Capital Project Delivery

AWWA MANUAL M47
Second Edition

American Water Works Association

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Introduction

Capital projects are those construction projects that further the growth of a utility’s infrastructure or upgrade or replace aging infrastructure. These capital projects involve a significant amount of monetary investment (capital) and, when completed, are expected to service the utility and its customers for decades. The term capital project delivery refers to the method of contracting for the construction of these projects. Depending on the delivery method, the term may also include the design or short-term or even long-term operation of the project. Figures I-1, I-2, I-3, and I-4 illustrate typical water utility construction projects.

Figure I-1 Large water transmission pipeline (courtesy of Beaumont Cherry Valley Water District, J. Reichenberger, P.E., District Engineer)
Figure I-2  Steel water tower (courtesy of B. Steglitz)

Figure I-3  Prestressed circular or cast-in-place rectangular reservoir (courtesy of Beaumont Cherry Valley Water District, J. Reichenberger, P.E., District Engineer)

Figure I-4  Headquarters/admin building (courtesy of A. Kramer)
In the past, the design-bid-build approach was the traditional project delivery method used by most large and small water utilities—particularly publicly owned utilities. However, within the last decade or so, other delivery methods such as design-build, design-build-operate, and others have evolved based on successful experiences in the private sector. As projects became more complex, owners sought the assistance of program managers (PM) and construction managers (CM) to assist them in project delivery.

Manufacturers are taking big strides in the development of technology for treating water. These are not subtle changes but major differences in construction and operation of these systems. Owners are faced with new problems on how to contract for this technology in such a rapidly changing world. The boards of directors, commissioners, and management of water utilities are quietly wondering what risks are being assumed. How do they protect themselves? What are utilities getting into?

The purpose of this manual is to provide public and private water utilities with a menu of various project delivery methods, a roadmap to implementing the method, and analysis of applicability, the risks involved, the advantages and disadvantages. It provides utility staff and management with a foundation for discussion with other utilities, consultants, and construction contractors as to the applicability of a particular method to the utility’s project.

This introductory chapter discusses the principal terms used in the manual, explains the major differences in project delivery methods for publicly owned versus privately owned utilities, and previews the chapters of this manual.

**PRINCIPAL TERMS**

The terminology used in contracts and construction varies from locale to locale. The terms used in this manual are not intended to be the only correct terms that can be used. For example, a project manager is sometimes called a resident manager, a project engineer, a construction manager, or a resident engineer. Depending on the project and locale, there may be differences in the meanings of the terms. The contract documents for a project should define the terms to be used on a specific project.

The term *owner* refers to the entity, usually a utility, that arranges the financing for the project, contracts with the other participants, and operates and maintains the project after it is completed.

The term *consultant* refers to a professional or a firm hired by the owner to perform planning, design, management, construction observation, and other services. In this manual, the consultant is also referred to as the *engineer* or *design engineer* (in reference to engineering-related services). Of course, a consultant may also perform services other than engineering, such as architectural design.

The term *contractor* refers to the firm or consortium that constructs the project. Other groups, such as the American Society of Civil Engineers (ASCE) and the American Water Works Association (in its standards), refer to the *contractor* as the *constructor*. This manual uses the terms interchangeably. The word *contractor* usually implies a general or prime contractor, i.e., the firm with prime responsibility for the construction of the project. Firms hired by the general contractor to provide construction services, usually in specialty areas, are *subcontractors*. The terms *vendor*, *equipment supplier*, or *equipment manufacturer* refer to the entity that designs, manufactures, delivers, and often provides installation assistance, startup, and training for equipment or materials furnished to the owner. These terms are normally used in the context of owner-procured or owner-purchased equipment. Sometimes the terms are also used to describe those entities that provide material and equipment to a general or subcontractor.

The term *contract administration* is used in this manual to refer to the owner’s project management efforts throughout the entire project delivery process. Contract administration
occurs over the complete project from planning through postconstruction. The term *construction management* is more specific to the construction phase of the project.

Other terms are defined as needed in the following chapters.

**PUBLICLY OWNED VERSUS PRIVATELY OWNED UTILITIES**

There can be differences between publicly owned utilities and privately owned utilities when constructing projects. For example, a private owner may not be bound to competitive bidding as strictly as a public entity. Public utilities may be precluded from using some project delivery types as a result of policy, charter, or state or local law. For the purposes of discussion in this manual, the utility is assumed to be either publicly or privately owned unless strong differences exist. In that case, the differences will be discussed. The utility should discuss any of the “nontraditional” project delivery methods with its legal counsel beforehand.

**PROJECT DELIVERY METHODS AND OVERVIEW**

Table I-1 presents a summary of some of the project delivery methods available and typical projects for which they might be considered.

**RECENT TRENDS**

Although it is difficult to quantify increases in actual expenditures, the following trends are occurring:

- Design-build projects are becoming more prevalent in water treatment. Agencies that have gone with design-build for water treatment facilities include the city of Seattle, Wash., the city of Orlando, Fla., and the city of Detroit, Mich., among others.

- Agencies with large capital improvement programs to replace aging infrastructure or to accommodate growth in their service areas have retained program managers to set criteria for design and construction, select design consultants, perform design review, conduct the bidding process, select the contractor, and manage the construction and startup phases. Agencies that have used program managers include the Southern Nevada Water Authority, city of San Francisco Public Utilities Commission, city of San Diego, and others.

- Seawater desalination and other water resource projects are areas where private entities are being formed to provide complete design-build-operate services. Two recent notable projects in California include the Cadiz Groundwater Storage and Dry Year Supply Program and Poseidon Resources’ Carlsbad Desalter.

**CHAPTER PREVIEW**

The manual is presented in three main sections intended to divide the topic of project delivery into distinct areas of discussion. However, some overlap is occasionally necessary to provide a complete discussion.

Section I contains three chapters and introduces conventional project delivery. Chapter 1 discusses the traditional (design-bid-build) construction project, including the project phases, participant responsibilities, and advantages and disadvantages. Chapter 2 introduces construction documents, which include bidding requirements, contracts, drawings, and specifications; the chapter also reviews standard contract documents developed by the Engineers Joint Contract Documents Committee (EJCDC) and others. Chapter 3 discusses the reasons for prequalifying contractors and the steps in selecting contractors.
Increasingly, drinking water supply projects are constructed using nontraditional or alternative project delivery methods. Section II introduces the commonly used alternative approaches to construction projects and contract administration. These approaches range from construction management performed by the project owner (chapter 4) to design-build and turnkey projects (chapter 7) in which a private firm completes all the phases of the project. Other chapters in section II discuss hiring a construction management firm to provide contract administration (chapter 5), projects with multiple prime

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**Table 1-1  Summary of project delivery methods**

<table>
<thead>
<tr>
<th>Project Delivery Method</th>
<th>Brief Description</th>
<th>Types of Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design-bid-build</td>
<td>Traditional method wherein owner provides a complete design, openly invites bids, and issues a single construction contract to a constructor. Owner provides oversight of the constructor's workmanship and materials.</td>
<td>Applicable to any project, large or small.</td>
</tr>
<tr>
<td>Multiple prime contracts</td>
<td>Owner provides complete design, openly invites bids for more than one part of the project. Multiple construction contracts are on-going simultaneously—often on the same site. Owner provides oversight of each constructor's workmanship and materials.</td>
<td>Applicable to parts of projects that are easily separated (e.g., pipeline segments) or that require different skills and experience (e.g., pipelines versus treatment facilities, reservoirs, or buildings).</td>
</tr>
<tr>
<td>Design-build</td>
<td>Owner provides a partial design and design criteria, openly invites bids or proposals to complete the design and construct the facility, and issues a single contract to a design-construction entity. Owner frequently retains some control over the design to ensure conformance with the design criteria and provides some oversight of the constructor's workmanship and materials for conformance with established criteria.</td>
<td>Applicable to any type of project, but best suited for projects like reservoirs, water treatment facilities where the equipment is &quot;packaged&quot; and represents a major portion of the cost, or when there is need to complete a project in an abbreviated time frame. A membrane treatment plant is a good example.</td>
</tr>
<tr>
<td>Design-build-maintain</td>
<td>Essentially the same as design-build but requires the constructor to maintain the facility for a prescribed period of time.</td>
<td>Applicable to any type of project but particularly applicable to a complex project involving equipment and machinery such as a water treatment plant.</td>
</tr>
<tr>
<td>Turnkey</td>
<td>Essentially the same as design-build but with the design-build entity also providing additional services such as site selection and purchase, financing, or both.*</td>
<td>A water treatment facility—particularly a complex facility—involving new or innovative technology and where the owner does not have a site or the financial resources immediately available.</td>
</tr>
<tr>
<td>Design-build-own-operate-transfer</td>
<td>Essentially the same as a turnkey, except the constructor actually owns the facility and operates it for an extended period of time. At the end of the contract time period, the constructor transfers ownership to the utility. Usually payment is made based on the quantity of treated water, often with “take or pay” consequences.</td>
<td>A water treatment facility—particularly a complex facility—involving new or innovative technology. May be appropriate where owner does not have capital funds available.</td>
</tr>
</tbody>
</table>

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* Design-Build Institute of America (DBIA) 2006. A variety of techniques may be used by owners in the process of delivering their capital projects. Some of the more common methods are presented in Table I-2 along with a brief description and typical applicable project types.
Table 1-2  Project delivery variants and options

<table>
<thead>
<tr>
<th>Option</th>
<th>Brief Description</th>
<th>Types of Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prequalifying and selecting contractors</td>
<td>Technical and financial qualification statements are requested from equipment suppliers, construction contractors, and design-build entities from which a short list of three or four entities are selected that may then bid for the project.</td>
<td>Very large complex projects requiring specialized expertise and experience, e.g., dams or projects involving new technology.</td>
</tr>
<tr>
<td>Equipment prepurchase</td>
<td>Owner prepurchases equipment and requires the constructor to take delivery of the equipment and install it or prenegotiates a price with a particular vendor or subcontractor and requires all bidders to use the equipment or subcontractor at the prenegotiated price. This alternative may result in significant cost savings to the owner because the contractor's markup on the purchase of the equipment is eliminated. But there is additional risk the owner must bear in terms of schedule and delivery.</td>
<td>For projects when an owner wants a particular brand of equipment to match existing equipment; or when particular manufacturer's equipment substantially impacts the detailed design; or when the owner needs to accelerate the project.</td>
</tr>
<tr>
<td>Construction management</td>
<td>Owner retains a firm to provide services during the design, construction, and commissioning to oversee and manage the design firm, oversee the bidding, and oversee the construction and startup. Usually limited to a single project.</td>
<td>Almost any project where owner does have the technical or staff resources available.</td>
</tr>
<tr>
<td>Program management</td>
<td>Similar to construction management except the consultant now manages the entire capital improvement program. Usually extends for many years. Program managers are typically precluded from doing any design or construction work on the projects.</td>
<td>Typical when owner is a large entity with a large number of capital projects in various stages of design and construction at a given time.</td>
</tr>
<tr>
<td>Construction management at risk</td>
<td>Similar to construction management except at some point in the design process, the construction management entity offers to construct the project for a guaranteed maximum cost. Construction manager then takes on the role of constructor.</td>
<td>Applicable to any project, but usually limited to a larger, more complex project.</td>
</tr>
</tbody>
</table>

contractors (chapter 6), and projects with a guaranteed maximum price, i.e., construction management at risk (chapter 8).

Section III discusses general issues common to all project delivery methods, including budgeting and payment procedures (chapter 9), performance clauses that give the contractor incentives to complete the project on time (chapter 10), warranties that are guarantees of the contractor's and suppliers' materials and work (chapter 11), risk allocation (chapter 12), disputes and claims (chapter 13), communication (chapter 14), selecting consultants (chapter 15), and partnering (chapter 16). These general issues apply to all types of projects and contract administration.

At the end of this manual, the bibliography lists resources that can be consulted for more detail about the topics introduced in these chapters, and a substantive index is provided for the convenience of the reader.

REFERENCE

Design-Build Institute of America (DBIA).  
SECTION I

Conventional Project Delivery

- Conventional Project Delivery: Design-Bid-Build
- Construction Documents: Overview and Application
- Prequalifying and Selecting Contractors