U.S. Department
of Transportation

Federal Transit Administration

TURNKEY EVALUATION GUIDELINES

Prepared by
John A. Volpe National Transportation System Center
U.S. Department of Transportation
Cambridge, MA
for
Federal Transit Administration
Turnkey Demonstration Program

August 1996
Final Report

OFFICE OF PLANNING

FTA-MA-90-7012-96-1
DOT-VNTSC-FTA-96-9

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	August 1996	Final Report

4. TITLE AND SUBTITLE
Turnkey Evaluation Guidelines

5. FUNDING NUMBERS
TP601/U6045

6. AUTHOR(S)
Douglas B. Lee, Terrence M. Sheehan, Philip A. Mattson

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Department of Transportation
Research and Special Programs Administration
John A. Volpe National Transportation Systems Center
Cambridge, MA 02142

8. PERFORMING ORGANIZATION REPORT NUMBER
DOT-VNTSC-FTA-96-9

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Department of Transportation
Federal Transit Administration
Office of Planning
400 7th Street SW
Washington, DC 20590

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
FTA-MA-90-7012-96-1

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
This document is available to the public through the National Technical Information Service, Springfield, VA 22161

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

This report documents the methodology to be used for evaluating whether transit projects procured using the "turnkey" method result in cost savings, faster completion, or other net benefits such as successful application of more advanced technology. The Federal Transit Administration (FTA) Turnkey Demonstration Program, as mandated by the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), is required to select some number of prototype projects for comparison of turnkey to traditional procurement methods. The turnkey method is "an innovative procurement technique in which a public entity contracts with a single private entity to deliver a complete and operational product, such as a fixed guideway system or extension of an existing system."

The recommended evaluation methodology is an application of benefit-cost analysis (BCA) principles, and consists of (1) construction of a base alternative (counterfactual) against which to compare the impacts of the turnkey variation chosen for the given prototype demonstration project, (2) estimation of the impacts of the turnkey alternative, (3) translation of the impacts into measures of net benefits, and (4) determination of the key factors leading to favorable turnkey results.

14. SUBJECT TERMS
transit, turnkey, design-build, benefit-cost, counterfactual, procurement, risk, project planning

15. NUMBER OF PAGES
234

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	

PREFACE

The "Turnkey" method is "an innovative procurement technique in which a public entity contracts with a single private entity to deliver a complete and operational product, such as a fixed guideway system or extension of an existing system." ISTEA (The Intermodal Surface Transportation Efficiency Act of 1991) authorized the FTA (Federal Transit Administration) to select two or more transit projects to participate in the Turnkey Demonstration Program. Five projects ultimately were selected: Baltimore Phase II Central Light Rail Line, Los Angeles Union Station Gateway, San Francisco Bay Area Rapid Transit Airport Extension, San Juan, Puerto Rico Tren Urbano, and New Jersey Hudson-Bergen Light Rail.

The FTA is responsible through Section 3019 of ISTEA to report to Congress on the progress of the demonstration program, the identification of the associated turnkey guideline modifications and the results of the comparative cost and schedule differences between the conventional and turnkey projects. To assist FTA in meeting this legislative requirement, various turnkey program industry outreach workshops have been convened including: the Engineering and Procurement Turnkey Roundtable Seminar (February 1993); Transit Agency Senior Management Turnkey Roundtable Seminar (March 1993); Turnkey Finance Roundtable Seminar (April 1993); FTA/APTA Turnkey Evaluation Workshop (June 1993); Contracting and Finance Workshop (March 1994); Design and Construction Workshop (May 1995) and, Risk Management Workshop (February 1996). Also, sponsoring agency workshops were conducted in Baltimore (October 1993), San Juan (November 1994), Los Angeles (May 1995) and Oakland, California (June 1995).

This document was prepared as part of the oversight function of the FTA Turnkey Demonstration Program. The report will be used to assist the FTA in the integration of data and information gained from each of the turnkey demonstration projects into a report to Congress. The report is authored by Douglass B. Lee and Terrence M. Sheehan, with assistance from Philip A. Mattson (all from the John A. Volpe National Transportation Systems Center) and Richard J. Lobron (Lobron Consultancy), under the guidance and critical review of Edward L. Thomas, Chief of the Capital Development Division, and Salvatore Caruso, of the Federal Transit Administration, Office of Planning.

METRIC/ENGLISH CONVERSION FACTORS

ENGLISH TO METRIC

LENGTH (APPROXIMATE)

1 inch (in) = 2.5 centimeters (cm)
1 foot (ft) = 30 centimeters (cm)
1 yard (yd) = 0.9 meter (m)
1 mile (mi) = 1.6 kilometers (km)

AREA (APPROXIMATE)

1 square inch (sq in, in^2) = 6.5 square centimeters (cm^2)
1 square foot (sq ft, ft^2) = 0.09 square meter (m^2)
1 square yard (sq yd, yd^2) = 0.8 square meter (m^2)
1 square mile (sq mi, mi^2) = 2.6 square kilometers (km^2)
1 acre = 0.4 hectare (ha) = 4,000 square meters (m^2)

MASS - WEIGHT (APPROXIMATE)

1 ounce (oz) = 28 grams (gm)
1 pound (lb) = .45 kilogram (kg)
1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)

VOLUME (APPROXIMATE)

1 teaspoon (tsp) = 5 milliliters (ml)
1 tablespoon (tbsp) = 15 milliliters (ml)
1 fluid ounce (fl oz) = 30 milliliters (ml)
1 cup (c) = 0.24 liter (l)
1 pint (pt) = 0.47 liter (l)
1 quart (qt) = 0.96 liter (l)
1 gallon (gal) = 3.8 liters (l)
1 cubic foot (cu ft, ft^3) = 0.03 cubic meter (m^3)
1 cubic yard (cu yd, yd^3) = 0.76 cubic meter (m^3)

TEMPERATURE (EXACT)

°C=5/9(°F - 32)

METRIC TO ENGLISH

LENGTH (APPROXIMATE)

1 millimeter (mm) = 0.04 inch (in)
1 centimeter (cm) = 0.4 inch (in)
1 meter (m) = 3.3 feet (ft)
1 meter (m) = 1.1 yards (yd)
1 kilometer (km) = 0.6 mile (mi)

AREA (APPROXIMATE)

1 square centimeter (cm^2) = 0.16 square inch (sq in, in^2)
1 square meter (m^2) = 1.2 square yards (sq yd, yd^2)
1 square kilometer (km^2) = 0.4 square mile (sq mi, mi^2)
10,000 square meters (m^2) = 1 hectare (ha) = 2.5 acres

MASS - WEIGHT (APPROXIMATE)

1 gram (gm) = 0.036 ounce (oz)
1 kilogram (kg) = 2.2 pounds (lb)
1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons

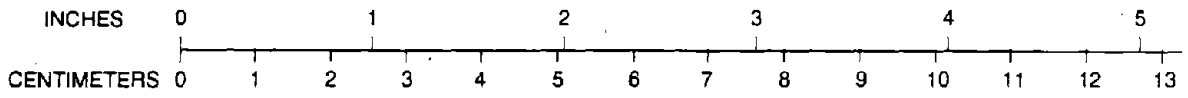
VOLUME (APPROXIMATE)

1 milliliter (ml) = 0.03 fluid ounce (fl oz)
1 liter (l) = 2.1 pints (pt)
1 liter (l) = 1.06 quarts (qt)
1 liter (l) = 0.26 gallon (gal)
1 cubic meter (m^3) = 36 cubic feet (cu ft, ft^3)
1 cubic meter (m^3) = 1.3 cubic yards (cu yd, yd^3)

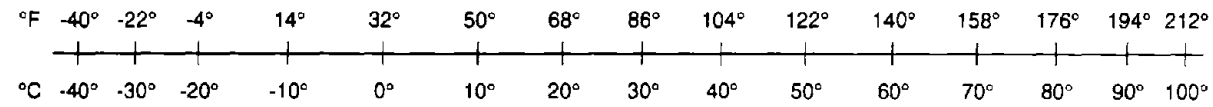
TEMPERATURE (EXACT)

°F=9/5(°C) + 32

QUICK INCH-CENTIMETER LENGTH CONVERSION



QUICK FAHRENHEIT-CELSIUS TEMPERATURE CONVERSION



For more exact and or other conversion factors, see NIST Miscellaneous Publication 286, Units of Weights and Measures. Price $2.50. SD Catalog No. C13 10286.

Updated 8/1/96

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. TURNKEY EVALUATION AIMS AND CONCEPTS

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) requested that at least two urban transit investment projects be acquired by means of a process referred to as "turnkey," to demonstrate the concept and determine whether it can serve to "advance new technologies and lower the cost of constructing new transit systems." The turnkey method is defined as "an innovative procurement technique in which a public entity contracts with a *single private entity to deliver a complete and operational product*, such as a fixed guideway system or extension of an existing system"[1] or "a transit system project wherein the contracting agency enters into a contractual agreement with a consortium of firms, or an individual firm, a vendor or vendors to construct a transit system or system element that meets specific *performance* criteria."[2]

1.1. PURPOSE OF THE GUIDELINES

These guidelines are intended to be applied to the evaluation of prototype turnkey demonstration projects funded in part by the US Congress and Federal Transit Administration (FTA). Their purpose is twofold:

(1) Provide those responsible for evaluating FTA turnkey projects a common set of guidelines from which to begin their evaluations.

(2). Provide a comprehensive structured overview for those considering application of the turnkey concept to projects other than the current prototype cases.

Each of these purposes is explained in more detail in the following sections of this document.

---

[1] FTA (June 1993); emphasis in original.

[2] ASCE (1993); emphasis added. These definitions do not provide a hard line between turnkey and traditional methods, but they suggest the important characteristics by which they differ.

The demonstration projects are to be evaluated in comparison to traditional methods, to assess whether the turnkey strategy does, or can, result in lower costs, shorter construction times, reduced risk, or other benefits such as successful application of more advanced technology. Turnkey methods have been used in the private sector and by a few government agencies,[3] but not in the public transit industry to any notable degree. Five projects have been selected so far by the FTA as prototype examples of the "turnkey" approach to acquisition of transit capital improvements.[4]

1.1.1. Guidelines for the Evaluation of Prototype Demonstrations

The application of guidelines will insure consistency among FTA-sponsored turnkey evaluations, and permit the findings of different evaluation contractors and projects to be summarized and compared. They will provide guidance to the evaluators in structuring and carrying out their evaluations and will assist Congress and other persons seeking to understand and utilize the evaluations.

1.1.2. Overview for Aid in Designing Turnkey Projects

Turnkey concepts have been applied to private and public projects, including some in transit (see Appendix A), but a balanced description of the myriad components of turnkey procurement has not previously been assembled. Because turnkey is a method for completing transit construction projects in a potentially more efficient and effective manner than traditional methods, it is necessary to understand traditional transit procurement methods in order to understand turnkey methods. This document will provide a basis for understanding both traditional and turnkey construction techniques.

Due to the complexity of most construction projects, each is unique to a major extent. No attempt is made here to cover exhaustively all aspects of both traditional and turnkey construction methods; what is covered is comprehensive but only to a consistent level of detail. Interested persons should be able to use these guidelines to understand and evaluate the impact of applying turnkey techniques to a transit construction project. The

[3] The US. Army Corps of Engineers has constructed several recreation facilities using what it refers to as "Turnkey Acquisition" (see Napier, Holcomb, et al., May 1988). The first step is essentially a design competition, with the owner evaluating and selecting a combination of technology, preliminary design, and construction price. The second step is final design, done by the contractor but approved by the owner, after which construction may begin. Other than being allowed to make price-quality tradeoffs in bid selection, this process provides little for transit procurement that cannot currently be accomplished by conventional contracting.

[4] FTA (August 1992). Initially four were selected (BART airport extension, Baltimore LRT extension Phase II, LA Union Station Gateway administration building, and San Juan Tren Urbano), with a fifth (New Jersey Hudson-Bergen LRT line) added subsequently.

guidelines can be used as a checklist for designing a turnkey process for any particular transit capital project.

1.2. METHODS FOR EVALUATION

The basic idea of turnkey procurement is that cost savings, schedule gains, and perhaps better end results may be achieved by transferring a larger share of management responsibility for design, construction, and operations to private contractors. These benefits might stem from avoiding some of the costs and delays typically associated with government-managed transit system procurement, from removing part of the need for detailed oversight, from allocating risk to those participants most able to control it, and from improving the organizational environment for communication and system integration.

Application of turnkey methods creates a range of possibilities from modest differences with current practice to potentially major alternatives. Because of the wide variation in the characteristics and circumstances of possible turnkey projects, and the small number of projects relative to this variation, evaluating the benefits of the turnkey approach calls for an unusually careful study design.

An experimental design approach is unworkable because of the impossibility of conducting even two identical trials (one without the turnkey treatment and one with), let alone enough replications for statistical validity. Nor can the lack of physical controls be compensated by statistical controls; there are far too few observations and far too many possible influencing factors. Hence, econometric analysis is also not feasible.

Thus, rigor can only be achieved by understanding the specific differences between traditional methods and possible turnkey variations, so as to be able to construct or predict what would have happened under the traditional acquisition methods that were not actually followed. The differences between the "with" and the "without" are the impacts of the turnkey strategy. The impacts, once observed, must then be translated into exhaustive and non-overlapping measures of benefits and costs. Given that a critical underlying cost factor is the assignment of risk -- often for rare or highly uncertain events, and under turnkey methods, allocated in non-traditional ways -- an explicit valuation of risk burdens is necessary.

A large number of turnkey variations are possible, and it is unlikely that all of them generate positive net benefits, or even that any generic strategy is always successful or not successful. The burden of evaluation is to identify the conditions -- occurring before

and/or during implementation -- that lead to positive net benefits from the turnkey approach versus the traditional method.

1.3. ALTERNATIVE ACQUISITION STRATEGIES

Evaluation requires that at least two alternatives be defined: one that describes present and future conditions in the absence of the action(s) being evaluated, and one or more that describe departures from the base or status quo alternative. Because turnkey is a process change (rather than an investment choice, an operating program, or a policy alternative), the alternatives must be described in process terms, starting with preparation for the procurement and contracting phase, progressing through design, construction, testing, and, in some cases, operation.

1.3.1. The Traditional Method

Current and historical methods for transit system delivery do not constitute a single common process, but, rather, a range of variations and adaptations that, at some level, are unique to every project. Thus it is necessary to aggregate and generalize the common components of all "traditional" procurement implementations, while still preserving enough specificity to be able to describe turnkey variants with precision.

This requires separating the functional requirements of the process from the methods by which those requirements are (traditionally) or could be (under turnkey) satisfied. Final engineering design is a functional requirement, but it could be produced by a contractor working directly for the transit agency specifically for that purpose, or by a turnkey vendor having responsibility for several steps in the functional requirements. Functional requirements are stated as steps in an ordered sequence, typically in series although also in parallel where that is possible. The time scale is not fixed -- only the ordering -- and, in fact, observed time duration of the actual schedule is an important evaluation measure.

1.3.2. Turnkey Variations

Alternatives to the traditional method are described in terms of variations from the traditional implementation for satisfying the same functional requirements. The critical descriptors are such factors as the point in the process of transit system development that the variant starts from, the functional requirements encompassed within the turnkey process, the parties responsible for performing the functions, and the distribution of risk across affected parties.

A welter of terms has arisen to characterize the differences among turnkey strategies, such as design-build, design-built-operate, build-operate-transfer, superturnkey, and civil/systems turnkey. The nature of these strategies is discussed below in Chapter 9.

1.3.3. The With- and-Without Comparison

For a given turnkey site, two alternatives are to be compared: One is the turnkey alternative that was actually followed, and the other is the scenario that would have been followed had the turnkey owner adhered to its own traditional procurement process. Documenting what actually happened sounds simple enough, but the description must be explicit in terms of how each functional requirement was accomplished and how each type of risk was allocated among participants.

What would have happened -- under the traditional alternative -- can never be known exactly, but it can be reconstructed after-the-fact (using the same functional requirements and risk allocation terms) from whatever forecasting or backcasting analytic tools are applicable. Predicting how a given transit property would have acquired the same assets under its own traditional process depends most heavily on information obtained from the same property. If similar projects have recently been completed by the same owner using the traditional process, then specific descriptions of those projects are clearly pertinent. Where risks are involved that have a significant random component, evidence of the frequency distribution of such risks may need to be obtained from a sample of similar projects and properties. This "counterfactual" -- how things would have turned out had the traditional process been followed instead of the turnkey -- is a constructed composite of the most similar examples, probably taken from the experience of the same owner. It is essential that this "null" alternative be thoroughly documented, i.e., that it not be simply "made up."

1.4. IMPACTS

Impacts of the turnkey variant relative to the traditional implementation necessarily stem from the differences between the turnkey and the traditional. The first step, then, is to describe as explicitly as possible what those differences are. Next, the possible changes that might result from the alternative process should be enumerated. These might include functions carried out by turnkey vendors instead of government agencies or government contractors, the number of checkpoints/sign-offs encountered along each branch, the levels and nature of government oversight required, and the allocation of risk under traditional versus turnkey. These in turn can be translated into such measures as the size of staff needed, the time required for each task, and the value or cost of the risk burden to each participant.

When these impacts are finally tabulated as benefits and costs, the alternatives should be functionally comparable; i.e., whichever branch is taken -- traditional or turnkey -- the results (the performance of the project) should be compared in equivalent terms. For example, if the public sector chooses to shift some of the risk to a turnkey provider, the cost of that risk as borne by the government (as if it had to buy insurance to cover the risk) should be included in the traditional (base) alternative, for comparison to the turnkey cost which contains the risk imbedded in the contract price.

1.5. NET BENEFITS

In contrast to the typical project evaluation, in which a capital investment expenditure is assessed against the future benefits stemming from the investment, turnkey evaluation does not have any category of expenditures that are obviously "costs" as distinct from "benefits." Thus there is a single table containing all the "benefits", whether positive or negative and whether valued in dollar terms or not. Some examples are shown in Figure 1-1. Benefits should be quantified and valued if at all possible, even if it means trial numbers or ranges, so that the best guess available of net benefits can be constructed. There is no meaningful benefit-cost ratio and none should be calculated.

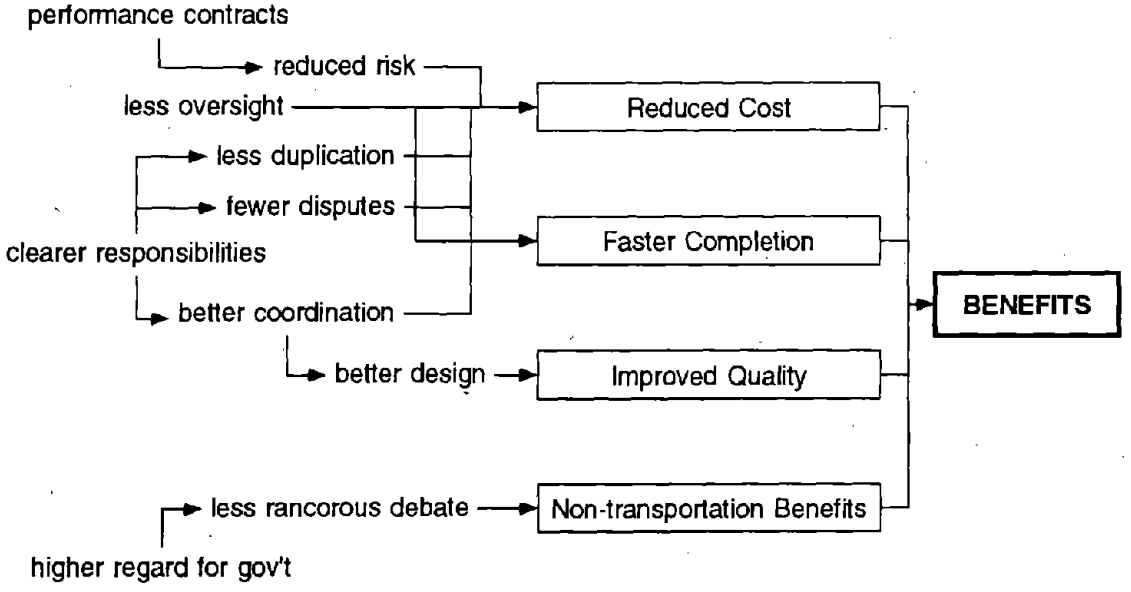


Figure 1-1. Examples of Impacts and Benefits.

For further discussion of the methodology for evaluating the turnkey approach versus traditional procurement methods, see Chapter 10.

1.6. ORGANIZATION OF THE GUIDELINES AND RELATED REPORTS

These guidelines have been organized consistent with the normal progression of most construction projects, from initial project planning through construction. The guidelines begin with a detailed overview of the turnkey concept and the transit project development process (Chapters 1 and 2). The major functional elements of transit construction projects are discussed in order of their occurrence in Chapters 3 through 6. Cross functional elements (i.e., those major functional elements that cut across or are present in several functional areas) are reviewed in Chapters 7 and 8. Chapter 9 covers Prototype Turnkey Strategies and Chapter 10 is devoted to Evaluation Methodology. Appendices A and B provide additional background information and references.

Several papers are currently in progress to provide greater depth in selected aspects of the turnkey process:

Procurement and Disadvantaged Business Enterprises. The intent of this report is to provide greater detail on both constraints and opportunities for turnkey alternatives that are found in state and local laws.

Finance. This report is emphasizes the possibilities for financing turnkey transit projects in part through joint development activities.

Project Control. This report describes strategies and methods for maintaining effective project control under turnkey procurement, while allowing contractors to seek ways to reduce costs.

Risk. This report elaborates on the types of risk that need to be made explicit, and the various ways to minimize them, as well as quantifying risks for evaluation purposes.

Engineering and Design. This report explains how the concepts of and requirements for value engineering apply (and don't apply) under turnkey methods, and how to elicit cost-effective design that maximizes life-cycle performance.

Environmental Mitigation. This report is intended to show how incentives for environmental quality and constraints on negative impacts can be accomplished under turnkey.

This group of reports will be published sometime subsequent to these guidelines, and will supplement the information contained here.

2. TRANSIT PROJECT DEVELOPMENT PROCESS

Major transit investment projects have been undertaken since before the turn of the century, but financing shifted from the private sector to the public, especially after the second World War. The federal government has provided capital grants since the Urban Mass Transit Act of 1965, and the current process has evolved around the federal grant process. It has also been strongly influenced by the National Environmental Policy Act (NEPA), which required an Environmental Impact Statement (EIS) for each federally-funded project, and by the "3-C" process initially developed for metropolitan area highway planning.[1] It has also been affected more recently by the Clean Air Act and Amendments, and ISTEA.

2.1. MAJOR PHASES

In broad outline, the transit project development process can be divided into four phases: project planning, preliminary engineering, final design, and construction.

2.1.1. Project Planning

The first phase includes the development of a long range transportation plan for the area, the selection of candidate projects for major investment studies (MIS), the selection of the locally preferred alternative (LPA), and the request for approval (in the event of federal funding) to proceed with preliminary engineering.[2]

---

[1] The three "C"s stood for continuing, comprehensive, and cooperative, as described in FHWA Policy and Procedure Memorandum 50-9, "Urban Transportation Planning," June 21, 1967. See Edward Weiner, "History of Urban Transportation Planning," in George Gray and Lester Hoel (eds.), Public Transportation, 2nd ed., Englewood Cliffs, NJ: Prentice-Hall, 1992, pp. 46-76 for a brief review of highway and transit planning legislation and policy.

[2] The "Major Investment Studies" process is the successor to "Alternatives Analysis," and builds upon the same methods (see "Procedures and Technical Methods for Transit Project Planning," Draft, Washington, DC: UMTA, February 1986. No comparable guidance or explicit instructions have been issued regarding MIS, and each state and urban area is taking its own approach.

Long range plans and attendant capital improvement programs have changed considerably over the past several decades, so as to de-emphasize fixed outcomes over long (twenty year) time horizons, and instead emphasize shorter range options and greater flexibility. Whatever form it takes, however, some areawide planning and analysis effort must underlie the identification of potential projects and provide demand forecasts based on regional development patterns.

MIS and EIS analyses are often combined into a process that incorporates extensive interaction between technical information and political deliberation. Thus the LPA is generally a project that has been exposed to public scrutiny and has acquired a consensus of citizen and political support. The possibilities for turnkey alternatives prior to selection of the LPA appear to be limited at present, although a few regions have attempted (notably Houston and Honolulu) to begin a turnkey process before selection of a specific modal technology.

2.1.2. Preliminary Engineering

Once a project technology and general alignment have been agreed upon, more detailed engineering design and feasibility studies are done. Project management oversight, system definition, value engineering, EIS, financial planning, and cost control functions are normally accomplished in this phase. Opportunities for turnkey variations exist for some portions of preliminary engineering.

2.1.3. Final Design

The final design phase prepares the project for bidding by developing detailed working drawings and specifications. The phase ends with the Full Funding Grant Agreement (FFGA) and selection of the successful contractor. Final design along with elements of construction could potentially be packaged as turnkey projects.

2.1.4. Construction

During construction, the primary functions are to ensure that the final result is built according to the standards and specifications agreed upon, and to deal with exceptions or other alterations to the project specifications issued to the contractor. Operations may also be considered for turnkey procurement, generally for a specified period of time.

2.2. PREVIOUS EXPERIENCE WITH TRANSIT PROJECTS

Transit system capital projects have shown a historical pattern of taking longer and costing more than initially claimed at the time the LPA was selected and the EIS accepted.[3] As new requirements have been added to serve such purposes as technical review, political review, environmental review, financial viability, and management oversight, the elapsed time from inception to operation has lengthened. The planning process has also become more costly.

To the extent that essential requirements must be satisfied, the time and effort to satisfy them are unavoidable. It is possible, however, that some current procedures are not essential for public control, and that the basic requirements could be accomplished with more dispatch at less cost.

2.2.1. Costs

The reasons for cost overruns include poor cost estimation, delays, change orders to the scope of work, unexpected contingencies, and inefficiency. Excessive staff, poor construction management, less-than-optimal design, weak contracting procedures, and many other factors also can contribute to cost overruns.

2.2.2. Delays

Delays have the effect of increasing nominal costs but reducing the present value (in discounted constant dollars) of costs by delaying expenditures; more importantly, delays reduce the present value of benefits by postponing their start. Delays occur for a number of reasons, including breakdown of the political consensus, changes made after previous decisions had been committed, unexpected obstacles that must be resolved, and poor construction management. Clearly, some of these delays are unavoidable, and equally clearly, some could be avoided.

2.3. DESIGN OF TURNKEY ALTERNATIVES

The evaluation strategy applied to the design of turnkey alternatives and aligned against the project development process results in three fundamental dimensions for describing turnkey variations and measuring their impacts:

---

[3] Don H. Pickrell, Urban Rail Transit Projects: Forecast Versus Actual Costs and Ridership, prepared for FTA, Cambridge, MA: US DOT/VNTSC, October 1990.

(1) **Phases** of the project development process define the milestones or work that must be accomplished prior to the subsequent phase.

(2) **Functions** are derived from functional requirements that must be performed for any project, whether turnkey or traditional.

(3) **Traditional versus Turnkey** methods for implementing the functional requirements can vary from minor refinements (e.g., performance contracting) to radical transformation (e.g., a single design-build-operate contract issued early in project planning).

2.3.1. Functions by Phase

Four major functions are illustrated in Figure 2-1 with respect to their level of effort over each phase. Engineering includes selection of technology, design and alignment, bidding specifications, and construction review. Finance includes the securing of revenue sources, the design and implementation of financing instruments, budget management, and cash flow management. Public review is concerned with those steps in the process at which public commitments must be made for the process to go forward, including selection of the LPA and various signoffs by FTA. Management controls are instruments for accomplishing consistency and coordination among the elements of the project.

These functions must be performed whatever the procurement method, and the relative level of effort will remain approximately the same whether done by a turnkey vendor or a public agency. Some of these functions are more easily turned over to a vendor than others; public review is almost exclusively a public sector responsibility, and securing financing from tax sources can only be accomplished through the political process. Engineering and management, however, offer considerably more opportunity for a reduced government role. Because of the typical patterns in the relative levels of effort of the functions by phase in the project development sequence, turnkey opportunities increase as the phases progress.

2.3.2. Turnkey Variations

The essence of the turnkey strategy is to state the desired end result in terms of performance requirements rather than detailed design and construction specifications. This lets the turnkey contractor determine the most efficient means for achieving the goal, potentially reducing the total resources (labor, materials, etc.) required to produce the product, the time to complete the project, and the level of oversight effort expended on the part of both parties. These potential gains exist whether the buyer is a private

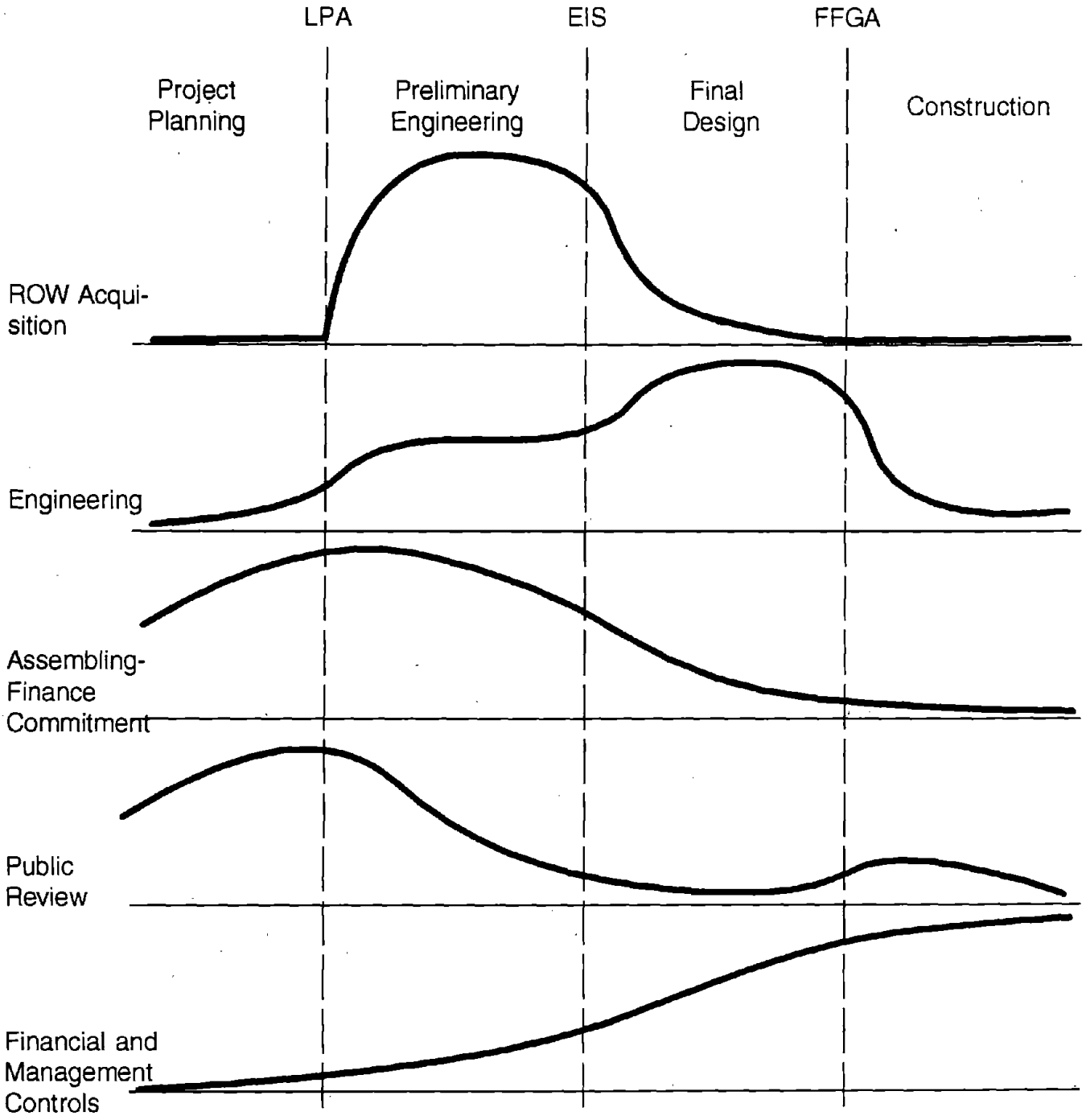


Figure 2-1. Level of Effort by Functional Requirement and Phase.

firm or a government agency.

Any time a procurement is undertaken, a choice can be made to substitute performance requirements for design specifications. Rather than buying a predetermined physical object, the buyer can require that it be able to do certain things; rather than describe how something will be built, the buyer can describe the essential qualities (e.g., durability, maintainability) of the physical object. Thus a turnkey approach can be applied to any procurement -- no matter how large or small -- and to any degree. The range of variation from traditional to turnkey is therefore infinite, and the differences could be microscopically small or dramatically radical.

Although such a wide range of possibilities could be explored, at a practical level it is necessary to start with something specific. For the transit development process, a primary turnkey option has emerged, represented in Figure 2-2. That alternative branches from the traditional process after preliminary engineering and the final environmental impact statement have been completed, turning final design and construction over to the turnkey vendor. This option is labeled "design-build" or

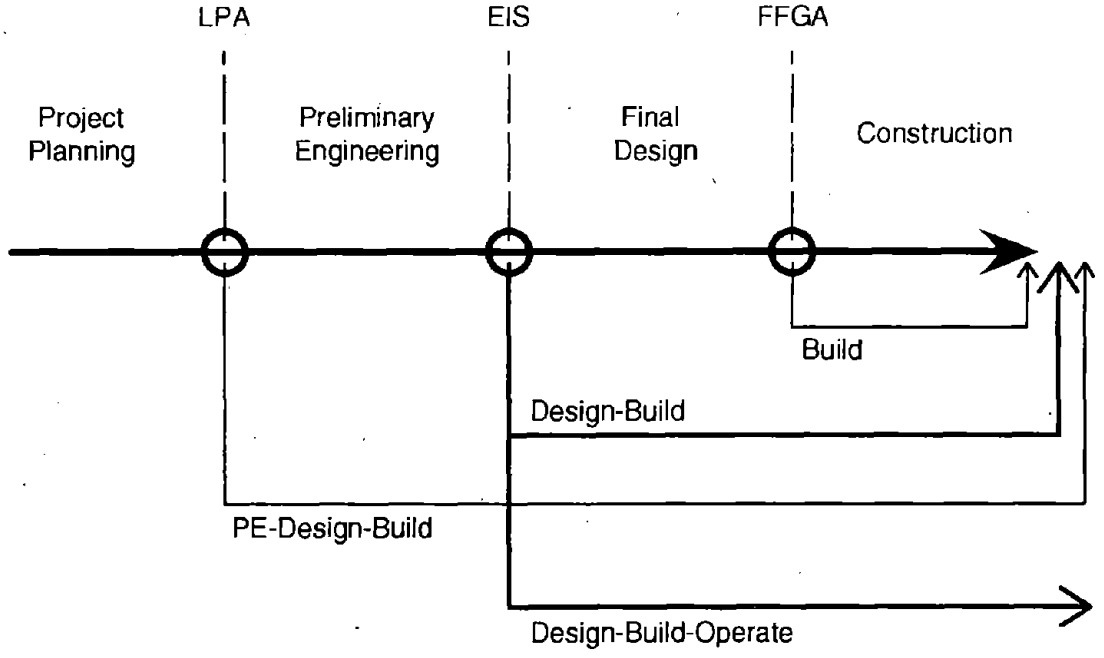


Figure 2-2. Primary Turnkey Variations.

"design-build-operate." Other turnkey variations identified in the diagram are a design-build option branching off after project planning rather than PE, and a build option (or build-operate option) branching after final design that would simply turn more of the prime contracting and contract management over to a single vendor, with more emphasis on performance as opposed to design specifications. A richer range of turnkey variations may emerge as experience with the idea is gained, and some additional concepts are summarized in Chapter 9 below.

2.3.3. Turnkey Impacts

Whatever turnkey variation is selected, its impacts are measured relative to what would have occurred under the "traditional" process. Most major functions and activities have to be undertaken, but the procurement method may affect the total level of effort for an activity as well as its distribution among phases. Figure 2-3 illustrates three functions that could potentially vary significantly between traditional and turnkey approaches.

Government oversight in supervising private contractors might be reduced, especially in later project phases. Procurement effort -- including real estate, design contracts, and construction -- would need to increase relative to traditional methods prior to awarding a turnkey contract, but could result in savings downstream. Construction might be able to start sooner under a turnkey vendor, evening out the demands for construction resources and easing the management control and oversight burden. These hypothetical impacts shown in the diagram are meant to indicate the potential for changes under a turnkey strategy; they are not forecasts of what is likely to happen. It is up to the evaluators at each turnkey site to assess the extent to which the potential was actually realized on that particular project, or even whether the potential is realizable.

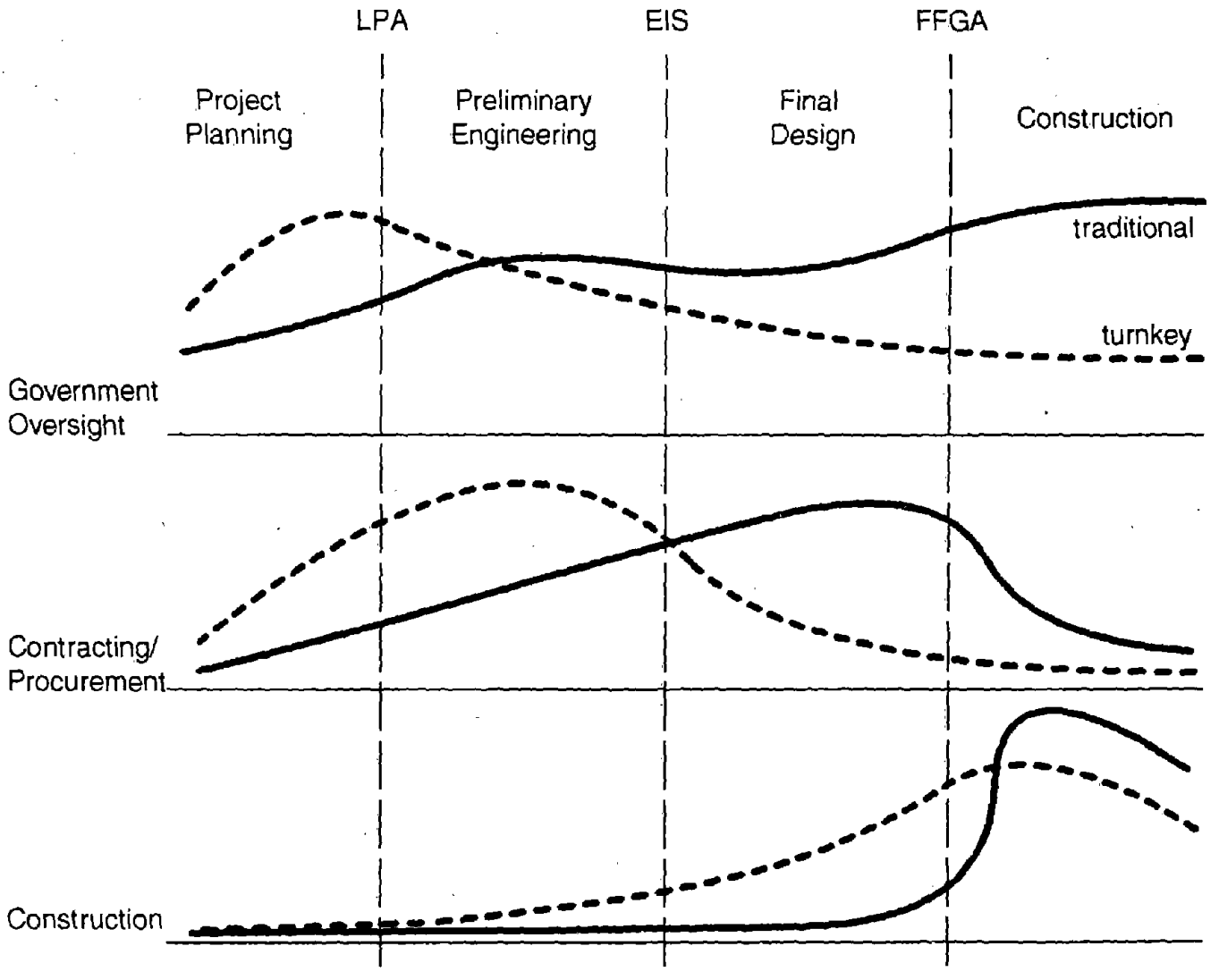


Figure 2-3. Traditional versus Turnkey Functions by Phase.

3. PROJECT PLANNING

The purpose of project planning is to gain a sufficiently comprehensive understanding of the region's transportation and land use trends and patterns to be able to identify potentially valuable capital projects for further development. Sound technical information needs to be generated in a form that will facilitate political discussion and decision.

3.1. FUNCTIONAL REQUIREMENTS

Project Planning has four subphases: system planning (long range planning), major investment studies (alternatives analysis), the locally preferred alternative, and consent for Preliminary Engineering (PE). System planning takes a comprehensive look at the region and identifies corridors or problem locations where investment is likely to be worthwhile; investment studies develop alternative projects for the selected corridors and generate technical information for choosing among the alternatives; selection of the LPA is the public decision process for choosing a course of action; and consent for PE supplements the LPA with additional project management plans and procedures.

3.1.1. Project Planning Overview

Planning at the project level seeks to describe, in both quantitative and qualitative terms, the transportation, demographic, land use, and related resources and problems affecting the metropolitan area.[1] Technical studies include employment and demographic forecasts, land use forecasts, travel demand analysis, and design and evaluation of alternatives. The information collected and developed should allow decisionmakers to understand the tradeoffs among alternatives, and to prioritize problems to be addressed.

[1] Procedural, technical, and compliance requirements are described in the FHWA-FTA joint planning regulations, issued as FHWA 23 CFR Part 450 and FTA 49 CFR Part 613, Federal Register, "Statewide Planning; Metropolitan Planning Agencies," January 1992.

3.1.1.1. Project Planning Inputs

Major inputs to project planning must be developed as part of the data gathering and analysis efforts that are carried out more or less continuously and which form the foundation for developing proposals for capital investments:

(1) Inventories of the capital stock, in highways, transit, and other transportation facilities.[2]
(2) Performance measures of existing services, including fares, tolls, congestion, condition, operating costs, and revenues.
(3) Spatial distributions of population, land use, travel, employment, cultural resources, economic activity, and geographic features.

3.1.1.2. Project Planning Outputs

(1) Technical analysis documenting corridor needs, alternatives considered, costs and benefits of preferred alternative, and financing proposal.
(2) Locally Preferred Alternative
(3) Project Management Plan (PMP)
(4) Project Management Oversight (PMO)
(5) Consent for Preliminary Engineering

3.1.1.3. Project Planning Processes

Figure 3-1 shows the process flow for all of the major Project Planning Inputs, Process and Outputs, consistent with the provisions of ISTEA. The process starts with Initial Planning concepts for transportation projects which generate long and short range plans. This is followed by an Analysis of Alternatives and a Draft Environmental Impact Statement of the proposed Alternatives. This leads to a recommendation of a Preferred Project (Locally Preferred Alternative) and finally a Project Management Plan, which serves as the point to request consent for the next phase called Preliminary Engineering. After each stage, FTA makes a decision on whether or not to proceed to the next stage. The following details the functional requirements of these components.

---

[2] ISTEA requires the development of management information systems to include traffic congestion, pavement, transit performance, and monitoring; these sources should provide an increasingly important source of information for documenting project planning recommendations. Interim regulations have been published as FHWA 23 CFR Parts 500 and 626 and FTA 49 CFR Part 614, "Management and Monitoring Systems; Interim Final Rule," Federal Register, vol. 58, no. 229, pp. 63442-63485, December 1, 1993.

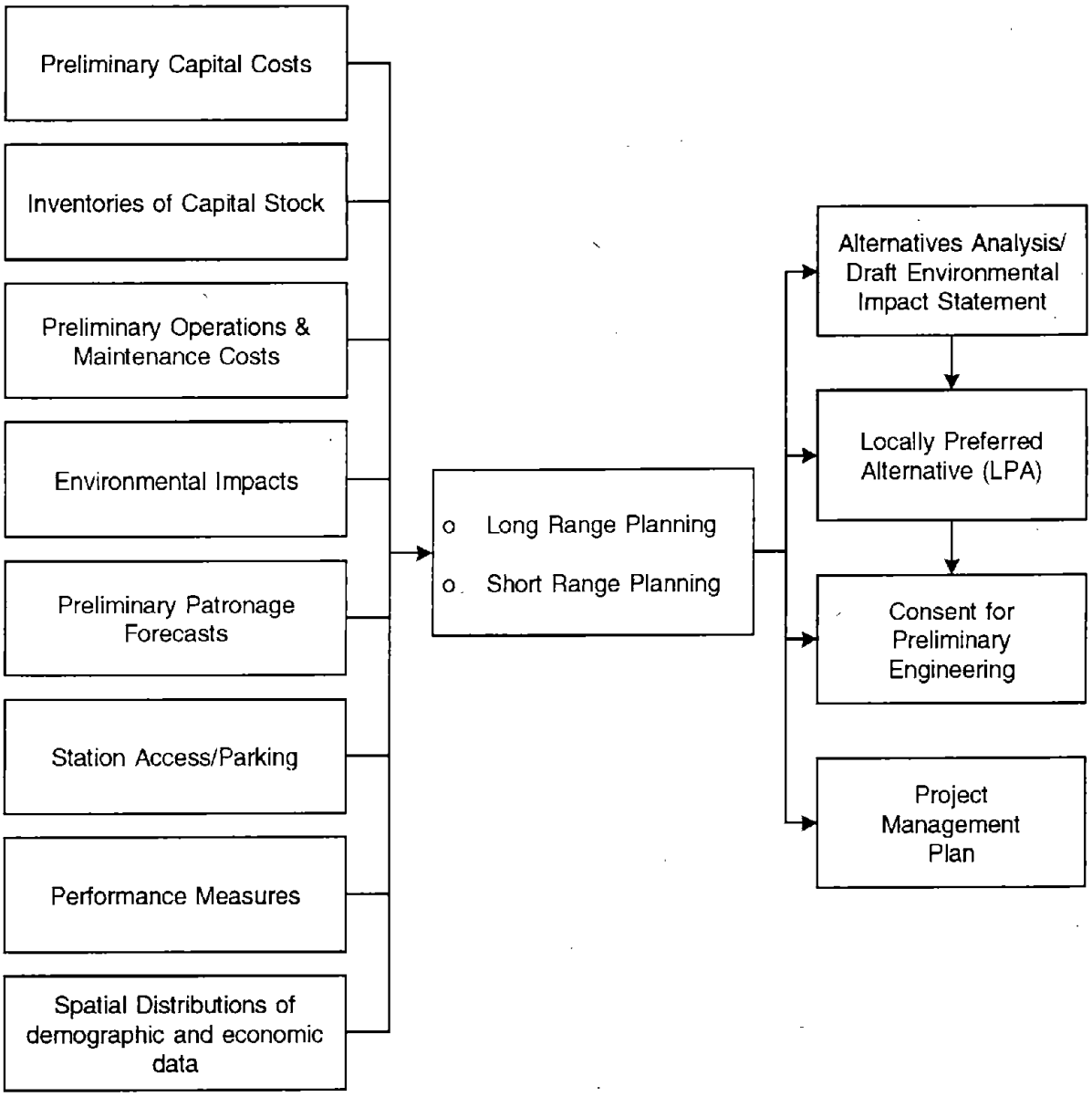


Figure 3-1. Project Planning Phase Inputs and Outputs.

3.1.2. System Planning

The functional requirements for providing long- and short-range planning for transit has its antecedence in the Federal Aid Highway Act of 1962. This Act was the first piece of federal legislation to mandate transportation planning as a condition for receiving federal highway funding in urbanized areas. Two features of this Act are particularly significant. First, it called for a planning process in urban areas rather than in cities, which set the scale at the metropolitan or regional level. Second, it required the creation of planning agencies, generally referred to as Metropolitan Planning Organizations (MPOs), to carry out the planning process. The National Mass Transportation Assistance Act of 1974 required that applicants for transit projects be subject to the same planning requirements and guidelines as highway projects. It further formalized inter-modal transportation planning.

The Urban Mass Transportation Administration (UMTA) and the Federal Highway Administration (FHWA) issued joint regulations in October 1975 to guide urban transportation planning. The regulations provided for the joint designation of MPOs to carry out transportation planning. MPOs are intended to be the forum for cooperative decision making by principal elected officials of general purpose local government. A multi-year prospectus and annual unified work program had to be submitted specifying all transportation-related planning activities for an urban area as a condition for receiving federal planning funds. These have been modified by more recent joint planning regulations issued in 1993.

This culminated in a urban transportation planning process which is required to produce a **Long-Range Transportation Plan.**, This plan is reviewed annually to confirm validity. This transportation plan has to contain a *long-range element* and a *shorter-range* ***Transportation Systems Management (TSM)*** element for improving the operation of existing transportation systems without new facilities. A multi-year ***Transportation Improvement Program (TIP)*** also must be developed to include proposed highway and transit projects within the coming 3 years.

3.1.2.1. System Planning Inputs

(1) Goals and Objectives
(2) Systems Inventories
(3) Travel pattern surveys
(4) Existing needs and problems
(5) Transit ridership forecasts
(6) Financial assessment

3.1.2.2. System Planning Outputs

(1) Long Range Transportation Plan
(2) Transportation Systems Management
(3) Transportation Improvement Plan

3.1.3. Major Investment Studies

Whenever a locality seeks federal funds for building a fixed guideway, requirements set forth in the Surface Transportation Act of 1978 mandate a detailed Alternatives Analysis. and Draft EIS (DEIS). The Alternatives Analysis must include a TSM option that involves better management and operation of the existing street and highway network and transit system. The DEIS is to include any environmental legislation not specifically covered in this Act.

The major investment studies must cover the following substantive areas:

(1) Social, Economic, and Environmental Impacts
(2) Conceptual Engineering
(3) Operations Planning
(4) Transportation Impacts (supply and demand estimates)
(5) Financing
(6) Evaluation of Alternatives
(7) Public Involvement

Studies must cover capital and operating costs, ridership attraction, effects on mode choice and levels of automobile use, environmental impacts and energy consumption, impacts on land use and development patterns, extent of neighborhood disruption and displacement, job creation, and other factors considered important by the local community. FTA mandates that as part of the Alternatives Analysis process, the calculation of measures that can be compared from project to project. Specific legislative mandates that need to be addressed and contained in the major investment studies include:

3.1.3.1. Air Quality Planning

The 1977 Clean Air Act establishes the concept of "non-attainment" areas - areas in which the National Ambient Air Quality Standards are exceeded for one or more pollutants. Areas that are in non-attainment must develop and implement plans that will reduce pollution. A proposed transportation project must demonstrate that it will reduce pollution relative to the alternatives.

3.1.3.2. Energy Conservation Planning

A proposed transportation project must demonstrate that there will be a reduction in the consumption of energy, generally measured in British Thermal Units (BTUs). Under the provisions of the Energy Policy and Conservation Act, states may receive Federal assistance for the development of energy conservation plans with program measures to promote the use of carpools, vanpools and public transportation.

3.1.3.3. Environmental Impact Reporting

NEPA states that Federally-assisted projects must be subjected to an assessment which determines the probable effects on the physical environment and social and economic conditions. The important consideration here is that there is an adequate consideration for alternatives and the need for wholesale documentation throughout the planning process.

3.1.3.4. Section 4(f) Statements

The Department of Transportation Act of 1966 Section 4(f) seeks to assure that public parkland and other 4(f) areas are not utilized for or disrupted by transportation facilities except in cases of extreme need. Because most public parks, recreation areas and historic sites are in most urban areas, there is a high probability that 4(f) impacts will occur. Thus, reasonably exhaustive investigations of alternatives is important to show that 'tests' regarding which project receives highest consideration. These tests include (1) costs for the alternative and disruption costs; (2) technical feasibility such as grades and curvatures; and, (3) environmental and other impacts on adjacent areas if the project went ahead as proposed.

3.1.3.5. Americans with Disabilities Act (ADA) Requirements

The Americans with Disabilities Act of 1990 establishes a clear and comprehensive prohibition of discrimination on the basis of disability. The Act requires "new vehicles purchased by public entities operating fixed route transportation systems to be readily accessible to and usable by the disabled." It further requires "public entities operating fixed route transportation systems to provide paratransit services for individuals whose disabilities preclude the use of the fixed route system."

3.1.3.6. Buy America

Legislation requiring that public agencies give preference to domestic suppliers or mandate a minimum domestic content for selected purchases applies to major transit

investments. Regulations are found in 49 CFR Part 661 that implement Section 401 of the Surface Transportation Assistance Act of 1982. Unless modifications are made, these regulations apply to turnkey as well as traditional procurements.

3.1.3.7. Public Participation

Organizations and individuals need to be provided with a variety of opportunities to learn about and comment on the project during the planning process. These include public meetings; meetings with organizations, businesses and individuals; regular meetings of project committees; status reports; and, newspaper articles. This participation is an integral part of the process for assessing all public, environmental, historic and economic impacts associated with the project.

During project planning, impacted community groups ("stakeholders") should be identified. Identification can be through self-identification or agency outreach. Outreach will be through:

- Newspaper articles.
- Legal notices.
- Community meetings.
- Distribution of information materials (flyers).

Community groups will be kept informed of the project's progress and given an opportunity to comment on and make changes in the project. Community participation at this project stage is used to build community support.

3.1.3.8. Major Investment Studies Inputs

(1) Long Range Transportation Plan
(2) Transportation Systems Management (TSM)
(3) Transportation Improvement Plan (TIP)

3.1.3.9. Major Investment Studies Outputs

(1) System Description (selected and rejected alternatives)
(2) Operating Performance Requirements
(3) Patronage Estimates
(4) Preliminary Alignment
(5) Capital and Operating Cost Estimates
(6) Financing Plan
(7) Master Schedule

(8) Project Development Budget
(9) Draft Environmental Impact Statement

3.1.4. Locally Preferred Alternative

Upon the successful completion of MIS, the local lead agency formally selects the LPA. The local lead agency submits a report to FTA with a request for approval to initiate the next phase, Preliminary Engineering. FTA approval can be expected when the Locally Preferred Alternative is supported by an acceptable degree of local financial commitment and is found to be justified based on a comprehensive review of its environmental impacts, Social and Neighborhood Effects, Economic benefits, Transportation benefits, Costs Analysis, and Land Development and Growth benefits.

3.1.4.1. LPA Inputs

(1) Major Investment Studies
(2) Draft EIS

3.1.4.2. LPA Outputs

(1) Locally Preferred Alternative

3.1.5. Consent for Preliminary Engineering

If the local area has generated adequate documentation for its LPA, and has demonstrated political and financial commitment to the project, FTA will generally give consent for the process to continue into preliminary engineering. Also required are a PMP and a PMO process.

3.1.5.1. Project Management Plan

When the Locally Preferred Alternative has been selected, a Project Management Plan is required by FTA to be developed for the project to proceed. Each transit project is unique and thus must reflect specific requirements of the project and its management philosophy. As outlined by FTA, the following is the generic outline of the contents of a PMP.

(1) Parameters and Constraints
(2) Organization and staffing
(3) Management Control
(4) Labor Relations and Policy

(5) Risk Management and Insurance
(6) Procurement of Services
(7) Procurement of Materials and Equipment
(8) Design Program
(9) Right-of-Way Acquisition
(10) Community Relations
(11) Construction Program
(12) Requirements for Interagency and Master Utility Agreements, Approvals, Permits
(13) Conflict Resolution
(14) Planning for Operations Start-up
(15) General Joint Development Program

3.1.5.2. Project Management Oversight

Project Management Oversight takes the elements of the PMP and condenses relevant topics for transmittal to FTA regional headquarters for their review. PMO is a relatively new concept, started by FTA less than ten years ago. The PMO contractor is the "eyes and ears" for the regional FTA grants administrator. Due to the overwhelming amount and diversity of projects in any given FTA region compared to the paucity of available staff, the PMO concept was started to help FTA keep track of major, complex projects. The fundamental aspects of this oversight involve checking, regulating and controlling the performance and execution of a FTA related construction project. This includes cost control, scheduling and time control, purchasing and inventory control as well as quality control throughout the entire planning, design and construction process. This monitoring is conducted independently or in concert by owner representatives, construction managers, engineers, project managers and others.

For a given project which is substantial in nature (e.g. over $300 million), the PMO sends the regional administrator monthly updates on the project. Included in these updates are recommended actions and possible outcomes.

3.2. TRADITIONAL IMPLEMENTATION

This section describes the current practice for satisfying the requirements outlined in the previous section.

3.2.1. Long and Short Range System Planning

In an effort to manage demand for federal funds, UMTA issued in 1984 a revised "Urban Mass Transportation Major Capital Investment Policy." Under this policy, FTA uses the results of local planning studies to calculate the cost effectiveness and local financial support for each project. These criteria are used to rate the projects. FTA funds projects that it ranks high on both criteria, as long as the total of available funds are not exceeded.

Elected officials, concerned citizens and representatives of the regional Metropolitan Planning Organization (MPO) combine to be a forum for cooperative transportation decision-making for an urbanized area.

The TIP serves as the mechanism that focuses and prioritizes the projects, establishes the relationship among projects and notifies the pubic of project status for the metropolitan area. ISTEA requires the TIP to cover a minimum of three years, submitted as part of the overall planning process for accreditation and, be updated at least biannually. Under ISTEA, highway and transit planning are combined in a multi-modal approach to problems. When the entire planning process, including the TIP and other planning documents are presented for approval and certification, the FTA and Federal Highway Administration (FHWA) together determine whether the prescribed approach is reasonable (e.g., facilitate inter-modal planning) and can propose recommendations to strengthen the plans pursuant to Federal guidelines (e.g., Clean Air Act attainment measures). Projects can only be contained in the TIP if funding is already earmarked, or is reasonably identifiable. The range of alternatives typically includes one or more rail options and/or bus guideway/HOV alternatives.

If one or more corridors appear to be candidates for fixed guideway transit investments, local officials select a primary corridor, identify a small set of promising alternatives, defined in terms of mode and general horizontal and vertical alignment, for detailed study.

3.2.2. Major Investment Studies

Although FTA no longer formally approves the initiation of an Alternatives Analysis, it is incumbent for local officials to decide when it is necessary and, to designate a lead local agency to analyze alternative solutions. The designated lead agency studies the priority corridor in detail, looking at alternative solutions to the transportation problems identified in the initial planning.

To determine and satisfactorily attain these requirements, an alternatives analysis process must yield two key outcomes: a cost effectiveness assessment and a DEIS. The cost effectiveness and DEIS analysis and can be arrived at the same time or sequentially (e.g.. cost effectiveness is the determinant for subsequently pursuing a DEIS), depending on the practices and culture of the local lead agency. The cost effectiveness assessment (referred to as Step 1.a) involves several related processes: development of a citizen involvement mechanism; choice of demand forecasting techniques; choice of cost-effectiveness analysis methodology; and, selection of a small set of transportation alternatives for analysis. The DEIS (referred to as Step 1.b) addresses social, economic and environmental issues, likely impacts associated with implementing each alternative and addresses input from public hearings.

3.2.3. Public Participation

Community participation is typically through a community outreach office. Outreach workers are assigned to specific communities or groups to insure continuity. Support for outreach workers in the form of pamphlet/flyer preparation and the administrative details for community and public meetings is frequently contracted out to specialized firms.

A typical community participation structure for MIS is the following:

Project Committees:
- Steering Committee
- Technical Committee
- Advisory Committee

Public Meetings:
- Scoping Meetings
- Public Hearing on the DEIS

3.3. POTENTIAL TURNKEY VARIATIONS

The "turnkey" strategy, generically, means that some functions that normally would have been carried out by the public agency or "owner" of the project are instead passed to a private firm. Of particular interest are those functions involving management and supervision.

Table 3-1 illustrates the shift of responsibility, function by function, that would occur under a turnkey approach. Actual variations from the traditional approach may select only a few functions to turn over to a contractor, or may turn them over only partially.

Table 3-1.
Project Planning Turnkey Variations by Functional Responsibility

Function Number	Responsibility: Function Name	Conventional = owner agency ... Turnkey = contractor
3.1.1	Project Planning	responsible for all project planning
3.1.2	System Planning	responsible for all system planning
3.1.3.1	Air Quality Planning	responsible for conformance to air quality requirements
		represents project owner at all hearings
3.1.3.2	Energy Conservation Planning	performs all energy conservation reporting
		represents project owner at all hearings
3.1.3.3	EIS reporting	performs all environmental impact studies
3.1.3.4	Section 4F	performs all Section 4(f) parkland use testing and feasibility studies
		proposes and evaluates 4(f) parkland use alternatives
		represents project owner at all hearings
3.1.3.5	ADA Requirements	responsible for design of all accessibility items
		responsible for project conformance to ADA requirements
3.1.3.6	Buy America	ensures conformance with Buy America requirements
		presents all certifications concerning Buy America requirements
		performs and monitors all required Pre-award and Post-delivery Buy America audits
3.1.3.7	Public Participation	coordinates all public relations regarding project
		responds to all external inquiries concerning project

Table 3-1.
Project Planning Turnkey Variations by Functional Responsibility
(cont'd)

Function Number	Responsibility: Function Name	Conventional = owner agency / Turnkey = contractor
		schedules all press conferences and public hearings
		represents owner at all hearings and public conferences on project
3.1.4/3.3.2	Locally Preferred Alternative	develops all potential alternatives for consideration as the LPA
		presents alternatives to MPO
		represents owner at all hearings and presents recommendations for LPA
3.1.5.1	Project Management Plan	prepares and submits project management plan to FTA
		addresses potential issues related to FTA Section 13c labor impact requirements
3.1.5.2	Project Management Oversight	coordinates all activities with PMO consultant
		serves as prime liaison with PMO consultant
		serves as prime liaison with FTA personnel and advisors
3.3.3	Hardware Selection	selects all hardware for project or system

Source: Richard J. Lobron, Lobron Consultancy, Ltd.

Various portions of the Project Planning phase can be contracted out (and are), but, because of the major requirements for political debate and public input, and the attendant risks, the introduction of turnkey methods in this phase appears to be more risky than at later stages. In addition to the difficulties and uncertainties presented by political review and agreement, another obstacle to turnkey procurement during project planning is the need to base contracts on conceptual designs with limited engineering detail. Extensions to existing systems may be feasible in this regard.

3.3.1. Environmental Impact Review

At the present time, FTA regards the environmental review process as unsuitable for turnkey procurement or as part of a turnkey project. The review process is inherently political, i.e.., it is a public decision process. The risks of drawn out controversy and unresolved conflict are largely outside the control of a private sector turnkey vendor, and there seems to be little to be gained by attempting to pass if off from the public sector.

3.3.2. Locally Preferred Alternative

For reasons similar to environmental impact review, it is probably necessary that the local MPO commit to a particular project before it becomes feasible to consider whether the project can be acquired using turnkey methods.

3.3.3. Selection of Hardware Technology

Whether a community can acquire a turnkey transit system without specifying the technology (e.g., standard steel wheel on steel rail versus rubber tire or advanced guideway) beforehand is open to question. Several urban areas have started this strategy, but none are still in progress or completed. A multi-stage approach seems necessary, such that competing technologies are compared and one selected before proceeding.

A strategy followed by Houston was to define performance envelopes that the system would need to satisfy, for such characteristics as capacity, peak headways, maximum noise levels, etc. For environmental impacts, this effectively meant "worst case" analysis.[3]

---

[3] See Booz-Allen & Hamilton, "Evaluation of Houston's Turnkey Experience," July 1994.

3.3.4. Integrated Systems

The possibility exists for entering into a contract for a complete system, perhaps using proprietary technology, once an alignment and performance requirements have been locally agreed upon. The vendor in such a case would supply all facilities, control systems, and vehicles, and perhaps operate the system for some period of time.

3.3.5. Procedures, Responsibilities, Risks

The risk in the project planning phase is that time and effort may be expended in the planning process, but no viable projects can be identified or agreed upon. Given the primary public sector role in making such decisions, this type of risk is necessarily borne by the community as a whole, primarily the local community.

3.3.6. Public Participation

Because many of the functional requirements of community participation are labor and time intensive, there few benefits to having these functions performed by a turnkey contractor. Since many of these functions are seen as political functions, their is usually a reluctance on the part of transit agencies to turn these functions over to a turnkey contractor. Due to the sensitive nature of community participation, it is likely that it will be handled by the transit agency under either the traditional or turnkey methods.

3.3.7. The Honolulu Example

The City of Honolulu undertook the acquisition of a new transit system several years ago using a turnkey approach. A schematic comparison of the traditional process and Honolulu's is shown in Figure 3-2. The general alignment and station locations were selected in project planning, and a locally preferred alternative was adopted on that basis, but choice of technology was left for the first step in a three-step turnkey process. The first step required proposals for systems, necessarily based on additional engineering design. Selecting the winning proposal yielded a specific technology.

Step two carried design into final design, and also included development of joint development plans. It was hoped that the joint development would result in substantial contributions to capital costs, but the result fell short and the City was unwilling to enact a sales tax to complete the financing. Thus step three, which would have included construction and operations, was not initiated.

In terms of the dimensions of turnkey scope as described in Chapter 9 (Prototype Turnkey Strategies), Honolulu's approach was both long (from technology selection

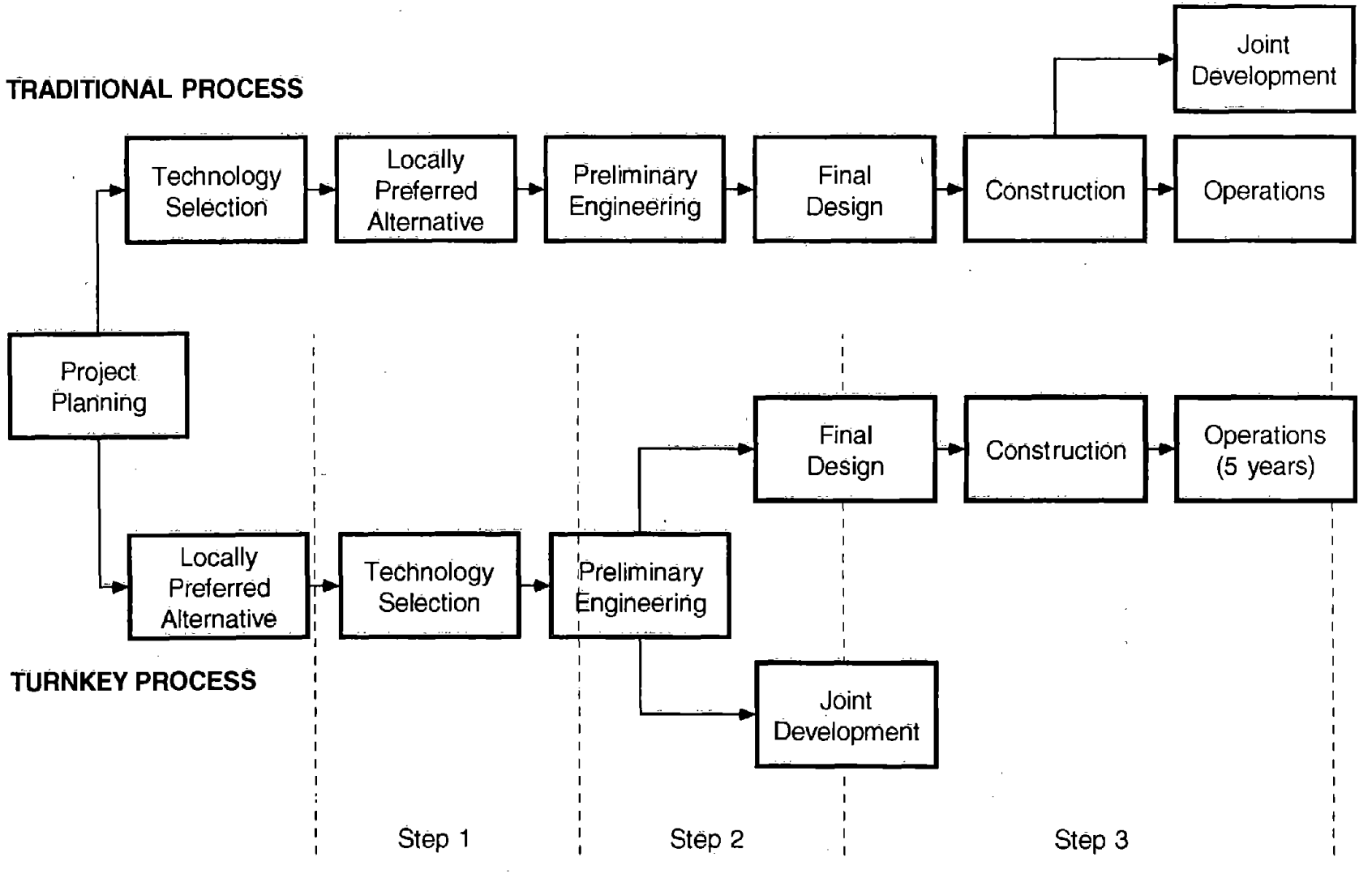


Figure 3-2. Comparison of Honolulu's Turnkey Process with Traditional.

through operations) and broad (civil, systems, vehicles, and joint development). Partly as a consequence of the failure of Honolulu's effort and a similar one in Houston, current turnkey projects are much narrower in scope; the possible exception is San Juan.

3.3.8. Extensions to Existing Systems

For projects that consist of extension of an existing system, turnkey contracting during the project planning phase may be a more likely possibility than for new systems. The political process may be less arduous, and the turnkey process might be initiated with further design and construction work contingent upon formal financial commitment to build the extention. Design and performance standards will have already been established by the existing system, and these guidelines and specifications can be provided to potential turnkey vendors. Performance requirements are unambiguous, in that operations must match and be fully compatible with the existing system.

3.4. EVALUATION

3.4.1. Potential Impacts

For most of the impacts associated with turnkey versus traditional procurement during the Project Planning phase, the transfer of responsibility implies a corresponding transfer of work effort to the contractor. Thus agency staff or direct contractor staff working on these functions could be shrunk, and turnkey contractor staff would expand. Whether these offsets are equal, or result in a positive or negative net change, is the task of the evaluator for each project. A net shrinkage in labor effort (agency staff costs decrease by more than turnkey contractor costs increase) implies that the turnkey method is more efficient, if the results are at least as good as would have occurred under traditional methods.

Similarly, transferring responsibilities to a turnkey contractor may result in speeding up the project (if the contractor accomplishes the same results sooner) or slowing it down (if the time and effort required to prepare the project for turnkey contracting exceeds any time savings once the contractor starts).

3.4.2. Benefits

Potential benefits of turnkey procurement are reduced labor, material, and capital costs; a faster schedule to completion and operation; and other benefits such as higher reliability, lower long run operating cost, better design, and greater attractiveness to ridership. Because the critical functions in Project Planning depend heavily on public

review and political decision processes, it is not obvious what advantages a turnkey contractor might have to reduce costs or shorten the schedule. Other, less immediate benefits, however, might be important.

4. PRELIMINARY ENGINEERING

The major objective of Preliminary Engineering (PE) is to investigate the merits of alternative configurations and designs. Project management oversight, which continues throughout the life of the project, system definition, value engineering, Final Environmental Impact Statement (FEIS), financial planning, and cost control functions are accomplished in this phase. In PE the project is developed from a planning stage to a level of definition that allows important preliminary cost estimates to be made. These investigations require appropriate analysis of all system elements, their interrelations and their costs. PE accomplishes system design and integration that is:

(1) Comprehensive in that all functional and system aspects are covered/treated;

(2) Consistent in level of detail across functions;

(3) Intermediate in level of detail between the first cut provided by Project Planning (the strategic level, Chapter. 3) and the Final Design level (Chapter. 5) that prepares the project for construction.

This intermediate level will occur for any capital guideway project, whether large or small, simple or complex.

Figure 4-1 shows overall inputs and outputs for the PE phase.

4.0.1. Preliminary Engineering Inputs

(1) System Description
(2) Performance Requirements
(3) Preliminary Patronage
(4) Preliminary Alignment
(5) Preliminary Environmental Statement
(6) Master Schedule
(7) Project Budget
(8) Facilities Requirements

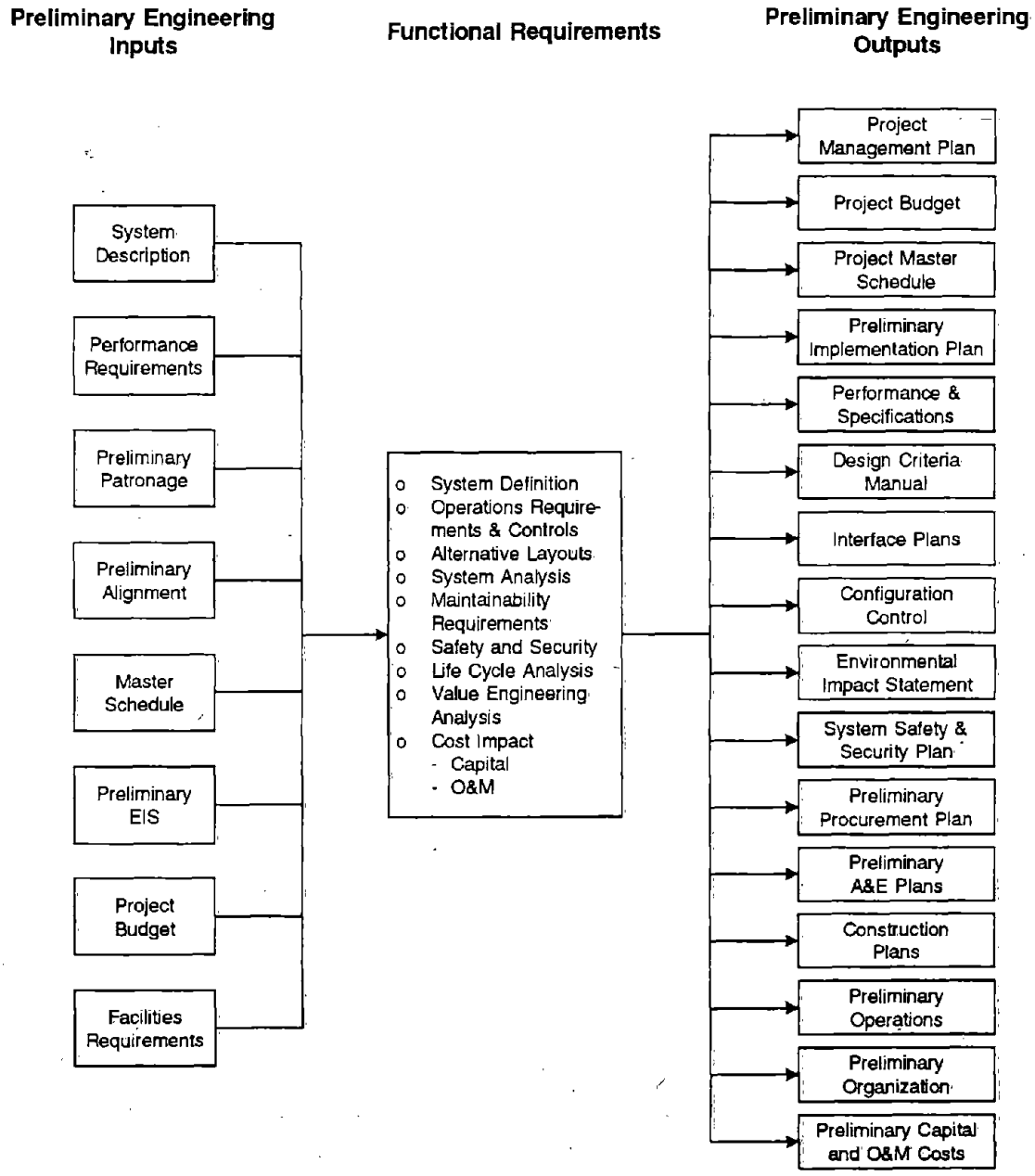


Figure 4-1. Preliminary Engineering Phase Inputs and Outputs.

4.0.2. Preliminary Engineering Outputs

(1) Project Management Plan
(2) Project Budget
(3) Project Master Schedule
(4) Preliminary Implementation Plan
(5) Performance and Specifications
(6) Design Criteria Manual
(7) Interface Plans
(8) Configuration Control
(9) Environmental Impact Statement
(10) System Safety and Security Plan
(11) Preliminary Procurement Plan
(12) Preliminary A&E Plans
(13) Construction Plans
(14) Preliminary Operations
(15) Preliminary Organization
(16) Preliminary Capital and Organization and Management (O&M) Plan

4.1. FUNCTIONAL REQUIREMENTS

This section describes the functions and activities that must be served during the Preliminary Engineering phase. These activities must be covered in this process whether traditional or turnkey. Activities include the development of system performance specifications for vehicle, stations and guideways and the development of grantee procurement bid packages which define the system that suppliers will respond to. The bid package generally consists of documentation such as contract approach; work statement if efforts to be performed; interrelationships and responsibilities of the various project participants; bidding instructions and evaluation criteria; preliminary project schedule; technical provisions/specifications; preliminary drawings of the alignment, stations and other fixed facilities; terms and conditions proposed by a grantee for the final contract and, acceptance by all relevant public and private bodies of the Final Environmental Impact Statement.

4.1.1. System Definition

The further definition and quantification of the proposed project is generally considered to be the primary function of the PE phase.

4.1.1.1. System Configuration and Scope

The scope of work for PE system configuration and scope should include stated agency input, distinguishing between "information" and "criteria," the PE project management network, a time-phased breakdown of the work elements to be performed, a definition of expected level of parametric and conceptual analyses and, a definition of the product expected, including all subelements.

Throughout the PE phase, the budget and scope of the proposed work should be kept commensurate with that accepted in the Project Planning phase. The requirements for documentation must be defined and channels for communication formalized.

4.1.1.2. Design and Operational Criteria

The design and operational criteria are typically defined in detail during the PE phase, although there may be modifications in Final Design. Activities include:

Collection of data characterizing the natural and built environments, such as surface and subsurface survey data, utility surveys and utility relocation estimates.

Undertaking studies of systems requirements, including configuration and operational evaluations, rolling stock requirements, noise and vibration studies, fare collection needs, security, safety and ADA.

Selection of guideway and structure types compatible with alternative route analysis including alternatives of alignment and profile require studies on costs, feasibility, schedule, environmental impacts, etc., identification of surface, elevated, and underground elements and, identification of utility and real estate impacts.

Develop station criteria, to including station type based on cost, schedule, construction methodology and impact on environment, architectural definition, fare collection, security, concessions, circulation, intermodal connections, parking facilities, finish materials, signage and graphics, lighting, mechanical and electrical equipment, ADA needs, station layouts compatible with guideway profile and alignment, defined by appropriate sections and elevations, applicability of system-wide procurement, utility interfaces and, proposed station maintenance procedures and associated costs.

Develop maintenance facilities criteria, typically layouts for railyards, bus garages, etc., definition of maintenance requirements in terms of inspections, repair cycles, functions, staffing, materials, testing, etc. and, consideration of needs for future expansion.

Develop operational criteria for system components and selection of systems and subsystems appropriate to the project including:

- vehicles
- power and distribution needs
- train controls
- communications
- ventilation
- track structure and drainage
- safety and fire protection
- fare collection
- work equipment

4.1.1.3. Value Engineering and Peer Review

Value engineering (VE) and peer reviews are mechanisms which allow for knowledgeable professionals with different perspectives to review and comment on the efforts of the PE design team. A value engineering incentive clause (VEIC) provides a method for the contractor to propose changes in contract plans and specifications that will lower total costs without degrading performance, maintainability or reliability. Properly used, value engineering will eliminate unnecessary design complexity and help lower political risk. The Preliminary Engineering phase is generally accepted as the single best point in time to receive the maximum benefits from a VE review.[1] A review team is formed consisting of both personnel who are familiar with the design being reviewed as well as personnel with no vested interest in the current design. The recommendations from this review team are used to trigger the incentive clauses contained in the Value Engineering element of the contract.

VEIC's can vary to meet particular conditions depending on unique characteristics of the project. They should, however, always contain a clear description of what the clause is and how it is to be applied. The following are elements of a typical description:

(1) The contractor may submit to the engineer, in writing, a value engineering change proposal to modify the plans, specifications or other requirements

---

[1] EG&G Dynatrend, "Assessment of Financial Control Systems and Risk in the Transit Construction Industry," *prepared for FTA/OTAS Washington DC*, pp. 10-3 and 10-4, December 1994.

of the contract to reduce the total cost of construction without reducing design capacity or quality of the finished product.

(2) If accepted by the owner, net savings resulting from the value engineering change proposal will be shared equally by the owner and the contractor.

(3) This special provision applies to all change proposals initiated and developed by the contractor and identified as such by that entity at the time of submission to the engineer; however, nothing in the proposal shall be construed as requiring the engineer to approve it.

Federally funded transit construction contracts generally have a VEIC whereby the prime contractor can submit a value engineering change proposal (VECP). The FTA requires the following:

- o Peer reviews for bus facilities, conducted at the end of PE
- o Value engineering on major capital projects which include new fixed guideway segments, or major extensions or rehabilitation of existing systems
- o VE to be conducted before major design decisions are fixed
- o VE study workshop administered by an impartial, diverse team (typically a one-week effort) and conducted as follows:
  - information phase
  - creative phase
  - analytical phase
  - developmental phase
  - presentation
- o VE study report in two weeks

4.1.1.4. Final Environmental Impact Statement

A functional and legal requirement of the PE phase is to complete the Final Environmental Impact Statement (FEIS), and any Supplemental Environmental Impact Statement (SEIS) as required. The FEIS provides a qualitative and quantitative assessment of the proposed project on the environment. It provides definitive comments of the project as compared with the no-build and other identified alternatives, and provides a primary basis for allowing the project to move forward. A work program should be developed to ensure that the FEIS will complete circulation concurrent with the completion of PE. This must include a Community Outreach effort ensuring that the community's input throughout the entire project planning and PE stages have been

incorporated into the document as well as to offset any potential opposition due to inadequate communication.

4.1.2. Financial Requirements and Resources

An important function of the PE phase is the development of preliminary cost estimates upon which the viability of the proposed project depends. The costs of various project elements is critical in conducting trade-off analyses. A financial plan must also be developed to meet the funding requirements.

4.1.2.1. Cost Estimates

Cost estimates should be prepared in sufficient detail to permit the designation of viable funding sources in the Federal, state, local and private sectors. Estimates must include the following components:

- o Capital costs reflecting all activities for the following:
  - final design
  - real estate
  - equipment and construction
  - project management
  - inspection
  - testing and start-up
  - all expenses, contracted and force account, leading to operations
  - contingencies commensurate with level of detail
- o Operating and maintenance costs based on the operating plans formulated in the PE phase

4.1.2.2. Sources of Funding

A firm and legal commitment of funding from respective sources is a functional requirement and must be obtained. Financial resources available should meet estimated costs. The Federal government through FTA has been the primary source of capital funding in the past twenty-five years. This funding usually must have a local and/or state match of some pre-determined proportion (e.g., 80% Federal, 20% State/Local Bond) to qualify for funding. The two main categories of FTA funding are Section 9, which is distributed on a formula basis and the discretionary Section 3 which is for major capital investments such as new fixed guideway projects. Local funding may come in the form of general obligation bonds, sales, fuel or other excise taxes, or through other alternative financing techniques. These alternative techniques may include assessments,

fees, negotiated investments, private donations, a state-run lottery, use of property and property rights, private development and, public/private partnerships.

4.1.3. Project Management

The management of PE is ultimately the responsibility of the owner/agency. An important function of the PE phase is to establish the scope of the activities to be undertaken, and to establish appropriate controls on quality, cost, and schedule. A requirement for FTA financial support is that a Project Management Plan (PMP) be developed and approved, reflecting the specific requirements of the project and the management philosophy.

4.1.3.1. Management

In addition to general project development, management is also traditionally responsible for the following areas:

- Human resources, including labor relations, Department of Labor (DOL) wages and classification, and other applicable Federal, state and local regulations.
- Project Safety, including Occupational Safety and Health Administration (OSHA) requirements.
- Equal Employment Opportunity (EEO) and Affirmative Action requirements.
- Local Area Awareness Studies.
- Agreements addressing Third Party interests associated with the proposed project, e.g.:
  - franchise utilities - power, phone, cable, gas and steam and other.
  - public agencies - streets, sewer, water, drainage, navigation, fire, traffic and other.

4.1.3.2. Work Breakdown Structure

A Work Breakdown Structure (WBS) displays and defines the product(s) to be developed or produced and relates the elements of work to be accomplished to each other and ultimately to the end product. Manageable work packages are the building blocks of a WBS. A key benefit of installing a WBS is that it facilitates better management control and accountability. The major packages of work lend themselves to representation through network diagrams which show the sequencing of the work and can be used to highlight critical components. These packages are represented on the network diagrams with numbers or alpha-numeric identifiers. This work sequencing tends to be of a hierarchical form with the lower tiers identified in the PE stage. Some of the more

detailed elements or elements in the higher tiers of a WBS may not be fully defined until final design and project execution.

4.1.3.3. Configuration Control

The configuration of the project involves the physical and technical definition of the design and performance criteria. It exists for system-wide elements such as capacity, safety and security, subsystem elements such as vehicles, communications and power distribution and, for fixed facilities such as guideway and stations. Configuration Control consists of evaluation, coordination, and approval or disapproval of changes in the configuration of an item after establishment of a configuration baseline.[2] This baseline consists of approved technical documentation with drawings uniquely numbered (or otherwise identified) and sequenced.

It is the responsibility of the agency proposing the project to provide design criteria and applicable standards for the conduct of the PE effort. The agency should also make clear the lines of responsibility and authority for any deviations from the prescribed approach.

The review of work during the PE phase should include the following:

- In-Progress Preliminary Submittal which will:
  - recommend organizational approach
  - evaluate rejected alternatives
  - identify major utility conflicts and include all affected parties
  - identify major physical constraints

- Preliminary Design Submittal which will:
  - define the bounds of the PE effort and final design
  - record the basis for the design requirements
  - describe the impact of the construction activities
  - document the concurrence of the participants
  - estimate the project costs
  - establish the Right Of Way (ROW) limits

- Control Mechanism for Design Changes which will:
  - control deviations from design criteria
  - establish procedures for solving design problems in the field to expedite the work

---

[2] EG&G Dynatrend, "Project and Construction Management Guidelines," *prepared for FTA/OTAS Washington DC,* p. 3-25, September 1990.

4.1.3.4. Quality Assurance/Quality Control (QA/QC)

Quality Assurance (QA) are those actions performed by the transit agency and the FTA to directly improve the likelihood that the contractor's work will result in a project that meets the required performance standards. The Quality Assurance Program should be an integral part of the above submittals. Quality Control (QC) are those actions performed by the contractor to fulfill the stated requirements for quality. Generally, QC refers to the act of taking measurements, testing, and inspecting a process or product to ensure it meets specification. A more detailed account of a QA/QC plan involving the New York Metropolitan Transit Authority can be found in the next chapter Final Design, Section 5.1.4, as well as the "Quality Assurance and Quality Control Guidelines," published by FTA/OTAS in March 1992.

4.1.3.5. Master Schedule and Schedule Control

The Master Schedule is a plan showing the phasing and implementation of the project. Although first proposed in the Project Planning phase, it becomes especially critical in the PE and Final Design phases. This schedule is usually presented in the form of the Critical Path Method (CPM) in PE with major milestones for Final Design, Construction and Start-up. A simplified Critical Path Method program should be implemented for use in the PE phase showing sequence of activities; windows for completion necessary interfaces and, updates on status and progress. The CPM tool should be tied to financial and cost data and function as a primary management information system. Schedule control involves reviewing the schedule for reasonableness, adequacy of the CPM program, as well as monitoring updates and corrective measures undertaken to make up for schedule slippages. The WBS elements must be scheduled, with clear lines of authority and responsibility for their execution.

4.1.3.6. Cost Control

The organizational lines of authority and responsibility for cost control must be clearly delineated. A cost budget should be developed consistent with the WBS elements, and integrated with schedule controls. Also, administrative procedures for establishing "Force Accounts" occur at this time (Force Accounts are special project-specified funding usually from FTA but can also be from state and/or local sources from which project personnel may charge their costs). The following budget information is desirable:

- comparison of actual costs to planned costs
- reviewing/updating estimates and forecasting costs
- managing contingencies

- planning for and documenting within the General Ledger and Personnel/Payroll system, the 'force account' support to the project

4.1.3.7. Information Management

Minicomputers and microcomputers have become valuable tools for project and information management. Software that has been developed and applied to design and construction applications has allowed project managers the ability to better manage three key phases: planning, scheduling and control. CAD and similar computer software allows for the distribution and organization of management information and to conduct "What if?" analysis. Start, finish and other scheduling constraints can be modeled. Reports can be generated and updated quickly complete with graphics, charts resources and cost information. This information, although commenced in PE, can be continually upgraded and changed throughout the life of the project. In addition, procedures are put into place to ensure that all information flows are monitored and controlled so that appropriate personnel receive appropriate information in a timely manner.

4.1.4. Real Estate Acquisition and Management

Most capital transit projects involve real estate and a program to manage real estate acquisitions and easements is essential. In order to eliminate project delays and litigation, the process for real estate acquisition should be timely, predictable and organized. It should include: identification of permanent and temporary interests in real estate needed; required utility and railroad easements; planned procedures to appraise, acquire, develop, and dispose of real estate, including costs and funding and, planned procedures for property management.

4.1.5. Preliminary Procurement

4.1.5.1. Procurement Strategy/Design Consultant

In most cases, an agency will form a selection board to conduct major procurement activities. These activities include: rating the capabilities of interested design organizations; compiling "short lists" of capable firms; interviewing and ranking the most capable firms and, providing recommendations to management.

The acquisition process to select a design consultant is usually initiated while continuing review of the scope of work progresses. It is imperative that the scope of design work be delineated as clearly as possible to minimize costly problems later in the project development.

4.1.5.2. Acquisition Disputes and Claims

Should disputes arise, an agreed upon set of procedures to resolve differences is essential. Means of accomplishing this include mediation, arbitration, an independent board of consultants, a contract board of appeals, and litigation. It is critical that disputes be resolved before they impede project progress. Disputes and claims are discussed in more detail in Chapter 7.

4.1.6. Construction Safety

A variety of hazards is associated with most large capital projects. To the extent possible, risks should be identified and their consequences quantified. A program of risk control through prevention measures or insurance coverage will meet many needs, but some "residual risks" will remain. While these risks cannot be avoided, controlled, or insured, they must be reconciled as meeting some test of acceptability.

4.1.6.1. Safety Programs

A well documented body of literature and case studies exists upon which to establish accident prevention programs. Federal, state, and local health and safety standards and regulations will apply in all jurisdictions. A safety program should be in place for all project phases:

- o Design professionals working in the field
- o Operational requirements for future system safety
- o Construction, the industry recognized as being least safe including:
  - a system for review and approval of enforcement;
  - routine documentation and accident reporting;
  - safety training;
  - environmental hazard mitigation;
  - incident investigation.

4.1.6.2. Insurance Protection

There are two primary alternatives for insurance protection, conventional and "Wrap-up." In the Conventional approach, each contractor and subcontractor arranges their own coverage and all marginal and secure firms and insurers participate equally. With "Wrap up" Insurance (also called a Coordinated Insurance Program), the owner negotiates policy terms and costs, eliminates cross litigation between contractors and subcontractors and ensures that uniform coverage and cost control are manageable. Insurance protection is discussed in more detail in Chapter 7.

4.2. TRADITIONAL IMPLEMENTATION

This section describes the current practice for satisfying the requirements outlined in the previous section.

4.2.1. Project Management

The management function can be accomplished with (1) in-house staff; (2) with a combination of agency staff supplemented with consultants or, (3) through a general consultant charged with the primary responsibility for design. Expanding and shrinking agency staff is costly and slow, and acquiring the full range of skills for major construction is difficult. Hence the agency will generally function as the prime contractor, but supplement its capabilities with private architecture and engineering (A&E) firms.

The larger or more complex the project, the greater the number of such firms will be hired, in order to have more independent assessments, i.e., more people doing the same thing and checking each other's work. For projects as small as a single rail transit station, the agency may issue more than a hundred different contracts to a large number of different contractors. Thus there is a substantial amount of redundancy built into the traditional process, in part to prevent politically embarrassing revelations of mismanagement, and in part because public agencies assume that contractors will try to get away with whatever they can.

A major contract normally issued during the PE phase is for the services of a general engineering contractor (GEC). The GEC supervises day-to-day construction, provides information to the agency on the activities and performance of other contractors and subcontractors hired by the agency and in general, ensures that the PE functional requirements are implemented so that Final Design can begin.

4.3. TURNKEY VARIATIONS

One of the biggest issues in turnkey contracting/project development is redefinition of the functions of management and the interfaces between the owner and turnkey vendor-designer-builder. Most of that redefinition has to be resolved here in the PE phase. Depending on the nature of the specific project and the owner's posture with regard to risk, significant portions of PE responsibility may shift to the private sector turnkey contractor.

Attributes of the "pure" turnkey approach to PE are shown in Table 4-1. For each functional requirement, the activity described would become the responsibility of the turnkey contractor ("C") instead of the agency ("A"), or as otherwise indicated in the table. The spectrum from pure traditional to pure turnkey has many intermediate points, for each function, so the impacts of following the turnkey strategy depend upon the degree to which it differs from the traditional method.

4.3.1. System Definition

For a turnkey project, the requirement at this phase is also to develop the conceptual framework within which the turnkey operator will function and exercise some appropriate degree of freedom commensurate with the intended benefits associated with the turnkey process. The thinking within the owner/agency management should be strategic in nature, identifying their responsibilities in preparation to turning over substantial control of selected elements of the project to the turnkey contractor.

4.3.1.1. Design and Operational Criteria

To maintain cost and schedule control, the owner/agency will have to establish which subsurface and utility "unknowns " to assume responsibility for, and which can be better managed by the turnkey vendor at a later point in time. The question of the acquisition and responsibility for subsurface information needs careful analysis. A complete "hands off" policy by the owner will lead to high contingency allowances by turnkey bidders.

The physical and analytical bounds to be placed on the turnkey contractor must be defined, e.g., are a family of structure types acceptable? Can variations in the alignment be tolerated to accommodate alternative concepts? Can unorthodox construction methodology be utilized in the interests of cost or schedule?

As in the case in Hawaii, it may be prudent to delineate finish materials and "specialty items" to be furnished and installed by the owner at a later date, thereby gaining control over high visibility items for which quality standards may be particularly difficult to enforce in the hands of a turnkey contractor.

In the interests of encouraging competition among turnkey vendors, design criteria will be somewhat generic for those subsystems selected for acquisition through the turnkey process. For other than new-start projects, consideration must be given to the integration of new equipment with existing systems.

Table 4-1.
Preliminary Engineering Turnkey Variations by Functional Responsibility

Function Number	Responsibility: Function Name	Conventional = owner agency / Turnkey = contractor
4.1.1.1	Preliminary System Configuration	performs all preliminary Systems studies
		determines alternative routes and selects preferred route
4.1.1.2	Preliminary Design and Operational Criteria	performs all preliminary design
		performs surveys
		performs systems analysis to ascertain requirements
		selects guideway and structure
		develops station criteria
		develops system component designs
		develops facilities design and layouts
		defines ongoing operational standards
4.1.1.3	Preliminary Value Engineering/Peer Review	selects value engineer or peer reviewer to assess all work products of C and subcontractors
4.1.3.2	Preliminary Work Breakdown Schedule	develops work breakdown schedule
4.1.3.3/4.3.3.3	Preliminary Configuration Control	can add any phase to project
		can delete any phase from project
4.1.3.4	Quality Assurance	performs all QA assessments on subcontractors
		submits design and engineering work to assessment by independent parties other than A
4.1.3.5	Schedule Control	establishes all schedules for design

Table 4-1.
Preliminary Engineering Turnkey Variations by Functional Responsibility
(cont'd)

Function Number	Responsibility: Function Name	Conventional = owner agency / Turnkey = contractor
		establishes all schedules for construction
		monitors compliance to schedule by subcontractors
		does not monitor schedule on an ongoing basis
4.1.3.6	Cost Control	responsible for all cost control
		no change orders permitted in project
4.1.3.7	Information Management	develops all management information systems
4.1.4/4.3.4	Real Estate Acquisition and Management	responsible for acquiring property
		responsible for funding/financing real estate acquisitions
		responsible for obtaining government authority
4.1.5/4.3.5	Preliminary Procurement	responsible for design regardless of budget
4.3.6	Risk Management	responsible for certain risks (see Chapter. 8 Risk Allocation)
		obtains and maintains necessary professional and liability insurance to protect A
4.1.1.4/4.3.1.3	Final EIS	responsible for performing FEIS
		responsible for obtaining government approvals on FEIS
4.1.2.1/4.3.2	Cost Estimates	provides all cost estimation
4.1.3.1/4.3.3	Project Management	responsible for control of labor and materials

Source: Richard J. Lobron, Lobron Consultancy, Ltd.

4.3.1.2. Value Engineering and Peer Review

In the Traditional process, the VE review team is comprised of personnel who are familiar with the design being reviewed, especially agency staff as well as personnel with no vested interest in the current design. While VE in the traditional process can produce worthwhile financial and operating benefits, it can serve to slow down the design process. In Turnkey, VE is *de facto* incorporated into the ongoing design process, even while construction has commenced. As design progresses, it is anticipated that VE is incorporated into the design without otherwise slowing or impeding the process, nor without special consultation with agency staff. A risk is that the design may produce potential atheistic and/or political problems which cannot be adjusted without serious financial penalties to the agency much later in the process. Special creativity may be required to incorporate appropriate value engineering incentives in turnkey contracts, which by their nature should already be capitalizing on unique vendor capabilities, proprietary methods and equipment, etc. through the selection process.

4.3.1.3. Final Environmental Impact Statement

Depending on the nature and extent of the turnkey elements in the project, some deviations from the approved DEIS may have been introduced. The execution of any supplemental studies required may be the action of the owner or its agent, or of the turnkey contractor, depending on the contractual language.

4.3.2. Financial Requirements and Resources

4.3.2.1. Cost Estimates

Estimates of capital costs for typical turnkey-type projects are generally the sum of the owner/agency direct costs for procurement and management of the project, plus the turnkey vendor costs (his bid price), and any applicable contingencies in accordance with risk sharing analyses.

4.3.3. Project Management

Cost and schedule control will largely be the responsibility of the turnkey vendor. It will fall upon the owner to implement the appropriate oversight procedures to get the "warm feeling" that tells him his turnkey vendor is doing the job. Similarly, self-policing quality control may be directed by the turnkey construction contractor, but follow-up by the owner is essential.

4.3.3.1. Management

Depending on the specifics of any given turnkey project, some responsibility for routine management areas, typically labor and safety, will be handed off to the turnkey vendor. Particular attention must be paid by the owner/agency to the interests of Third Parties in the development of a turnkey project. Policy decisions regarding easements, relocation's, and real estate transfers as well as studies, meetings, reviews, presentations and other interfaces with the general public will continue to be largely the responsibility of the sponsoring agency. The contractor(s) will largely handle the administrative details at the direction of the sponsoring agency.

4.3.3.2. Work Breakdown Structure

Assuming that a generalized WBS is developed by the owner, it is appropriate that the turnkey contractor be directed to "flesh out" in further detail the owner's WBS, or an approved alternative. This can then be the basis of a future project management tool common to both organizations.

4.3.3.3. Configuration Control

The technical baselines established during Preliminary Engineering are normally used for monitoring purposes during the construction phase and fabrication processes. There are instances, however, where changes are required, especially in early design, before construction is impacted. All changes to the baselines must be technically reviewed and approved by responsible individuals as set forth in the Project Management Plan. In the traditional method, changes do not materially affect construction because construction has not commenced. In the case of turnkey, changes may have substantial and even have adverse impacts to the project. For example, with construction occurring as configuration control is being finalized, the degree and type of changes may delay the project. For the turnkey contractor, there needs to be a point in the process when the configuration control baselines should not be allowed to materially change, and design must be adequate to allow for concurrent construction.

4.3.3.4. Schedule and Schedule Control

In traditionally structured projects, problems concerning the coordination, clarity, completeness and constructability of the drawings and specifications may create a legally charged atmosphere which can result in schedule delays. Because responsibility for both design and construction is contained within the design/build firm, these problems should be less likely to occur. Even when changes are needed, the design/build entity should be

better able to respond and adapt to changes during PE than in the traditional environment with the changes being implemented less formally and more quickly.

4.3.4. Real Estate Acquisition and Management

The question of easements, utility modifications, and other "third party" interfaces can become somewhat more problematic under a turnkey contract than the traditional approach. Knowledge of the full extent of these issues requiring negotiations with outsiders will be incomplete before turnkey contract award. Issues of configuration, alignment, new infrastructure requirements, etc., may intentionally be only loosely defined at this point.

4.3.5. Preliminary Procurement

4.3.5.1. Procurement Strategy/Design Consultant

The development of the acquisition process for turnkey design and build warrants considerable effort on the part of the owner. It should include rigorous selection criteria to ensure that the increased responsibilities surrendered to the contractor are in good hands.

The scope of work to a turnkey contractor will include not only major elements of design, but also a very large portion of the budget representing construction and subsystems acquisition and installation.

4.3.6. Risk Management

Turnkey contracting provides a mechanism to significantly reallocate risk sharing between the public and private sectors. The potential for large profits can attract turnkey vendors to assume larger risks. See Chapter 8 for more detail into Risk Management.

4.4. EVALUATION

For the purposes of this Turnkey Evaluation Project, it would be beneficial for the Evaluation Contractor (EC) to have some level of interaction with the PMO. It is recommended that quarterly, the EC reviews the PMO progress reports and incorporates this information into the EC analysis. In this way, the EC can develop an 'actual' scenario to compare to the baseline (traditional) alternative. Moreover, this can help the EC to develop an amicable relationship with the PMO and seek information vital for the

EC to do an effective job; information that the EC might not have been able to obtain and/or verify on its own.

4.4.1. Potential Impacts

Direct impacts derive from transferring responsibilities from the agency to the turnkey contractor. Indirect impacts depend upon the levels of skill and effort required to prepare the turnkey procurement, versus the productivity gains from utilizing a potentially more capable resource. For additional impact considerations, see Chapter 7 (Contracts and Procurements) and Chapter 8 (Risk Allocation) .

4.4.2. Benefits

If the contractor is more productive, then total costs will be lower and the schedule will be shortened.

5. FINAL DESIGN

The Final Design stage refines the Preliminary Design and begins the preparation of final cost estimates, drawings and specifications. It represents the phase when the conceptual design of the system is further defined to that which will actually be implemented. Individual construction bid packages, schedules and management plans are produced and commenced. If FTA agrees to fund the project, they will negotiate a Full Funding Agreement with the grantee at the end of Final Design. This agreement binds the local agency to complete construction of the project, set a fixed ceiling on the federal contribution, and establishes a schedule for federal contributions.

The final products of the Final Design Phase are final drawings, technical specifications, and contract documents required to solicit construction contract bids. The quality of these drawings, specifications, and contract terms has a direct impact on contract bids. The owner should strive to place construction contractors in the best possible position to submit realistic bids by providing as complete information as possible.

Overall fundamental inputs and outputs for the Final Design phase are shown in Figure 5-1.

5.0.1. Final Design Inputs

(1) Project Management Plan
(2) Project Budget
(3) Project Master Plan
(4) Preliminary Implementation Plan
(5) Safety & Security Plan
(6) Preliminary Procurement Plan
(7) Preliminary Construction Plan
(8) Preliminary A&E Plan
(9) Preliminary Organization Plan
(10) Preliminary O&M Plans
(11) Preliminary Capital and O&M Plan

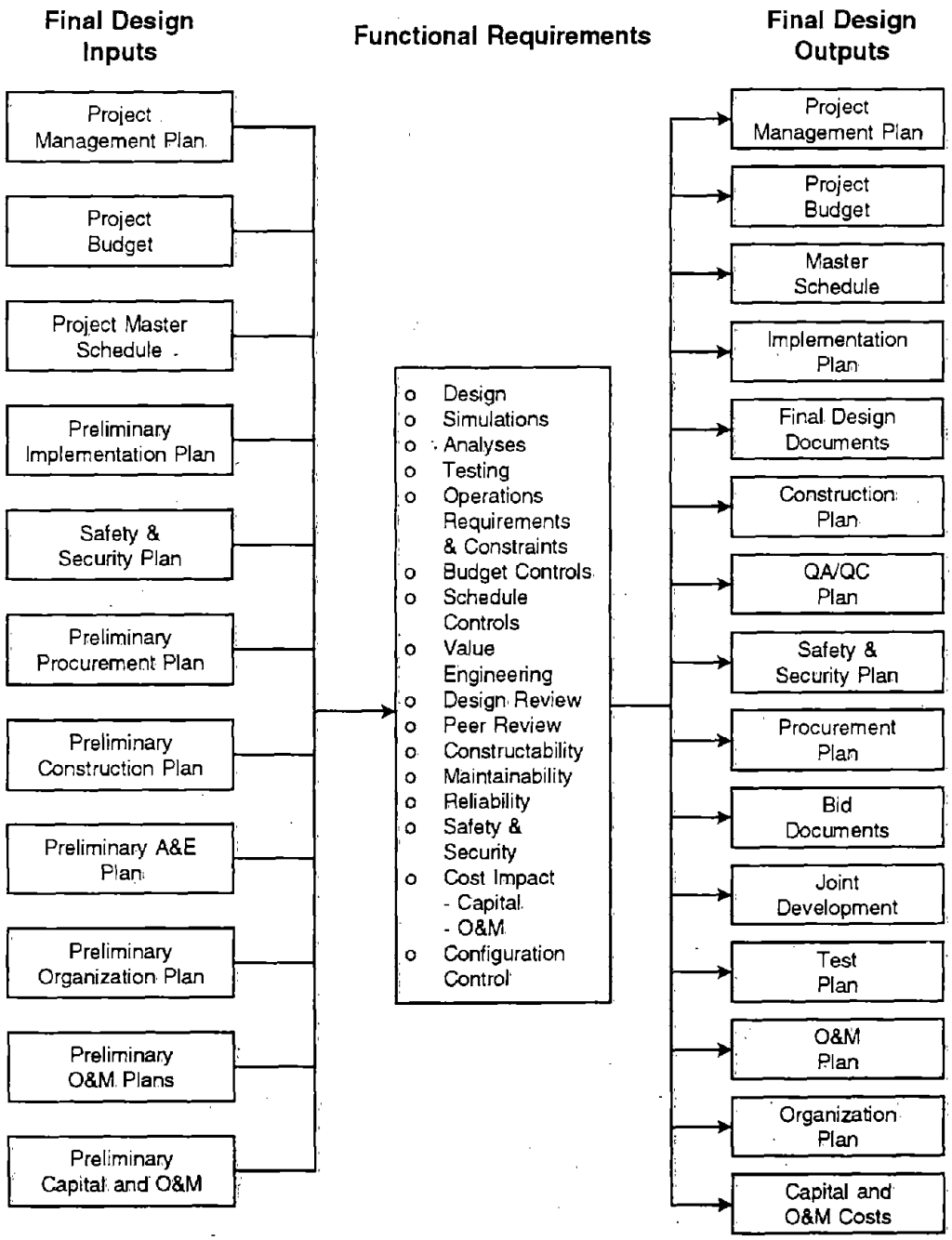


Figure 5-1. Final Design Phase Inputs and Outputs.

5.0.2. Final Design Outputs

(1) Project Management Plan
(2) Project Budget
(3) Project Master Plan
(4) Implementation Plan
(5) Final Design Documents
(6) Construction Plan
(7) QA/QC Plan
(8) Safety & Security Plan
(9) Procurement Plan
(10) Bid Documents
(11) Joint Development
(12) Test Plan
(13) O&M Plan
(14) Organization Plan
(15) Capital and O&M Plan

5.1. FUNCTIONAL REQUIREMENTS

This section describes the functions that must be completed during Final Design, such as Scope, Cost and Time management and, Contracts and Procurement management. These functions must be covered by any design process, whether traditional or turnkey. Measures for quality assurance, risk management, project control and site mobilization are determined. Administration of construction management procedures such as progress payments, change orders, inspections and disputes are defined. Various operational analyses are performed including those on availability achievement, safety and security and, operations, maintenance and training. Management plans for quality assurance and testing, schedule, cost document control, configuration management, etc., are generated. Final designs of equipment and facilities are made including: vehicles, computers, software and other control equipment; power distribution; fare collection; guideways, stations, maintenance facilities; utility relocation; graphics and, communication systems. Procurement of many long lead time items such as vehicles, fare collection, and computer software are initiated.

5.1.1. System Engineering

The following items should be included within the scope of Final Design in support of efforts to finalize the project's definition:

- Designation of organizational responsibilities

- o Work breakdown structure
- o Required design documentation
- o Definition of system interfaces
- o Constructability, reliability and maintainability
- o Interface of maintenance and operations
- o Design review schedule

5.1.1.1. System Configuration and Scope

By the beginning of Final Design, the project is almost fully defined. The following issues may still require additional clarification and definition:

- o Clear delineation and assignment of risks to the party which is best able to control them
- o Disclosure of all engineering and geotechnical information gathered
- o Provision for contract adjustments for differing site condition
- o Identification of contract obligations of both owner and contractor
- o Definition of avenues for contract adjustment for delays resulting from action, lack of action, or delayed action

5.1.1.2. Design and Operational Criteria

Design criteria in Final Design are based upon the foundation laid during the Preliminary Design effort. Design reviews are the primary means of exercising control and guidance over the design process. Design reviews accomplish the following:

- o maintain quality standards in design work
- o ensure that operational needs are fulfilled
- o assure that evolving design product will be biddable and constructible
- o maintain interface compatibility
- o assure compliance with design criteria

Operational criteria define the operating environment, incorporating and synthesizing the equipment parameters and infrastructure configuration. At the final design stage, there should be little if any refinement from the criteria established in Preliminary Engineering.

5.1.1.3. Value Engineering and Peer Review

In addition to scheduled design reviews, VE and Peer Review provide independent critique of the products of Final Design. The focus of VE, however, should be in the

PE Phase when the benefits tend to be the greatest. Peer Review may be an appropriate vehicle for specialized independent input to the owner on issues which present unique problems or where an outside critique is desired.

5.1.2. Project Management

Management Control Systems is the art of directing and coordinating human and material resources throughout the Final Design stage by using modern management techniques to achieve predetermined objectives of scope, cost and time. The essential function of these objectives is to assure that project work is structured and subdivided into manageable segments, that responsibility for accomplishment of milestones of each segment of work is assigned and that each work segment is adequately defined to facilitate verification and performance measurements.

Scope management is the function of controlling a project in terms of its goals and objectives through the processes of conceptual development, full definition or scope statement, execution and termination. It is embodied in the Project Management Plan. Cost management is the function required to maintain effective financial control of the project through the processes of evaluating, estimating, budgeting, monitoring, analyzing, forecasting, and reporting the cost information. Time management is the function required to maintain appropriate allocation of time to the overall conduct of the project through successive stages of its natural life-cycle by means of the processes of time planning, time estimating, time scheduling, and schedule control.

Control and successful implementation of a project can only be achieved if all parties clearly understand their respective roles and responsibilities achieved through careful planning and communication. The status of the project at any given time is only apparent through consistent and accurate feedback. Often this feedback can only be fully understood through proper interpretation of the project environment. Collectively, these activities come under the heading Communications Management. The functional role of Communications Management is to provide a medium for processing and deciphering the different sources and different forms of information. From this, project team management has a 'roadmap' of what kind of message(s) to send, knowing who to send the message(s) to, and translating the message(s) into a language all can understand. Thus, appropriate information can be sent on time to the appropriate element(s) to reduce misunderstandings and bottlenecks in the project.

Inputs and outputs for the project management function are listed below and shown in Figure 5-2.

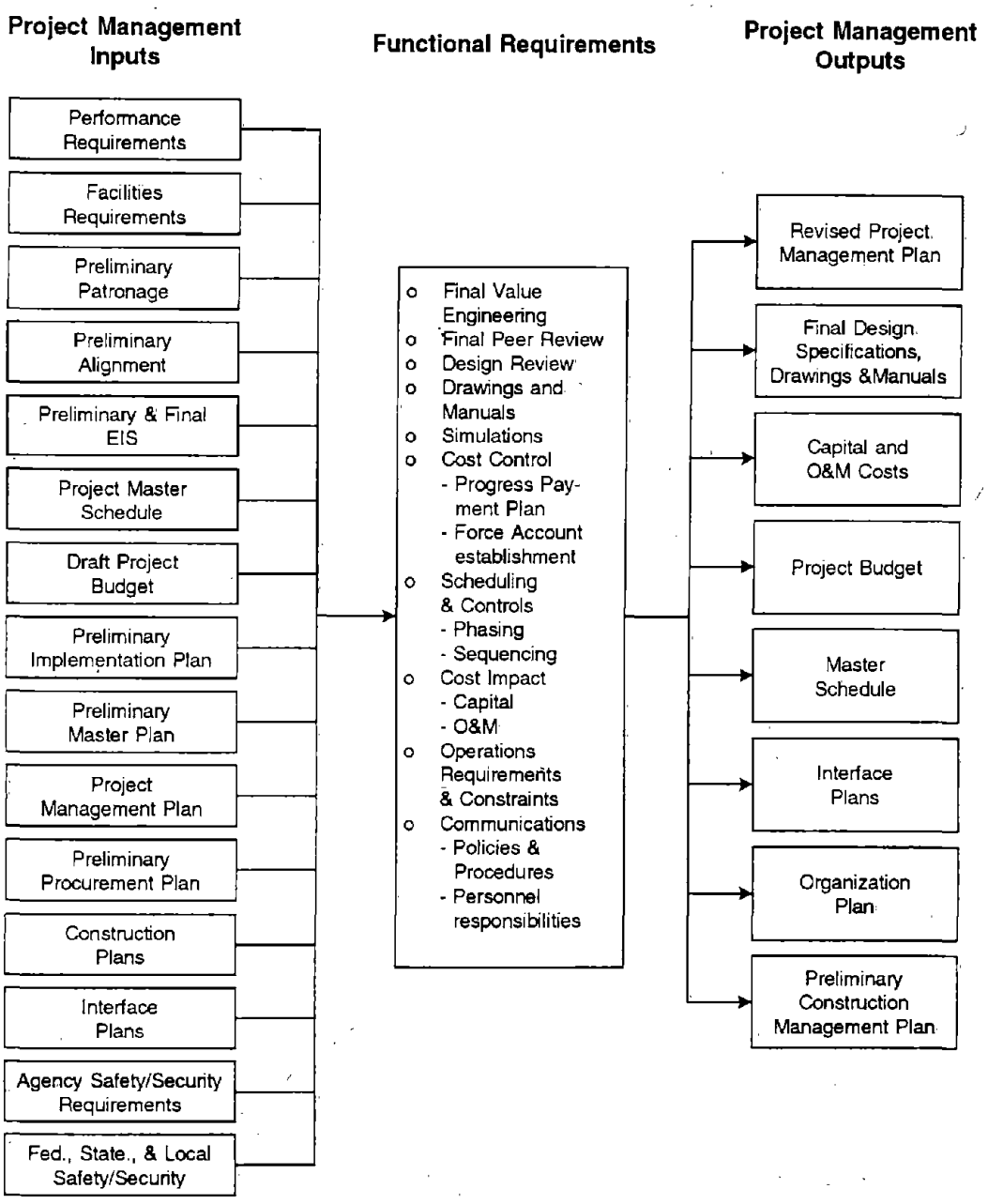


Figure 5-2. Final Design Phase Project Management Inputs and Outputs.

5.1.2.1. Project Management Inputs

(1) Facilities Requirements
(2) Performance Requirements
(3) Preliminary Patronage
(4) Preliminary Alignment
(5) Preliminary and Final EIS
(6) Draft Project Budget
(7) Project Master Schedule
(8) Preliminary Implementation Plan
(9) Preliminary Master Plan
(10) Project Management Plan
(11) Preliminary Procurement Plan
(12) Construction Plans
(13) Interface Plans
(14) Agency Safety and Security Requirements and Guidelines
(15) Federal, State and Local Safety and Security Laws and Ordinances

5.1.2.2. Project Management Outputs

(1) Revised Project Management Plan
(2) Final Design Specifications, Drawings and Manuals
(3) Project Budget
(4) Capital and O&M Costs
(5) Master Schedule
(6) Interface Plans
(7) Organization Plan
(8) Preliminary Construction Management Plan

5.1.3. Contract/Procurement Management

All capital projects require contractor services. Due to a general scarcity of resources, long project lead times and increasing complexities of the legal system under which projects operate, a contract document is required to clarify roles and responsibilities and to legally bind the parties. To ensure fairness in the acquisition process, it is vital to have defined procurement procedures. It is vital for project management to have a clear understanding of the theory, practices and processes of the entire discipline of contract/procurement management so that their personnel/goods/real estate/service acquisition activities may not become isolated (and potentially illegal) incidents, but relate to an integrated whole upon which to build a successful project.

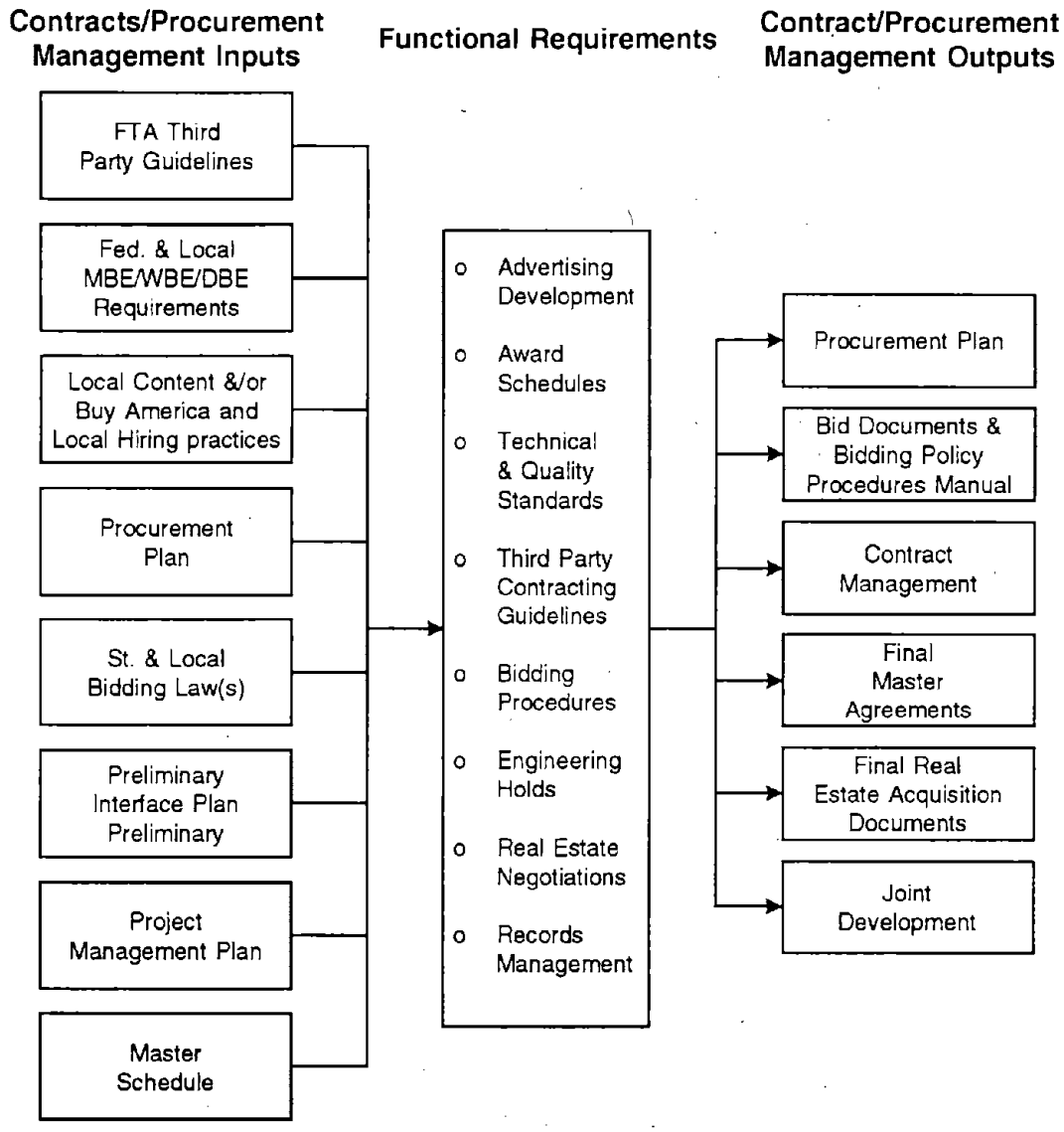


Figure 5-3. Final Design Phase Contract/Procurement Inputs and Outputs.

Inputs and outputs for contracting and procurement are listed below and shown in Figure 5-3. A complete treatment of contracts and procurements can be found in Chapter 7.

5.1.3.1. Contract/Procurement Management Inputs

(1) FTA third party guidelines
(2) Federal and Local MBE/WBE/DBE requirements
(3) Local content and/or Buy America requirements, and Local hiring practices
(4) Procurement Plan
(5) State and Local Bidding Law Procedures, if applicable
(6) Interface Plan
(7) Project Management Plan
(8) Master Schedule

5.1.3.2. Contract/Procurement Management Outputs

(1) Procurement Plan
(2) Bid Documents and Bidding Policy Procedures Manual
(3) Contract Management
(4) Final Master Agreements
(5) Final Real Estate Acquisition Documents
(6) Joint Development
(7) Defined responsibilities of each party

5.1.4. Quality Assurance/Quality Control (QA/QC)

Quality Assurance (QA) are those actions performed by the transit agency and the FTA to directly improve the likelihood that the contractor's work will result in a project that meets the required performance standards. Quality Control (QC) are those actions performed by the contractor to fulfill the stated requirements for quality. The Quality function is the process of ensuring that all aspects of a project and its results fully meet the needs and expectations of the project's client, participants and taxpayers - both internal (relating to the project's system of development), and external (relating to the project's performance or service). The primary components of the quality management function are:

A. Overall Quality Philosophy - The involvement of all project participants in ensuring that project goals, requirements and performance standards are in compliance with the expectations of both the client and the project team.

B. Quality Assurance - The managerial processes that determine the organization, design, objectives and resources, and that provide the project team, client and taxpayers with performance standards and feedback on the project's performance.

C. Quality Control - The technical processes that examine, analyze and report the project's progress and conformance with performance requirements.

The Quality program includes plans for testing components of the project. Tests include those of subsystems and components, and would include attending factory and/or on-site tests. The testing program plans are produced in tandem with the Operations and Maintenance plans to insure a seamless integration with the overall system.

The Quality Management program includes a system-wide safety, security and fire-protection planning and implementation program. This program involves two key goals. First, working closely with designers early in Final Design, a systemic strategy to ensure the safety and security of patrons and employees of the facility after it becomes operational. This includes planning to anticipate crime problems and emergency response procedures; establish goals; select and evaluate countermeasures; consider limits, constraints and trade-offs and, establish a cost-benefit strategy. Second, adequate precautions and planning be taken to ensure that the worksite(s) is safe and secure during construction for workers and the general public.

Inputs and outputs for the quality assurance functions are listed below and shown in Figure 5-4.

5.1.4.1. Quality Assurance Inputs

(1) Project Management Plan
(2) System Description
(3) Facilities Requirements
(4) Draft Project Budget
(5) Value Engineering
(6) Peer Reviews and Recommendations
(7) Agency Guidelines
(8) Agency Safety and Security Requirements and Guidelines
(9) Federal, State and Local Safety and Security Laws and Ordinances

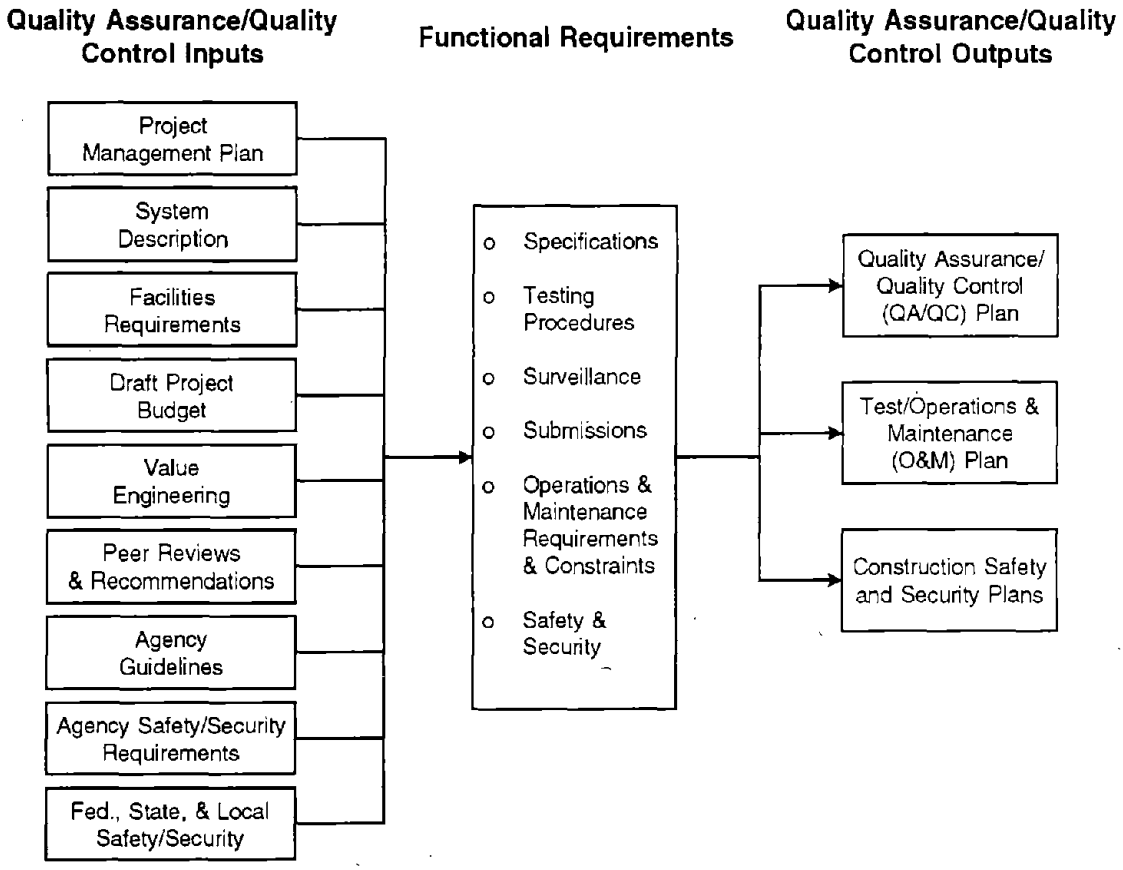


Figure 5-4. Final Design Phase Quality and Safety/Security Management Inputs and Outputs.

5.1.4.2. Quality Assurance Outputs

(1) Quality Assurance/Quality Control (QA/QC) Plan
(2) Test/Operations & Maintenance (O&M) Plan
(3) Construction Safety and Security Plans

5.2. TRADITIONAL IMPLEMENTATION

This section describes the current practice for satisfying the requirements outlined in the previous section.

5.2.1. Project Management

Management control of a major transit project is not a single process, but consists of numerous multi-staged tasks. Various levels of review and approval are established before products are available for subsequent activities. These include normal internal reviews and approvals established by the grantee and its contractors as well as PMO methodology employed by the grantee and the financing agency. For example, schedule information is a basis for funding information which together are vital components of the Project Management Plan. For the sake of simplicity, the process of fulfilling the functional requirements of scope, time, cost and communication management respectively, are represented as the Project Management Plan and Final Design Specifications; Project Budget and Capital O&M Costs; Project Schedule; and, Communications Management made up of the Interface Plans, Organization Plan and Preliminary Construction Management Plan.

5.2.1.1. Revised Project Management Plan

The Project Management Plan is a continually evolving document describing project approach, organization, staff, external relationships, project reporting and reviews, cost control techniques, and staffing and reporting to be used during Final Design. The critical paths for all elements of inputs for PE are finalized and approved. The final Value Engineering and Peer review inputs are presented. Inspection, analysis and demonstration activity used to verify compliance are agreed upon and success criteria (i.e., pass/fail) are established. As part of the conflict resolution element, procedures for changing scope or cost of contracts (Change Orders) are presented. Through review with the agency and the Prime Contractor, a system is put into place during pre-construction, and compliance is monitored by the agency during construction. Ultimately, information from this document, and the outputs that follow, serves as a

guide so that a bidding construction contractor knows what his bid is to be based upon after Final Design is complete.

5.2.1.2. Final Design Specifications, Drawings, and Manuals

The Final Design specifications provide detailed requirements and procedures for guidance of all those involved in construction, modification, rehabilitation and installation work for all system elements and final route alignment. These Drawings and Manuals are detailed directives which when combined together will indicate all details of the permanent construction and installation work. Three major categories of design review occur to reach final design. Typically, they are referred to as the 30-percent review, the 60-percent review and the 90-percent review (although the exact percent complete could vary slightly depending on the nature of the project). The 30-percent review is to demonstrate that the approach to all major design concepts and features has been resolved and the final design can continue without delay. The 60-percent review is to ensure that all major features of design are progressing in accordance with prior direction, major engineering decisions have been made, most drawings, preliminary specifications and other documents are well advanced. The 90-percent review is to ensure that drawings and specifications are completed and checked when submitted for review. At this stage, the cost estimate is verified against the design-to-cost figure established for the project.

5.2.1.3. Project Budget

As the project design moves along, the Project Budget is being constantly updated and revised based on estimates from staff and consultant studies. These estimates are based on assumptions of future trends along with the assessment of probabilities, uncertainties and inflation that could occur during the project (commonly referred to as contingency). Statistical techniques assist in the development of a project cost confidence level consistent with the degree of risk desired. These studies serve as the basis for constructing the total cost of final design, real estate acquisition, construction, project management, inspection, operation start-up costs, and all other costs required to prepare the Project for revenue operations.

An important ingredient also contained in the project budget is a process for cost control. In general, it involves the gathering, accumulating, analyzing, monitoring, reporting and managing costs on an ongoing basis. Contractor invoices are monitored and payments to contractors, including a Progress Payment Plan based on amount of work accomplished are reviewed. Also included is oversight on release of retainage. (e.g., attorney fees for real estate issues).

Of special importance is the establishment of Force Accounts. These are special project-specified funding from FTA, state and/or local sources from which project personnel may charge their costs. This procedure is incorporated into the General Ledger accounting system and insures adequate project record keeping and cost control are maintained.

5.2.1.4. Capital and O&M Costs

Cost estimates are prepared for all system components. All Capital and O&M cost estimates are reviewed, updated and finalized by agency and/or contracted cost engineers based on a final Operations plan and anticipated vehicle and manpower needs. Various life-cycle approaches are used as inputs to constructing a maintenance plan.

5.2.1.5. Master Schedule

The management of time is crucial to the successful completion of a project. In the Final Design phase, the PE master plan schedule is reviewed by the agency and the PMO to determine if the project can still be carried out within the proposed sequence of tasks and within the required time frame. The process involves identifying and updating critical path tasks, checking for logical sequencing of tasks, the ability to maintain existing service during construction, and the ability to operate interim segments. Delays can be caused by one contractor affecting the schedules of others. However, responsibility for maintaining the schedule is solely on the agency. The agency addresses any scheduling problems through procedures incorporated in the Interface Plans.

5.2.2. Communications Management

5.2.2.1. Interface Plans

Continuing the process started in Preliminary Engineering, these plans identify responsible parties and recipients of information, and procedures for distribution of information. Generally, the agency Engineering and/or Construction department is responsible for all interface planning. As organization and staffing are put into place, this liaison staff acts as the conduit for information flows for the private sector design and construction contractors (and subcontractors) and the various public and quasi-public sector elements. Included are the scheduling of meetings and the compilation and distribution of minutes. The staff ensure open lines of communication, produce and ensure administration of a plan for conflict resolution. The interface plan is monitored and revised as situations warrant.

5.2.2.2. Organization Plan

This is the plan describing all personnel reporting responsibilities. Each functional position is defined by a position description. The position description covers Responsibilities, Authority, Reporting relationships, and, Requisite qualifications and experience. The responsibilities, authority and reporting relationships are constructed into an Organizational Chart, which is distributed. As personnel are hired and depart, the organizational chart is continually updated.

5.2.2.3. Preliminary Construction Management Plan

This plan is drafted during Final Design by the Engineering and/or Construction department and is to provide for scheduling, liaison, guidance and control of all planned construction. Throughout construction, this plan will serve as the guide for the Prime Contractor for building the project. In the Final Design process, therefore, it is important that all information contained within this plan is adequately shared with appropriate personnel and departments. In this way, the opportunity for feedback before construction can eliminate potential misunderstandings and waste. The plan is also constantly reviewed by a Project Management Oversight team.

5.2.3. Quality Assurance and Safety Management

General quality and safety/security guidelines are promulgated from the agency Board of Directors and senior management. The Quality staff takes these guidelines and prepares the detailed plan for executive approval and implementation. The process for Quality and Safety/Security Management is achieved through the Quality Assurance/Quality Control Plan, Test/O&M Plans, and, Preliminary Construction Safety and Security Plans.

5.2.3.1. Quality Assurance/Quality Control (QA/QC) Plan

The QA/QC program provides a planned and disciplined approach to assure that (1) all work performed is in accordance with specifications; (2) all equipment has been tested and is functioning as specified and, (3) the detection of undesirable conditions and their corrections have been addressed through the use of a set of procedures, inspections, tests and plans. The QA/QC plan is generally designed and implemented by the agency during the early stages of Final Design. The party(s) responsible for QA/QC are identified, inspection requirements, testing requirements, staffing and organization for the program, materials standards criteria are set, quality trend data is obtained and surveillance results are gathered.

A representative example of a successful Quality Assurance plan is from the New York City Transit Authority. It incorporates the standards and requirements set forth by the Authority's Vice President and Chief Engineer, Board of Directors, the Federal Transit Administration and various Federal, State and local agencies and their representatives. The critical elements of the N.Y.C.T.A. QA/QC plan are as follows:

Organization: Authority and accountability are clearly established.

Training and Certification: Inspectors and Auditors are certified and periodically re-certified to perform their assigned functions.

Design Control: Ensure design activities are in compliance with applicable codes, standards, and regulatory requirements affecting quality.

Procurement Control: Evaluate contractors prior to bid award to determine their ability to meet quality requirements. Suppliers are subject to inspection, surveillance and audit as they produce contracted items or services.

Document Control: Identify appropriate organizations, coordinate interfaces, collect and file, distribute and dispose of appropriate documents.

Construction Control: Oversight of construction documentation relating to quality.

Inspection and Test: Verification of conformance to design requirements, on a regular basis by inspectors independent of the contractors.

Measurement and Test Equipment Control: Independent re-calibration of instruments.

Statistical Process Control: The application of formal statistical sampling and control procedures that permit accurate monitoring of the process by which a task is performed.

Quality Evaluation Methods: The technical process of gathering measured variables and statistical samples for decision making. Evaluation methods include Graphs and Charts, Pareto diagrams and Exception Reporting.

Corrective Action: Identify problems, with the ability to stop work until corrective problems are resolved.

Non-Conformance and Warranty: Disposition or replacement procedures for items not conforming to established requirements, codes, drawings, etc.

Audits and Records: Program of specific audits with identifiable and retrievable records.

5.2.3.2. Test/Operations and Maintenance (O&M) Plan

This is the plan that states the type of functional tests that will be performed on items submitted for acceptance as meeting all requirements to assure their continuous quality. Acceptance test procedures and report format, whether performed in a laboratory or in the field, are drafted and reviewed with agency, Prime Contractor and manufacturer representatives. Throughout the Final design stage, operating departments analyze and define the operating and maintenance needs of the project. The findings of this plan are incorporated into the overall agency O&M strategic plan.

5.2.3.3. Preliminary Construction Safety and Security Plans

These are system-wide safety, security and fire protection system plans designed to ensure the safety of workers and the general public at work sites, and to protect contractors' and grantee's equipment and property. These plans provide basic guidance to field and office personnel on the rules and regulations regarding safety procedures relating to job controls (i.e. proper permits obtained, approval of shop drawings), daily railroad operations (i.e. flagging rules, setting up track), equipment (i.e. inspection certificates for use of cranes or other hostling equipment, proper licensed operators), housekeeping job site (i.e. daily inspection of work, weekly job meetings). This plan includes procedures to be followed prior to, during, and after agency inspection visits.

Plans are continually reviewed and compliance is verified through on-site inspection visits by agency inspectors. Plans are tied into a comprehensive insurance program to increase the efficiency of both programs. The agency also investigates accidents and breach of security incidents. A list of deficiencies are compiled at the agency and/or the PMO team takes corrective actions to fix deficiencies.

The plans also describes security and safety systems when the facility is operational. These include hardware and devices; station and vehicle design; personnel and operations; judicial policy and, land use.

5.3. TURNKEY VARIATIONS

The turnkey method is a procurement technique in which a public entity contracts with a single private-sector entity to deliver a complete and operational product, such as a fixed guideway system or an extension of an existing system. Experience in the private sector and with the U.S. Army Corps of Engineers suggests that turnkey contractors, motivated by the profit incentive, can be better able to control project staffing, schedule and costs, with obvious benefits to the project owner. This is primarily because the project owner and other external organizations are contractually prohibited from impeding or otherwise impacting the scope and administration of the project once it has commenced. This section details possible turnkey variations of the traditional process elements that satisfy the functional requirements.

A full turnkey assignment of functional responsibilities for the Final Design phase would be as shown in Table 5-1. If the "C"s (turnkey contractor responsibility) were replaced by "A"s (agency responsibility), the assignment would describe the traditional process. Gradations along each functional category are possible. The closer the actual turnkey process is to the full or "pure" turnkey variation, the larger the expected impacts.

5.3.1. Project Management

5.3.1.1. Revised Project Management Plan

The hiring of a private sector turnkey Contractor takes a certain degree of control away from the public sector agency. The turnkey Contractor has full responsibility for Project Management, Design and Construction Management. Owner staffing is primarily an oversight role to the project and its direction. Because of the autonomy the turnkey contract provides, power to hire and fire can and is employed by the turnkey contractor as an important control measure. This is an important variation because hiring and firing are not subject to external, political considerations as in the traditional process. Accountability to politicians and community remains with the Owner, providing some insulation to keep politics and the community from controlling the project staffing and its costs.

A responsible turnkey proposer will not guarantee System Performance which it knows it cannot deliver. This is a check and balance not found in the Traditional approach. The agency must select a responsible and responsive turnkey contractor with experience in the proposed technology contained in the bid package. The Contractor will demonstrate to the agency formally and informally that design reviews and checks have been conducted and are accurate.

Table 5-1.
Final Design Turnkey Variations by Functional Responsibility

Function Number	Responsibility: Function Name	Conventional = owner agency / Turnkey = contractor
5.1.1.1	Final Systems Configuration	coordinates all system coordination and scoping
5.1.1.2	Final Design and Operational Criteria	coordinates final design reviews of subcontractor activity
5.1.1.3	Final Value Engineering/ Peer Review	activity is reviewed by an independent third party
5.1.2	Final Project Management	develops project management protocols
		establishes performance criteria for all project participants
		establishes budget and cost guidelines
		monitors project conformance to plan
5.1.3	Final Contract/ Procurement Management	develops procurement plan
		is not bound by A's procurement regulations in contracting with subcontractors
		is not bound by A's procurement regulations in acquiring materials and services
		selects all suppliers and subcontractors
5.1.4	Final Quality Assurance	develops Quality Assurance Plan
		develops QA/QC testing protocols
		performs testing of QA and QC
		ensures safety and security plan conformance
5.2.1.2/5.3.1.2	Final Design Specs, Drawings and Manuals	develops and edits all design specifications

Table 5-1.
Final Design Turnkey Variations by Functional Responsibility
(cont'd)

Function Number	Responsibility: Function Name	Conventional = owner agency / Turnkey = contractor
		edits and produces all drawings
		edits and publishes all manuals
5.2.1.3/5.3.1.3	Project Budget	develops all project budgets
		monitors conformance to budget by all project participants
5.2.1.4	Capital and O&M Costs	estimates all capital and O&M costs for the project
5.2.1.5/5.3.1.4	Master Schedule	produces a project master schedule
5.2.2	Communications Management	manages all communications
5.2.2.3	Preliminary Construction Management Plan	drafts the Preliminary Construction Management Plan
		establishes schedule, liaison, guidance and control of construction activities
		coordinates all activities and communications with PMO team
5.2.3.1/5.3.2.1	Quality Assurance/ Quality Control Plan	designs QA/QC program
		implements QA/QC program
		tests and approves site inspectors
		assumes full responsibility for project conformance to code, standards and regulatory requirements in both design and construction aspects
		evaluates capabilities of subcontractors to ensure quality
		coordinates all document distribution

Table 5-1.
Final Design Turnkey Variations by Functional Responsibility
(cont'd)

Function Number	Function Name	Responsibility: Conventional = owner agency / Turnkey = contractor
		responsible for all site inspections to confirm adherence to design requirements
		ensures calibration of all measuring instruments
		determines sampling requirements for test samplings
		establishes all evaluation methodologies for QC
		responsible for implementing corrective actions
		responsible for providing A with all warranties, replacements or credits related to non-conformance to QC standards
5.2.3.2	Test O&M Plan	produces testing protocols for O&M actions
5.2.3.3	Preliminary Construction Safety and Security Plan	produces safety and security plans
		provides all necessary personnel and equipment to implement safety and security plans
		implements independent verification of project conformance to safety and security plans
		responsible for loss, injury or difficulties caused by non-compliance to S&S plan
		investigates all accidents and security breaches

Source: Richard J. Lobron, Lobron Consultancy, Ltd.

5.3.1.2. Final Design Specifications, Drawings, and Manuals

The turnkey Contractor has been awarded the contract without complete final design specifications, and is finishing design while commencing construction. The contract was awarded with somewhere between 15 and 65 percent of design completed. The content of the design may include reference reports (e.g. geotechnical) and standard drawings which are lacking full detail. There will will be little or no subsequent review by the agency over the turnkey Contractor. Therefore, it is possible that 100 percent final design will not occur, or that what the turnkey Contractor will consider to be 100 percent design will be less than what an agency considers 100 percent final design. It is also possible that the agency will receive final design specifications at the completion of the construction phase.

5.3.1.3. Project Budget

The turnkey contractor will submit a bid package that includes a firm bid price. Thus, any extra costs and overruns due to design, technological and system integration risks fall onto the contractor. The project can be canceled during the Final Design stage if costs exceed budget or unforeseen conditions (e.g. toxic waste) make the project unreasonable. Any Value Engineering and Peer Review input is provided for by the turnkey Contractor within the bid. The Turnkey contractor should provide a guaranteed unit price list of all components of the bid. If a change order is absolutely necessary, the agency will refer to the price list for remediation. The agency role on budgets once the bid is approved should be reduced to just oversight, and possibly a reduction or reassignment of the cost estimating staff. There should be a corresponding reduction in force account funding.

FTA guidelines state that they will issue a Full Funding Grant Agreement (FFGA) at the conclusion of Final Design. However, the turnkey contract will be signed and executed before this point. The turnkey variation is that FTA will have to issue the FFGA in the absence of final design plans, which they have never done before.

5.3.1.4. Master Schedule

The responsibility of the schedule lies with the turnkey Contractor, as long as the right-of-way is provided for as agreed. Delays not related to agency intervention will cause increased costs, and reduced profits for the turnkey Contractor. This provides strong incentives for the Contractor to maintain schedule. Similarly, Owner delays will be cause for Contractor claims. Therefore, it is very important that the Owner's schedule be realistic and not politically driven.

5.3.2. Quality Assurance

5.3.2.1. Quality Assurance/Quality Control (QA/QC) Plan

The QA/QC plan is developed by the turnkey Contractor and is contained in the bid package. The agency should retain the right to perform inspection based on their past practices, but fundamental quality issues are presented and resolved during the selection process of the turnkey contractor. It is vital for the agency to have prescriptive legal accountability safeguards in place to assure that they can address potential quality deficiencies if they arise.

5.4. EVALUATION

5.4.1. Potential Impacts

5.4.1.1. Project Management

For most of the impacts associated with turnkey versus traditional procurement during the Project Management part of the Final Design phase, the transfer of responsibility implies a corresponding transfer of effort to the contractor. Agency staff who routinely performed contract administration or inspections may be reduced or reassigned, while contractor staff may expand. A provision for no Change Orders would likewise reduce the need for agency staff to assess the necessity of these changes. It is the responsibility of the evaluator to determine whether net labor shrinkage actually occurred using dollar cost comparisons and, if that made the turnkey method more efficient.

5.4.1.2. Project Budget

The impacts derived from the Project Budget involve how contract payment provision were structured to maximize cash flow benefits to the private and public sectors. This may have the impact of lowering administrative costs and/or other project costs. It is the responsibility of the evaluator to determine if the administration of the Project Budget was materially different for a turnkey project, resulting in productivity or other gains.

5.4.1.3. Interface Plans

The impacts derived from the Interface Plans involve how the turnkey relationship affected communications. Conflict resolution plans may not be adequately implemented by a lack of qualified staff and/or inadequate contract language, implying inefficiencies in the turnkey method. Similarly, adequate conflict plans may make for swifter resolutions which can keep

the project on schedule. The evaluator may note conflicts as they occur and subsequent administrative responses.

5.4.1.4. Quality Assurance/Quality Control (QA/QC) Plans

The transfer of responsibility for quality plans shifts the risk of implementing the plans to the contractor. This implies a measure of trust from the owner to the contractor that could be very beneficial or prove problematic. For example, non-conformance claims may not be made until well into construction, making for costly 're-work.' Similarly, contractor's strict adherence to the QA/QC plans may serve to reduce warranty claims years later. The evaluator may measure the directives of the QA/QC plan to actual efforts by the owner and contractor.

5.4.2. Benefits

The potential benefits of design-build or design-build-operate ("turnkey") procurement are ultimately measured in lower costs, shorter time to completion, and higher transportation performance. Impacts such as improved allocation of risk (see Chapter 8) and different approaches to contracting (see Chapter 7) need to be valued in commensurate dollar terms for purposes of evaluation.

6. CONSTRUCTION

The Construction Phase encompasses the physical building of the transportation infrastructure, including the manufacture and installation of subsystems, and subsequent testing. It is generally considered to commence upon award of the construction contract, and is complete upon resolution of all items on the "punch list", testing and startup.

During the Final Design phase of a fixed guideway project, a full funding grant agreement between FTA and the grantee is negotiated, with defined limits on Federal funding. It is the responsibility of the grantee to complete the project and absorb any additional cost incurred.

Overall fundamental inputs and outputs for the construction phase are shown in Figure 6-1.

6.0.1. Construction Inputs

(1) Project Management Plan
(2) Project Budget
(3) Project Master Plan
(4) Implementation Plan
(5) Final Design Documents
(6) Construction Plan
(7) QA/QC Plan
(8) Safety & Security Plan
(9) Procurement Plan
(10) Bid Documents
(11) Joint Development
(12) Test Plan
(13) O&M Plan
(14) Organization Plan
(15) Capital and O&M Plan

6.0.2. Construction Outputs

(1) Ways and Structures
(2) Guideways

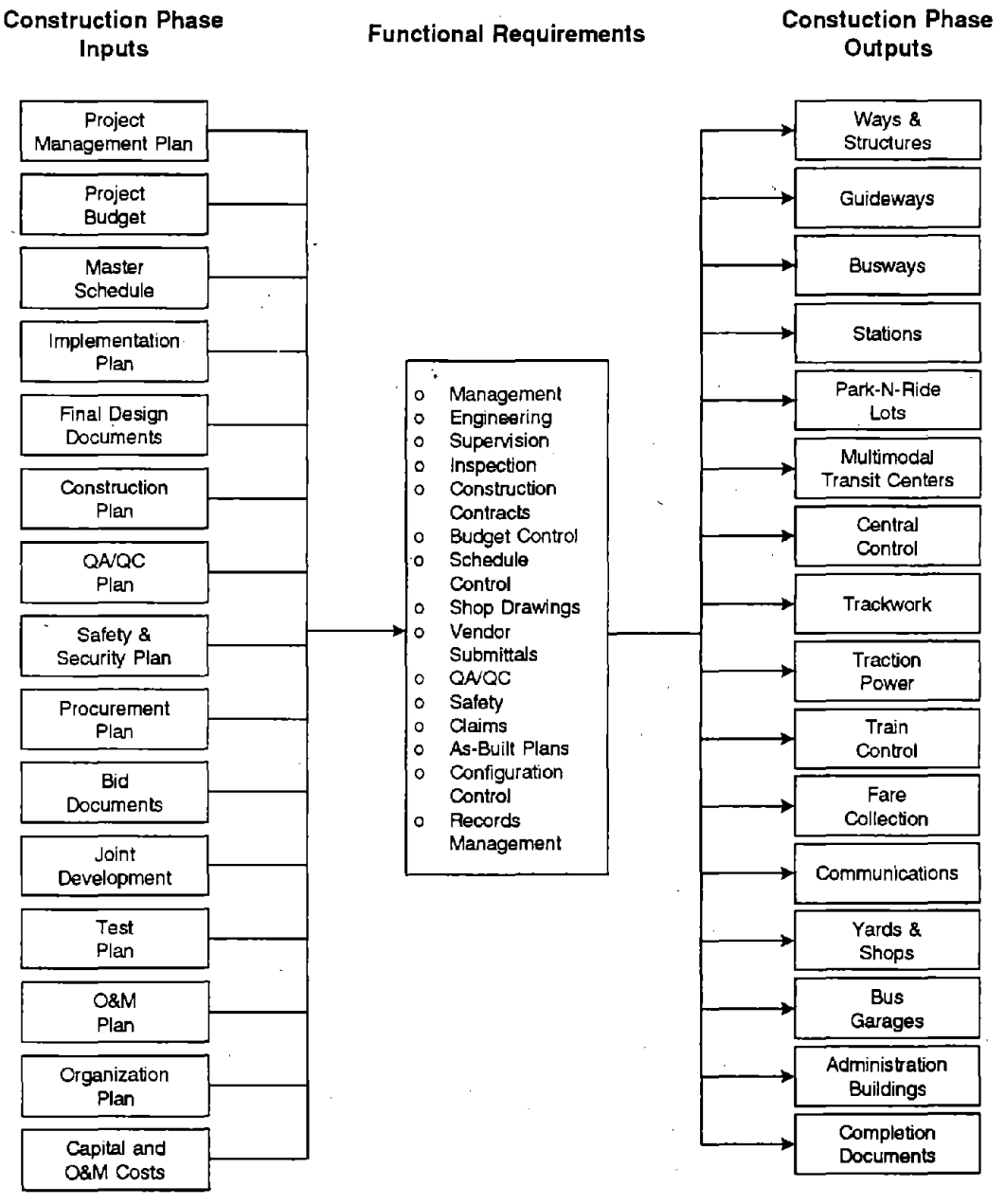


Figure 6-1. Construction Phase Inputs and Outputs.

(3) Busways
(4) Stations
(5) Park-N-Ride Lots
(6) Multimodal Transit Centers
(7) Central Control
(8) Trackwork
(9) Traction Power
(10) Train Control
(11) Communications
(12) Fare Collection
(13) Yards & Shops
(14) Bus Garages
(15) Administration Buildings
(16) Complete Documents

6.1. FUNCTIONAL REQUIREMENTS

This section describes the functions and activities that must be served during the Construction phase. These activities must be covered in this process whether traditional or turnkey. The building of fixed facilities highlights the activities of this phase. The facilities include guideway spans, columns and foundations, stations and, maintenance shops. Installation of command and control systems, power distribution and, fire protection/evacuation systems are completed. Operating and maintenance training of the agency's personnel begins.

6.1.1. Management

Construction management involves the oversight of construction work, both contractor and force account. It includes all controls on cost, schedule, and budget, as well as inspection and testing.

Construction management involves those actions necessary to ensure the successful completion of the fully functional transportation facility. It is the most labor and cost intensive phase of the entire project development, requiring the greatest effort in management control. Effective construction management requires:

- clear definition of management objectives
- well defined team roles and responsibilities
- requirements and procedures for coordination
- a written and widely promulgated management plan
- a problem identification and resolution process

6.1.1.1. Organization

Generally, the Project Manager assumes overall responsibility for cost and schedule. Design support is required on a day-to-day basis. Testing, Inspection and Quality Assurance, Change Order Approvals, Invoices, Submittals required of the contractor, technical Test Results, Value Engineering proposals, and the like all must be analyzed and verified to be in compliance with requirements.

6.1.1.2. Third Party Issues

Routine third party issues range from public inquiries of a general nature, to the negotiation of approvals of other jurisdictions and agencies of relevant project elements. Permits for numerous activities associated with construction are required (e.g., traffic control, right of way, utilities, etc.). Where technically complex questions arise, special engineering or legal expertise may be required. Utility complications and real estate disputes are typical examples.

6.1.1.3. Systems

Systems integration issues in the traditional approach are generally resolved by the conclusion of Final Design. Turnkey projects will in all likelihood initiate early construction activities before complete definition of all systems is completed.

6.1.1.4. Management Controls

Day-to-day Management Control must be vested at a management level in the organizational hierarchy commensurate with the authority required to effectively execute the work. The mechanism of the Work Breakdown Structure (WBS), or similar organizational tool, is necessary for maintaining control over the multitude of activities and functions, and integrating them into the overall project schedule and plan. Quality is assured by management through an appropriate program of controls.

6.1.1.5. Financial Management/Budget Controls

Budget assumptions made during contract bid preparation and refined during the Preliminary Engineering and Final Design phases are replaced by actual bids during the Construction phase. In the event of cost overruns, additional charges are also factored into the cash management system. Financial managers need to analyze the discrepancies between estimated and actual (variances) as they occur, and direct attention to cost elements that will benefit from greater oversight. Some of the frequently encountered reasons for budget overruns are the following: (1) quantity variances caused either by

design errors or by contractor errors; (2) quality variances caused by either mistakes made in interpreting the specifications of the contract, or the project being over-designed (more quality in the design than specified in the contract); (3) underestimation of subcontractor costs, typically from cost escalation between the bid date and when the subcontract is placed; and (4) unforeseen circumstances ("force majeur") that allow the contractor to be compensated for additional costs.

Whatever the mechanisms used for contracting the project, financial data must be collected and monitored, and decisions made regarding the acceptability of deviations between planned and actual.

6.1.2. Acquisition/Procurements

The purchase of goods and services is a primary activity during the construction phase. It is essential to ensure the orderly flow of resources contributing to the final product, through such mechanisms as Procurement Management Plans, contract administration procedures, and means of resolving disputes.

It is particularly important that grantees develop effective contract documents and procedures to minimize the incidence of disputes with construction contractors. Elements of the project which may be particularly susceptible to misinterpretation or change require focused attention. This applies especially to clauses dealing with changed conditions and quantity variations.

6.1.2.1. Construction Contracts

Contracts must be reviewed prior to award for compliance with a multitude of federal, state and local requirements, such as Affirmative Action, Budget and Capital Program limitations, Insurance, Bid and Bond Review for responsiveness, Financial Status of Apparent Low Bidder, Value Engineering incentives, etc.

6.1.2.2. Disputes

Dispute resolution procedures are standard contract topics, and typically include the following means of resolution:

- Independent Board of Consultants - Jointly appointed at the beginning of construction. They meet periodically or upon request to mediate or arbitrate disputes.
- Board of Contract Appeals - Appointed from within the agency to settle disputes

- o Arbitration - Jointly appointed after dispute arises. Decisions are binding and not subject to appeal or litigation
- o Mediation - Jointly appointed after dispute arises. Negotiates non-binding settlement with parties
- o Litigation - In appropriate court

A recent technique for resolving disputes, especially those involving subcontractors, is called Alternative Dispute Resolution (ADR). This technique is discussed in Chapter 7.

6.1.3. Communications

Although communications are an integral part of project management, they are of paramount importance during the organizationally complex construction phase. Since the needs of any given project present unique challenges to the grantee, a fully effective communications system must be "up and running" at the start of construction.

Procedures and mechanisms must be instituted to provide a steady interchange of information within, and external to the organization. A variety of agencies, institutions, and the general public needs to be fully informed to maintain continued community support to the project.

6.1.3.1. Records Management

An orderly flow of documentation is required to maintain control over the multitude of detailed information generated by the typical transportation construction project. Routine, but important documents are daily progress reports, daily work schedules, materials status reports, inspection and testing reports and Resident Engineer logs. Design changes, contractor claims, shop drawings, as-built drawings, etc., also must be managed conscientiously to maintain effective project cost control and claims containment.

6.1.3.2. Vendor Submittals

Submittals are documentation required of the builder or designer/builder which show in detail the origin, fabrication, manner of installation, or some other pertinent aspect of a specified element of the project. A typical example might be special trackwork, such as a high speed turnout, for which the construction and installation must conform to detailed technical specifications referenced in the contract. The vendor's submittal consists of drawings and descriptive materials demonstrating that the proposed work element meets the referenced requirements. Refer to Chapter 7 for further discussion.

6.1.3.3. As-Built Drawings

These include drawings, notes, and other descriptive material showing the configuration of all hardware as built.

6.1.4. Quality Assurance

Quality Assurance (QA) typically refers to the range of activities which monitors, measures, and verifies that prescribed standards of quality are achieved in the finished product. A QA program in the construction phase should include the following attributes:

- o adequate inspection resources to ensure that work is performed in accordance with engineering requirements
- o equipment testing through the development, manufacture, and installation phases
- o enforcement of remediation measures in a timely manner
- o system hardware controls adequate for overall system performance

6.1.5. Safety

The safety of the operational systems has the highest priority from the onset of systems planning through to construction, testing, start-up and operation. Emergency operational plans and training of operating personnel are management obligations.

The grantee generally includes in the Project Management Plan a management strategy to address the issue of construction safety. This includes certification that the requisite assignment of responsibilities, and the establishment of appropriate procedures and controls have been accomplished. Public safety concerns must also be accommodated.

6.1.6. Testing

The testing phase culminates with the acceptance of an operating transportation system based on the satisfactory completion of the construction of fixed facilities, the installation and test of all subsystems and components, and their integration into a system. Tests include subsystems and components, on-site performance testing of major systems, and integration tests of the entire system in its operating environment.

6.1.7. Operations

6.1.7.1. Startup

Startup includes taking the accepted operating system, correcting all deficiencies, and administering warranty guarantees. Operating and maintenance plans and procedures, and operating, safety, and security programs are completed during startup. Responsibility for training, operations, and maintenance is transferred from the contractor to the owner.

6.1.7.2. Mature Operations

Responsibility for operations may be left with the contractor, usually for fixed period time on the order of five to twenty years.

6.2. TRADITIONAL IMPLEMENTATION

This section describes the current practice for satisfying the requirements outlined in the previous section.

6.2.1. Management

The previously mentioned overall project Management Plan typically has as a subelement, the Construction Management Plan, which addresses the particular needs of each construction phase. The key elements of the Management plan include provisions for awarding construction contracts; construction oversight, inspection, and QA; schedule and cost controls; third party interfaces addressing construction impacts, utilities, and coordination with other agencies and, coordination between multiple construction contractors

6.2.1.1. Organization

Traditional projects often exhibit parallel management organizations for the grantee/owner and the construction contractor. A grantee Project Manager assumes overall responsibility for cost and schedule within the Construction Division. The Engineering Division typically provides design support on a day-to-day basis. Both Divisions are often supplemented with Design Engineering and Construction Management consultants respectively.

The Construction Division assumes responsibility for testing, inspection and Quality Assurance, and oversees such items as Change Order Approvals, Invoices, selected Submittals required of the contractor, technical Test Results, and the like. The Engineering Division assumes responsibility for the more technical Submittals, Value Engineering proposals from the contractor, and engineering Change Order analyses.

6.2.1.2. Third Party Issues

Within the grantee's organization, the Construction Division and its management consultant are the primary interface for routine third party issues. These may include public inquiries of a general nature, as well as negotiating necessary reviews and approvals of other jurisdictions and agencies of relevant project elements. Permits for numerous activities associated with construction are required (e.g., traffic control, right of way, utilities, etc.).

Where technically complex questions arise, engineering or legal expertise may be sought from within the organization. Utility complications and real estate disputes are typical examples.

6.2.1.3. Systems

By the conclusion of Final Design, all aspects of the project should be firmly fixed in the Traditional approach.

6.2.1.4. Management Controls

The responsibility for day-to-day Management Control is traditionally vested in one individual. The mechanism of the Work Breakdown Structure (WBS) is a primary tool for organizing the multitude of activities and functions, and integrating them into the overall project schedule and plan.

Quality is maintained through the implementation of the QA program. However, detailed inspection of the contractor's work is usually held to a minimum through the enforcement of a required contractor's Quality Control program.

6.2.1.5. Construction Manager

A construction manager (CM) is a professional retained by the owner to interface with the design professional and trade contractors on various aspects of the work. There are many different variations of construction management contracts, including (1) one in which the CM is a pure agent for the owner and does not hold trade contracts, and (2)

one in which the CM provides a guaranteed maximum price for the work and retains all subcontractors. The common thread running throughout these types of contracts is that the CM will be actively involved in reviewing the design for constructability and cost effectiveness. Value engineering efforts can result in a substantial savings to the owner in terms of both time to construct and total construction costs.

During construction, the CM plays a major role in project scheduling, payment requisition review, and change order analysis. The latter responsibility is particularly important, because the CM may look more objectively at the design and potential ambiguities in it than would the design professional on the project.

6.2.2. Acquisitions/Procurements

6.2.2.1. Construction Contracts

Contracts are reviewed prior to award for compliance with a multitude of requirements (see Chapter 7, Contracts and Procurement Management for more detail):

- Affirmative Action
- Budget and Capital Program
- Insurance
- Bid Review
- Apparent Low Bidder's Financial Status

Contracts usually contain Value Engineering clauses intended to encourage initiative and ingenuity on the part of the construction contractor, which can result in cost reduction. The concept behind contractor-submitted value engineering proposals is that the agency's design and construction plan is considered to be only one way in which the desired project can be accomplished. A contractor may have knowledge of a better design or methodology which can be implemented, and the cost savings shared by agreed upon formula between owner and builder.

6.2.2.2. Disputes

The grantee's Project Management and Construction Management Plans incorporate guidelines for handling disputes with contractors. To be effective, dispute resolution procedures must be effective enough not to slow down construction. Most disputes stem from flawed contract documents or errors of judgment by the contractor. Dispute resolution procedures are standard contract topics, often including the following means of resolution:

- o Independent Board of Consultants
- o Board of Contract Appeals
- o Arbitration
- o Mediation
- o Litigation

6.2.3. Communications

The Project Master Plan usually has a Communication subelement. It focuses on the need for dialogue between the grantee/owner and the public, addressing:

- o delineation of authority for release of information
- o designation of an individual as point-of-contact
- o distinction between grantee and its contractors
- o plan for regularly scheduled information dissemination and exchanges

There is also the need for specificity of communication requirements and expectations between the grantee and contractor. This is often covered in the Construction Management Plan. Even in relatively small projects, considerable time and effort are devoted to the flow of project information, as detailed below.

6.2.3.1. Records Management

An orderly flow of documentation is required to maintain control over the multitude of apparent minutiae generated by the typical transportation construction project. Routine, but important documents are:

- o daily progress reports
- o daily work schedules
- o materials status reports
- o inspection and testing reports
- o Resident Engineer logs

6.2.3.2. Shop Drawings, Submittals, and Claims

These topics are discussed in Chapter 7.

6.3. TURNKEY VARIATIONS

It is during the design and construction phases that the Turnkey process should begin to deliver improvements over the traditional approach. The responsibilities for the resolution of technological issues and construction management will now be primarily in the hands of the private sector as denoted by the Contractor "C" (as opposed to the public sector or Agency "A"), as shown in Table 6-1. This indicates one end of the spectrum, namely, the full or "pure" turnkey or design-build approach to construction. Many variations along this spectrum can be devised and implemented, both with respect to which functions are passed off to a turnkey contractor and with respect to how completely the function is transferred. The closer the approach to "pure" turnkey, the larger the expected impacts relative to traditional procurement methods.

There are extensive risks associated with the construction phase of fixed guideway transit projects. There are tried and tested means to address some of these risks, such as programs to promote worker safety on the job, QA/QC enforcement to assure quality of the constructed product, technological aids to enhance site security, etc. However, there will typically remain numerous risks of unknown magnitude and implication, such as those under the general heading of "differing site conditions". These may include geotechnical unknowns, including the presence of hazardous materials, and underground utilities whose existence or condition is not known until encountered during construction.

In general, a move to Turnkey contracting will have the effect of shifting some elements of risk from the public sector to the private sector. The private partner will tend to be more responsible for the technological and project management risk, including design, system integration, and implementation. The public partner will retain responsibility for political and financial support, real estate acquisition, operating revenues, etc. Risk allocation issues are described further in Chapter 8.

6.3.1. Management

The grantee's most important role is to oversee the turnkey vendor and represent the public sector interest in the project. It can also support the project by facilitating those third party interfaces for which it is better suited, i.e., addressing construction impacts on the community at large, utilities, right-of-way and real estate issues, permits, and coordination with other agencies. Such activities can also be executed by the turnkey vendor, but at the cost of hefty contingencies included in the bid.

Construction oversight is exercised through a quality control program. There may or may not be coordination by the grantee between multiple construction contractors,

Table 6-1.
Construction Phase Turnkey Variations by Functional Responsibility

Function Number	Function Name	Responsibility: Conventional = owner agency / Turnkey = contractor
6.1.1.1	Organization	performs all project management duties
6.1.1.2	Third Party Issues	handles all public inquiries
		handles all governmental approvals
		handles all utility issues
6.1.1.4	Management Controls	responsible for establishing management controls
		monitors compliance to management controls
		is not bound by A's personnel regulations in issues related to project personnel
6.1.1.5	Financial Management and Budget Control	responsible for budget conformance; no change orders permitted
		responsible for all working capital financing of project activities
		responsible for long-term asset financing
6.1.2/6.3.2	Acquisitions/Procurements	is not bound by A regulations on competitive procurement
6.1.2.1	Construction Contracts	responsible for subcontractor conformance to governmental regulations, where applicable to the project
6.1.2.2	Disputes	arbitrates all disputes among subcontractors and suppliers
6.1.3/6.3.3	Communications	manages all communications between A and project contractors
		manages all communications with regulatory bodies

Table 6-1.
Construction Phase Turnkey Variations by Functional Responsibility
(cont'd)

Function Number	Responsibility: Function Name	Conventional = owner agency / Turnkey = contractor
		manages all public relations and media interaction
6.1.3.1	Records Management	prepares and retains all project documentation, including schedules, cost support and inspection records
6.1.3.2	Shop Drawings/Claims	coordinates preparation of all drawings and manuals
6.1.3.3	As-Built Drawings	coordinates preparation of all as-built drawings
6.1.4	Quality Assurance	responsible for all QA/QC practices
6.1.5	Safety	responsible for implementation of safety practices
		responsible for all losses related to safety violations
6.1.6	Testing	produces testing protocols
		performs testing of equipment or facility
6.1.7	Operations	operates facility or equipment
		coordinates transfer of asset to A
		performs initial training in operating and maintenance procedures
		performs training in safety and security procedures

Source: Richard J. Lobron, Lobron Consultancy, Ltd.

depending upon how the project elements have been packaged for award. Day-to-day construction inspection, testing, QA, and schedule and cost controls are now in the domain of the turnkey vendor. The grantee may have inspection responsibilities to the extent that unit pricing payment has been utilized where material quantities are uncertain.

The grantee will still exercise review and processing of submittals, Value Engineering proposals from the contractor, and engineering Change Orders, largely through the function of the General Engineering Consultant. The grantee's posture with regard to the approval of submittals becomes somewhat ambiguous under the design/ build concept. Such approval, as opposed to information-only review, could conceivably release the turnkey vendor from performance liability of the subject component, subsystem, etc.

6.3.2. Procurements

Most grantee procurement actions are history by the time construction commences in a turnkey contract. The emphasis in this area of activity shifts to enforcement and dispute resolution. The long term, risk and responsibility sharing nature of turnkey contracts requires that means for handling disputes be addressed in great detail. As with conventional contracts, most disputes will stem from flawed contract documents by the grantee or errors of judgment by the contractor. Dispute resolution procedures include the following:

- o Independent Board of Consultants
- o Board of Contract Appeals
- o Arbitration
- o Mediation
- o Litigation

6.3.3. Communications

Communications provisions incorporated into the contract at time of formation tend to be used during the Construction phase. In the traditional method, all direct communication is established through the owner, typically through the owners construction department and as stated in the Interface Plans. The variation is that, typically in a turnkey project, all communications to other contractors and externally are channeled thorough the design-builder. The intent is that every direct contact and communication between the owner and a contractor and/or external entity (e.g. Department of Public Works) dealing with the design-builder is a possible source of claims or excuses from performance for the design-builder.

Also, the design-builder does not want the owner unilaterally communicating with the architect, especially during construction. The owner may be conditioned in traditional projects to contact the architect directly, but in a design-build project this serves as needless meddling. If the owner is uncomfortable with the arrangement, the design-builder will typically propose that any communication between owner and architect be in writing, with a copy to the design-builder.

6.4. EVALUATION

6.4.1. Potential Impacts

One of the major advantages of the design-build method is that construction phasing can commence sooner because the builder does not have to wait for complete design plans. Site preparation and utilities relocation, for example, can occur while architectural plans are finalized, cutting overall project completion time. For most of the impacts associated with turnkey versus traditional procurement during the Construction phase, the transfer of responsibility implies a savings in the amount of time needed to build the project.

In traditional construction projects, the design is normally completed before the construction contractors submit bids. Thus, only minimal scheduling coordination between the designer and builder is required. In a design-build scenario, scheduling can become very complex. Many design-build projects are scheduled on a fast-track basis in which design and construction occur simultaneously (see Figure 7-2 on p.7-40). The design and construction activities must be coordinated on one integrated schedule, and the designer must comply strictly with the schedule or construction may be delayed. Under these construction procedures, configuration management becomes even more critical. Because designers are not ordinarily held to strict schedules, they must be sensitized by the design-build contractor to those portions of the schedule which are critical and must be given priority.

Thus the potential for cost savings and particularly for time savings is greater for a turnkey contract that integrates Final Design and Construction than for alternative arrangements -- traditional or turnkey -- that keep them separated.

6.4.2. Benefits

There is a benefit to be derived from delivering a completed system faster, especially in high density corridors looking for relief from congestion. Time savings also reduce project costs, for example, if the time needed to build and complete a project is cut in half for a turnkey project and the owner can cut its interest costs on bond issues. Moreover, in times

of high inflation, the reduction in time may reduce costs because the adverse effects inflation may impose on wages, materials and services.

7. CONTRACTS AND PROCUREMENT MANAGEMENT

The contracting process is cross-cutting with respect to the project development phases, so it is extracted as a separate section. To construct the traditional and turnkey scenarios for a specific site, information about contracting and procurements will need to be integrated into the functional descriptions.

Negotiated contracts will not be considered, due to the near universal requirement for competitive bidding for construction by state and local laws. The purpose of this chapter is to clearly define the process of contracts and procurement management, to define responsibilities in contracting, and to provide for the assurance of contract requirements which leads to a successfully designed and built project. This chapter discusses (1) the Functional Requirements of Contracts and Procurements, (2) the traditional process of Architect-Engineer and Contractor Acquisition, (3) a discussion of Alternative Dispute Resolution (ADR) techniques, (4) potential Turnkey variations from the traditional process and, (5) Evaluation.

7.1. FUNCTIONAL REQUIREMENTS

This section describes the functions and activities that must be addressed during the Contracts and Procurement Management phase. These activities must be covered in this process whether traditional or turnkey.

7.1.1. Model Contract Contents

Contract documents published by the American Institute of Architects (AIA) typically form the foundation for contract development in the design and construction industry. Because no two projects are identical, no two contracts are identical. However, there are certain basic components which are fundamental for successful contracting. The following are the functional contractual requirements, as culled from standard AIA contracts, for entering into a transit design and construction project in the United States.[1]

[1] A detailed treatment of the functional requirements for design and construction contracting can be found in *"Legal Guide to AIA Documents (Third Ed.),"* by Werner Sabo, John Wiley and Sons, 1991 and. *"Sweet on Construction Industry Contracts (Second Ed.),"* by Justin Sweet, John Wiley and Sons, 1992.

General Provisions: This includes the basic definitions of Work, the Project, Drawings, Specifications, Execution, Correlation and Intent.

The Owner: This includes the definition of who the owner is, information and services required of the owner, the owner's right to stop work and the owner's right to carry out work.

The Contractor: This includes the definition of the contractor is; the contractor's ability to review contract documents and review field conditions before commencing activities; assert responsibility for supervision and construction procedures, labor and materials, warranty for materials and equipment furnished, applicable taxes, permits, fees and notices as applicable; administration of allowances, schedules, shop drawings, product data and samples; access to, and use of the site and, indemnification.

Administration of the Contract: This includes determining the entity(s) who will administer the contract; definition, administration and steps to resolve claims and disputes and, rules and notices for arbitration.

Subcontractors: This includes definition of a subcontractor; process to furnish the owner the names or entities of subcontractors who will perform work; subcontractor relations and, contingent assignment of subcontracts.

Changes in Work: This includes the environment in which changes will be allowed and the process for initiating change orders and directives.

Time: This is defined as the period, including authorized adjustments, allotted in the Contract Documents for substantial completion of work. It includes provisions for addressing delays and extensions.

Payments and Completion: This includes the total amount payable by the owner for the project; a schedule of values allocated to various portions of the project; method of payment (e.g. progress payments) and, steps to determine final completion and final payment.

Protection of Persons and Property: This includes safety precautions and programs and, emergency procedures.

Insurance and Bonds: This sets out assumption of liability insurance by the appropriate parties and, the furnishing of performance, labor, material, payment and other bonds.

Uncovering and Correction of Work: This section addresses procedures for uncovering work, addressing unforeseen conditions and, for addressing nonconforming work.

Termination or Suspension of the Contract: This section provides for stopping work due to: an issuance of a court order or other binding act of government, noncompliance by the owner in matters regarding the contractor (e.g. nonpayment for legitimate services rendered) or, termination for cause by the owner.

7.1.2. Procurement Process

The functional requirement for procurements resides in the legislatively mandated policies and procedures in the state where the transit project is being built, as well as those of the sponsoring transit agency and/or governmental unit.[2] Note that references in this chapter to the Federal Acquisition Regulations (FAR), FTA Guidelines, and other related Federal laws are intended to serve as a guide, but they are not to be considered exhaustive nor superior to state statutory guidelines. Depending on the state where a turnkey transit project is being built, it is incumbent on the evaluator to fully research and understand that state's current applicable contract and procurement laws to be able to apply these evaluation guidelines properly.

7.2. TRADITIONAL IMPLEMENTATION

The traditional contracting method consists of a separate owner, a separate Architect/Engineer designer, and a Construction Contractor. The Architect/Engineer (A-E) is selected by the owner to design the project. The construction contractor is then acquired by the owner by the lowest responsible bid proposal after market competition. The Architect/Engineer is accountable to the owner for competent design and typically oversees construction. This method is intended to give the owner/agency control over design, a fiduciary relationship with the designer to monitor the contractor, a single

[2] Executive Order 12612 directs that Federal agencies not substitute their judgment for that of the recipient, unless the matter is primarily a Federal concern and that agencies, to the maximum extent feasible, defer to the States to establish standards rather than setting national standards (This principle is generically known as the 'New Federalism'). Similarly, the companion common grant regulation requires states to follow their own state procurement law.

source of construction, a known total price before construction starts, price competition, and impartial selection. It often results in an adversarial relationship, however, between the designer and the construction contractor over issues of interpretation. It is the owner's responsibility to have defined contract policies and procedures in place to mitigate any differences and ultimately to ensure that the project is completed on time and at budget.

The traditional process sequence for A-E and contractor acquisition is depicted in Table 7-1. The steps in this process are discussed more fully in subsequent sections.

7.2.1. Architect-Engineer (Design) Services Acquisition

Some design work can be done with an agency's own work force, but additional services of Architect-Engineer (A-E) firms are also employed. An A-E firm is any individual, firm, partnership, corporation, joint venture or other legal entity, licensed by the state to practice the professions of architecture and/or engineering.

The goal in the traditional selection process is to choose a slate, or a "short list", of three to five of the most highly qualified firms from which a selection (in order of preference) may be made. The public announcement, evaluation, selection, negotiation and award must be accomplished in accordance with Public Law 92-582, the *"Brooks Act."* Besides giving guidance to minimum acquisition procedures, the Brooks Act mandates that design contracts be awarded on the basis of demonstrated competence and qualifications for the type of professional service required, and not solely on the basis of low price.[3]

---

[3] Additional uniform policy and procedures are contained in the Federal Transit Administration circular 4220.1B, *"Third Party Contracting Guidelines,"* the Federal Acquisition Regulations System which consists of the Federal Acquisition Regulation (FAR), as well as any agency acquisition regulations that implement or supplement the FTA and FAR guidelines. FAR citations of special interest for A-E Procurement include the following:

For projects using federal funds, the process for obtaining A-E services is fully covered in FAR Part 36.

FAR 15.9 sets forth a 6% limit on A-E fees for the entire project cost for design services.

FAR 30.1 requires a Disclosure Statement of Cost Accounting Practices and Certification in certain cases and following Cost Accounting Standards for all negotiated contracts over $100,000. This is derived from the Truth in Negotiations Act (87-653), where contractors must certify cost and pricing data for contracts over $100,000, or face a downward adjusted contract price if they are found to be inaccurate.

FAR 22.8 requires submission of written affirmative action compliance programs where fees are over $50,000 and 50 or more employees are involved.

Table 7-1.
Traditional Process Sequence for Architect-Engineer (Design) and Contractor Acquisition

- Architect-Engineer (Design) Services Acquisition
  - -Evaluation Board Establishment
  - -Screening and 'Short-List' Submittal
  - -Final Selection Board Review and Recommendation
  - -Selection Memorandum
  - -Selection
- Construction Contract Planning
  - -Organizational and Contracting Strategies
  - -Contract Pricing Alternatives
  - -Contract Packaging and Scheduling
- Construction Contract Formation
  - -Procurement Plan
  - -Bid Documents and Policies and Procedures Manual
  - -Contract Documents Development
  - -Bidder Pre-Qualification and Selection
  - -Requests for Proposals (RFP) Development
  - -Bid Cycle Management
  - -Bid Receipt and Evaluation
  - -Contract Award
  - -Bid Protest (if applicable)
  - -Final Master Agreements
  - -Final Real Estate Acquisition Documents
  - -Joint Development (if applicable)
  - -Notice to Proceed
- Construction Contract Administration
  - -Mobilization and Commencement
  - -Progress Billing and Payments
  - -Submittal
  - -Progress Billing and Payments
  - -Notifications and Change Orders
  - -Backcharges
  - -Brief-Form Contracting
  - -Claims
  - -Contract Closeout
- Construction Contract Monitoring
  - -Functional Contract Support
  - -Contract Reporting
  - -Contract Auditing

7.2.1.1. Evaluation Board Establishment

Generally, a Screening/Slate Board and a Final Selection Board with a minimum of three to five members each are established.[4] The boards review data collected in response to the Public Announcement (SF 254's and SF 255's) as well as data maintained in designated areas. A member of one board may not serve as a member of another board on the same project.

7.2.1.2. Screening/Slate Board and 'Short-List' Submittal

This board reviews the data submitted and eliminates those firms that do not meet published qualification criteria. The remaining firms are further reviewed and each firm is numerically rated in accordance with the published evaluation criteria. The five highest- rated firms will comprise the "Short List" that is submitted to the Final Selections Board.

7.2.1.3. Final Selection Board Review and Recommendation

After receipt of the Screening/Slate Board report, the Final Selection Board is convened and a detailed review and evaluation of the "Short List" is conducted. Discussion are held with at least three of the highest-rated firms. During the interview process, the firms are requested to make a brief presentation of general capabilities and qualifications for the project, the organizational structure proposed, design approach and related experience. A question and answer period will then ensue.

When all interviews are completed, each member of the board independently evaluates the firms in accordance with the published selection criteria and the results of the interviews. The results are tabulated and the firms ranked in order of preference.

7.2.1.4. Selection Memorandum

In additional to the board report, the decisions of the Final Selection Board are documented in a memorandum of recommendation, signed by the member chairing the board, and submitted through appropriate channels to the selecting official. The memorandum serves as a report describing the project scope, estimated A-E fees, and estimated construction contract award amount.

7.2.1.5. Selection

The selection of an A-E firm will be based on the recommendations of the A-E Final Selection Board's interviewing Project Team. Upon receipt of selection notification, the

[4] The requirement and procedure for establishing Evaluation Boards is described in FAR 36.602-2.

contracting officer provides written notification to the selected A-E firm. The contracting officer also forwards notification letters to all other firms recommended for interviews but not selected.

7.2.2. Construction Contract Planning

The business of construction is performed through contracts. In the Preliminary Engineering phase, the owner sets in motion essential processes so that when design is completed and construction is to commence, the known elements of risk are acknowledged and are attempted to be minimized. Contracting practices are planned and organized in a manner consistent with overall company objectives, project-specific circumstances and technical, schedule and commercial risks. As such, an owner's contract plan should address the details described in the following subsections.

7.2.2.1. Organizational and Contracting Strategies

Owners choose an organizational alternative that best suits their control objectives and requires a level of involvement they are able to meet. Options range from a Single Prime, where the owner awards one large contract for virtually all project related services, to the Multiple Prime concept, where as many as 200 separate contracts will be awarded. In between these two extremes lie a wide variety of approaches, each requiring different control strategies and different levels of owner involvement through the project life. Agencies with large, experienced staffs usually embark on the multiple primes format.

7.2.2.1.1. Single Prime

This is the most common traditional contractual approach for small and medium size projects. A single business entity acting as the contractor is in complete and sole charge of the field operations, including the marshaling and allocation of manpower, equipment, and materials. This approach has the design function awarded separately from the build function. A third party, the Architect-Engineer, is under contract to the owner rather than as a part of, or subcontract to, the constructor's organization.

7.2.2.1.2. Multiple Prime Contractors

This is the most common traditional contractual approach for large projects. Typically, there is no dominant contractor, and most of the organizations associated with the construction are performing under separate, direct contracts with the owner. That is, there is more than one contractor holding substantial contracts directly with the owner to perform specific parts of the same project. The owner has responsibility for overall

project management and coordination, replacing a general contractor or a construction manager.

7.2.2.2. Construction Contract Pricing Alternatives

Although lump-sum payments represent a large share of the traditional method of payment, it is important to note that occasionally other payment methods are used. In fact, there is an infinite number of ways of determining how the owner will pay the contractor for work performed. For most public sector construction projects, they can be divided into two major groups of fixed price and reimbursable contracts. The following shows the most common contract types:

7.2.2.2.1. Lump Sum

On the basis of a low bid, the Contractor agrees to perform the stipulated work in exchange for a fixed sum of money. This lump sum commonly includes all labor, materials, project overhead, company overhead, and profit.

7.2.2.2.2. Cost Plus Fixed Fee

Under a straight, cost plus fixed fee compensation scheme, the contractor is paid an amount equal to the cost of developing the full system (where the design and construction costs for each system component are agreed to in advance), plus a fixed fee amount to provide the contractor with some return from the project. In this instance, the owner assumes full risk for the total cost of the project should the project experience serious cost overruns.

7.2.2.2.3. Unit Pricing

Unit pricing represents a variation of the lump-sum method. The contractor agrees to be paid a set cost per unit of each item, such as per-cubic-yard of excavation. The actual total amount paid is based on the actual measured units constructed on the project, times the unit price agreed to. The unit-cost for each item commonly includes all labor, materials, project overhead, company overhead, and profit. Sometimes overhead items are paid separately.

7.2.2.2.4. Guaranteed Maximum Price

The contractor is reimbursed the cost of doing the work, including labor, materials and project overhead, plus a fee, including company overhead and profit, up to a pre-arranged maximum price. Once that price is reached the contractor must finish the job at no additional cost to the owner. If the job is finished under the maximum price,

there is often a sharing of the cost difference between the owner and the contractor as an incentive to the contractor to reduce costs.

7.2.2.2.5. Lump Sum plus Special Reimbursable Costs

The contractor is paid a lump sum fee, for specified work and depending on the nature of the project, is reimbursed for stipulated items. These items may include office overhead or the rental costs of equipment for the time used on the job.

7.2.2.3. Contract Packaging and Scheduling

The first task the person(s) responsible for Contract Formation (in the Final Design phase) must undertake before Final Design commences is to determine the orderly subdivision of the work into distinct contracts, or preliminary contract "packages." Basic decisions must be made concerning: (1) the number of contracts to be used; (2) their respective scope of work; and, (3) schedule requirements of their bidding and award. Contract packaging efforts depend directly on the organizational approach chosen for the project, such as multiple primes.

7.2.3. Construction Contract Formation

A broad-based Contract and Procurement strategy was first determined in Preliminary Engineering phase. In the Final Design phase, the process specifically defines the terms and conditions by which goods, services and real estate can be acquired. The process of Contract Formation begins with the decision to contract for project-specific goods and/or services and ends with a written agreement signed by both parties - the contract. This process is depicted in Figure 7-1. Owners embarking on the formation of construction contracts have three general sources of contract and contract-related (i.e. bidding) documents:

What Worked Last Time: The owner chooses the most appropriate and best documents from its files of previously used documents.

Standard Documents Available in the Industry: These include bidding and contract documents published by professional associations or certain industry groups involved with construction. Examples include those provided by the American Institute of Architects (AIA), the Associated General Contractors of America (AGC) and the National Society of Professional Engineers (NSPE).

Reference Documents Maintained by the Owner or Its Representatives: These include documents prepared and maintained for a range of applications.

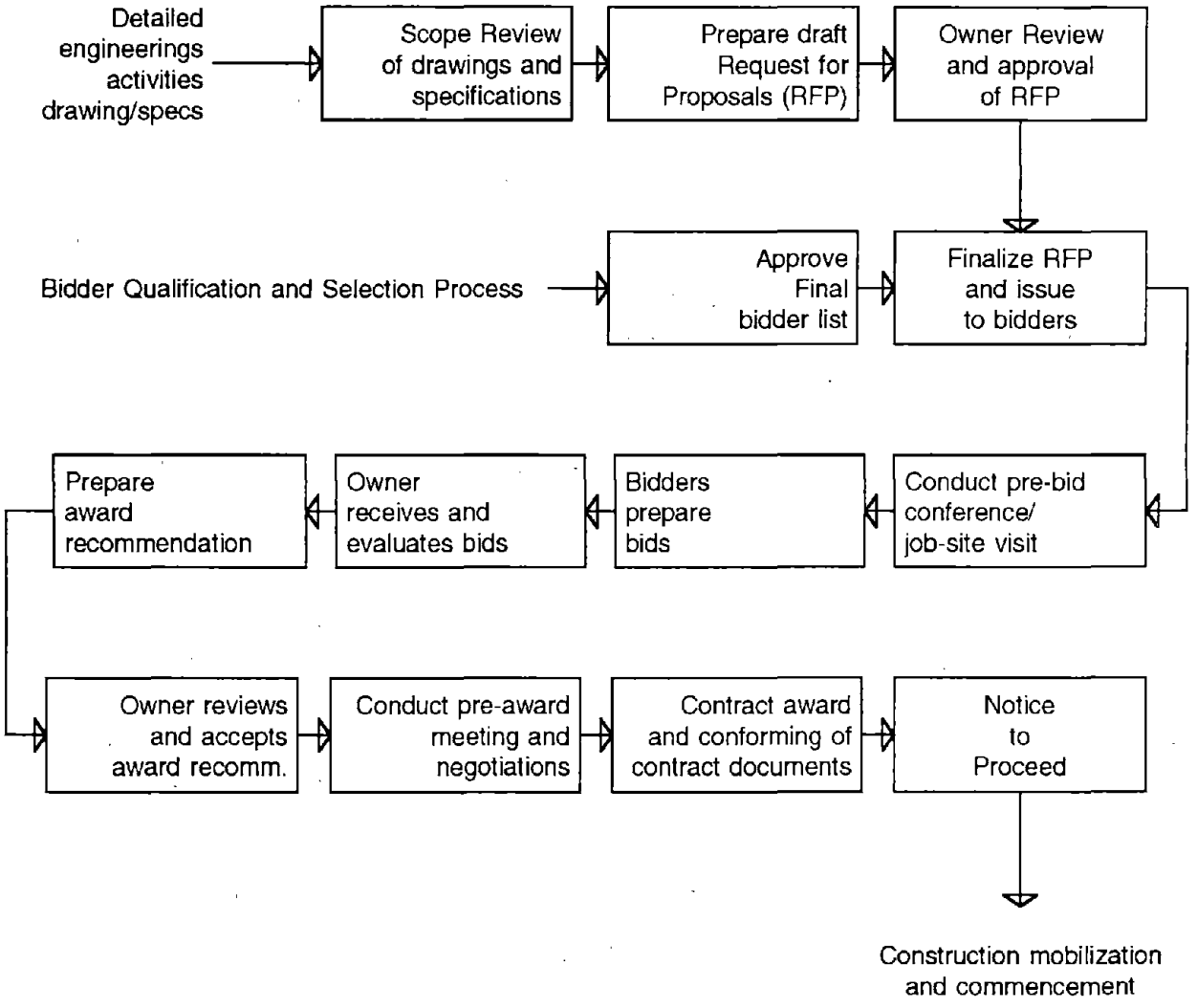


Figure 7-1. The Contract Formation Process.

They usually contain standard clauses and terms and provide for the modification or insertion of project, owner, contract or jurisdictionally specific terms and conditions.

7.2.3.1. Procurement Plan

The Procurement plan is designed to identify and obtain the major materials, components and systems for the project. This planning effort entails the development of advertising and award schedules for projects in the capital program, assuring that financing is available, and that all contract approvals can be obtained. This process commences sometime during Preliminary Engineering. Procurement of many long lead time items such as vehicles, rail, fare collection and computer software are initiated. Agency policy, legal procedures and past practices serve as a basis for setting up the Bid Procedures Policy Manual.

7.2.3.2. Bid Documents and Policy Procedures Manual

This manual sets forth the standards for third party contracts. It is prepared by the agency Materials, Law and/or Construction Department(s). These standards are intended to ensure that services are obtained in a timely fashion, efficiently and economically, adhering to principles of good administrative practices and sound business judgment. The manual is organized to allow the user maximum flexibility to initiate, develop, execute, and administer third party contracts within the parameters of Federal, State, local and agency requirements, and consistent with the technical and quality standards required. All procurement transactions, regardless of whether by sealed bid or by negotiation and without regard to dollar value, are conducted in a manner that provides maximum open and free competition consistent with FTA Circulars, Office of Management and Budget Circular A-102 (Attachments B and O) as well as various state, local and agency Standards and Code of Ethics, and local content and local hiring practices. The manual establishes a plan for resolving conflicts between competing bidders who feel that they were denied equal opportunities to winning a bid.

Contract managers also establish a uniform method for identifying and controlling Engineering Holds pending their resolution. An Engineering Hold is a notation placed on documents to identify uncertain or incomplete documentation, discrepancies, non-conformance, unapproved design features, requirements or uncertain design information. Examples of such instances include: an item of information that exists in a document which has not been approved for purposes for which the document has been released, and previously approved information which because of a development occurring after approval, places the approved information in doubt.

7.2.3.3. Contract Documents Development

The initial step in the development of contract documents is to determine program requirements. This more closely defines what is needed, how to obtain, who participates and monitoring and control. The following are the general components:

Technical Performance Specifications: Preparation of the technical performance requirements. This describes the minimum level of quality for systems, material and equipment that the owner/agency expects.

A Collection of Existing Documentation: A collection of all existing drawings and currently known data for the project and the construction site.

A Program of Facility Needs: This is a statement of square footage with diagrams and operational and functional requirements and a general architectural program for the project. It provides information on the functional elements required; the area needed by each and the interrelationship of the functional elements.

Drawings: Prepared by the responsible Architect-Engineer for the owner, these graphically depict location, size, shape, and details of construction or composition of the work.

7.2.3.4. Bidder Pre-Qualification and Selection

Most states have statutes that require a general contracting firm wishing to bid on public work in those states to be adjudged qualified before it can issue bidding documents or before it can submit a proposal. There are several reasons to qualify including 1.) To identify stable contractors, 2.) to prevent contract performance problems, 3.) to ease the evaluation process and, 4.) to obtain the positive benefits of contractor competition. To pre-qualify, contractors must submit detailed information concerning their equipment, experience, finances, current jobs in progress, references and personnel. Evaluation of these data results in a determination of whether the contractor will be allowed to submit a proposal. Transit contractors usually submit qualification questionnaires at specified intervals and are rated as to their maximum contract capacity. Their construction activities are reflected in their current ratings, with proposal forms being issued only to those qualified to bid on each project. The pre-qualification certificate may also limit the contractor to certain types of work, such as grading, concrete paving or bridge construction.

7.2.3.5. Request for Proposals (RFP) Development

The RFP includes, in addition to the program of requirements, details of the bid requirements and competition rules such as:

- o Proposal form(s)
- o Bonds and Security:
- o The Miller Act of 1935 prescribes the requirements of performance and of payment bonds used in conjunction with federal construction projects. This statute provides that on all federal construction contracts of more than $25,000, the contractor shall furnish a performance bond for the protection of the United States and a payment bond for the protection of persons supplying labor and materials in the prosecution of the work.
- o Owner - required contract terms or contract to be signed
- o Competition rules including:
  - who administers the competition and makes judgments;
  - business licensing requirements;
  - communication during the bid process;
  - schedule of bid period and project, including site visit and orientation meetings;
  - discrepancies and interpretations;
  - any constraints that may exist due to financing;
  - selection of finalists (evaluation team and method);
  - submittal requirements;
  - ownership of proposal and design rights including publication and exhibitions rights;
  - rejection criteria;
  - evaluation and analysis weighing system.

In addition to the competition rules, the method of payment or 'award' to be used by the agency is presented in the RFP. The award method is very important because of the "one-off" or unique nature of most construction projects, i.e., there is no list price for what a project should cost (Slatter 1990). For public agencies, bidding is seen as an efficient way to reach the market price and eliminate the possibility of favoritism and corruption. There are many restrictions placed on award methods by various regulatory agencies. These include minority and small-business hiring goals, minimum percentage of work that must be done by the contractor's own forces, prevailing wage rules, and

local resident hiring goals. The following are a sampling of the current methods for award for public sector transit projects.[5]

Competitive Bid: A contractor is selected by the lowest price proposal, in market competition.

Cap: A fixed price is set by the owner against which contractors propose a level of quality and options for a project.

Negotiation: The price and/or contractor are selected by negotiation between the owner and either several contractors or one contractor.

Qualification and Price Proposal: The contractor is competitively selected based on qualification and price. The process is often quantified with a ranking formula.

Time and Price Proposal: The contractor is competitively selected based on the proposed schedule and price. The process is often quantified with a time-price formula.

Qualification, Time and Price Proposal: The contractor is competitively selected based on their qualifications, proposed schedule, and price. The process is often quantified with a ranking formula.

Design and Price Proposal: The contractor is competitively selected based on their proposed design and price. The process is often quantified with a ranking formula.

7.2.3.6. Advertisement of RFP and Bid Period

In all jurisdictions laws regulate and control the award of public construction projects. These legal requirements start in the first step in the construction process; that is, notice must be given to interested and qualified members of the construction industry in advance of the bidding on any project financed by public funds. In addition, all bidders must be treated alike and afforded an opportunity to bid under the same terms and conditions. The contracting agency may be required to give notice by placing advertisements for bids in newspapers, magazines, trade publications, or other public media. These advertisements are referred to as "Notice to Bidders" or an "Invitation to

[5] Christopher M. Gordon, "Choosing Appropriate Construction Contracting Method," (1994).

Bid." A 'bid date' is included which states that last day bids may be submitted for consideration. Prior to the bid date, the following occurs:[6]

Pre-Bid Conference: The owner typically holds this meeting two weeks after the advertisement for bid, requiring all bidders submitting a proposal to attend. The meeting stresses risk and appropriate elements of the project, rules for contacts between bidders and owners and organizations using the facility (e.g. a transit station having restaurant space, with amenities that will be needed for a restaurant).

Job-Site Visit: Bidders formally visit and review the job site with the owner, usually at around the time of the pre-bid conference. The owner may share any site investigation data not already released, but no new survey or geotechnical data is gathered at this time.

Addenda Issued as Needed: Any owner addendum that was not previously released must be submitted at this time prior to bid submittal.

7.2.3.7. Bid Cycle Management

On public projects, an acceptable bid must be "responsive" to the invitation for bids and instructions to bidders. Responsiveness is determined by whether the bid as submitted is an offer to perform, without exception, the exact work as called for by the invitation, and upon acceptance will require the contractor to perform in accordance with all the terms and conditions thereof. A bid is non-responsive if it contains qualifications or conditions not in the invitation or if it offers performance which varies from the invitation. Additionally, a bid may be non-responsive if it does not conform to the technical bidding requirements established in the instructions to bidders.

Occasionally, a bid may appear low, but is the product of mistakes by the bidder in calculating bid prices. Before proceeding further, the owner performs due diligence to ensure that mistakes that are made in calculating bid prices are not carried further to the evaluation process. Throughout the entire process, contract managers review documents to assure compliance with design criteria, completeness, cost effectiveness, and adequate quality assurance and warranty provisions; assess whether bidding procedures and documents maximize competitive bidding and are in compliance with state and local laws; and, maintain all official contract files.

---

[6] See John Fish (1991), "Cost Control in Design-Build."

7.2.3.8. Bid Receipt and Evaluation

After competitive bid proposals have been submitted and found to be responsive, the owner, after careful study and evaluation of the bids received, must identify the contractor to whom the project will be awarded. During the bid evaluation element of the process, it should be noted that in most localities in the United States, the main determinant for acceptance is "the Lowest and Most Responsible Bid." This term has been held to mean the lowest bidder whose offer best responds in quality, fitness, and capacity to the particular requirements of the proposed work. In the case of public contract-awarding bodies, the law gives them discretionary power as to which contractor is the lowest responsible bidder, such discretion not to be interfered with by the courts in the absence of fraud, collusion or bad faith.

Contract Award Ranking: It is a difficult matter to establish a practical criteria for evaluating bids that is all inclusive and unambiguous. Most public agencies employ a method of qualitative rankings measured against a common base (e.g. record of performance).

Procurement/contract negotiations: These negotiations are a process of communications, discussions and agreement between the parties for supply of goods/services in support of procurement objectives. This process culminates in the "Best and Final Contract Offer." This is the final offer by the bidder to perform work after incorporating negotiated and agreed changes in the procurement documents.

7.2.3.9. Contract Award

The final outcome of the acquisition process is the award. The contract is awarded to one prospective supplier through acceptance of a final offer generally by either the issuance of a purchase order or the signing of a legally binding contract formalizing the terms under which goods/services are to be supplied.

7.2.3.10. Bid Protest (if applicable)

Bid protest is a resolution process by which an unsuccessful supplier may seek remedy for what it considers an unjust award. Generally, a mediator or judge is required to address the owners and suppliers positions and render an opinion whether the award should proceed or be rejected, usually resulting in the process starting over again.

7.2.3.11. Final Master Agreements

The Master Agreements involve utilities, railroads, etc., for any required relocation or joint right-of-way use. Agreement issues not fully resolved in the Preliminary Engineering phase must be adequately resolved in Final Design before construction can commence. The agreements detail 1.) the level of involvement for all parties, 2.) the rights of all parties, 3.) the method for conflict resolution to assure continuation of the project and, 4.) specify all improvement or replacement standards to the degree practical. The process involves agency staff reviewing all documents, drawings and surveys for their completeness (e.g. all utilities identified in design drawings are covered), cost effectiveness, definition of ownership and maintenance responsibilities in preparation of construction.

7.2.3.12. Final Real Estate Acquisition Documents

For issues not resolved in the Preliminary Engineering phase, these documents represent the conclusion of negotiations and contracts for acquisition of real estate along the route alignment before construction can commence. The process involves agency staff reviewing real estate negotiations and acquisitions, reviewing condemnation actions, attending zoning hearings, comparing acquisition costs with budget and identifying priority sites for acquisition.

7.2.3.13. Joint Development (if applicable)

In the public transportation field, the term joint development refers to a private real estate development that is closely linked to public transportation services and station facilities. It can be an office tower built on the air rights of a subway station or a retail mall with a direct entrance to a transit terminal. Regardless of the form it takes, joint development is a pairing of public and private resources to achieve a project or a product that will benefit both sectors. Usually, the development would not take place without this public-private cooperation; because the development requires the improved accessibility and expanded market created by the transit improvement, and the transit agency needs the financial resources and entrepreneurial skill of the private sector to achieve ridership and financial goals. Also, joint development projects often require contractual agreements between the developer and a public agency and close planning and cooperation among several public agencies.

7.2.3.13.1. Innovative Contracting and Procurement Types

There are a number of innovative contracting and procurement schemes which focus on sharing costs and benefits with private sector interests. The level of participation of the

private sector needs to be identified in the Final Design stage to allow for changes in design, construction and financing. The following are some examples:

Land/Air Rights Leasing: Where a transportation agency owns land adjacent to its facilities that is being utilized to its full potential, the full value can be recaptured by leasing air, surface, or subsurface rights. The lease provides a steady income stream to offset operating costs or capital improvements.

Cost Sharing: Developers and building owners wishing to have transit stations interconnected or integrated with their commercial facilities are sometimes willing to share operating expenses and/or contribute to capital construction costs.

Advertising/Marketing: The renting or leasing of advertising in high traffic areas. Methods include (1) kiosks in terminals and on boarding paths; (2) rental display cases; (3) audio-visual displays; and, (4) panel boards on and in trains and buses.

Concessions: Concession can be grouped into two major categories: (1) manned retail outlets (e.g. newspaper stands, retail stalls) and (2) mechanical devices (telephones, automated teller machines). They generate revenue for transit agencies through what are generally termed as "revenue percentage" or "sales override" leases, or through annual concession fees under a "master lease" agreement.

7.2.3.13.2. Three Phases for Carrying Out Joint Development

Regardless of the scale or complexity of a joint development project, the role of the public sector agency, be it a transit or renewal agency or a development corporation, is usually divided into three phases:

(1) Policy-making and planning;
(2) Developing a marketable project and,
(3) Dealing with Developers

These three phases, illustrated in Table 7-2, occur whether a jurisdiction is renovating an old terminal to include retail and office space or developing a multi-million dollar center city project. In most cases, local governments, not the private sector, initiate joint development ventures because they own the land and see the need to build the new transportation facility. Usually, it is the role of local government to package the project so that it is acceptable to the public and attractive to potential developers. To

Table 7-2.
Phases for Carrying Out Joint Development

FIRST PHASE - PUBLIC POLICY-MAKING AND PLANNING
- Identifying joint development opportunities
- Defining joint development goals and policies
- Coordinating with other public agencies
- Building public support

SECOND PHASE - DEVELOPING A MARKETABLE PROJECT
- Preparing a project budget
- Assembling a project team
- Preparing a market analysis and concept plan
- Resolving public issues related to:
  - -Intergovernmental coordination
  - -Special studies
  - -Legal Authority
  - -Capital improvement
  - -Regulatory changes
  - -Additional land assembly
  - -Accessibility between the transit facility and the private development
  - -Funding and financing
  - -Public information

THIRD PHASE - DEALING WITH DEVELOPERS
- Locating interested developers
- Selecting a developer
- Negotiating an agreement
- Specifying the role of a developer
- Monitoring the developer
- Renegotiating with the developer
- Adhering to commitments and schedules

Source: Public Technology Inc., Joint Development (September 1983).

accomplish this, the public sector first must set the stage by doing some necessary groundwork. The following is a discussion of the steps most local governments must take before they prepare a specific plan or negotiate with a private developer.

7.2.3.13.3. Negotiating an Agreement

The negotiation of a final agreement between a public agency and a developer is a critical step in the joint development process. Depending on the nature of the project and the developer selection process, negotiations may cover a wide variety of topics or be limited to a few. Items frequently negotiated include:

-Land sale or lease terms
-Automatic lease increments or public participation in project revenue.
-Land use mix and density of development
-Responsibility for the construction of utilities
-The developer's responsibility for the completion of the project
-The design and construction of project amenities.
-The design and constriction of access ways to the public transit facility.
-The scheduling of public and private sector construction.
-The architectural design of the building and the streetscape treatment.
-The penalties and sanctions the developer will incur if he defaults or falls behind schedule.

Although there are other important variables, the success of the negotiations from the public point of view depends to a large extent on the expertise of the negotiating team. Regardless of whether the project is in a weak or strong market area, the public agency needs specialized legal and economic advice to present its case effectively and to strike the best deal. Developers have definite advantages when they enter negotiations. They have specific goals, and they usually are experienced in negotiating. Also, they have developed market data to support their positions. The staff of the public transit agency can be benefited from the assistance of specialized legal and economic consultants during their contract negotiations

7.2.3.14. Notice to Proceed

The beginning of contract time is established by a written notice to proceed, which the owner dispatches to the contractor.

7.2.4. Construction Contract Administration

Contract Administration is a term describing the commercial handling of a contract once it is awarded and until it is formally terminated (contract closeout) or dies an unplanned death (through contract default or early termination). Contract administration controls are designed to ensure commercial compliance with the terms of each contract. Even under ideal conditions, this is generally an arduous task for project owners. They must monitor not only the contractors but also their own compliance. Routine duties involving receipt and review of contract submittal, maintenance of voluminous contract records, and monthly progress payments sometimes obscure critical risks encountered during the performance period. Change Orders, claims, early payment or overpayment, and unsatisfactory performance can be prevented by implementing a structured contract administration program.

7.2.4.1. Mobilization and Commencement

The initial phases of contract management set the stage for its success or failure. Once the contract administrator has been selected and given an executed copy of the contract documents, he or she should begin to acquaint himself or herself with their contents. Since the job is to ensure contractual compliance of a commercial nature, it is vital that the administrator become intimately familiar with the requirements of both parties, owner as well as contractor. Because it is inconvenient to wade through huge stacks of materials - material in several documents or buried in unrelated documents - it is important to develop contract abstracts. These abstracts reduce the contracts to their essential elements - the commercial requirements of both parties. These abstracts should be amended as changes occur. At this time, three initial tasks must be completed:

(1) An initial set of contractor submittal must be received, reviewed and filed.
(2) An initial meeting between the contract administrator and the contractor's job-site representative is held.
(3) The system and facilities for maintaining contract records is established.

7.2.4.2. Progress Billings and Payments

Unlike the purchase of finished goods, the buying of contract services requires periodic progress payments as the work evolves. Unplanned or subjective determination of progress results in overpayment to contractors. This can damage the owner in two ways: owners who pay for performance early incur unnecessary costs due to the time value of money; and, once payment has been made for performance yet to be

accomplished, owners lose the payment leverage needed to ensure proper and timely completion.

There are three general bases upon which partial payments may be made:

(1) Cost
(2) Time
(3) Actual performance, or progress

Of the three, payments based on progress are by far the most preferred from the owners point of view.

7.2.4.3. Submittals

The submittal is certification that the builder/supplier is providing technically complex components in accordance with accepted standards. An example of a submittal are shop drawings.[7] When shop-drawings are first received from a supplier, the contractor is responsible for checking them carefully against the contract drawings and specifications. The shop drawings are then forwarded to the A/E for examination and approval. The checking and certifying of these drawings is properly the responsibility of the A/E. Once these drawings are approved, they are 'submitted' as officially becoming part of the project and contract.

7.2.4.4. Notifications and Change Orders

Virtually every contract will change to some extent before it is completed. Formal and constructive changes represent the most pervasive and threatening factors jeopardizing project completion. A change-order program that identifies changes early, allows for thorough evaluation of need for a change before it is ordered, and provides responsible pricing and payment controls is essential for project owners. Balancing the risk of improper change authorization with the freedom to implement management decisions in a timely manner is a major challenge to project owners and their agents. The need for change is generally caused by one or more of the following reasons:

(1) Defective or Incomplete Design Information
(2) Late or Defective Owner-Furnished Material and Equipment
(3) Changes in Regulatory Requirements

---

[7] The term "Shop Drawings" include such fabrication, erection and setting drawings, manufacturer's standard drawings or catalog cuts; performance and test data; wiring and control diagrams; schedules; samples; and, descriptive data pertaining to material, machinery, and methods of construction as may be necessary to carry out the intent of the contract drawings and specifications. (Clough, 1981).

(4) Changed or Unknown Site Conditions
(5) The Impact of Collateral Work by Others
(6) Ambiguous Contract Language and Contract Interpretations
(7) Restrictions in Work Method
(8) Late or Inadequate Contractual Compliance on the Part of the Owner
(9) Delay or Acceleration

7.2.4.5. Backcharges

Backcharges are a response by the owner to instances where a contractor or supplier for various reasons is unable or unwilling to perform work determined to be its responsibility and included under the scope of work in the contract. The practice of charging a contractor for the cost of correcting inadequate work or work that was not performed represents a reversal of normal owner-contractor roles. Generally, the incidence of backcharge situations increases as the number of prime contractors and vendors associated with a construction project increases.

7.2.4.6. Brief-Form Contracting

Brief-form contracts are short-duration, low-cost work that cannot be planned and priced in advance. Unforeseen events such as emergencies and planning errors fall in this category. Common applications are:

(1) Emergency Work
(2) Housekeeping Services
(3) As Relief for Large Contractors
(4) As Competition for Change Orders to Existing Contractors
(5) When Existing Contractors Have Been Performing Unsatisfactorily
(6) When No Contractor is Available to Perform Backcharged Work

7.2.4.7. Claims

A claim is a request, or demand, for cost or time compensation, over and above that which has been granted or contemplated, from one contractual party to the other. The vast majority of claims, be they initiated by owner or contractor, are settled through negotiation, adherence to the terms of the contract, or some mutually agreeable adjustment in time and cost performance among the owner and contractor(s). In general, claims are filed for the following reasons:

(1) Defective Work

(2) Delays Caused by the Contractor
(3) As a Counterclaim in retaliation to a claim

Although seldom encountered, another type of claim arises from termination or breach of contract. This generally occurs when a contractor fails to complete work or for some reason leaves the work site.

7.2.4.8. Contract Closeout

Construction contracts should be formally terminated once performance has been completed and final payment has been made by the owner. Depending upon the contractors scope of work, the owner's objectives and, the specifics of the contract in question, closeout involves the receipt of documentation from the contractor. Commonly required documentation includes:

(1) Releases of Liens from the Contractor and Its Suppliers and Subcontractors
(2) Titles to Major Equipment Incorporated in the Facility
(3) Warranty Documentation
(4) As-Built Drawings
(5) Inspection and Acceptance Records
(6) Operating and Maintenance Manuals

In addition, other items may be required before the contractor is released from its contractual obligation. They may include spare parts, special tools and consumable supplies.

7.2.5. Construction Contract Monitoring

Project contract planning, the formation of contracts containing compliance controls and effective contract administration can be implemented at the very beginning of a project. After that time, the owner and contractor need assurances of continuing control, be able to identify problems that may jeopardize the project success and, take corrective action when the problems are identified. The systems and activities which address these concerns are called Contract Monitoring. There are countless strategies that can be used to implement contract monitoring. The following section broadly outlines approaches to this process.

7.2.5.1. Functional Contract Support

Every owner appoints a Project Manager representing it for all project considerations. The Project Manager designates home office and field staff that are responsible for protecting the interests of the owner. Typical generic positions include:

Construction Specialist: They are responsible for monitoring the technical performance of contractor at the site. Called area engineers or discipline engineers, each is assigned a group of contractors, a construction discipline (e.g. civil), or physical work areas (e.g. yard structures).

Resident Engineers: These field engineering personnel are usually divided by engineering discipline. They may perform engineering-design services needed as construction proceeds and act in liaison between the site office and engineering staffs in the home office.

Contract Administrator(s): This position performs contract administration functions at the site office.

Construction Accountant(s): This position is responsible for payroll, invoice receipt and payment, FTA state and local funding reporting, and collection of actual cost data.

Construction Cost Engineers: They prepare cost reports and cash-flow reports and perform estimates.

7.2.5.2. Contract Reporting

Owner management should be apprised of contracting status and performance information on both a continuous and exception basis. Periodic management reports should be issued to identify key factors influencing successful project completion. For this to occur, the following should be met:

(1) Status and performance information should be presented in a format that allows analysis
(2) Reports should allow monitoring of contractor progress
(3) Contract reports should focus on owner performance as well
(4) Contract reports should allow "management by exception"
(5) Information should be timely

7.2.5.3. Contract Auditing

In order to determine the efficiency of contracting processes or to ensure that contract charges are correct, most owners consider the use of some sort of contract audits during the course of a major construction project. Auditing differs from most of the other contract-related function already described in that it is not directly required in order to conduct contracting business. Auditing represents an arm's-length review of processes designed to protect the owners financial and public relations integrity.

There are three broad areas of auditing, each conducted differently with a different set of objectives:

Financial audits: Financial audits are designed to ensure that financial information regarding the status of the owner or contractor represents actual conditions. They are usually performed by Public Accounting organizations.

Cost Audits: Cost audits, on the other hand, have a direct application to many contracting elements. Their purpose is to test and verify charges made to the owner under a contractual agreement. As such, they involve detailed examinations of contractual billings. Their scope usually involves the matching of contractor charges to (1) the contractual terms and prices; (2) verification that the work was performed; and, (3) evidence of costs, labor hours or other resource expenditures to achieve that performance (variance analysis). Cost auditing is performed after the fact; that is, amounts that have already been paid to a contractor are verified for accuracy, applicability and reasonableness.

Operational Audits: Operational auditing differs from the cost variety in that it examines processes that are being conducted or contemplated in the future. Operational audits look forward and seek to identify ways by which to improve contracting activities and controls for the benefit of the owner or contractor. Its goals are increased effectiveness, economy and efficiency. Although costs are sometimes reviewed as indicators of contracting economy or effectiveness, operational audits focus their attention on control systems and processes.

Audit techniques are used to describe and quantify errors or overcharges in the various contract types described earlier. For lump-sum or firm-fixed price contracts, the area of frequent error or overcharge is with change orders. For unit-price contracts, the area of frequent error or overcharge is in the determination of quantities. For cost plus

contracts, the area of frequent error or overcharge is in the determination and allowability of costs.

7.3. ALTERNATIVE DISPUTE RESOLUTION (ADR)

Because of the enormous expense of traditional reference disputes to third-party determination by litigation or arbitration, the last 10 to 15 years have seen the development and acceptance of alternative dispute resolution (ADR) techniques. Parties with complex construction litigation may now avoid an expensive full-blown trial, with all the attendant expense of attorneys, accountants and consultants. The alternative dispute resolution techniques that receive increasing acceptance typically provide for the involvement of the top decision makers for the parties in informal, structured settlement proceedings, with the introduction of the dynamic of a third-party expert to assist in reaching a fair and equitable settlement.

Techniques for alternative dispute resolution include nonadjudicatory procedures, quasi-adjudicatory procedures, and adjudicatory procedures.

Nonadjudicatory procedures include:

(1) Mediation
(2) Early neutral evaluation
(3) Advisory arbitration or trial
(4) Mini-trial
(5) Disputes review board
(6) Escrow Bid

Quasi-adjudicatory procedures include:

(1) Judicial arbitration
(2) Special master

Adjudicatory procedures include:

(1) Judicial preference
(2) Project arbitration panel
(3) Modifications to standard arbitration

A party must properly evaluate whether its goals in the dispute resolution will be fulfilled by any particular dispute resolution technique.[8]

7.4. TURNKEY VARIATIONS

The goal of the design-build contract is to set out risks and responsibilities assumed by the owner and design-builder. For the owner to obtain true single source responsibility from its design-builder, the contract should clearly establish the full scope of the design-builder's undertaking. Regardless of contract form, the previously stated functional requirements need to be addressed. However, there are certain subjects within these functional requirements that may vary from the traditional method and are addressed in Sections 7.4.1 through 7.4.6. This is followed by Section 7.4.7 which examines the variations experienced in Honolulu and Houston.

7.4.1. Legislative Issues to be Addressed

There are two primary issues affecting design-build. First, with respect to public documents, is whether design-build is feasible at all, given the constraints of federal public competitive bidding polices and the Brooks Act. The second issue is presented by state licensing statutes, which hamper the ability of the design-build contractor to provide the design side of its services. These obstacles serve the purpose of safeguarding the public, and may be somewhat impervious to change. Because this demonstration program is federally mandated, it is assumed that the federal challenges in regard to the first issue will be appropriately addressed in the federal forum, at least for a one-time exception. Therefore, the relevant issue here is whether state and local licensing statutes can be amended to accommodate design-build contracting, distinct from the traditional legal form, and whether this directive can sustain legal challenge while providing the flexibility needed to deliver a successful project to the owner. The following presents current state licensing laws and related issues in the turnkey demonstration states and, an examination of Federal statute Section 13c.

7.4.1.1. Licensing Laws and Related Issues for the Prototype Turnkey Demonstration Projects

States require individuals desiring to practice architecture to satisfy specified educational and other requirements and to obtain a document. Typically, states define architecture and the practice of architecture, engineering and the practice of engineering, and contracting, and they require a license to carry on the particular defined activity. The

[8] Detailed treatment of these ADR procedures can be found in *"Alternative Dispute Resolution in the Construction Industry"* by Robert F. Cushman et al, John Wiley and Sons Law Publications, 1991.

definitions of architecture or practicing architecture fall into several general categories: (1) Definitions in terms of service or creative work; (2) Definitions in terms of "performing" services; (3) Definitions in terms of "rendering" service and, (4) Other definitions.

The form of the definition is important because states generally prohibit the unlicensed practice of architecture and engineering, but not all activities equate to practicing architecture or engineering or to performing such services. As one commentator has observed, the dictionary definition of rendering include both "perform" and "furnish."[9] If the statute proscribes "rendering" services, does the unlicensed contractor's furnishing of plans prepared by the licensed A-E to the owner constitute rendering? Alternatively, so long as the unlicensed contractor is only a conduit for those plans, is the contractor "performing" services? These considerations give rise to uncertainty with respect to the validity of design-build in a number of states.

In addition, the statutes often include other relevant provisions. They exempt a number of activities form the statutory definitions; those exemptions may include preparation of shop drawings, supervision of construction, and design-build. Finally, some states expressly declare contracts by unlicensed persons to be unenforceable.

In short, there are clear risk elements here. One is where a person performs some or all of a contract but is denied recovery for those services if the person has not complied with an enforcing state's licensing law. The design-builder may be vulnerable to such a result because it provides a combination of services through a single entity. A design-build entity fronted by a contractor has the license needed to perform construction services but may lack the license needed to perform design services. Conversely, the design-build entity fronted by an A/E may have an adequate design license but not a contractor's license. The design-build joint venture may be composed of parties who together have the design and construction licenses, but the joint-venture may not itself have either license. Legally the design-build entity may be found to lack an element critical to the right to recover on its contracts. The issue may be raised by the owner to avoid payment, or by professionals jealously guarding their market and professional niches.

7.4.1.2. State-by-State Survey - Demonstration Project States

The four design-build demonstration projects will be held in Los Angeles and San Francisco, California; Baltimore, Maryland; San Juan, Puerto Rico; and Hudson-Bergen,

[9] See Quatman, "Validity of Design/Build Under State and Federal Law, in Design/Build: Issues for the 90's and Beyond," *A.B.A. Forum on the Construction Industry* (1990).

New Jersey. The following discusses, by demonstration project state, the effect of state licensing laws for architects on the design-build market.[10]

California

The California Code permits partnerships between architects and non-architects, but requires the architect's name to appear on all instruments of service, such as blueprints, drawings, etc. and bars the designation of any non-architect as an architect. Joint ventures may face an additional hurdle. A joint venture composed of two or more licensed contractors must obtain a joint venture license in order to be awarded a contractor or act as a contractor.

Maryland

The Maryland Business Occupational and Professional Code is the primary legal instrument related to licensing. It requires persons to be licensed before practicing architecture. It permits licensed architects to practice architecture for others through corporation or partnerships and permits a corporation or partnership to provide professional services through a licensed architect. Corporations and partnerships must also meet compositional requirements, which include the requirement that at least two-thirds of the directors or partners be licensed in Maryland or another state. In addition, a licensed Maryland architect must be in responsible charge of the architectural practice. In anticipation of several design-build projects in this decade, the Maryland State Finance and Procurement Code 3-602 (1991) - Capital Projects - specifically lists design-build as an alternative construction method that should be considered for capital projects.

New Jersey

New Jersey law defines practicing architecture firms in terms of "rendering" professional architectural services. The law permits sole proprietors or business associations that may render engineering services to contract to provide architectural and engineering services if (1) the proprietor or association contracts with the owner in writing for the coordinated rendering of architectural and engineering services, and (2)

[10] See Park, John J., E. Mabry Rogers and Walter J. Sears III, "Chapter 3: The Effect of Licensing Laws on Design-Build" Projects, *Design-Build Contracting Handbook*, pp.76-103.

the architectural services are provided pursuant to a separate written subcontract. The subcontract must provide: "The licensed architect shall exercise independent professional judgment consistent with accepted standards of the practice of architecture with regard to the project as its circumstances may dictate." Thus, a design-build single entity appears to be infeasible while a joint-venture approach, or a design-build contractor with the designer as the lead, appears to be feasible.

Puerto Rico

Licenses are available only to residents, unless a designer forms an association with a designer licensed and domiciled in Puerto Rico, or a designer of "renown or international prestige." Failure to comply with the licensing provision is a misdemeanor, but the statute is silent as to rights to enforce contracts. More importantly, Puerto Rican law makes it necessary to initiate a joint venture for design-build contracts.

7.4.1.3. Section 13c

In addition to licensing laws, there needs an explicit recognition of the potential affects of Section 13c (49 U.S.C. app. § 1609). It states "It shall be a condition of any assistance under Section 3 of this Act that fair and equitable arrangements are made ...to protect the interests of employees affected by such assistance. Such protective arrangements shall include (1) the preservation of rights, privileges, and benefits (including continuation of pension rights and benefits) under existing collective bargaining agreements or otherwise; (2) the continuation of collective bargaining rights; (3) the protection of individual employees against a *worsening of their positions with respect to their employment* (emphasis added); (4) assurances of employment to employees of acquired mass transportation systems and priority of re-employment of employees terminated or laid-off; and, (5) paid training or retraining programs." Actions created by the turnkey contractor may impact other areas of the organization (e.g. a turnkey built heavy rail line over previous bus line negatively impacts the displaced bus operators). Clearly from this legislation, the treatment of employees if this Act is invoked needs to be addressed as part of the overall evaluation.

7.4.2. Turnkey Team

Once it has been established that it is legal to enter into a design-build agreement, it is essential to determine the legal form of business. In the traditional method, the architect and contractor are separate so the legal form of business is somewhat inconsequential. In design-build, it is essential to know how the team is constituted, especially initially

for the purpose of awarding the contract. Although there is an infinite number of possibilities for organizing a design-build entity, these organizations can generally be categorized into one of five formats consisting of:

(1) The architect as the prime contractor and the contractor as a subcontractor (Prime Architect Design-Build).

(2) The contractor as the prime contractor and the architect as a subcontractor (Prime Contractor Design-Build).

(3) The architect and the contractor form a limited partnership or a joint venture (a general partnership) and the combined entity is the prime contractor (Partnership Design-Build).

(4) The architect and the contractor form a design-build corporation (either a S-corporation or a C-corporation) and the resulting corporation is the prime contractor (Corporation Design-Build).

(5) The Design-Build-Operate-Transfer (DBOT) team which is a single business entity that performs the design, construction, construction and long-term financing, as well as the temporary operation of the project. It can take on any of the previously discussed four business forms and at the end of the operations period, which can be many years, operation of the project is transferred to the owner.

7.4.3. Characteristics of Acquisition Strategies

Review and analysis of the four major organizational approaches of Multiple Primes and Single Prime in the Traditional method, Design-Build and Design-Build-Operate-Transfer yields several variations. These conclusions are summarized in Table 7-3 and described in the following paragraphs.

7.4.3.1. Number of Construction Contracts

For Design-Build-Operate-Transfer, Design-Build, and Single Prime, there is essentially one contract between the contractor and the owner. Although all three will need to subcontract work out, the responsibility for performance is theirs only; the owner only engages in oversight. Multiple Primes are typically used on large projects where extensive geotechnical and right-of-way demolition and construction work is required. The type of agency that uses the multiple primes approach is typically large and mature,

Table 7-3.
Characteristics of Alternative Contracting Strategies

Strategy / Feature	Multiple Prime	Single Prime	Design/Build	Design-Build-Operate-Transfer
Number of Construction Contracts	**MANY**	**ONE**	**ONE**	**ONE**
Type of Technical Contract Specifications	**PRESCRIP-TIVE**	**PRESCRIP-TIVE**	**PERFOR-MANCE**	**PERFOR-MANCE**
Acquisition Experience of Most Agencies	**MODERATE**	**EXTENSIVE**	**LOW**	**LOW**
Owner Involvement and Coordination Demands	**EXTENSIVE**	**MODERATE**	**LOW**	**LOW**
Expected Claims, Change Orders and Backcharges	**HIGH**	**MEDIUM**	**LOW**	**LOW**
Operating Risk Exposure to the Vendor (Revenue + Function)	**LOW**	**LOW**	**LOW**	**HIGH**
Proprietary Technology Admissible	**NO**	**NO**	**YES**	**YES**

and has a knowledgeable and experienced staff that has successfully managed large projects with multiple contractors in the past. Moreover, the packaging of work into many small contracts may stimulate the use of smaller local contractors, especially DBE, WBE and MBE businesses. Also, a type of "portfolio effect" is achieved by spreading out risk to many contractors. However, the benefits of the "portfolio effect" on risk must be weighed against increased management and control demands.

7.4.3.2. Type of Technical Contract Specifications

For both the Single and Multiple Prime traditional contracts, the project is well defined technically. The A-E has incorporated all of the required technical specifications into the design. For Design-Build and DBOT, the location of major structures is determined in the Systems Planning phase and may be accompanied by a small degree of shop drawings, usually completed by agency staff. Performance Specifications will describe the system. Otherwise, there may be minimal technical detail at the time of contract award.

7.4.3.3. Acquisition Expertise of Most Agencies

Design-Build-Operate-Transfer and Design-Build are relatively new contracting methods in public transit agencies. For DBOT and D/B, although there is just one contract, the level of contract formation basically defines if the project is going to be a success. Since responsibility for cost, schedule and technical issues will be assured by the contractor, the owner must be satisfied that adequate controls exist before the contract is signed. This requires extensive bidder qualification and a detailed examination of specific contractor controls in the contract documents, and the owner must monitor the use of these controls during the execution of the project. These surveillance controls are essentially the owner's direction of the project.

For Single and Multiple Primes traditional contracting in public transit agencies, there is a lot of institutional history and experience that contributes to exacting directives of how work is to be performed and the commensurate responsibility for performance.

7.4.3.4. Owner Involvement and Coordination Demands

The major effect of an organizational approach is to dictate commensurate owner involvement in project-specific activities. Depending upon the subsequent assignment of responsibilities within the boundaries of any given approach, the owner's involvement varies greatly. Because the owner, by nature of the approach, must delegate detailed control responsibility to the DBOT and D/B contractor, it must assure itself that the contractor has the intent, personnel and systems to exercise such control. The owner's

duty then reverts to surveillance of the contractor's controls throughout the project duration.

The Single Prime approach provides for a classic division of project responsibility between engineering and construction efforts. The owner is not typically involved in subsequent delegation of responsibility within either of these contracted efforts. And coordination of work performed by any subcontractors to either the A-E or Single Prime is the responsibility of these respective companies.

In the Multiple Primes approach, the owner becomes the ultimate coordinator of all contractors on the site. In a sense, the owner has replaced the single prime in its role of subdividing the work and awarding individual subcontracts. The main disadvantages are extreme demands on the owner (and A-E) for staffing, responsiveness, and organizational strength.

7.4.3.5. Expected Claims, Change Orders and Backcharges

There are two factors the substantially contribute to claims, change orders and backcharges:

(1) Design is not totally or substantially complete at the time of construction contract award.

(2) Inflation, escalation of material and labor prices, and changes in the work occur during the length of time required to perform all project construction work.

Because design is the responsibility of the DBOT and D/B contractor, it is difficult to justify a construction claim for its own inability to coordinate design and construction sequencing. Likewise, changes in work should only occur at the direction of the owner, necessitating a justifiable change order. Otherwise, the frequency of claims should be minimal.

For the Single and Multiple Prime contractors, they are abiding by the dictates of the A-E and the owner. If these contractors encounter unforeseen conditions, such as unanticipated rapid inflation, labor unrest or geotechnical problems, it is the responsibility of the owner to pay. If the A-E changes a design feature, it is up to the owner and the A-E to define responsibility; the contractor is paid by the owner to ensure continuation of the project.

7.4.3.6. Operating Risk Exposure to the Vendor

For the Multiple and Single Primes and Design Build Contractors, there is low risk exposure because they hand-off the project before revenue operations commence. There is an element of risk that the project as delivered is not what the owner expected, but this is a litigious issue related to the original specifications of the job. Operating risk exposure is high to the DBOT because of the inherent obligation to operate the system for some period of time before transferring it to owner.

7.4.3.7. Admissibility of Proprietary Technology

It is highly unlikely that proprietary technology would be used in either a Single or Multiple Prime relationship. The A/E and construction contractor are separate, and at time adversarial entities. The use of proprietary technology by either entity would result in the forfeiture of trade secrets by the copyright holder to the other entity without royalty payment. In a D/B and DBOT arrangement, their very contractual relationship calls for a sharing of technology, whether or not it is proprietary. Generally, agreements concerning the use of proprietary documents and technology in D/B and DBOT contracts are nonexclusive licenses, for use by the licensee solely in connection with the current project.

7.4.4. Payment

There are three common methods of providing payment to the design-builder. First, payment may be made for the construction and the design work in its entirety on a straight cost-plus-fee arrangement. Under this arrangement, the owner assumes the risk of the entire cost of the project. Second, the parties may agree to a lump sum price for the entire contract, with the design-builder's focusing on performance requirements expected of him in developing a price, because the final design may not be complete. In this situation, it is critical for both the owner and design-builder to have a strong understanding of what the final product will be, in order to avoid issues relative to whether the scope of work is complete.

A third pricing alternative is to compensate the design-builder for it design efforts on a cost-plus-fixed-fee basis, with lump sum price's being established as soon as the design is sufficiently complete to allow a reliable estimate to be made. This is a hybrid of the lump sum and cost-plus-fixed-fee approaches and was developed as an attempt to do away with the risk allocation problem by deferring the final price until the plans and specifications are sufficiently definite. This option allows the design-builder to fill in the details of the design in enough detail to estimate the project's cost, thus alleviating the need for a final, biddable set of plans.

The Houston Design Build Monorail project proposed a hybrid compensation scheme that coincided with each of the three D/B contract phases. Phase I support services for PE and the FEIS analysis was to be covered by a cost plus fixed fee contract with budgetary ceiling. Phase II system component work was to be compensated on a lump sum, firm fixed price basis. Phase II design and construction management of fixed facilities was to be compensated on a cost plus fixed fee basis. Phase III operations and maintenance was an option to be exercised at the Houston METRO's discretion on a lump sum, firm fixed price basis.

7.4.5. Change Orders

Most projects experience some sort of change sometime during the life of the project. In the traditional method, project changes during construction are typically handled in a sequential manner. The change is first proposed by the proponent of the change, and is then reviewed by the design professional if someone other than the design professional initiated the proposed change. The design professional provides the owner with recommendations and prepares the necessary drawings and specifications to document the change. If approved by the owner, the design professional issues a *change order*. Only then is the contractor permitted to proceed with the approved change.

The design/build entity should be better able to respond and adapt to changes during construction than parties using traditional methods of project delivery. The link between the discovery of a problem or changed circumstances, and the solution to the problem or change, is much closer in a design/build project, since both design and construction activity takes place under the same roof. Finding a solution and then communicating that solution to those responsible for implementing the change may be done less formally and more quickly. Documentation can often be prepared while the change is being implemented, since the primary purpose is to *record* the change rather than *instruct* the contractor. Depending on the contractual arrangement between the design/build entity and the owner, and the extent of owner involvement in certain project decisions, owner approval may not be necessary at all.

7.4.6. Insurance

Insurance is based upon broad categories of risks that have been identified through past experience, with the traditional roles of contracting parties, the owner, the contractor, architect, subcontractor, suppliers, lenders, or surety defined by custom and case law. The underwriting process is very subjective and a function of the underwriter's experience in assessing risks. There is not sufficient loss experience in design-build to give the underwriter rating firms categories that are clearly defined. Currently, no single policy of insurance covers the risk of design-build. Consequently, the

design-builder must look to conventional types of insurance covering the design and construction process to protect claims and losses. How the design-builder obtains and implements insurance coverage in an environment tailored exclusively for the traditional method represents the turnkey variation. The following are potential methods that a design-builder can address risk associated with professional liability and third party issues with insurance.

7.4.6.1. Professional Liability

The design-builder is generally required to furnish proof of professional liability coverage to the owner to commence work. The professional liability insurance forms and coverage for design-build entities are quite similar to the professional policies obtained under traditional methods of contracting. There are two basic variations of contractor's professional liability insurance policies that are available. One provides coverage for negligent errors, omissions, and acts of design professionals but excludes faulty workmanship or construction that is not in accordance with the design of the project or the construction documents, failure to complete construction in a timely manner, and consequential losses arising from such acts. The other variation of contractor's professional liability insurance includes all the standard coverage but broadens coverage by adding provisions that include direct or contingent liability for faulty workmanship for work performed by or for the design-builder. The scope of the professional liability insurance, including faulty workmanship, can be written in the declarations of the policy or can be added through a professional activities endorsement that is attached to the architect's or engineer's professional liability policy. The faulty workmanship provision covers damages arising from the replacement of the faulty work itself.

7.4.6.2. Third Party Liability Issues

As in the traditional method, the design-builder will most likely have to subcontract some portion of the work to subcontractors and will definitely have to procure materials from a host of suppliers. It is critical that the design-builder has appropriate legal safeguards in place to ensure that subcontractors and suppliers conform to the master contract. One or more of the following remedies could be used:

Incorporation of Reference Clauses: The incorporation by reference clause provision incorporates the general contractor's agreement with the owner by reference into the subcontract between the general contractor and the subcontractor or supplier.

Scope of Work Clause: This clause imposes an obligation to the subcontractor to do whatever is necessary to complete their portion of the project so long as it is reasonably inferable from the contract documents.

Flow-Down Clauses: A typical contractor/subcontractor/supplier flow-down provision transfers to the subcontractor or supplier all obligations that the contractor owes to the owner.

7.4.7. Experience with Other Agencies: Honolulu and Houston Turnkey Projects

In developing the procurement procedure, particular attention must be given to jurisdictional regulations. Often local requirements are designed around the traditional lowest bid process. However, it may be a prudent deviation to carry out a Request For Proposals (RFP) process where the award is based on a number of criteria, not just bid price. Although there is a paucity of mass transit turnkey contracts presently, the competitively negotiated RFP process used for the turnkey procurement of the Honolulu Rapid Transit System is a useful example.[11] This process involved the following steps:

- Formal Advertisement
- Release of RFP
- Formal communication with proposers during proposal preparation period and addenda to amend the RFP in response to questions and requests
- Receipt of Proposals
- Confidential evaluation of Proposals and selection of a Competitive Range
- Questions and information requests made of Proposers in the Competitive Range and discussion meetings with each one separately
- Final addendum to RFP and Request for Best and Final Offers
- Evaluation of Best and Final Offers and selection of Contractor

Turnkey contracts can be structured in varying ways to provide benefits to both owner and contractor. One common element is the shifting of design responsibility to the contractor. In the most extreme example, the owner may provide the contractor with the broadest outline specifications. Generally the owner's needs will be given in greater detail, but far short of the detailed design necessary to construct the project. The

[11] Elms, Charles P. "Comparison of Super-Turnkey Procurement with the Traditional Approach for the Design and Construction of Fixed-Guideway Transit Systems," Lea+Elliot, Washington D.C., *presented at the APTA 1992 Rapid Transit Conference, Los Angeles Cal.*, pp.9-10 June 1992.

contractor then retains architects or engineers to design the project within the outline specifications, and takes full responsibility for design and then construction.

Turnkey contractors further refine the process by having "phased design and construction" subcontracting. This concept is diagrammed on Figure 7-2. Specific engineering specialties (e.g., mechanical or electrical) are assigned to the subcontractors, with the only coordination being provided by the owner's design professionals. There is an expectation of time savings in the construction phase.

7.4.7.1. Contract Clauses

The Houston Monorail Project provides valuable insights to contract clauses related to the design-build project. They are broken down to what are considered typical and special clauses of design-build procurement.[12]

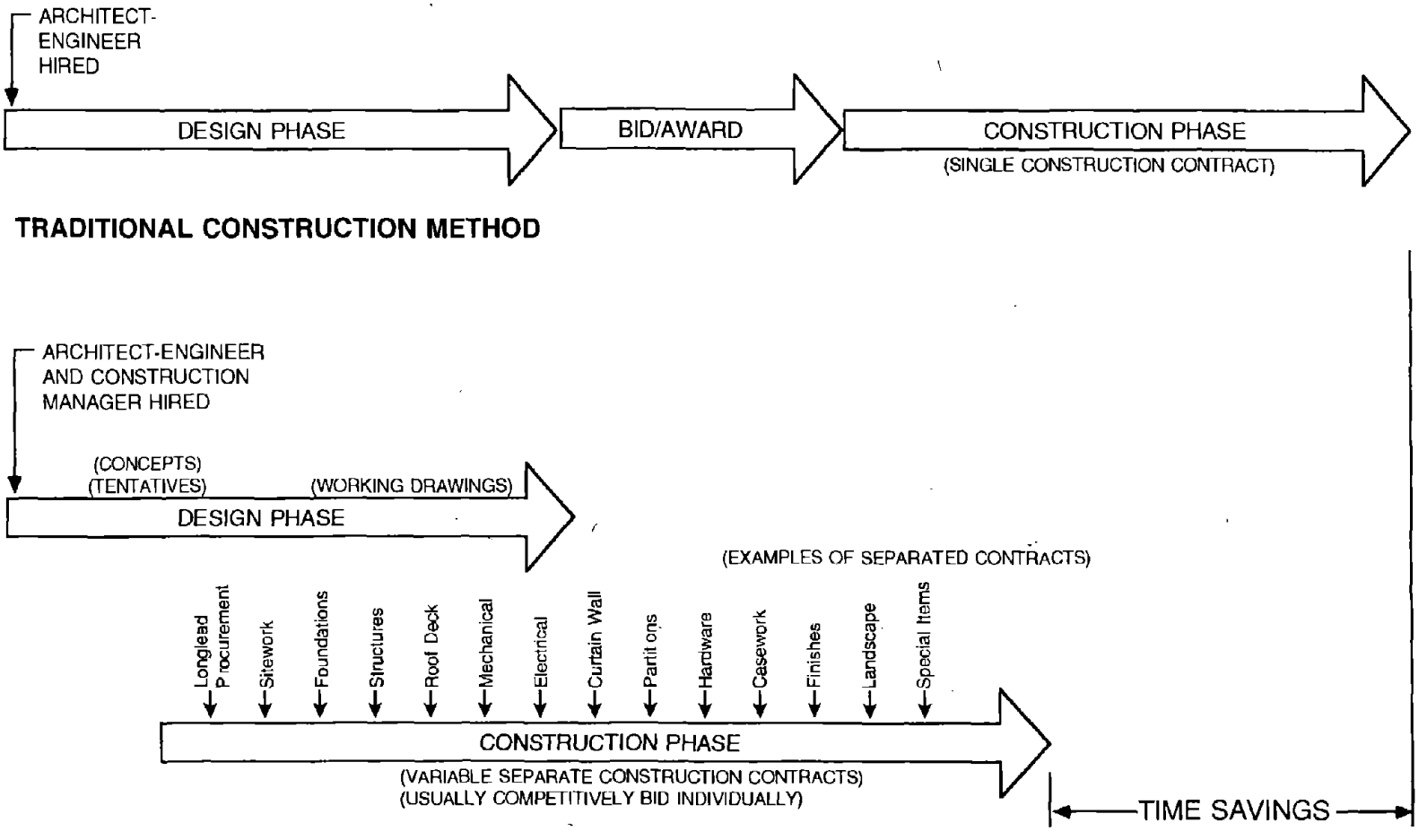
7.4.7.1.1. Typical Clauses

Directed Changes. METRO could direct the contractor to make any change in project work within the scope of the turnkey contract including changes in contract drawings, designs or specifications; method or manner of performance of the work; installation and testing schedules, time or rate of delivery; increases or decreases in the amount of service to be furnished under the contract. Increases or decreases in project costs resulting from such changes were to be equitably reflected in the contract price (see Pricing of Adjustments below).

Proposed Changes. Both METRO and the contractor could propose changes to the work which were within the scope of the contract. Furthermore, the contractor could submit an Engineering Change Proposal (ECP) complete with a price proposal for such proposed change.

Pricing of Adjustments. The price of work, added, deleted or changed (whether directed by METRO or proposed by METRO or the contractor) was to be determined by the negotiation of pricing proposals submitted by the contractor for this purpose. Such changes were to be considered "negotiated procurements" distinct from the original turnkey procurement. For such changes, the contractor was to submit a "Certificate of Current Cost and Pricing Data." The price and other terms negotiated for each change were to be documented in a modification to the original contract.

[12] Booz, Allen & Hamilton, "Evaluation of Houston's Turnkey Experience," *prepared for FTA/OTAS Washington DC*, pp. 5-20 through 5-22, July 1994.



Source: from Public Technology, Inc. (September 1980).

Figure 7-2. Traditional versus Turnkey Design and Construction Scheduling.

Stop Work Orders. The Contracting Officer could at any time, require the contractor to stop all, or any part, of the work called for by the contract for up to 45 days. If project development was to resume following cancellation of a previously issued Stop Work Order, an equitable adjustment was to be made to the contract price and schedule to reflect the costs and scheduling impacts of the work delay.

Termination. The performance of work under the contract could have been terminated by METRO (either all or in part) is such termination was considered in METRO's best interest. The Contractor and METRO would then determine the amount owed to the Contractor by METRO.

Default. METRO was allowed to terminate the Contract in whole or in part if: (i) The Contractor failed to make delivery of the supplies or to perform services including installation and testing, within the specified time, or (ii) the Contractor failed to perform any of the other provisions of the Contract.

Disputes. Disputes arising under the Contract which were not disposed of by agreement were to be decided by the Contracting Officer. Appeals could then be made by the Contractor to the METRO Contract Appeals Committee.

7.4.7.1.2. Special Contract Clauses

Options. The turnkey contract contained a number of options that METRO could exercise. These options included:

-Options to construct the Southeast/Universities and Texas MedicalCenter/Astrodome Lines.
-Options for contractor operations and maintenance on the Initial Line as well as the SE/Universities and TMC/Astrodome Lines (individual options on each).
-Options for fleet additions on the Initial Line as well as the SE/Universities and TMC/Astrodome Lines (individual options on each).

Progress Payments. METRO was to make progress payments on a monthly basis as work proceeded. However, 5 percent of progress payments were to be withheld until final acceptance of contract work (full payments could be received after 50 percent of the project was complete assuming work was satisfactory). Furthermore, progress payments were not to be made if the

work was considered to be unsatisfactory or the total value of the work for the payment period fell below a specified level (i.e., $500,000).

Contract Prices - Generic Catalogue of Prices. Turnkey contract proposers were to include a Generic Catalogue of Prices showing the cost of all system components. Payment for the various items listed in the Generic Catalogue of Prices was to constitute full compensation for furnishing plant, labor, equipment needed to compete work in conformity with the contract.

Increased or Decreased Quantities. This contract provision was to apply to METRO initiated changes to work through field adjustments, design changes, differing site conditions, and other adjustments. For such changes, the contractor's unit cost estimates in the Detailed Pricing Schedules and Catalogue of Prices was to be utilized in Phase I (the preliminary engineering/final environmental impact analysis phase) for negotiation of changes to the contractor's prices necessitated by preliminary design work, environmental analysis and alignment refinement. The revised Detailed Pricing Forms were then the serve as the Contractor's firm, fixed price for the Phase II effort. Upon completion of Phase I, the Catalogue of Prices was also to be adjusted to reflect changes in the Detailed Pricing Forms for Phase II and was to be maintained throughout Phase II (including for negotiations related to design changes).

Economic Price Adjustments. METRO was to make adjustments in the contract price to reflect increases or decreases in the costs of labor and materials due to inflation. These adjustments were to be effective as of the Phase II Notice To Proceed. For the purpose of adjustment, the contract price of each work item (e.g., guideway, stations, maintenance facilities, etc.) was broken down into the (fixed) proportions represented by the following inputs: (i) shop labor, (ii) material and (iii) field labor. The costs of each of these inputs were then to be adjusted based on percentage changes in the "shop labor", "material" and "field labor" indices from the beginning of the project to the midpoint of the construction schedule for each individual work item.

Limitations on Price Increases. The turnkey contractor (HMT) was to inform METRO if the cost of any major item relating to the fixed facilities exceeded the cost in the cost data baseline at the start of Phase I by more than 5 percent. METRO would then determine of (i) it should raise the

value of the Current Working Estimate (CWE) or require HMT to find some means of reducing the cost. If the latter path was chosen, HMT would be responsible for the cost of any alterations designed to lower costs. (HMT was required to provide estimates of the capital cost of fixed facilities in the RFP).

Liquidation Damages. In the event that the Phase II work was not completed as specified in the contract and with 2,400 days of the Phase II NTP, the turnkey contractor was to pay METRO $11,500 for each day such completion was delayed, the amount not to exceed $5 million (i.e., compensation for damages due to loss of revenue, increased administration costs, inconvenience to the public and impact on other contracts). The assessment of liquidation damages was in addition to remedies provided elsewhere in the contract.

Warranty Period. The contractor was to warrant all equipment, materials, fixtures and facilities supplied (in accordance with the General Provisions) for a period of 2 years from the start of revenue service.

Final Payment. Final payment to be made after the work has been accepted as provided in the turnkey contract.

Acceptance. Final acceptance of the project by METRO was to be in accordance with Review, Verification and Acceptance Provisions.

7.4.7.2. Experience with Houston and Honolulu Design/Build Joint Development

Private sector funding in the form of joint development proposals by design build bidders represented a significant amount of proposed project funding in Houston and Honolulu. Joint development proposals included leasing arrangements, air and/or ground rights for development purposes and concessions. Of the estimated $1.1 billion costs in Houston, $130 million was expected to come from private joint development sources. In Honolulu, 35 percent of project financing was expected to come from private joint development sources to avert a general excise tax. Ultimately, neither funding amounts substantially materialized and contributed to the eventual cancellation of both projects. Analysis by Booz, Allen & Hamilton for the Houston.Monorail D/B project provides some useful insights to future use of joint development.

"While joint development mechanisms can provide an effective source of project funding, project sponsors should keep the following in mind when considering inclusion of joint development opportunities in a turnkey

contract: Joint development opportunities do not directly contribute to the effectiveness of the design-build process which is the turnkey method; Developers typically demand a market-based return on their investments; Traditional turnkey consortia are not real estate developers; Differing attitudes regarding acceptable risk and return can impede formation of contractor consortia including both real estate developers and traditional turnkey consortia members; Only the public sector can implement the measures and grant the concessions needed to capture the value represented by these opportunities. Based on these findings, it is preferable if joint development opportunities be excluded from the turnkey contract."[13]

7.5. EVALUATION

7.5.1. Potential Impacts

For most of the impacts associated with turnkey versus traditional procurement during the Contracts and Procurement phase, the transfer of responsibility implies corresponding transfers of risk to the contractor. The strategies and models for allocating risks between design-builder and owner through contract documents vary greatly and depend on factors such as project type, bargaining strength, owner involvement, owner requirements, amount of risk assumed by the owner, and the parties sophistication in the use of the turnkey model.

In all cases, however, it is critical to the evaluation of the project that risks as stated in Chapter 8 be identified and the context in which they were allocated in the contract language. For example, if the contract stated that the contractor is responsible for unforeseen conditions (e.g., hazardous waste), it would be expected that the bid price would be substantially higher than without the provision. Assuming hazardous waste was found and if this premium price is lower than what the costs would have been if the agency absorbed the costs through change orders, this would imply that the turnkey method is more efficient.

Although not exhaustive, additional areas for consideration include the following:

[13] Booz, Allen & Hamilton, Inc., "Evaluation of Houston's Turnkey Experience", *prepared for FTA/OTAS, Washington DC*, Pg. 8-3, July 1994.

7.5.1.1. RFP Preparation Effort

Before any design-build project can commence, the Request for Proposals needs to be prepared and advertised. It is up to the owner/agency to determine how much time and effort is needed. If, for example, the RFP only states performance specifications, leaving the bulk of the specific work to the bidders, this may imply a reduction of effort and time by the owner. Evaluation may consider a reasonable approximation of how long (short) it takes to get turnkey Request for Proposals (RFP) documents publicized for review vs. a traditional RFP, and did this result in any demonstrable effect on ability to respond in a timely way, ability to commence work and price.

7.5.1.2. Sophistication of Contract Preparers/Effect on Competition

The design-build response to the RFP should be more complex than a traditional RFP response because it includes design and construction (and possibly operation). This implies that the design-build firm would need to have staff requiring greater skills and sophistication to fully respond to a RFP. Companion to this is the fact the design-build firm must accept the risks of losing the bid in open competition, resulting in a near or total loss of time, effort and money. Both of these points would appear to put a drag on the number of competitors, and thus be inefficient. Evaluation may focus on how the turnkey process contributed to or took away from competition, in terms of the number of bids received and corresponding bid prices, how many were not rejected due to deficiencies and other problems and, how this affected the bargaining leverage for the owner.

7.5.1.3. Effect on Minority Set-Asides

Localities typically set a percentage of the total contract which is set-aside for Minority/Women/Disabled Enterprises. The inability to meet these goals may jeopardize the ability for the owner to approve the bid, resulting in an otherwise worthy bid being disqualified. Evaluation should focus on whether the turnkey process enhances or takes away from MBE/WBE/DBE, local contracting, small business and related policy goals as it relates to bids being withdrawn, rejected or accepted.

7.5.1.4. Permitting, Licensing and Inspection Issues

The assignment of the responsibility to obtain building and other permits, licenses and inspections is appropriately with the design-builder. The design-builder is the experienced entity responsible for the overall design and construction of the project and is in the best position to obtain everything necessary. However, there is an explicit trust that this exercise will be done well, and implies a provision of no harm to the owner in

the event of an oversight or omission. For example, by the design-builder assuming permit, licensing and inspections leads to a net shrinkage in labor effort (e.g., agency staff costs for permits and inspections decrease more than turnkey contractor costs and effort increase) implies that the turnkey method is more efficient. However, if the design-builder for whatever reason does not obtain a necessary permit or does not perform a necessary inspection resulting in legal action which leads to long, costly delays in the project, this may imply handing over this process to the design-builder is inefficient. Evaluation should focus on the process for obtaining local and state permits and licenses, and measure the impacts of this process on Work Breakdown Structure, the Master Schedule and overall costs. Depending on local conditions, it may be appropriate to suggest actions by the FTA to better facilitate the permit and licensing process for future turnkey projects.

7.5.1.5. Payment and Verification

As has been discussed in section 7.2.2.2, several methods of payment are available to a design-build contractor; straight cost-plus-fee, lump sum and, a hybrid of the lump sum and cost-plus-fixed fee approaches. In the traditional method, the A/E regularly examines the contractor's work to determine whether payment is justified and the work is proceeding in accordance with the design. In the design-build approach, the owner has to make some tough decisions regarding how much trust regarding payment can be practically and politically accorded to the design-builder. That is, will the owner be advancing payments for work that is said to be occurring and at high quality, without verification procedures. One way to avoid this problem is for the owner to (1) insist that a detailed set of plans be developed prior to the start of construction and, (2) retain the services of a consulting engineer to evaluate the design-builder's payment applications and compliance to design. Note that these methods will increase owner oversight and costs. Evaluation should focus on the level of owner oversight versus the traditional level and, if there is a increase or reduction in oversight, measure the impact on project cost and quality.

7.5.1.6. Change Orders

The design/build entity should be better able to respond and adapt to changes during construction than parties using traditional methods of project delivery. When both design and construction responsibility reside within the same design/build entity, it is in the best interests of both disciplines to maintain a cooperative and harmonious relationship. With this in mind, the process for effecting change should be simplified, and the time required to implement the change can be reduced when the project is delivered using the design/build approach. Evaluation thus may focus on the number,

type and dollar amount of change orders, and the length of time and level of effort needed to address and resolve them.

7.5.2. Benefits

Shifting from a specification-oriented contract to a performance-oriented contract may require higher levels of contracting and contract preparation skills, as well as perhaps more effort prior to issuing RFPs. These costs should be offset by benefits in faster scheduling, lower design and construction costs, and better solutions to design and construction problems.

8. RISK ALLOCATION

Uncertainties, unknowns, and unforeseen events are inherent in capital construction projects. The list of risks presented in Table 8-1 is intended to be both exhaustive and non-overlapping, with respect to the types of transit projects for which turnkey methods are applicable.

8.1. FUNCTIONAL REQUIREMENTS

Particular risks tend to be associated with particular phases in the transit project development process, as indicated in Table 8-2. The largest share of risks appear in the construction phase.

In practice, all risks are assigned, de facto, whether or not they are made explicit or individually priced. The determination -- if it is made explicit -- may be discovered in legal contracting language, in accepted practice, through litigation, or by some other means. The allocation of risk cannot be avoided, but it can be revealed, partitioned, and modified.

8.1.1. Traditional Process

Typically, risk is only partially acknowledged, its costs are not separately identified, and most of it stays with the owner. Private firms may purchase insurance, and contractors are usually required to be bonded to ensure that the project can be completed even if the contractor fails. Geotechnical risks for conditions different from what appears on the surface may be explicitly assigned by specifying what happens if prior information is incorrect or insufficient, and problems are encountered. A contingency fund is established to cover likely cost increases due to change orders, unanticipated conditions, and unforeseen events.

Thus risk is handled in the traditional process via numerous ad hoc means that often fail to reveal its true cost.

Table 8-1.
Types of Transit Project Risk

Risk	Description
1 Political	Collective decision process, agreements among local government agencies, willingness of interest groups to reopen prior decisions, ability of groups to disrupt or impede process; environmental reviews; historic, archeological, and religious sites; legal challenges to project continuation.
2 Funding	Commitments by public and private participants to provide monetary and in-kind contributions to support the project.
3 Financing	Willingness of financial institutions to lend money based on the opportunity costs of funds and the perceived level of funding commitments, to allow matching of cash flow with expenditures.
4 Right-of-way	Ability to acquire all necessary ROW in sufficient time to avoid delays in design and construction.
5 Speculative effort	Chance that planning and design work undertaken for the purpose of securing funding or contracts will fail to produce the intended results.
6 Bids exceed estimates	Submitted bids exceed cost esimates so that the budget becomes insufficient to accomplish planned construction.
7 Geotechnical	Difference between what is known about subsurface conditions and the actual nature of such conditions (not including utilities).
8 Hazardous materials	Uncovering of unexpected toxic, nuclear, or otherwise hazardous materials during construction that require costly disposal or treatment.
9 Underground utilities	Deviation between stated and actual locations of underground utilities, and the unknown existence of pipes, conduits, etc., that may or may not be obselete.
10 Inflation	Growth in the general level of prices or relevant components of general prices that are incorrectly forecast or which change so as to substantially alter the relative magnitudes of cost components.
11 Federal, state, and local regulations	Changes in regulations or changes in the legal interpretations of existing regulations that create unanticipated costs, including Buy America, Davis-Bacon, OSHA, DBE, FTA, and state employment regulations.

Table 8-1.
Types of Transit Project Risk
(cont'd)

Risk	Description
12 Design and integration; coordination	Possibility that the subelements of design or the subsystems of the project will not resolve themselves into a coherent functioning whole.
13 Changed requirements	Changed or unanticipated requirements discovered after the point in the development process when they should have appropriately been incorporated, not elsewhere classified in the list of risks.
14 Construction performance	Hidden defects, covered up without external evidence; skill shortages, labor conflicts.
15 Subsystem test	Possibility that the project facility does not function poperly when completed, or fails under stress.
16 System integration test	Possibility that the facility functions properly on its own but not when operated with the larger system of which it is a part.
17 Schedule	Slippage in the schedule that extends the project duration or complicates the coordination among subsystems.
18 Construction safety	Control of workplace hazards to reduce accidents to workers and property.
19 Site security	Prevention of theft and from sabotage.
20 Act of god (force majeur)	Earthquake, flood, hurricane and similar natural catastrophes during construction that can only be mitigated at best.
21 Failure to complete	Contractor fails to produce the facility, or lacks the capacity to finish the job.
22 Seismic	Risk that the facility will be seismically unsafe after constructed or will be damaged or destroyed in an earthquake.
23 Operating	Possibility that the system will not generate adequate capacity, or will otherwise result in unexpected operating costs or conditions.
24 Market (ridership or revenue)	Possibility that the service will not attract sufficient cusstomers at reasonable fares to generate planned revenues (revenue bonds or parking garages); decline in value of revenue source.

Table 8-2.
Risks by Project Development Phase

Risk	Primary Phase	Other Phases
1 Political	Sys. Plan	All Others
2 Funding	Sys. Plan	Prelim Engr
3 Financing	Sys. Plan	Prelim Engr
4 Right-of-way	Sys. Plan, PE	Final Design
5 Speculative Effort	Final Design	Sys. Plan, Prelim Engr
6 Bids exceed estimates	Final Design	Prelim Engr
7 Geotechnical	Construction	Final Design
8 Hazardous materials	Construction	Final Design
9 Underground utilities	Construction	Final Design
10 Inflation	Construction	Final Design
11 Federal, state, and local regulations	Construction	Final Design
12 Design and integration; coordination	Construction	
13 Changed requirements	Construction	Final Design
14 Construction performance	Construction	
15 Subsystem test	Construction	
16 System integration test	Construction	Operation
17 Schedule	Construction	Final Design
18 Construction safety	Construction	
19 Site security	Construction	
20 Act of god (force majeur)	Construction	Operation
21 Failure to complete	Construction	
22 Seismic	Operation	
23 Operating	Operation	
24 Market (ridership or revenue)	Operation	

8.1.2. Turnkey Variations

Each risk is addressed at the appropriate stage in the project development process. The turnkey strategy allows some shifting of risk to private contractors, and the potential advantage of doing so is that some particular risks are addressed more efficiently -- at lower cost -- by the private sector. "Defensive" actions, designed primarily to avoid blame for possible future costs, can add to project costs in the same way they add to medical bills. To the extent that risk can be allocated to those parties most able to reduce the probability of adverse consequences or control the costs of such consequences, real savings are possible.[1]

In specific turnkey demonstrations, risk may not be allocated optimally, with the results that costs are higher than necessary because the turnkey contractor was forced to bear risks which were largely beyond its control. Thus it is vital that the turnkey evaluation identify reasons why impacts were greater or less than expected.

In order to deal with risk more effectively, it is necessary to identify each specific risk and quantify its costs. The general method is to compare the specifics of each risk with its equivalent "sure" cost, represented, say, by an insurance premium that an owner would be willing to pay to avoid the consequences of the risk.

8.1.3. Allocation of Risk to Participants

Identifying and isolating risk factors allows attention to be directed at reducing uncertainties and their potential cost impacts. Under a turnkey strategy, identifying risk categories also allows the costs to be allocated to participants in ways not possible under conventional procurement. The traditional patterns and some possible variations are shown in Table 8-3.

Participants are grouped into two categories. "Owner" includes the local transit agency, the transit operator, local governments, the FTA, state agencies, financial institutions serving government agencies, and taxpayers. "Turnkey Contractor" includes construction contractors, equipment vendors, other suppliers, private equity contributors, insurance providers, and financial institutions serving any of these. Risk can additionally be allocated among entities within these two categories, but the primary focus is risk allocation between public and private.

---

[1] This principle was applied very explicitly in the Honolulu turnkey effort; see Luglio, "Evaluation.." (1993).

Table 8-3.
Allocation of Risk to Participants

Risk	Owner	Contractor
1 Political	full	
2 Funding	full	may participate
3 Financing	full	may participate
4 Right-of-way	full	up to full
5 Speculative Effort	before RFP	before RFP
6 Bids exceed estimates	full	
7 Geotechnical	discretionary	discretionary
8 Hazardous materials	discretionary	discretionary
9 Underground utilities	discretionary	discretionary
10 Inflation	prior to award	after award
11 Federal, state, and local regulations	regulatory changes only	full compliance with existing regulations
12 Design and integration; coordination	traditional	turnkey
13 Changed requirements	full	
14 Construction performance	may share	full
15 Subsystem test		full
16 System integration test	identify subsystem defects	correct subsystem defects
17 Schedule	defined requirements	conditional performance
18 Construction safety		full
19 Site security		full
20 Act of god (force majeur)		full (insurance)
21 Failure to complete	may share	full (capped)
22 Seismic	apply standards	meet standards
23 Operating	Design-Build	Design-Build-Operate
24 Market (ridership or revenue)	Design-Build	Design-Build-Operate

The term "full" generally implies that all risk of the particular type is borne by that party, but some range of variation may be possible if indicated. Where allocation is "discretionary," a greater shifting to turnkey vendors is feasible.

8.1.4. Instruments for Managing Risk

The various mechanisms for minimizing and assigning risk, as shown in Table 8-4, are available under traditional procurement as well as turnkey. Under turnkey, however, a broader array of instruments is likely to be used, and with greater depth and refinement. Contract language needs to be more precise but less restrictive, for example. The items listed are meant to be distinct, but may overlap.

Types of risk and instruments for managing them do not match one-for-one, but they can be grouped into related categories. Table 8-5 shows 5 or 6 "problem categories" with instruments associated with risk types. "Political Assurance" lists ways of demonstrating a public commitment to a project, which reduce the political and funding uncertainties of going forward. "Margin of Safety" instruments provide a cushion to fall back on, and "Hedging" allows risky outcomes to be converted into known costs. Bonding, for example, is essentially and insurance premium for covering failure to complete.

The "Explication/Allocation" category are instruments that help clarify which party is bearing responsibility for each risk. "Contract Performance" instruments are aimed at oversight and communication so as to detect deviations early on and correct them, analogous to insurance. "Risk Minimization" instruments seek to reduce the cost of risk by separating and assigning risks, providing more complete or reliable information, or through incentives.

Most of these risk associations are only one of several possible applications of instruments to risks, and some instruments can address several types of risks at the same time.

8.2. EVALUATION

The costs of risk can be reduced by careful management in general, and, under turnkey, by assigning risk to those parties most capable of taking the appropriate steps to minimize risk costs.

Table 8-4
Instruments for Managing Risk

Abbr	Instrument	Description
FFGA	Full Funding Grant Agreement	Agreement between FTA and owner to provide a total amount of funding under given conditions.
ROD	Record of Decision	Letter of Intent from FTA indicating that the project is approved for federal funding.
LOC	Letter of Credit	Indication of willingness by lender to allow borrower to receive funds.
BdR	Board Resolution	Public commitment by local legislative body to provide funds or in-kind contributions.
ResF	Reserve Funds	Deposit of funds in a restricted account as evidence of ability to pay.
ConF	Contingency Funds	Set-aside of revenues beyond anticipated requirements to allow for unexpected needs.
DedT	Dedicated Taxes	Earmarked tax instruments of revenues as evidence of political funding commitment.
Bond	Bonding	Insurance (performance bond) required of contractor to ensure that resources are available to complete the project if the contractor should fail for some reason.
SubD	Subordinated Debt	Financial instrument whose claims for repayment are subordinate to (come after) other financial instruments.
Ins	Insurance	Means for pooling risks of a similar type among many entities.
FPC	Fixed Price Contract	Contractor is obligated to deliver specified product for a predetermined price.
Contr	Contract Agreements	Legally binding agreements among participating parties that specify actions that will occur under all contingencies.
Index	Cost Indexing	Unit prices or fixed prices are adjusted according to an agreed-upon price index.

Table 8-4
Instruments for Managing Risk
(cont'd)

Abbr	Instrument	Description
LCaps	Liability Caps	Specify the maximum amount a party can be held responsible for under stated conditions.
PPP	Public-Private Partnerships	Agreements among public agencies and private sector participants to share risks and responsibilities.
PMO	Project Management Oversight	Third-party overseer of project management to ensure proper controls.
PQual	Prequalification	Scrutiny of potential contractors' capabilities, previous performance, and experience to assess capacity and reliability.
CorG	Corporate Guarantees	Binding commitments from members of joint venture consortium.
RIsol	Risk Isolation	Identifying and fencing off (partitioning) selected risks (e.g., utilities) so as to remove uncertainty from other functions (e.g., construction).
Info	Information	Providing additional knowledge that reduces the degree of uncertainty (e.g., geotechnical)
Multi	Multiple Contracts	Breaking the project into subprojects, reducing the probability that a single failure will bring down the project.
Accom	Accommodation	Willingness to make appropriate accommodations within the scope of a contract so as to minimize unecessary costs
Rept	Schedule and Cost Control Reporting	Requirements to report milestones, measures taken to control costs, results, and other progress information.
Incen	Incentive Clauses	Schedule rewards and penalties, value engineering incentives, and other performance incentives.
QA/QC	QualityAssurance/Quality Control	Supervision, review, inspection, and testing to ensure that the final product meets specifications.

Table 8-5.
Instruments versus Risks

Problem Category	Instrument	Risk
Political Assurance	FFGA	Political
	Record of Decision	Funding
	Letter of Credit	Speculative Effort
	Board Resolution	
Margin of Safety	Reserve Funds	Financing
	Contingency Funds	Inflation
	Dedicated Taxes	Act of God
Hedging	Bonding	Seismic
	Insurance	Right-of-Way
	Multiple Contracts	Failure to Complete
	Indexing	
Explication/Allocation	Fixed Price Contract	Regulations
	Contract Agreements	Integration
	Liability Caps	Changed Requirements
	Public/Private Partnerships	Operating
	Subordinated Debt	Market
Contract Performance	Project Management Oversight	Construction Performance
	Prequalification	Subsystem, System Test
	Corporate Guarantees	Schedule
	Schedule/Cost Reporting	Construction Safety
	QA/QC	Site Security
Risk Minimization	Risk Isolation	Bid Exceeds Estimates
	Information	Geotechnical
	Accommodation	Hazardous Materials
	Incentive Clauses	Utilities

8.2.1. Impacts

Simply assigning risk to a turnkey vendor does not necessarily reduce risk. Apparent costs may increase because the contractor monetizes the cost of risk in the bid price, whereas the public sector made no specific allowance for the risk, in effect self-insuring.

To make valid comparisons between risk costs under turnkey versus risk under the traditional process, each particular risk type must be identified and quantified in dollar terms, for both alternatives.[2] If no shifting of risk occurs under turnkey relative to the traditional process, then there is no need to address it explicitly for benefit-cost purposes. Each category of risk that is shifted, however, must be analyzed separately from other types of risk.

Monetization of risk is the result of multiplying the probability of an undesirable occurrence times the cost of its occurrence, summed over all possible occurrences. This is the "expected value" of the risk. In part because the risk is uncertain to begin with, the possible events and their probabilities are not known. Judgment and experience are necessarily used, considering as many scenarios as feasible. There is no correct answer, because there is no way to know what the "true" probabilities are, but there is relevant actuarial history, which combined with expert judgment results in risk assessments that investors are willing to put their money into. Contractors are sensitive to the risks they face, and must incorporate its cost into their bids. What is necessary for evaluation purposes is construction of a suitable counterfactual: the expected value of the same risk under the traditional alternative.

8.2.2. Benefits

Benefits are the net reductions in the cost of risk resulting from the turnkey alternative relative to the base alternative, summed over all of the types of risk that are shifted as a result of using the turnkey strategy.

---

[2] The strategy recommended in the present report is to partition risk types and quantify each one using whatever empirical evidence can be obtained; an alternative "integrated" approach using Monte Carlo methods is suggested in Touran and Bolster (1994).

9. GENERIC TURNKEY STRATEGIES

There are many ways to design a turnkey acquisition, some constituting small departures from traditional practice and some being radically different. Strategies being explored in the demonstration projects are relatively conservative, perhaps in part due to the failure of previous efforts at more ambitious turnkey acquisition. That there may be a consensus-of-the-moment, however, should not be interpreted as representing the full range of options.

This chapter describes a broad array of turnkey alternatives, grouped into somewhat arbitrary "generic" categories. As abstracted in Figure 9-1, the characteristics of these generic types are arrayed along three dimensions -- one pertaining to the share of design work completed before initiating a turnkey procurement, a second pertaining to the functions (or phases) of project development that are covered, and the third pertaining to the breadth of physical components encompassed -- that portray the scope of contractor responsibility. The reality is that turnkey methods are almost infinitely varied in their combinations and permutations, and the dimensions of variation are no doubt more than three, but the nature of the possibilities can be illustrated via these generic alternatives.

9.1. SHARE OF DESIGN COMPLETED BEFORE TURNKEY

The most commonly used measure of the "type" of turnkey strategy being considered is the percentage of engineering design that is completed before awarding a turnkey contract. The less that is left to do, the lower the risk of unsatisfactory performance. At the extreme end, all design work is completed and the contractor begins construction, much the same as under traditional acquisition. Potential for turnkey benefits is correspondingly lower.

9.1.1. Technology Not Selected

At the low design-completed end of the spectrum, an owner can consider starting a turnkey process even before project planning is completed, with performance requirements and general alignment determined but hardware technology unspecified. The overall scope for the turnkey vendor would tend to be vary broad in such a case,

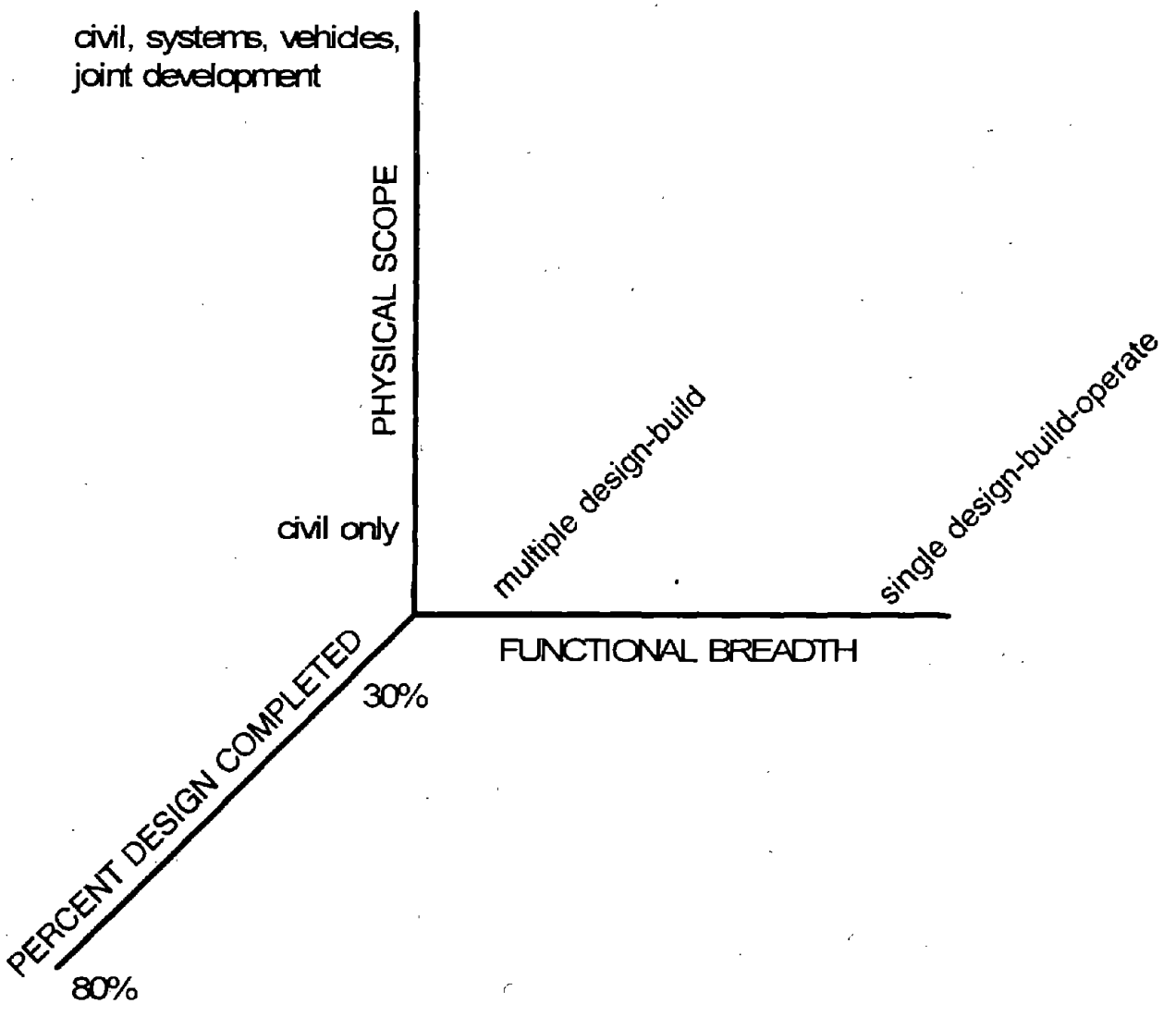


Figure 9-1. Three Primary Dimensions of Turnkey Scope.

allowing for proprietary technology, vehicle purchase, initial operations, and joint development as included within the turnkey procurement. Houston and Honolulu sought to initiate the turnkey process in advance of selecting a technology.[1]

9.1.2. Prescriptive Specifications

At the other end of the scale, the greater the detail in design, and the more the specifications are prescriptive rather than performance-oriented, the less a turnkey approach differs from the traditional approach. Once design has reached, say, 80% of final design, the opportunities for shortening the schedule by overlapping site work and final design largely disappear. A turnkey construction contract might involve somewhat less oversight and fewer change orders, but these benefits could also be achieved with traditional methods.

9.2. SPAN OF PROJECT DEVELOPMENT FUNCTIONS/PHASES

In addition to varying the amount of engineering design that is completed before beginning the turnkey process, the functional scope may also be varied. These will tend to be correlated, in that more design work done under turnkey implies more functional responsibility as well, but considering the two separately introduces some additional options (see Chapter 7 on Contracts for additional discussion).

9.2.1. Multiple Turnkey Contractors

If a project can be compartmentalized around civil or systems components, each of these may be acquired using turnkey methods. A rail line or extension can be broken into segments, or into track versus stations, or into facilities (civil) and controls (systems). The owner is then left with the management, scheduling, and integration of multiple prime contractors, as is typical under traditional acquisition.

9.2.2. Single Design-Build

The prototypical "turnkey" strategy is to specify a desired end state for a system, turn over the implementation of the product to a contractor, and take possession once the system is ready to operate. It is then up to the contractor to control costs, enforce specifications, and integrate tasks efficiently.

---

[1] Schneck and Laver (1994); Luglio (September 1993).

9.2.3. Design-Build-Operate

Contracts and management processes that span from initial design through initial operations are difficult because the period of time over which they must remain effective is relatively long, and hence critical factors are likely to change. Including operation and maintenance within the scope of the contract, however, creates incentives to design and build for operability, reliability, and maintainability.

9.3. PHYSICAL SCOPE

Civil construction projects, mainly fixed facilities, are probably the easiest types of projects to acquire using turnkey methods. Integrating electronic systems increases the challenge to the contractor, and including vehicles as well expands the possibilities for synergy but also the possibilities for failure. Adding real estate development creates another dimension for both achievements and problems.

9.3.1. Civil Construction Only

Turnkey has been most successful where the facilities are primarily civil construction projects, such as prisons and military buildings or engineering works.

9.3.2. Civil and Systems Combined

Adding electronic and computer systems increases the challenge and the breadth of skills required, but is readily feasible.

9.3.3. Civil Construction, Systems, and Vehicle Acquisition

Complete systems are offered by vendors of proprietary technology, and have some record of success. Complete integrated systems using non-proprietary technology are less common using turnkey procurement methods.

9.3.4. Complete Transit Systems Plus Joint Development

The greatest breadth of responsibility and skills required comes from combining complete systems with real estate development. Coordinating construction, vehicle acquisition, operational testing, and joint development is demanding because the communications are difficult as well as involving substantial risk in each of these activities individually.

Table 9-1 shows how several example and demonstration turnkey projects fit into two of the turnkey scope dimensions.

Table 9-1.
Physical Scope versus Functional Breadth

	Multiple Design-Build	Single Design-Build	Design-Build-Operate
Civil or Systems		Los Angeles	
Civil+Systems	BART[1]	Baltimore	
Civil+Systems Vehicles		San Juan	New Jersey
Civil+Systems Vehicle Joint Development			Honolulu Houston

[1] excluding utilities relocations and change orders

10. EVALUATION METHODOLOGY

This chapter continues and expands the conceptual framework for evaluation presented in Chapters 1 and 2, providing greater detail along with examples on identifying and quantifying benefits. The evaluation methodology is derived from benefit-cost analysis (BCA) principles, because benefit-cost is the generally accepted standard for comparing choices and expressing the consequences of one government action versus another. This approach requires constructing a base alternative against which to compare the turnkey variation, as elaborated below. Description of the methodology proceeds in four steps: (1) construction of the base and program alternatives, (2) estimation of the impacts of the turnkey alternative, (3) translation of the impacts into measures of net benefits, and (4) the role of qualitative descriptive narrative.

10.1. CONSTRUCTING THE ALTERNATIVES

The base alternative is the state of the world in the absence of the action being evaluated. This scenario is a constructed or "backcast" alternative, in the sense that it is a forecast of what would have happened at a particular agency if the turnkey option selected by that agency had not been chosen or implemented. In retrospective or "post hoc" evaluation -- such as turnkey evaluation -- this alternative scenario is often referred to as the counterfactual: a set of reference facts against which to compare an alternative set of facts.

10.1.1. Project, Policy, and Program Evaluation

BCA can be applied to many problems of public sector choice or evaluation. The primary categories are investment or project evaluation (whether the payoffs from an initial capital investment are sufficient to warrant the investment), policy or regulatory evaluation (which policy or regulation is preferred when all consequences are considered), and program evaluation (whether a government program has been or will be successful). In all of these cases, a common set of basic principles is drawn upon, such as the comparison of a base alternative to one or more other alternatives, estimation of the impacts attributable to the non-base alternative, discounting future costs and benefits, valuation in constant dollars, and evaluation based on the criterion of net benefits.

The differences among these types of analyses reflect the particular aspects of BCA that tend to be prominent in that type of analysis. Benefit-cost ratios, for example, are sometimes used for project evaluation to rank alternatives with respect to initial expenditures versus future payoffs. In program evaluation -- such as turnkey evaluation -- the emphasis is on separating out the impacts of the program from the many other factors that may have influenced the observed outcome.

10.1.2. Retrospective versus Prospective Benefit-Cost Analysis

One distinction that may help to clarify the methodological approach that is suitable for turnkey evaluation is to contrast prospective BCA with retrospective BCA, as diagrammed in Figure 10-1. Any of the three types of BCA problem can be done a priori (before the fact) or post hoc (after the fact), but project evaluation is typically prospective while program evaluation is typically retrospective.

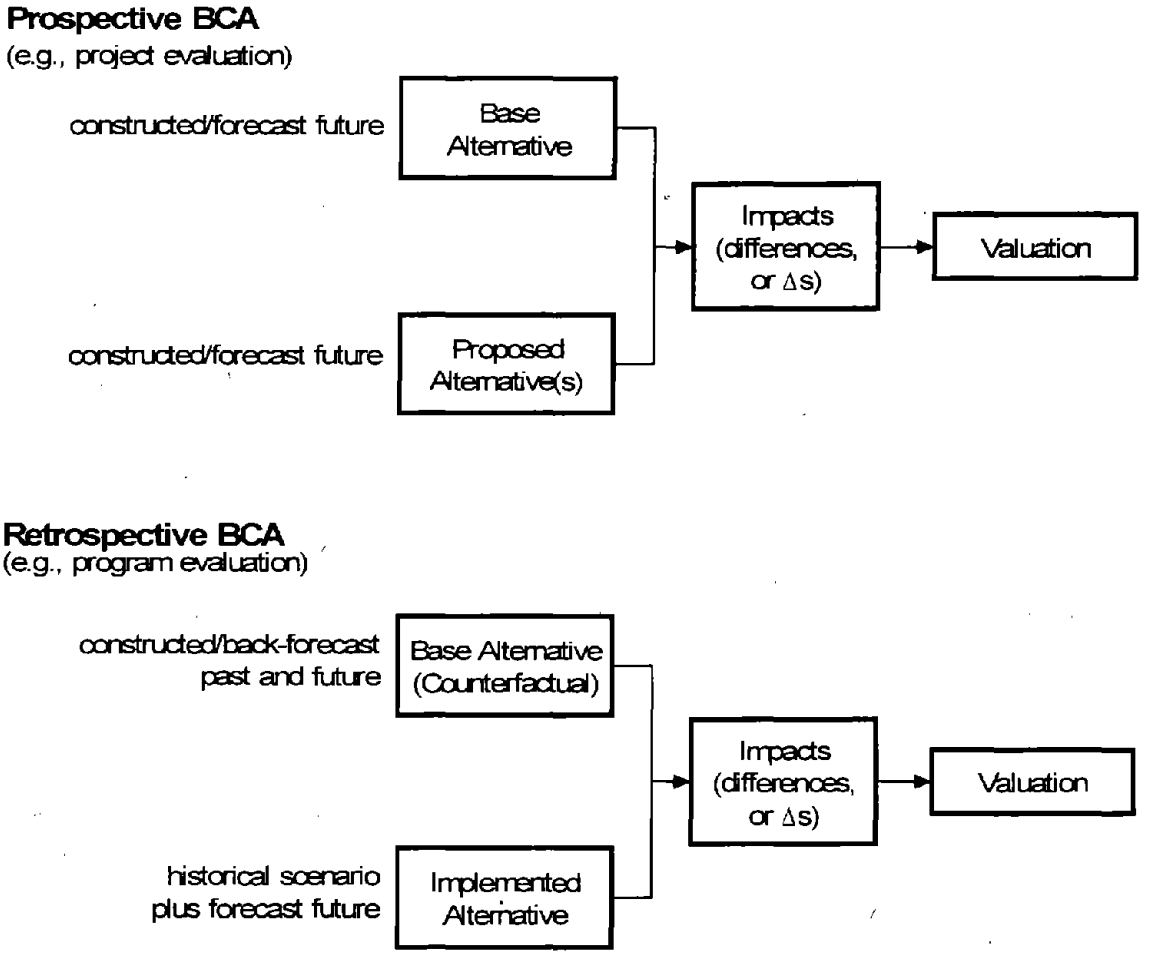
The main difference is that, in the retrospective case, the non-base alternative has been implemented and the results have, in part, already occurred. Although this history is, in principle, a set of facts, in practice what happened in the past is only slightly easier to guess than what will happen in the future. To reiterate, the major problem in turnkey evaluation is to separate the influences of the program (turnkey) from other influences that also had a hand in determining the actual outcome.

10.1.3. Experiments, Statistics, and Counterfactuals

Many methods have been developed for the purpose of attempting to quantify the impacts of a "treatment." To use the biological or medical metaphor, the objective is to measure the differences caused by a particular treatment relative to all other possible causes. Three methods sometimes applied to this problem are experimental design, multivariate statistics, and the constructed counterfactual; the last is most applicable to turnkey impact estimation.

The experimental design method consists of three components: a pre-test, to establish the conditions prior to the treatment; a post-test, to establish conditions after treatment; and a control group, to measure what would have happened without the treatment. For plant experiments, all known or suspected factors (e.g., temperature, light, moisture, soil acidity, nutrients) influencing the attributes of interest (growth rate, size of fruit) are controlled either by ensuring that all subjects receive the same amount or by administering controlled amounts. For medical experiments, only the general characteristics of the sample (e.g., women over 40) and the application of the treatment can be controlled; other factors are "controlled" statistically, by collecting data from each subject on all other potentially relevant factors.

Type of Benefit-Cost Analysis (BCA):



Base = most likely state of world without project, policy, program, or other action

Figure 10-1. Comparison of Prospective and Retrospective BCA.

Statistical methodology has been developed in the social sciences as a substitute for controlled experiments, because controlling the treatment (e.g., family structure, police, housing) is difficult or impossible and controlling other factors was always impossible. The statistical approach operates on the idea that "natural" experiments are occurring all the time; the real world normally contains enough variation among all variables of interest to be able to identify statistically the explanations for individual outcomes. Implementing this methodology thus depends on being able to get data from a sample that captures the various combinations and permutations of treatment in conjunction with other factors. Econometrics is the expression of this method in the field of economics.

Both of the above approaches assume that the experimental or statistical populations are large enough to permit the structural relationships of interest to rise above the "noise" of unwanted influences. For turnkey evaluation, obviously, the noise vastly overwhelms the sample size. Hundreds, if not thousands, of "independent" turnkey prototype trials would need to be conducted to even begin to establish a cause-and-effect pattern. Instead, it is necessary to construct, analytically, the non-treatment state of the world that cannot be physically or statistically controlled. The "do nothing" alternative (no turnkey) is a forecast/backcast of what would have happened without the treatment (turnkey). The techniques for constructing this counterfactual rely on knowledge-based heuristics rather than multiple replications of an experiment or pseudo-experiment.

10.1.4. Preliminary Functional Comparison

The first step is to sketch out the turnkey alternative, i.e., describe in block functional requirements form (the major headings underneath the functional requirements for each phase) the process that was actually followed or is planned for the turnkey project. Then, describe in similar terms the counterfactual, i.e., the process that would have been followed at the given site, using traditional procurement methods.

Schematically, these are two parallel paths through the functional requirements, laid out in an ordered sequence but with an undefined time scale. Figure 10-2 illustrates these two parallel paths for a project that deviates from traditional after preliminary engineering has been completed.

It is tempting to use the task list or work breakdown structure (WBS) for the turnkey project to represent the tasks that must be accomplished under each alternative. Care should be taken in doing this, however, because the WBS may be organized around inputs rather than functions, or it may be specific to the turnkey process. For example, the turnkey WBS may implicitly assume a lower level of redundancy than is required in the traditional procurement process. The result, for evaluation purposes, would be to incorrectly impute to the base alternative some attributes not normally present, thereby

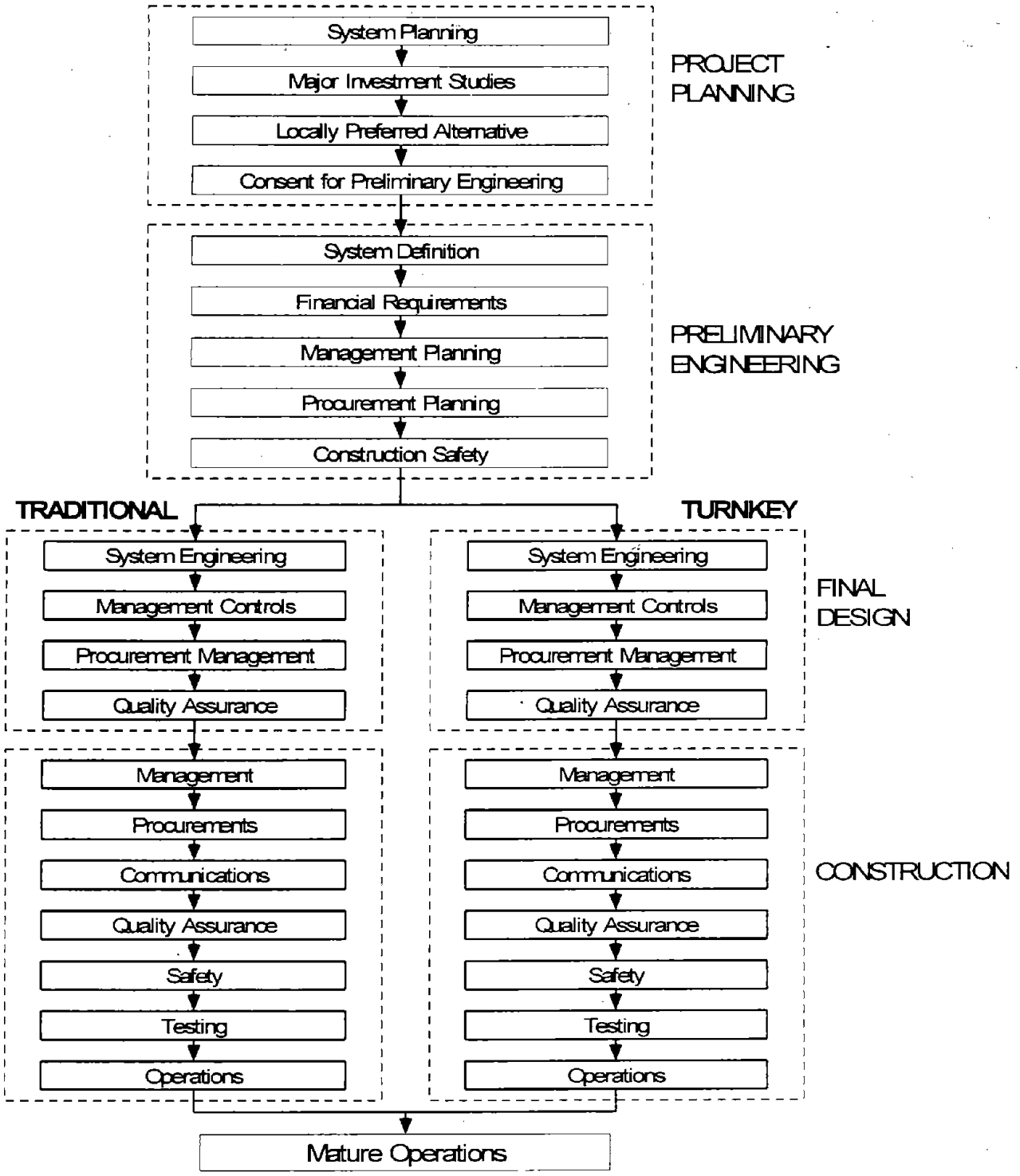


Figure 10-2. Preliminary Site-Specific Comparison of Traditional vs. Turnkey.

understating the true differences between turnkey and traditional.[1]

10.1.5. Focused Functional Comparison

For all parts of the process in which there is a difference between the traditional and turnkey processes, the differences should be elaborated at a level of detail represented by the second level of headings under functional requirements. Differences may not have been apparent at the previous (block) level (e.g., differences in the type of design work done in preliminary engineering), but should nonetheless be broken out at the detail level.

Description at the detail level should be in terms of inputs, processes, and outputs, focusing on the differences between traditional and turnkey. Where the paths of the two processes are identical -- after review of the detailed functional requirements as applied to the project -- no further elaboration is required. An important objective in this detailed functional analysis is to ensure that activities carried out differently in anticipation of turnkey are fully captured.

10.1.6. Identifying Comparable Projects

Many sources of data may be useful, in addition to the agency undertaking the present project, and different data sources may be useful for different aspects of comparison. Estimating risk experience, for example, calls for a relatively large number of cases, whereas contracting procedures are probably unique to the agency in question. Projects by the same agency, of the same type (light rail, underground, cut-and-cover, etc.), same political and economic environment, same geology, etc., are desirable input data. By and large, most of these conditions cannot be met for any project, so pieces or functional aspects of similar projects must be decomposed and incorporated in the counterfactual. A hierarchy of preference for traditional-method comparables might be something like the following:

- transit projects by the same agency
- building projects by the same agency
- transit or transportation projects by other agencies in the same region
- building projects by a public agency in the same region
- transit projects by public agencies in other regions
- transportation projects in the same region

---

[1] Booz-Allen & Hamilton (1996) warn of relying too heavily on the turnkey project to construct the "conventional project" alternative.

The ordering is likely to be different for each component. Judgmental tradeoffs must also be made between these preferences and both timeliness and quality of data available for the comparable. For example, BA has judged that office building construction projects in San Juan are a better source of information for San Juan transit construction than is, say, light rail in Sacramento.

10.1.7. Decomposition and Reassembly of the Counterfactual

To use data from a project other than the prototype turnkey project itself, the comparable project must be broken down into "components," consisting of one or more functional requirements in the project development process. These components can then be reassembled using parameters pertaining to the turnkey project. This decomposition and reassembly allows non-turnkey differences between the turnkey project and the comparable project to be controlled, while maintaining the traditional character of the base alternative.

For example, the Baltimore light rail extension has proceeded in two phases, one conventional and the second turnkey. Thus phase one provides a natural starting place for constructing the counterfactual: same agency, same type of construction, similar geology, close in time, and similar on other factors that tend to influence both projects in the same way.

Part of the strategy taken by BA[2] for cost estimation is to decompose the phase one into major categories, with quantities and unit costs. In simplified form,

$$\textit{Total Cost} = \textit{miles of track} \times \$\,\textit{per mile} + \textit{no. of stations} \times \$\,\textit{per station}$$

The base cost estimate for the phase two turnkey project uses the costs per track mile and per station from phase one, and the miles of track and number of stations from phase two. This is one way of constructing the counterfactual for the phase two project. The correct level of detail for decomposition depends upon the likely magnitude of the impact (turnkey versus traditional) and the number of factors influencing it. Descriptive variables other than cost can be treated in analogous ways.

---

[2] The Booz-Allen & Hamilton team headed by Don Schneck. They have prepared work plans for evaluating two projects: Baltimore's light rail extension, in Booz-Allen & Hamilton (1995); and San Juan's Tren Urbano, in Booz-Allen & Hamilton (1996). They refer to the counterfactual or base alternative variously as the baseline model, reference point, or conventional project for comparison.

10.1.8. Adjustments to Data on Similar Projects

After comparable projects are identified and descriptive data acquired describing them, some adjustments will inevitably be needed to place them in the context of the counterfactual. These adjustments include corrections for inflation, local differences in prices of inputs, differences in technical specifications between the comparable and the prototype project, differences in project size and contract scope, and differences in alignment and site characteristics. For example, unit costs taken from a comparable project that occurred several years prior to the turnkey project should be adjusted for inflation.

Figure 10-3 represents this process in a simplified form. Data on "similar" (for purposes of estimating the likely outcome of the base alternative) projects are collected, adjusted as necessary to make the non-turnkey projects as comparable as possible to the turnkey project (without turnkey), transforming them into the counterfactual.

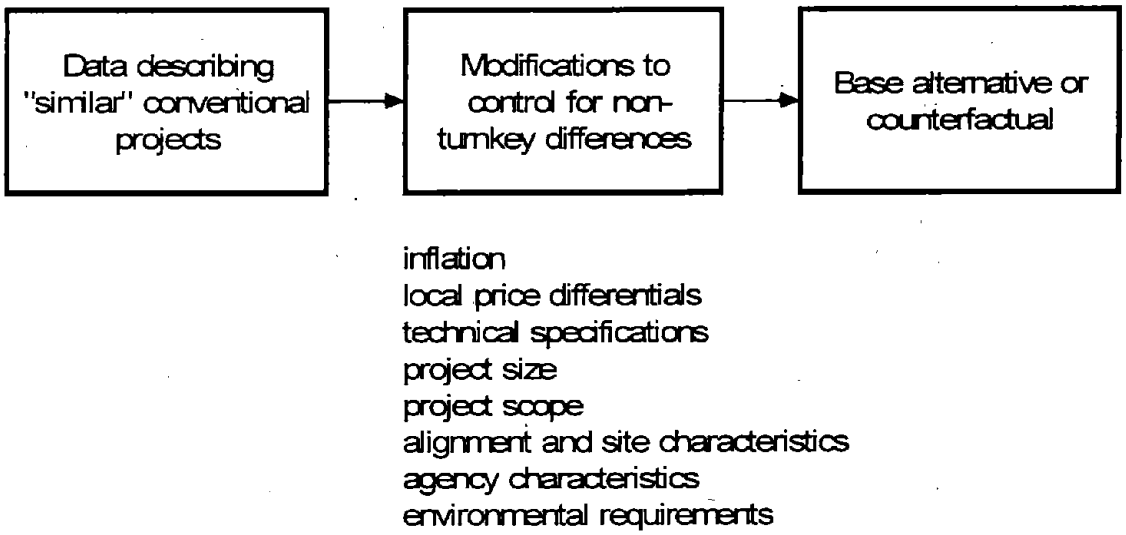


Figure 10-3. Using Data from Comparable Projects.

For example, it is necessary to compare the elapsed time and level of effort for contract preparation under turnkey and conventional procedures. For the base alternative, comparable conventional projects must be found with similar contract scopes, and perhaps decomposed additionally into in-house versus consultant legal and engineering services. Presumably, agency or public sector experience is essential for the former, whereas hired services are more universal.

10.2. IMPACTS

The impacts of turnkey procurement versus traditional methods are the differences in the states of the world between the way things would have been without the turnkey and the way things are with the turnkey. Measuring the impacts is accomplished by comparing the base alternative or without-scenario or counterfactual to the turnkey scenario. The differences -- or "deltas" -- can be described in narrative form, quantified in natural units such as size of staff, schedule days, number of change orders, or layers of management, and valued in dollars. To the extent that quantification or valuation are impossible, impacts may be left in descriptive narrative form.

10.2.1. Impacts Dependent on Local Conditions

The evaluation methodology should seek not only to measure differences between the prototype turnkey project and the associated conventional procurement, but also to identify causes for those differences or lack of difference. This concept is represented in Figure 10-4. For example, achieving cost savings from more efficient construction planning may depend upon having a stable and strong political commitment before the project is contracted; if political risk remains high, the turnkey contractor may not choose to make initial investments in knowledge and equipment that will reduce overall costs if the project is completed on schedule, but not if the work is terminated or modified in the middle.

10.2.2. Impacts Dependent on How Turnkey is Implemented

Another set of factors affecting the "success" of turnkey concerns the details of how it is implemented. Poor contract preparation or excessive oversight, for example, may nullify the savings that could have been achieved under turnkey, but were not in the particular instance. Establishing such cause-and-effect relationships requires that intermediate impacts and their linkages be documented as well as the final differences in outcome between turnkey and traditional procurement.

Thus any benefits associated with the turnkey procurement method must be closely tied to the necessary conditions for realizing the benefits.

10.2.3. Quantification of Impacts

For each functional process where differences occur between traditional and turnkey at the particular site, means need to be developed for quantifying the impacts. Quantitative measures can be derived from the qualitative description generated in the previous step.

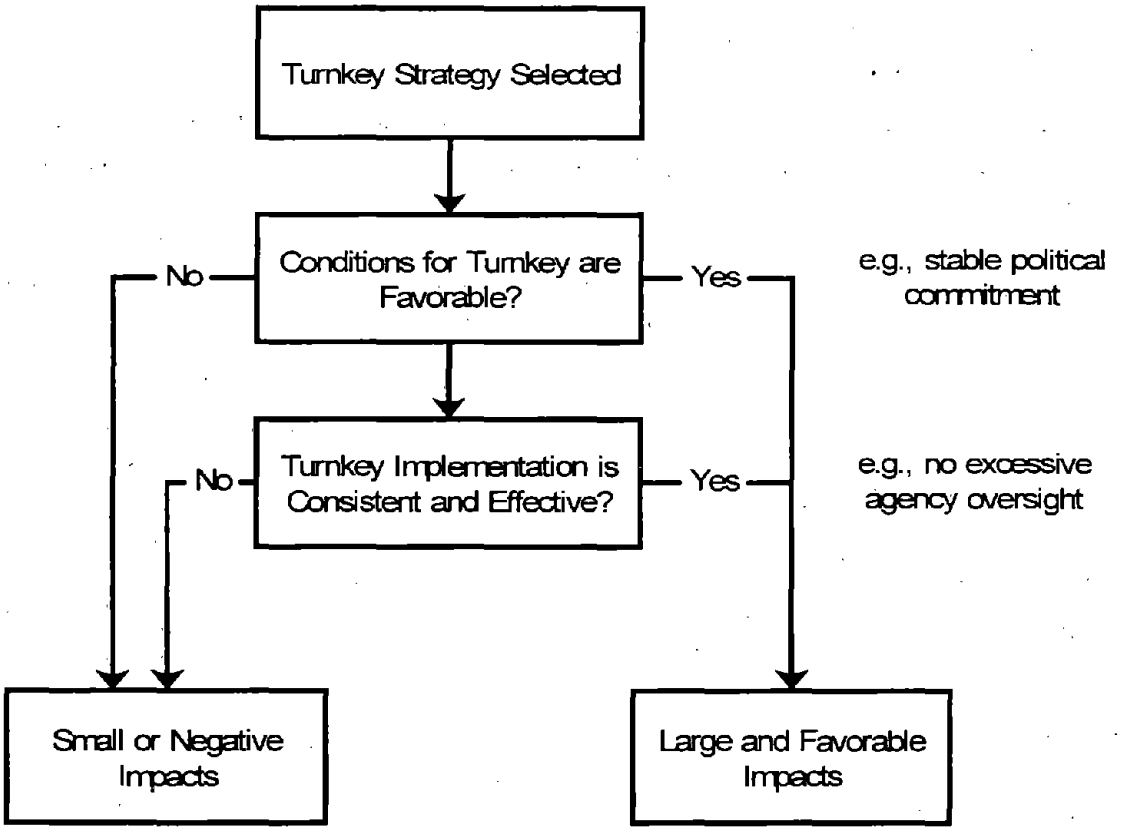


Figure 10-4. Conditions Affecting Turnkey Effectiveness.

Measures should be used that are appropriate for the function, such as level of effort, skill requirements, schedule, channels of communication, decision participants, assignment of risk, contracting methods, roles and responsibilities, etc.

10.3. TRANSFORMING IMPACTS INTO BENEFITS

The potential benefits of the turnkey procurement strategy are four:

(1) Reduced Costs
(2) Faster Completion
(3) Quality Improvements
(4) Non-Transportation Benefits

Most impacts should translate into cost and time savings, if, indeed, they are benefits. Improved risk management, for example, is a cost saving. The concept of turnkey procurement is to acquire the same product in less time at lower cost, so quality gains, while desirable and feasible, are incidental. Moreover, quality improvements should either translate into cost savings for the agency (the incremental cost of the improved product at traditional-method prices) or user benefits. Non-transportation benefits may be acknowledged (e.g., equity or economic development) but are likely to be zero or negligible. An outline of the BA approach from alternatives to benefits is shown in Figure 10-5 in diagram form.

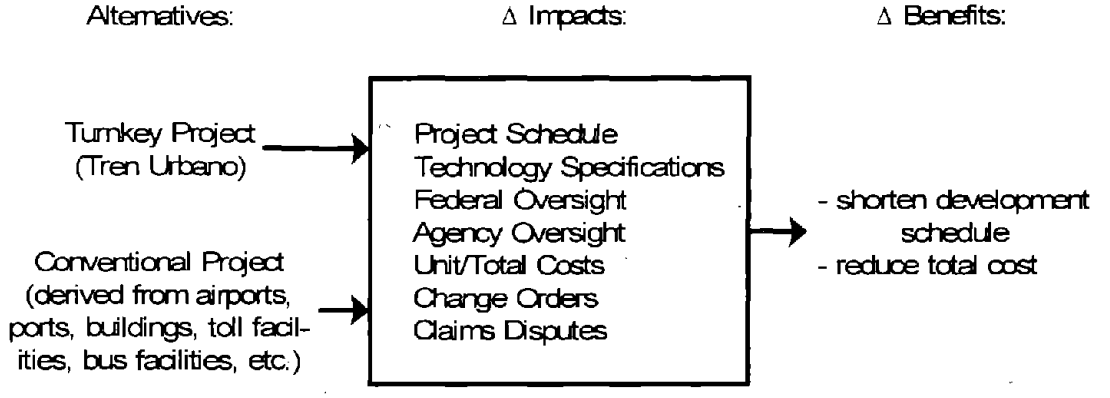


Figure 10-5. Simplified Schematic of Booz-Allen Evaluation Framework.

10.3.1. Impact Linkages

Impacts are the link between the action taken (turnkey) and the associated net benefits (cost savings, time savings, quality improvements). Several links may occur in the process, and various exogenous and instrumental variables may affect the magnitude of the impact. An example is shown in Figure 10-6. Some of the intermediate impacts are institutional, such as organizing to provide a single point of responsibility; these impacts do not constitute benefits per se, but such changes can be described and documented if they occur.

10.3.2. Quantification of Risk

Risk analysis is an especially difficult but critical part of measuring impacts and transforming them into benefits. All assignments of risk should be made explicit, as

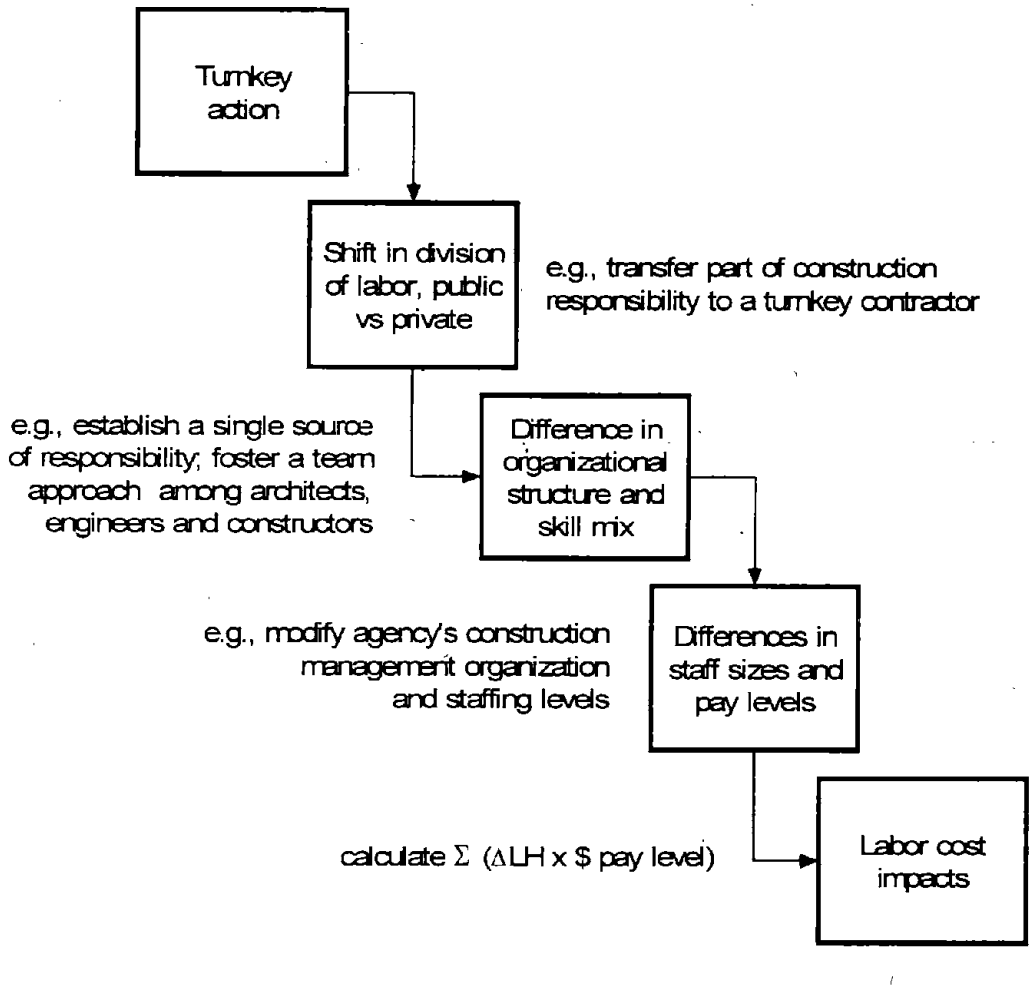


Figure 10-6. Linkages between Action and Benefits.

outlined in Chapter 8. Risk consists of two components: the likelihood of the risk or adverse consequences, and the cost of the consequences. Thus each risk has an expected value, which is generally different from what actually happens. Private vendors will incorporate risk estimates into their bid prices, whereas public agencies may understate or avoid explicit recognition of contingencies. It is the expected value of risk that is relevant, so probability estimates should be based on the actuarial history of comparable experience to the extent feasible.

Empirically, this means that a larger sample or base of similar projects is required to generate a good estimate of the risk rate; one or two examples is not sufficient. Comparable projects for the particular type of risk must be found, and the experience

pooled into an average rate. Insurers are in the business of judging risk, and they have an accumulated knowledge of various risks and their long run consequences.

10.3.3. Valuation of Benefits

Many techniques have been developed and applied for converting impacts into dollar and time equivalents. For turnkey purposes, these should be based primarily on revealed preference rather than stated preference (valuations that depend upon surveys or opinions).

To the extent that impacts can be stated in dollars (or time, which can be converted to dollars), the results can be added arithmetically to arrive at a summary estimate of net benefits (positive benefits minus disbenefits). Uncertain parameters of estimates can be varied within ranges that are thought to bound the uncertainty (e.g., risk rates, attributes of the counterfactual), to yield upper and lower bounds for the net benefit estimate.

10.3.4. Scoring and Weighting

Under no circumstances should impacts that have not been converted into dollar-valued estimates of benefits be added together, such as through scoring and weighting methods. Implicitly, weights on attributes constitute prices, but they are not made explicit as dollar valuations and are therefore ambiguous. Use of scoring and weighting methods permits subjective opinions to be injected inadvertently into an analytic process, creating an illusion of rigor when none may exist. If impacts of social value cannot be translated into explicit dollar valuations, they should be left in qualitative verbal terms or natural units.

10.4. QUALITATIVE ELABORATION

Where expected differences cannot be found in practice, or are different from anticipated, explanation can be provided in qualitative terms for what caused the lack of impact or unexpected impact. Verbal description is not an adequate substitute for quantitative analysis, and the effort to measure differences should not be abandoned without serious effort, especially when it seems clear that differences did occur as a result of the turnkey method. Moreover, narrative description that is not rigorously focused on impacts that lead to benefits (time and dollars) can easily fill many pages with no useful information.

It is necessary, nonetheless, to provide textual explanation of linkages and measured impacts that document the causes or at least the plausibility of the claimed impacts, or lack of them.

APPENDIX A:
RECENT EXPERIENCE WITH TURNKEY PROCUREMENT IN TRANSIT

APPENDIX A:
RECENT EXPERIENCE WITH TURNKEY PROCUREMENT IN TRANSIT

Prepared by: Richard J. Lobron, Lobron Consultancy, Limited

In recent years, extensive attention has been focused on the use of "turnkey" procurement strategies within the mass transit industry. The intent of such strategies is to create efficiencies in the management of major capital projects with attendant enhancements in the control of budget and scheduling factors related to the activity.

In a "turnkey" program, the public sector entity retains the services of a private sector contractor and transfers responsibility for the design and construction of a capital project to that entity. With such a transfer, an element of risk is created on both parties to the transaction: the public entity relinquishing a portion of its authority to approve each specific activity related to project, the contractor assuming various forms of business and operating risk which are generally avoided in a standard government contract arrangement. In some instances, the contractor further agrees to operate the newly developed assets for a period of time on behalf of the project sponsor.

A key ingredient required for achieving success in this form of project implementation is the element of trust. In transferring responsibility for aspects of design and construction management, the public entity must rely on the competence of the contractor. Conversely, by assuming significant business risks computed on stated project scope and treatments, the contractor must be certain that interference in the progress of the project will be minimized and that significant amendments to the project will not be initiated by the project sponsor. Due to the nature of a "turnkey" arrangement, all parties must trust their counterparties to act strictly in good faith in all facets of the transaction.

A-1. SURVEY OF PURCHASED TRANSPORTATION EXPERIENCE

While the use of "turnkey" practices for major system development purposes in transit is somewhat new, the use of such procurement methods has been applied by transit concerns for many years in smaller applications. Such transactions have involved the acquisition of vehicles and facilities as well as management oversight of transit activities under operating contracts.

This section identifies issues which have been faced by transit agencies in using turnkey strategies for purchased transportation. The lessons learned from the use of the method in the purchased transportation arena may be helpful in defining appropriate issues for review in assessing the success of the practice in larger turnkey system applications.

1.1. SUMMARY

1.1.1. Definition of "Turnkey"

Section 5326 of US Federal Transit Laws (codified) defines a "turnkey system project" as a project under which a recipient makes a contract with a seller, firm or consortium to construct a major mass transportation system that meets specific performance criteria. In some instances, the seller may operate the system for a period of time.

However, the phrase "turnkey" may also describe any activity through which the public sector entity transfers project responsibilities to a private sector entity for the design, construction, and manufacture of equipment, facilities and services. In some instances the asset is operated by the contractor, as well. In this sense, the transit industry has used this mechanism quite often in standard business operations.

1.1.2. Data Sources

The Federal Transit Administration Section 15 report for 1992 indicates that over 100 transit properties currently utilize some level of "purchased transportation" for the performance of fixed route motor bus service in their territories. In many cases, the purchaser of transportation service places responsibility for acquiring related vehicles and support facilities on the private contractor.

Twenty-four properties operating over 250 vehicles in maximum service use private contractors to provide fixed route service. The total transportation purchased by these large agencies amounts to over 1,100 motor buses in service.

A survey of transit properties using purchased transportation services was performed to explore the agencies' experiences under these arrangements. We contacted four of the operators whose purchased transportation volume encompassed over 40% of the total activity and interviewed senior transit management at the properties.

In addition, we contacted several smaller agencies which use purchased transportation to provide significant portions of their transportation activity. We also identified several major providers of such service and inquired into practices and problems faced in their involvement with the transit community.

The focus of our inquiries was related to practices and experiences associated with acquisition of the vehicles and facilities necessary to perform the service. In most instances the private contractor was responsible for providing the capital equipment and facilities for the service. This situation is most directly comparable to the projects under review in the Volpe Center's turnkey demonstration project.

1.1.3. Results of the Review

Unless otherwise noted, the comments presented reflect the responses received from both public sector transit agency sponsors and contractor representatives.

1.1.3.1. Agency Goals

The general consensus of those public transit agencies contacted in the survey was a very positive reaction to the effectiveness of the purchased transportation format of operation. The basic goal for entering into such arrangements was a perception that efficiencies in management and operating costs would be achieved, while maintaining service levels at pre-contracted points. This perception has proven accurate for the agencies surveyed, although in most cases quantification of savings was not available. In one example, a ten percent savings in operating costs has been experienced by the public sector sponsor within six months of contract initiation, while another property has experienced cost savings of approximately thirty percent.

The contractor respondents noted that additional goals stated by sponsors include desires to increase ridership and fare revenue. These goals are generally achieved.

1.1.3.2. Acquisition of Vehicles and Facilities

In most instances surveyed, the contractor is responsible for providing vehicles and support facilities associated with the transportation services. The vendor is given responsibility for the design, construction and operation of all necessary vehicles and support and maintenance facilities associated with the service. Public transit agencies contracting for the service do not involve themselves in the detailed level of design or construction activities as would be necessitated in cases in which the public entity retained responsibility. Occasionally, the public agency will define a broad definition of required vehicle fleet (e.g.- 40 foot buses), but the contractor is responsible for fulfilling this need. One respondent defines specifications related to passenger comfort, such as air conditioning, seats, and signage requirements.

In some cases, a design review occurs in vehicle acquisition activities, however, no involvement with facility development efforts is evident at any of the contacted properties.

1.1.3.3. Timeline for Implementation

The general time required between the issuance of requests for proposals and Board action selecting the contractor is generally 90-120 days. The time allowed between Board action and the implementation of service varies from 30 days to 180 days, based on the specific needs to acquire vehicles and facilities to perform the service. All transit respondents stated that the time requirements for implementing contracted service is significantly less than standard practice under internally directed programs.

Contractors noted that larger contracts requiring acquisition of large vehicle fleets may require up to twelve months for full implementation.

1.1.3.4. Operational Responsibilities

In every case surveyed, the transit agencies provide contractors with schedule requirements on a continuing basis. In most instances, public relations and customer communications are performed by the public agency, although complaints are sometimes referred to the contractor for resolution. All issues related to personnel, labor relations, tort liability, insurance and conformance to governmental regulations, such as ADA, Clean Air, and OSHA requirements are the responsibility of the contractor. All respondents believe that this transfer of responsibility was a key factor in the success of purchased transportation services.

1.1.3.5. Agency Control Over Contractor

Controls performed by transit agencies vary, however, all contacts noted that payment is based on conformance with pre-established performance indicators. On-time performance is a key factor in evaluating contractor success. The quality and care of vehicles is carefully noted. Other factors, such as comments or complaints from the public users of the service are also key considerations.

Most arrangements place the burden of cost control on the contractor through the use of fixed rate contracts, therefore the sponsor does not become involved or concerned with financial issues, except to the extent that financial conditions may adversely impact the quality, appearance and delivery of service.

Several respondents believe that it is essential that the financial health and long-term viability of prospective contractors be defined and confirmed prior to entry into contractual arrangements. Failure to confirm financial viability can lead to serious deterioration in service quality in the event that a contractor suffers financial stress. Sponsors generally assess contractor financial condition on a continuing basis, while also performing continuing quality checks on cleanliness, upkeep and operational quality of vehicles and facilities.

Schedule performance is monitored through agency personnel, such as project managers, street supervision and traffic checkers.

Controls over farebox revenue include reconciliation between deposits and farebox data, as well as trend analysis.

1.1.4. General Levels of Satisfaction

All sponsors noted cost savings achievements while maintaining or increasing service levels. Reduction in problems related to labor relations and increased control over driver hours and driver responsiveness to customer concerns were other benefits noted. Savings are generally achieved through enhanced efficiency in manpower scheduling and management.

Concerns Expressed - Each sponsor noted different concerns including:

- Less flexibility over vehicle use during non-peak hours, since the contractor may schedule equipment for use in other non-related service such as school bus activity.

- Financial instability of a contractor led to unreliable service due to labor and equipment problems.
- Some resistance by existing employees was experienced.
- Contractor ownership of the facility reduced the sponsor's options with regard to contracting with competing contractors.
- Continual review of comparative prices is required as contractor rates change. In some instances, the sponsor found that in-house rates became more competitive than contractor rates.
- Lack of clarity in contractor responsibilities prior to service implementation can create difficulties in interpretation of the contract.
- Contractor upkeep on vehicles leased from the sponsor agency is sometimes problematic.

The transit agencies expressed no concerns with the use of "turnkey" procurement methods in acquiring vehicles or facilities through use of the contractors. In fact, most agencies noted a significant improvement in efficiency of the procurements, as well as significant savings attained through the ability to benefit from such assets without developing internal expertise and management resources in construction or design.

An issue noted by contractors is the length of the service contract. In order to achieve the greatest cost efficiencies on a purchased service contract involving vehicle or facility acquisition by the contractor, the length of the arrangement should be established for a period of at least five years.

A three year contract with two one-year options would allow the contractor to amortize the capital investment necessary to obtain the equipment or facilities over a longer period of years. This condition reduces the impact on each particular year's operating budget. Of course, appropriate performance and termination conditions for non-performance would be understandably an important aspect of any such arrangement.

Contractor respondents also noted that any equipment or facility performance issues of particular concern to the contracting public agency should be clearly defined at the inception of the contract, rather than during the implementation phase of the contract. Conceptual changes or amendments to the proposed designs can cause unnecessary and costly delays not only in the asset acquisition phases of the contract, but implementation of the contracted fixed route service, as well.

1.1.5. Points To Consider in Turnkey Demonstration Projects

This review has identified certain areas of particular concern for entities involved in "turnkey" arrangements. It is recommended that the turnkey demonstration project management review include procedures to evaluate test site treatment of the following issues:

- Methods used to ensure the long-term financial viability of prospective contractors.
- Methods used to control the contractor's ongoing performance including site inspections, measurement of activity levels and conformance to schedule.
- Methods employed to transfer cost control issues to the contractor through use of fixed fee contracts and application of penalty and incentive clauses.
- Methods used to define contractor responsibilities clearly and completely prior to implementation of contract activities.
- Methods for assigning respective responsibility for liabilities and related costs of insurance.

1.1.6. Conclusions

The experiences of the surveyed public transit agencies in using private contractors to acquire vehicles and support facilities has been very positive. All respondents have been satisfied that vehicles and facilities provided by contractors have been appropriate to service the transit customers.

All respondents believe that the time required to complete the acquisitions through turnkey procurement was significantly less than would be experienced through normal procurement processes.

Most respondents maintain ongoing control over contractor activities through review of schedule conformance with on-site street supervision. Continuing review of financial conditions of the contractor and service activity, together with the presence of fixed fee and incentive / penalty clauses ensures contractor sensitivity to cost.

1.2. CAPITAL METROPOLITAN TRANSPORTATION AUTHORITY - AUSTIN, TEXAS

The Capital Metropolitan Transit Authority operates approximately 210 buses in fixed route service in the Austin area. Purchased transportation contracts are used to provide fixed route service through the use of 17 contractor provided mid-size vans as well as a separate shuttle service using 86 Authority owned buses.

1.2.1. Quality Controls

Among the controls established by Capital Metro to oversee the contracted operations are the following activities:

- Report formats include weekly and monthly reports related to on-time performance, accidents, complaints, maintenance, mileage, revenue, and late/missed trips.
- Liquidated damages are used to penalize the contractor for non-conformance with on-time performance standards. Rights of assurance are applied to problems related to maintenance or cleanliness issues.
- Capital Metro project management supervision and route checkers monitor reports and road performance on the contractor's service

1.2.2. Agency-Contractor Responsibilities

Some fixed route service contractors are required to provide vehicles for service. In those instances in which the contractor provides vehicles, the Authority established a design requirement for vehicles powered by Liquid Natural Gas. Other vehicle specifications defined by the Authority included

- new vehicles required at the commencement of the contract.
- radios provided by the Authority.
- seating capacities.
- signage and marking, as approved by the Authority.

All other vehicle design aspects were delegated to the contractor. The Contractor is fully responsible for procuring the equipment and placing it into service.

Support facilities and personnel are provided by the contractor. The Authority is not involved with facility issues, except for initial review at the time of proposal evaluations.

The contractor is solely responsible for all personnel actions, vehicle issues and other operating activities associated with servicing the defined fixed route service segments.

Contractor responsibilities in the acquisition of project vehicles or facilities include:

- adherence to applicable governmental regulations.
- planning and implementation of acquisition transactions involving vehicles or facilities.
- performance or delegation of design, engineering and construction aspects of vehicle or facility acquisition.
- quality assurance of vehicle or facility production.
- risk management, including provision of insurance.
- scheduling, management and budgeting of acquisition projects.
- contracts, safety issues, testing and operation of vehicles or facilities acquired for performance of fixed route service.

These conditions reflect the existence of a "turnkey" environment with regards to related capital acquisitions. The public agency defines the desired quality and quantity of service to the transit customers, while the details and process of acquiring the capital assets needed to provide the service are delegated to the expertise and experience of the private sector provider.

1.2.3. Difficulties Experienced

As noted, the service vehicles in some instances are owned by the contractor. The Authority lacks flexibility in assigning this equipment to alternative duty during non-peak service periods, since the contractor may have scheduled the vehicles for other uses.

This lack of control has been partially remedied through the Authority's direct acquisition of a large portion of the vehicles used in purchased transportation service. When service providers are retained, the Authority assigns the buses to the contractor, without losing control over the overall use of the vehicles.

1.2.4. Benefits Derived

The Authority has achieved cost savings and enhanced scheduling flexibility through use of the purchased transportation format. The acquisition process involved with obtaining the service vehicles and commencing service was also appreciably shorter than standard procedure.

1.3. COUNTY OF FAIRFAX, VIRGINIA

The Fairfax County Department of Transportation utilizes purchased transportation services to operate certain fixed route services in the County. These contracts comprise approximately 30% of transit activity in the County, with the remaining service provided by the Washington Metropolitan Area Transportation Authority. The county uses two forms of contracting arrangements, one in which the county provides capital assets for use by the contractor; the other in which the contractor must acquire vehicles and support facilities to service the contract.

1.3.1. Selection Process

County DOT management issues Requests for Proposals [RFP] to solicit responses from the service contractor community for a grouping of individual routes. The RFP presents clearly defined performance standards including the following elements:

- required service schedules.
- service standards to be provided by the successful contractor, addressing issues such as supervisory and dispatching responsibilities, training, driver performance, and complaint protocols.
- operator requirements, including drug and alcohol testing mandates, training, appearance, and general duties.
- equipment requirements.
- maintenance and vehicle cleanliness standards.
- insurance requirements.

1.3.2. Quality Controls

Among the controls established by Fairfax County to oversee the contracted operations are the following activities:

- Report formats and frequency are established, to include accident reports, run reporting, ridership statistics and supervisory reports.
- Farebox reconciliation procedures.
- County DOT retains the right to inspect any and all vehicles without prior notice.
- Penalty and incentive clauses are used to reward and penalize the contractor for handling of performance standards.
- DOT supervision and route checkers monitor reports and road performance for the contractor's service.

1.3.3. Agency-Contractor Responsibilities

In most instances, the county provides the service vehicles. Under those circumstances in which the contractor is required to provide vehicles for service, the County dictates certain service characteristics, such as:

- proper safety inspection
- age not to exceed *n* years
- radio equipped, as approved by the county
- seating capacities
- signage and marking, as approved by the county

The contractor proposes vehicle selections for the county's approval. The county retains the right to purchase the equipment in the event that the contractor is replaced in the future.

Support facilities are provided by the contractor. The contractor presents facility designs for the county's review. The county is not involved with facility construction issues.

The contractor is solely responsible for all personnel actions, vehicle issues and other operating activities associated with servicing the defined fixed route service segments. Contractor responsibilities on the capital acquisition aspects of the project include:

- adherence to applicable regulations.
- planning and implementation of acquisition transactions involving vehicles or facilities.

- performance or delegation of design, engineering and construction aspects of vehicle or facility acquisition.
- quality assurance of vehicle or facility.
- risk management, including provision of insurance.
- scheduling, management and budgeting of acquisitions.
- contracts, safety issues, testing and operation of vehicles or facilities acquired for performance of fixed route service.

These conditions reflect the existence of a "turnkey" environment with regards to certain capital acquisitions. Under one arrangement, the public agency defines the desired quality and quantity of service to the transit customers, while the details and process of acquiring the capital assets needed to provide the service are delegated to expertise and experience of the private sector provider.

1.3.4. Difficulties Experienced

Prior experiences of the county have involved unreliability of certain service contractors - a condition caused by the financial instability of the service provider. This dilemma can be avoided through thorough review of the contractor's financial condition prior to entering into the service contract.

1.3.5. Benefits Derived

The county has experienced substantive cost savings through the use of purchased transportation services. The county also enjoys enhanced flexibility in schedule enhancements and overall resource assignments. The pace at which vehicles and service facilities are placed into service is much quicker under the "turnkey" environment.

1.4. BEAVER COUNTY TRANSPORTATION AUTHORITY [BCTA] - ROCHESTER, PENNSYLVANIA

The BCTA has successfully used the services of purchased transportation contractors since its inception in 1980. The Authority relies on the contractor to provide transportation and maintenance services for all fixed route service in the Beaver County service territory.

The current fixed route fleet consists of 13 vehicles, all of which are owned by the Authority. The maintenance facilities are owned and operated by the contractor.

1.4.1. Quality Controls

Among the controls established by BCTA to oversee the contracted operations are the following activities:

- BCTA establishes all service schedules and handles customer relations issues.
- The contractor must produce reports consistent with formats and frequency which have been established by the Authority, including accident reports, run reporting, ridership statistics and supervisory reports.
- BCTA retains the right to inspect any and all vehicles without prior notice.
- BCTA supplies all fare collection equipment, and establishes an expected average daily revenue levels to be maintained by the Contractor.
- Liquidated damages are used to penalize the contractor for non-conformance to schedule, equipment performance or cleanliness standards.
- BCTA supervision and route checkers monitor reports and road performance for the contractor's service.
- BCTA reviews the safety record and overall quality of the driving records of each individual contracted driver.
- BCTA oversees contractor compliance with pre-established maintenance standards.
- BCTA reviews parts inventory records on a frequent basis.
- BCTA is undertaking a risk management audit to review safety conditions at the contractor's site.

1.4.2. Agency-Contractor Responsibilities

BCTA procures and supplies all vehicles to the contractor for service operations. Support facilities and personnel are provided by the contractor. BCTA is not involved with facility issues.

The contractor is solely responsible for all personnel actions, vehicle issues and other operating activities associated with servicing the defined fixed route service segments. Contractor responsibilities over the capital assets include:

- maintaining quality assurance of vehicles and the contractor's facility.
- contracts, safety issues, testing and operation of vehicles or facilities acquired for performance of fixed route service.

The use of "turnkey" procurement is not applied to vehicle procurements at BCTA. The Authority is currently exploring available methods of using "turnkey" mechanisms for acquiring or constructing a new maintenance facility.

1.4.3. Difficulties Experienced

The ownership of the facility by the contractor has created a condition in which the ability of BCTA to attract competitive operating contractors is hampered. The cost of erecting a facility to support a small fleet, without the ability to spread the capital cost over a larger volume of vehicle activity places potential competitors in an unfavorable position.

The Authority is considering actions to remedy this condition by soliciting private partners for the construction of a BCTA owned facility, which would be operated by contractors. In this manner, future proposals for transportation or maintenance can be priced without concern for capitalizing the assets.

1.4.4. Benefits Derived

All issues pertaining to the management of transportation and maintenance activities is delegated to the contractor. Flexibility in adjusting service schedules is achieved, as are operating expense and administrative cost savings.

1.5. PACE - SUBURBAN BUS DIVISION OF THE CHICAGO REGIONAL TRANSPORTATION AUTHORITY

The PACE system operates service throughout the suburban Chicago area using approximately 400 motor buses in fixed route service. Private operating contractors have been used on the PACE system successfully for many years and currently operate 200 buses in fixed route service.

1.5.1. Selection Process

PACE management issues Invitations For Bids [IFB] to solicit responses from the service contractor community for each individual route. The IFB presents clearly defined performance standards including the following elements:

- required service schedules.

- service standards to be provided by the successful contractor, addressing issues such as supervisory and dispatching responsibilities, training, driver performance, and complaint protocols.
- operator requirements, including drug and alcohol testing mandates, training, appearance, and general duties.
- equipment requirements.
- maintenance and vehicle cleanliness standards.
- insurance requirements.

1.5.2. Quality Controls

Among the controls established by PACE to oversee the contracted operations are the following activities:

- Report formats and frequency are established, to include accident reports, run reporting, ridership statistics and supervisory reports.
- PACE retains the right to inspect any and all vehicles without prior notice.
- PACE supplies all fare collection equipment, and establishes an expected average daily revenue levels to be maintained by the Contractor.
- Liquidated damages are used to penalize the contractor for non-conformance to schedule, equipment performance or cleanliness standards.
- PACE supervision and route checkers monitor reports and road performance for the contractor's service.

1.5.3. Agency-Contractor Responsibilities

PACE contractors generally are required to provide vehicles for service. PACE dictates only the following requirements:

- proper safety inspection.
- age not to exceed ten years.
- radio equipped, as approved by PACE.
- seating capacities.
- signage and marking, as approved by PACE.

Support facilities and personnel are provided by the contractor. PACE is not involved with facility issues.

The contractor is solely responsible for all personnel actions, vehicle issues and other operating activities associated with servicing the defined fixed route service segments. Contractor responsibilities on the capital acquisition aspects of the project include:

- adherence to applicable regulations.
- planning and implementation of acquisition transactions involving vehicles or facilities.
- performance or delegation of design, engineering and construction aspects of vehicle or facility acquisition.
- quality assurance of vehicle or facility.
- risk management, including provision of insurance.
- scheduling, management and budgeting of acquisitions.
- contracts, safety issues, testing and operation of vehicles or facilities acquired for performance of fixed route service.

These conditions reflect the existence of a "turnkey" environment with regards to related capital acquisitions. The public agency - PACE - defines the desired quality and quantity of service to the transit customers, while the details and process of acquiring the capital assets needed to provide the service are delegated to expertise and experience of the private sector provider.

1.5.4. Difficulties Experienced

A problem was experienced in a situation in which the contractor experienced financial difficulties, which resulted in a deterioration of service quality. Similar situations have been averted through a thorough review of the financial condition of proposers during the selection phase of the contract. In addition, PACE must continually monitor contractor market pricing levels to ensure that purchased service consistently provides cost-efficient provision of transit service.

1.5.5. Benefits Derived

PACE enjoys the use of vehicles and support facilities on a sizable portion of its fixed route service without the need to design, procure and monitor construction of the assets. Difficulties related to asset quality or applicability must be remedied by the contractor, without additional expense or disruption to PACE service.

1.6. REGIONAL TRANSPORTATION DISTRICT - DENVER, COLORADO

The Denver RTD operates approximately 25% of its fixed route service through the use of purchased transportation contracts. These arrangements involve the use of 144 buses, either owned by the contractor or leased by the contractor from the district. The District initially explored the use of purchased transportation services in the late 1980's in response to laws requiring privatization which were promulgated by the Colorado State Legislature.

1.6.1. Quality Controls

Among the controls which have been established by the RTD to oversee the contracted operations are the following activities:

- Report formats and frequency have been established, which include accident reports, run reporting, ridership statistics, supervisory and maintenance reports.
- RTD management retains responsibility for schedule development and public relations.
- Frequent quality control inspections of the fleet facility.
- Liquidated damages are used to encourage the contractor to conform to schedule, equipment performance or cleanliness standards.
- RTD project management supervision and route checkers monitor reports and road performance for the contractor's service.

1.6.2. Agency-Contractor Responsibilities

RTD contractors are not required to design vehicles for service. Instead, the District develops the vehicle specifications and then requires the contractor to acquire the equipment directly through purchase or to lease the buses from the District. The specific equipment acquisition requirements vary from contract to contract. The District retains the right to purchase any contractor owned equipment upon termination of the service contract.

Support facilities and personnel are provided by the contractor. The RTD has the right to inspect the facility designs but does not delay approvals. Otherwise, the RTD is not involved with facility issues.

The contractor is solely responsible for all personnel actions, vehicle maintenance issues and other operating activities associated with servicing the defined fixed route service segments.

Contractor responsibilities on the capital acquisition aspects of the project include:

- adherence to applicable regulations.
- planning and implementation of acquisition transactions involving vehicles.
- planning and implementation of acquisition transactions involving facilities.
- performance or delegation of design, engineering and construction aspects of facility acquisition.
- quality assurance of facility construction and vehicle manufacture.
- risk management, including provision of insurance.
- scheduling, management and budgeting of acquisitions.
- contracts, safety issues, testing and operation of facilities and vehicles acquired for performance of fixed route service.

These conditions reflect the existence of a "turnkey" environment with regards to those vehicles which are purchased directly by the contractors, to the extent that while design activities are performed by the District, the contractor manages and oversees the manufacturing phases of the acquisitions.

With regard to support facilities, a "turnkey" environment exists in that the District does not become involved with the facility design or construction, but defines the requisite service to be provided, leaving decisions of process to the contractor.

1.6.3. Difficulties Experienced

In the early phases of purchased transportation activities, the District experienced problems with the quality of maintenance on vehicles which affected the safety and reliability of the fleet. This situation was of particular concern with regards to vehicles leased from the District by contractors and then returned in disrepair at the conclusion of the contract period.

In order to avoid similar circumstances in the future, the District has implemented a strong focus on strict, continual quality control inspections and reviews, with requirements, controls and penalties clearly defined in contract documents. In addition,

contractors are encouraged to acquire the vehicles directly, with the District providing design and retaining the right to purchase the equipment at the end of the contract term.

1.6.4. Benefits Derived

Cost savings have been achieved through the use of contractors. In the acquisition of facilities, savings in cost and time have been experienced.

1.7. METRO-DADE TRANSIT AGENCY - MIAMI, FLORIDA

Metro-Dade Transit operates approximately 600 vehicles throughout the Miami metropolitan area. The Agency uses purchased contract arrangements to provide certain fixed route services through use of 21 vehicles.

1.7.1. Selection Process

Agency management issues Requests for Qualifications [RFQ] and selects four firms to bid on the defined work. The contract is awarded to the pre-qualified firm which submits the best price. Among the items included in the qualification and bidding process are the following:

- required service schedules.
- service standards to be provided by the successful contractor, addressing issues such as supervisory and dispatching responsibilities, training, driver performance, and complaint protocols.
- operator requirements, including drug and alcohol testing mandates, training, appearance, and general duties.
- equipment requirements.
- maintenance and vehicle cleanliness standards.
- insurance requirements to be provided by the contractor.

1.7.2. Quality Controls

Among the controls established by Metro-Dade Transit to oversee the contracted operations are the following activities:

- Report formats and frequency are established, to include accident reports, run reporting, ridership statistics and supervisory reports.

- Agency management retains the right to inspect any and all vehicles without prior notice and performs frequent safety and cleanliness checks on the vehicles and facilities.
- Liquidated damages are used to penalize the contractor for non-conformance to schedule, equipment performance or cleanliness standards.
- Agency supervision, service supervisors, safety inspectors and route checkers monitor reports and road performance on the contractor's service.

1.7.3. Agency-Contractor Responsibilities

The Metro-Dade service contractors generally are required to provide vehicles for service. The agency dictates only the customer comfort specifications such as the following requirements:

- air conditioner capacity.
- proper safety inspection and strict conformance to system safety standards.
- radio equipped, as approved by the agency.
- seating capacities and seat types.
- signage and marking, as approved by the agency.

In earlier contracts, the age of the vehicles was not restricted, however, recent contracts require the contractor to provide new vehicles. Recognizing the financial impact of new vehicle cost on the contractor's position, the Agency provides methods to protect the contractor's position in the event that the contract is terminated after the initial three year period. Through use of pre-defined equipment cost amortization schedules, funded through the contract period or through agreements to purchase the vehicles at contract termination, Metro-Dade assists the contractor in managing the financial burden of providing high quality vehicles for the agency's customers.

The agency does not become involved with other design or manufacturing concerns on the vehicles. Support facilities and personnel are provided by the contractor. The agency is not involved with facility issues. The contractor currently leases the maintenance facilities.

The contractor is solely responsible for all personnel actions, vehicle issues and other operating activities associated with servicing the defined fixed route service segments. Contractor responsibilities on the capital acquisition aspects of the project include:

- adherence to applicable regulations.

- planning and implementation of acquisition transactions involving vehicles or facilities.
- performance or delegation of design, engineering and construction aspects of vehicle or facility acquisition.
- quality assurance of vehicle or facility.
- risk management, including provision of insurance.
- scheduling, management and budgeting of acquisitions.
- contracts, safety issues, testing and operation of vehicles or facilities acquired for performance of fixed route service.

These conditions reflect the existence of a "turnkey" environment with regards to related capital acquisitions. The public agency defines the desired quality and quantity of service to the transit customers, while the details and process of acquiring the capital assets needed to provide the service are delegated to the expertise and experience of the private sector provider.

1.7.4. Difficulties Experienced

In the latter years of service contracts, the absence of clearly defined maintenance standards can cause an environment in which the quality and reliability of service vehicles can become problematic. Through a clear definition of equipment standards, together with appropriate penalty or incentive clauses, defined at the commencement of the contract, public agencies can avoid this situation.

1.7.5. Benefits Derived

Metro-Dade Transit has experienced significant operating cost savings through the use of purchased transportation services. The agency also enjoys greater flexibility in scheduling and service enhancement activities as a result of its use of purchased transportation. The period necessary to acquire vehicles and facilities to support the contract services is somewhat less than experienced under standard conditions.

1.8. METROPOLITAN TRANSIT AUTHORITY OF HARRIS COUNTY - HOUSTON, TEXAS

The Harris County MTA [METRO] operates approximately 12% of its fixed route service through the use of purchased transportation contracts. These arrangements involve the use of 94 buses, owned by the Authority.

1.8.1. Quality Controls

Among the controls which have been established by METRO to oversee the contracted operations are the following activities:

- Reports from the contractor to METRO include accident reports, run reporting, ridership statistics and supervisory reports in formats and frequency defined by the Authority.
- Authority management retains responsibility for schedule development and public relations.
- METRO performs frequent maintenance quality control inspections of the fleet.
- An Authority project administrator oversees compliance to contract terms and report presentation requirements. Authority operation street supervisors monitor road performance.

1.8.2. Agency-Contractor Responsibilities

The Authority specifies and procures all vehicles. The contractor chooses, acquires and maintains the support facilities, which are reviewed for acceptability by the Authority. Other than the initial inspection, the Authority is not involved with facility issues.

The contractor is solely responsible for all personnel actions, vehicle maintenance issues and other operating activities associated with servicing the defined fixed route service segments.

Contractor responsibilities on the capital acquisition aspects of the project include:

- adherence to applicable regulations.
- planning and implementation of acquisition transactions involving facilities.
- performance or delegation of design, engineering and construction aspects of facility acquisition.
- quality assurance of facility construction.
- risk management, including provision of insurance.
- scheduling, management and budgeting of acquisitions.
- contracts, safety issues, testing and operation of facilities acquired for performance of fixed route service.

Turnkey procurement mechanisms are not applicable to vehicle acquisition at this property, in that the Authority specifies and procures the equipment.

With regard to support facilities, a "turnkey" environment exists in that the Authority does not become involved with the facility design or construction, but defines the requisite service to be provided, leaving decisions of process to the contractor. The Authority retains the right to inspect the facility to ensure its appropriateness for Authority related activities.

1.8.3. Difficulties Experienced

Contractor business failures have created past difficulties in the quality and reliability of service. Careful evaluation of the contractor's financial viability prior to contract award can alleviate this problem.

In allowing the contractor to own the facilities, continual rental or facility repair costs have been included in contract pricing. This situation can be controlled either by setting facility costs in the contract terms or renting Authority owned facilities to the contractor for use in the contract.

1.8.4. Benefits Derived

Lower operating costs have been experienced through use of the purchased transportation format. Costs are continually evaluated to ensure that the Authority can not provide the service at a lower cost. In addition, the system has provided improved flexibility in scheduling service adjustments on the contracted routes.

In the acquisition of necessary support facilities, savings in cost and time have been experienced.

A-2. THE SEPTA / BOMBARDIER "TURNKEY" PROCUREMENT

In cases where such understandings can be developed at the outset, "turnkey" procurement mechanisms can be very effective. A prime example of the successful implementation of such a strategy occurred in the late 1980's at the Southeastern Pennsylvania Transportation Authority (SEPTA), the mass transit operator in the Philadelphia, Pennsylvania region.

In 1984, SEPTA assumed the operation of an aged regional rail system from the Consolidated Rail Corporation. The system had existed since the early 1800's under the ownership of the Pennsylvania and Reading Railroads. The network is comprised of eight commuter rail lines serving the City of Philadelphia and the four counties of southeastern Pennsylvania. In 1986, the SEPTA commuter rail fleet consisted of 336 vehicles ranging in age from ten to fifty-five years. The vehicles were maintained at two facilities, each of which were approaching 100 years of service. For a variety of factors related to an expanding ridership base and ongoing equipment maintenance scheduling needs, the Authority embarked on an attempt to acquire rail vehicles and support facilities. Due to timing issues associated with operating and financial concerns, the Authority chose to implement a "turnkey" procurement process for the acquisition.

2.1. THE PROCUREMENT

In August 1986, SEPTA issued a Request For Proposal (RFP) which solicited proposals for "...electrically propelled rolling stock, associated maintenance, and a maintenance facility..." Proposers were requested to submit proposals for rail vehicles sufficient to operate seven five-car trainsets on the SEPTA Regional Rail network. The RFP stated that the technology of the equipment submission could be either electric self-propelled (MU) or electric push-pull vehicles with locomotion.

The RFP also required that the proposers submit responses which addressed the design and construction of appropriate facilities to maintain and to store the vehicles. An additional feature of the solicitation required that proposals assume responsibility for the performance of all maintenance on the equipment and the facility for a period of at least five years following delivery, including the acquisition of necessary support staff and supplies.

The RFP included no detailed designs of equipment, facilities or maintenance requirements, other than generic requirements such as the fleet size and standards. The Authority mandated that the proposed equipment should be of a design existing in service elsewhere in the United States.

Submissions were received from several manufacturers of rail vehicles within the four week period allotted for responses. The submission provided by Bombardier, Inc. of Canada and Barre, Vermont was deemed the most responsive, responsible proposal received by the Authority. In November 1986, less than three months following the initial distribution of the RFP, the SEPTA Board awarded the contract to Bombardier, Inc.

2.2. PROJECT MANAGEMENT

In order to fully achieve the efficiencies available from the "turnkey" mechanism, SEPTA management retained the services of an independent consultant, experienced in the factors associated with the vehicle maintenance and transportation aspects of passenger rail operations. The consultant was assigned full responsibility to serve as the Authority's sole representative to the turnkey contractor. The consultant's role was to interact directly with affected parties within the SEPTA organization, such as rail, operational and maintenance departments, as well as senior management in order to

SEPTA / BOMBARDIER "TURNKEY" PROJECT TRANSACTION SCHEDULE	
RFP issued	August 6, 1986
Board Approval & Preliminary Agreement signed	November 3, 1986
Vehicle Manufacturing Commenced	Spring 1987
Facility Design commenced	April 1987
Construction Contract Signed	July 1987
Revenue Service Start-up	November & December 1987
Maintenance Operations commenced	December 1987
Facility Construction commenced	Spring 1988
Facility Move-in & Operation	November & December 1988

define the specific needs, requirements and concerns of the Authority. This information was then communicated to the turnkey contractor through the consultant.

All correspondence and operational decisions related to the design and construction of the vehicles and facility as well as the formation of a ongoing maintenance program were coordinated by the consultant. In this fashion, the Authority avoided internal bureaucracies normally associated with a project of this magnitude.

The Authority also assigned a senior manager to coordinate all financial and administrative aspects of the transaction. In conjunction with the independent consultant and the Authority's legal counsel and procurement personnel, this individual was responsible for negotiating the substantive agreement documentation between the Authority and the contractor. The coordinator also developed, negotiated and implemented all financial transactions related to the acquisition.

2.3. EQUIPMENT

The equipment acquired through this transaction included a fleet of 35 push-pull coaches manufactured by the turnkey contractor, Bombardier Inc. The cars were similar in design to vehicles used at other commuter rail services in New Jersey, Boston and New York. Alterations to designs recommended by the turnkey contractor were generally accepted, with minor alterations related to the specific operating conditions existing on the Authority's railroad. The manufacturer/contractor and its subcontractors assumed most liabilities associated with the design and construction of the equipment.

Since the RFP required that the equipment be manufactured under existing designs, the transaction allowed the manufacturer to merely continue an ongoing assembly line which was producing vehicles for another agency. This situation created an exceptional delivery schedule, with the vehicles procured through this transaction being placed in revenue service by November/ December 1987, less than 12 months following Board approval of the transaction.

The procurement also included the acquisition of seven AEM-7 electric locomotives manufactured by ABB Asea and assembled by the General Motors Electro-Motive Division. These units, which were also in service on Amtrak's Northeast Corridor service as well as in other locations, were constructed by GM-EMD under contract with Bombardier, Inc. All management of the locomotive production was coordinated through the turnkey contractor, with advice from SEPTA's independent project consultant.

In addition to designing and manufacturing the equipment, the turnkey contractor defined the necessary spare parts required to support the fleet of vehicles, within a budget pre-established by SEPTA in the context of the procurement award.

2.4. FACILITY

Under the terms of the turnkey agreements, Bombardier agreed to design and construct a maintenance facility for support of the push-pull fleet on land owned by SEPTA. The facility included a shop building, a receiving/dispatching yard as well as a train crew building and a detached railcar washer. The price for the facility was established under the terms of the initial agreements, although both parties acknowledged that the exact terms and conditions for the construction aspect of the project could not be firmly established until design had been completed and final subcontractor offers had been received.

The concept design for the facility reflected the joint efforts of SEPTA and Bombardier and became the basis for design development of the final facility configuration. The facility was intended, at a minimum, to service, inspect and maintain the acquired push-pull cars and locomotives. In order to maximize project speed, "pre-engineered" facility technology was applied in the creation of the facility. The entire complex was designed for ready expansion of both the yard and the shop. The contractor and its subcontractors assumed most liabilities associated with the design and construction of the facility.

Bombardier initiated design activities on the facility before a specific agreement of duties and responsibilities had been executed between the parties. This element of trust between SEPTA and the contractor was evident throughout the course of the project and was greatly responsible for achieving the full level of benefits available through the turnkey mechanism.

Early in the procurement process, the Authority initiated steps to acquire a thirty-seven (37) acre site in Frazer, Pennsylvania. The location, which was surrounded by rail lines owned by AMTRAK and CONRAIL, was situated along the route used by SEPTA's heaviest traveled commuter line. Throughout the design phase of the project, issues related to permits, utility easements and other such matters were generally handled by the Authority's real estate department, with technical support provided by the turnkey contractor.

In order to perform the design engineering aspect of the facility project, Bombardier retained the services of an architectural - engineering firm holding experience in rail

facilities. All communications and decisions related to the design of the facility were coordinated by the turnkey contractor, with advice from SEPTA's independent consultant. The design was tailored to meet the specific needs of the vehicles to be serviced, as recommended by the manufacturer. Subsequent to the facility design phase, the turnkey contractor engaged the services of all necessary subcontractors to manage and implement the construction phase of the project. While SEPTA's independent consultant and operating personnel were advised as to the ongoing progress of the construction, all daily issues and decisions were provided by the Bombardier project manager on site. Construction of the facility commenced in April 1988, with completion by October of the same year.

The completed facility included approximately 50,000 square feet of service, inspection and maintenance space, as well as 10,000 square feet of administrative, storeroom, welfare and toolroom space. Two shop tracks were designed to service intact train sets for efficient production oriented maintenance and cleaning work on both cars and locomotives. Pits and floor spots were also provided in the facility for locomotive inspections and major repair activities. In addition, all necessary equipment and support requirements were installed and in-service at the facility's opening in November 1988. The specialized maintenance equipment included a TWD 60 ton radial controlled overhead traveling crane, 2 split rail tables and one drop table. The turnkey contractor also constructed the dispatching yard which contains 2.1 miles of track and catenary, 10 turnouts, connections to the AMTRAK mainline to Harrisburg as well as supporting lighting, fencing and road systems.

2.5. MAINTENANCE OPERATIONS

In its proposal to SEPTA, Bombardier agreed to provide a complete equipment warranty and service arrangement over the first five years of operation. The contractor offered to maintain the entire fleet of newly acquired cars and locomotives as well as the support facility according to a pre-agreed schedule of activities. The contractor agreed to be responsible for hiring and instructing all maintenance and administrative personnel as well as for acquiring and maintaining all necessary maintenance and administrative equipment and supplies, including tools, computers, office furniture and stationery.

The schedule of events associated with the construction of the vehicles and the facility necessitated a period of almost twelve months in which no vehicle storage or maintenance facilities were available to SEPTA. Accordingly, the contractor and SEPTA arranged temporary usage of an AMTRAK car shop yard in Philadelphia. The contractor provided all servicing of the fleet in revenue operation during the initial year of service. The contractor provided all servicing of the fleet in revenue operation during

the initial year of service, despite the absence of a completed formal agreement on the maintenance activities.

The maintenance operation aspect of the turnkey arrangement produced the largest levels of conflict between the parties. Despite frequent differences between SEPTA and the contractor, however, the benefits associated with turnkey programming were achieved through continued good faith efforts on both sides of the transactions. The execution of the maintenance contract was delayed due to concerns related to liability indemnifications and cost control mechanisms within the arrangement, for which the primary risks were assumed by the contractor.

Eventually, the necessary agreements were executed and maintenance operations moved into the new facilities at Frazer, PA. with a complete complement of staff and equipment provided by the contractor. The maintenance efforts included the performance of predictable activities such as daily inspection and cleaning during the night hours. Other activities, such as locomotive inspections were carried out on day shift. Progressive coach maintenance and progressive extraordinary cleaning was carried out on evening shift in order to minimize equipment downtime.

The arrangements required that the contractor provide a specified consist for revenue service by 6:30 AM each weekday morning, with the proviso that SEPTA operators return the equipment to the receiving yard by 9:00 P.M. the previous night. All responsibility for car movements and inspections within the yard boundaries were placed with the Contractor. Each morning a SEPTA car inspector reviewed the fleet prior to releasing the cars for revenue service.

Payments for the maintenance service provided for a capped "Management Fee" which encompassed all direct expenses and overhead costs associated with managing the program, as well as a 10% administrative fee. Additional terms provided for reimbursement of extraordinary costs. During the term of the maintenance arrangement, Bombardier provided SEPTA with an equipment availability on-time performance of 99.23%.

2.6. FINANCING

The total value of the equipment and facility was approximately $85 million. The transaction was completely financed through a series of leasing transactions designed and negotiated by SEPTA directly with international financial institutions. No federal or local capital grants were involved with the project. Accordingly, SEPTA was reliant on the successful consummation of private financing for payment of the equipment and the

facility. Financing documentation between SEPTA and the financial institutions was not completed until almost the date of delivery for the equipment and the facility. Accordingly, the manufacturer/contractor was placed in a position in which much of the equipment and facility was designed and constructed without complete certainty of SEPTA's ability to pay for the products. However, the overriding assumption that both parties were striving to achieve the transaction in "good faith" caused Bombardier to proceed despite this level of uncertainty.

The executed financial arrangements for the equipment were developed as "true" operating leases as defined in FASB 13 and applicable tax codes. Such methodology enabled the Authority to use operating funds in meeting rental payments as required under funding agreements at the time. Furthermore, pricing on the leases took advantage of accelerated depreciation permitted under the "safe harbor" provisions of the tax code which existed at the time. The facility costs were financed through a "municipal" lease through which tax-exempt rates were applied. Overall, the transaction financing allowed the Authority to acquire the vehicles and facility at a level of cost equal to approximately 75% of the present value of the assets. The costs of maintenance operations under the turnkey mechanism were charged as a period expense in the years of the arrangement.

2.7. CONCLUSIONS

The SEPTA/Bombardier rail transaction can serve as an example of the issues surrounding the application of "turnkey" procurement structures in a transit environment. The acceleration of project implementation and completion was the prime benefit derived through the shifting of responsibility and risk from the public sector to the private sector. Much of this achievement was accomplished through the internal coordination of communications between the Authority and the manufacturer/contractor. Furthermore, the mutual understandings of continuing "good faith" efforts allowed the transaction to continue forward momentum, sometimes in the absence of specific legal documentation of responsibilities.

It should be noted that many of the decisions allowed within this particular example were available due to the absence of direct federal grant funding for the procurement. However, even in applications involving federal funding, many aspects of this transaction can be considered in developing a framework for success.

VOLPE TURNKEY DEMONSTRATION PROJECT
QUESTIONNAIRE Re: EXPERIENCE IN PURCHASED TRANSPORTATION ACTIVITIES

QUESTION	*Austin*	*Fairfax*	*Beaver County*	*PACE*	*Denver*	*Metro-Dade*	*Houston*
In-house Motor Bus Fleet	210	75	23	400	508	505	925
Purchased Transportation Motor Bus Fleet	84	75	23	208	144	21	94
System's goal in using purchased transport	cost savings	reduce unit cost paid by county	historic method of service; competitively priced service delivery, while maintaining quality	reduce costs while keeping service levels	legislative mandate	legislative mandate	Achieve cost savings
Problems encountered	lack flexibility in using vehicles during non-peak service if contractor owns vehicles	Unreliability of contractors due to financial instability; Resistance by existing employees	lack of options with vendor ownership of facility	pricing has changed over time	contractor upkeep of leased equip; reduced vehicle scheduling flexibility	contractor upkeep of vehicles towards contract end	unreliability of contractors due to financial viability
Does contractor provide vehicles	Yes & No; contractor owns 17 mid-size vans	Generally, No ; 10 buses provided by contractor	no, except contractor must supply spares	yes	yes either purchased or leased from agency	yes	no
Does contractor provide facilities	yes	Yes & No	yes - owns facility	yes	yes	yes	yes
What level of transit property oversight exists over daily contractor operations?	on-time performance	traffic checkers do ridership counts and on-time perform. staff gets monthly reports & deal with complaints	general management and checkers for on-time performance	service monitors & contract specialists	street supervisors & QC inspections	street supervisors safety inspections contract mgmt.	street supervision; maintenacne quality control inspectors; program adminsitrator

VOLPE TURNKEY DEMONSTRATION PROJECT
QUESTIONNAIRE Re: EXPERIENCE IN PURCHASED TRANSPORTATION ACTIVITIES

QUESTION	*Austin*	*Fairfax*	*Beaver County*	*PACE*	*Denver*	*Metro-Dade*	*Houston*
What issues should a transit property address	N/A	Property should retain ownership of vehicles & facilities contractor responsibilities should be clearly defined Use fixed price contract w/ service adjust provisions Penalties/ incentives for performance are essential	Property should attempt to retain ownership of vehicles and facilities to allow flexibility in selecting contractors; contractor responsibilities should be clearly defined; property should have constructive access to contractor employees to ensure implementation of public policies	ensure experience of contractor; hold pre-bid meetings	Focus on QC inspections on vehicle maintenance; set standards for acceptable performance at contract inception	Focus on QC inspections on vehicle maintenance	control property rental and repair costs through ownership of facility
Who designs the vehicles provided by contractor	contractor; agency approves design	county noted performance characteristics, contractor proposes, county approves	Authority specs, contractor comments, authority approves	Agency gives broad spec; contractor identifies	Agency	agency states rider comfort issues [A/C, seats, signs]; contractor does rest	n/a
Who designs facilities provided by contractor	contractor	contractor proposes County reviews	N/A	contractor	contractor, with agency approval	contractor	contractor, with initial agency approval
Who manages construction of facilities	contractor, if applicable.	contractor proposes schedule for review	contractor	contractor	contractor	contractor	contractor
What is the time required from RFP to submission date	60 days	90 days	60 days	90-120 days	60 days	180 days	6-8 weeks

VOLPE TURNKEY DEMONSTRATION PROJECT
QUESTIONNAIRE Re: EXPERIENCE IN PURCHASED TRANSPORTATION ACTIVITIES

QUESTION	*Austin*	*Fairfax*	*Beaver County*	*PACE*	*Denver*	*Metro-Dade*	*Houston*
Time from submission to Board action	30 days	90-150 days	30-60 days	30 days	30 days	n/a	6-8 weeks
Time from Board action to start-up	4 months	up to 9 months	30 + days	30-60 days	up to 12 months, based on vehicles	90 days	6-10 weeks
Who assumes labor responsibilities	contractor	contractor	contractor	contractor	contractor	contractor	contractor
Tort liability	contractor	contractor	contractor	contractor	contractor	contractor	contractor, agency sets insurance requirements
Public relations	agency	contractor & county	agency	agency	agency	agency	agency
Scheduling	agency	County w/ some contractor support	agency	agency	agency	agency	agency
Have you identified cost savings from these arrangements	yes - no numbers available	yes - $600,000 per year - about 10% savings	yes - unit costing appox 30% less than neighboring agencies	yes, but not quantified	yes, but not quantified	yes; approx. 30%	yes, but not quantified
Who is responsible for planning and scheduling of construction projects associated with contractor provided facilities or vehicles?	contractor	contractor has lead, but proposes schedule for county review	N/A	contractor	contractor	contractor	contractor
Who is responsible for compliance with appropriate government regulations, such as ADA, Clean Air Act, OSHA or FTA Act Section 13 provisions?	contractor	Joint responsibility within specific area of concern - contractor has ADA in facilities and vehicles, while county has ADA in marketing	agency	contractor	contractor	contractor	contractor

VOLPE TURNKEY DEMONSTRATION PROJECT
QUESTIONNAIRE Re: EXPERIENCE IN PURCHASED TRANSPORTATION ACTIVITIES

QUESTION	*Austin*	*Fairfax*	*Beaver County*	*PACE*	*Denver*	*Metro-Dade*	*Houston*
Who is responsible for related real estate acquisition?	N/A	whoever builds the property	both	contractor	contractor	contractor	contractor
Who is responsible for ongoing safety and security concerns at the facility?	contractor	contractor	contractor	contractor	contractor, with agency QC inspections once every 3 mths.	contractor, with agency safety inspections	contractor
Who owns vehicles or facilities provided by the contractor?	both	contractor, with county having option to buy upon contractor replacement	agency & contractor	contractor	contractor, with agency option to buy	contractor	contractor owns or leases
Who maintains the vehicles or facilities provided by the contractor	contractor	contractor	contractor	contractor	contractor	contractor	contractor
What other benefits from the arrangement have been identified?	none noted	more direct control		savings while maintaining service levels	general savings	flexibility in implementing new activities	improves cost of service; improves overall efficiency in matching vehicles to service provided
What form of financial management oversight exists?	project mgr. & street supervision	fixed price contract; review farebox revenue data vs. recorded farebox readings	per hour contract w/ fixed prices	fixed price & penalties	fixed price contract with penalties	fixed fee contract w/ liquidated damages	fixed price contract

APPENDIX B:
GLOSSARY

A&E	Architecture and Engineering
A-E	Architect-Engineer
ADA	Americans with Disability Act
ADR	Alternative Dispute Resolution
AGC	Associated General Contractors of America
AIA	American Institute of Architects
BCA	Benefit-Cost Analysis
BCTA	Beaver County Transportation Authority
BTU	British Thermal Unit
CM	Construction Manager
CPM	Critical Path Method
CWE	Current Working Estimate
D/B	Design-Build
DBOT	Design-Build-Operate-Transfer
DEIS	Draft EIS
EC	Evaluation Contractor
ECP	Engineering Change Proposal
EIS	Environmental Impact Statement
FAR	Federal Acquisition Regulations
FEIS	Final Environmental Impact Statement
FFGA	Full Funding Grant Agreement
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GEC	General Engineering Contractor
IFP	Invitations for Bids
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991

LPA	Locally Preferred Alternative
MIS	Major Investment Studies
MPO	Metropolitan Planning Organization
NEPA	National Environmental Policy Act
NSPE	National Society of Professional Engineers
O&M	Operations and Maintenance
PE	Preliminary Engineering
PMO	Project Management Oversight
PMP	Project Management Plan
QA	Quality Assurance
QC	Quality Control
RFP	Request for Proposals
RFQ	Requests for Qualifications
SEIS	Supplemental Environmental Impact Statement
TIP	Transportation Improvement Program
TSM	Transportation Systems Management
UMTA	Urban Mass Transportation Administration
VE	Value Engineering
VECP	Value Engineering Change Proposal
VEIC	Value Engineering Incentive Clause
WBS	Work Breakdown Structure

APPENDIX C:
REFERENCES

American Society of Civil Engineers, Mini Forum on Transit Turnkey Development: Meeting Report, prepared for FTA/VNTSC, Washington, DC: ASCE, June 1, 1993.

Booz-Allen & Hamilton, Detailed Scope of Work: The Baltimore Turnkey Evaluation, prepared for FTA, Washington, DC: Booz-Allen & Hamilton, June 29, 1995.

Booz-Allen & Hamilton, San Juan Tren Urbano: Turnkey Evaluation Plan, prepared for FTA, Washington, DC: Booz-Allen & Hamilton, April 15, 1996.

Branca, Anthony J., Cost Effective Design/Build Construction, Kingston, MA: R.S. Means, 1987.

Clough, Richard H., Construction Contracting, Fourth Edition, New York: John Wiley, 1981.

Colby, Edward E., Practical Legal Advice for Builders and Contractors, New Jersey: Prentice-Hall, 1972.

Cushman, Robert F, and Kathy Sperling Taub, Design-Build Contracting Handbook, New York: John Wiley, February 1992.

Cushman, Robert F., and G. Christian Hedemann, Avram S. Tucker, Alternative Dispute Resolution In The Construction Industry, Somerset, NJ: John Wiley, 1991.

Day and Zimmerman, Inc., Project Management Oversight Procedures, prepared for UMTA, Philadelphia, PA: D&Z, Inc., March 1986.

Doyle, Frank J., and Charles P. Elms, "Honolulu's Super-Turnkey Procurement Process," paper for APTA, Honolulu, HA: City and County of Honolulu, June 1992.

Elms, Charles P., "Comparison of Super-Turnkey Procurement with the Traditional Approach for the Design and Construction of Fixed Guideway: Transit Systems," paper prepared for FTA, Washington, DC: Lea+Elliot, June 1992.

Federal Highway Administration/Transit Administration, "Management and Monitoring Systems; Interim Final Rule: 23 CFR Parts 500, 626 and 49 CFR Part 614," Code of Federal Regulations, 58, 229 (December 1, 1993) pp. 63442-85.

Federal Highway Administration/Transit Administration, "Statewide Planning; Metropolitan Planning Agencies: 23 CFR Part 450 and 49 CFR Part 613," Federal Register (January 1992) pp. .

Federal Transit Administration, "Announcement of the Initiation of a Turnkey Demonstration Program; Solicitation of Letters of Intent to Propose; Notice," Federal Register, 57, 157 (August 13, 1992) pp. 36575-79.

Federal Transit Administration, "Summary of the Transit Agencies Roundtable Seminar on Turnkey Development," paper, Washington, DC: US DOT/FTA, March 10, 1993.

Federal Transit Administration, with Public Works Financing and KPMG Peat Marwick, "Financing Turnkey Transit: Experts Roundtable," paper, Washington, DC: US DOT/FTA, April 30, 1993.

Federal Transit Administration, Turnkey Development of Transit Projects: APTA/FTA Workshop, notebook, Washington, DC: US DOT/FTA, June 10, 1993.

Fish, John, Cost Control in Design-Build, transactions of the AACE 35th annual meeting, Seattle, WA: American Association of Cost Engineers, June 1991.

Fisk, Edward R., Construction Project Administration, Third Edition, New York: John Wiley, 1988.

General Services Administration, Design-Build Request for Proposals Guide, Washington, DC: GSA, November 1991.

General Services Administration, Design-Build Request for Proposals Guide, Washington, DC: USGSA - Public Building Service, November 1991.

Gilbreath, Robert, Managing Construction Contracts, New York: John Wiley, 1983.

Hartung, Jon F., Risk Allocation by Use of Turnkey Contracts, San Francisco, CA: Fapella, Braun & Martel, 1987.

Keefer, Louis B., Profit Implications of Joint Development: Three Institutional Approaches, prepared for UMTA, Arlington, VA: Louis E. Keefer Associates, November 1984.

Luglio, Jr., Thomas J., and Jeffrey A. Parker, Innovative Procurement Methods: Review of Issues, Experience and Applications to FTA-funded Fixed Guideway Projects, prepared for FTA, Woburn, MA: EG&G Dynatrend, Inc., March 1992.

Luglio, Jr., Thomas J., Project and Construction Management Guidelines, prepared for FTA, Woburn, MA: EG&G Dynatrend, September 1990.

Luglio, Thomas J., and Jeffrey A. Parker, Turnkey Procurement: Opportunities and Issues, prepared for FTA, Washington, DC: US DOT/FTA, June 1992.

Luglio, Thomas J., Evaluation of the Detroit People Mover System Turnkey Development: Study Design and Management Plan, prepared for FTA, Burlington, MA: EG&G Dynatrend, October 1993.

Luglio, Thomas J., Evaluation of the Honolulu Rapid Transit System Turnkey Development: Study Design and Management Plan, prepared for FTA, Burlington, MA: EG&G Dynatrend, September 9, 1993.

Luglio, Thomas, Quality Assurance and Quality Control Guidelines, prepared for FTA, Burlington, MA: EG&G Dynatrend, 1992.

Minden, Stephen D., Design-Build in the Public Sector: a case study of the Commonwealth of Massachusetts DCPO projects for three correctional facilities, MSc Thesis, Boston, MA: Massachusetts Institute of Technology, 1986.

Mohr, Lawrence B., Impact Analysis for Program Evaluation, 2nd ed, Thousand Oaks, CA: Sage, 1995.

Napier, Thomas P., Timothy D. Holcomb, Robert G. Kapolnek, and Abelardo Rivas, Six Case Studies on Alternative Construction Methods: One-Step "Turnkey" Facility Acquisition and Architectural Fabric Structure Technology, USA-CERL Technical Report P-88/14, Champaign, IL: US Army Corps of Engineers, Construction Engineering Research Laboratory, May 1988.

Napier, Thomas R., and Steven F. Freiburg, One-Step and Two-Step Facility Acquisition for Military Construction: Project Selection and Implementation

Procedures, Technical Report P-90/23, Champaign, IL: US Army Corps of Engineers, August 1990.

National Center For Regional Mobility, and George Mason University, Transcript of Conference Proceedings: Turnkey Preproposal Conference, prepared for FTA, Fairfax, VA: George Mason University, October 12, 1992.

New York City Transit Authority, Project Management Procedures Manual: Volumes 1-3, New York: NYCTA, December 16, 1985.

Office Of The Federal Register, National Archives and Records Administration, Federal Acquisitions Regulations, Washington, DC: US Government Printing Office, October 1 1993.

Office of Management and Budget, Grants and Aid to State and Local Governments: Administrative Requirements, Circular A-102, Washington, DC: US Government Printing Office, October 1, 1993.

Public Technology, Inc., Joint Development: A Handbook for Local Government Officials, prepared for UMTA, Washington, DC: PT, Inc., September 1983.

Public Technology, Inc., Transportation Construction Management, prepared for Urban Consortium for Tech. Initiatives, Washington, DC: PTI, September 1980.

Ritterskamp, James J., Purchasing Manager's Desk Book of Purchasing Law, New Jersey: Prentice-Hall, 1987.

SR Associates, Handbook for Competitive Contracting, prepared for Southern California Assoc. of Gov'ts, Costa Mesa, CA: SR Associates, 1986.

Schneck, Donald C., and Richard S. Laver, Evaluation of Recent Turnkey Procurement Experience: The Houston Monorail Project, prepared for FTA, Philadelphia, PA: Booz-Allen & Hamilton, July 1994.

Slatter, S., "Strategic marketing variables under conditions of competitive bidding," Strategic Management (May 1990) pp. 11.

Tarricone, Paul, "Deliverance," Civil Engineering (February 1993) pp. 36-40.

Thomsen, William T., Transit Turnkey Implementation: Seizing the Opportunities and Controlling the Risks through Effect Proj. Mgmt., prepared for FTA, Miami, FLA: Urban Engineers, Inc., June 10, 1993.

Touran, Ali, Paul J. Bolster, and Scott W. Thayer, Risk Assessment in Fixed Guideway Construction, prepared for FTA, Boston: Northeastern University, January 1994.

Touran, Ali, and Paul J. Bolster, "Integration of Financial and Construction Risks: A Simulation Approach," paper for TRB, Boston: Northeastern University, January 1994.

Twomey, Timothy R., Understanding the Legal Aspects of Design/Build, Kingston, MA: R.S. Means Company, 1989.

U.S. Congress, Intermodal Surface Transportation Efficiency Act, Washington, DC: US GPO, December 18, 1991.

UMTA, Capital Cost of Contracting, Circular 7010.1, Washington, DC: UMTA, December 5, 1986.

UMTA, Project Management Oversight, Final Rule, Washington, DC: Federal Register, September 1 1989.

UMTA, Third Party Contracting Guidelines, Circular 4220.1B, Washington, DC: UMTA, February 5, 1990.

Wideman, R. Max, Project Management Body of Knowledge, : Project Management Institute, March 28, 1987.

Yarema, Geoffrey S., The Next Step in the Turnkey Demonstration Program: Developing an Effective Contract, prepared for FTA, Los Angeles, CA: Nossaman, Gunthner, Knox & Elliot, June 10, 1993.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1996 - 701-889/40010