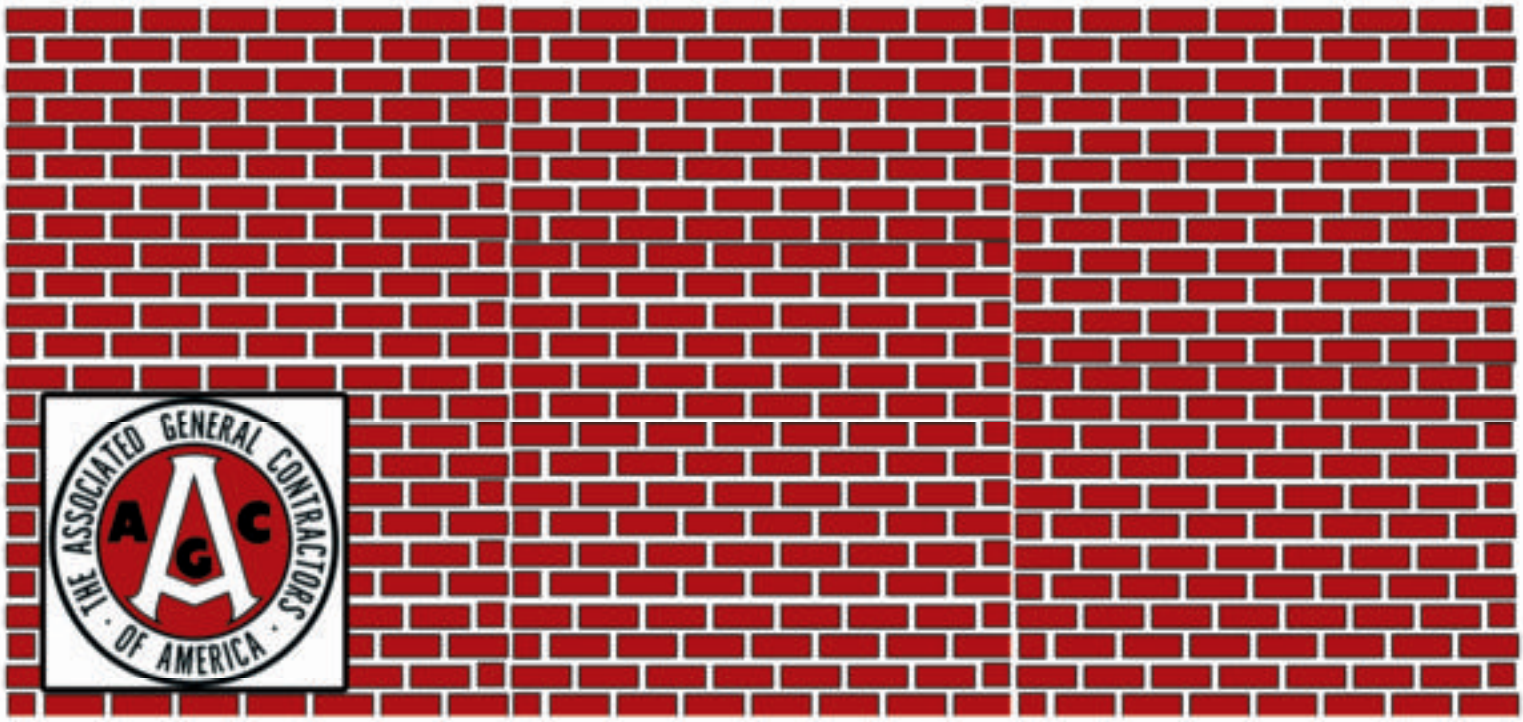
School Construction Guide

The Associated General Contractors of America



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Printed in the United States of America.

School Construction Guide

The Associated General Contractors of America

Building Your Quality of Life

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Introduction to School Construction Section I

INTRODUCTION TO SCHOOL CONSTRUCTION SECTION I

1.1 INTRODUCTION

The school construction market has always been an important market for the construction industry and it will continue to be so in the future. The need for new school facilities is growing in many areas as the student population increases. In other areas, existing school facilities have become technologically outmoded or have outlived their useful life and need to be replaced. In addition, schools are no longer just a physical collection of classrooms but are becoming high-tech facilities where the latest in communications and computer technologies are being utilized to prepare today's students for the challenges of tomorrow. School construction is changing and getting more complex.

Students, teachers, parents, and others want a learning environment that is functional, comfortable, up-to-date technologically, and safe. In addition, school owners facing shrinking budgets are looking for facilities that not only meet the needs of students and teachers but also are economical to build, operate, and maintain. Meeting these diverse and often conflicting needs presents both a challenge and opportunity to the construction industry. This section will discuss the challenges and opportunities presented by today's school construction market as well as describe the school construction process which will serve as the outline for the remainder of this manual.

1.2 WHO IS THE CLIENT?

There are many stakeholders in any school construction project because education affects just about everyone in a community. Those directly impacted by the project will be the students and teachers that use the completed project on a daily basis. Community groups that may also use the facility as well as help pay for it are impacted as well. The residents in the community where the school project is located also need to be considered because residents often shoulder all or part of the cost of the school project through taxes and other levies.

Despite the involvement and interest of many diverse groups in a school construction project, there is usually one entity that is responsible for planning and executing the project for the community. For public schools this may be the school district and for private schools this could be the school or church council. It is this entity's responsibility to understand the educational needs of the community; know the financial, social, and other constraints faced by the community; and then develop a viable program for school construction that balances those needs and constraints. Throughout this manual the term "school owner" will be used to denote the public or private entity charged with procuring design and construction services that meet the needs of the community for new, renovated, or expanded school facilities.

1.3 UNIQUE CHALLENGE OF SCHOOL CONSTRUCTION

As noted in the introduction to this section, school construction offers many unique challenges. School owners today are looking for high-tech facilities that incorporate and teach the latest in communications and computer technology. This technology includes state-of-the-art audiovisual equipment in the classrooms and auditoriums; availability of wired and wireless data networks

throughout school buildings; advanced security and access control systems for safety; physical environments that address ergonomics, thermal comfort, lighting, and acoustics; among other things. Schools today are expected to have a longer life, low operation and maintenance (O&M) costs, and be flexible to adapt to changing educational needs. In addition, school owners are faced with shrinking budgets and want facilities that are also economical to build, operate, and maintain. The challenge for the construction industry is to help school owners address these conflicting needs.

1.4 GENERAL CONTRACTOR ROLES

1.4.1 General Contractor Roles

There are a variety of valuable roles that the general contractor can assume on a school construction project. These roles include the following:

- Program Manager
- Construction Manager
- Design-Builder
- General Contractor

Each of these roles involves different challenges and responsibilities and will be discussed briefly in the following paragraphs.

1.4.2 Program Manager

Sometimes school owners will have multiple school projects that need to be completed within a given time frame. These multiple projects are often referred to collectively as a program. The construction, renovation, and expansion of multiple school properties is a very complex and time consuming undertaking that requires expert coordination and management. Most school owners do not have the in-house staff or expertise to undertake a multi-project "program." The general contractor has both the experienced personnel and expertise to help the school owner successfully complete its program. As the program manager, the general contractor works as an extension of the school owner's staff to help the school owner coordinate multiple projects and complete its program on time and within budget.

1.4.3 Construction Manager

Many school owners and architects do not have the in-house construction expertise that the general contractor has developed. The general contractor has an intimate knowledge of the local construction market; labor, material, and equipment cost and availability; efficient and economical construction means and methods; estimating and scheduling expertise; as well as specializes in construction management. The construction manager assists and advises the school owner throughout the design and construction process.

Acting as a construction manager, the general contractor can provide invaluable assistance to the school owner and its design team throughout the project. During the design phase, the gen-

eral contractor can provide assistance by reviewing the design for constructability, performing value analysis, and monitoring schedule and budget. After the design is complete, the general contracting firm can help the school owner plan and schedule construction and select and coordinate quality specialty contractors. The general contractor can coordinate construction and monitor progress and budget through project completion.

1.4.4 Design-Builder

The general contractor can act as the design-builder and take responsibility for the design as well as the construction of the school project. With design-build, the school owner only has one entity to contract with and that entity is responsible for taking the project from inception to completion for the school owner. Working as a design-builder, the general contractor obtains and coordinates the necessary design services as well as manages the construction process.

1.4.5 General Contractor

Most school projects use the traditional design-bid-build project delivery system and the general contractor assumes its traditional role on the project. The school owner retains the services of an architect that forms a multi-disciplinary team of design professionals to design the project. The general contractor that will build the project is then selected through a competitive bid process. The successful general contractor is responsible for assembling and coordinating the construction team which includes its own forces as well as specialty contractors such as electrical, mechanical, and plumbing.

A qualified construction team is key to the success of a school construction project. The general contractor assumes the leadership position on the construction team and uses its expertise to convert the design team's plans and specifications into physical reality for the school owner. To successfully deliver a school construction project, the general contractor must be able to coordinate its team of dozens of subcontractors and suppliers as well as its own forces. This requires that the general contractor understand the unique aspects of school construction, the needs of the school owner, and be very adept at planning and scheduling the project.

1.5 SCHOOL CONSTRUCTION PROCESS

1.5.1 Process Overview

The construction of a new school or the renovation or expansion of an existing school can be represented by the simple seven-step flow chart shown in Figure I-1. While the flow chart is simple, the actual process is not and the successful completion of each step is critical to the overall success of the project. Further, the school construction process is shown to be linear step-by-step undertaking and in reality steps overlap. The flow chart does, however, provide a framework for understanding the school construction process and categorizing like activities. The following paragraphs will briefly discuss each of these seven steps.

1.5.2 Step 1: Plan The Project

There is a need that is the underlying driving force of any construction project and school construction is no different. That need may arise out of a growing student population, new curricular initiatives, outmoded or crumbling physical facilities, or other factors. The first step in the school construction process is to define that need and develop a plan for addressing it.

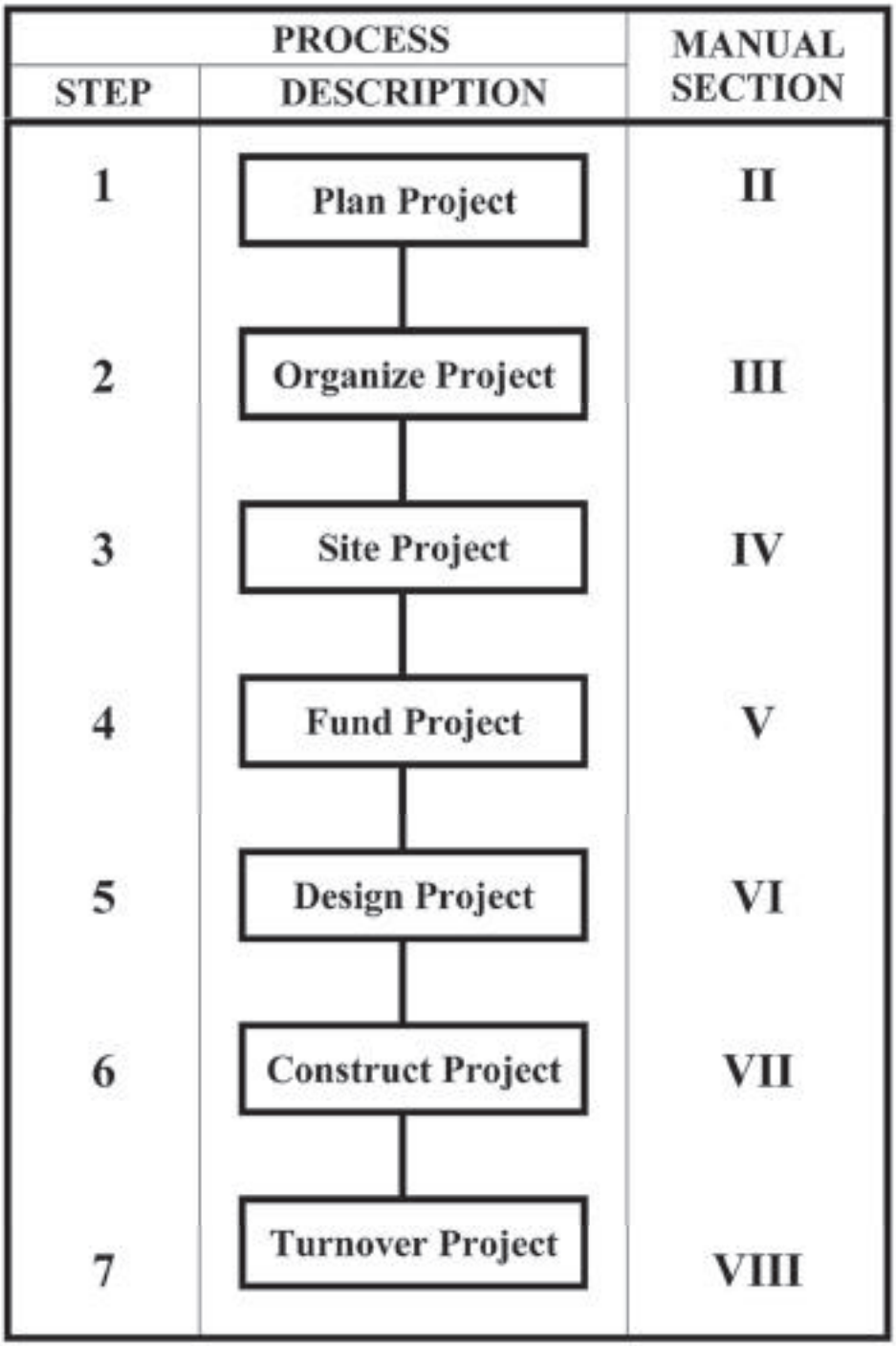

Figure I-1
School Construction Process

The planning process starts with the selection of a planning team. The planning team will first conduct a needs assessment that substantiates the need for the school construction project by documenting current conditions and analyzing future educational needs and community demographics. With this data, the planning team can then establish general parameters for the school construction project such as student capacity, space needs, and site requirements. Alternatives that meet the general parameters for the school construction project can then be explored by the planning team that may include constructing a new facility, renovating an existing facility, expanding an existing facility, or any combination of the three. Conceptual cost estimates for the alternatives can then be developed and a preferred alternative selected that best meets the needs of the school owner. Based on the preferred alternative, an educational specification is developed by the planning team that serves as the basis for project design.

1.5.3 Step 2: Organize The Project

Once the planning process is complete, the planning team can turn its attention from what has to be done to how it is going to get done. The school owner usually needs outside expertise to complete the project that includes both designers and contractors. Designers include architects, engineers, and others that convert the requirements of the educational specification into a set of plans for a school facility that can be built. Contractors include the general contractor as well as specialty contractors and suppliers that together will take the designers' plans and turn them into physical reality for the school owner.

There are a variety of ways that a school construction project can be organized to take it from concept to completion. The way that designers and contractors are organized to design and build the school project is often referred to as a "project delivery system." Deciding how a school construction project is going to be organized is an important second step in the school construction process. There is no one right way to organize a school construction project and the school owner should consider the alternatives and select the best alternative for a particular project. How the project will be organized can impact all of the remaining steps in the school construction project including funding and siting the project.

1.5.4 Step 3: Site The Project

The planning process and the resulting educational specification will determine if the project requires a new site or involves the renovation or expansion of an existing facility. If a new site is required, the school owner will need to identify potential sites, investigate the suitability of each site, determine the "all-in" cost of each site, select the preferred site, and then acquire the site. On the other hand, if the project involves the renovation of an existing facility the school owner needs to determine that the existing facility is suitable and economical. This step is very important because it can significantly impact the amount of project funding required as well as project design and construction.

1.5.5 Step 4: Fund The Project

In order to undertake the school construction project, the school owner must have the necessary funding in place. The educational specification is an important prerequisite to seeking funding for the school construction project. The educational specification will serve as the basis for the devel-

opment of a preliminary budget for the school construction project. In addition, the nature of the project defined by the educational specification may determine the funding sources available to the school owner. The purpose of the school construction project as well as whether it is new construction or the renovation or expansion of an existing facility may determine what funding sources are available or not available to the school owner. The outcome of this step will be a funding strategy for the school construction project.

Obtaining the necessary funding for the school construction project is a complex undertaking and vital to project realization. Without the necessary funds, the project cannot become a physical reality. The funding process starts with the planning team obtaining necessary outside expertise which includes financial advisors as well as the architect and general contractor. Once the necessary expertise has been assembled, potential funding sources both inside and outside the community need to be identified and a realistic project budget must be established. With this information, a strategy can be developed for funding the school construction project. This funding strategy can either lead to traditional financing using bonds, government grants, and other sources resulting in school ownership or alternatives to project ownership such as build-own-lease and other similar arrangements.

1.5.6 Step 5: Design The Project

With the educational specification and funding strategy in place, project design can begin. Depending on how the school owner decides to organize the project, the first step in the design process may be to determine the design services needed, select the design team, and contract with the team. Once the school owner has the design team under contract, the design process can start with a review of the school owner's educational specification and end with the preparation of construction documents. The school owner should be actively involved throughout the design process through design reviews to ensure that the completed design meets its needs and expectations.

1.5.7 Step 6: Construct The Project

The first step in the construction process is to select and contract with the construction team. Selection of the construction team will depend on how the school owner chooses to organize the project. Once the design is complete and construction contracts signed, work at the site can commence and continue until the project is complete.

1.5.8 Step 7: Turn Over The Project

The final step in the school construction process is the turning over of the completed project to the school owner. This is a very important step because it includes system testing and startup, inspection and punchlist, training of the school owner's personnel, as well as project closeout. It is during this final step that the school owner, design team, and construction team determine if the quality and performance criteria set forth in the educational specification have been met.

1.6 OVERVIEW OF THIS GUIDE

The purpose of this guide is to help those involved in a school construction project better understand the process so that the project is successful for everyone. A successful school construction project is one that is completed on time, within budget, and meets the needs and requirements of the school owner. The general contractor has unique knowledge, skills, and abilities that can be invaluable to the success of a school construction project at each stage of this process.

This manual has been divided into eight sections that step the reader through the school construction process from project planning through project turnover. This section provided an overview of the school construction process that included a discussion of the various roles that the general contractor can assume on a school construction project. The remaining seven sections each address a step in the school construction process outlined in the previous section.

Section II addresses project planning and is followed by organizing the project in Section III. Siting considerations for either new construction or the renovation or expansion of an existing school facility are covered in Section IV. In Section V, methods of funding the project are covered. Designing the project is discussed in Section VI followed by constructing the project in Section VII. Finally, project closeout and the turnover of the project are addressed in Section VIII.

Planning the Project — Section II

PLANNING THE PROJECT SECTION II

2.1 INTRODUCTION

The first step in the school construction process is to plan the project. Planning the school construction project involves a number of steps starting with assembling a project team and ending with the development of an educational specification for the project. This section will provide a step-by-step process for planning a school construction project. This is a very important step in the school construction process because the information developed will be the basis for applying for permission to proceed with the school construction project as well as requesting for funding for the project and designing the project.

2.2 PLANNING PROCESS

The planning process for a school construction project can be broken down into the following seven steps:

- Step #1: Assemble The Planning Team
- Step #2: Conduct A Needs Assessment
- Step #3: Establish Facility Parameters
- Step #4: Identify Alternatives
- Step #5: Develop Conceptual Cost Estimates
- Step #6: Select An Alternative
- Step #7: Develop An Educational Specification

The following paragraphs will discuss each of these steps.

2.3 STEP #1: ASSEMBLE THE PLANNING TEAM

2.3.1 Planning Team Importance

This first step in planning the school construction project is to assemble the planning team. This is a very important step because the composition of the planning team can impact the success of the school construction project. In this case, success is not just getting the project built but also includes the ability of the completed project to satisfy the needs of the project stakeholders. These stakeholders include the school's owner from the standpoint of operation and maintenance as well as the teachers and students who use the facility on a daily basis and other groups that use the facility throughout its life. In addition other stakeholders such as residents of the surrounding neighborhoods where the school will be located, community leaders, school administrators and employees other than teachers, and the general citizenry could also be included.

2.3.2 Planning Team Composition

School construction project planning teams are typically composed of individuals both inside and outside the owner's organization. Individuals on the planning team should be selected on the basis of needed knowledge and experience. The planning team's knowledge and experience needs to address the entire life cycle of the project that includes planning, design, construction, and use. Use of the school facility includes not only how the school construction project fulfills its primary educational mission but also the maintenance and operation of the facility.

2.3.3 Outside Consultants

Generally, the owner's organization will not have all the necessary knowledge and expertise to analyze and plan all aspects of the proposed school construction project. Outside consultants with specific experience and expertise can play a key role in obtaining and analyzing information for the planning team as well as providing helpful advice and recommendations in areas where the planning team does not have expertise. Outside consultants can include the following:

- Educational and curriculum consultants for assistance in determining the educational objective and needs of the proposed project.
- Statisticians and demographers to assist in analyzing community data and determining the need for the proposed school project.
- Architects in determining the preliminary space needs and layout of the proposed school project including both the building and site.
- Construction managers for the preparation of conceptual estimates and schedules as well as advice on construction matters and constructability reviews.
- Finance consultants for advice on project funding sources, availability, and costs.
- Other consultants such as engineers, specialty designers, real estate professionals, and legal counsel as needed.

2.4 STEP #2: CONDUCT A NEEDS ASSESSMENT

2.4.1 Needs Assessment

Conducting a needs assessment is the first step toward substantiating the need for the school construction project and developing a plan for meeting that need. A needs assessment serves as the basis for the planning process and substantiating the need for getting approval and financing. Typical data that should be gathered and analyzed in a needs assessment includes the following:

- Proposed School Project Data
- Community Demographics
- School District Data

All three of these categories provide important information regarding the need for the proposed school construction project. While the data is divided into three categories, it will typically be gathered simultaneously and is very much interdependent.

2.4.2 Proposed School Project Data

The proposed school project data directly supports the need for the proposed school project and should be supported and derived from community and school district data to the extent possible. This data is localized to the area where the proposed school project will be located. Information that should be gathered to support the proposed school project includes the following:

- Educational Objective
- Historical & Current Enrollment
- Capacity Constraints
- Physical Condition & Upgrade Needs
- Projected Enrollment

Educational Objective. The educational objective of the proposed school project needs to be defined. This includes defining the grades, curricula, and other factors that the proposed school project will address. In addition, any specific initiatives or enhancements to students' educational experience or anticipated performance outcomes should also be documented.

Historical & Current Enrollment. If the proposed school project involves the renovation, expansion, or replacement of an existing facility, then the historical and current enrollment of that facility should be documented by grade. On the other hand, if the proposed school project is a new facility then the historical and current enrollments of existing schools that will be impacted by the construction of the new school need to be documented. Historical and current enrollment data will provide the context for justifying the need to the proposed school project.

Capacity Constraints. The maximum capacity of existing school facilities that will be impacted by the proposed school project needs to be documented. If not currently documented, the capacity can be determined by considering a number of factors including the number and size of classrooms; capacity of support areas such as libraries, cafeterias, gymnasiums, and others; target class sizes and teacher contract provisions; among other factors. In determining capacity constraints, it may be helpful to consider current government regulations and recommendations, school district guidelines, and other similar data.

Physical Condition & Upgrade Needs. In addition to capacity constraints, the physical condition and upgrade needs of any existing school facilities that will be impacted by the proposed project should also be considered. For example, the physical condition of an existing building that would be replaced by the proposed school project should be documented. Similarly, if the construction of a new school would reduce the student population in adjacent schools so that they could use freed space for other curriculum initiatives like computer laboratories and media centers then this should be included in the needs analysis.

Projected Enrollment. Enrollment projections are usually required in any needs assessment for a proposed school project. A five-year projection by grade is typically mandated. These projections should reflect the historical enrollment trends as well as factor in community demographics and overall school district projections. Whenever possible, data from outside sources should be used to support enrollment projections.

2.4.3 Community Demographics

Community demographics should also be analyzed to assist in developing realistic enrollment projections for the proposed school project. A study of community demographics may require an outside consultant and could include the development and analysis of community statistics including the following:

- Population Dynamics
- Housing Starts
- Job Market Trends
- Birth Rates
- Migration Trends

Community demographics are very important to showing why the proposed school project is needed.

2.4.4 School District Data

In addition to information directly supporting the need for the proposed school project, additional data about the school district may also need to be provided. The reason for gathering this data is to provide an overview of the size of the school district and its operation. School district data that might be required includes the following:

- Total District Enrollment
- Total Number Of Schools In District
- District-Wide Enrollment By School
- District-Wide Enrollment By Grade
- Other Pertinent District Information

This data should be used to illustrate why the proposed school project is needed and its impact on the overall school district wherever possible.

2.5 STEP#3: ESTABLISH FACILITY PARAMETERS

2.5.1 Facility Parameters

Based on the information gathered in the needs assessment, the specific parameters for the proposed school project can begin to be identified and quantified. These parameters should be aimed at fulfilling the proposed school facility's educational objective and include the following:

- Student Capacity
- Space Planning
- Site Planning

2.5.2 Student Capacity

Student capacity refers to the number of students that the proposed facility will support. The capacity of a school facility can be expressed in a variety of ways and the specific method prescribed by the state or other approving authority needs to be followed. However, in general project capacity can be expressed in the following ways:

- **Initial Capacity.** The initial capacity is the number of students that the school facility will serve when it is complete.

- **Core Capacity**. The core capacity is the maximum number of students that the school facility infrastructure will support without having to expand or duplicate it. Core capacity refers to the maximum number of students that common areas such as kitchen, cafeteria, auditorium, and libraries in the base school facility will support for future additions of instructional areas.

- **Maximum Capacity.** The maximum capacity is the maximum number of students that the facility can hold based on considerations such as number of classrooms, educational program requirements, and the maximum classroom size specified in teacher contracts. The maximum capacity is the maximum allowable number of students that can use the facilities given constraints imposed by local, state, and Federal regulations and guidelines.

- **Planned Capacity.** The planned capacity is the maximum anticipated number of students that will use the facility based on the analysis of area demographics and projected student population. The planned capacity may also include an allowance for uncertainty associated with the projected student population. The planned capacity should be less than or equal to the maximum capacity.

- **Design Capacity.** The number of students that the school facility is being designed for. If the school facility is sited and designed for future expansion, then the design capacity for the instructional areas such as classrooms in the base project may be different from the design capacity for support areas which are sized based on future additions and expansion of the base project.

Each of these measures of student capacity is an important consideration in the school construction planning process.

2.5.3 Space Planning

Preliminary Space Plan. A preliminary space plan that supports the educational objective and anticipated enrollment for the proposed school project should be developed as part of the needs assessment. This preliminary space plan should identify what spaces are required by function and then assign an approximate area to each space. Even though this space plan is preliminary, it is very important that it be as accurate and inclusive as possible because it will serve as the basis for obtaining permission to proceed with the project, estimating project costs, and obtaining funding for the proposed school project.

Space Types. There are a variety of different types of spaces that need to be incorporated into a school project. The actual types of spaces included will depend on the school and its curriculum. In general, spaces typically incorporated into schools can be divided into the following three categories:

- Instructional Spaces
- Instructional Support Spaces
- Building Support Spaces

Instructional Spaces. Instructional spaces include any space that is used specifically for instruction which includes classrooms, laboratories, and similar spaces. A list of possible instruction support spaces is provided in Table II-1. It should be noted that this list will vary depending on the grades served by the proposed school project as well as the curriculum included. In addition, the spaces in Table II-1 are listed by function only and are not broken down into subspaces which need to be accounted for. For example, a school may need individual practice rooms as well as a group music practice room to meet its educational objective in the performing arts.

Instructional Support Spaces. Spaces that support the educational objective of the school but are not used directly for instruction are categorized as instructional support spaces. An example of an instructional support space might be the school cafeteria. A list of possible instructional support spaces is provided in Table II-2. These instructional support spaces are listed by function and may include primary as well as subspaces to fulfill the function.

- Classrooms
- Laboratories
- Art
- Music
- Business Education
- Homemaking
- Industrial Arts
- Science
- Physical Education
- Others

TABLE II-1
INSTRUCTIONAL SPACES BY FUNCTION

- Library
- Media Room
- Cafeteria
- Kitchen
- Auditorium
- Locker Rooms
- Administration
- Guidance
- Health
- Others

TABLE II-2
INSTRUCTIONAL SUPPORT SPACES BY FUNCTION

Building Support Spaces. Building support spaces include all those spaces that are not instructional or instructional support spaces but are needed to have a functioning building which include among other things mechanical equipment rooms. A list of possible building support spaces by function is presented in Table II-3.

2.5.4 Building Area

Using the space planning information, a preliminary estimate of overall building area can be made. This estimate is very important because it will define the size of the facility and provide a basis for comparing the proposed facility with other similar facilities in the school district as well as other facilities in the state and nationally. The building area can also be used to develop a conceptual cost estimate for the project. The following paragraphs will define building area classifications as well as metrics that are sometimes used to compare school buildings. The following topics relating to building area will be discussed:

- Gross Building Area
- Net Building Area
- Gross Less Net Building Area
- Building Space Efficiency
- Per Student Building Area
- Guidelines & Requirements

Gross Building Area. Gross building area is the total area of the school building and is typically expressed in terms of gross square feet. The method used to calculate gross building area, building areas included in the calculation, and the criteria for including a particular area in the calculation can vary. For example, the gross building area is typically calculated using dimensions to the outside wall surface but could be based on the centerline of exterior walls or the interior surface of exterior wall depending on how it is defined. Similarly, open sky courts are typically not included in the gross building area and basements only if they meet specified headroom criteria. The gross building area should be computed in accordance with the method specified by the state or other approving authority.

In the absence of specific requirements for calculating the gross building area for the school project, the definition of the architectural area of a building that is published by The American Institute of Architects (AIA) in AIA Document D101 can be used. According to this definition, the gross area of the proposed school project would be the sum of all areas of the building including stairwells, basements, and other areas with headroom height. Additionally, covered walkways and roofed-over courts should be included at one-half their actual area. Open-sky courts, roof overhangs, and other similar areas should not be included.

- Restrooms
- Maintenance
- Mechanical Rooms
- Electrical Rooms
- Teledata
- Circulation (Hallways & Stairways)
- Elevators & Escalators
- Receiving & Storage
- Others

TABLE II-3
BUILDING SUPPORT SPACES BY FUNCTION

Net Building Area. Net building area typically includes those spaces that directly support the educational objective of the proposed school project. These spaces include both the building's instructional and instructional support spaces. Examples of instructional and instructional support spaces are provided in Tables II-1 and II-2, respectively. Net building area is typically measured from the inside face of the enclosing walls.

Gross Less Net Building Area. The difference between the gross building area and the net building area is the building area that includes building support spaces such as those listed in Table II-3, the thickness of exterior and interior walls, and other unusable building areas.

Building Space Efficiency. The ratio of the net building area to the gross building area provides an indication of how efficiently building space is utilized. Building efficiency can be expressed as a decimal fraction or percentage with the maximum theoretical values being 1.00 or 100 percent, respectively. In general, the higher the building space efficiency the better. However, care must be taken when making comparisons based on building space efficiency to make sure that these comparisons are reasonable and valid. The building space efficiency for schools with different educational objectives, designs, and geographic locations can vary.

Per Student Building Area. Per student building area is another metric that is sometimes used to compare school building efficiency. Per student building area is expressed as square feet per student and can be computed using either the gross or net building area. Per student gross building area can be calculated as follows:

$$\text{Per Student Gross Building Area} = \left(\frac{\text{Student Capacity}}{\text{Gross Building Area}} \right)$$

Similarly, per student net building area can be calculated as follows:

$$\text{Per Student Net Building Area} = \left(\frac{\text{Student Capacity}}{\text{Net Building Area}} \right)$$

The student capacity used will impact the per student building area calculated and affect any comparisons made on this basis. Therefore, it is important that the student capacity used to calculate per student area be documented and consistent with any comparisons made.

Guidelines & Requirements. Many states have guidelines regarding minimum and maximum allowable areas for various functions as well as the maximum building area per pupil that the facility must meet. The planning team must be aware of these guidelines and requirements and adhere to them.

2.5.5 Site Planning

Preliminary Site Plan. Site planning is a necessary part of the project planning process. Like building planning, site planning at this stage of the project requires the identification of what functions and facilities need to be included. Site planning will establish the minimum land area required for the proposed school project. The minimum land area for the site will be expressed in acres and will serve as the basis for identifying potential project sites as will be discussed in Section IV.

Site Functions. In addition to the proposed school building, the site will need to accommodate other functions and facilities that may include the following:

- Parking for administrators, faculty, support staff, students, visitors, and others.
- Sidewalks, student drop-off and pick-up zones, and bus unloading and loading areas.
- Roads and driveways to provide access for delivery trucks, maintenance vehicles, and waste pick-up throughout the site.
- Trash enclosures, maintenance sheds and garages, athletic equipment storage areas, and other outdoor facilities.
- Physical education, intramural, recess, and competitive athletic program areas including athletic fields and stadiums.
- Agricultural, horticultural, wildlife, and park areas including greenhouses.
- Spaces to accommodate other facilities or functions necessary for the facility to achieve its educational objective, also considering the possibility for future expansion.

Guidelines & Requirements. States and other approval authorities often have guidelines and requirements regarding the minimum site area based on educational objective and student capacity, functions and facilities that must be provided, among other things. In addition, most metropolitan areas have zoning requirements that include minimum parking facilities including handicapped requirements, minimum setback, and landscape and green area requirements among others that can impact the minimum area of the site. When planning the project, all of these guidelines and constraints need to be taken into account in order to ensure that any potential sites identified will be acceptable.

Site Requirement Adjustments. The minimum site area determined using state and other approval authority guidelines and requirements might be reduced based on the design and use of the site. Some factors that might result in a reduced site area requirement are as follows:

- Construction of a multi-story school facility.
- Construction of either an underground or multi-story above ground parking facility.
- Incorporation of rooftop physical education or recess areas.
- Joint use or off-site use of needed facilities or functions.
- Athletic facilities or stadiums shared with other schools.

The planning team should be aware of these possible site adjustment factors and incorporate them into the facility site plan where advantageous.

2.5.6 Facility Planning Requirements

Public school construction projects must comply with state and Federal laws and regulations in order to qualify for public funding. There are typically multiple state entities that play a role in approving a school construction project, the site, and funding. These state agencies vary from state to state and include not only the state's department of education but also the state archi-

tect's office, environmental protection agency, and others. The number of state agencies involved will make the process of building, renovating, or expanding a school building a complex process.

2.6 STEP #4: IDENTIFY ALTERNATIVES

2.6.1 School Project Alternatives

Once the future needs for the school construction project have been identified, the next step is to identify viable alternatives for meeting these needs. In general, these alternatives will be as follows:

- Construct A New Facility
- Renovate An Existing Facility
- Expand An Existing Facility

The following paragraphs will briefly discuss each of these options as well as the need to consider the impact on existing facilities. Section IV will address site identification, analysis, and selection in more detail.

2.6.2 Construct A New Facility

Constructing a new facility typically includes the acquisition of land, site improvements, and construction of the project. A new facility will typically take the longest to complete when compared to the renovation or expansion of an existing school facility. In addition, the total cost of a new school facility will typically be greater than that of renovating or expanding an existing facility. However, constructing a new school facility may be necessary to meet the needs of a growing student population, address the migration of student population within the school district, meet today's educational objective and facility needs, or simply replace an existing building that is not practical or feasible to renovate or expand.

2.6.3 Renovate An Existing Facility

All or part of an existing school facility can be renovated to meet the needs identified in the needs assessment and educational objective. Renovation has the advantage of reusing an existing facility and avoiding the need to acquire additional land and incur site development costs. Depending on the magnitude of the renovation project and the urgency of the project, the work can be accomplished over summers and in restricted areas during the school year.

When considering renovation, the planning team needs to consider factors beyond the renovation work that needs to be accomplished. First and foremost, the planning team needs to consider the physical condition of the building as well as the adequacy and condition of the building's mechanical, electrical, and plumbing (MEP) systems to support needs of the renovated building. It may be determined that upgrading the building and its MEP systems may be cost prohibitive or just not possible to meet modern codes and requirements. Similarly, the possibility of encountering hidden or unexpected conditions including hazardous materials that need to be mitigated before proceeding with the renovation must be considered as well. Lastly, if the existing building is considered to be a historical building it may add to the cost of the renovation as well as prevent changes or modifications needed from being made.

2.6.4 Expand An Existing Facility

Expanding an existing facility can involve aspects of both constructing a new building and renovating an existing building. If an existing facility is to be expanded by adding an adding a new addition, the adequacy of the existing MEP systems need to be evaluated to determine if they are adequate for the proposed addition or if additional capacity needs to be added. Also, the possible requirement that the existing building be upgraded in whole or part to meet current code requirements as a result of the addition needs to be explored.

2.6.5 Need To Explore The Options

Even if the planning team has a preferred option at this time, it should still explore other alternatives because often the state, other authorizing authorities, and funding sources will want to know that other alternatives were considered and why they were not chosen over the preferred alternative. This is especially true when the proposed school project involves the construction of a new school facility that will result in abandoning existing facilities. The various alternatives for meeting the school needs identified should be documented along with the reasons for not considering them further even if it is obvious to the planning team.

2.6.6 Existing Facility Impact

If any of the options result in buildings that will be abandoned as a result of the proposed school project, the disposal or alternate use of these buildings needs to be noted and addressed as part of the proposed project plan.

2.7 STEP #5: DEVELOP CONCEPTUAL COST ESTIMATES

2.7.1 Need For Conceptual Cost Estimates

Conceptual cost estimates need to be developed as part of the planning process for each alternative the planning team is considering. An estimate is nothing more than a prediction of the probable cost of completing the project. Cost estimates play an important role in the decision process that leads to selecting a particular alternative and obtaining funding for the project. In general, the detail and accuracy of cost estimates increase as the project progresses from concept to completion. However, it is not possible to develop each viable alternative to the point that a detailed estimate can be made. In addition, the planning team cannot wait until the design is nearly complete before doing a detailed cost estimate to begin seeking project funding. Therefore, the planning team must rely on conceptual cost estimates to select among alternatives and obtain project financing.

2.7.2 Generating Conceptual Cost Estimates

The goal of a conceptual estimate is to predict the final cost of the completed school construction project based on limited and incomplete information. Even though very little information is available about a particular alternative, it is possible to generate a reasonably accurate conceptual cost estimate based on the preliminary information developed in the needs assessment.

Despite the fact that no two schools appear the same, schools with similar educational objectives are similar in design and construction. Therefore, a reasonable conceptual estimate for a school project can be developed using historical data available locally, statewide, and nationally.

2.7.3 Conceptual Cost Estimate Components

The conceptual cost estimate needs to include all aspects of the project in order to ensure that the estimate is as accurate as possible. In general, the conceptual cost estimate needs to address the following project elements:

- Land Acquisition
- Site Development
- Construction
- Equipment & Furnishings
- Disposal Of Abandoned Buildings
- Planning & Design Fees
- Financing
- Allowances & Contingencies

2.7.4 Who Should Generate The Conceptual Cost Estimate?

The accuracy of the conceptual cost estimate will be a function of the detail in which the project is analyzed, the availability of detailed historical cost data, and the expertise of the person preparing the estimate. Estimating, especially conceptual cost estimating, is more of an art than a science. It is very important that the planning team have an experienced estimator doing the conceptual cost estimate based on the needs assessment. The construction manager can provide the needed expertise and will typically have detailed cost data from previous construction projects, access to data bases and other publicly available cost information, access to material and equipment suppliers and specialty contractors, as well as experience in actually constructing school facilities. A conceptual cost estimate by an experienced construction manager can greatly reduce to owner's risk of financing and budget problems during construction.

2.7.5 Operating Cost Estimate

In addition to developing a conceptual cost estimate for the construction of the proposed school facility, a cost estimate for operating the facility should also be developed. An operating cost estimate is sometimes required by the state or other authorizing authority to determine the impact of the proposed school project on annual operation and maintenance budgets. The operating cost estimate for the proposed school project should address the cost of additional administrative staff, faculty, and support staff; facility operation; and ongoing facility maintenance and upkeep.

2.8 STEP #6: SELECT AN ALTERNATIVE

Given the review of the alternatives, the planning team should select a preferred alternative. This alternative may not be the "best" alternative but is preferred given the constraints. It is very important that the planning team document how the preferred alternative was selected and show how the selected alternative meets the educational objective and project needs.

2.9 STEP #7: DEVELOP THE EDUCATIONAL SPECIFICATION

The last step in the planning process should be the development of an educational specification or "ed spec" for a proposed school construction project by the planning team. The educational specification should summarize all the information developed in the previous six steps of the planning process for the preferred alternative. The educational specification should describe the owner's project needs and expectations as well as establish measurable performance criteria for the completed project. An educational specification is similar to an architect's program for a project and should be complete to the degree that the design team can use it as the basic document from which to design the facility. The educational specification will also serve as the basis for applying for permission to proceed with the proposed school project and requests for funding.

Organizing the Project — Section III

3.1 INTRODUCTION

There are a variety of ways that a school construction project can be organized to take it from concept to completion for the school owner. How a construction project is organized is often referred to in the construction industry as a "project delivery system." Deciding how a school construction project is going to be organized is an important second step in the school construction process. The reason that selecting a project delivery system is important and must be done early in the school construction process is that the project organization impacts all of the remaining school construction process steps. Often there is little thought given to selecting a project delivery system and it is just assumed that the new school project will be organized in the same way that past school construction projects have always been organized. This section will discuss some common project delivery systems that are used on school construction projects. There is no one right way to organize a school construction project and the school owner should consider alternatives and select the best alternative for a particular project.

3.2 WHAT IS A PROJECT DELIVERY SYSTEM?

A project delivery system defines how a school construction project will be organized in order to take it from the school owner's concept to physical reality. This organization needs to be matched to the school owner's in-house design and construction capabilities as well as the unique characteristics of the project itself. The way in which the project is organized will affect how efficiently and effectively it can be designed and built.

Unlike most business organizations, organizations formed to design and build construction projects are temporary. In most cases, the owner, designers, and constructors come together to complete a construction project and then after it is complete disband and go their separate ways. In fact, most of the people and organizations that are involved in a construction project are not involved through the entire design and construction process. Specialty consultants perform their portion of the design and then move on to another projects and specialty contractors move on and off the construction site as required by the construction sequence. In addition, people within the organizations change throughout the project because different expertise is needed in the various project phases, people get involved in other projects, or leave the organization.

Project delivery systems are very important in construction because they provide a common framework that people and organizations associated with the construction project understand and can work within. A project delivery system assigns authority and responsibilities to people and organizations as well as defines the relationship between them. These responsibilities, authorities, and relationships are typically defined in the contract documents that provide the blueprint for the project delivery system.

3.3 PROJECT DELIVERY SYSTEM CATEGORIES

3.3.1 Project Delivery System Categories

There are a number of project delivery systems that are used on construction projects today.

However, these project delivery systems can be grouped into the following two categories:

- Construction Manager/General Contractor
- Design-Build

The following paragraphs will briefly describe each of these project delivery system categories and the more common project delivery systems that fall into each category. A more detailed discussion of each of the individual project delivery systems is included throughout the remainder of this section.

3.3.2 Construction Manager/General Contractor

The construction manager/general contractor (CM/GC) category includes a number of project delivery systems that are commonly used on school construction projects. Project delivery systems that fall into this category require that the school owner contract directly and separately with both the designer and the general contractor to complete the project. The two most common project delivery systems that fall into this category are the following:

- Design-Bid-Build
- Construction Manager At Risk

The major difference between the design-bid-build (DBB) and construction manager at risk (CM@Risk) is when and how the general contractor is typically brought into the project delivery process. With design-bid-build project delivery, the design team completes the design first and then the school owner contracts with the general contractor to build the project based on that design. With design-bid-build, the general contractor is selected based on low price through a competitive bidding process.

When using the construction manager at risk project delivery system, the general contractor is often referred to as the construction manager. The general contractor is usually selected by the school owner based on qualifications or "best value" that addresses both qualifications and price. Typically, the general contractor is involved in the school construction project during project planning and design. In addition to being responsible for constructing the school project, the general contractor also assists the school owner and its design team throughout the planning and design process. During the planning and design process, the general contractor can provide valuable input and assistance regarding cost, schedule, and construction issues.

3.3.3 Design Build

The design-build project delivery system only requires the school owner to contract with one entity for both the design and construction of the school project. The entity that the school district contracts with on a design-build project is referred to as the design-builder. Typically, the design-builder will be a general contractor on a design-build school construction project. However, the design-builder could also be an architect, developer, or other entity. Like a construction manager, the design-builder can be selected by the school owner based on qualifications, price, or "best value" that addresses both qualifications and price.

3.3.4 Selection Methods

Selection Methods. Common methods for selecting a construction manager/general contractor or design-builder were mentioned for each of the project delivery systems discussed above. The selection process is important and can have a major impact on determining which project delivery system is appropriate for a particular school project. It is recommended that the selection method be determined at the same time that the project delivery system is selected. The three basic methods that can be used for selecting a construction manager/general contractor or design-builder are as follows:

- Price-Based Selection
- Qualifications-Based Selection
- "Best Value" Selection

Price-Based Selection. The construction manager/general contractor or design-builder can be selected based solely on low price for the project scope of work. Price-based selection is typically accomplished through a bidding process although selection based on low price can also be done through negotiation. Pure price-based selection is used on design-bid-build to select a general contractor based on low bid. Price-based selection can also be used to select a design-builder for a design-build project. However, selecting a design-builder based on low bid can be very risky for the school owner because the project is not well defined at the point when a design-builder is selected and the school owner may not get the project it wants. The most common method for selecting a general contractor for a public design-bid-build school construction project is price-based selection using a competitive bidding process.

Qualifications-Based Selection. With qualifications-based selection, the construction manager/general contractor or design-builder is selected solely on the qualifications to perform the work. Qualifications-based selection can consider a number of factors such as past experience on similar types of school construction projects as well as the expertise and capabilities of the project team. Qualifications-based selection usually involves a negotiated price for the construction of the school project and may not be able to be used on a public school construction project. Qualifications-based selection is most often used in the selection of a construction manager/general contractor for a project using construction manager at risk and in some cases when it is allowed, selection of a design-builder. However, qualifications-based selection can also be used to select a general contractor when it is allowed after the school project design is completed instead of bidding the project and selecting the general contractor with the lowest bid as is typically done in design-bid-build. For CM at Risk, if fees and/or general contractor are considered as selection criteria, most still agree that it is a quality-based selection.

"Best Value" Selection. "Best value" selection is any selection process where the successful construction manager/general contractor or design-builder is selected based on both price (total construction cost) and qualifications. Using "best value" the school owner weighs each competing firm's price and qualifications and makes a selection. For a design-build project, the conceptual design of the school would also be a major factor in the selection process. The school owner should determine what qualifications or design criteria are most important to it and establish an evaluation method based on it that factors in price. This method should then be applied equally to all construction managers/general contractors or design-builders competing for the project so that the selection process is both logical and fair. "Best Value" selection is most often used to select a construction manager/general contractor for a construction manager at risk or design-build project which requires serv-

ices beyond constructing the school project in accordance with construction documents prepared independently by the design team. "Best Value" can be used on public school construction projects as long as the selection process meets the requirements of the state and other approving authorities.

3.4 DESIGN-BID-BUILD PROJECT DELIVERY

3.4.1 Design-Bid-Build Project Delivery

Figure III-1 illustrates the design-bid-build project delivery system. Design-bid-build is probably the most common project delivery system used today for school construction. Under this project delivery system, the school owner contracts separately with both an architect and general contractor to get the project completed. The school owner first contracts with the architect to perform the design. Once the design is complete, the school owner typically puts the project out to bid to either a select or open list of qualified general contractors.

3.4.2 Design-Bid-Build Process

The first step in the design-bid-build process is for the school owner to contract directly with the architect for the design. The architect gathers information which includes the educational specification from the school owner and designs the project. The school owner has an opportunity to review the design as it develops to ensure that the design will meet its needs and expectations.

After the design is complete, the school owner then puts the project out to bid. Award is made based on the lowest price because all general contractors bidding on the project should be qualified to build the project and all requirements should be defined in the drawings and specifications. Since all general contractors are bidding on the same requirements, then the only difference between bidders should be their ability to manage the project and their businesses efficiently. Therefore, the school owner receives the lowest possible price to build the project through the bidding process, knows exactly what the finished project will look like, and knows the cost of the project before the first shovel of dirt is turned.

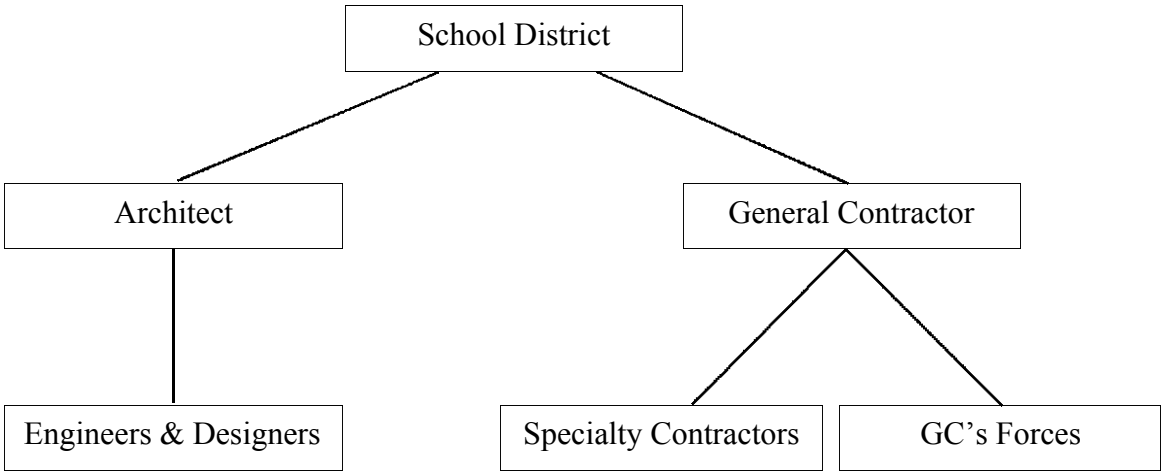

Figure III-1
Design-Bid-Build
Project Delivery System

3.4.3 Design-Bid-Build Concerns

While there are advantages to using design-bid-build on a school construction project, there are also some things that the school owner should consider about design-bid-build. For one, the design is done by the architect and its engineering subconsultants without input from the general contractor and its specialty subcontractors that will ultimately build the project. Once the design is complete, it is often very difficult to make changes in materials, equipment, and systems. Changes early in the design process are often easy to make and can result in reduced construction costs because they are less expensive, result in more efficient installation, or have better availability than what was specified. In addition, different materials, equipment, and systems may also reduce the school owner's operation and maintenance costs over the life of the school as well. Further, having construction expertise involved throughout the design process can help the school owner and the design team stay on track with budget and schedule.

Another disadvantage is that the design-bid-build process is sequential. First the design is completed, then the project is bid and the lowest responsible bidder is selected, after that a contract for construction is executed, and lastly the constructor begins work on the project. This sequential process takes time and is slower in delivering the project than some other project delivery systems. This schedule issue is particularly important when the school owner needs the completed project as soon as possible.

Another consideration is that the school owner has separate contracts with both the architect and the general contractor. There is no direct contract between the architect and general contractor as shown in Figure III-1. As a result, problems with the design that are discovered during construction can place the school owner in the middle between the architect and general contractor because the owner holds separate contracts with both the architect and general contractor. Resolving design problems can slow construction and result in delayed project completion and increased costs for the school owner. Similarly, if the project does not function as planned after completion, the school owner may also find itself caught in the middle between architect and general contractor which can be costly in terms of time and money.

3.4.4 Recommendations For Making Design-Bid-Build Work Well

School projects are successfully completed every day using design-bid-build. It is generally believed that design-bid-build results in the lowest construction cost through the bidding process as long as the scope of the project is well defined and few if any changes occur after design is complete and the construction contract awarded. However, as noted above, there are risks and trade offs in using design-bid-build that the school owner should consider. For the most part, the risks associated with design-bid-build can be mitigated by the school owner as follows:

- **Architect Selection.** Select a qualified architect that not only has experience in school construction but also has experience in the local construction market where the project is being built. When selecting an architect, interview not only the architect but also other school owners that the architect has worked for, the general contractors that completed the school projects designed, and those that use and maintain the completed school facilities.

- **Architect's Subconsultants.** Once the architect has been selected, request a list of engineering and design subconsultants that the architect plans to use on the project. Today's schools are becoming increasingly complex as more and more educational technology is installed and environmental systems become more important. The school owner should make sure that the architect's preferred engineering and design subconsultants have experience in school construction and understand the unique challenges presented by it.

- **Architect's Fees.** When negotiating the design fee, the school owner needs to understand that the quality of the design is a critical success factor in any school construction project. Good design takes time and will save the school owner money both in construction costs and facility operation and maintenance costs. The school owner should work with the architect to define the scope of design services it needs which includes construction and start up services and then negotiate a reasonable fee for those services.

- **General Contractor Prequalification.** To the extent possible, general contractors should be prequalified before being invited to bid on the school project. Prequalification should consider more than just size and financial stability. General contractors should be screened to ensure that they have the necessary experience and expertise to manage the project and have a track record of successful projects and satisfied owners.

If the school owner does not have the in-house construction expertise to monitor the project's budget and schedule during the design phase or review the design for constructability, then it may want to consider a different project delivery system. Specifically, retaining a construction manager to advise the school owner and its design team throughout the design process and during construction may be a good alternative for the school owner as discussed in Section 3.8. The next section will discuss the use of a construction manager at risk project delivery system that the school owner may want to consider.

3.5 CONSTRUCTION MANAGER AT RISK

3.5.1 Construction Manager At Risk Project Delivery

Construction management is a broad term covering a variety of project delivery methods that all include a construction manager as part of the project team to oversee scheduling, cost control, constructability, project management, building technology, bidding or negotiating construction contracts, and construction. While the term implies the management of construction only, construction managers may also assist the school owner during the planning and design phase of the school construction process. Construction management is appropriate for school construction projects that are relatively complex, require close monitoring of budget and schedule, can benefit from the input of the construction manager during design, or those that require extensive coordination of consultants and specialty contractors.

The construction manager at risk project delivery system is illustrated in Figure III-2. The construction manager is brought in at the beginning of the project as the owner's advisor and, like the general contractor in Figure III-1, the construction manager contracts with and coordinates the specialty contractors. The school owner can contract with the construction manager based on a fixed fee, percent of construction cost, or percent of construction cost with a guaranteed maximum price.

With design-bid-build, the general contractor does not get involved with the project until after the design is complete and the owner either puts the project out to bid or contacts the general contractor to negotiate the work. As a result, the school owner is forced to rely on the architect for pre-bid cost estimates and scheduling. The architect's expertise is typically not in material and equipment procurement or construction means and methods. Input to the design process by a knowledgeable construction manager can be very valuable to the school owner during the design process. Constructability reviews and value analyses coupled with ongoing budget and schedule reviews by a construction manager could result in better material and equipment selection, increased construction efficiency, and lower life-cycle costs for the project.

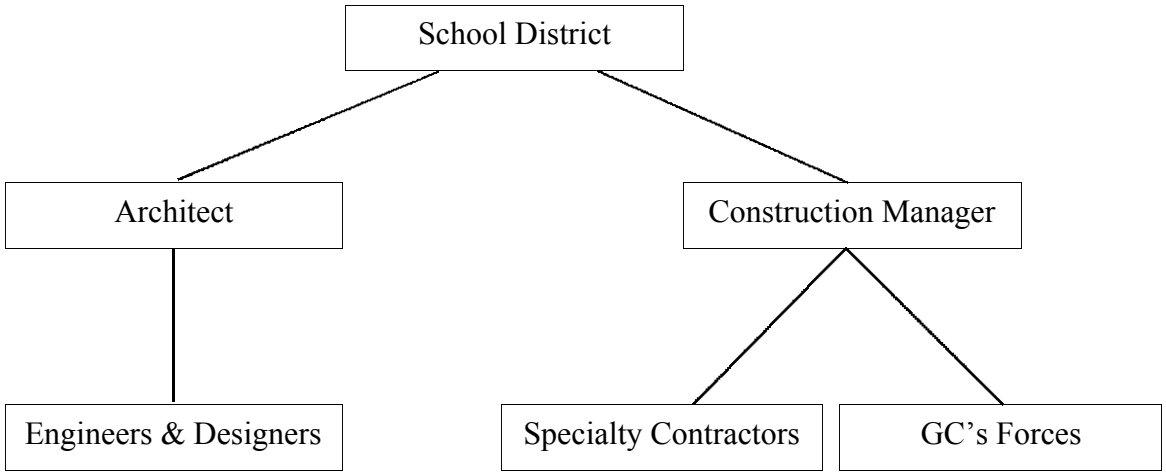

Figure III-2
Construction Manager—At Risk
Project Delivery System

3.5.2 Construction Manager At Risk Process

If the school owner decides to use the construction manager at risk project delivery system, the first step is to select and retain either the architect or construction manager. It is up to the school owner as to whether it wants to retain the architect or construction manager first. However, in most cases the architect will be retained first because of the need to have the architect involved in the planning process. No matter which is selected first, that entity should be involved in the selection of the other entity. The reason for this is that for this project delivery system to work well, the owner, architect, and construction manager must work well together as a team.

During the deign process, the construction manager will review the design on an ongoing basis to ensure that the school project can be built within budget and schedule. The construction manager will also provide input to the architect regarding constructability or how efficiently the project can be built which effects both project costs and schedule. Both the architect and construction manager should also perform ongoing value analyses to identify ways in which the design can meet the school owner's needs and expectations at a lower cost using alternate designs and materials.

Once the design is complete, the construction manager contracts with needed specialty contractors and begins work. The construction manager is responsible for completing the project on schedule and in accordance with the plans and specifications prepared by the architect and its design consultants. During the construction process, the construction manager at risk operates very similar to a general contractor on a design-bid-build project.

3.5.3 Construction Manager At Risk Concerns

It can be very advantageous to have a construction manager involved as a construction advisor throughout the planning and design process and then responsible for project construction. However, there are some things that the school owner should consider before adopting construction manager at risk as the project delivery system for its school construction process.

One concern is that the school owner probably will not know the total cost of the project until after the start of construction. This differs from design-bid-build where the total construction cost is established in the contract with the general contractor before construction begins. The reason for this is that the construction manager is involved with the project during the planning and design stage and it is too risky to give the school owner a fixed price for construction until after all specialty contractor and supplier contracts have been finalized. Instead, the construction manager and owner often agree on a guaranteed maximum price for construction to cap the school owner's risk plus a fee for the construction manager. The construction manager then works to complete the project for a cost less than the guaranteed maximum price for the school owner.

Another concern is that for this project delivery system to work, the school owner, architect, and construction manager must work as a team. Both the architect and construction manager must understand their respective roles during the planning and design process as well as respect the other's role. Both have different knowledge and expertise that is needed to ensure a successful project outcome and must work together to deliver a school facility that meets the school owner's needs and can be built within budget and on schedule.

Lastly, the school owner should realize that with the construction manager at risk project delivery system it has separate contracts with the architect and construction manager. Like design-bid-build, there is no direct contract between the architect and construction manager. As a result, the school owner may find itself in the middle of disagreements between the architect and construction manager during the planning and design process. Due to their respective roles in the process, the architect and construction manager may find that they have conflicting objectives which may need to be resolved by the school owner. For instance, the school owner may

have directed the architect to provide a certain level of finishes in the building that are in conflict with the project budget established by the school owner that the construction manager is responsible for staying within. In addition, design problems discovered during construction as well as the failure of systems to perform as planned after occupancy can take time to resolve and require the school owner's involvement.

3.5.4 Recommendations For Making CM At Risk Work Well

Some recommendations for making construction manager at risk work well are as follows:

- **Construction Manager Selection.** The construction manager is a member of the project team and a consultant during the planning and design process on construction issues. Select the construction manager based on qualifications not competitively based on lowest fee.

- **Construction Manager Scope Of Work.** Fully understand the construction manager's proposed scope of work including responsibilities and services as well as fees prior to entering into the construction management agreement. Make sure that the construction manager's scope of work, responsibilities, and fees are fully described in the construction management agreement. Always use a standard contract agreement such as those published by the AGC as the basis for contracting with the construction manager and involve attorneys and other advisors if the standard agreement is modified.

- **Build A Team.** Make sure that the architect and construction manager can work as a team. If necessary, schedule team building or partnering sessions early in the project to build familiarity and understanding, open communication channels, and establish a common vision and set of objectives for the project.

If the school owner wants to avoid separate contracts with an architect and construction manager and would like one entity responsible for both design and construction, then it may want to consider design-build as an alternative to either the design-bid-build or construction manager at risk project delivery systems.

3.6 DESIGN-BUILD

3.6.1 Design-Build Overview

With design-build, only one organization is responsible for both the project design and construction. Under design-build, the school owner only has one contract for the complete delivery of the school project that includes both design and construction. The design-build project delivery system is illustrated in Figure III-3.

From Figure III-3, it can be seen that the school owner only needs to administer one contract for the school construction, renovation, or expansion project. In addition, there is one entity responsible for both design and construction and the school owner no longer finds itself between the architect and general contractor. This means that if there are design problems that impact construction,

it is the design-builder's responsibility to resolve them within the design-build team and the school owner does not have to get involved. Further, if the performance of the building systems do not meet the measurable performance criteria agreed to at the beginning of the project, it is not a question of whether it is a design or construction issue that the school owner needs to resolve. Instead it is again an issue that the design-builder needs to resolve within the design-build team and the school owner does not need to be involved. The only time that the school owner should be faced with a change order on a design-build project is if it makes a change to the agreed to project criteria or if the design-builder encounters conditions beyond its control that it could not have reasonably anticipated at the beginning of the project.

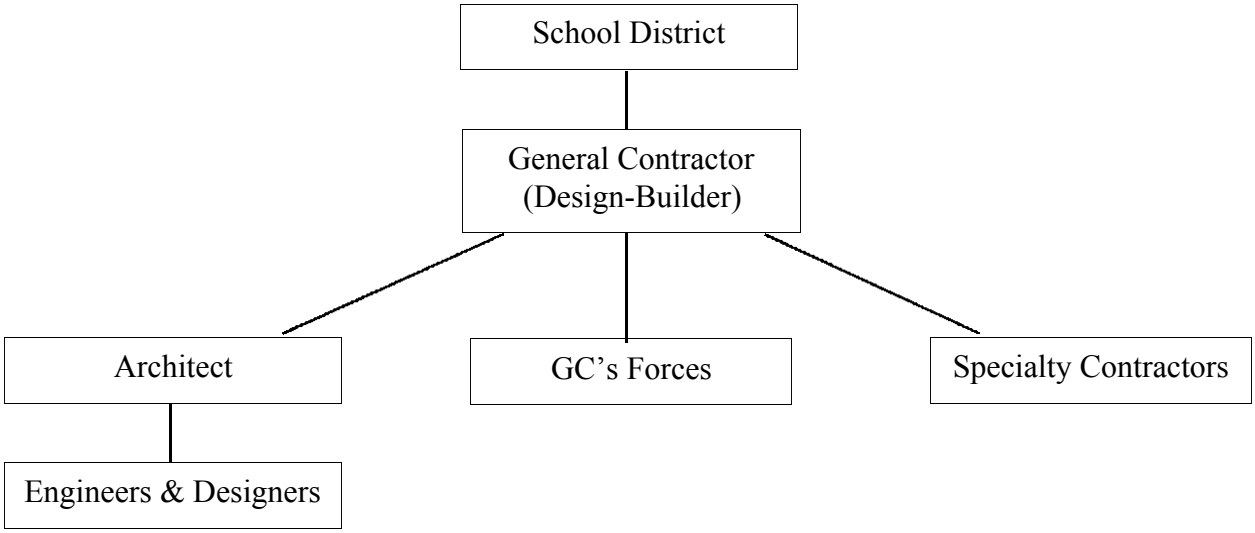

Figure III-3
Design Build
(GC as Design Builder)
Project Delivery System

As a result of the designers and constructors all working together on the same team on a design-build project, the school owner also gets the advantage of construction expertise throughout the design process and design expertise throughout the construction process. Similar to construction management at risk, having designers and constructors working together as a team can result in shorter construction schedules and increased construction value for the school owner. In addition, with design build the school owner only has one contract to manage which reduces the school owner's administrative burden and makes project management from the school owner's viewpoint much simpler. However, the burden of defining and verifying the quality on the project, particularly during construction, may require the school owner to consider hiring additional resources to supplement their own. Typically, this is the role the architect fills on a design-bid-build project.

3.6.2 Design-Build Organizations

The lead organization on a design-build project is typically referred to as the design-builder. On commercial and institutional construction projects, the design-builder is typically a general con-

tractor who takes responsibility for overall project delivery and retains an architect to do the design. Engineering is either performed by specialty contractors and suppliers with in-house design capabilities, subcontracted to outside consulting engineers, or a combination of both. The design-builder could also be an architect or other private entity such as a developer that either has the necessary in-house expertise to design and construct the school facility or subcontracts all or part of the needed design and construction expertise. If the school owner decides to use design-build on a school project it should make sure that the design-build organization has the necessary expertise, experience, and financial capability to successfully complete the school construction project.

3.6.3 One-Stage Design-Build Process

Under the one-stage design-build process, the school owner selects a design-builder to take the school construction project from inception to completion. The design-builder can be selected based on low price, qualifications, or a combination of both. Often the selection of a design-builder involves a request for qualifications (RFQ), request for proposals (RFP), shortlisting, interviews, and evaluations to select the design-builder for the school construction project. Once selected, the design-builder begins design and construction of the school project.

3.6.4 Two-Stage Design-Build Process

Public design-build projects are often completed using a two-stage process. The first stage involves selecting a qualified design-builder based on qualifications as well as projected total project cost. The selected design-builder works with the school owner to define its needs and expectations if it hasn't adequately defined them in its educational specification, establish measurable performance objectives for the completed project, and then take the design to a predetermined point. At this point, the design-builder has the opportunity to reconfirm its original projected project cost and schedule for the project and the school owner has the opportunity to evaluate the design to date.

If both the design-builder and school owner find that they are in agreement at the end of this first stage, they can negotiate and execute a contract for the second stage that involves completing the design and construction the project. If the design-builder and school owner do not want to proceed together with the completion of the project, the school owner pays the design-builder for work performed to date and then can use the design documents developed to date to negotiate with another design-builder or bid the design out with multiple design-builders for completion.

3.6.5 Design-Build Concerns

In addition to procurement laws and regulations that may prohibit the use of design-build on publicly funded school projects there are other considerations that the school owner should consider and address before attempting to use design-build on a school construction project. A very important consideration is professional and contractor licensing laws in the state where the project will be built. The school owner needs to make sure that state licensing and procurement laws will allow design-build and, if they will, make sure that the design-builder's organizational structure meets the requirements.

A big concern for school owners considering design build is whether or not they will get the school facility they expect or not at the price they have been promised. The design-builder prepares its proposal based on the project criteria provided by the school owner and a lot of the details have not been defined at the time that the design-builder is selected and a contract to build the facility is executed. This is different than design-bid-build and construction manager at risk where the design is typically complete before construction starts and the school owner knows exactly what it is getting. The school owner needs to realize that if it makes changes during design and construction that are beyond the original project criteria, the design-builder may be due a change order and additional money and time to accommodate the change in criteria.

Additionally, selecting a design-builder based solely on price can increase the school owner's risks because true design build is a team effort. Competitively bidding a design-build project to multiple design-builders who in turn bid it to multiple designers, specialty contractors, and suppliers can result in scope conflict and confusion regarding project requirements. Competitive bidding works best with design-bid-build project delivery because the project requirements are defined in detail and all general contractors are bidding on the same requirements. With design-build, project requirements are not fully defined when the design-builder is selected and low price may not provide the school facility that the school owner ultimately wants or needs. Competitively bidding a design-build project and award based on low price should be used with caution and only under the direction of someone experienced with this approach.

Selecting a design-builder is typically better if it is based solely on qualifications or a combination of qualifications and price. Unfortunately, public procurement laws and regulations often make it difficult if not impossible to select a design-builder on other than pure price competition in the public sector. If this is the case, a two-stage procurement process that first addresses design and then construction can sometimes overcome the obstacles to design build on publicly funded projects. In any event, before embarking on a design-build project be sure that procurement laws and regulations as well as designer and contractor licensing laws will allow you to use the design-build project delivery system on the school construction project.

3.6.6 Recommendations For Making Design-Build Work Well

Recommendations for making design-build work well for the school construction project include the following:

- **Project Criteria.** Detailed project criteria establishing the scope and requirements of the school construction project needs to be set prior to requesting proposals from design-builders. The project criteria need to be in greater detail than the educational specification developed in the project planning stage. In addition to establishing the general requirements for the school facility, the project criteria needs to address the school owner's preferred materials and equipment, desired systems, operation and maintenance (O&M) expectations, among other details. If the school owner does not have in-house design expertise that not only can define but also effectively communicate project criteria then it should retain an outside architect to develop the project criteria. Defining measurable project criteria that establishes the school owner's needs and expectations and can be used to determine if the design-builder met those needs and expectations is the key to design-build project success.

- **Design-Builder Expertise.** Design-build project delivery requires that the design-builder be able to manage design as well as construction. There may be no qualified design-builders in the area where the project is being constructed and the project may be to small to make it attractive or feasible for experienced design-builders to come in from outside areas to do the work. If this is the case, the school owner should reconsider the decision to use the design-build project delivery system.

- **School Owner Involvement.** The school owner needs to stay involved throughout the design and construction process. The agreement between the school owner and design-builder should provide for regular design reviews as well as schedule and budget updates from the design-builder. If the school owner lacks the expertise to participate in these design reviews or monitor quality during construction then it should consider retaining an outside consultant to assist it during construction.

- **Design-Builder Selection.** If allowed by law, select a design builder based on "best value" not solely on price. Know what designers and specialty contractors, and suppliers will be working with the design-builder and how much experience they have had working together on design-build projects. Whenever possible, hire a design-build team that has worked together in the past and not a design-builder that procures needed design and specialty construction firms based solely on price.

3.6.7 Design-Build Variations

There a number of variations that the school owner may want to consider if it can and wants to use design-build on a school construction project. The term "turnkey" is often used interchangeably with the term "design-build" but typically turnkey construction includes the acquisition of land for the project as well as the design and construction of the project. Therefore, the school owner can have the design-builder purchase and supply the land as well as design and construct the building.

In addition, the school owner can contract out not only the design and construction of the school but also the school's operation and maintenance for a predetermined period of time. The school owner can lease the building as well as the land if it is not owned by the school owner the way private corporations lease buildings they use. This would be a form of school privatization where the school owner uses the building for a predetermined lease period and at the end of the lease the building either reverts back to the entity leasing the building to the school owner or the school owner itself. When the school owner takes ownership of the school building at the end of the lease period it is sometimes referred to as build-operate-transfer (BOT).

If the school owner is considering using one of these design-build alternatives that involve long-term financial commitments, it should work closely with its financial advisors to analyze the advantages and disadvantages of such an arrangement. The school owner should also work with its financial advisors to draft the request for proposal for such an arrangement and the proposed agreement.

3.7 FAST-TRACK CONSTRUCTION

Fast track construction is not a project delivery system itself but a method for reducing the time required to take a project from concept to completion. Fast track can be used with any of the project delivery systems discussed in this section. In essence all fast tracking does is overlap the design and construction phases of the school construction project. This allows construction to start before design is complete and throughout the project both design and construction activities are carried out simultaneously. With fast-track construction, the project is designed based on identifiable systems and bid by system. These identifiable systems are typically referred to as "packages" and are bid to contractors that specialize in that work.

The advantage of fast tracking a project is that the overall project schedule is significantly reduced because design and construction are carried out concurrently on a fast track project and sequentially on a traditional design-bid-build project. The disadvantage of fast track construction is that construction begins on the project before the design is complete. As a result, assumptions made when designing one part of the project may not be valid as later parts of the project are designed. Fast track construction, by its very nature, often results in coordination problems because design is not complete before the construction starts.

Sometimes the school owner will need a new or renovated school facility as soon as possible and outside the normal planning process. Often this occurs as a result of the sudden loss of a school facility due to fire, flood, or other unanticipated disaster. Fast-track works very well with the construction manager at risk and design build project delivery systems and avoids some of the risks that the school owner may face attempting to fast track a school construction project. With construction management at risk and design-build project delivery, both design and construction can be carried out as a team effort with increased communication. Fast track takes advantage of having the designer and contractor working together rather than as separate entities.

3.8 CONSTRUCTION CONSULTANT

3.8.1 Construction Consultant

The school owner can also retain the services of a construction consultant to assist it with the successful completion of the school construction project. The construction consultant will usually be a construction manager or general contractor that can assist the school owner throughout the school construction process. If a general contractor were chosen for this role, it would be different than the general contractor responsible for the construction. The scope and involvement of the construction consultant will depend on the project and the needs of the school owner. The construction consultant can be involved only during the preconstruction phase of the project or throughout the entire project including planning, design, construction, and commissioning.

3.8.2 Construction Manager-Agency

The construction consultant is often referred to as a construction manager but is really an advi-

sor to the school owner and assumes no risk for project delivery. The assumption of risk is the difference between a construction manager/general contractor working as a construction consultant or a construction manager at risk which is actually a project delivery system as discussed earlier. As a result, involving a construction consultant to assist the school owner with the construction process is usually referred to as construction manager – agency. There are two construction manger – agency variations and these variations are as follows:

- Owner Holds Multiple Prime Contracts
- General Contractor Holds Specialty Contracts

Each of these variations will be discussed in the following paragraphs.

3.8.3 Construction Manager-Agency: Owner Holds Prime Contracts

The construction manager-agency arrangement where the owner holds separate prime contracts is illustrated in Figure III-4. With this project delivery system, the construction manager is retained by the school owner to provide input throughout the design process. The construction manager also develops cost estimates and schedules to ensure that project can be completed within the school owner's budget and on time as designed by the architect. During construction, the construction manager continues to provide input to the owner as well as coordinating construction activities. Under this project delivery system, the school owner contracts directly with all specialty contractors. Instead of paying the general contactor's markup, the school owner pays the construction manager a fee which is either a percentage of the construction cost, a fixed fee, or a percentage of the construction cost up to a guaranteed maximum amount.

The disadvantage of this project delivery system for the school owner is that it ends up holding all of the specialty construction contracts. Even though it is the construction manager's responsibility to help the school owner manage the contracts, the school owner is ultimately responsible to the various specialty contractors for project coordination and scheduling. In addition, the school owner is still contractually in the middle between the architect, construction manager, and specialty contractors as shown in Figure III-4.

The school owner can reap the benefits of this project delivery system and reduce its risks by selecting a qualified construction manager with expertise in school construction and the capability of managing multiple prime contracts. When selecting a project manager, make sure that the project manager has a thorough knowledge of the local construction market; has the expertise to provide input during the design process to improve facility constructability, value, and operations and maintenance; and has the ability to prepare realistic budget estimates and schedules for the project.

If the school owner is not comfortable with holding multiple specialty contracts and assuming ultimate responsibility for their coordination but still wants the advantages of a contraction manager, it can use a variation of this arrangement and select a general contractor to manage the construction process as discussed in the next section.

3.8.4 Construction Manager-Agency: GC Holds Specialty Contracts

In order to reduce the school owner's risk in contracting with and coordinating multiple specialty contractors, a general contractor can be included as shown in Figure III-5. Under this arrangement, the school owner has a construction manager that advises it throughout the design and construction process as well as a general contractor that is responsible for contracting with and coordinating specialty contractors throughout the construction process. The construction manager's scope of work is the same during the design process as it is in the previous arrangement but it is greatly reduced during the construction process with the general contractor coordinating day-to-day construction operations.

This variation of the construction management project delivery system provides the school owner with the same advantages as the previous variation without having to hold and coordinate all of the specialty contracts. In addition, once the design is complete it can be bid to multiple general contractors and the cost of the project is known before construction begins. However, reducing risk typically results in increased cost and this project delivery system is no exception. The school owner is now paying both a construction manager and general contractor which will probably increase the cost of the project. The project organization has become more complex with the construction manager and general contractor both attempting to fulfill essentially the same role for the school owner. The school owner needs to decide if the assistance provided by the construction manager along with the reduced risk provided by the general contractor is worth the increased project cost. If not, the school owner may want to consider using the construction manager at risk project delivery system as discussed in Section 3.5.

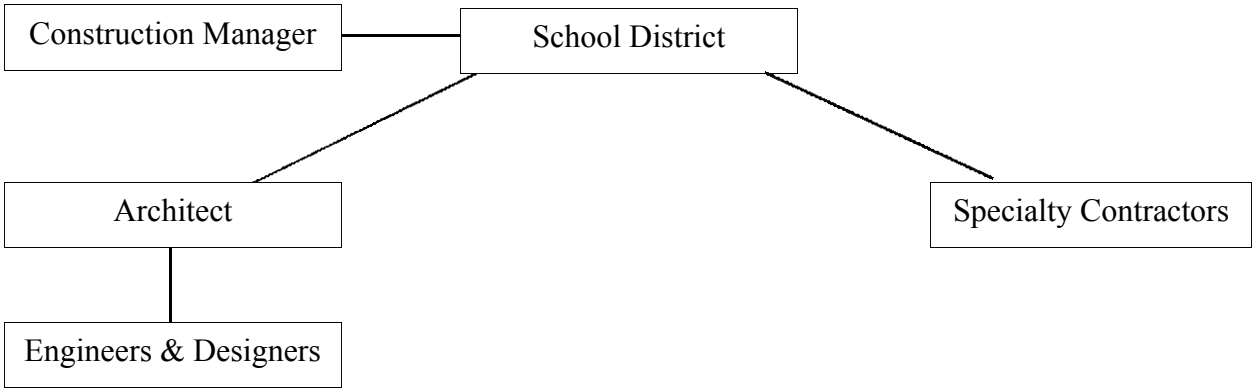

Figure III-4
Construction Manager—Agency
(Owner Holds Separate Prime Contracts)

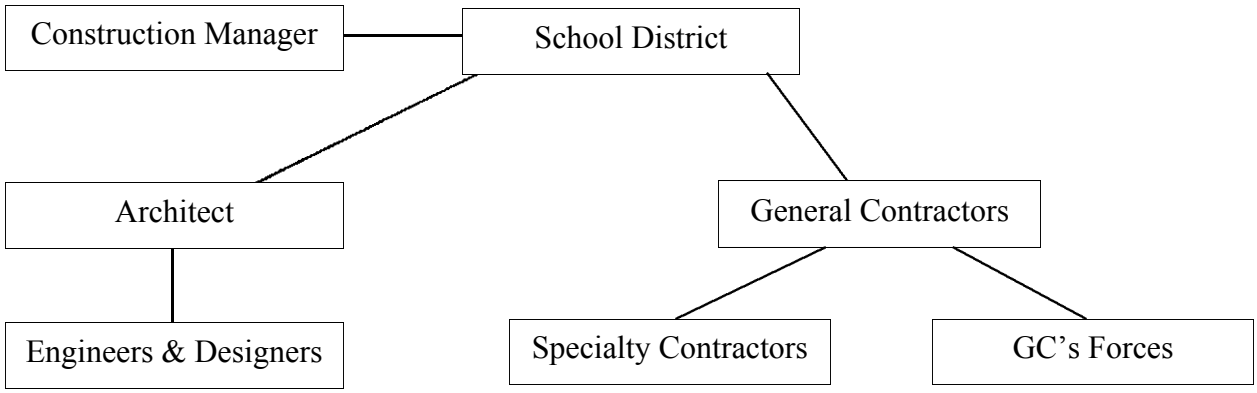

Figure III-5
Construction Manager—Agency
(GC Holds Specialty Contracts)

3.8.5 Program Manager

A construction consultant may be referred to as a program manager when the construction manager/general contractor is advising the school owner on a multi-project program that involves the construction, renovation, and expansion of a number of school facilities. A program manager is essentially a variation on the construction manager-agency arrangement where the construction manager is advising the owner on several projects instead of just one. Like construction manager-agency, the program manager only advises the school owner and does not assume any risk for coordination, schedule, or budget. The program manager's fee can be based a time and expenses, a percentage of the construction cost, a fixed fee, or a percentage of the construction cost up to a guaranteed maximum amount.

3.9 SELECTING A PROJECT DELIVERY SYSTEM

Selecting a project delivery system is an important decision because it impacts how the remainder of the project will be carried out. The school owner should consider the advantages and disadvantages of each project delivery system paying particularly close attention to the risks involved. There is no one right or wrong project delivery system. Each project is unique and the project delivery system should be tailored to the specific school construction project as well as the capabilities of the school owner.

4.1 INTRODUCTION

The requirements of the school construction project were established by the planning team and documented in the educational specification. The educational specification should identify the type, size, and characteristics of the school construction project and include space estimates for needed buildings, playground and athletic facilities, parking and access roads, among other things. Using this information, the planning team next needs to review its siting options for meeting the educational specification requirements. In general, there are three options for siting the project that include:

- Acquire A New Site For A New Facility
- Renovate An Existing Facility
- Expand An Existing Facility

All three options should be considered when planning a school construction project even though the preference may be to build a new facility. The reason for considering all three options is that the planning team might discover that renovating or expanding an existing facility is more cost effective, timely, and easier than constructing a completely new facility. In addition, when applying for financing, the public or private entity considering financing the project as well as others that might be impacted by the school financing may want to know that all options were considered and why one option was selected over others.

4.2 NEW SITE ACQUISITION

4.2.1 Site Selection Process

The site selection process involves the following ten steps:

- Step #1: Establish Site Selection Criteria
- Step #2: Identify Potential Sites
- Step #3: Determine Suitability
- Step #4: Analyze Infrastructure
- Step #5: Investigate Site
- Step #6: Determine "All-In" Site Cost
- Step #7: Select Preferred Site
- Step #8: Develop Site Plan
- Step #9: Get Site Approved
- Step #10: Acquire Rights To Site

4.2.2 Step #1: Establish Site Selection Criteria

Based on the educational specification, the site requirements for the planned school construction project need to be determined. These site requirements will serve as the basis for identifying and evaluating potential sites. In fact, the planning team should use the site requirements both as a checklist when identifying potential sites and as an evaluation tool when selecting the preferred site.

Site evaluation criteria should be more than just the physical size and anticipated cost of the potential site. Evaluation criteria should address all the site related issues that the planning team has identified as important to the success of the school construction project. For example, it might be desired to locate the school in a neighborhood setting to promote engagement between the neighborhood and school as well as minimize bussing which would impact site evaluation criteria. Among other project-specific considerations, the evaluation criteria should include the following:

- Shape and topography of the site.
- Proximity of the site to highways, airports, and railroads.
- Nearness to streams, rivers, ponds, lakes, marshes, and other waterways.
- Availability of adjacent land for future expansion.
- Other factors identified by the planning team that could impact construction cost or the suitability of the site for its intended use.

As an aid to selecting the preferred site and also for use in justifying the site selected to others, the planning team can develop a site selection scorecard with points assigned to each criterion and rules for assigning points. A site selection scorecard will make screening potential sites easier and more efficient as well as provide a more objective basis for selecting the preferred site.

The criteria for selecting the preferred site can be divided into required and preferred criteria. Required criteria must be met and would include things like the minimum amount of land that would be acceptable for the project. Preferred criteria do not necessarily need to be met but are desired and can be used to distinguish between potential sites that meet the required criteria. An example of a preferred criterion might be adjacent land available for future expansion.

The planning team should establish a minimum number and maximum number of potential sites that it will consider. Unless the project site has already been selected, the planning team should identify at least two potential sites for consideration even if there is a preferred and an alternate. The reason for this is that site selection and acquisition takes time and the project could be delayed if the preferred site is found to be unsuitable or suddenly unavailable for some reason and the entire siting process must be started over again. On the other hand, site analysis is expensive and not more than three potential sites should be identified for detailed analysis unless there is good reason for doing so. Setting a minimum and maximum number of sites that will be considered along with required and preferred selection criteria will expedite the siting process.

4.2.3 Step #2: Identify Potential Sites

Using the site selection parameters established in Step #1, the next step in siting the project is to identify potential sites for consideration. These potential sites must meet the required criteria established by the planning team as well as address some or all of the preferred criteria as well. The result of this step should be one or more potential project sites that will be analyzed in greater detail in the following steps of the site selection process.

Step #2 can be performed by the planning team as a whole or delegated to interested members of the planning team that comprise a site selection team. In either case, outside consultants will typically be required to provide both needed expertise as well as an independent third party perspective. Among others, these outside consultants can include the following:

- Architect
- Civil Engineer
- Real Estate Agent
- Construction Manager

Each of these consultants provides special expertise needed to develop a short list of potential sites as well as assist in the detailed analysis of each site as discussed in the following steps. These consultants may be an individual retained by the planning team for the site selection and acquisition process but more likely will be a firm that includes individuals that have in depth knowledge associated with specific areas of interest. For instance, the civil engineering firm may have surveyors as well as site designers.

The architect will typically be the architectural firm that was retained to do the design of the school building and facilities. It is important that the architect is involved in the site selection process because the site will impact the layout of the facility as well as the design of the building. Surrounding property and conditions as well as building codes and zoning could impact the design and significantly increase the cost of construction on one site compared to another.

Expertise in site analysis and development is needed when identifying potential sites and that is what the civil engineer provides. The civil engineer will not only look at the topography and layout of the site to determine what earthwork needs to be performed but will also take a preliminary look at soil and subsurface conditions that can significantly impact the cost of construction. In addition, the civil engineer can perform a preliminary review of the adequacy of access roads, utilities, storm water run off and containment, environmental issues, among other things.

A real estate agent is also needed if it is anticipated that one or more parcels of land will need to be purchased for the school project. This real estate agent can assist in the identification of potential sites by locating available sites, researching property values and recent real estate activity in the area, appraising the market value of the property, and discussing the availability of property not currently on the market with property owners. The real estate agent can provide a preliminary assessment of the availability and practicality of acquiring potential project sites.

The construction manager can assist by reviewing potential sites for constructability as well as providing a preliminary cost estimate for site improvements which include demolition of existing surface and subsurface structures, earthwork, utility relocations, and site improvements based on the educational specification and civil engineer's preliminary analysis. In addition, the construction manager can identify any site-related work or constraints that would impact the construction schedule.

4.2.4 Step #3: Determine Suitability

In step #2, only enough information was gathered about potential sites to develop a short list of sites. In this step, a more in-depth review of the short-listed sites will be made. The purpose of this review is to further ascertain the suitability of the sites from the standpoint of availability for acquisition, constraints such as zoning, etc. This step can be performed concurrently with the analysis of infrastructure in Step #4 and the site investigation in Step #5 but should be completed as soon as possible because if a short-listed site is not suitable it should be dropped from consideration as soon as possible.

4.2.5 Step #4: Analyze Infrastructure

The infrastructure for each potential site needs to be analyzed to determine if it will support the proposed school project. This includes a review of the availability of emergency services such as fire, police, and ambulance services. Infrastructure analysis should include the adequacy of streets and roads that provide access to the school. In addition, the availability of needed utilities also needs to be considered which include:

- Electricity
- Natural Gas
- Water For Drinking & Fire Suppression
- Sanitary & Storm Sewers
- Telecommunications

If adequate infrastructure is not readily available for the school construction project then the cost of providing the needed infrastructure needs to be estimated or obtained from the serving utility and included in the "all in" cost of the site. In a remote area, the cost of providing some or all of these services on site may need to be estimated. When comparing the cost of providing the service on site versus the cost of having it provided by a local utility, the cost of operating and maintaining the service over the life of the facility needs to be factored into the decision process.

4.2.6 Step #5: Investigate Site

The physical condition of each potential project site also needs to be investigated to identify potential problems as well as providing a basis for determining an accurate "all-in" cost estimate for the site in Step #6. The following is a list of things that can seriously impact the suitability

of the site for a school project as well as the project cost and schedule:

- Site History
- Site Environmental Constraints
- Site Boundaries & Elevations
- Easements For Utilities & Public Infrastructure
- Underground Tanks & Structures
- Above Ground Structures & Vegetation
- Hazardous Materials Or Conditions
- Soil & Subsurface Conditions
- Other Factors

Site History. It is very important the history of potential sites be investigated as part of the siting process. The investigation into site history can be conducted by talking to long-time residents in the area as well as searching public records regarding the site. For instance, construction could be delayed or halted if it is found that the site has historical significance. Similarly, if the site was once a landfill or dump there may be hazardous materials buried there or deposits of methane gas.

Site Environmental Constraints. Environmental constraints can also seriously delay or even halt the school construction project. Prior to proceeding with site selection and acquisition, any environmental constraints that would impact the school project need to be identified and addressed. These include not only protected plants and wildlife on the site but also the impact that the school project might have on adjacent land.

Site Boundaries & Elevations. A survey of the short-listed sites should be performed to determine the exact layout and boundaries of the site as well as ownership. In addition, the location of all existing underground and overhead utilities should be identified as part of this survey. This survey should result in the development of a site map or "plot plan."

Easements For Utilities & Public Infrastructure. The location of utility easements as well as any easements for any future public development such as the widening of adjacent streets or underground storm and sewer drains should be identified. These easements should be included on the site map that was developed as part of the site survey.

Underground Tanks & Structures. The existence, location, and extent of any underground tanks or structures need to be identified as part of the site investigation. Underground tanks need to be located and their composition and contents should be analyzed to determine if it is hazardous or not. Underground tanks should be removed or appropriately marked and abandoned in place if they are not hazardous and will not interfere with construction. Similarly, abandoned foundations, tunnels, basements and other structures can delay construction and are very expensive and time consuming to remove. If it is determined to leave them in place then a review needs to be made to determine what impact if any the abandoned underground structures will have on new facility design and construction.

Above Ground Structures & Vegetation. Any existing above ground structure located on site needs to be inspected to determine how difficult it will be to remove it for construction. Similarly, vegetation such as trees need to be reviewed to determine how difficult it will be to clear the site and dispose of the removed vegetation. In addition, mature trees that will be kept need to be identified so that they can be protected during construction.

Hazardous Materials Or Conditions. The site needs to be checked for hazardous materials or conditions. These materials or conditions may be found during the review of the site history or the review of underground tanks and structures. These hazardous materials or conditions need to be mitigated by the current owner prior to acquisition of the land for the school project. Failure to identify these conditions prior to construction may result in increased construction costs and delays.

Soil & Subsurface Conditions. Soil and subsurface conditions also need to be investigated at this time. Soil type can impact foundation and construction costs. Similarly, if there is a great deal of rock the cost of excavation will probably increase considerably for that site.

Other Factors. Any other factors that impact the ability to build and use the site for its intended use should be investigated at this time. For instance, in a rural area where a potential site is surrounded by farm land there may be concern that rain runoff from fields that cross school property contains fertilizers, pesticides, or other chemicals.

4.2.7 Step #6: Determine "All In" Site Cost

Using the information developed about the sites under consideration, the next step is to develop the "all-in" cost for the sites. A cost for acquiring and developing each site needs to be prepared for the purpose of comparing the short-listed sites. The site cost estimate should include not only the anticipated cost of purchasing the site but also costs that are required to make the site ready for its intended use. These costs might include grading or the removal of subsurface structures.

At this point in the evaluation, the only site improvement costs that need to be included are those that are unique to each site. These costs would include the anticipated purchase price and site preparation costs including grading and the installation of underground utilities. Construction costs that will be the same for each site do not need to be included at this time because they should not impact the selection of the preferred site. For example, the cost of the school building does not need to be included in the "all in" site cost if it is the same for all sites under consideration. However, if the foundations or building construction will be significantly different for one site versus another then these cost differences need to be factored into the analysis.

4.2.8 Step #7: Select Preferred Site

Using the site selection criteria developed in Step #1, a preferred site should be selected from those short listed in Step #2 of the site selection process using the information developed in Steps #3 through #6. Site selection will be very straight forward if a site selection scorecard has been developed and those making the site selection rank the potential sites based on total points awarded to each site. However, even if a site selection scorecard is used to select the preferred site, those responsible for selecting the preferred site should review the sites to make sure there are no other factors that have emerged during the site selection process that would change the selection criteria or impact the selection of the preferred site.

4.2.9 Step #8: Develop Site Selection Report

A report that summarizes the site selection process, reasons for selecting the preferred site, and includes all supporting documentation should be prepared for use in getting the site approved by an outside entity, assistance in obtaining financing, working with public officials regarding zoning and other land issues, and as a source of information during design. This report can include an updated site plan that includes the location and orientation of the planned school building and associated infrastructure based on the site survey and other information developed in Step #5.

4.2.10 Step #9: Get Site Approved

If site approval is required for the planned school construction project by an outside entity such as the state or federal government, then the planning team needs to obtain approval prior to acquiring rights to the preferred site.

4.2.11 Step #10: Acquire Rights To Site

Once the site has been approved, the process of acquiring the site can begin. Acquisition can be anything from outright purchase of the site by the owner to obtaining the option to purchase the property at a stated price pending school project funding approval.

4.3 EXISTING FACILITY RENOVATION

4.3.1 Existing Facility Renovation

Renovation involves the upgrading of an existing facility within its current structure and does not include any physical expansion such as adding a new addition to the existing school building. The process for determining the feasibility of renovating an existing school facility to meet the needs expressed in the educational specification is not as involved as acquiring a new site. However, it is very important that the existing facility be thoroughly analyzed to determine if it is physically and economically possible to renovate it. The review of an existing school facility for renovation should include the following as a minimum:

- Review Building & Infrastructure Physical Condition
- Assess The Potential For Hazardous Materials
- Determine Code Compliance
- Investigate Adequacy Of Existing Building Systems
- Define Occupancy Requirements During Renovation

The following paragraphs will discuss each of these considerations. In general, qualified outside consultants should be used by the planning team to conduct the analyses required to determine the suitability of an existing facility for renovation.

4.3.2 Review Building & Infrastructure Physical Condition

The physical condition of the school building and its associated infrastructure needs to be reviewed to determine its current condition and repair or replacement needs. The school building's structural system should be thoroughly reviewed to determine its condition and adequacy for its intended use. Similarly, the exterior building envelope including walls, windows, roof, and other elements should be thoroughly inspected to determine current condition and any repair or replacement work that needs to be performed as part of the renovation. Exterior infrastructure such as athletic fields and playgrounds, roads and parking lots, and landscaping also needs to be reviewed to determine its condition and needed repairs. At the completion of this review, a report should be prepared documenting the school facility's physical condition and the estimated cost of needed repairs.

4.3.3 Assess The Potential For Hazardous Materials

The potential for encountering hazardous materials during the renovation process needs to be assessed because removing or otherwise encapsulating hazardous materials can significantly impact the cost of the renovation project. Hazardous materials found in older buildings can include a variety of materials, such as asbestos, as well as other materials defined as hazardous under applicable federal and state laws. A report should be prepared documenting the findings of the hazardous material investigation including the estimated cost of removing or encapsulating any hazardous materials found.

4.3.4 Determine Code Compliance

Depending on the extent of the required renovation and the authority having jurisdiction, the existing facility may or may not need to be upgraded to meet current building code requirements. This is very important because bringing an existing building into compliance with current building codes can be very expensive and may even be impossible in some instances. The first thing that needs to be determined is to what extent the local authority having jurisdiction will require the renovated building to meet current codes. Often this depends on the estimated cost of the renovation in relation to the appraised value of the building rather than the changes actually being made. Above a certain percentage the entire building typically needs to be upgraded to meet current building codes rather than just the areas being renovated.

Upgrading to meet current building codes can include retrofitting seismic bracing into the existing structure, installation of fire suppression systems, upgrading life safety and security systems, emergency power and lighting, adding means of egress which could include widening interior hallways or adding exterior fire escapes, expansion of restroom facilities, and addressing the requirements of the Americans with Disabilities Act (ADA) which could include upgrading accessibility both inside and outside, among other things. At the completion of the code review, a report should be prepared along with an estimated cost for the required upgrades. In addition, any discussions with the local authority having jurisdiction regarding code compliance issues should be documented and included in the report because completion of a school renovation project takes time and code enforcement personnel sometimes change during the course of a project.

4.3.5 Investigate Adequacy Of Existing Building Systems

The adequacy of existing building systems needs to be investigated when considering a school renovation project to ensure that the existing building systems are adequate to support the intended use of the renovated facility. This includes the electric power distribution system; heating, ventilation, and air conditioning (HVAC) system; plumbing system; and telecommunication system. Schools built today must be able to support the educational technologies of tomorrow. This means that the electric power distribution system within the renovated school building must be able to reliably support computer and other sensitive electronic loads. The HVAC system must be adequate to provide a comfortable learning environment that includes indoor air quality considerations and the increased cooling load presented by information technology equipment. Also, the school building needs an up to date telecommunications infrastructure that includes structured cabling system and high-speed Internet access.

In addition to adequacy, the age and condition of the school building's mechanical, electrical, and plumbing (MEP) systems need to be evaluated. Even if the existing MEP systems are adequate, they may not be reliable or energy efficient. As part of investigating the adequacy of existing building systems, the building maintenance and operating costs need to be considered to determine if the systems are economical or need to be replaced. In addition, equipment like boilers should be inspected and tested for safety as part of the evaluation of existing building systems.

A report detailing the adequacy and condition of building systems needs to be prepared that identifies what system upgrades, repairs, and replacements need to be included in the renovation project along with an estimated cost for this work.

4.3.6 Define Occupancy Requirements During Renovation

If the school facility needs to remain in operation during all or part of the renovation project, this needs to be taken into account. Working in an occupied building often requires additional safety measures and slows construction because the sequencing of work is often determined by occupants' needs and schedules rather than the construction sequence. As a result, occupancy requirements and schedules need to be defined and noted in the construction contract documents. Renovation of an occupied building will typically take longer and cost more than work in an unoccupied building and this needs to be estimated and included when comparing alternatives.

4.4 EXISTING FACILITY EXPANSION

Analyzing the feasibility of expanding an existing facility includes elements of both acquiring a new site and renovating an existing facility. The amount of investigation required depends on whether the facility expansion will require the acquisition of adjacent land or not. However, whether new land is acquired or not, many of the same analyses required for new site acquisition need to be performed for a facility expansion to determine what will be required and what site improvements will cost. In addition, if the new addition will physically tie into the existing school building most of the analyses required for a building renovation will also need to be performed. Most importantly, this includes an analysis of the adequacy of the existing building systems to support the expanded facility.

FUNDING THE PROJECT SECTION V

5.1 INTRODUCTION

Obtaining the necessary funding for the school construction project is a complex undertaking and vital to project realization. Without the necessary funds, the proposed project will not become reality. Using the planning and site information developed in previous steps, funding sources can be identified and a realistic project budget needs to be developed for the proposed project. Next a funding strategy needs to be developed for obtaining needed funding not provided by grants from the Federal and state governments or other sources. Implementation of the funding strategy should result in obtaining the balance of the needed funds for the project which will allow the project to move to detailed design which is the next step in the school construction process.

This section will provide an overview of the funding process for the proposed school project as well as discuss alternatives to project ownership. It should be noted that while obtaining the necessary funds for the school project is presented as Step 4 in the school construction process, the funding process actually starts during the planning stages of the project. Ideally, the planning of the project would be completed to the detail described in Steps 1 through 3 of the school construction process but often this is not possible. Many times the school owner will need funds to complete the planning process so the funding process may actually be completed prior to completion of detailed project planning.

5.2 PROJECT FUNDING PROCESS

The project funding process for a school construction project can be broken down into the following six steps:

- Step #1: Assemble The Funding Team
- Step #2: Identify Potential Funding Sources
- Step #3: Prepare A Project Budget
- Step #4: Determine Funding Eligibility
- Step #5: Develop A Funding Strategy
- Step #6: Obtain Necessary Funding

5.3 STEP#1: ASSEMBLE THE FUNDING TEAM

5.3.1 Funding Team Composition

The first step in funding a project is to assemble a funding team. The funding team can consist of the entire planning team or be delegated to interested members of the planning team that make up the funding team. The owner's in-house or outside legal counsel should be part of the funding team as well as representatives from the owner's in-house accounting and finance functions. In addition to members of the planning team, outside consultants will usually be required to assist in securing funding for the proposed school project.

5.3.2 Outside Consultants

Among others, the funding team should include the following outside consultants:

- Architect
- General Contractor
- Financial Advisor

The following paragraphs will discuss the services that each of these consultants can provide during the funding process.

5.3.3 Architect

The architect played an important role in the project planning process which included assisting in the preparation of the educational specification, development of a preliminary facility plan on which the conceptual cost estimate was based, and assisted in the evaluation and selection of the project site. During the funding process, the architect can continue to assist the planning team and its outside consultants in a variety of ways. Among other services, the architect can help further define the project design for funding purposes as well as make modifications to the design to meet funding eligibility requirements. The architect can also prepare preliminary building and site layouts, renderings, and models to illustrate the scope of the project and design. If needed, the architect can provide an opinion that the plan meets state and other authorizing authority project requirements as well as meet with community leaders and citizens to explain the design.

5.3.4 General Contractor

The general contractor prepared the conceptual cost estimate based on the educational program and architect's preliminary design during the planning process. The general contractor also assisted the project team in the identification and selection of the site for the project which included the development of site-specific development costs. During the funding process the general contractor can continue to refine the conceptual cost estimate that includes the project financing costs. The general contractor can also develop a preliminary project schedule that includes the funding process as well as the projected rate and timing of project expenditures for the financial advisor. The general contractor is also available to answer questions regarding the conceptual cost estimate or discuss the planned construction methods and sequence.

5.3.5 Financial Advisor

Financial Advisor. Depending on the owner and the planned source of funds for the proposed school project, the financial advisor may be one person or a team of financial professionals with different and needed expertise.

Public School Construction. Most public school construction is financed by issuing bonds. The school district is typically the issuer of the bonds and a team of financial professionals is

often required to issue the bonds and maintain them over their life. Among others, the following firms and individuals will be required for the bond issue:

- Bond Underwriter
- Bond Counsel
- Bond Registrar

The bond underwriter provides guidance to the school district concerning the structuring and marketing of the bond issue as well as information about bond rating, timing of the issue, bond issue fees, and anticipated net proceeds from the bond issue. In addition, the bond underwriter manages the bond issue which includes among other things the sale of the bonds either through competitive or direct placement. The bond counsel is an outside attorney retained by the school district that provides an opinion about the legality of the bond issue as well as whether or not the interest paid to bond holders is tax exempt. The bond registrar is responsible for making payments of interest and principle to bond holders in accordance with the terms and conditions of the bond issue over the life of the bonds.

Private School Construction. For a privately funded school project the financial advisor might be a fund-raising consultant that assists the owner putting together a fund-raising campaign, estimating the potential proceeds from the campaign, identifying possible key donors, and raising funds for the project.

5.3.6 Other Outside Consultants

Other outside consultants may need to be involved during the funding process. The civil engineer may need to be involved to provide an opinion regarding the selected site that addresses the suitability of the site, environmental issues, subsurface conditions, site development requirements or costs, among other things. The real estate professional that assisted in site selection may also need to be involved regarding the appraised value of the land and other issues. The planning team should engage other outside consultants to assist with project funding as required.

5.4 STEP #2: IDENTIFY POTENTIAL FUNDING SOURCES

5.4.1 Potential Funding Sources

Potential funding sources for the proposed school construction project include the following:

- Federal Funding
- State Funding
- Local Funding
- Private Funding

5.4.2 Federal Funding

Federal support for public school construction has traditionally been minor compared to state and local support. However, the availability of Federal funds to assist in the construction of school facilities for targeted communities or a particular aspect of a school facility should not be overlooked. For example, the Federal government does provide assistance for the construction of school facilities for Native American, military, and other Federally connected communities. Similarly, funds may be available from the Federal government to accommodate students with disabilities, special instructional programs, laboratory or shop equipment, or the incorporation of energy saving or production technologies into the school facility.

5.4.3 State Funding

State grants to school districts are a major source of funding for school construction, renovation, or expansion projects. Most states have a variety of grants available for different purposes and types of school construction projects. However, just because a grant is available does not mean the school district will receive it. In addition to availability, the school district must be eligible to receive a state grant. The amount of the state grant will also vary based on a number of factors including the wealth of the community that the proposed school project will serve. Finally, most states have more eligible projects than they have funding so projects are often prioritized by need and urgency which can delay state funding.

5.4.4 Local Funding

Local funding is required to make up the difference between the amount that the Federal and state will provide and the total cost of the public school construction project. For public school construction projects, this difference is usually obtained by the school district issuing bonds.

5.4.5 Private Funding

There are alternative methods of financing a proposed public school construction project that involve private funds. These alternative methods usually involve some form of long-term lease of facilities, improvements, or equipment to the school district. Under the right circumstances and if permitted by the state or other authority, long-term leasing can be a very attractive alternative for the school district.

5.5 STEP #3: PREPARE A PROJECT BUDGET

A preliminary project budget that includes all costs that are needed to complete the proposed project must to be developed by the planning team. This preliminary project budget must be reasonable because it will be the basis for determining the amount of project funding that will be required to complete the project. Too low of a budget will result in the proposed project being placed in jeopardy because it is under funded and too high of a budget and the project may appear too costly and not be funded. In addition, the preliminary budget should be broken down into sufficient detail so that costs eligible for certain types of funding or not allowed by other types of funding can be identified and addressed during the funding process. A realistic all-inclusive project budget is needed before proceeding with project funding.

Much of the work required to prepare a preliminary project budget for funding was done during the planning and site selection stages of the project. Developing a project budget for funding requires the planning team and its consultants to review the conceptual estimate in detail and revise it as required based on the latest information. During the planning phase, conceptual cost estimates were developed by the planning team and its consultants for the following:

- Land Acquisition
- Site Development
- Construction
- Equipment & Furnishings
- Disposal Of Abandoned Buildings
- Planning & Design Fees
- Financing
- Allowances & Contingencies
- Other Applicable Costs

During the site selection process, the estimate for land acquisition and site development became site specific and increased in accuracy. Similarly, the initial estimate for planning and design fees should be more accurate at this point since the planning team has determined how the project is going to be organized and delivered. Finally, construction costs as well as allowances and contingencies can be further refined because the project delivery system and site have been selected.

5.6 STEP #4: DETERMINE FUNDING ELIGIBILITY

Once potential state funding sources have been identified, the next step is to determine eligibility. Each state has different requirements for determining the eligibility of a proposed school construction project for state funding. Eligibility requirements can be based on population served, characteristics of the project, property wealth served by the school, or a variety of other factors. If the project is eligible for state funding, then the extent to which it is eligible for state funding needs to be determined. State grants normally do not cover the entire cost of a proposed school project. Usually there is a sliding percentage scale that determines the percentage of eligible project costs that will funded by the state. For example, the state may determine for a particular project that it will provide thirty-five percent of the new facility construction exclusive of land acquisition and development costs.

5.7 STEP #5: DEVELOP A FUNDING STRATEGY

Once the planning team knows how much funding it will receive from Federal, state, and other sources for the proposed project, it needs to develop a funding strategy for obtaining the remaining funds locally. In the above example, the state will fund thirty-five percent of the new facility exclusive of land acquisition and development costs. Additionally, assume that the Federal government will provide a grant that amounts to three percent of the new facility cost for a special instructional program. This means that the planning team will need to develop a funding strategy to obtain the

remaining sixty-two percent of the new facility cost plus land acquisition and development costs. For a public school project, the balance of funds needed for the project will usually be obtained from the issue of bonds.

5.8 FINANCING SCHOOL CONSTRUCTION WITH BONDS

5.8.1 Types Of Bonds

Borrowing alternatives to obtain the local share of needed financing for a public school construction project are usually restricted by the state or other authorizing authority. The local share of most public school construction projects is financed with bonds. There are a number of different types of bonds that are used to finance school construction. These various types of bonds are usually classified by the purpose to which the bond proceeds will be used. For example, there are building bonds for the construction of new facilities and fire and life safety bonds for the upgrade of existing facilities to current codes and standards. The types of bonds that can be issued for a particular project will vary from state to state and the planning team and its consultants need to determine the types of bonds available to finance a particular project and select the preferred alternative from those available.

5.8.2 Referendum Versus Non-Referendum Bond Financing

One important distinction between different sources of local funds is whether or not a particular mode of financing requires a voter referendum or not. A referendum involves submitting to popular vote an issue such as the construction of a new school that has already been approved by an elected or appointed authority like a school board. A referendum is usually required to construct a new public school or use certain types of financing for the project. Issuing bonds for school construction, renovation, or expansion by the school district typically requires a voter referendum. However, there are school construction projects that may not need a referendum for bond financing such as school building repair under a certain dollar amount. In cases where a bond referendum is not required the state board of education typically must approve the use of bonds for the stated purpose.

5.8.3 Bond Legal Requirements

State laws and regulations typically govern the issuance of bonds for public school construction. These laws and regulations need to be fully understood and adhered to by the school district for the bond issue to be legal. It is very important that the school district have an attorney to advise the school district as to whether a referendum is required or not. If a referendum is required, then the school district needs to know how it must be conducted. In addition, the school district should retain needed financial advisors such as an underwriter and bond counsel to advise the school district about arranging the bond issue and selling the bonds.

5.8.4 School District Debt Limit

School districts, like other public and private entities, have debt limits that can restrict or prevent them from issuing bonds and taking on more debt. The debt limits along with the method

of determining debt limits for the school district varies from state to state. The planning team with the help of its financial advisors needs to determine what its debt limit is and make sure that the planned bond issue will not exceed the debt limit.

5.8.5 Conducting A Bond Referendum

The procedure for conducting a bond referendum for the proposed public school project will be determined by state and local laws and regulations. Again, these specific requirements for conducting a bond referendum will vary from state to state and possibly from school district to school district within a state. The planning team and its outside consultants must be aware of the statutory requirements for conducting a bond referendum and adhere to them.

5.8.6 Bond Issue Schedule

Financing school construction with bonds takes time. This is especially true when a referendum is required to approve the use of bonds for the proposed school construction project. The planning team needs to be aware of the time required to obtain local bond financing for the project. The underwriter and the school district's attorney can develop a step-by-step plan for issuing the bonds that complies with applicable laws and regulations along with an estimated time for each step. The general contractor can build the time required to obtain local funding into the overall project schedule to provide a realistic estimate of project duration.

5.9 CHARTER SCHOOLS

A charter school is a semi-autonomous public school that is operated by parents, teachers, and/or other community members. The school operates under a "charter" or contract with the school district or state. The charter addresses things such as the school's mission, educational standards, curriculum, school governance, and facilities, among other things. Its charter and state law determines the degree of the charter school's autonomy. Whether charter schools are authorized as well as their definition and characteristics varies from state to state. However, due to their unique relationship with the state, charter schools may be able to take advantage of funding sources and methods that are not available for traditional public school construction projects.

5.10 STEP #6: OBTAIN NEEDED FINANCING

The final step in the project funding process is to implement the funding strategy and obtain the needed local funding. Local funding often requires passing a bond issue which is critical to moving ahead with the school construction project and typically requires a great deal of effort, energy, and time on the part of everyone involved in the project. It should be noted that state funding is usually contingent on the owner obtaining local funding for the balance of funds needed. Therefore, the school owner will usually not receive any state funds until local funding is in place.

5.11 ALTERNATIVES TO PROJECT OWNERSHIP

5.11.1 Ownership Alternatives

As mentioned previously, there are alternatives to the school operator financing and owning the proposed school facility. These alternatives eliminate the need for the school operator to obtain financing for the proposed facility. Instead, financing becomes the developer's responsibility and the school operator enters into a long-term lease agreement with the developer for the use of the facility. There are a number of possible alternatives to facility ownership which include the following:

- Sale Leaseback
- Build-Own-Lease
- Build-Operate-Transfer
- Build-Own-Operate

The following paragraphs will discuss each of these alternatives. If the planning team is considering these or other alternatives to project ownership, the ability and consequences of the school district entering into a long-term arrangement that does not involve school facility ownership needs to be investigated. This investigation needs to include an economic analysis that compares the alternative arrangement to traditional facility ownership in order to establish it as a viable and reasonable facility acquisition alternative. In addition, the planning team needs to determine if the alternatives being considered are legal or if implementation would require a change in state or local laws.

5.11.2 Sale-Leaseback Arrangement

Under a sale-leaseback arrangement, the owner and operator of a school facility sells the facility to another firm and then leases it back from that firm. The terms and conditions of the lease may require that the new owner make certain improvements to the facility and site as part of the terms and conditions of the long-term lease. The advantage of this arrangement for the original school facility owner converts an existing physical asset into cash. This influx of cash from the sale of an existing school facility can be used to provide needed operating funds for that facility, fund deferred and needed maintenance at other facilities, or provide funds for needed capital improvements at other facilities. The original owner benefits from any improvements made to the facility by the new owner and pays for those improvements through lease payments over the lease term. Under a sale-leaseback agreement there is no need for the school operator to obtain funding for the needed improvements.

5.11.3 Build & Lease Arrangement

A build and lease arrangement also eliminates the need for the school operator to obtain funding to construct the proposed school facility. With a build and lease arrangement, the school operator enters into a long-term lease with a private developer for the school facility. The school facility is financed and constructed by the developer in accordance with the educational speci-

fication and conceptual design developed in the planning stage of the project. The extent to which the school operator is responsible for maintenance of the buildings and property over the life of the lease is determined by the terms and conditions of the lease.

5.11.4 Build-Operate-Transfer Arrangement

With a build-operate-transfer (BOT) arrangement the school operator enters into an agreement with the developer not only to build the school project but also operate it for a specified period of time. In this case, the developer may be made up of a number of participating firms that may include a property management company. Over the period of time that the agreement is in effect, the school operator makes lease payments to the facility owner. At the end of a specified period, facility ownership changes from the original owner to the school operator. The terms and conditions of the ownership transfer as well as any payment that is required to accompany the transfer is determined by the BOT agreement between the school operator and the developer.

5.11.5 Build-Own-Operate Arrangement

Using a build-own-operate arrangement, the developer constructs the school facility to meet the requirements of the educational specification and conceptual design developed during the planning stage. The school operator leases the facility from the owner and the owner continues to own and operate the facility. At the end of the build-operate-own period the school facility reverts totally back to the developer. The advantage of a build-own-operate arrangement is that the school operator does not have to have a maintenance staff for the building nor does it need to be concerned about ongoing maintenance or budgeting for major repairs or replacements. If a school is no longer needed in the area at the end of the agreement, the school operator does not have to worry about disposing of the existing building since it is owned by the developer.

5.11.6 Other Alternatives

This section discussed a few alternatives to owning the school facility. The purpose of this discussion was to provide an idea of the possible alternatives to facility ownership that the planning team can consider. It should be noted that the terms and conditions of any of these alternatives are not fixed and are negotiable. The planning team should determine the type of arrangement that would be most advantageous to the school operator and then work with developers to determine the feasibility and cost of such an arrangement.

Designing the Project — Section VI

DESIGNING THE PROJECT SECTION VI

6.1 INTRODUCTION

With the educational specification complete, site selected, and a funding strategy in place, the design of the school project can begin. This section will cover the school design process starting with a discussion of the design team composition, specifying design services, and then selecting and contracting with a qualified design team to provide those services. The design process is then covered in detail followed by a discussion of the design team's role during construction as well as commissioning and closeout.

6.2 DESIGN TEAM COMPOSITION

6.2.1 Design Team Composition

A school project is a very complex undertaking and requires a number of design professionals from a variety of disciplines. These design professionals must operate as a team in order to ensure that the school owner's needs and expectations are met. The design team is usually made up of the following three categories of design professionals:

- Architects
- Engineers
- Specialty Consultants

The following paragraphs will describe the roles and responsibilities that each of these categories of design professionals plays in a school construction project.

6.2.2 Architects

Typically the architect is the lead design professional on a school construction project. The reason for this is that the architect has the expertise to develop the physical layout of the building and site based on the school owner's educational specification, perform preliminary code reviews, and select materials for the interior and exterior of the school building. In addition, state professional licensing laws often require that an architect be the lead design professional on any building project.

In this manual, the term architect will be used to refer to either an individual architect or an architectural design firm that the school owner has retained to design the school facility. In most cases, the school owner will retain an architectural design firm rather than a sole practitioner because of the complexity of school construction. The work involved in a school project normally requires more than a single designer to complete the design in a reasonable amount of time. In addition, school project design often requires several architects with complimentary skills as well as support personnel to complete the school design. Whether sole practitioner or firm, the architect must be registered in the state that the school construction project will be located.

As the lead design professional, the architect normally selects and retains the remainder of the design team. These include engineers and specialty consultants as well as other architects if specific architectural expertise is required that the lead architect does not have. Sometimes, the architectural firm will also have in-house engineers and specialty consultants so the number of outside engineers and specialty consultants that the architect must contract with is reduced. The architect is responsible for coordinating and managing the efforts of the design team throughout the school construction project.

The school owner may, alternatively, retain some or all of the engineers and specialty consultants directly. However, in doing so the school owner may find itself coordinating the design whether or not it wants to. The school owner should have good reasons for wanting to contract directly with engineers or specialty consultants. If the school owner has a particular engineer or specialty consultant that it wants on the project, it should make this known prior to contracting with the architect and ask that the architect retain the preferred engineer or specialty consultant directly as a subconsultant.

6.2.3 Engineers

There will be a variety of engineering disciplines involved in the school construction project. Among others, the following disciplines may be involved in the project:

Civil Responsible for the site layout and design. Designs underground drainage and sewer lines, is concerned about site drainage, and designs surface roads and parking lots.

Structural Responsible for designing the school building foundation and structure.

Electrical Responsible for the design of the building power distribution, lighting, communications, and fire alarm systems. In addition, responsible for the design of exterior lighting and power distribution, and underground electrical service.

Mechanical Responsible for the design of the heating, ventilating, and air conditioning (HVAC), HVAC controls, plumbing, and fire protection systems. Also responsible for the design of underground site piping including the water, gas, and fire water services to the building.

In addition to the above disciplines, a particular school construction project may require other engineering disciplines due to the complexity of the project or as a result of unique conditions. Among others, these more specialized disciplines could include geotechnical or fire protection engineers. Sole practitioners or consulting engineering firms must be registered as professional engineers in the state where the project is located.

Like the architect, consulting engineers can be retained as sole practitioners or as a firm if they are not members of an integrated architecture/engineering (A/E) firm. Due to the magnitude of work and the complexity of school construction projects it is common to use consulting engineering firms and not sole practitioners. The range of expertise offered by engineering firms varies around the country. It is not common to have a full-service engineering firm design a school construction project. It is more common to have separate civil/structural and mechanical/electrical/plumbing (MEP) firms involved with the project. However, in some parts of the country, the needed MEP design will be provided by two firms: an electrical firm and a mechanical/plumbing firm. Throughout this manual the term engineer will be used to denote either a member of an A/E firm, sole practitioner, or a consulting engineering firm.

6.2.4 Specialty Consultants

In addition to architects and engineers, there are often a number of specialty consultants involved in a school construction project. These specialty consultants may be architects or engineers by training but have chosen to focus on a particular building system or function. Specialty consultants are particularly important in school construction because the quality of the design impacts the ability of the school building to perform its function and support education. Specialty consultants can include interior design, acoustics, illumination, life safety and security, environmental, kitchen, communications, audiovisual, laboratory, data systems, among others. The complexity of the school construction project and the expertise of the primary architects and engineers involved will determine the need for specialty consultants.

While some specialty consultants may be professional architects or engineers, many will not be. Many of the industry groups that represent various specialty consultants, however, have certifications for their own specialties. The purpose of these certifications is to recognize those practitioners who have obtained a recognized level of expertise as defined by their peers. The school owner should encourage the architect to select specialty consultants that are certified in their particular specialties whenever possible.

6.3 SPECIFYING DESIGN SERVICES

6.3.1 Specifying Design Services

Before retaining a design team, the school owner should determine what design services it requires for the school construction project. These design services will vary depending on the particular school construction project and the expertise and availability of school owner personnel. The necessary design services will serve as the basis for the agreement between the school owner and the architect and are categorized as follows:

- Typical Design Services
- Additional Design Services

The following paragraphs will discuss these two categories of services.

6.3.2 Typical Design Services

Typical design services are those services that are usually required on any commercial or institutional building project. These services include the review of the owner's program or school owner's educational specification, design of the building, assistance in selecting the general contractor to build the project, periodic review of construction work in process at the site, and review of the completed work to assure that it is in accordance with the contract documents.

6.3.3 Additional Design Services

There are a variety of additional design services that the design team can provide as needed. These services can include developing the program or educational specification for the school owner, working with local building officials to solve unusual problems, construction of detailed models or mock-up of the building, performance of required studies and tests, providing an on-site representative during construction, preparation of record drawings after construction, among other services. When selecting a design team for a school project, the school owner should make sure that it understands what scope of services the design team must provide to the project.

6.4 SELECTING THE DESIGN TEAM

The design team can be selected in a variety of ways using a variety of criteria. Selection criteria can include the design team's project concept, qualifications, fee for design services, or any combination of these and other pertinent criteria. The selection process can be as complex as a design competition or as simple as negotiating a fee with the design team that the school owner has pre-selected. However the school owner decides to select its design team, it should decide on the criteria and process it will use. For public school construction projects, the design team selection process may be restricted by law. If there are multiple candidates, the selection criteria and process should be documented and provided to each candidate so that proposals can be focused to address the school owner's needs. The process should be fair, as simple as possible, and transparent.

6.5 DESIGN-SERVICE AGREEMENTS

6.5.1 Owner-Architect Agreement

The owner-architect agreement defines the relationship between the school owner and architect throughout the design and construction process. Some school owners and government agencies have their own agreement for design services that they use while others do not. If the school owner does not have its own agreement, it should consider using a standard design agreement published by a recognized construction industry group. These standard owner-architect agreements are developed by the sponsoring group and typically reviewed and accepted by other industry professional and trade organizations as well.

Both the American Institute of Architects (AIA) and the Associated General Contractors of America (AGC) publish families of standard agreements for each of the project delivery systems discussed in Section III. These documents include an owner-architect agreement tailored to the particular project delivery system. It is recommended that industry standard documents be used if at all possible. If appropriate, the school district should consult with legal counsel before choosing the documents to be used.

6.5.2 Subconsultant Agreements

Subconsultant agreements are those between the architect and other design team members for the performance of their portion of the design work on the project. The school owner does not have a direct contractual relationship with any of the architect's subconsultants. However, the school owner's agreement with the architect should require that the architect's subconsultants be bound to all applicable provisions of the owner-architect agreement such as insurance requirements and the ownership and use of work product. This is usually accomplished with a flow through clause in the owner-architect agreement.

6.6 DESIGN TEAM COMPENSATION

6.6.1 Compensation Methods

The design team's fee for services can be structured in a variety of ways. Typical ways of structuring the design fee for a school construction project include the following:

- Fixed Fee
- Hourly Rate Plus Expenses
- Percent Of Construction Cost
- Combination Of Methods

Fixed Fee. Establishing a fixed fee for the design and construction services is probably the simplest method of establishing compensation. The fixed fee can be set through a price competition involving competing design teams or through negotiation with the preferred design team. Even though the school owner may request a fixed fee from each design team competing for the project, it may end up negotiating to some extent with the preferred team because of changes in scope and services.

Hourly Rate Plus Expenses. The design team's fee can also be structured based on an hourly rate plus expenses. Under this method, the school owner is billed for time worked on the project by the design team. Billing is usually on a monthly basis. The design team provides the school owner with rate schedules that include the hourly rate for personnel or personnel classifications as well as the cost of reproduction and other services that the design team may provide. With an hourly rate plus expenses, the school owner only pays for the work performed and actual expenses incurred. However, auditing the design team's invoices on larger projects can become very cumbersome and tedious. An hourly rate plus expenses works best on small renovation or expansion projects that must be completed quickly and the number of design professionals involved is small. This method can also be used effectively when there is a need for additional design services beyond the originally agreed scope of services.

If the school owner decides to use an hourly rate plus expenses, it should establish a detailed scope of services with the design team as well as a guaranteed maximum price. The school owner should also make sure that overhead and profit is included in the hourly personnel rate quoted. In addition, the school owner and design team should agree on what expenses are reimbursable, the unit price for services such as copying and printing, how expenses will be accounted for and billed, as well as any markup the design team intends to include. Reimbursable expenses should be included in the guarantee maximum price.

Percent Of Construction Cost. Another common way of structuring the design team's design and construction fee is as a percent of the construction cost. The percent applied will need to be negotiated between the school owner and the design team and will vary from project to project and from one location to another. If the school owner elects to use the percent of construction cost then it should establish a guaranteed maximum design fee based on the estimated project cost plus a reasonable variance from this estimate. In addition, it should define what is included in the "construction cost," and establish an agreed to scope of services that the percentage of construction cost covers.

Combination Of Methods. Often a combination of the above methods is used on a school construction project. Design and construction services that are covered in the school owner's agreement with the design team are typically performed on either a fixed fee or percent of construction cost basis. However, there are always unexpected occurrences during design and construction that require further consideration of the design. When this occurs, the additional design work is often performed based on hourly rates plus expenses. The school owner should consider establishing hourly personnel and expense rates in its contract with the design team for small changes and additional work outside the anticipated project scope covered by the design agreement.

6.6.2 Progress Payments

The timing and method of making progress payments will also be established in the agreement between the school owner and the design team. The timing and amount of progress payments will vary depending on the fee structure used. Typically, the school owner will be billed monthly for progress during the previous month or based on some other set of milestones such as the completion of each stage of design. If the architect is the lead designer and other architects,

engineers, and specialty consultants are subconsultants to the architect then all progress payments made by the school owner should flow through the lead architect. On the other hand, if the school owner contracts separately with some members of the design team, it will need to negotiate progress payment schedules with these entities.

6.7 PROFESSIONAL LIABILITY INSURANCE

6.7.1 Need For Professional Liability Insurance

Professional liability insurance or what is often referred to as "errors and omissions" or "E&O" insurance addresses problems that may be attributed to errors and omissions in the design. Professional liability insurance protects the designer against liability arising from errors, omissions, and negligent acts during design. The designer's professional liability insurance also protects the school owner from losses that result from the designer's performance. Without insurance, the design firm may not have the financial ability to reimburse the school owner for losses it sustains as a result of the designer's negligence.

The school owner should consider requiring design team members whose work could result in significant exposure to carry professional liability insurance. This requirement for professional liability insurance should be defined in the owner-architect agreement and as well as key subconsultant agreements. In conjunction with its risk management or insurance consultants, the school owner should determine the coverage needed which includes the following:

- Type Of Professional Liability Insurance Required
- Minimum Claim & Maximum Deductible Amounts
- Any Time Limits On Coverage

6.7.2 Insurance Coverage Period

Coverage Period. Every insurance policy has a defined period that determines the time limits on the policy's coverage. Professional liability insurance is no different and it is often categorized by its coverage period as either a claims-made or occurrence-based insurance policy. If the school owner decides to require the design team to carry professional liability insurance, it should decide whether the coverage is to be claims-made or occurrence-based.

Claims-Made Coverage. Claims-made insurance policies insure against claims made during the active policy period. To be protected by a claims-made insurance policy, the designer's policy must be continuously in force from the time of the occurrence to the time of the claim. Claims-made insurance policies can be problematic for the construction process because the owner will have difficulty ensuring that the designer maintains continuous coverage after construction is completed.

Occurrence-Based Coverage. Occurrence-based insurance policies cover claims where the insured event occurred during the active policy period. With occurrence coverage, the right to protection under the insurance policy is determined by the point in time when the act or omission that caused the damage occurs. The insurance policy must have been in force at the time of the occur-

rence but the policy does not have to be in effect when the claim is made. For coverage under an occurrence-based policy, the policy need not be in effect when the claim is filed. An occurrence-based insurance policy in place during the project remains effective after the project has been completed for any claims that are covered and the cause of which occurred during project performance.

Hybrid Coverage. There are also hybrid policies that include characteristics of both the claims-made and occurrence-based policies. The period for a hybrid insurance policy sometimes requires that the occurrence take place during the active policy period and that the claim be made either during the active policy period or within a specified time period after the expiration of the insurance coverage.

6.7.3 Understand Professional Liability Coverage

Always review the terms and conditions of the professional liability coverage provided by designers to make sure that it meets the owner-designer contract requirements. This review should include coverage periods, deductibles, insurance limits, and other terms and conditions. For example, a professional liability insurance policy that includes a high deductible and/or a very low claim limit will not protect the school owner. Someone who understands professional liability insurance to mitigate the school owner's risk should perform this review.

6.8 DESIGN PROCESS

6.8.1 Design Process

The actual design process varies from project to project depending on project participants, size, and complexity. In general, however, the design process can be divided into the following five phases:

- Review Of Owner's "Ed Spec"
- Programming
- Schematic Design
- Design Development
- Construction Documents

All design progresses through these five phases whether it is performed by a single designer "on the back of an envelope" or by a team of design firms preparing the construction documents for a construction project. The only difference is whether the stages are explicitly identified and used for design milestones with deliverables and design reviews at the end of each phase or whether it is a continuous process that moves from programming to construction. In either case, understanding the design process in terms of these five phases will help the school owner better manage the design process. The following paragraphs will describe each of these phases.

6.8.2 Review Of Owner's "Ed Spec"

The first step in the design process is for the design team to review the educational specification for the project. If the educational specification is sufficiently detailed and comprehensive the design team can proceed with schematic design. If the educational specification is not complete or lacks detail, the design team will need to do additional project programming before starting design on all or part of the school project. Typically, programming is an additional service as discussed earlier.

6.8.3 Programming

If programming is required, the design team further defines the owner's needs and expectations based on the educational specification and other information gathered from the school owner. The design team should then translate these needs and expectations into measurable performance objectives that will serve as the basis for the design of the school project. At the end of this stage, the school owner should review the program to ensure that it meets its needs and expectations. In addition, a conceptual cost estimate and schedule should be developed for the project. The design team on traditional design-bid-build projects typically develops this conceptual cost estimate and schedule. However, if a construction manager is involved in the project then preparation of the conceptual estimate and schedule is usually part of the construction manager's scope of services. Similarly, on a design-build project the design-build team will perform conceptual estimating and scheduling.

6.8.4 Schematic Design

During the schematic design phase, the design team performs code reviews and any required studies or testing required to complete the design. The design team selects materials, equipment, and systems that will be used in the design and develops outline plans and specifications for the project in accordance with the program requirements.

At the end of the schematic design phase, the school owner should perform a design review that includes a constructabilitity review and value analysis. Constructability addresses the efficiency with which the building can be built. Value analysis, on the other hand, entails determining if the school owner's needs and requirements could be met using alternative materials, equipment, and systems at a lower cost. Constructability reviews and value analyses are most effective early in the design process. If the school owner does not have the in-house expertise to perform the design review, it should retain an individual or firm that can.

After completing the design review, the conceptual cost estimate and schedule should be updated to reflect the current status of the design. The school owner should approve the schematic design and revised budget and schedule before the design team begins design development.

6.8.5 Design Development

In this phase, the design team prepares more detailed plans and specifications that further define the project. Again, the school owner should perform a design review that includes both a constructabilitity review and value analysis. After completion of the design review, the project cost estimate and schedule should be updated based on the increased design detail. The design along with the updated cost estimate and schedule should be approved by the school owner before the design team begins the development of detailed construction documents.

6.8.6 Construction Documents

On traditional design-bid-build projects, the design team completes the design in sufficient detail that it can be bid and then built. On a design-build project the detail that the designer provides on a traditional design-bid-build project may not be required because the work is not competitively bid and both the architect and general contractor are working together as a team. In either case, the school owner should perform a design review that includes both a constructability review and value analysis. In addition, the project cost estimate and schedule should be updated to ensure that the project is still within the school owner's budget and will be completed when needed. The construction documents in conjunction with the updated budget and schedule should be approved by the school owner before they are put out for bid or used to start construction.

6.9 UNIQUE DESIGN CONSIDERATIONS

6.9.1 Unique Design Considerations

The design of a school presents some very unique design challenges that must be addressed by the design team. The physical environment in a school building must support learning and make it easy for students and teachers to interact. A poor physical environment is also a poor learning environment. There are a number of design considerations that contribute to student learning and need to be addressed in the design of a school facility. These design considerations include the following two important aspects of interior design and should be addressed in any school construction project:

- Lighting Quality
- Classroom Acoustics & Noise Control

6.9.2 Lighting Quality

Lighting quality is very important in schools and it is not just about light quantity. Most of what students do is visual and poor lighting quality can seriously impact their ability to learn. Lighting and lighting control systems in schools should be designed to support specific instructional media such as chalkboards, white boards, video, computer displays, and others. In addition, the function of the space should also be considered. Lighting requirements will be different for classrooms, auditoria, libraries, laboratories, study areas, gyms, and circulation spaces. Exterior lighting for security and safety as well as parking lots, sports, landscaping, and other applications should also be considered. Additionally, the operation and maintenance cost of the lighting system needs to be considered as part of lighting quality.

The Illuminating Engineering Society of North America (IESNA) publishes recommended practices for lighting educational facilities that should be considered in the design of a school. Two publications that should be considered in designing lighting systems for schools are:

- IESNA Lighting Handbook, 9th Edition, Chapter 12: Educational Facility Lighting.
- Lighting For Educational Facilities, ANSI/IESNA Rp-3-00.

6.9.3 Classroom Acoustics & Noise Control

Acoustics and noise control are as important as quality lighting in a school facility. Poor acoustics and lack of noise control can have a serious impact on the quality of education. The Acoustical Society of America (ASA) has two publications that should be considered in the design of classrooms:

- Acoustical Performance Criteria, Design Requirements, And Guidelines For Schools, ANSI S12.60-2002.
- Classroom Acoustics: A Resource For Creating Learning Environments With Desirable Listening Conditions, 2000.

6.10 INCORPORATING INFORMATION & EDUCATIONAL TECHNOLOGY

Today's schools are high-tech facilities that incorporate the latest in communications and computer technologies. Information and educational technology includes a variety of systems and equipment including wired and wireless local area networks (LAN), audiovisual equipment such as liquid crystal display (LCD) projectors and document cameras, closed circuit television (CCTV), sound systems, computer work stations, among many other technologies. In addition, today's schools are incorporating more are more security and life safety systems to protect students and teachers. The school owner and design team need to take this into account when designing a school facility.

As part of the educational specification prepared by the school owner or program prepared by the architect, there should be a comprehensive listing of the required information and education technology, where it will be located, and what building services will be required. Equipment rooms and closets should be identified, sufficient raceways and pathways need to be installed for structured cabling systems, and the electrical and mechanical systems need to be included to address the needs of the information and educational technology equipment. If the information and educational technology equipment is to be installed after completion of the base building by either school owner personnel or other firms contracting directly with the school owner, the school owner should make sure that the design is coordinated and the building is ready to receive the equipment when it arrives.

The design of the school facility should not only consider what information and educational technology will be included today but what technologies will be adopted in the future. The design should provide spaces for future equipment and pathways for future cabling as well as mechanical and electrical services for the anticipated equipment. Future proofing a school facility during the design process is typically much more economical than trying to retrofit the facility after the fact.

6.11 CONDUCTING DESIGN REVIEWS

6.11.1 Types Of Design Reviews

There are two types of design reviews that should be conducted during the design process. These design reviews are as follows:

- Design Team Reviews
- School Owner Design Reviews

6.11.2 Design Team Reviews

Internal design reviews should be scheduled by the architect and performed at regular intervals as required by the complexity and scope of the project. The architect should be responsible for organizing, performing, and documenting the results of these reviews. Internal design reviews should include members of the design team, key suppliers and manufacturers, outside specialists, contractors where appropriate, and others that are impacted by the design process. Internal design reviews should include not only a technical review of the design but also a review of the project schedule and budget. A constructability review and value analysis should be performed as part of each internal design review as well.

6.11.3 School Owner Design Reviews

School owner design reviews should be scheduled in accordance with the agreement between the owner and architect. School owner design reviews are a must. It is through these reviews that the school owner keeps informed of the design and its progress. School owner design reviews should be scheduled only after corresponding internal design reviews are completed and should involve representatives throughout the school owner's organization that are affected by the design. Comments received from the school owner during the review process must be incorporated into the design or responded to.

6.11.4 Design Review Components

The design review should include the following components:

- Compliance With Educational Specification
- Code Compliance
- Quality Of Design Documents
- Constructability
- Value Analysis
- Budget
- Schedule

Compliance With Educational Specification. The design review should ensure that the design meets the school owner's requirements as expressed in the educational specification. If the design cannot or does not meet the requirements set forth in the educational specification, it should be brought to the school owner's attention and a course of action agreed upon. In general, the school owner and architect can decide to modify the educational specification or change the design to comply with the educational specification.

Code Compliance. The design must comply with all applicable building codes. As noted earlier, the design team must know what codes have been adopted by the local authority having jurisdiction (AHJ), the code edition currently in force, and any additions, modifications, or deletions made by the AHJ. During the design review, the design should be reviewed for code compliance to make sure design changes made since the last review have not impacted compliance. In addition, the design team should be aware of any building code changes made by the AHJ during the design process so that they can be addressed.

Quality Of Design Documents. The design review should consider the quality of the design documents being prepared by the design team. This includes both the drawings and specifications prepared by individual design team members. In addition, drawings and specifications prepared by the design team should be checked to ensure that they are properly coordinated and cross-referenced. Poorly documented and unorganized design documents can result in significantly higher construction costs as well as change orders and disputes during construction.

Constructability. The constructability of a project refers to the ease and efficiency that a project can be put together. A detailed analysis of the construction sequencing, means and methods will ensure that the project can be efficiently built. This analysis will reveal any problems which might affect either the schedule or cost of construction. Unusual design details, unique materials and site accessibility should all be prime considerations during the constructability review.

Value Analysis. The objective of value analysis is to identify alternate materials, equipment, and ways of doing things that will provide the school owner with the same function at a lower initial cost, increased operational efficiency, or greater durability over the life of the building. Cost cutting to meet budget is not value analysis and should not be referred to as such.

Budget. The construction cost estimate should be reviewed and updated during each design review to ascertain that the project is still within the school owner's budget. Any significant budget deviations should be brought to the attention of the school owner when they are discovered even if the overall project is still within budget. Substantial budget deviations on the overall project or part of the project should be either approved by the school owner or be completely resolved before proceeding to the next design.

Schedule. Often the planned project schedule is not updated during design reviews and this can create problems. As the design progresses, the materials, equipment, and systems that will be incorporated into the school become better defined. This results in better information on delivery schedules as well as installation and startup requirements being available for incorporation into the construction schedule. The schedule should be updated during design reviews to make sure that lead times on major materials and equipment won't result in a delay in planned project completion.

6.11.5 Scheduling Design Reviews

The architect should coordinate and schedule regular design reviews to ensure that the design is proceeding as planned and will meet the school owner's requirements. Often, design reviews will occur at the end of each stage or predefined milestone in the design process. These stages or milestones may vary from project to project. What is important is that design reviews are scheduled

early in the design process because it is at this time that design changes can be most easily and efficiently made. The further into the design process, the more difficult and expensive it is to make changes.

6.12 DESIGN CHANGE PROCEDURE

A procedure for design changes and modifications should be established at the outset of the project. This is important because there may be subsequent changes in the school owner's requirements that would necessitate changes to the design. These changes need to be documented and agreed to by the school owner because they might impact construction as well as the project schedule and budget. In addition, the design team should be compensated for significant design changes.

6.13 DESIGN TEAM ROLE IN PROCURING CONSTRUCTION SERVICES

Construction services need to be procured by the school owner in order to convert the school design into physical reality. There are a variety of ways that the school owner can obtain the needed construction services for the project. These procurement methods can range from selection based on low price through a competitive bidding process to a pure qualifications-based selection and negotiated price. The architect can assist the school owner in identifying qualified general contractors, putting together bid/proposal packages, soliciting bids/proposals, assisting the school owner in selecting the appropriate general contractor, and then helping with the contracting process. Assisting the school owner with the procurement of construction services can be very valuable if the school owner does not have the in-house expertise. If the school owner needs the architect's help in procuring construction services it should be sure that these services are included in its agreement with the architect.

6.14 DESIGN TEAM ROLE DURING CONSTRUCTION

During construction, the general and specialty contractors procure the necessary materials and equipment and put work in place at the project site. The design team's scope of services during construction will be determined by the owner-designer agreement. The design team should visit the site regularly to ensure that the work is being completed in accordance with the design documents. In addition, the design team should review submittals, respond to requests for information (RFI), process pay requests, and issue required design modifications and changes. At the completion of this phase, the installation is inspected, put in service, and tested to ensure that it meets the needs and expectations of the school owner. During the construction phase, the design team monitors progress and at the end of the project reviews the work in place for compliance with the contract documents.

6.15 DESIGN TEAM ROLE DURING COMMISSIONING & CLOSEOUT

The design team can also provide valuable assistance during the commissioning and closeout phases of the project. During these phases of the project, the design team can assist the school owner in the following ways:

- Design team reviews the completed work to ensure that it meets plans and specifications.
- Design team observes or performs required system start up, testing, and checkout procedures and documents as required.
- School owner and local authority having jurisdiction inspect the work with the design team and witness any required testing.
- Design team collects, catalogs, and provides the school owner with manufacturer operating instructions, maintenance manuals, test reports, certifications, guarantees, and warranties.
- Design team provides the school owner with a complete set of record drawings for the school project if this service is part of the agreement between the school owner and architect.

Constructing the Project — Section VII

CONSTRUCTING THE PROJECT SECTION VII

7.1 INTRODUCTION

Once the design is complete, the project needs to be constructed. This section will address the construction process beginning with selecting the construction team. The construction services agreement is then covered followed by a discussion of insurance and bonding requirements. Partnering agreements and the importance of managing time and schedule are also covered in this section.

7.2 CONSTRUCTION TEAM COMPOSITION

The construction team typically consists of the general contractor, specialty contractors, and suppliers. Specialty contractors on a school construction project will typically include electrical, mechanical, sheet metal, masonry, glass and glazing, roofing, finishes, and many others. Suppliers include manufacturers, fabricators, distributors, and other firms that furnish the needed materials and equipment for incorporation into the project.

7.3 CONSTRUCTION TEAM ORGANIZATION

7.3.1 Construction Team Organization

The manner of organizing the construction team is determined by the project delivery system that will be used. The project delivery system will determine who the general contractor contracts with, the general contractor's role and responsibilities on the project, and the risks assumed by the general contractor, among other things. The following paragraphs will briefly discuss the construction team's organization for each of the common project delivery systems discussed in Section III.

7.3.2 Design-Bid-Build

The most common project delivery system used on school construction projects is traditional design-bid-build. Using this project delivery method, the general contractor usually contracts directly with the school owner to construct the project in accordance with the plans and specifications prepared by the design team. The general contractor is responsible to the school owner for completing the project on time and within budget in accordance with the contract documents. There is no direct contract between the general contractor and the design team.

The general contractor typically selects and contracts directly with specialty contractors and then takes responsibility for overseeing their performance. Under this arrangement, the specialty contractors are referred to as subcontractors. The general contractor is responsible for coordinating the subcontractor's work and seeing that they are paid for their work in an appropriate and timely fashion.

A variation on the traditional design-bid-build project delivery system is one where the subcontractors have separate and direct contracts with the owner. Depending on the owner-general contractor agreement, the school owner or the general contractor may have the responsibility for scheduling and coordinating the work of the specialty contractors which are now all considered to be separate prime contractors. This variation increases the school owner's risk because while the general contractor may have responsibility for coordinating and scheduling the separate specialty contractors' work, it has no direct contract with and control of them. The school owner will need to take a much more active role in the day-to-day construction process to ensure that the project plan is followed.

Separate prime contracts are often used on fast-track construction projects because the design is broken down into individual "bid packages" that cover a particular trade and/or phase of the work. For example, there may be a bid package for site work that would be bid to earthmoving contractors. Separate prime contracts allow construction to proceed while other parts of the design are being completed. However, since design is not completed when construction begins the design of other key systems may be restricted by early design decisions that can't be reversed.

7.3.3 Construction Manager

As noted in Section III, there are several variations of the construction manager project delivery system that may affect the general contractor's role and responsibility. Under the agency option, the school owner holds separate prime contracts and the construction manager advises the school owner throughout design and construction. The general contractor can serve as the construction manager, perform any of the construction work it chooses or do a combination of both. All of the general contractor's contracts are directly with the school owner and not with the subcontractors.

One variation on the agency option discussed in Section III is having a traditional general contractor as well as a construction manager. Under this scenario the general contractor can act as either the construction manager or general contractor. As a construction manager, the general contractor contracts directly with the school owner to also provide assistance throughout the design and construction process. If the general contractor assumes the role of general contractor under this scenario, it contracts with and is responsible for the performance of the specialty contractors as it does under traditional design-bid-build project delivery.

The third construction manager variation is having the construction manager "at risk" and the general contractor assumes both the role of construction manager and general contractor. The general contractor's contractual arrangements are very similar to those on a traditional design-bid-build project. The general contractor has a direct contract with the school owner and holds all of the specialty contracts as well. The main difference between the general contractor's role on a traditional design-bid-build project and this construction manager variation is that the general contractor is involved with the project from the outset as the school owner's advisor on construction issues, budget, and schedule.

7.3.4 Design-Build

In a design-build project where the general contractor acts as the design-builder, the general contractor has a direct contract with the school owner that involves both design and construction of the project. In addition to being responsible for selecting, contracting with, and coordinating specialty contractors during construction, the general contractor is also responsible for providing and managing the design team.

7.4 SELECTING THE PROJECT TEAM

The school owner can select the construction team in a variety of ways. The most common method of selecting the construction team for a design-bid-build project is through the competitive bidding process where the successful general contractor is the one that submits the lowest responsive and responsible bid. Whenever possible, it is recommended that the school owner prequalify potential general contractors based on experience and expertise, quality of work, financial stability, and the ability to work with the school owner to successfully complete the project. If the school construction project is privately funded, the school owner could choose a general contractor based on qualifications and/or past experience and negotiate directly with that firm.

Under the construction manager project delivery system, the construction manager is typically selected based on qualifications only or a combination of qualifications and price. General and specialty contractors performing the construction work are typically selected based on lowest responsive bid. Again, if possible the school owner should prequalify general and specialty contractors prior to soliciting bids for the work. Occasionally, the construction manager and a team of specialty contractors may be selected as a team.

There are a number of ways that the design-builder can be selected. Selection can be based on parameters varying from qualifications only to low price. Since design is part of the design-builder's scope of services and there are a number of qualitative factors that should be taken into account, selection usually involves a combination of qualifications and price to get the best value for the school owner. There are a variety of selection methods available for both publicly or privately funded school construction projects that convert qualitative criteria to quantitative criteria through point systems and other means.

7.5 CONSTRUCTION SERVICES AGREEMENT

7.5.1 Construction Contract

The construction contract defines the relationship between the selected general contractor and school owner throughout the construction process. Often, the parties will utilize a standardized construction agreement, which will reference other documents, such as drawings and specifications, to be made part of the overall construction contract.

7.5.2 Contract Conditions

Contract conditions typically include the following:

- General Conditions
- Supplemental Conditions
- Special Conditions

In many cases, the supplemental and special conditions will be combined into one document referred to as either "supplemental" or "special" conditions. The following paragraphs will describe the purpose and content of each document.

General Conditions. General conditions are usually standard form documents published by a trade or professional organization or developed by the school owner. Among other things, the general conditions of the construction contract normally define the role and responsibilities of the various parties to the construction project, set forth procedural rules for payment and dealing with disputes and claims, and define project start and completion. The general contractor should thoroughly understand the general conditions for bidding and project administration.

Supplemental Conditions. Supplemental conditions are normally used where the school owner uses standard form general conditions. The supplemental conditions of the construction agreement normally modify the standard form general conditions to better meet the school owner's individual needs and project requirements regarding the management and administration of the project.

Special Conditions. Unlike supplemental conditions, special conditions are project specific and deal with the school owner's special requirements and restrictions for the particular project at hand. Special conditions address such things as the required sequencing of work, restrictions on personnel and construction operations, mobilization and demobilization, material delivery and handling, and site access and security. The general and supplemental conditions usually impact the pricing of the bid because these documents define the risk that the general contractor is subjecting itself to in undertaking the project. In contrast, the special conditions usually have a direct impact on the estimated cost of performing the work because they impact productivity.

7.5.3 Plans & Specifications

Plans and specifications detail the project scope of work. Plans provide a graphic representation of the work to be performed. Plans show how finished work is to appear, how materials and components are to be integrated together, and the dimensions and layout of the work. Specifications, on the other hand, are typically provided in text format. Specifications are very important because they not only list acceptable materials and equipment for incorporation into the work but also specify how materials and equipment must be installed and tested. For example, specifications normally define concrete placement procedures, testing requirements and cure times that all have an effect on project cost and schedule.

The content, detail, and accuracy of the plans and specifications are important to the success of a school construction project. A poorly prepared set of plans results in additional risk and possibly increased costs for the school owner. Whenever possible, the general contractor should advise the school owner to retain qualified design professionals and pay a reasonable fee for their services. The school owner needs to understand that saving money on design may result in increased costs during construction.

7.5.4 Addenda

Contract conditions, plans, and specifications are not perfect documents. During the bid period, changes and clarifications sometimes are necessary as a result of school owner review, design team checking, or general contractor analysis. When issues are discovered, a solution is developed by the school owner with the aid of the design team and general contractors invited to bid are notified of the change through an addendum. Addenda can significantly add, delete or change the character of the work. The general contractor preparing a bid must keep abreast of all addenda issued during the bid period in order to ensure that the project cost estimate is accurate. Most standard bid forms require the general contractor to list all addenda received during the bid period and incorporated into the bid price. Failure to list all addenda issued during the bid period may disqualify the general contractor’s bid.

7.5.5 Other Documents

In addition to the above documents that are commonly included in construction agreements, there are a number of other documents that could be included in the construction agreement. These other documents could include one or more of the following:

- Work Included/Excluded
- Owner-Furnished Work
- Project Schedule

Work Included/Excluded. Sometimes the contract documents will include a list of included and excluded work or just a section entitled "Scope of Work." This is particularly common on renovation work. The purpose of this list is to clarify the scope of work for the general contractor. This list should supplement information contained in the plans and specifications. Procurement and installation of major equipment and components may be excluded from the construction firm's scope of work. Additionally, ancillary work not traditionally part of the general contractor's work for a particular type of project may be included in the scope of work. An accurate understanding of what is and is not included in the project is necessary to develop an accurate estimate of project cost.

Owner-Furnished Work. Most construction agreements allow the school owner to furnish labor, equipment, or materials for the construction project. In most cases, labor furnished by the school owner is for tenant improvement and finish work in preparation for occupancy that may or may not affect construction cost and schedule. The more important consideration is owner-supplied material and equipment. In the case of material, the general contractor preparing the bid must ascertain the delivery schedule as well as who will pay shipping and handling costs. The same is true for equipment except the construction firm also needs to determine any additional costs associated with the installation and startup process such as on-site manufacturer representation, certifications, and specialized test procedures. Additionally, for equipment or materials the responsibility for warranty periods, maintenance and repair should be clearly defined. For example, in the case of computer-based instrumentation and control systems software the responsibility for required software modifications, debugging and updates must be clearly defined.

Project Schedule. Any project schedule included in construction agreement by the school owner should be closely scrutinized and reviewed by the general contractor. The project schedule that is included with the bid documents to be incorporated in the construction agreement may restrict the construction firm's operations and increase the cost of performing the work. The school owner’s schedule may require out-of-season construction, use of more or different equipment than would normally be required, or inefficiencies due to the required stacking, crowding or uneven man-loading of trades. Any project schedule imposed by the school owner could have a significant impact on the estimated cost of construction.

7.6 CONSTRUCTION CONTRACT CHAIN

7.6.1 Construction Contract Chain

There is a chain of contracts that go from the school owner to the lowest tier subcontractor or supplier on a school construction project. The general contractor must make sure that all of these contracts are coordinated to minimize risk resulting from voids and overlaps. The general contactor's contract chain may include the following agreements:

- Owner-General Contractor Agreement
- General Contractor-Subcontractor Agreement
- General Contractor-Supplier Agreement
- Subcontractor-Subsubcontractor Agreement

Owner-General Contractor Agreement. The owner-general contractor agreement defines the relationship between the school owner and the general contractor.

General Contractor-Subcontractor Agreement. This agreement establishes the relationship between the general contractor and the subcontractor for the scope of work that is to be performed. A subcontractor is a firm that has a direct contract with the general contractor to perform a portion of work at the site. A subcontractor is not a supplier because a supplier only furnishes equipment and materials that are incorporated into the work at the site. This is true despite the fact that the supplier may custom fabricate those materials and equipment. The difference is that even though the supplier is performing a portion of the work when fabricating equipment and materials for the project, the work is not being performed at the construction site.

General Contractor-Supplier Agreement. The general contractor will also have to have agreements with its material and equipment suppliers. Standard purchase orders will typically be used as the subcontractor-supplier agreement. However, if there are requirements for the school construction project that are extraordinary, the purchase order should be modified to reflect these changed requirements.

Subcontractor-Subsubcontractor Agreement. The subcontractor-subsubcontractor agreement establishes the relationship between second-tier and third-tier contracting firms on a school construction project. For example, this agreement would establish the sheet metal contractor's relationship with a testing and balancing firm if the testing and balancing firm was a subcontractor to the sheet metal contractor. The subcontractor-subsubcontractor agreement should be very similar if not identical except for scope to the general contractor-subcontractor agreement.

7.6.2 Flow-Through Clauses

As noted above, on any construction project there is a chain of contracts that tie together all parties from the school owner down to the lowest tier subcontractor or supplier. In order to ensure consistency in each contract tier, flow-through clauses are incorporated into most contracts. These clauses bind parties on one contract tier to the applicable contract requirements of the next higher tier.

In addition, each tier of contracts typically has a requirement that it will tie its lower tier subcontractors and suppliers to the applicable requirements that it is bound to as well.

7.7 MODEL CONSTRUCTION DOCUMENTS

7.7.1 Model Construction Documents

There are a number of standard contract documents that are offered by professional organizations in the construction industry. These standard agreements have been developed not only by the sponsoring organization but have involved input from a number of other stakeholders in the construction process in an effort to create consensus. Stakeholders that are typically involved in the development and revision of standard contract documents include owners, architects and engineers, general and specialty contractors, insurance carriers and sureties, construction attorneys, and others. As a result, these standard construction agreements are generally considered to be reasonably balanced and fair to all parties involved in a construction project.

7.7.2 Who Publishes Standard Construction Documents?

There are a number of industry organizations that publish sets of standard construction agreements. The two most common standard agreements used on school construction are those published by the American Institute of Architects (AIA) and the Associated General Contractors of America (AGC). In addition both the AIA and AGC publish standard construction agreements for design-build as does the Design-Build Institute of America (DBIA). The AGC has the most comprehensive set of documents that address traditional design-bid-build, construction management, and design-build project delivery.

7.7.3 Consistency Throughout The Contract Chain

The chain of agreements that extend from the school owner to the lowest tier subcontractor or supplier should all be consistent. All of these agreements are typically linked together and each party in the chain is typically bound to applicable provisions in the agreements up the chain through a flow-through clause as discussed above. To ensure a consistent set of requirements, the general contractor should make sure that its agreement is consistent with the terms and conditions of its subcontracts and supplier agreements.

Standard construction agreements were developed by their sponsoring organization as a set. These sets include individual agreements for the various links in the contract chain as discussed above. The terms and conditions of each agreement in a set of standard agreements are designed to be compatible and consistent with the other agreements in that set.

7.8 SUBCONTRACTING THE WORK

7.8.1 Subcontracting Process

A subcontractor is an entity that has a direct contract with the general contractor to perform a portion of the work at the project site. The subcontracting process is a method of construction

organization under which a general contractor enters into separate contracts, referred to as subcontracts, with various specialty contractors for the performance of some or all of the work. As discussed above, this results in a chain of contracts for the construction project that runs from the school owner to the general contractor and from the general contractor to subcontractors and suppliers. Further, the contract chain extends from subcontractors to subsubcontractors and the subcontractors' suppliers.

The subcontracting process is both efficient and economical in the application of resources. General contractors cannot support a full-time staff of skilled craftsmen for each and every trade required for school construction. Accordingly, the subcontracting process allows the general contractor to keep a smaller group of full-time employees for project administration and any specialty work the general contractor performs. When the need arises, the general contractor can draw on subcontractors to perform other specialty work required on a project.

In this way, specialty contractors are able to offer full-time employment to employees skilled in a particular specialty. Further, specialty contractors can perform their work more efficiently and effectively than a general contractor that does not have the proficiency, skills or equipment to perform the specialized work. For example, electrical contractors understand the unique requirements for the handling, installation and testing of medium-voltage cable which results in a safe installation with a good service life. Additionally, many construction specialties have special licensing, insurance and bonding requirements not to mention labor considerations that would be difficult for a general contractor to cover.

7.8.2 Subcontract Limitations

Some owners place a limitation on the amount of work that can be subcontracted on a project while others may require that all work be subcontracted. The reason that some owners place a limit on the amount of work that can be subcontracted is to avoid potential problems associated with extensive subcontracting on a project. These potential problems can include the following:

- Difficulties in coordinating subcontractors.
- Loss of efficiency due to the number of subcontractors involved.
- Fragmented responsibility for portions of the project.
- Other reasons.

The probability that difficulties such as those listed above actually occur on a job is to a considerable extent dependent on the general contractor's experience, organization and management skills. The school owner should not arbitrarily control the number or type of subcontractors that the general contractor can use on a project. Such restrictions can impact the general contractor’s ability to manage the project as effectively and efficiently as possible for the school owner. If the school owner prequalifies potential general contractors based on experience, expertise, and quality the number of subcontractors and the way that the general contractor organizes the project should not be a concern for the school owner.

7.9 INSURANCE REQUIREMENTS

7.9.1 Purpose Of Insurance

Insurance is a contract of indemnity where the insurer promises, for a consideration, to assume financial responsibility for a specified loss or liability. The term "indemnity" refers to the restoration of the victim of a loss up to the amount of the loss. The insurer has a duty to indemnify the insured, meaning that the insurance company is required to make whole the victim of the loss by payment, repair, or replacement. The insurance company also has a duty to defend the policyholder from claims and lawsuits arising from coverage.

7.9.2 Typical Insurance Requirements

Typically, insurance coverage required on school construction projects is the same as that required on other types of projects. However, specific insurance coverage and coverage limits may differ on school construction projects and the general contractor should work closely with its insurance carrier to ensure that it has appropriate coverage for the type of work being done. In addition, the general contractor should always review contract requirements and work closely with its insurance carrier to ensure that school owners'unique contract requirements are met. The following insurance is typically required on school construction projects:

- General Liability Insurance
- Automobile Insurance
- Worker's Compensation Insurance
- Builder's Risk Insurance (On New Construction)

In addition, there are a number other insurance policies and endorsements that complement these standard insurance policies that may or may not be contractually required. The following paragraphs describe insurance that is typically required by contract on school construction projects along with some of the more common policies and endorsements that the general contractor may want to have or encourage the school owner to obtain.

7.9.3 General Liability

The purpose of general liability insurance is to protect against general risks of loss that arise from third parties affected by the work. General liability insurance is also referred to as "public liability," "commercial general liability," or "comprehensive general liability" insurance. With general liability insurance, the insurer agrees to pay damages to the injured party for occurrences for which the general contractor is insured. The insurer also agrees to provide legal defense for any related lawsuits brought against the general contractor.

It is common for the owner-general contractor agreement to require that the general contractor purchase comprehensive general liability insurance. The reason for this is that the general contractor has greater exposure to claims by third parties arising from the work than the school owner. The general contractor has the ability to manage the project and better control the risk

exposure. Also, the owner-general contractor agreement typically requires the general contractor to indemnify the school owner and others against these claims.

Typical exclusions from the general liability insurance include the following:

- Liability for injury to the general contractor's own employees.
- Professional liability.
- Liability for property damage that is not owned by the general contractor.
- Automobile, watercraft, and aircraft liability.
- Liability arising from pollution.

Each of these items can usually be insured by adding them as endorsements to the general liability insurance policy or by separate policy.

7.9.4 Automobile Insurance

Automobile insurance protects the general contractor from financial loss resulting from either liability or property loss. It also protects the general contractor from losses resulting from bodily injury or property damage arising out of the ownership, maintenance, or use of a covered vehicle. Similarly, auto insurance also protects against property damage to the general contractor's own vehicle due to collisions and named perils. The general contractor is typically required by contract to carry automobile insurance.

7.9.5 Worker's Compensation Insurance

Worker's compensation insurance is protection provided to an employee by an employer in accordance with a no-fault/limited liability agreement. Worker's compensation laws exist in all fifty states that require employers to compensate their employees for employment-related injuries regardless of fault. In return for this no-fault coverage, the employee agrees that he or she cannot bring legal action against the employer for compensation greater than the statutory amount. Employee compensation includes reimbursement for medical costs and lost wages as well as specific amounts for permanent injury. Worker's compensation insurance requirements and limits are governed by state laws.

7.9.6 Employer's Liability Insurance

Employer's liability insurance complements worker's compensation insurance by protecting the general contractor from claims by employees for injuries and deaths that are not covered by worker's compensation.

7.9.7 Other Types Of Insurance

Umbrella Excess Liability Insurance. An umbrella excess liability insurance policy provides an additional layer of coverage over and above the limits of the general contractor's other liability coverage. An umbrella excess liability insurance policy is an economical way to meet contractual coverage limits in excess of the general contractor's normal liability coverage and can also broaden the coverage of these policies.

Contractor's General Property & Equipment Insurance. Typically the school owner's builder's risk insurance does not cover the value of the tools and equipment used to build the project. If not contractually required, the general contractor should consider obtaining insurance to protect tools and equipment used on the project if it does not have the financial ability to replace them if they are destroyed or lost.

Professional Liability Insurance. The design-build agreement between the school owner and the general contractor acting as design-builder may require that architects and engineers have professional liability insurance as discussed in Section VI. If the general contractor is subcontracting the design to an outside architect, there should be a requirement in the design-builder-architect agreement that requires the architect to carry professional liability insurance that meets the requirements of the owner-design-builder agreement. If the general contractor is performing design in house, it should have professional liability insurance to comply with the owner-design-builder agreement. The general contractor can either have a separate professional liability policy or work with its insurance carrier to get this coverage added to its general liability coverage.

On a design-build school project, the general contractor should make sure that all of its subcontracts require professional liability insurance if design is part of the subcontractor's scope of work. The agreement between the school owner and general contractor on a design-build project will typically require that all subcontractors providing design either in house or using an outside design firm provide professional liability insurance for their part of the work.

7.9.8 Builder's Risk Insurance

Builder's Risk Insurance Coverage. Builder's risk insurance is a key element in the school construction project's property insurance coverage. Builder's risk insurance covers losses that arise during the construction phase of the project due to insured risks such as fire and theft. Builder's risk insurance is designed to cover all property that has been or will be incorporated into the project.

"Named Peril" Versus "All Risk" Policies. Builder's risk insurance is available in either a "named peril" or "all risk" policy. "All risk" coverage is usually required by owner-general contractor agreements. "All risk" policies are preferred because these policies include coverage for all perils unless specifically excluded from the policy. The general contractor should carefully review the school owner's builder's risk insurance policy to determine exactly what perils have been excluded as well as its deductibles and limits. In addition to specified perils, builder's risk insurance typically excludes losses from the following occurrences:

- Loss Of Use Of Occupancy
- Penalties Form Noncompliance Or Noncompletion Of The Contract
- Normal Wear & Tear
- Latent Defects
- Loss Due To Faulty Work Or Design
- Other Similar Losses

Builder's risk may not only cover the permanent work in place but may also include temporary buildings and other structures at the job site as well. Similarly, materials and equipment that will be incorporated in the project may also be covered when stored properly away from the construction site, in transit to the construction site, and while temporarily stored at the construction site. In addition, the general contractor's tools and equipment may also be protected by builder's risk insurance if on-site and not covered by other insurance. The terms and conditions of the builder's risk policy should be reviewed to determine exactly what is covered.

School Owner's Obligation To Provide. Owner-general contractor agreements typically require that builder's risk insurance be obtained by the school owner. The school owner has an insurable risk in the project and as the project progresses the insured interest increases to the contract sum, the insured limit, or until the school owner occupies the project. Also, once the project is complete and the school owner occupies the project, the insurance can easily be converted without any lapse or overlap which could occur if the general contractor obtained the builder's risk insurance and the school owner had to obtain a separate policy for the completed project.

If the school owner is self insured, then the general contractor may be required to provide builder's risk insurance for the school construction project. The general contractor should review the proposed construction agreement and determine who is responsible for providing builder's risk insurance. If the general contractor is required to provide it then the general contractor should work with its insurance carrier to provide the required coverage.

Subrogation. A subrogation clause is common in many forms of insurance including builder's risk insurance. Subrogation can be defined as the assignment to an insurer by the terms of the policy or by law, after payment of a loss to the insured, the rights of the insured to recover the amount of the loss from the party that is legally liable for it. In the case where the school owner provides builder's risk insurance and the general contractor causes or contributes to damage on the project, the general contractor may be exposed to action by the school owner's builder's risk insurance carrier for recovery of its loss under the policy.

To avoid this from happening and defeating the purpose of having one builder's risk policy that covers the project for everyone, many owner-general contractor agreements include a "waiver of subrogation." Using a waiver of subrogation, the school owner, general contractor, design team, and subcontractors waive all rights against each other for damages caused by fire and other perils covered in the builder's risk insurance. A waiver of subrogation results in the insurance carrier relinquishing the right to collect for damages paid on behalf of the school owner, its policyholder. Care should be taken however to make sure that the insurance carrier will allow the school owner to waive its subrogation rights. In some cases, the builder's risk policyholder cannot waive subrogation without written permission of the insurance company.

7.9.9 Owner-Controlled Insurance Program

Typically, the general contractor and each subcontractor will be required to carry its own insurance coverage for the school construction project in accordance with the contract documents. However, an alternative to each contractor carrying its own insurance coverage for the project is for the school owner to provide wrap-up insurance coverage. This owner-supplied wrap-up coverage is referred

to as an owner-controlled insurance program (OCIP). An OCIP provided by the owner usually includes general and excess liability insurance, workers'compensation insurance, builder's risk insurance, as well as other coverage.

There are advantages and disadvantages to an OCIP for both the school owner and contractors. An OCIP can result in reduced construction costs for the school owner due to insurance savings resulting from eliminating the need for each contractor to purchase its own insurance coverage and including it in its construction price. In addition, if the school owner obtains insurance coverage for the entire project then it knows what is covered as well as policy limits and deductibles. The disadvantage for the school owner is that there are costs associated with implementing an OCIP including the time and effort required in procuring the necessary coverage as well as the costs associated with administering the program. Before deciding to establish an OCIP for a project, the school owner should consult with its legal and insurance advisors that the benefits of an OCIP will outweigh the costs.

There are also advantages and disadvantages of an OCIP for the general contractor and its subcontractors. The claims process under an OCIP will often be more streamlined because there is one entity that is coordinating all insurance coverage for everyone working at the school construction site. This will often reduce coverage disputes and subrogation issues between contractors, insurers, and others. Additionally, small contractors and minority contractors who would otherwise be unable to obtain needed insurance to work on the project are covered under an OCIP. The disadvantages of an OCIP for contractors include the possibility of disrupting existing insurance coverage as well as bidding becoming more difficult because only insurance coverage supplanted by the OCIP should be eliminated from the contractor's bid. In addition, contractors with a good safety record lose their bidding advantage over contractors with a poor safety record with an OCIP. Contractors should consult with their insurance carrier before deciding to bid on a school construction project with an OCIP.

7.9.10 Consult Your Insurance Carrier

Insurance carriers are constantly developing new insurance products and repackaging old products to meet the changing needs of the construction industry. The general contractor should work closely with its insurance advisors to ensure that it has the coverage it needs for the type of work that it is doing at the best price possible.

7.10 BONDING REQUIREMENTS

7.10.1 Bonding Overview

Bonding is not the same as insurance. Bonding is providing performance security to the school owner on school construction projects. Insurance is a contractual arrangement between two parties: the insurer or insurance company and the insured or general contractor. Bonds, on the other hand, are a three party agreement that operates as follows:

- The school owner requires a bond as a guarantee that the selected general contractor will perform as obligated and the surety will pay certain specified damages to the school owner if the general contractor does not perform.

Surety bonds are essentially a credit transaction between the general contractor that is providing construction services (principal) and the surety for the benefit of the school owner (obligee). The surety provides the financial backing and guarantees that the obligations of its principal will be met. In the event that the principal defaults, the surety will step in and complete or correct the work. In short, bonds provide guarantees and offer protection to the school owner against loss due to the failure of the general contractor to perform as promised. Insurance provides protection against losses due to damage or injury. A summary of surety rights is as follows:

- Surety bond is a credit transaction and not a transfer of risk.
- Surety has both a contractual right to indemnification and an equitable right of subrogation against its principal. Subrogation right entitles the surety to any funds payable to its principal in the event that the bond is called by the obligee.
- Indemnification right assumes that the surety will be reimbursed and held harmless for money expended in the performance of the bond. Assets of the principal will be at risk to cover any losses by the surety.

7.10.2 Types Of Bonds

There are a variety of types of bonds that may be required by the school owner on a school construction project. These bonds can include any or all of the following:

- Bid/Proposal Bond
- Payment Bond
- Performance Bond
- Completion Bond
- Maintenance Bond

The following paragraphs will briefly discuss each of these bonds.

7.10.3 Bid/Proposal Bond

A bid bond is used to qualify general contractors submitting bids or proposals on a project. This bond guarantees that if the bid or proposal is accepted, the general contractor will enter into a contract with the school owner to perform the work specified on the project. The bid bond also guarantees that the general contractor will provide any additional guarantees (bonds) necessary to comply with the contract documents.

There are two types of bid bonds:

- Liquidated Damages Bond
- Difference-In-Price Bond

The liquidated damages bond reimburses the school owner an established amount to cover its losses resulting from the general contractor not entering into a contract to perform the work. A difference-in-price bond covers the difference between the general contractor with the lowest proposed price and the next higher proposer.

7.10.4 Payment Bond

A payment or "labor and material" bond guarantees the general contractor's contractual obligations to pay specified subcontractors and suppliers on the project. Payment bonds are especially important to subcontractors and suppliers on no-lien or public projects.

7.10.5 Performance Bond

A performance bond guarantees to the school owner the performance of the general contractor's obligations under the contract. The surety's guarantee of performance is not greater or less than that of its principal as defined by the contract documents. It is very important to clarify whether or not the school owner wants design services covered by the performance bond on a design-build school project. Sureties would typically like to have design services excluded from the performance bond and just guarantee the general contractor's performance during the construction phase as it does on traditional design-bid-build projects.

7.10.6 Completion Bond

A completion bond is typically used to guarantee that some portion of the work that is not completed at the time when final completion should occur will be completed at an agreed upon time. Completion bonds are usually not required by the school owner but can be very useful to the general contractor when trying to close out a school project with work that still needs to be completed. In accordance with the owner-general contractor agreement, the school owner will often have the right to withhold retainage until all work is completed. In some cases, the retainage amount that the school owner will hold is much greater than the cost of the work that needs to be completed. For example, if the school project is completed in winter the general contractor may not be able to complete landscaping until spring. It may be to the general contractor's advantage to offer the school owner a completion bond for the cost of completing the landscaping in return for its project retainage. The cost of the completion bond will probably be small when compared to the cost of the school owner holding the project retainage until landscaping is complete in the spring.

7.10.7 Maintenance Bond

Maintenance or warranty bonds guarantee the correction of defined defects in the construction that appear within a specified time after completion of the project. This bond can be used to extend the warranty period for faulty workmanship and materials beyond the typical one-year warranty period required by contract and covered by the performance bond.

7.10.8 Consult Your Surety

The general contractor should always consult its surety regarding project bonding requirements. This is especially true on design-build projects where the surety may be required to provide a performance bond that covers design as well as construction. Sureties typically charge a higher bond premium rate for design-build projects.

7.11 PARTNERING AGREEMENTS

Partnering sessions can be very effective on school construction projects. There is often no time set aside on a school construction project for the school owner, architect and its main subconsultants, general contractor and its principle subcontractors, and others to get together to discuss individual goals and objectives for the project. While each participant's primary goal is the "successful" completion of the school project, the problem is that different project participants may define "successful" differently. This difference in how each project participant defines "successful" may lead to misunderstandings and conflicts during construction. Also, a frank discussion of what each project participant needs and expects from others to successfully complete its part of the overall project is also very helpful.

Partnering sessions are normally held either just before or just after construction begins. An outsider who is not a project participant usually facilitates the partnering session. This ensures that there is no feeling of bias and promotes an open dialogue about the project. The result of a partnering session is an agreement that states the consensus goals and objectives of the project as well as defines how the parties will communicate and treat one another. Partnering agreements are nonbinding and rely on each signing party's integrity to be successful.

7.12 MANAGING TIME & SCHEDULE

7.12.1 Importance Of Managing Time & Schedule

"Time is of the essence" on school construction projects just like it is on most other construction projects. However, when a school construction project is completed is important because it can have a major impact on the school's usefulness and the school owner's operations. Complete the school project late and the new school could sit idle until the next school year or at least the next semester when students and teachers can begin to use the new facility. Complete a school project too early and it may sit idle until summer when the owner can occupy and ready it for the upcoming school year. The general contractor needs to manage time and schedule on a school construction project to ensure that the building is substantially complete when the school owner wants it.

7.12.2 Long-Lead Materials & Equipment

There are a number of long-lead materials and equipment on school construction projects and the general contractor needs to ensure that they are ordered, fabricated, and delivered in accordance with the project schedule. In addition to typical long-lead items like structural steel, there are a variety of other education-specific materials and equipment that need to be in place prior to building occupancy and use. These include chalkboards and white boards, auditoria seating, audiovisual

equipment, custom millwork, athletic equipment, laboratory equipment, kitchen equipment, among many others. The general contractor needs to include procurement in its project schedule which includes activities for ordering, shop drawing submittal and approval, fabrication, and delivery specific long lead equipment and material.

7.12.3 School Owner Furnished Materials & Equipment

The school owner may decide to furnish certain materials and equipment to the general contractor for installation. Often, these materials and equipment may be long lead items such as chillers and boilers that could delay the completion of the project if they were not ordered until after the school owner and general contractor have finalized negotiations and entered into a construction contract. Sometimes the school owner may want to purchase materials and equipment for the project because it believes that it can purchase them at a lower cost than the general and specialty contractors. If this is the case, the general contractor should educate the school owner about the risks inherent in purchasing construction materials and equipment which are different from purchasing operation and maintenance supplies.

If the school owner decides to furnish materials and equipment for construction, the general contractor needs to include owner-supplied materials and equipment in its schedule and notify the school owner as to when materials and equipment should be delivered to the project site to meet the schedule. The general contractor also should make the school owner aware that it is its responsibility to store and protect materials arriving before they are needed on site. Warranty issues as well as special start up and testing requirements on owner furnished materials and equipment also need to be worked out with the school owner in advance.

7.12.4 Can You Finish The School Project Early?

As noted above, finishing the school project early may not be to the school owner's advantage. If the school owner wanted the school in June for the following school year and it is finished two months early in April, the school owner may refuse to take possession of the project until the contractual completion date. The general contractor should review its agreement with the school owner to determine whether it can complete the project early or not. If the general contractor believes that it can complete the project early, it should bring this to the attention of the school owner to find out if the school owner wants the project early.

As will be discussed in Section VIII, substantial completion of the school construction project often results in the start of manufacturer warranties, shifts responsibility for operating and maintaining the facility to the school owner, and transfers insurance responsibility from the general contractor to the school owner among other things. If the general contractor completes the project early and the school owner refuses to take possession, the general contractor may be required to pay for operating, maintaining, and securing the school until the contractual completion date.

7.12.5 Project Scheduling Considering Timing Of Funding

School construction projects usually span several budget periods which is typically not a problem. However, there are times when only a fixed amount of the school's construction cost is allocated in a given fiscal year and this is stated in the contract documents. When this occurs, the general contractor should be careful to schedule the project so that progress at the site does not exceed the school owner's ability to pay. If the general contractor is not careful in a situation like this, it might find itself paying for construction that is complete but can't be paid for by the school owner until the next fiscal year. The general contractor should make sure that there are no contractual restrictions on the amount of funding that the school owner can release in any one fiscal year.

Turning Over the Project — Section VIII

TURNING OVER THE PROJECT SECTION VIII

8.1 INTRODUCTION

Project closeout is the final stage of the construction process. Project closeout includes all of the activities required for an orderly transfer of the completed project from the general contractor to the school owner. School facilities are becoming increasingly complex as more and more educational technology and advanced communications and control systems are being incorporated into these projects. Project closeout activities can adversely impact project schedule and budget as well as the school owner's satisfaction with the construction team's performance. The complexity and importance of project closeout demands that the general contractor begin planning for project turnover during the bid or proposal stage of the project. The general contractor should have a plan for project closeout that includes documented procedures and checklists to ensure that the turnover is both orderly and timely. This section will address the steps involved in the orderly transfer of the completed school facility to the school owner.

8.2 PROJECT CLOSEOUT OVERVIEW

8.2.1 Project Closeout Categories

There are four categories of project closeout activities that are addressed in this section. These four categories of closeout activities are as follows:

- System Start up & Testing
- Construction Closeout
- Contract Closeout
- Financial Closeout

System start up and testing includes all activities that need to be performed in order to ensure that systems are operating as specified. The construction closeout category refers to all activities that need to be completed before construction is complete and the general contractor can demobilize and move off site. Contract closeout activities refer to all of those activities that the general con-

tractor must complete in order to fulfill its contract with the school owner but do not directly impact construction at the site. Lastly, financial closeout refers to those activities that need to be completed in order to receive final payment following successful completion of start up and testing, construction, and contract closeout activities.

8.2.2 Contractual Responsibility For Closeout Activities

Throughout this section the general contractor is identified as having responsibility for the performance of closeout activities. Since the general contractor has a contract directly with the school owner for the completion of the project that includes closeout activities, it does have ultimate responsibility to the school owner for all closeout activities. The general contractor, however, typically transfers responsibility for the performance of certain closeout activities to specialty contractors and suppliers through its contracts with them.

8.3 SYSTEM START UP & TESTING

8.3.1 System Start Up & Testing

The first step in the project closeout process is to start up and test building systems. There is no one time when all building systems are started and tested. The specialty contractor that installed the system usually does start up and testing. Systems requiring start up and testing include heating, ventilating, and air conditioning (HVAC); potable water; life safety and security; emergency lighting and power; elevators; security; food service equipment; data and telecommunications; and other systems. In addition, some systems require final adjustment as well as checkout and testing such as balancing the air distribution system. Start up and testing usually occurs after a particular system has been installed.

All system testing should be performed in accordance with the contract documents, manufacturer recommendations, industry standards, and recommended practices. All system testing should be documented whether documentation is required by the contract documents or not. It is through testing that the general contractor demonstrates that the installation is in accordance with the plans and specifications for a traditional design-bid-build project or meets the school owner's performance criteria on a design-build project. In addition, records of all system testing should be archived in the general contractor's project file as well as provided to the school owner.

8.3.2 Testing System Interoperability

Buildings are becoming more complex with mechanical, electrical, and other systems becoming more interdependent. In the past, building systems were viewed as independent and tested and operated that way. Today this is changing as building management systems (BMS) monitor and control not only mechanical system operations but also the electrical systems including lighting and interface with life safety and security systems. The ability of these systems to operate together as planned needs to be verified as part of the start up and testing process. Therefore, in addition to individual system start up and testing, interrelated systems need to be tested together to ensure that they will operate together properly.

8.4 CONSTRUCTION CLOSEOUT

8.4.1 Construction Closeout Activities

Construction closeout activities include the following:

- GC Develops Initial Punchlist
- GC Provides Notice Of Substantial Completion
- A/E Inspects & Issues Final Punchlist
- GC Addresses Punchlist Items
- Authority Having Jurisdiction (AHJ) Issues Certificate Of Occupancy
- A/E Issues Certificate Of Substantial Completion
- GC Demobilizes
- A/E Issues Final Certificate For Payment

The following paragraphs will describe each of these construction closeout activities. It should be noted that the description of these activities is typical and the actual activity sequence and requirements will depend on the contract requirements as well as the requirements of the local authority having jurisdiction. Also, closeout activities may need to be performed in phases if the contract documents provide for partial owner occupancy prior to overall project completion.

8.4.2 GC Develops Initial Punchlist

When the general contractor believes that the school project is substantially complete, it should perform a detailed inspection of the condition and status of the work in place with its subcontractors. The purpose of this inspection is to determine if the work has progressed to the point that the school facility is sufficiently complete for the school owner to use it. In the process of performing this detailed inspection, the general contractor should develop a detailed list of work that must be completed or corrected prior to final completion. The items on this list will need to be completed before the general contractor receives its final payment for the project.

8.4.3 GC Provides Notice of Substantial Completion

When the general contractor ascertains that the work is sufficiently complete for the school owner' use, the general contractor will notify the A/E that it considers the project substantially complete. The general contractor should also submit its initial punchlist to the A/E along with its notice of substantial completion. The failure to include any deficiency on the initial punchlist does not relieve the general contractor of its responsibility for completing all work in accordance with the contract documents.

8.4.4 A/E Inspects & Issues Final Punchlist

Upon receipt of the contractor's list and notice of substantial completion, the A/E will review

the work in place to determine that the work is completed to the point that the facility can be used by the school owner for its intended use. The A/E will also prepare a final punchlist that includes the general contractors initial punchlist. If the A/E discovers any item that prevents the school owner from using the school facility, the general contractor must complete or correct the item before the A/E issues the certificate of substantial completion if the deficiency was the result of the general contractor's work.

8.4.5 GC Addresses Punchlist Items

Punchlist items can include both incomplete and nonconforming work. The general contractor should review the final punchlist with the A/E to ensure that the items noted are within the contract scope and do not conform to the contract requirements. Once the final punchlist has been reviewed and agreed upon, the general contractor should develop a plan for addressing individual punchlist items. Any punchlist items that impact the general contractor's ability to obtain a certificate of occupancy from the authority having jurisdiction or the ability of the school owner to use the project should be addressed first so that project substantial completion is not delayed. Other minor items such as correcting damage to building finishes should be scheduled with other finish work.

Some work on the punchlist may not be completed immediately due to circumstances beyond the general contractor's control. For example, if the project is completed in the middle of winter the general contractor may not be able to complete the landscaping. Since all work needs to be completed prior to final completion, this item could delay final payment for months. One way to avoid this problem is for the general contractor to obtain a completion bond that guarantees either the AHJ or school owner that the remaining work will be completed in a reasonable time. The project can then be closed out with this assurance.

8.4.6 AHJ Issues Certificate Of Occupancy

The certificate of occupancy or "C of O" is usually issued by the authority having jurisdiction over the project. The AHJ is typically the city or municipality where the project is located but could also be the county or state for a rural school owner. The AHJ is usually the government entity that issued the building permit to the general contractor based on its review of the A/E's design. The certificate of occupancy is issued by the AHJ when the project is substantially complete and inspections by the AHJ indicate that the constructed project complies with all applicable codes and agreements between the school owner and AHJ during the project planning and design stages.

8.4.7 A/E Issues Certificate Of Substantial Completion

Once the architect/engineer determines that the school construction project is sufficiently complete for the school owner to occupy, it will prepare and issue a certificate of substantial completion. Substantial completion is defined in AIA A201-1997 subparagraph 9.8.1 as follows:

> *Substantial Completion is the stage in the progress of the Work when the Work is designated complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.(a similar definition is found in AGC 200-2000, subparagraph 2.3.17)*

Obtaining the certificate of occupancy for the project is usually a prerequisite for the A/E issuance of a certificate of substantial completion because the building cannot be occupied or otherwise used without it.

Substantial completion is very important because it is the completion date specified in the construction contract. When substantial completion is attained and the certificate of substantial completion is issued by the A/E, the following shift in contract obligations and responsibilities occur:

- School owner can move into the building.
- School owner takes over responsibility for operation and maintenance of the school facility including security, maintenance, utilities, and damage to the work.
- School owner needs to provide insurance for the completed project if the school owner is not self-insured.
- If there is a liquidated damages clause in the construction contract it is no longer enforceable.
- The general contractor's contractual warranty period starts.

The A/E will submit the certificate of substantial completion to the owner and general contractor for their review and acceptance. Upon acceptance of the certificate of substantial completion, the school owner will usually pay withheld retainage to the general contractor adjusted for work that is incomplete or not in accordance with the contract documents.

Sometimes the certificate of occupancy is withheld due to design deficiencies or other issues beyond the general contractor's control. Without a certificate of occupancy, the A/E cannot issue a certificate of substantial completion for the project and the school owner cannot occupy the school project and use it for its intended use. As a result, the general contractor will retain responsibility for the project until the authority having jurisdiction's concerns are resolved. When this happens, the general contractor should immediately notify the school owner that it is not responsible for the delay in project completion and that it will submit a change order for the additional costs associated with assisting the school owner resolve the issues as well as any costs incurred as a result of the delay in substantial completion.

8.4.8 GC Demobilizes

Once the work is substantially complete, the general and specialty contractors can demobilize. All contractor-owned materials and equipment are removed from the site along with temporary utilities and structures. The site is then cleaned up and readied for the school owner to move in.

8.4.9 A/E Issues Final Certificate For Payment

Once the general contractor has addressed all punchlist items and demobilized from the site, written notice that the work is ready for final inspection and acceptance is given to the A/E by the general contractor. The general contractor should also submit a final application for payment along with its request for final inspection and acceptance of the project. The A/E should respond to the

general contractor's request by promptly performing a final inspection of the work to determine that it is in accordance with the contract documents and complete. Once the final inspection is completed and the A/E is satisfied that the school construction project is complete, it will issue a final certificate for payment to the school owner for payment.

8.5 CONTRACT CLOSEOUT

8.5.1 Contract Closeout Activities

Contract closeout activities include the following:

- Submit Required Record Drawings
- Submit Test Reports
- Provide Operation & Maintenance Manuals
- Put Warranties & Guarantees In Force
- Supply Required Extra Materials & Spare Parts
- Orient & Train School Owner's Personnel

All of these activities are typically required by the construction contract documents and need to be accomplished before final project completion and payment.

8.5.2 Submit Required Record Drawings

Record drawings that provide information about the installation of equipment and systems during construction typically are required by the contract documents. These record drawings are kept in the field and marked either with changes to the original design due to actual field conditions encountered or with additional detail about the installation which was not shown on the design drawings. The responsibility for translating the field's marked-up set of drawings to a set of record drawings varies between projects. Sometimes it is the general contractor's responsibility to provide a final set of record drawings based on the field's marked up drawings and other times it is the A/E's responsibility. If it is the general contractor's responsibility to provide record drawings, the general contractor should determine early in the project what the contractual requirements for record drawings are and what format is required.

8.5.3 Submit Test Reports

Test reports required by the contract documents need to be submitted to the school owner documenting the tests that were actually performed and the results of those tests. In additional, the general contractor should consider submitting documentation on any additional tests that it performed. As noted previously in this section, test reports provide evidence that the general contractor met the construction contract requirements for the project. Test reports can be very valuable in establishing a baseline for building system performance and providing protection from claims by the school owner after occupancy that the system is not operating as specified. For example, if the school owner's operation and maintenance personnel make changes to the

school's air distribution settings or controls after construction that impact operation, the general contractor can demonstrate through test reports that the building was operating properly at turn over to the school owner.

8.5.4 Provide Operation & Maintenance Manuals

It is often the general contractor's responsibility to provide operation and maintenance manuals for the systems and equipment incorporated into the project. These documents provide important information regarding the operation, maintenance, and repair of building systems. Again, it is important to know what is required in the contact documents so the general contractor can provide it in the format the school owner desires.

8.5.5 Put Warranties & Guarantees In Force

All equipment warranties and guarantees need to be placed in effect. Care should be taken to understand the terms and conditions of the manufacturer's equipment warranties and guarantees to ensure that the period they cover coincides with the general contractor's contractual warranty for the project as well as any warranty requirements for specific equipment contained in the project specifications. The general contractor should understand what triggers the start of the manufacturer's warranty period so that actions taken on site do not inadvertently initiate the warranty period prematurely. Such actions may result in the general contractor having to supply the school owner with an extended warranty in order to meet contractual requirements and that can be expensive.

8.5.6 Supply Required Extra Materials & Spare Parts

Extra materials and spare parts required by the contract documents should be turned over to the school owner and a receipt for delivery obtained. It is very important to document the receipt of the required extra materials and spare parts by the school owner. Often extra materials and spare parts are just placed in equipment rooms and storage areas and sometimes these materials and spare parts are used when needed at other schools or lost or misplaced during move in and occupancy. Without a receipt showing that the required extra materials and spare parts were provided, the general contractor may have to provide another set in order to obtain final completion and payment.

8.5.7 Orient & Train School Owner's Personnel

This is a very important activity because thorough orientation and training of the school owner's operations and maintenance personnel will result in less call backs after project completion. Often orientation and training of the school owner's personnel can be done during start up and testing. However, complex building systems may require more in depth instruction and training for proper operation and maintenance. Investing the time necessary to properly orient and train the school owner's personnel during construction will pay dividends later.

8.6 FINANCIAL CLOSEOUT

8.6.1 Financial Closeout Activities

Financial closeout activities include the following:

- Obtain Lien Releases
- Resolve Any Outstanding Change Order Requests
- Make Application For Final Payment

The following paragraphs will discuss each of these financial closeout activities.

8.6.2 Obtain Lien Releases

A mechanic's lien is a right created by statute to obtain payment for work performed or materials and equipment provided for the improvement of land. Liens can be filed by subcontractors and suppliers against the owner's property if they have not been paid for their work or materials. Typically, liens cannot be filed against public property so lien releases are typically not be required as part of the final payment process for public school construction projects. On the other hand, liens can be filed against private school construction projects and lien releases from all subcontractors and suppliers will probably be required as a condition for final payment on these projects.

8.6.3 Resolve Any Outstanding Change Order Requests

Any outstanding change orders should also be resolved prior to final payment by the general contractor. Failure to resolve them prior to final payment may result in the general contractor being barred from pursuing compensation at a later date. If there are unresolved change order requests, they must be recognized in writing at the time of final payment.

8.6.4 Make Application For Final Payment

As noted previously, the general contractor should submit final application for payment along with a request for final inspection. After the A/E determines that the project is complete in accordance with the contract documents, the A/E will issue the final certificate for payment to the general contractor and school owner. Once the school owner makes final payment, the project is complete.

8.7 SCHEDULING & TRACKING PROJECT CLOSEOUT

8.7.1 Scheduling Project Closeout

The activities required for the transfer of the project from the general contractor to the school owner are as important to the success of the project as any of the procurement or construction activities. As a result, project closeout activities need to be planned and scheduled in the same

detail as other construction activities. Time must be provided at the end of the project to perform the start up, testing, and inspection activities that are required to obtain substantial completion. In addition, many of these closeout activities are intertwined with other ongoing construction activities as well as need to be coordinated with the school owner's move in schedule. Closeout activities must be included in the general contractor's construction schedule.

8.7.2 Tracking Project Closeout Activities

Including closeout activities in the overall construction schedule is only the beginning. As can be seen from this section, closeout activities involve a lot of detail and interface points to be managed. The overall construction schedule for a school project often does not provide sufficient detail to effectively manage closeout activities. Therefore, the general contractor should develop short-interval schedules within the framework of the overall construction schedule to manage closeout activities just like it does to monitor and control other construction activities. Tracking project closeout activities can be accomplished by using detailed schedules, responsibility matrices, and checklists. Detailed tracking of closeout activities will ensure that they are completed in a timely manner and do not delay either substantial or final completion of the school construction project.

8.8 PERFORMANCE CLOSEOUT

8.8.1 Performance Closeout Activities

Performance closeout activities include the following:

- Prepare & Analyze As-Built Estimate
- Prepare & Analyze As-Built Schedule
- Conduct Post-Project Construction Team Meeting
- Conduct Post-Project Meeting With The School owner
- Develop Project Lessons Learned & Disseminate

These activities will benefit the general contractor by providing valuable information about its performance on the project and can be used to improve performance on future projects. While the project closeout activities discussed in the following paragraphs are good practice, they are not likely to be contractually required.

8.8.2 Prepare & Analyze As-Built Estimate

The general contractor should prepare and analyze the as-built estimate at the completion of the school construction project to determine the accuracy of material and equipment takeoffs; reasonableness of the unit costs used for labor, material and equipment, and installation tools and equipment; among other things. The as-built estimate should be developed by eliminating any change orders from the final cost of the project and putting the final cost information in the same format as the original job estimate. This will allow the general contractor to perform a variance analysis and identify areas where the estimate accurately reflected the resources and costs required to per-

form the work as well as areas where the estimate was too low or high. A line item estimate that is lower than the actual cost to perform the work means that money was lost on that activity. On the other hand, a line item estimate that is consistently too high may impact the general contractor's ability to effectively compete on future competitively bid school construction projects. The results of this analysis should be used to improve the accuracy of future school construction cost estimates which in turn should result in more realistic and competitive bids.

8.8.3 Prepare & Analyze As-Built Schedule

An as-built schedule should also be developed at the end of the school construction project. Review of monthly schedule updates and the development of an overall as-built schedule to be compared against the original as-planned schedule will provide insights into the effectiveness of the original project plan as well as means and methods employed. This schedule review will also provide insight into the performance of subcontractors and suppliers and whether they should be used on future projects. An as-built schedule analysis will result in better planning on future school construction projects as well as a more accurate estimate of project overhead costs.

8.8.4 Conduct Post-Project Construction Team Meeting

Following the development and analysis of the as-built estimate and schedule for the school construction project, a post-project construction team meeting should be conducted. This meeting should include key personnel in the general contractor's organization as well as key subcontractors and suppliers. The purpose of this meeting is to review the as-built estimate and schedule and identify ways in which the next school construction project can be built more efficiently and better.

8.8.5 Conduct Post-Project Meeting With The School owner

Soon after project completion, the general contractor should conduct a post-project meeting with the school owner and A/E to their perspective of the construction process. The focus should be on how well the school owner and A/E felt that the general contractor responded to their needs during construction and any problems they saw with the general contractor's performance. The results of this meeting should be used by the general contractor to improve those processes that impact the school owner and the A/E such as submission of shop drawings, preparation of pay applications, conducting of meetings, effectiveness of communications, among other things.

A follow up meeting with the school owner about a year after project completion can also be valuable. Instead of focusing on the construction process, this meeting would focus on building performance and any problems the school owner has encountered in the first year of operation. Information gleaned form this meeting will provide insight into how customer-oriented subcontractors and suppliers are as well as what works and what doesn't. This meeting may impact future purchasing decisions, construction details, as well as provide valuable information regarding building operation and school owner expectations that can be used on future design-build school projects.

8.8.6 Disseminate Lessons Learned

All of this post-project review and analysis will be of no value if it is not disseminated and used throughout the general contractor's organization. Since school projects are often similar in scope and requirements, the application of lessons learned on one project can increase productivity and quality on future school construction and renovation projects. These lessons learned can be documented in terms of processes and procedures for future school construction projects, updates to estimating data bases, standard school construction schedules, and project case studies for marketing.

Acknowledgements

Author: Thomas E. Glavinich, D.E., P.E. The University of Kansas

Contributors: AGC wishes the thank its School Construction Task Force under the leadership of Gerald V. Anderson, Anderson Construction, Ft. Gaines, GA

Project Manager: Damian P. Hill, AGC of America

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