

The labor force: This is comprised of foremen, craftsmen, or journeymen, and skilled or semiskilled apprentices or helpers. Many different crafts are represented, such as masons, pipefitters, carpenters, electricians, and so on.

- 5 Major suppliers: Equipment and material manufacturers, transporters.
- 6 Financial institutions: banks, construction financial organizations.
- 7 Lawyers, insurers.
- 8 Federal and local regulators: code enforcement professionals.
- 9 Public services.
- 10 Utilities.
- 11 Safety professionals.
- 12 Quality assurance/quality control professionals.
- 13 Lean facilitators/coaches/mentors: These professionals provide support in the implementation of new lean approaches in design and construction.

Project delivery methods

The following information on delivery methods is intended to clarify some of the many options that are available for executing construction projects, and to set the stage for later discussion on lean construction projects. It is worthy of note that, while lean project delivery is identified as a method, the lean methodology has been applied with varying degrees of success to traditional projects. Examples are identified in later chapters.

There are a number of models for the process of designing and constructing facilities. Several of these models have been in existence for many years and have been used with varying degrees of success, depending on the type of project and the skills required. They are considered to be “traditional” methods. The basic workings of these delivery methods are discussed below in items 1 through 5 simply to describe the current practices in the construction industry. As the emphasis of this book is on lean construction and its variants such as integrated project delivery, the conversation will be focused on them after this introduction.

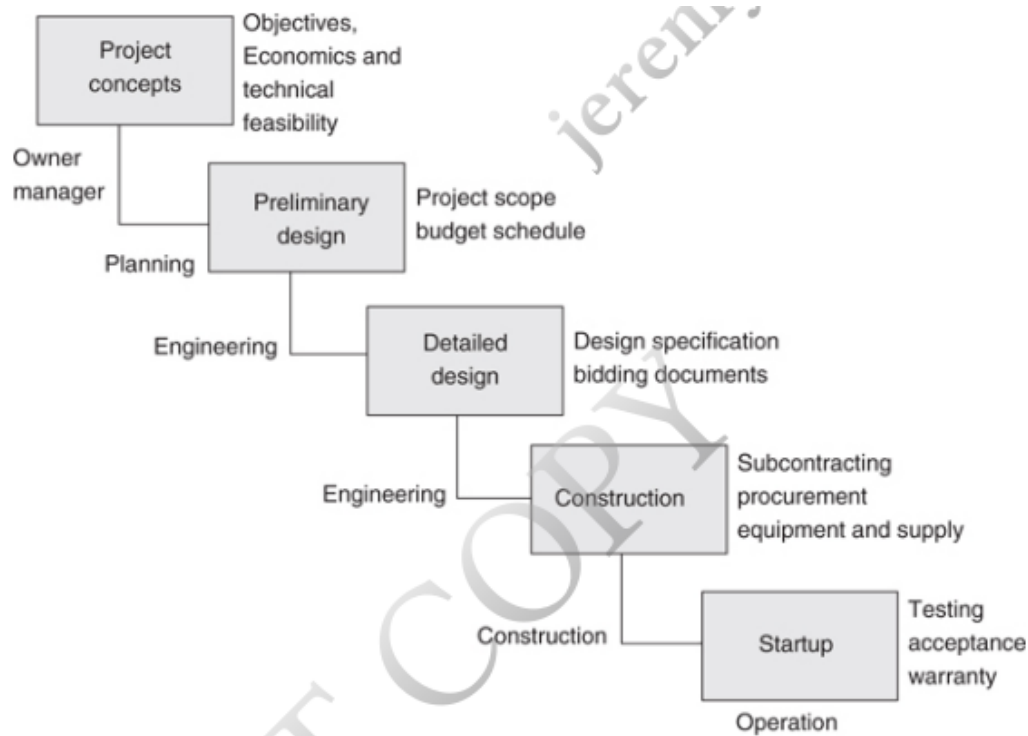
The project delivery methods include:

- 1 Design-bid-build (DBB),
- 2 Design-build (DB),
- 3 Engineer-procure-construct (EPC),
- 4 Design-CM contracts,
- 5 Design-agency CM contracts,
- 6 Fast-track construction,
- 7 Partnering,
- 8 Design-build-operate, and
- 9 Relational contracting/lean project delivery.

Design-bid-build contracts

Design-bid-build contracts represent the most frequently used type of project delivery systems for most construction projects and are considered to be the “traditional” delivery method. DBB projects have the following characteristics (Figure 1.4):

- 1 The project is conceptualized by the owner.
- 2 Planning is carried out based on the objectives to be met and on economic and technical feasibility.



[Figure 1.4 Traditional design-bid-build construction phases](#)

- 3 Programming is carried out to identify the uses and desired sizes of various spaces, followed by a schematic design to identify relationships of these spaces relative to each other. The scope of the project, preliminary budget, and schedule are derived.
- 4 Detailed design is usually carried out in stages, with intermediate checkpoints for verification by the parties to the project.
- 5 The design work culminates in the preparation of completed drawings and specifications, representing bid documents as well as detailed cost estimates. The bid documents are used to solicit construction bids, or are otherwise used to negotiate a construction price.
- 6 Bid analysis is carried out and a legally binding contract is then awarded. The drawings, specifications, and signed documents then become construction documents.
- 7 The contractor is given access to the site and instructed to proceed, based on legally established time frames. A contract may contain incentives for timely completion, as well as penalties for avoidable delays or cost overruns.
- 8 The owner, or agents of the owner such as architects/engineers or construction managers, monitor(s) the progress of the construction, ensuring that interim payments to the builder/contractor match construction progress.
- 9 At completion, there are acceptance inspections, leading to the commissioning of the facility for the owner's use. The project is turned over to the owner.

Design-build projects

Design-build (DB) projects accelerate delivery through concurrent design and construction activities. As is typical of all types of projects, a DB project is conceptualized by the owner; planning is carried out based

on the objectives to be met, and on the economic and technical feasibility of the project. Planning and schematic design are carried out by the owner's design professional and may include infrastructure and foundation details for the project. This information allows construction to start shortly after contract award, while the design builder continues the preliminary design to obtain a final design. Typically, their design professional develops a preliminary design and cost and schedule proposals for the overall project. In some DB projects the owner may review proposals from a number of design builders and enter into a legally binding contract with one that provides the most appropriate proposal. The design builder is given access to the site and instructions to proceed, based on legally established time frames. This type of contract may also contain incentives for timely completion, as well as penalties for avoidable delays or cost overruns. The DB organization initiates construction while finalizing the detailed design. The owner or agents, such as architects/engineers or construction managers, monitor the progress of the construction, ensuring that approvals for interim payments match the progress of the construction work.

Engineer-procure-construct (EPC) projects

These are configured in a manner very similar to DB projects. Most of the design and construction functions are performed or managed by one organization. This model, however, is used primarily for industrial projects that emphasize engineering design, as opposed to architectural design. The EPC projects typically have commissioning and maintenance phases included to allow for a plant to reach its designed operating capacity after acceptance.

Construction management (CM) contracts

The owner typically hires a CM organization, for a fee, to provide professional management services. Trade contractors contract directly with the owner on an individual basis and not through the construction manager, although the CM advises the owner on the formation and conduct of those contracts. The owner also contracts separately with a design concern (i.e., an architectural/engineering (A/E) firm) to obtain the design documents. In some instances, the A/E firm may play the role of the CM. This form of contracting places a heavy responsibility on the owner to coordinate the work, as the trade contractors do not have contracts with each other and have no contractual obligation to cooperate.

The CM agent typically has less clout to resolve design or construction issues than a general contractor and serves only as a mediator.

Design-agency CM contracts

In this type of contract, the owner hires a design team to prepare project construction documents, and hires a construction manager (CM) to oversee the construction phase of the project. This is often done based on a lump-sum or fixed-price contract. The CM may act as an agent of the owner, contracting directly with all the trade contractors. The CM prepares bid packages that are priced competitively by the trade contractors and reviews these bids to select the most appropriate ones.

CM-at-risk contracts

The construction manager in this type of contract assumes the risk of pricing and contracting directly with the respective trade contractors. In general, CM-type contracts are not as amenable to quality initiatives as DBB and DB contracts.

Construction Management at Risk (CM@Risk) is increasingly being used by the US public sector. Like design-build, it facilitates improved quality through a selection process based on factors other than the low bid. A scoring system is used to consider the previous performance of a contractor, based on various criteria. It is not the cheapest method – it is best used where there is uncertainty, such as renovation projects where the current state of a facility or its infrastructure may not be entirely known. This uncertainty is reduced by having the CM involved in managing the

design phases of a project, in the selection of sub or specialty contractors, and then assuming the risk for successful completion. Bidders tend to build in safety cushions for the unforeseen, but a guaranteed maximum price (GMP) approach may be used to set a specific limit to the owner's project cost. Consequently, project budgets for CM@Risk are somewhat generous, resulting on less emphasis by contractors on cost reduction, and fewer compromises in the area of quality.

Fast-track construction

Fast-track construction is valuable in meeting accelerated schedules demanded by the owner. It allows a contractor to commence construction immediately after contract award, while a designer simultaneously completes the construction documents. It may be carried out with or without a design builder.

Partnering

Partnering is the formation of a project team to deliver a construction project; the team commits to open communications in a spirit of trust and works to accomplish mutual project goals. While the team members work supportively to meet mutual goals, they also focus on their individual goals. Yet, they recognize that their individual success is linked to the overall success of a project.

Partnering has resulted in projects that are far less reliant on litigation to ensure that project objectives are met. It significantly reduces the fragmentation that characterizes many construction projects, as a result of which the employees of the involved companies tend to work more on an individual level rather than an organizational level.

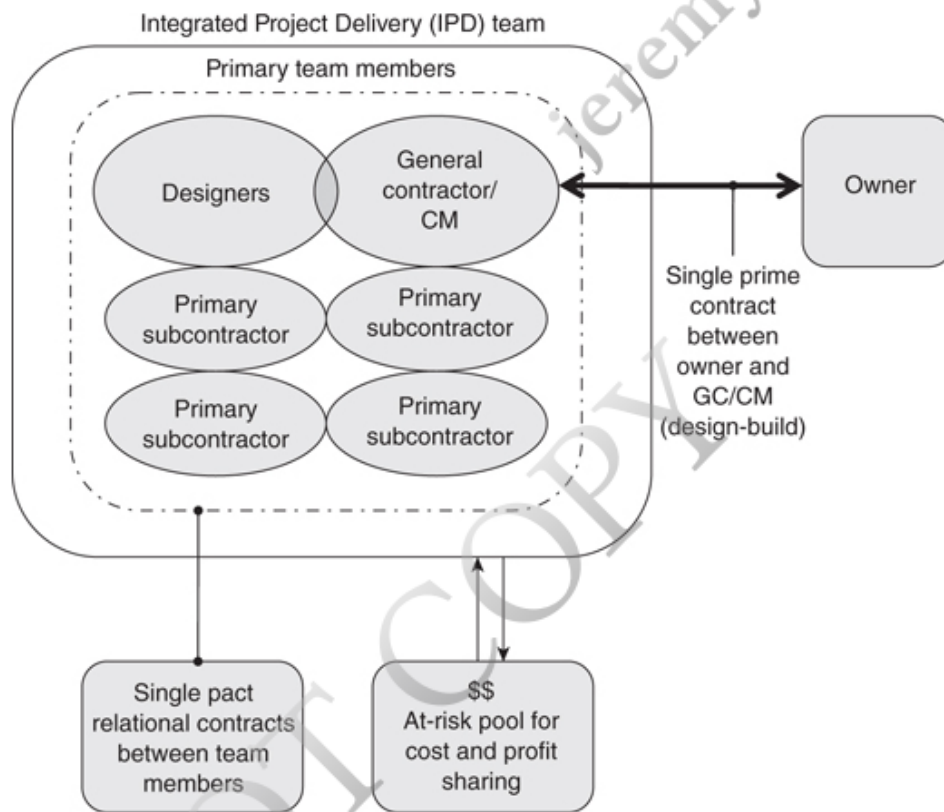
Design-build-operate (DBO)

Like design-build (DB) projects, DBO projects accelerate delivery through concurrent design and construction activities. DBO is an emerging collaborative concept, sometimes referred to as design-build-maintain. DBO are in the early phase of development and seem to have gained traction in public-private partnership projects.

Relational contracting/lean design and construction

Howell (2000) describes lean construction as a new way to design and build capital facilities. Lean theory, principles, and techniques jointly provide the foundation for a new form of project management. It uses production management techniques to make significant improvements particularly on complex, uncertain, and quick projects. Lean methods have reduced office construction costs by 25% within 18 months and in one case reduced the schematic design portion of the project design phase from 11 to 2 weeks.

Lean construction departs significantly from current project management practice. Processes are actively controlled, and metrics are used in planning system performance to assure reliable workflow and predict project outcomes. Performance is optimized at the project level. Whereas current project management approaches reduce total performance by attempting to optimize each activity, lean construction succeeds by optimizing at the project level, as opposed to the less effective current project management approaches, which reduce total performance by attempting to optimize each activity.



[Figure 1.5](#)