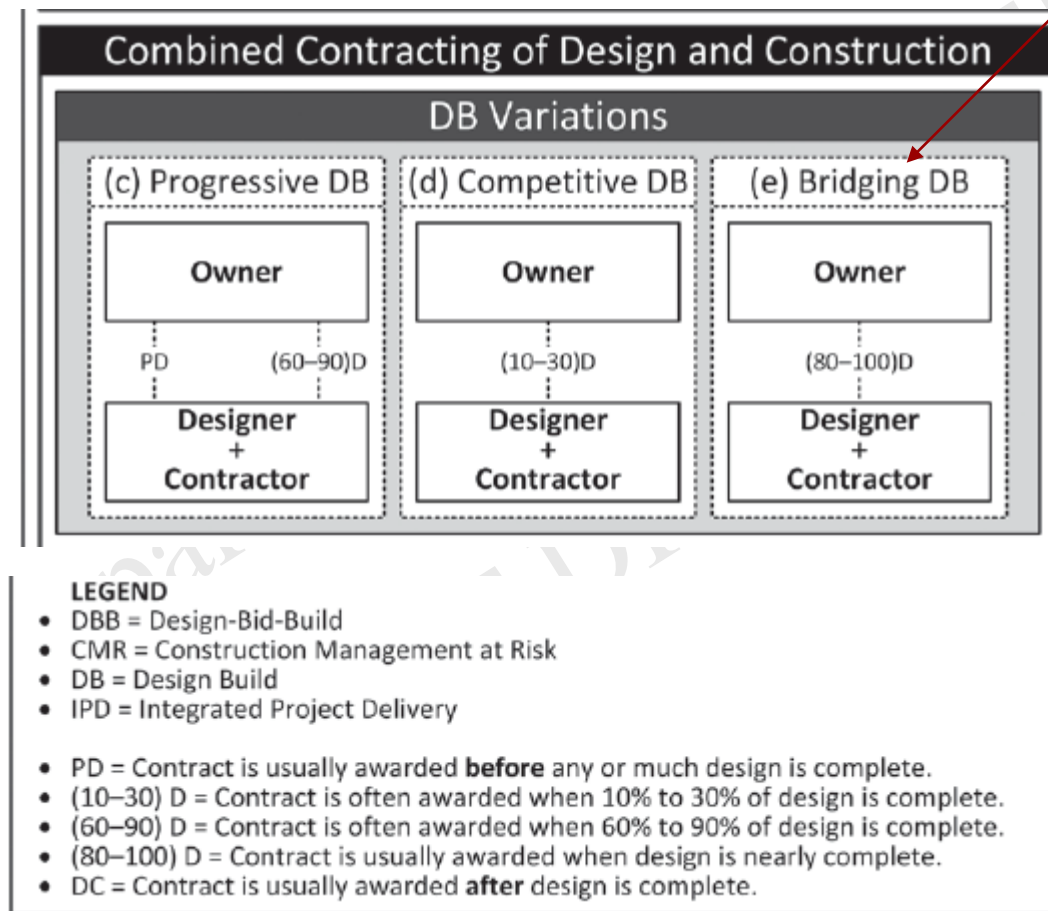
Combined contracting of design and construction: Competitive DB

- ❑ This **enhanced design** is part of the firms' proposal together with information about costs, quality, safety, and schedule.
- ❑ Once a **design-builder is signed** on the project, the **owner and the design-builder** will work jointly within the contractual boundaries, so there is **less owner control** over the **later design**.
- ❑ Whether the design is
 1. Self-performed by the design-builder or
 2. Service provided by a design consultant to the design-builder,the **management of design** services is substantially different from DBB.

Combined contracting of design and construction: Competitive DB

- ❑ Whereas the **project owner** is **highly involved** in design activities under
 1. DBB and
 2. In the initial phase of PDB,
involvement is **limited under CDB** to contractually **allocated responsibilities** for **design quality control and assurance (QC/QA)**.
- ❑ Any **further involvement** results in potential change orders and affects the initial CDB contract price.

Combined contracting of design and construction



Combined contracting of design and construction: Bridging DB

- ❑ Under **BDB**, the design–build contract is **awarded later** than in the **previous two processes**.
- ❑ Whereas BDB is very similar to CDB, as shown in Figure e, this method relies on a **set of advanced design documents** (bridging documents) that constitutes the **basis of the contract**.
- ❑ Therefore, the **owner's design consultant** will enhance the **level of design definition** beyond what is usually achieved under CDB.

Turnkey and build-operate-transfer (BOT) contracts

- ❑ Turnkey and build-operate-transfer (BOT) contracts provide a vehicle for **complete project delivery** by the contractor.

Prepared by Dr. Alavipour
DO NOT DISTRIBUTE

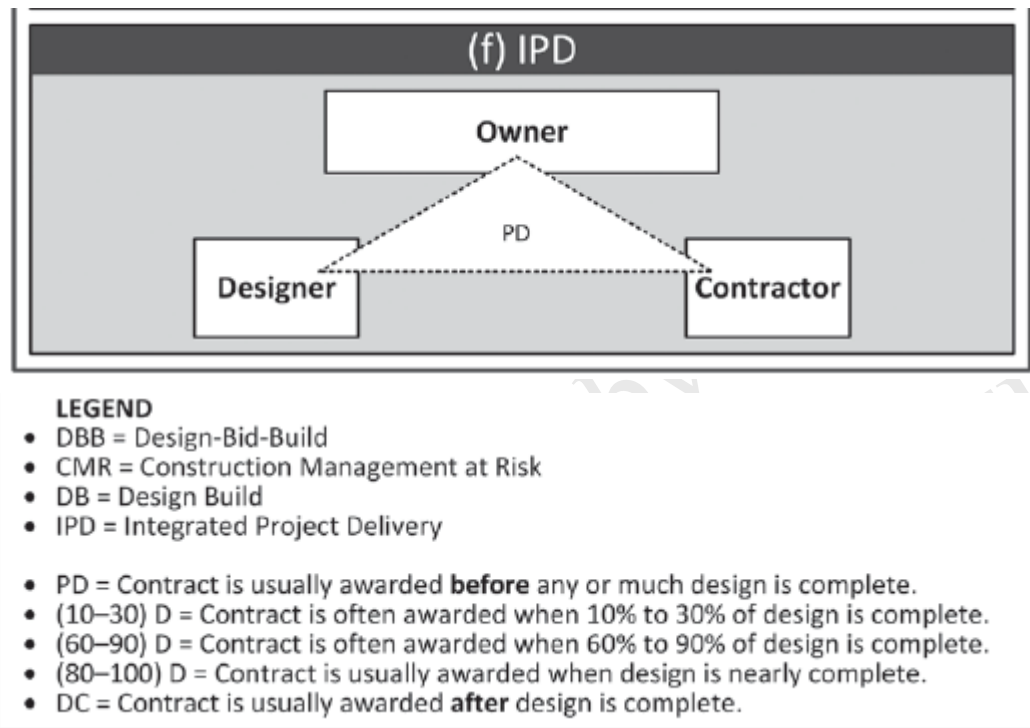
Turnkey and build-operate-transfer (BOT) contracts

- ❑ In a turnkey arrangement, the owner provides the **facility design requirements** to the contractor, which designs and constructs the facility **under a single contract**.
- ❑ The **single contract**
 - ❖ **Eliminates** the need for owner coordination and
 - ❖ **Reduces** project duration.
- ❑ Upon **completion**, the key to the project is **turned over to the owner** and the contract is closed out.

Turnkey and build-operate-transfer (BOT) contracts

- ❑ **BOT contracts** are an extension of the **turnkey method**.
- ❑ The contractor **designs, constructs, operates, and maintains** the facility for a predetermined concessionary period.
- ❑ In most cases, the **contractor receives no payment** from the owner for these services but **retains all or a portion** of the revenues earned by the project during the concession.
- ❑ This contracting method generally is used for bridges, highways, power plants, and similar projects that generate a **long-term revenue stream**.
- ❑ At the **end of the concession period**, **ownership transfers** from the contractor to the owner.

Integrated project delivery (IPD)



Integrated project delivery

Any project delivery method that contractually engages the contractor responsible for constructing the project at the beginning of the design process. Both design-build and at-risk CM are considered integrated project delivery models. However, there is a more formalized method of IPD that utilizes a multiparty agreement and represents a unique project delivery approach.

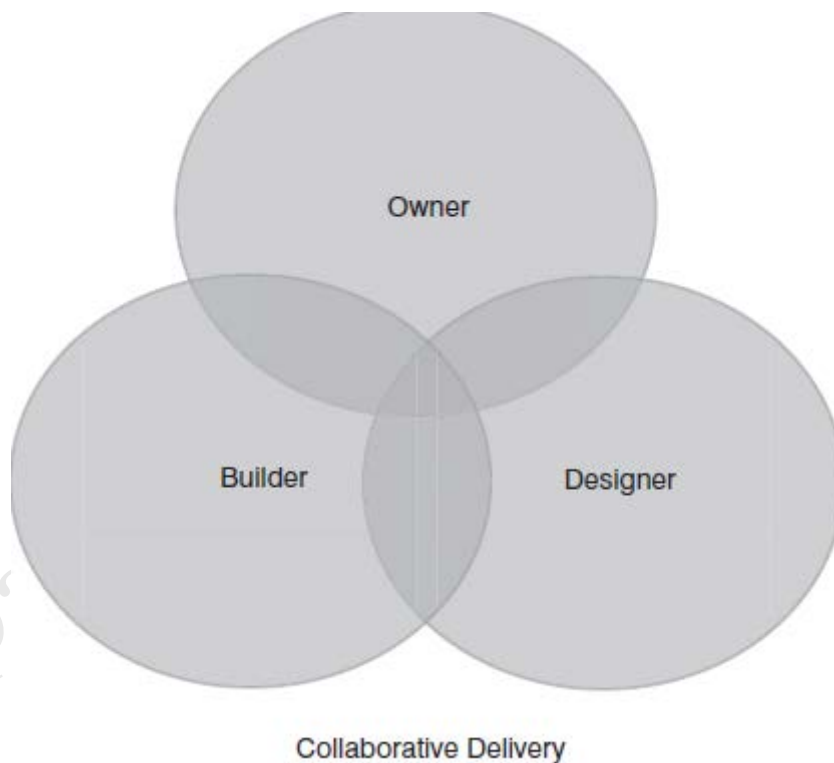
Integrated project delivery (IPD)

- ❑ IPD is the most recent approach to project delivery and is **based on lean construction principles**.
- ❑ As defined by the **American Institute of Architects** (AIA), IPD is

[...] a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction.

(AIA 2007; backcover)

Integrated project delivery (IPD)

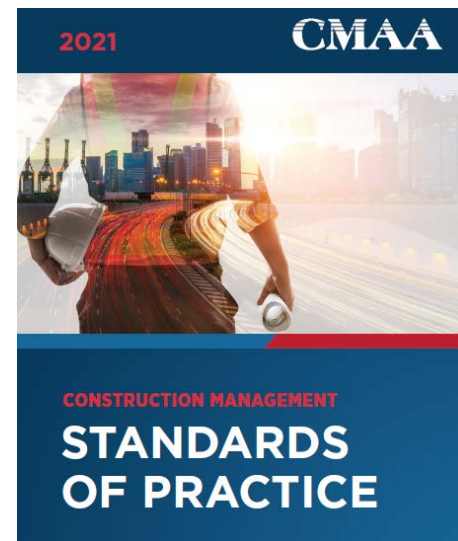


Integrated project delivery (IPD)

- ❑ From a contracting standpoint, **IPD substantially differs** from all other project delivery methods in the fact that it relies on one **multi-party contractual agreement**.
- ❑ **All the contractual lines** in the DBB, CMR, and DB forms are based on **two-party agreements**,
whereas **IPD contracts** are multiparty.
- ❑ As a minimum, they include the three main parties— the owner, the designer, and the general contractor—
but they can sometimes **incorporate additional parties**,
such as **specialty designers and contractors or vendors**.

A **basic framework** for IPD is shown in Figure f.

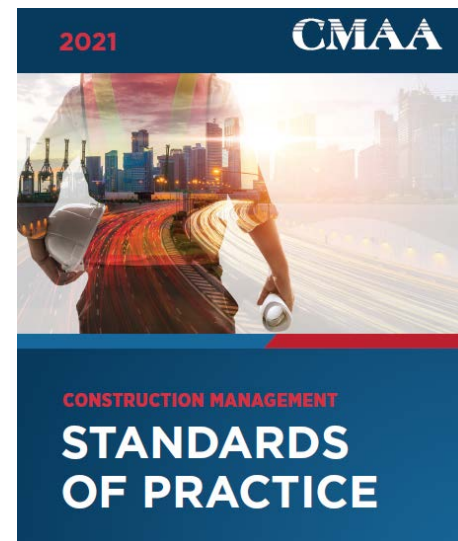
Variations of these basic delivery methods are possible depending on the specific needs of the project. Variations may be a function of jurisdictional or statutory requirements. Project participants may also assume multiple roles, resulting in variations in the basic delivery methods. For example, in certain specialty areas such as kitchen design, one firm might serve as the owner's technical advisor, designer, material supplier, and subcontractor at various points during a project.



Reasons for variations

Common reasons for basic delivery method variations include:

- » Different forms of professional and construction contracts
- » The degree of care, responsibility, and risk assumed by the parties involved
- » Pricing alternatives and methods of compensation
- » Fast tracking
- » Scope bidding



Project delivery selection

- ❑ As discussed earlier, **increasing numbers** of project delivery methods are used in the built environment, including **hybrids of the ones** discussed here.
- ❑ Whereas the **public sector** is constrained by laws, each private owner could hypothetically develop **their own project delivery method** or a multitude of them.

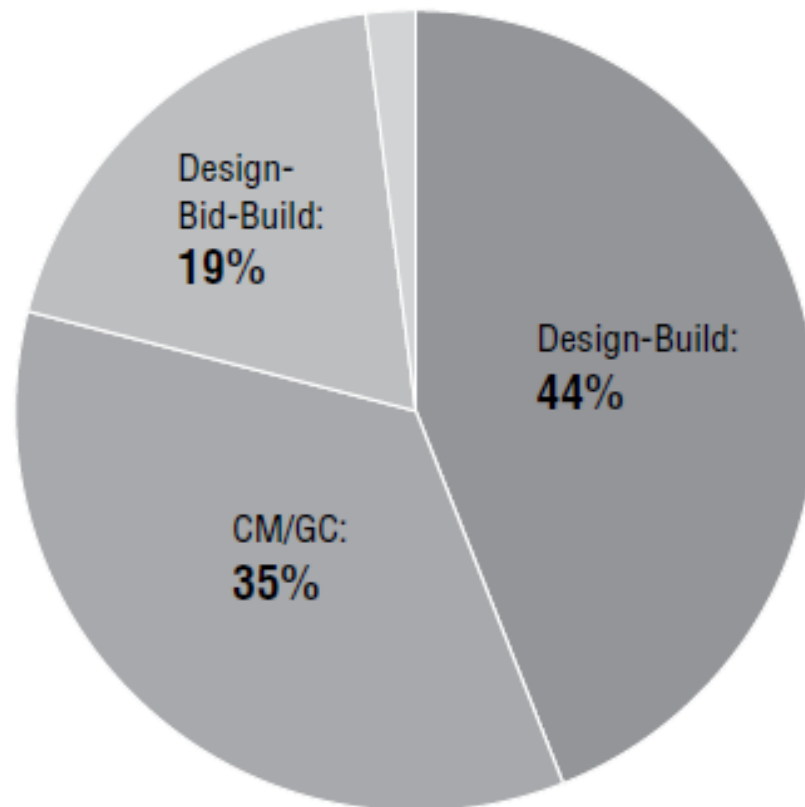
Prepared by Dr. Alavipour
DO NOT DISTRIBUTE

Project delivery selection

Acronym	Contract Type	Single or Multiple Contracts to Owners	Selection Criteria	Phased Construction
DBB	Competitively Bid	Multiple-Design Contract and Construction Contract	Low Construction Cost	No
	Negotiated	Multiple Design and Construction	Low Cost or Other	Possible
DB	DB	Single Contract with DB Firm	Usually Not Low Cost—Based on Performance	Yes
CM	CMA	Contracts Held by Owner—CM, Design, Construction, and Vendors	Based on Performance Expectations	Yes
	CM at Risk	Same as CMA Above Except CM and Construction Contracts Are Combined	Based on Performance Expectations	Yes

Project delivery selection

Market research by FMI, released in June of 2018, shows design-build is the fastest growing and most popular delivery method in the nation, accounting for nearly half of all construction spending by 2021.



Project delivery selection

Where could I find more info?

NOTE

You can learn more about the various project delivery approaches by accessing McGraw Hill's Smart Market Report entitled *Project Delivery Systems* at <https://dbia.org/wp-content/uploads/2018/05/Research-Project-Delivery-Systems-SmartMarket.pdf>.

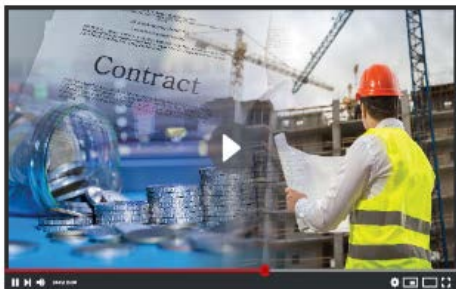
Project delivery selection

<https://dralavipour.com/video-courses>



Video Course 

قراردادهای ساخت و سیستم های تحویل
پروژه



Video Course 

روش اجرای عامل چهارمی CM-AT-RISK با
قرارداد حداکثر قیمت تضمین شده (GMP)



Video Course 

قراردادهای سه عاملی طرح-مناقصه-ساخت و
نکات مهم برای بهبود آنها



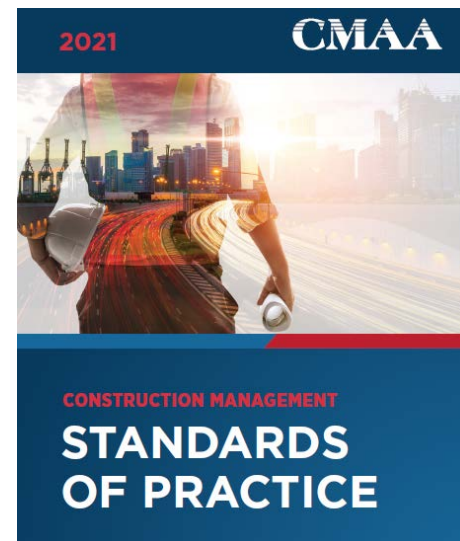
Video Course 

روش اجرا و قراردادهای دو عاملی طرح و
ساخت (Design-Build)

CONSTRUCTION MANAGER'S DUTIES AND RESPONSIBILITIES

Professional construction management

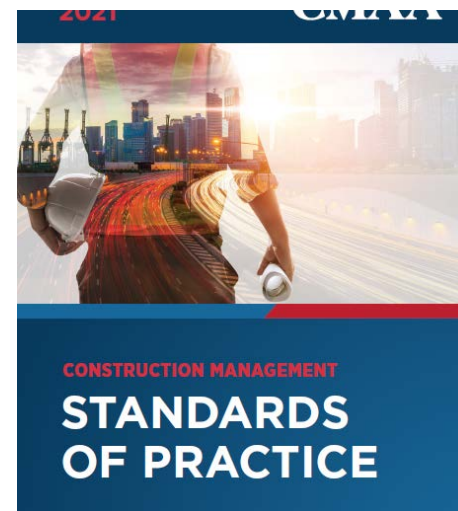
Regardless of the project delivery method used (discussed below), good construction management fundamentals and the standards described herein influence the successful outcome of a project or program. As a member of the team, the CM should assume a position of leadership. This should be a position of service, not dominance, which integrates all elements of the project delivery into a cohesive program and begins with the establishment of a management plan.



Professional construction management

In addition to an introduction to project delivery methods, this manual addresses the following distinct functions:

- | | | |
|---|----------------------------|--------------------------|
| 1. Professional Construction Management | 5. Quality Management | 9. Technology Management |
| 2. Project Management | 6. Contract Administration | 10. Risk Management |
| 3. Cost Management | 7. Safety Management | 11. Program Management |
| 4. Time Management | 8. Sustainability | |



Introduction

Trends in Expectations about Duties and Responsibilities of Construction Managers

David Arditi, M.ASCE¹; S. M. Reza Alavipour, Ph.D.²; and
The Committee on Management Practices in Construction (ASCE Construction Institute)

Abstract: This paper discusses the findings of a study conducted under the direction and supervision of the ASCE Committee on Management Practices in Construction (MPIC) to investigate the expectations of the parties involved in the construction process including designers, general contractors, subcontractors, owners, construction managers (CMs), and educators, relative to construction managers' duties and responsibilities. Statistical analysis was conducted to investigate if consensus exists among the parties and to highlight the agreements and disagreements between them. The findings were compared against the findings of an identical study also commissioned by MPIC 10 years before this study was performed. This study raises awareness among project participants about the fact that they should reconcile their differences and have a common understanding of CM duties over all phases of the construction project since general agreement over CM duties makes CM scope negotiations all the easier. DOI: 10.1061/(ASCE)CO.1943-7862.0001661. © 2019 American Society of Civil Engineers.

Author keywords: Designers; General contractors; Subcontractors; Owners; Construction managers; Construction management.

Read the paper uploaded to your profile...

Introduction



IIT Construction Engineering and Management Program – Chicago, Illinois

Please indicate below the construction management services expected in the Pre-Design Phase of the typical construction projects undertaken by your company.

Pre-Design Phase	Always Expected	Often Expected	Sometimes Expected	Seldom Expected	Never Expected
1. Develop scope of project and areas of use					
2. Conduct market research					
3. Collect typical operating costs, tax information, etc.					
4. Establish models for optimizing return on investment					
5. Develop broad outline schedule					
6. Develop conceptual budget					
7. Evaluate financing sources and alternatives					
8. Develop target design fees					
9. Develop feasibility study report					
10. Establish cash flow projections					

Let's see this file

Skills required to manage a construction project

To manage a construction project requires technical skills and knowledge (for example an electrical project would require the Project Manager to have knowledge in the electrical field, while managing a road project would require knowledge of the mechanics of road materials, and a concrete project would require knowledge of concrete structures).

Apart from the technical knowledge, Project Managers may also need to know and understand the performance of various types of equipment, pumps, and machines. Some of these items are used in the construction process while others will be included in the facility.

Prepared by Dr.
DO NOT DISTRIBUTE

Primary roles

- ◆◆ Managing the project team
- ◆◆ Performing pre-construction services
- ◆◆ Estimating the project
- ◆◆ Administering the contract
- ◆◆ Managing job site and construction operations
- ◆◆ Planning and scheduling the project
- ◆◆ Monitoring project performance
- ◆◆ Managing project quality
- ◆◆ Managing project safety
- ◆◆ Assessing and managing project risks

CONSTRUCTION MANAGEMENT ORGANIZATIONS

Introduction

❑ The **size and structure** of the construction management organization depend on

1. Size of the project,
2. Its complexity, and
3. Its location

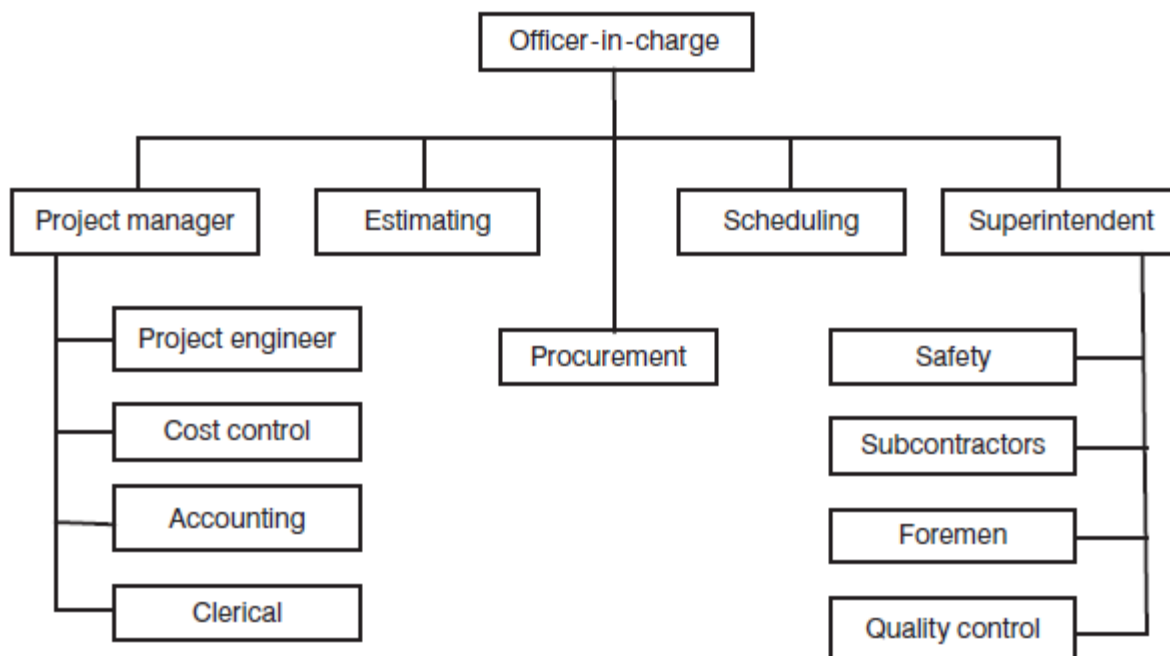
with respect to **other projects or the contractor's home office.**

❑ The cost of the **construction management organization** is considered project overhead and must be kept **economical to ensure** the cost of the **contractor's construction operation** is competitive with that of other contractors.

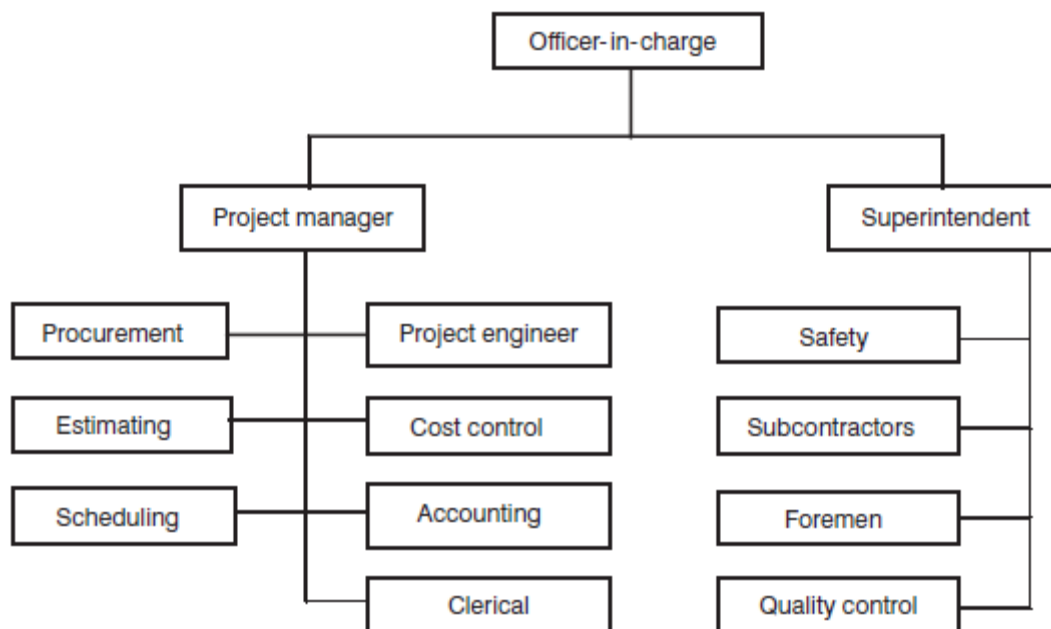
Introduction

- ❑ The goal in developing a **construction management organization** is to create the minimum organization needed to **manage the project effectively**.
 - ❖ If the project is unusually complex,
it may require **more technical people** than would be required for a simpler project.
 - ❖ If the project is located near other projects or the contractor's home office,
technical personnel can be **shared among projects**, or backup support can be provided from the home office.
 - ❖ If the project is located far from other contractor activities,
it must be **self-sufficient**.

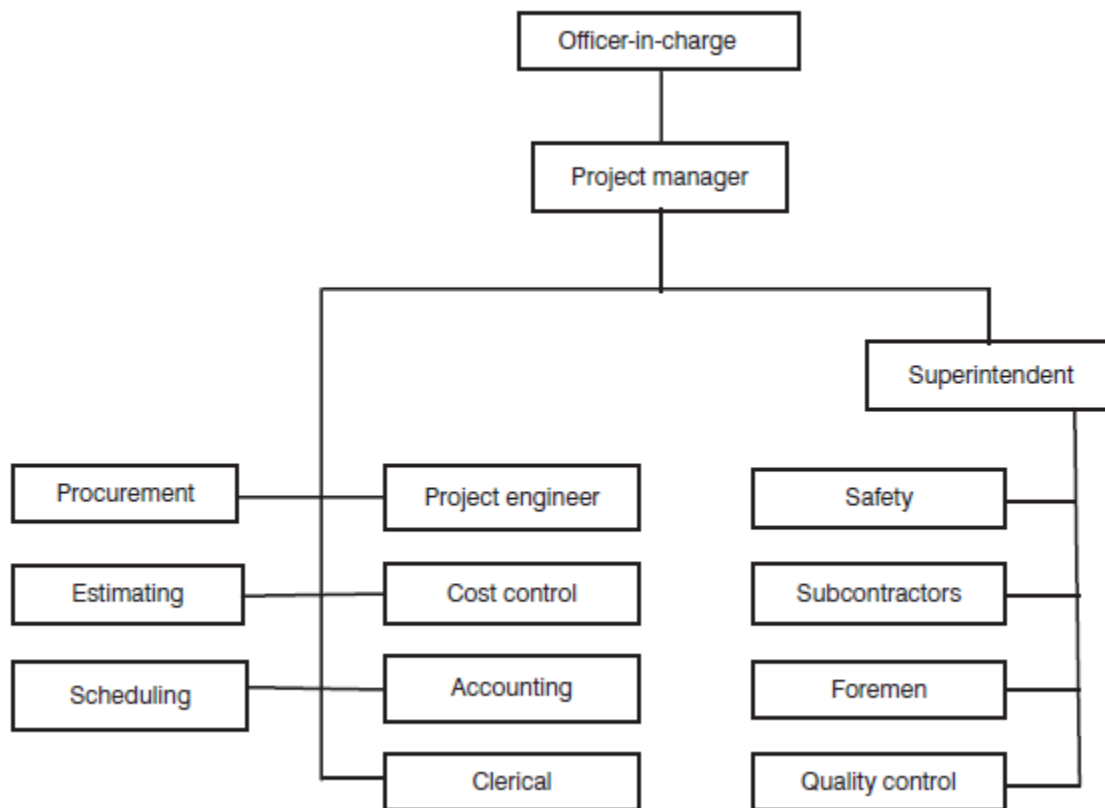
Contractor's project management organization with estimating and scheduling at home office



Contractor's project management organization with estimating and scheduling under project manager



Contractor's project management organization with superintendent reporting to project manager



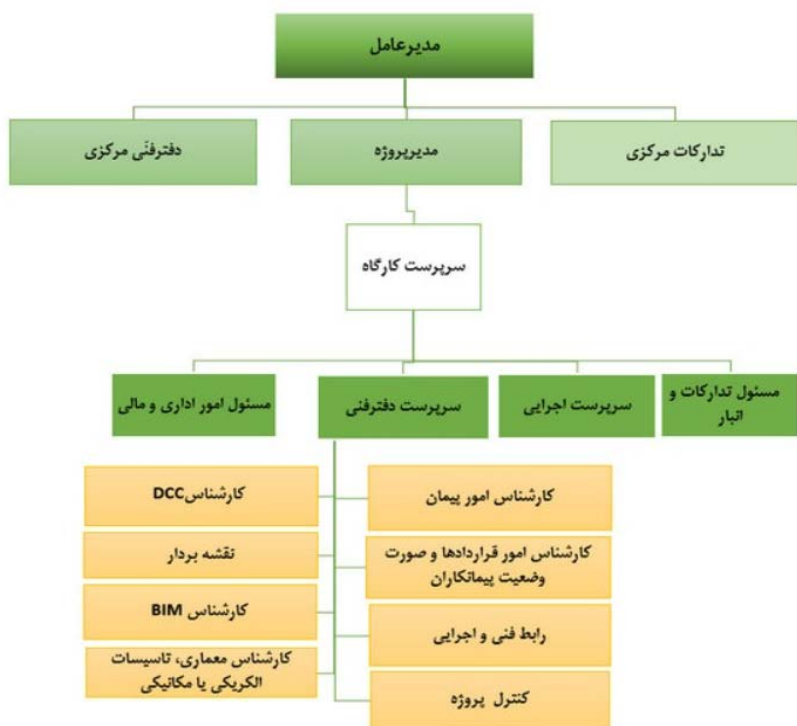
ساختار دفتر فنی در ایران

❑ ادبیات تولید شده بر اساس ساختار Estimators و Office Engineers و Field Engineers

❑ عدم توسعه مناسب به دلیل نبود آگاهی و وجود زیرساخت‌های مدیریت ساخت در گذشته

❑ متشکل از تخصص‌های متنوع از جمله مهندسين عمران، معماری، نقشه‌بردار، تکنسین‌های مختلف از دید فنی که

بسیاری اعتقاد دارند کارشناس کنترل پروژه نیز در این بخش فعالیت می‌کند که تفکر درستی نیست!



❑ بسیاری وظایف کنترل پروژه را در این دفتر

محدود به مدیریت اسناد و تهیه گزارشات

پروژه می‌نمایند.

❑ کنترل پروژه‌ای که به موارد منابع، زمان و هزینه

اطلاق می‌شود.

<https://sabzsaze.com/technical-office/>

نقش دفتر فنی در پروژه‌های ایران

- ❑ اصطلاح رایج در ایران **مهندس مترور** است که اگر بخواهیم نمونه مشابه آن را در ساختار مدیریت ساخت تعبیر نماییم به اصلاح **Estimator** می‌رسیم.
- ❑ عموماً متصدیان این بخش عملیاتی مانند **محاسبه** مقادیر، برآورد زمان و هزینه اجرای کار، برآورد منابع و اندازه‌گیری ورودی‌های تهیه پیشنهاد مناقصه و برنامه زمانی را به عهده دارند.
- ❑ البته استفاده از کارشناسان این دفتر برای محاسبات **مربوط به ادعا** نیز بسیار پررنگ بوده که همین وظیفه را Estimatorها در سیستم مدیریت ساخت بر عهده دارند.
- ❑ فراموش نکنید این دفتر فنی در هر دو بخش کارفرما/مشاور و پیمانکار وجود داشته و وظایف متفاوتی را بر عهده دارند.
- ❑ کار با نرم‌افزارهای متره اصلی‌ترین بخش متصدیان این بخش بوده که **تفاوت زیادی با آنچه در خارج از ایران** است، وجود دارد.

نقش دفتر فنی در پروژه‌های ایران

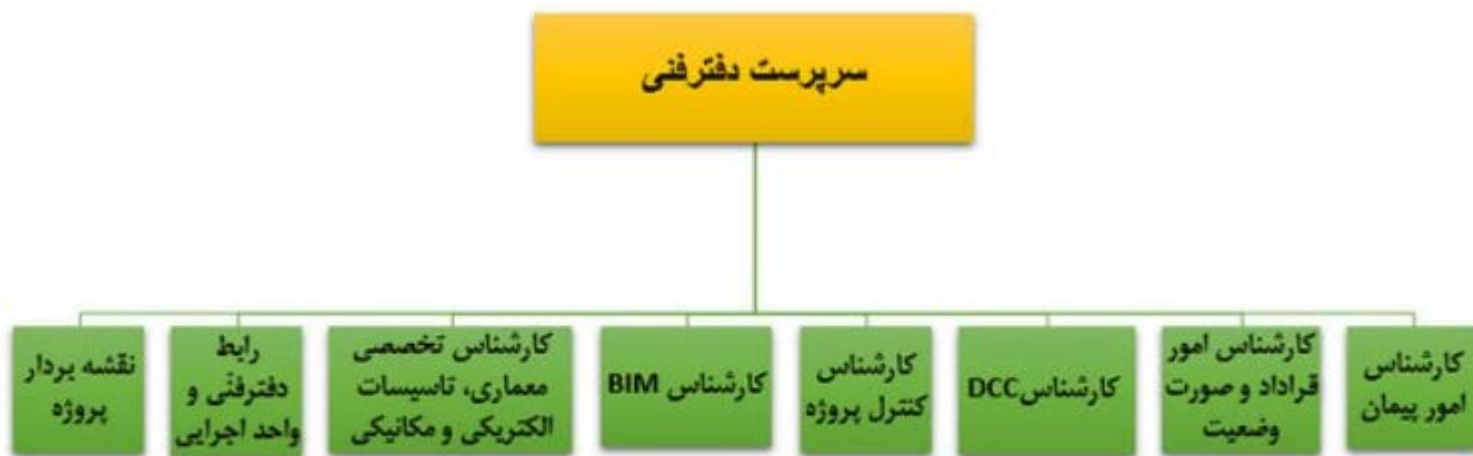
❑ **دفتر فنی کارفرما/مشاور** در حین اجرای کار وظایف متعددی از جمله بررسی صورت وضعیت‌ها، مدت اجرای

کار و نحوه صحیح اجرای کار را به عهده داشته و گاهی بررسی ادعاها را بر عهده دارد.

❖ **این وظایف عموماً** بر عهده Office Engineers و Field Engineers است!

❑ این افراد کارشناسانی برای حضور در فرآیند ادعا بوده و فراموش نکنید اگر **در این سطح به فعالیت بپردازید** در

پایین هرم شغلی CM قرار می‌گیرید.

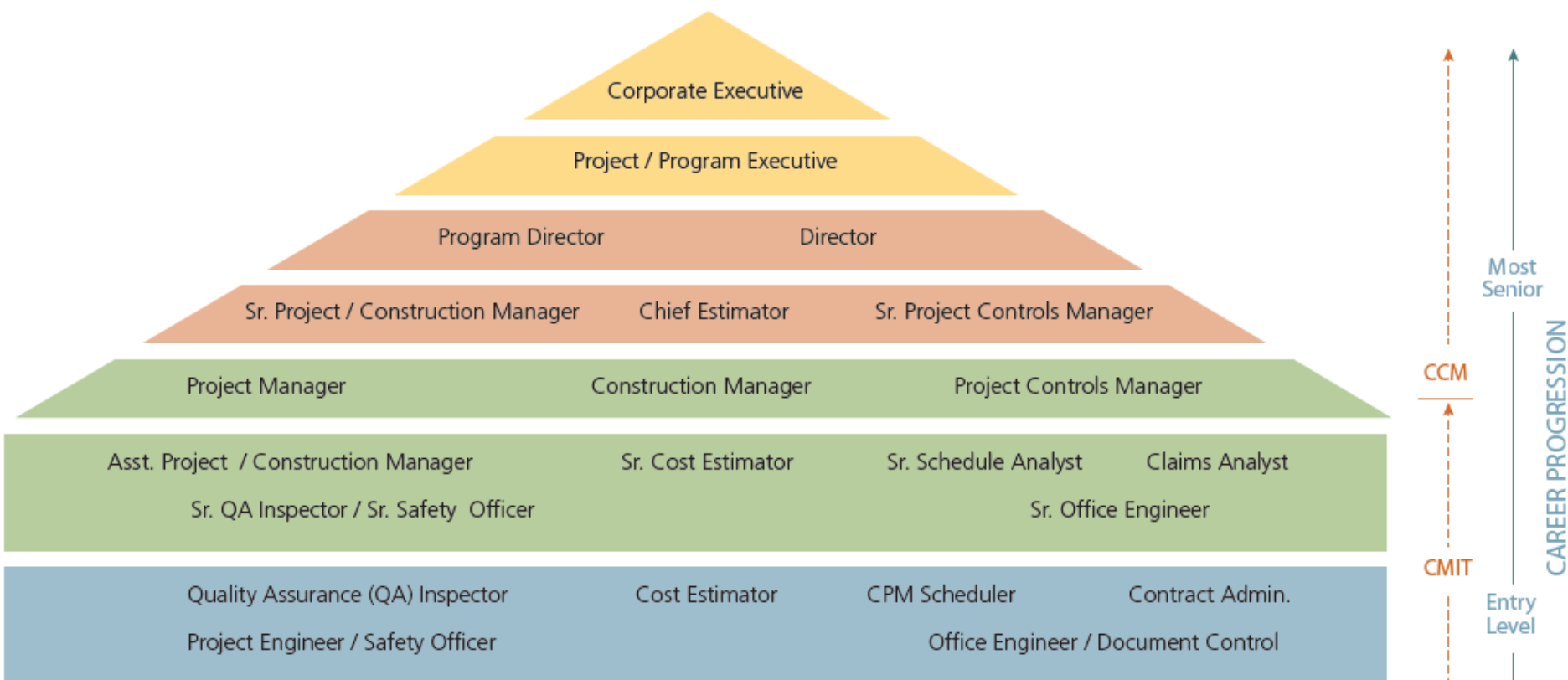


<https://sabzsaze.com/technical-office/>

جایگاه‌های شغلی دفتر فنی

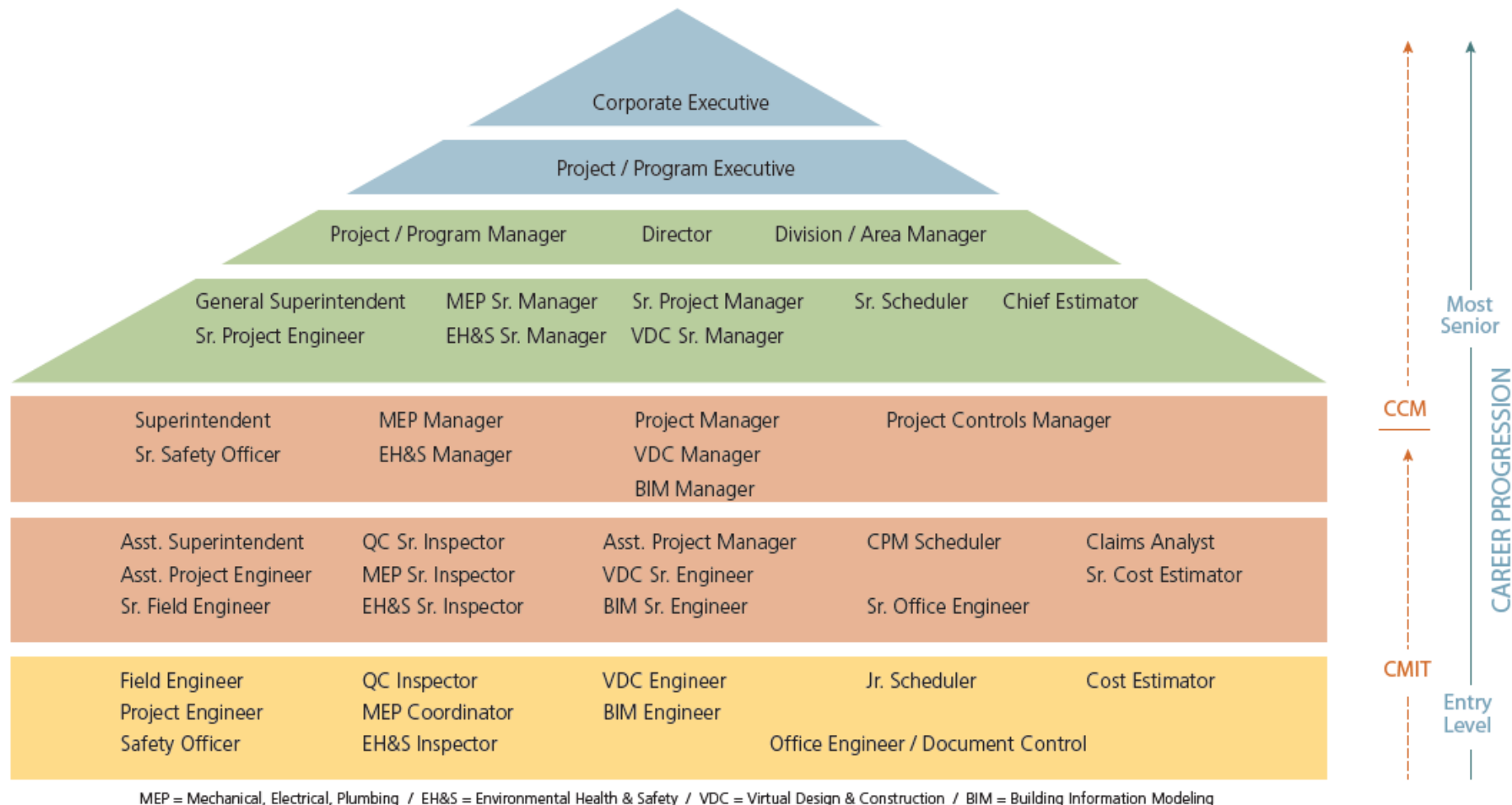
حال به سراغ نمونه ساختار یافته برویم!

Career progression agency construction management



Note: This is a general representation of potential career progress in an Agency CM firm. Actual titles, levels of progression and time spent at each level, will vary from company to company. There is no set progression of positions from one level to the next.

Career progression at-risk construction management



Note: This is a general representation of potential career progress in an At-Risk CM firm. Actual titles, levels of progression and time spent at each level. will vary from company to company. There is no set progression of positions from one level to the next.

DO YOU HAVE THE RIGHT STUFF?

- ☐ **FMI Corporation** is one of the **nation's leading consulting firms** to the **construction industry** (see its website at www.fminet.com).
- ☐ It has been conducting research and tracking construction management and manager success for **more than 65 years**.
- ☐ Based on its research, I have put together a **little fitness quiz**.
- ☐ **Get out a pencil and respond** to the following questions, using the **instructions given**.
- ☐ When you are all done,
 1. Add up your responses,
 2. Divide by the total number of questions, and
 3. Note your average score.

As you work through the quiz, keep in mind that there are **no right answers**.

Use the following scale of 1–7, where 1 = Strongly Disagree, 2 = Disagree, 3 = Somewhat Disagree, 4 = Neutral, 5 = Somewhat Agree, 6 = Agree, and 7 = Strongly Agree, to rate your reaction to each statement.

1. I consider myself detail oriented and take pride in making sure that everything is done correctly.

Strongly Disagree

Strongly Agree

1

2

3

4

5

6

7

2. I have strong written communication skills.

Strongly Disagree

Strongly Agree

1

2

3

4

5

6

7

3. I have strong verbal communication skills.

Strongly Disagree

Strongly Agree

1

2

3

4

5

6

7

4. I am good at meeting with people and finding new opportunities.

Strongly Disagree

Strongly Agree

1

2

3

4

5

6

7

5. I usually do whatever it takes to get the job done, even if it means working long hours.

Strongly Disagree

Strongly Agree

1

2

3

4

5

6

7

6. I have a good sense of humor.

Strongly Disagree

Strongly Agree

1

2

3

4

5

6

7

7. I like to look at problems in a systematic way, making sure that all aspects have been taken into account.

Strongly Disagree

Strongly Agree

1

2

3

4

5

6

7

8. I am very creative and am likely to find unique approaches to problems.

Strongly Disagree

Strongly Agree

1

2

3

4

5

6

7

9. I listen to what other people say and am willing to incorporate other people's suggestions into my plans.

Strongly Disagree

Strongly Agree

1 2 3 4 5 6 7

10. I like to work on projects that are visible and out there for the whole world to see and touch.

Strongly Disagree

Strongly Agree

1 2 3 4 5 6 7

11. I would rather work outdoors than in an office.

Strongly Disagree

Strongly Agree

1 2 3 4 5 6 7

12. I enjoy taking on risky projects, and I don't mind if there's some downtime between project activities.

Strongly Disagree

Strongly Agree

1 2 3 4 5 6 7

13. I don't mind getting dirty at work.

Strongly Disagree

Strongly Agree

1

2

3

4

5

6

7

14. I am more concerned about my own happiness in my choice of career than I am in what other people think of my choice.

Strongly Disagree

Strongly Agree

1

2

3

4

5

6

7

15. I like to compete.

Strongly Disagree

Strongly Agree

1

2

3

4

5

6

7

16. I do not take rejection personally, and I look at failure as an opportunity to learn.

Strongly Disagree

Strongly Agree

1

2

3

4

5

6

7

17. I do not give up easily.

Strongly Disagree

Strongly Agree

1 2 3 4 5 6 7

18. I like working in teams and with people of diverse backgrounds.

Strongly Disagree

Strongly Agree

1 2 3 4 5 6 7

19. I am able to prioritize and balance working on several tasks concurrently.

Strongly Disagree

Strongly Agree

1 2 3 4 5 6 7

20. I believe that there is always a solution to any problem and am willing to negotiate until a satisfactory solution can be found.

Strongly Disagree

Strongly Agree

1 2 3 4 5 6 7

So, how did you do?

- ☐ The nature of the questions should give you a **pretty good insight** into the type of **characteristics that tend** to show up in the **most successful construction managers**, at least according to FMI.
- ☐ If your **overall score** averaged a **4.0 or higher**,
you are probably well **suited for a career** in construction management.
- ☐ Remember, the industry is **filled with every kind of** personality and character type.

Do it and send your score to me via
ralavipour@gmail.com
Due on Wednesday!

- ❑ There are **so many positions** to fill and functions to **perform in construction management**

that it takes a **variety of skills, aptitudes, and characteristics** to get the job done.

- ❑ But one thing is sure: **every day is different in construction**, and you could **spend a lifetime learning** all there is to know about the industry.

Let's continue on the journey!

**CM ROADMAP
RELATED TO THIS SECTION**

CM Roadmap – Hard skills

مهارت‌های سخت (Hard Skills) - سطح کارشناسی و اجرایی					
سطح ۵	سطح ۴	سطح ۳	سطح ۲	سطح ۱	دپارتمان‌ها
	استاندارد مدیریت ساخت CMAA	متدولوژی Prince2	راهنمای PMBOK	مدیریت پروژه‌های صنعت ساخت	مدیریت پروژه
	تامین مالی پروژه			مدیریت مالی و هزینه پروژه ارزیابی اقتصادی پروژه	مدیریت مالی و هزینه
				برنامه‌ریزی و کنترل پروژه نرم‌افزار MSP نرم‌افزار P6	مدیریت برنامه‌ریزی و زمان‌بندی
		مدیریت کیفیت پروژه			مدیریت کیفیت
اجرای پروژه به روش CM			مدیریت ادعاء و اختلافات	آنالیز تاخیرات پروژه	مدیریت قرارداد
		مدیریت ایمنی پروژه			مدیریت ایمنی
مدیریت طرح		مدیریت چابک Agile	مدیریت پروژه به روش Lean دفتر مدیریت پروژه (PMO)		مدیریت طرح و برنامه
		مدیریت پایداری پروژه			مدیریت پایداری
			مدیریت ریسک پروژه		مدیریت ریسک
			نرم‌افزار Power BI	مدیریت اسناد و مدارک پروژه	مدیریت اطلاعات
	مدیریت BIM در پروژه		نرم‌افزارهای BIM		مدیریت مدل‌سازی اطلاعات ساختمان (BIM)

Relevant comprehensive courses



<https://dralavipour.com/general-course/PMBOK>



<https://dralavipour.com/general-course/construction-management>

Relevant comprehensive courses

CM Standards
Next years...

[https://dralavipour.com/gener
al-course/CM-Standards](https://dralavipour.com/gener-al-course/CM-Standards)

Prince2
Next years...

[https://dralavipour.com/gener
al-course/Prince2](https://dralavipour.com/gener-al-course/Prince2)

Prepared by Dr. Alavipour
DO NOT DISTRIBUTE

CM Roadmap – Hard skills



مهارت‌های سخت (Hard Skills) - سطح ارشد استراتژی

سطح ۵	سطح ۴	سطح ۳	سطح ۲	سطح ۱	دپارتمان‌ها
		منشور اخلاق در مدیریت پروژه			مدیریت پروژه
			استراتژی مدیریت هزینه و مهندسی ارزش		مدیریت مالی و هزینه
			استراتژی مدیریت برنامه‌ریزی و زمان‌بندی		مدیریت برنامه‌ریزی و زمان‌بندی
	استراتژی مدیریت کیفیت				مدیریت کیفیت
		استراتژی مدیریت قرارداد		اصول مدیریت ساخت	مدیریت قرارداد
	استراتژی مدیریت ایمنی				مدیریت ایمنی
استراتژی مدیریت طرح و برنامه					مدیریت طرح و برنامه
	استراتژی مدیریت پایداری				مدیریت پایداری
		استراتژی مدیریت ریسک			مدیریت ریسک
		استراتژی مدیریت اطلاعات			مدیریت اطلاعات
استراتژی مدیریت BIM					مدیریت مدل‌سازی اطلاعات ساختمان (BIM)

Relevant comprehensive courses



<https://dralavipour.com/video-course/web10>

Relevant comprehensive courses

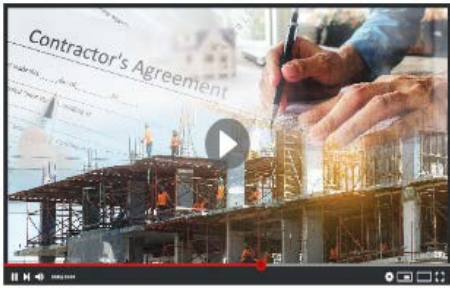


Video Course

موسسه تخصصی
و مدیریت ساخت آلایپور

روش اجرای عامل چهارمی CM-AT-RISK با
قرارداد حداکثر قیمت تضمین شده (GMP)

<https://dralavipour.com/video-course/web15>

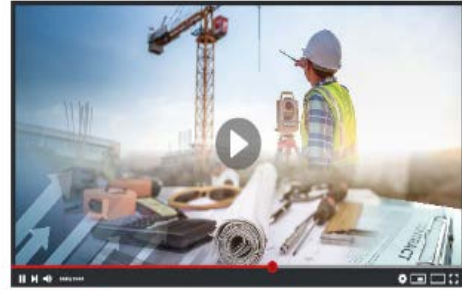


Video Course

موسسه تخصصی
و مدیریت ساخت آلایپور

روش اجرا و قراردادهای دو عاملی طرح و
ساخت (Design-Build)

<https://dralavipour.com/video-course/db>



Video Course

موسسه تخصصی
و مدیریت ساخت آلایپور

قراردادهای سه عاملی طرح-مناقصه-ساخت و
نکات مهم برای بهبود آنها

<https://dralavipour.com/video-course/web22>

Relevant comprehensive courses

Project Management Ethics
Next years...

**[https://dralavipour.com/gener
al-course/PM-ethics](https://dralavipour.com/gener
al-course/PM-ethics)**

موسسه مهندسی و مدیریت ساخت علوی پور (ACEMI)

دفتر آموزش



تهران، بلوار فردوس شرق، مجتمع آبگینه، طبقه سوم اداری، واحد C42



+۹۸ ۲۱ ۴۶ ۱۰۰ ۴۴۵



+۹۸ ۲۱ ۴۶ ۱۰۰ ۴۵۰



info@dralavipour.com



www.dralavipour.com



@alavipour_pm



@acemi_social



@alavipour_pm



@IRANACEMI





مدیریت پروژه‌های صنعت ساخت (ساختمانی، زیرساختی و صنعتی)

فصل سوم: قراردادهای ساخت
ساختار کلی مناقصات
ساختار قراردادی و تفصیلی مناقصات

ارائه دهنده:

سید محمدرضا علوی پور

(PhD, PMP, CMIT)

دانشگاه Illinois Tech آمریکا

What we will learn?

- ☐ How we get the work?
- ☐ Construction contracts
- ☐ Organization of contract documents
- ☐ Contract pricing methods
- ☐ Standard contract forms
- ☐ Bonds
- ☐ Insurance
- ☐ Procurement methods
- ☐ Making the bid/no bid decision
- ☐ Subcontracting

Prepared by Dr. Alavipour
DO NOT DISTRIBUTE

HOW WE GET THE WORK?

Introduction

- ❑ Before you can **start managing any project**, you must have a **project to manage**.
- ❑ To get a project to manage, the **contractor must first find projects to bid and then win** the opportunity to build them.
- ❑ Finding and getting work is a crucial factor in the **success of a construction firm**.
- ❑ **Obtaining information** about upcoming projects is a big part of the **overall marketing effort** of the construction company.

How about marketing?

Marketing efforts

- ❑ Today, as **construction management services** become more and more sophisticated, the **real effort** is focused on convincing owners that they should bring the construction management team on **board early** to **ensure** the greatest chances for **project success**.

Prepared by Dr. Alavipour
DO NOT DISTRIBUTE

The rules of the game

- ❑ Many states' **public contract laws** have required the selection of building contractors **solely** on the basis of the lowest responsible bid.
- ❑ **For years**, many **private owners** adopted **similar procedures** for buying construction services.
- ❑ Interestingly, **today legislative reforms** have resulted in **both public and private owners** having a few **more options available** to them.

The rules of the game

- ❑ Much of this section will **address those options**.

*However, before getting into those options, let's first take a look at the **aspects of the contracting laws** that **remain the same**.*

**First
Public vs. Private
Projects**

Public projects

☐ The **open bid process** must be used.

☐ In **open bidding**, the project must

1. Be **publicly advertised** in newspapers and trade journals, and
2. **Any contractor** is allowed to submit a bid.

open bid

A competitive bidding requirement for most public projects. An open bid is one that is advertised publicly and allows any qualified contractor to submit a bid on the project.

Private projects

- ❑ Private owners are **not restricted** by the rules set forth in **open bidding**.
- ❑ In other words, bidding is **“by invitation only.”**
 - ❖ Closed bid
- ❑ The **owners** often send out an invitation for **bids in letter form** to the **selected number of contractors**.
- ❑ They may **choose contractors** with whom they already have good working relationships or handpick contractors who have a reputation for quality and performance relative to the project type.

closed bid

Used with private projects and is not open to the public. Bidding is by invitation only, via an invitation for bids, to a selected list of contractors.

invitation for bids

A notification sent to a selected list of contractors, furnishing information on the submission of bids on a private project.

Private projects

- ☐ The owner can narrow the qualification criteria and limit the number of contractors who are allowed to compete.
- ☐ Prequalification, bid bonds, performance bonds, and labor and material payment bonds are **common requirements** of contracts for private work as well.

prequalification

The process in which an owner, based on minimum financial, management, and other qualitative data, determines whether a construction firm is fundamentally qualified to compete for a certain project or class of projects.

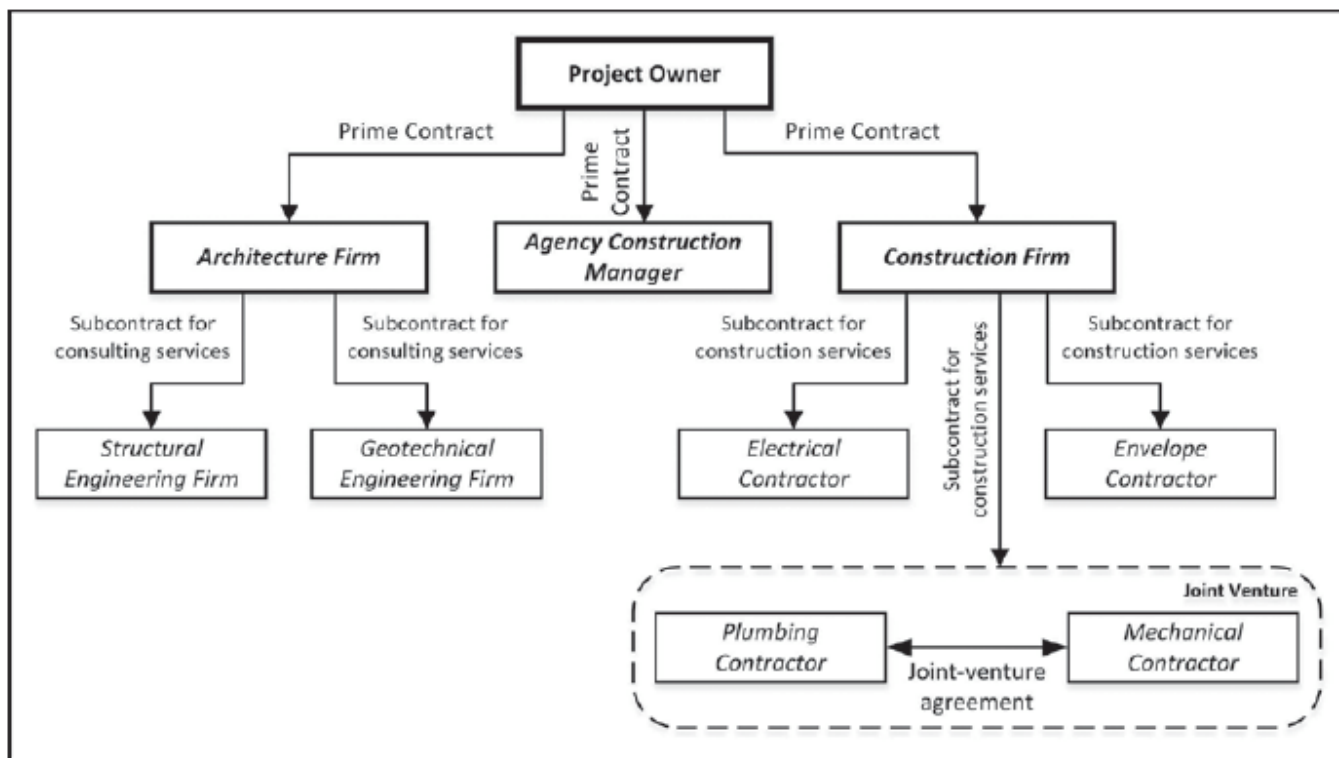
CONSTRUCTION CONTRACTS

Contract

- ☐ A **contract** is a legal document that describes the rights and responsibilities of the parties, for example, the **owner** and the **general contractor**.
- ☐ The terms and conditions of their relationship are defined **solely within the contract documents**.
- ☐ These documents should be **read and completely understood** by the contractor before deciding to **pursue** a project.
- ☐ They also are the **basis** for determining a project budget and schedule.

How does it relate to the success of the project?

Types of contracts



Construction manager and contract

- ❑ To manage a project successfully, the **project manager** must
 1. Understand the organization of the contract documents and
 2. Understand the contractual requirements for his or her project.

This knowledge is **essential**.

The **Project Manager** must understand the **laws governing the contract**. These laws **vary from country to country**, and from state to state. Clients and managing contractors **often operate in a different country**, and elect to use the laws of their home country, so the contract may **not necessarily** be within the **jurisdiction of the laws of the country** or state where the project is located. These laws and legal systems may be **unfamiliar to the contractor**, and can leave the unsuspecting contractor exposed to working within a legal system they aren't familiar with.

Contractor and contract

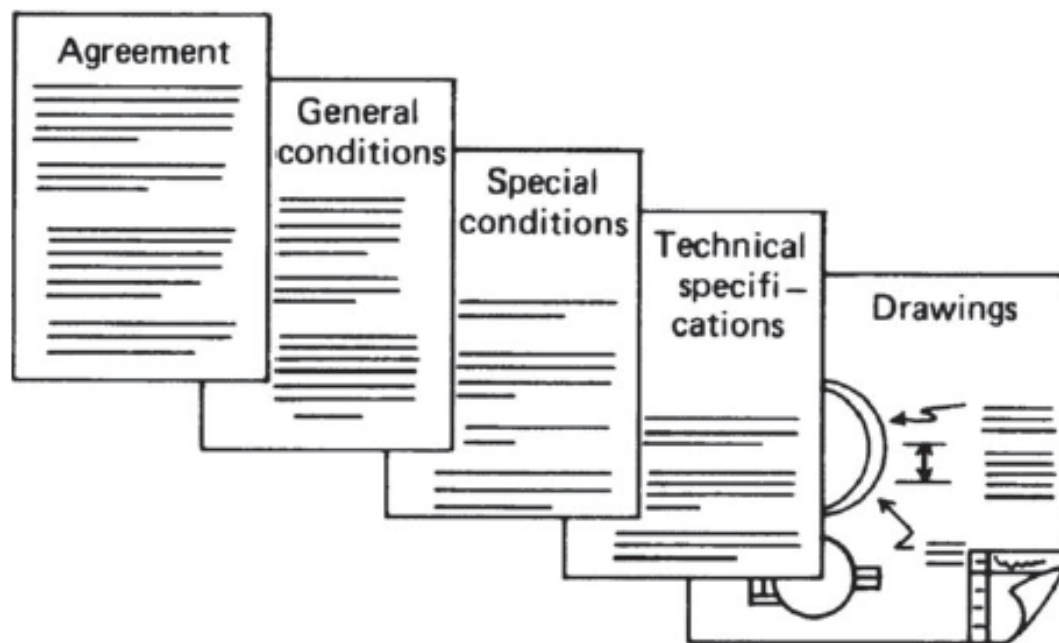
- ☐ The contractor is expected to have the **professional expertise** required to
 1. **Understand** the contract documents and
 2. **Select** appropriate subcontractors or
 3. **Select** qualified tradespeople, materials, and equipmentto **complete** the project safely and achieve the quality requirements specified.

Prepared by Dr. Alavipour
DO NOT DISTRIBUTE

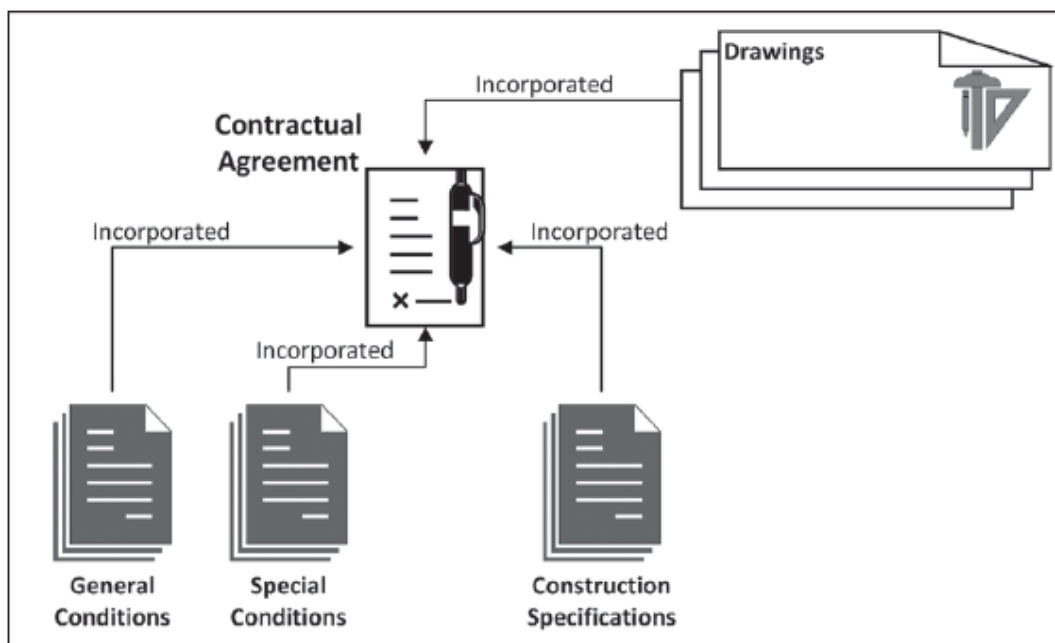
ORGANIZATION OF CONTRACT DOCUMENTS

Typical construction contract

- ❑ A **typical construction contract** consists of the five documents.
- ❑ A **special conditions** section is not always used,
unless there are **some specific requirements or restrictions** placed on the contractor for the project.



Typical construction contract



Typical construction contract

☐ In some cases, such as the **ConsensusDocs example** used in our claim course,

1. Agreement
2. General conditions

are **combined** into a single document.

☐ **Some project owners** use a project manual that contains

- ❖ General conditions,
- ❖ Special conditions,
- ❖ Soils report,
- ❖ Erosion control requirements,
- ❖ Prevailing wage rates, and
- ❖ Other project related documents



Invitation to bid

ADVERTISEMENT FOR BIDS

Sealed proposals will be received by ABC School District at the Central Administration Building, 1111 Penny Lane, Paso Robles, CA, until 2:00 p.m., April 1, 20__ for a

New Administration Building

(located at 101 Schoolhouse Circle, Paso Robles, CA)

at which time and place, they will be publicly opened and read.

A cashier's check or Bid Bond payable to the ABC School District in an amount not less than five (5) percent of the amount of the bid, but in no event more than \$10,000, must accompany the bidder's proposal. Performance and Payment Bonds and evidence of insurance required in the bid documents will be required at the signing of the contract.

Drawings and specifications may be examined at the office of A.B. Architects & Associates, 2000 Ponderosa Street, Atascadero, CA and at the Jackson County Builders Exchange.

Bid documents may be obtained from the Architect upon deposit of \$125 per set, which will be refunded in full on the first two sets issued to each general contract bidder submitting a bona fide bid, upon return of documents in good condition within ten days of bid date. Other sets for general contractors, and sets for subcontractors and dealers, may be obtained with the same deposit, which will be refunded as above, less the cost of printing, reproduction, handling, and distribution.

Bids must be submitted on proposal forms furnished by the Architect or copies thereof. Incomplete bid proposals will invalidate the bid proposal and the bid will be rejected and returned to the bidder. The right to accept any bid, or to reject any or all bids and to waive all formalities is hereby reserved by the ABC School District.

A pre-bid conference will be held on Friday, March 15, 20__ at 1:00 p.m. on the site of the proposed project. All bidders are required to attend the conference.

Could we change the contract documents?

Change of contract documents

❑ Any of the contract documents can be **modified** by

1. Addenda

❖ Addenda are issued by the **owner** prior to award of the contract.

2. Change orders

❖ Change orders are executed between the **owner and the contractor** after contract award.

Any addenda or change orders used also are considered to be contract documents

Agreement?

Agreement

☐ The agreement describes

- ❖ **Project** to be constructed;
- ❖ **Pricing method** to be used and
- ❖ **Cost**, if lump sum, or **Fee structure**, if cost-plus;
- ❖ **Time** allowed for construction;
- ❖ Any **liquidated damages**; and
- ❖ **Name** of the owner and the contractor

Supporting Documents?

Supporting documents

❑ Supporting documents may be incorporated into the **agreement** by reference or as exhibits.

❖ *Examples might be a geotechnical evaluation of the project site, erosion control plan requirements, traffic control plan requirements, and hazardous materials management plan requirements.*

These documents then become part of the contract documents.

General Conditions?

General conditions

- ☐ The general conditions provide a **set of operating procedures** that the **owner typically uses** on all projects.
- ☐ They describe
 1. **Relationship** between the owner and the contractor,
 2. **Authorities** of the owner's representatives or agents, and
 3. **Terms** of the contract
- ☐ Some owners use **standard general conditions** published by professional organizations such as those discussed later in this section.

What typically included in **General Conditions**?

Topics in general conditions

❑ Topics typically addressed in the **general conditions** are:

- ❖ Rights and responsibilities of the owner;
- ❖ Authorities of the designer or construction manager;
- ❖ Rights and responsibilities of the contractor;
- ❖ Bonds and insurance;
- ❖ Changes in contract scope of work;
- ❖ Changes in contract price or fee;
- ❖ Changes in contract time;
- ❖ Inspections;
- ❖ Uncovering defects and correction of work;
- ❖ Protection of personnel and property;
- ❖ Progress payments;
- ❖ Subcontracting;
- ❖ Contract close-out procedures;
- ❖ Warranty of work;
- ❖ Resolution of disputes; and
- ❖ Early termination of the contract.

Special Conditions?

Special or supplementary conditions

- ❑ The **special or supplementary conditions** contain any unique requirements for the specific project.
- ❑ Examples of special conditions requirements are:
 - ❖ Site access restrictions;
 - ❖ Site security requirements;
 - ❖ Permission requirements for night or weekend work;
 - ❖ Location of parking for contractor's employees;
 - ❖ Listing of equipment furnished by owner;
 - ❖ Required insurance coverage limits; and
 - ❖ Mandatory (prevailing) wage rates (generally only on public projects).

Special or supplementary conditions

❑ Owners who use standard general conditions

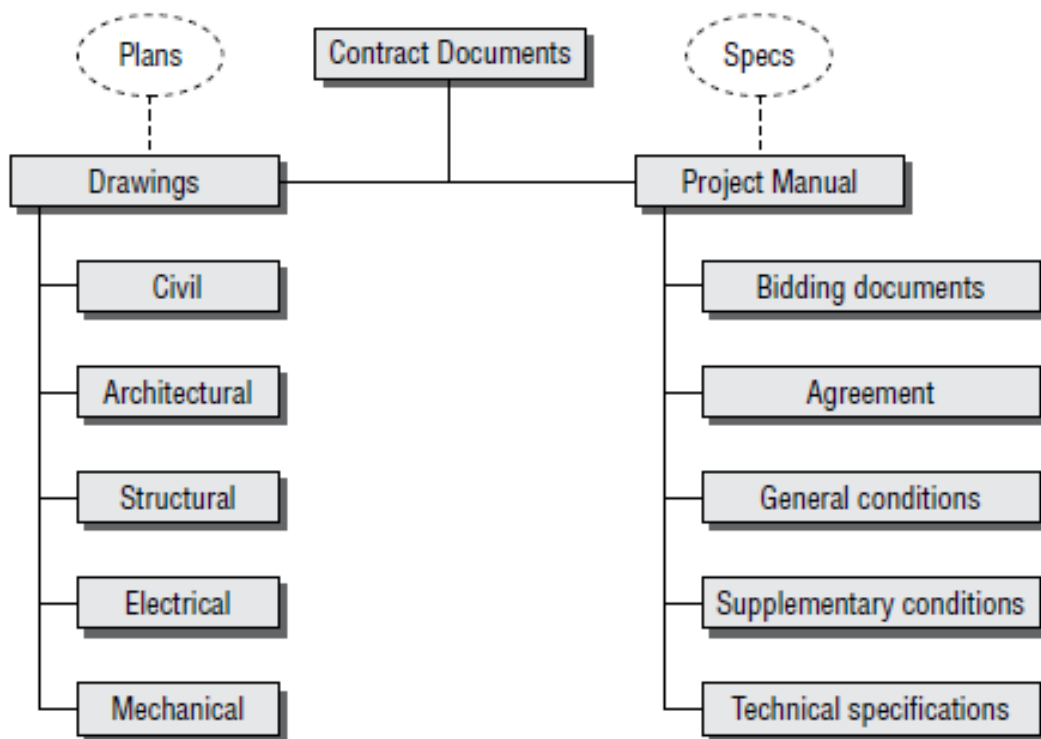
also may use the special conditions to **modify selected general conditions** requirements for a specific project.

❑ The **special conditions** for a construction contract usually are addressed in Division 00 of the **specifications**.

Specifications?

Division 00	Procurement and contracting requirements	Division 26	Electrical
Division 01	General requirements	Division 27	Communications
Division 02	Existing conditions	Division 28	Electrical safety and security
Division 03	Concrete	Division 31	Earthwork
Division 04	Masonry	Division 32	Exterior improvements
Division 05	Metals	Division 33	Utilities
Division 06	Wood, plastics, and composites	Division 34	Transportation
Division 07	Thermal and moisture protection	Division 35	Waterway and marine construction
Division 08	Openings	Division 40	Process interconnections
Division 09	Finishes	Division 41	Material processing and handling equipment
Division 10	Specialties	Division 42	Process heating, cooling, and drying equipment
Division 11	Equipment	Division 43	Process gas and liquid handling, purification, and storage equipment
Division 12	Furnishings	Division 44	Pollution and waste control equipment
Division 13	Special construction	Division 45	Industry-specific manufacturing equipment
Division 14	Conveying equipment	Division 46	Water and wastewater
Division 21	Fire suppression	Division 48	Electrical power generation
Division 22	Plumbing		
Division 23	Heating, ventilating, and air conditioning		
Division 25	Integrated automation		

Special or supplementary conditions



Specifications

- ❑ The **technical specifications** provide the qualitative requirements for construction materials, equipment to be installed, and workmanship.
- ❑ They **typically** are organized using the **MasterFormat** that was developed by the Construction Specifications Institute (CSI).
- ❑ Each **division of the specifications** is further subdivided using a **standard six-digit code** developed by CSI.
 - ❖ For example, **Section 064023** refers to interior architectural millwork.
 - ❖ Prior to 2004, the MasterFormat had fewer divisions shown in **next slide**.

Specifications – MasterFormat for technical specifications

Division 00	Supplemental conditions	Division 09	Finishes
Division 01	General requirements	Division 10	Specialties
Division 02	Site construction	Division 11	Equipment
Division 03	Concrete	Division 12	Furnishings
Division 04	Masonry	Division 13	Special Systems
Division 05	Metals	Division 14	Hoisting Systems
Division 06	Wood, plastics, and composites	Division 15	Mechanical
Division 07	Thermal and moisture protection	Division 16	Electrical
Division 08	Openings		

Specifications

❑ There are **four types of technical specifications** used in construction contracts:

1. Descriptive specifications detail the **required properties and quality** of a material, assembly of materials, or products;
2. Performance specifications establish **functional criteria** for acceptable materials or products;
3. Proprietary specifications identify **acceptable products** by brand name, model number, or trade name; and
4. Reference standard specifications reference **well-known standards** such as the American society for testing and materials (ASTM), American concrete institute (ACI), national electrical code (NEC), national plumbing code (NPC), and national fire protection association (NFPA).
 - ❖ The types of specifications are **not mutually exclusive**.
 - ❖ A single specification may **contain** descriptive and reference requirements.

Drawings

- ☐ The **drawings** show the quantitative requirements for the project and how the various **components go together** to form the completed project.
- ☐ The **drawings** may be printed on paper or produced electronically.
- ☐ The **initial set of drawings** issued to the contractor is updated, as required, throughout the **duration of the project** to reflect modifications made by **change orders**.
- ☐ These **updated construction drawings** become the basis for the **set of as-built** (or record) drawings that the contractor provides to the owner at **project close-out**.

CONTRACT PRICING METHODS

Lump sum

- ❑ **Lump sum** (sometimes called stipulated-sum or fixed-price) contracts are used when the **scope of work** can be **defined**.
- ❑ The **owner provides** a set of drawings and specifications, and the **contractor** agrees to **complete the project** for a lump sum.
- ❑ Lump sum contracts also **often are used** for design-build projects where
 1. **Owner** specifies **design criteria**, and
 2. **Contractor** agrees to design and construct the project for a **single price**.

Lump sum

- ☐ While the **exact scope of work** is **not defined** in a design-build project, the contractor
 1. **Controls** the design process and
 2. **Produces** a design that can be **built** for the **contract price**

- ☐ In a **lump sum contract**, the contractor is responsible for **determining** all the material, labor, equipment, and subcontract costs to establish the project cost.

- ☐ The **initial contract price** accepted by the owner at contract award may be modified during the life of the project by contract change orders.

Lump sum – Sample

Contract Amount	Actual Cost	Contractor Impact	Owner Impact
\$2,000,000	\$2,029,000	Contractor suffers a \$29,000 loss.	No impact, because the contract amount remains the same.
\$2,000,000	\$1,990,000	Contractor earns an additional \$10,000.	No impact, because the contract amount remains the same.

Unit price

☐ Unit price contracts are used

when the **exact quantities** of work are not known at the **time the contract** is executed.

1. Designer provides an **estimate of the quantity** of each material required, and
2. Contractor determines a **unit price** for each material

Prepared by Dr. Alavipour
DO NOT DISTRIBUTE

Unit price – Sample

- ❑ The cost data shown in **italics** would be entered on the form by the **contractor** and submitted to the owner as the **bid for the project**.

<i>Work items</i>	<i>Unit</i>	<i>Estimated quantity</i>	<i>Unit price</i>	<i>Bid amount</i>
Soil excavation	cubic yards	12,000	<i>\$6.00</i>	<i>\$72,000</i>
12" concrete pipe	linear feet	1,000	<i>\$18.00</i>	<i>\$18,000</i>
Crushed rock fill	cubic yards	3,000	<i>\$24.00</i>	<i>\$72,000</i>
Compacted fill	cubic yards	9,000	<i>\$15.00</i>	<i>\$135,000</i>
TOTAL				\$297,000

Prepared
DO NOT DIS

Unit price

- ☐ The **actual contract value** for each item is not determined
until the completion of the project.
- ☐ The **actual quantities of work** are measured throughout the completion of the project,
and the cost is determined by multiplying the actual quantity by the unit price established
by the contractor.
- ☐ Unit price contracts are used extensively on highway jobs or environmental clean-up jobs
where **exact quantities** of work are difficult to define.

Unit price – Sample

Work Item	Estimated Quantities*	Contract Unit Prices	Bid Amount	Actual Quantities	Final Cost
Trench excavation	14,000 CY	\$5.25	\$73,500	13,500 CY	\$70,875
8" pipe	1,750 LF	\$18.24	\$31,920	1,750 LF	\$31,920
Engineered fill	4,500 CY	\$22.50	\$101,250	4,700 CY	\$105,750
Backfill	9,500 CY	\$4.00	\$38,000	9,800 CY	\$39,200
TOTAL			\$244,670		\$247,745

* Provided by owner

Unit price – Sample

Item Number	Quantity	Unit	Description	Unit Price	Total Amount
1	550	cubic yard (cu yd)	Rock excavation (for structures and pipes only)	\$_____	\$_____
2	50	linear foot (lin ft)	8-in. C.I. force main	\$_____	\$_____
3	20	cubic yard (cu yd)	Trench excavation for pipes	\$_____	\$_____
4	200	square yard (sq yd)	Paving	\$_____	\$_____

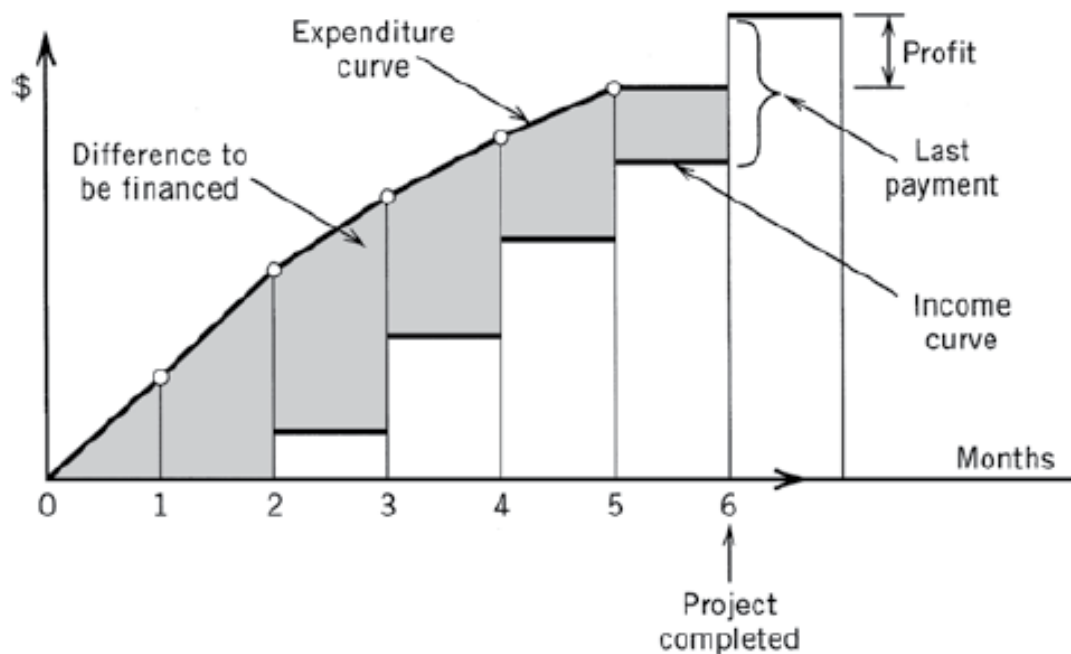
Lump sum and unit price

- ☐ Unit price and lump sum methods can **both be used** in the same contract.
- ☐ Sometimes the foundation portion of a building may be **unit price**, while the remainder of the building is **lump sum**.

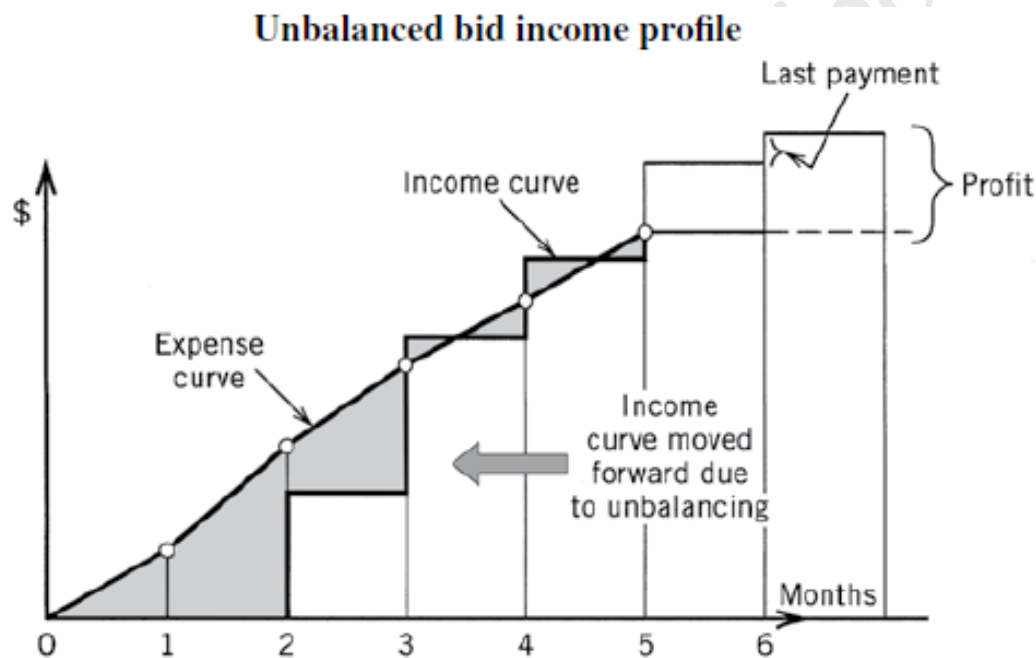
Prepared by Dr. Alavipour
DO NOT DISTRIBUTE

Unit price – Expense/income curves

Project expense/income curves

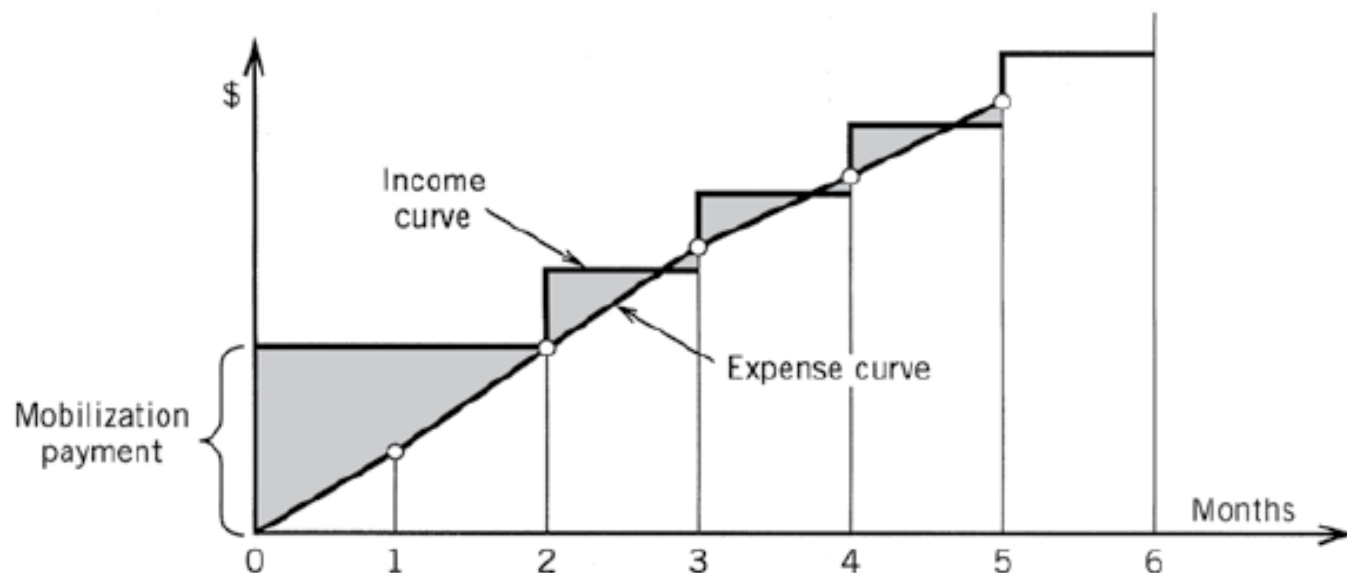


Unit price – Unbalanced bid



Unit price – Impact of mobilization

Income profile with mobilization payment



Cost price

- ❑ **Cost-plus contracts** are used
when the **scope** of work **cannot be defined**.
- ❑ They are sometimes referred to as cost-reimbursable contracts.
- ❑ All specified contractor's **project-related costs** are reimbursed by the owner, and
a **fee is added** to cover profit and company overhead.
- ❑ **Only those costs** identified in the contract are **reimbursable**.
 - ❖ They also frequently are used in **emergency conditions** such as reconstruction after a major natural disaster, such as a hurricane, earthquake, or flood.

time and materials

Another name for a cost-plus-fee contract. These are the two cost factors that are reimbursed under a cost-plus-fee contract. Time equates to the cost of the labor, and materials equate to the cost of the building products used in the construction.

Cost price

❑ The fee may be

1. Fixed amount

- ❖ The fee in a cost-plus-fixed-fee contract is a fixed amount **irrespective** of the **actual construction cost**.

2. Percentage of project costs

- ❖ The fee in a cost-plus-percentage-fee contract is a percentage of the actual project cost.

3. Incentive component

- ❖ The fee in a cost-plus-incentive-fee or cost-plus-award fee contract is a **variable** based on the contractor's performance.

The owner establishes a set of criteria that are used to determine the actual fee.

INCENTIVE/DISINCENTIVE PROVISIONS IN HIGHWAY CONTRACTS

By David Arditi,¹ Member, ASCE, C. Jotin Khisty,² Member, ASCE, and
Firuzan Yasamis,³ Student Member, ASCE

ABSTRACT: The objective of the study reported in this paper is to compare contracts that include incentive/disincentive (I/D) provisions against contracts that do not include I/D provisions, with regard to the consequences of these measures. The study involves both completed and ongoing highway and bridge renovation/rehabilitation projects undertaken by the Illinois Department of Transportation (IDOT). After a general overview of I/D implementation, the results of a study that covered 28 I/D contracts (contracts that included I/D provisions) and 29 non-I/D contracts undertaken by IDOT during the five-year period 1989–93 are presented. The major finding of this study is that the majority of the I/D contracts are completed on time or sooner, which supports the use of I/D provisions in these contracts. However, this saving in contract duration seems to be accompanied by increased project costs most of the time.

Read the paper uploaded for you!

Cost price – Sample

Actual Cost	Fee as % of Cost'	Contract Amount	Contractor Impact	Owner Impact
\$1,994,500	\$99,725	\$2,094,225	None. The contractor still earns a 5% fee.	\$94,225 over budget amount of \$2,000,000.

Cost plus with guaranteed maximum price

- ❑ A guaranteed maximum price (GMP) contract is a **type of cost-plus contract** in which the **contractor agrees** to construct the project at or below a specified cost.
- ❑ Any **cost exceeding** the GMP would be borne by the contractor.

guaranteed maximum price (GMP)

A contract methodology in which the contractor is reimbursed for actual costs of materials, labor, equipment, subcontracts, overhead, and profit up to a maximum fixed-price amount. Any costs over the maximum price shall be borne by the contractor. Any savings below the maximum price will revert to the owner. This type of contract is often implemented when design is less than 100 percent complete.

Cost plus with guaranteed maximum price

- ❑ Some of these contracts have a saving-sharing formula
if the **actual cost is less than** the guaranteed maximum value.
- ❑ This is to provide an **incentive to the contractor** to control costs.
 - ❖ *For example, 20 percent of the savings might go to the contractor and 80 percent to the owner.*
 - ❖ *In other GMP contracts, all the savings accrue to the owner.*

When using a GMP contract, a smart owner often provides an incentive to the contractor for working as efficiently as possible by agreeing to split any savings with the contractor. The owner may offer splits in the 60/40 range or even 50/50 range. However, even without shared savings, there is still a great incentive for the contractor to perform well. Any time a contractor can return money to an owner, the odds for repeat business go way up.

NOTE

Cost plus with guaranteed maximum price – Sample

GMP Contract Amount	Actual Cost Plus Fee	Contractor Impact	Owner Impact
\$2,000,000	\$2,029,000	Contractor suffers \$29,000 loss.	No impact. The contract amount remains the same.
\$2,000,000	\$1,990,000	No impact.	Owner receives benefit of \$10,000 savings.

STANDARD CONTRACT FORMS

موسسه مهندسی و مدیریت ساخت علوی پور (ACEMI)

دفتر آموزش



تهران، بلوار فردوس شرق، مجتمع آبگینه، طبقه سوم اداری، واحد C42



+۹۸ ۲۱ ۴۶ ۱۰۰ ۴۴۵



+۹۸ ۲۱ ۴۶ ۱۰۰ ۴۵۰



info@dralavipour.com



www.dralavipour.com



@alavipour_pm



@acemi_social



@alavipour_pm



@IRANACEMI

