

School Construction Projects

The process of educating young people seems to be continually developing. New insights regarding how students most effectively receive retain and gain understanding of information and principles affect teaching methods. New methods may incorporate new technologies and be best facilitated in different physical settings. Creating the most appropriate educational settings may necessitate new or remodeled facilities.

It is in the best interests of any school district contemplating a construction project to be aware of some of the critical decisions it will be faced with making before the work on the project commences. The process starts with the district evaluating its current circumstances. The district's immediate and future educational goals are then established. A plan as to how to move toward their realization within the district's unique context is prepared. This, however, is just the beginning. There are many more decisions the district will be called upon to make in order to gain facilities that enhance the education process.

The school district must consider how it intends to plan and manage the project and how the design and construction teams will be selected. In addition, a decision as to which project delivery method best suits the district's situation will have to be addressed before a project can get under way. Being aware of some of the most utilized project delivery methods, understanding their differing applications as well as the basic advantages and disadvantages of each method will prove useful. The purpose of this document is to provide school districts with basic information to assist them in moving forward with the construction planning process for their specific project by describing the common project phases, project team selection options, project management guidelines, and project delivery methods.

PROJECT PHASES

From inception to completion of a construction project a series of phases, each comprised of specific activities, occurs. A school district needs to assess what personnel resources they have to devote to each phase and determine whether people within the organization are available who have an appropriate amount of time and experience to effectively engage in some or all of the phases of the project. The school district may prefer to engage the services of an independent project manager to represent and guide them through some or all of the project phases. Additionally, who participates on behalf of the school district in each phase will be influenced by which priorities, considerations and concerns the district determines need to be emphasized and who has been assigned the authority to make the necessary decisions. Below is a brief summary of the common project phase activities:

- Planning Phase – Activities include defining objectives, needs, scope, budget, schedule, outside agency requirements and site investigations.
- Design Phase – Activities include final determination of construction scope, quality and schedule. This phase also includes the preparation of construction documents, selection of building systems, and comparison of the proposed design against the budget.
- Bidding Phase – Activities include contractor prequalification, construction cost proposal preparation and regulatory agency reviews.
- Construction Phase – Activities include construction task planning and scheduling, material procurement, fabrication and placement.
- Occupancy Phase – Activities include moving in furniture, equipment and people, building system operation training.

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PROJECT TEAM SELECTION

There are a variety of ways a school district can select the team members who will assist them through the construction project. The time at which team members enter the process is subject to choice. This choice is primarily dependent on the project delivery method that will be employed for the project.

In general, the architect and contractor selections can be made based on qualifications, price or a combination of the two. It is not necessary to use the same criteria to select both parties. The essential outcome that must be achieved through the selection process is to assemble the best team to work with the school district to complete a project that best satisfies the district's needs within their time schedule and cost budget.

Both the architect and contractor will be supported by other members of their respective teams. The architect's design team will include consultants to develop the various building systems specific technical aspects. Design consultants for a school project frequently include civil, structural, mechanical, plumbing, fire protection and electrical engineers; landscape, voice/data/video/security system, acoustical and food service designers. The contractor will have a few dozen subcontractors representing all the various trades needed to construct the building.

Common Selection Processes:

- Qualifications Based Selection (QBS): Selection of the architect and/or contractor is made based solely on the qualifications of the entity being considered. Cost is not a factor in the initial decision. A company's capabilities, experience, previous performance, competence, proposed team, availability, approach and references are evaluated to determine whether it is the best choice to address the project's unique needs.

Selection of the project's architect frequently includes consideration of the design consultants the architect proposes to be a part of his team. Generally, when the architect is selected the project scope is not yet settled and the services needed are not completely known. After selection, the architect and the design consultants (the "design team") work with the school district staff to jointly determine the actual project scope, define expectations and agree upon the services that will be necessary. The reasonable costs for services and the contract terms can then be negotiated. If an agreement cannot be reached with the selected company, negotiations can be undertaken with the next most qualified firm.

The State of Colorado requires that a qualifications based process be used to select design professionals for its construction projects. This includes architects, engineers, professional land surveyors and geotechnical engineers. The Federal Government has the same requirements. A qualifications based process has commonly been used by school districts to select design professionals. University of Colorado and Georgia Tech researchers have found that when the design professionals are selected using a qualifications based selection process, project cost increases incurred during construction are much less (a 3% average increase rather than 10%) than when alternative selection processes are utilized.

- Best Value Bid: Selection of the design professionals or construction contractor is based on both qualifications and proposed costs. The project scope and service requirements must be comprehensively defined by the school district before proposals are solicited. The evaluation considerations are weighted based on their relative priority to the school district. The submittals for qualification may be required to include qualifications, team experience, proposed services, work plan, project schedule,

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proposed solution and/or project costs (i.e. design fees, contractor fees, construction general condition costs).

- **Low Bid:** Selection of the design professional or construction contractor is based on a competitive bid process. Cost is the deciding factor for selection. The lowest responsible bid is selected to do the work. The project scope and service requirements must be completely defined before proposals are solicited. Most frequently a school district utilizes assistance from a design professional to establish project requirements, scope and service requirements. Without having these elements well defined it is likely that competing “bids” for design services will not include the same level of service. Therefore, the competitive bid process is most generally used in publicly funded projects for construction services rather than design services. The construction work scope and requirements are comprehensively defined by the documents prepared by the separately selected design team.

PROJECT MANAGEMENT

The coordination of the design and/or construction process occurs through project management. This can include administration, planning, organizing, staffing, budgeting, scheduling, monitoring and reporting. School districts can utilize their own staff or outsource the responsibilities to an independent entity to represent them. The extent of representative’s authority to make decisions on behalf of the school district must be clearly defined.

Our understanding is that the Colorado Department of Education (CDE) permits school district BEST Grant recipients to assign qualified in-house staff to manage smaller projects funded by cash grants. The CDE may permit districts with experienced construction management facility staffs to oversee larger projects. If a district does not have qualified staff then CDE will likely require that a separate manager be retained to represent them.

If a school district engages the services of an outside representative it could be an individual project manager or a construction management firm that advises the school district, monitors the design and construction teams’ performances, and communicates project status to the school district’s staff. The types of services available for construction project representation and management can vary significantly between companies. A school district must carefully assess what it needs from its representative. The services can include project scope definition, facility design program assistance, design and construction team selection, budgeting, scheduling, construction document review, quality control and comprehensive financial management, post occupancy operational training, preventive maintenance scheduling and warranty management and, finally, thorough documentation for reporting to the school board, oversight committee or citizen groups.

PROJECT DELIVERY METHODS

Construction project delivery can be most simply described as the process through which a project will be planned, designed and built. The responsibilities assigned to each participating entity, usually an owner, architect and a contractor, are defined by the specific delivery methods.

The primary objective is to select the construction project delivery method that best correlates to the school district’s needs in order to establish the framework within which to complete the planned work and measure success in relevant terms. Those measurements may be based on satisfaction of project requirements, cost, quality, time or safety. Each project delivery method offers distinct benefits and risks to the project owner. Which method to select depends on an owner’s priorities, resources, expertise and needs. The project delivery method selection is also influenced by how the project development phases will be structured, the length of the schedule compared to the project scope, whether the project includes new facilities or remodeling of existing facilities which may be occupied throughout all or most of the

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construction period, how the design and construction services will be procured and how the owner will manage the project. Some possible delivery methods are described below.

Design-Bid-Build Project Delivery Method

Design-bid-build has been the most commonly used project delivery method for publicly funded projects.

Defining Characteristics of Design-Bid-Build:

- The owner, architect and general contractor are the three primary parties involved.
- Two separate contractual agreements are executed. One agreement is between the owner and architect; the other is between the owner and general contractor. There is no contractual relationship between the architect and general contractor.

Typical Characteristics of Design-Bid-Build:

- The architect and general contractor are selected separately, often using different processes.
- The owner and designer customarily agree on a fixed fee for the services needed to complete the project. This is particularly the case when the designer has been selected through a qualifications based process.
- There is a linear, sequential progression through project planning, design and documentation, bidding and construction phases.
- The project design is developed through an interactive process between the owner and architect/design team. The owner and architect have the opportunity to identify, early in the development of the project, the expectations and the full scope of services needed to complete the project and optimize the benefits to the owner.
- Project design can proceed based on probable construction cost evaluations prepared by the architect/design team to assess whether it appears the anticipated construction scope can be accomplished with the budgeted funds.
- The project construction scope is fully defined in prescriptive contract documents (drawings and specifications) prepared by the architect/design team. The documents are completed before they are issued to the contractor for bidding or construction.
- The contractor is generally selected based on presentation of the lowest responsible bid for completion of the construction work described in the contract documents prepared by the architect/design team.
- Construction planning is completed by the contractor after selection. The planning is based on the contract documents prepared by the architect.
- The contractor holds the trade contracts and is responsible for coordination and completion of their work.

Advantages of Design-Bid-Build:

- Both the architect and the contractor contract directly with the owner. Therefore, they are both responsible directly to, and only to, the owner.
- Industry accepted legal documents have established the common roles and responsibilities of the involved parties.
- The architect prepares contract documents on which all invited general contractors base their bid proposals.
- The bidding process gives all invited general contractors an equal opportunity to be awarded the construction contract in a fair and impartial manner. All bidders have access to the same information.
- This method uses aggressive market place competition to produce the lowest construction contract cost. A presumption is that the competitive lump sum bid

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process will yield the best construction cost value of all the project delivery methods.

- An architect under a fixed fee contract has no motive other than maximizing the efficiency and quality of the project for the owner.
- More financial transparency is achieved with design-bid-build than with other methods.

Disadvantages of Design-Bid-Build:

- The design team has no control over the bid market or construction costs. Delays can occur if the bid proposals prepared by the contractors are higher than anticipated by the design team. Additional time may be needed to reconcile project scope, quality or schedule with the budget.
- Since the contractor is brought on board after design there is little opportunity for input on alternative systems or materials to those presented by the architect/design team, help with cost estimating, or cost saving ideas.
- There may be more disagreements between the architect and contractor with regard to design intent or work required by the contract documents than with the delivery methods that include the contractor in the design process.
- The project phases are sequentially scheduled. The design and documents must be finished before bidding or construction begin. This method may require more time to complete a project.
- The final contractor selection is generally based solely on price (lowest responsible bid). However, the quality and competency of the group from which bids will be accepted can be controlled through a pre-qualification process.
- Most of the risks inherent in a construction project are borne by the owner.

Construction Manager / General Contractor (CM/GC) Project Delivery Method

The CM/GC project delivery method has generally been chosen when a project schedule is compressed or the work is very complex and will occur over multiple phases. By involving the contractor earlier in the project development process it is possible to overlap phases and fast-track the construction process. Project design, construction cost control and scheduling efforts can benefit from the contractor's first hand knowledge of the marketplace.

Defining Characteristics of CM/GC:

- The owner, architect and CM/GC are the three primary parties involved.
- Two separate contractual agreements are executed. One agreement is between the owner and architect; the other is between the owner and CM/GC. There is no contractual relationship between the architect and CM/GC.
- The CM/GC is selected on criteria other than total construction costs. The selection can be based solely on qualifications (i.e. company experience, proposed project management staff, favorable client references) or a combination of qualifications and fees (i.e. costs for pre-construction services, project management services, proposed project approach, construction general conditions).

Typical Characteristics of CM/GC:

- The architect and CM/GC are selected separately, often using different processes and criteria.
- The CM/GC is selected during the design phase and begins providing services at this time.
- The CM/GC has influence over design, material and building system decisions, project requirements and project scheduling. The CM/GC has

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opportunity to evaluate the potential cost and construction feasibility of the proposed design.

- Subcontractor work frequently is competitively bid by companies included on a select list of bidders recommended by the CM/GC.
- A Guaranteed Maximum Price (GMP) is frequently prepared and used as the basis for the construction contract amount.
- The CM/GC holds the trade contracts and is responsible for coordination and completion of their work.
- If final construction costs are less than the GMP the savings are returned to the owner.

Advantages of CM/GC:

- Early involvement in the project development by the CM/GC allows more opportunity to control construction costs as a result of increased communication and collaboration with the design team and Owner. The CM/GC can influence the design, material and building system selections, project requirements and project scheduling to optimize the relationship between construction costs and final project value.
- Potential design deficiencies may be identified earlier. Consequently, the risk of schedule delays or additional costs may be reduced.
- Industry accepted legal documents have established the common roles and responsibilities of the involved parties.
- The design and construction phases can be overlapped which may allow the duration of the overall project schedule to be reduced. Documents for portions of the work may be issued in separate bid packages, with bids received and construction begun on those portions before the entire design is complete.
- The CM/GC can prepare construction cost estimates at each design phase providing the opportunity to adjust project scope or quality to meet the owner's budget. Therefore, the predictability of the final cost can be enhanced.
- Complex project requirements, particularly as may be required for building renovations, could benefit from the CM/GC delivery method. It is easier to accommodate such situations as starting/stopping work to coordinate with school schedules, require non-conventional work schedules or require specific security or clean-up procedures during construction. The costs for these types of requirements being performed at the level expected by the owner can be more appropriately addressed.
- Some of the risks inherent in the construction process are shared with the contractor.

Disadvantages of CM/GC:

- Project management costs are increased. An additional entity is participating in the planning and design process. Fees are incurred because of the cost estimating and review services provided.
- The contractor's final cost proposal is not prepared or presented until after a significant amount of fees for services have been incurred.
- Construction services price competition may be reduced. The project does not receive all the cost benefits that can be achieved from aggressive bidding by a larger group of contractors and subcontractors. The general contractor has less incentive to pursue efficiencies. There is an opportunity to unreasonably increase contingencies and allowances to reduce contractor financial risks. Consequently, financial risks accepted by the contractor on a design-bid-build project are passed back to the owner. General contractor mark-ups on subcontracts and money allocated for overhead expenses may

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be unreasonably high. Todd Construction, Inc. reports a State of Oregon study concluded that CM/GC projects generally cost 7% - 8% more than competitively bid projects of similar size and complexity.

- If the estimated or proposed construction costs are too high as a result of the situations noted above, the conclusion may be that the project scope must be reduced. At the end of construction when the actual costs are tabulated it may be found that the level of risk protection was too high. Though the owner realizes a cost savings at that time it may have been at the expense of needed facilities.

Design-Build Project Delivery Method

When the design-build project delivery method is utilized, one entity provides both the design and the construction services. This single entity manages the project cost, scope, quality and schedule. The design-build approach may appeal to owners that do not have adequate staff to devote to the project design or construction processes. The owner is provided a single source of responsibility for both design and construction. The single point of contact continues to be available through the warranty period after the facility is occupied.

Defining Characteristics of Design-Build:

- There is one contractual agreement that includes all design and construction services. The agreement is between the owner and the design-build entity.
- The design-build entity is responsible for providing all services related to design and construction. The design consultants and construction subcontractors enter into agreements with the design-build entity.

Typical Characteristics of Design-Build:

- The design-build entity can be a single company which provides design and construction services with its own staff. It can also be a partnership or joint venture of two independent companies coming together for a specific project. The team can be led by either the builder or designer.
- The design-build team can be selected based on qualifications, a proposed solution and/or a cost proposal.
- A contractual Guaranteed Maximum Price (GMP) can be established. A price and design submittal may be required with the original request for proposal (before a project design is developed with the owner and based on a design independently prepared by the design-builder) or prepared during the design process (at completion of project planning or preliminary design). The GMP usually contains cost contingencies intended to reduce the risk of the actual cost to complete the work exceeding the agreed upon proposal which was developed using preliminary information and documents.
- The services provided by the design team are under the authority of the design-build entity.

Advantages of Design-Build:

- All the design and construction costs are included in one contract amount. The design-build entity is responsible to deliver a completed project for the agreed upon cost.
- Allows the owner to look to one source for communication, accountability, project delivery and warranty issue resolution.
- Provides builder input and involvement in the project design from the very beginning of the planning process.
- Project phases can be overlapped to accelerate design and construction in order to complete the work sooner. Construction of portions of the work may begin prior to the design being finalized.

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Disadvantages of Design-Build:

- The cost of the project (GMP) is frequently accepted before design begins. The cost proposal may have been based on incorrect assumptions. This may result in the project design being the variable rather than the cost. The facility size or quality necessary to satisfy the district's needs may be compromised to meet a budget that did not correlate to those needs.
- All authority pertaining to project design services, cost, size, quality and schedule is delegated to the design-build entity. The project design team may be given less opportunity to discuss project program requirements with the Owner's staff. The Owner may have less influence over the final product.
- The architect does not work independently for the owner or serve the role of the construction contract administrator and the owner's representative during construction.

Integrated Project Delivery (IPD)

Integrated project delivery as a construction project delivery method is based on fully utilizing the expertise of all members of the project team (owner, architect and contractor) through highly collaborative working relationships structured to optimize the project outcome. Integrated project delivery concepts can be applied formally under the terms of the contract agreement as the delivery method or as an operational philosophy combined with other delivery methods.

Defining Characteristics of Integrated Project Delivery:

- There is a single multi-party contractual agreement that at least includes the owner, architect and contractor. Under this agreement all parties have equal standing. The objective is to establish incentives for all participants to collaborate and focus on the best interests of the project rather than their own individual interests. The multi-party agreement may also include other design consultants and/or some of the major subcontractors.
- Architect and contractor selected based on qualifications, ability to communicate project information with team members and ability to work collaboratively. Selection is not made on basis of cost.

Typical Characteristics of Integrated Project Delivery:

- The agreement defines all parties as equals. This is intended to support collaboration, communication and trust among parties.
- Every team member shares in the project financial risk and reward which is inherently tied to project success.
- Under the agreement all parties agree to not hold any of the other team members liable for potential mishaps. This creates an environment conducive to finding problem solutions rather than escalating criticisms and accusations.
- The agreement requires the maintenance of fiscal transparency between key participants.
- All participants come together early in the project and begin the interactive, collaborative process.
- There is an intensive design process involving all parties. Design responses are more intently scrutinized by all parties relative to program, cost, schedule and constructability early in the process. The design phase may be longer but the results receive more thorough consideration.
- Jointly developed project objectives and performance criteria are established.
- Collaborative decision making processes are expected.
- Working relationships are structured within the context of the agreement that foster trust, collaboration and open communication.
- Electronic building information modeling (BIM) is frequently used as tool to facilitate collaboration.

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- Project labor scheduling and material delivery/utilization practices are employed that increase efficiency. Waste in both areas is reduced to minimize expenses that do not add value to the project
- Project team members frequently work together in the same location to facilitate communication and collaboration.

Advantages of Integrated Project Delivery:

- Maximizes opportunity for thorough effective collaboration between the Owner, Architect and Contractor.
- The design is created in an environment that incorporates the specialized knowledge of the Owner, Architect and Contractor to inform the design and the construction process. The best outcome at the lowest true cost can be realized. The effects of proposed substantial design or system changes can be quickly evaluated.
- A goal is to optimize the project outcome not just the benefit to some of the individual participants. The goals of all the participants can be brought into alignment under what is best for the project.
- In a collaborative working relationship competition and conflict between team members may be reduced. Problems are resolved more effectively.
- Work flow predictability is improved. The schedule is more reliable which allows adequate resources to be allocated to the work with confidence that they will be effectively used.
- Increased trust results in lower cost and time contingencies.

Disadvantages of Integrated project Delivery:

- Standard industry accepted multi-party legal documents have not been fully tested in the marketplace.
- Regulatory restrictions on public entity contracting practices may not permit a multi-party agreement or the risk/reward sharing terms and incentives.
- A commitment is made to the contractor for project construction before any costs are known. Trust in the relationship rather than demonstrated performance is being relied upon.
- Construction services price competition may be reduced.

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