CONSTRUCTION PROJECT DELIVERY
VALUE ADDED STRATEGIES

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BIOGRAPHY

Stephen J. Kirk is President of Kirk Associates, which specializes in value analysis, choosing by advantages, life cycle costing, sustainability, facility economics, and strategic value planning services. He has over 25 years experience in applying value based design decision-making techniques to various construction project delivery methods. Facilities include multi-use facilities, hospitals, universities, airports, offices, housing, courthouses, research facilities, and museums. He is an instructor at the Harvard Graduate School of Design. Dr. Kirk is a registered architect, a Fellow of the AIA, a CVS-Life, and is a "LEED Accredited Professional." Steve is a Senior Fulbright Scholar in architecture and received his doctorate degree at the University of Michigan. He served as president of SAVE International in 1998-99, is Director and Vice President of Education for the Miles Value Foundation, and is a Fellow of SAVE. Dr. Kirk recently served on the Industry Advisory Panel of the US State Dept. Overseas Building Office. He is the author/co-author of eight books related to value analysis.

Stephen E. Garrett is a Principal of Kirk Associates, which specializes in value analysis services. Steve has over 22 years of professional experience including extensive skills in value engineering, cost estimating, scheduling, quality assurance/ quality control (QA/QC), strategic planning, project criteria development, and program management for projects using various construction delivery methods. He routinely is involved in large, complex projects for national and international clients. As principal, he typically leads highly skilled, multi-discipline teams in generating strategies, developing project criteria, increasing value, directing

planning efforts, and managing project completion efforts. He is also skilled in life cycle costing and frequently participates or runs workshops. His experience includes office, government, manufacturing, institutional, health care, education, and laboratory facilities. Steve received his Bachelor of Architecture degree from Lawrence Technological University. He is a Certified Value Specialist (CVS) and has been a member of SAVE for 10 years.

ABSTRACT

The construction industry has developed a number of new project delivery methods in response to owner requests for projects completed earlier and within budget. Each method has its strengths and weaknesses. Quality is sometimes compromised compared to the traditional "design, bid, build" approach. This presentation will start with VM applied in the traditional delivery approach, and then discuss how VM can be applied during these alternative project delivery methods. Key VM techniques will be highlighted for application to improve the weaknesses of each delivery method. Case studies will be used to illustrate how value based design decision-making methods can improve each delivery method. The presenters have years of first hand experience in applying VM to all types of construction delivery methods. The audience will become familiar with issues particular to each construction delivery method.

CONSTRUCTION DELIVERY METHODS

Over the past 30 years the construction industry has continued to evolve various construction delivery methods partly in response to owner requests for projects that are "on time, on budget." Now owners want products (including facilities) that are produced faster, better quality and cheaper to build. But what about life cycle cost effectiveness and environmentally sound? Yes, that too. And minimize risks to the Owner. This is similar to the automotive industry. The most common construction delivery methods used by owners include the following with their purported benefits and weaknesses:

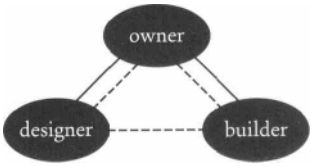
Delivery Method	Benefits:	Weaknesses:
1. Traditional, Design-Bid-Build	High Quality Good Sustainability	Long Schedule High Cost High LCC Poor Cost Control No Constructability Contractor Input No Risk Planning No Performa No POE (post occupancy evaluation)

2A. "Agency" Const. Mgt. (CM)	Accelerated Schedule Moderate Cost Good Cost Control Good Constructability Moderate Risks	Moderate Quality High LCC Low Sustainability No Performa No POE
2B. "At-risk" CM	Accelerated Schedule "Guaranteed" Cost Good Constructability Moderate Risks	Less Quality High Cost (actual) High LCC Low Sustainability No Performa No POE
3. Design-Build	Singular Responsibility Low Risk Low Cost Accelerated Schedule Good Constructability	Moderate Quality High LCC Low Sustainability No Performa No POE
4. Public Private Partnership (P3)	Accelerated Schedule Financing Singular Responsibility Low Risk Low Cost	Moderate Quality Moderate LCC Some Sustainability No POE

What Owners, Architects, and Contractors say about Design-Bid-Build:

The traditional approach to project delivery entails the clear separation of design from construction services. Design-Bid-Build uses design and documentation to competitively bid the construction contract.

The distinguishing characteristic of the traditional method is that it has separate primary contracts with an owner who holds one contract for architectural services and one for construction. Following is an illustration of the contractual relationships the various parties. The solid line indicates a contractual relationship. The dashed line indicates an informal relationship.



Design-Bid-Build

Design-bid-build is structured in a linear fashion, with design preceding construction so that full consideration of design issues can occur, and a complete set of construction documents is prepared before construction cost commitments are made.

The advantages of the traditional method rest in the clarity: All parties in the building industry are familiar with this way of working; roles and responsibilities are independent; design receives due time and consideration; scheduling is straightforward because phases do not overlap; construction cost commitments are reliable because they are based on full documentation. It works well for owners who want to be actively involved in the design process, for projects that need thorough and focused attention to design, and for owners who want to manage the process as simply as possible.

For decades, the traditional method was automatically assumed to be the best approach to project delivery. More recently, cost and scheduling pressures have pushed owners' interests in other directions. Design-bid-build is time consuming because its phases are organized end to end when many aspects of design and construction might be undertaken in a parallel fashion. The potential for disputes and change orders is exacerbated by the independence of architect and contractor. Observations like these have led to the development of an array of alternative project delivery options. Nevertheless, the conventional approach to project delivery remains the most popular method for getting a building designed and built. Unless a project is overwhelmed by an issue like time, risk avoidance or complex management, many owners argue that the traditional approach is still the best approach.

This project delivery option is characterized by its three phases, captured in the name design-bid-build, by its two independent contracts with the owner and by the linear phasing of the work. There are three prime players: owner, architect and contractor.

There are three phases in a typical project:

1. First, the owner engages the architect for the design and preparation of construction documents for the project.
2. Second, when design documents are complete, they are used for construction bidding. A contractor is selected based on the lowest responsible price, and construction cost commitments are made.
3. Third, the owner contracts for construction with the general contractor and the project is built.

The functional, technical and aesthetic quality of the building project is influenced by the project delivery method, but not determined by it. Each method can produce outcomes of the highest quality, although perspectives differ on this matter. The linear process of design-bid-build and the direct relationship between owner and architect yield certain perceived advantages for the project's quality, as indicated below.

Owner's Perspective

Since the design-bid-build method of project delivery is so well understood, it provides a degree of security and reliability in relation to design quality. Some owners prefer this method because:

- The owner can be a direct, active participant throughout the design process.
- If the owner makes changes during the process, impacts on cost and schedule can be relatively low because of the linearity of this delivery method.
- The design is generally resolved at the point of bidding, so that the final results and the final quality are relatively predictable.
- The completed design documents establish the standard of quality that the owner can expect the contractor to achieve.

Architect's Perspective

Architects often argue that this method ensures a higher level of quality for the following reasons:

- The architect's selection emphasizes professional qualifications and the potential overall quality of the project, along with time and cost concerns.
- The architect, in collaboration with the owner, has full responsibility in the early phases so that design receives focused attention.
- Because the architect and contractor are separate entities, certain advantageous checks and balances apply during construction.
- Flexibility of the process allows re-evaluating former decisions in light of later developments when it is to the project's advantage.

Contractor's Perspective

Because documentation is complete at the time of bidding, the contractor has a relatively clear sense of the quality expected by the owner.

Along with quality, budget and schedule are critical issues in all building projects. Time and money are inextricably linked in any building project, since time can be costly and financing may have a schedule of its own. While no delivery system is universally faster or less costly, these are the factors that have spawned the variety of project delivery methods now utilized.

Because the process is sequentially structured (from predesign to design, bidding and construction), the owner must have adequate time budgeted. The longer time line of design-bid-build is a significant reason why other methods of project delivery are being explored.
The design-bid-build method is a lengthy process because of its linearity. The independence of design, bid and construction phases sometimes means a project must be reworked when bids come in higher than expected. For public projects, the long time line is mandated by such requirements as those pertaining to developing and evaluating proposals and/or bids, and the owner's review process. The overall project calendar is extended when any of the component phases is delayed. To speed the process, overlapping of design and construction phases, known as fast tracking, is possible but relatively uncommon with this method. Contract incentives are another means to a shorter time line. If time is a critical factor, other project delivery systems frequently are utilized.

The primary costs of a building project are the costs of land, financing, fees to consultants, permits and the cost of construction. Often, life-cycle costs can exceed initial project costs.

Compared to other delivery methods, construction costs are the most predictable with design-bid-build; however, they are known later in the process than other methods because they are confirmed only when design documentation is complete.

What the Construction Management Association of America (CMAA) says about CM:

Construction Management is a professional management practice consisting of an array of services applied to construction projects and programs through the planning, design, construction and post construction phases for the purpose of achieving project objectives including the management of quality, cost, time and scope.

"Agency" CM is a professional service that can be applied to all delivery systems where the CM acts as the owner's principal agent in the management of a construction project or program, where the CM is responsible to the owner for managing the planning, design, construction and post construction phases, or portions thereof. The CM represents the interests of the owner in its dealings with other construction professionals, and with other private and public entities.

- Optimum use of available funds
- Control of the scope of the work
- Project scheduling
- Optimum use of design and construction firms' skills and talents
- Avoidance of delays, changes and disputes
- Enhancing project design and construction quality
- Optimum flexibility in contracting and procurement

Comprehensive management of every stage of the project, beginning with the original concept and project definition, yields the greatest possible benefit to owners from Construction Management.

"At-risk" CM is a delivery method which entails a commitment by the construction manager to deliver the project within a Guaranteed Maximum Price (GMP). The construction manager acts as consultant to the owner in the development and design phases, but as the equivalent of a general contractor during the construction phase. When a construction manager is bound to a GMP, the most fundamental character of the relationship is changed. In addition to acting in the owner's interest, the construction manager also protects him/herself.

What the Design Build Institute of America (DBIA) says about D-B:

As documented by the Design Build Institute of America, located in Washington, DC, many owner benefits can be gained through use of a D-B process which is well-designed and well managed. These include:

Singular Responsibility
With both design and construction in the hands of a single entity, there is a single point of responsibility for quality, cost and schedule adherence, which avoids "buck passing" and finger pointing. The owner is able to focus on scope/needs definition and timely decision making, rather than on coordination between the designer and builder.

Quality
The greater responsibility implicit in design-build serves as a motivation to seek high quality and proper performance for building systems by the D-B entity. Once the owner's requirements and expectations are documented in performance terms, it is the design-builder's responsibility to produce results accordingly. The design-builder warrants to the owner that the design documents are complete and free from error. (By contrast, with "traditional" design-bid-build, the owner warrants to the contractor that the drawings and specifications are complete and free from error. Because it is the owner's warranty for the design documents under "traditional" design-bid-build, the approach relies on restrictive contract language, extensive audit and inspection and occasionally, the legal system, to ensure final project quality.)

Cost Savings
Design and construction personnel, working and communicating as a team, evaluate alternative materials and methods efficiently and accurately. Value engineering and constructability are utilized more effectively when the designers and contractors work as one team during the design process.

Time Savings
Because design and construction are overlapped, and because bidding periods and redesign time are eliminated, total design/construction time can be significantly reduced. Design-build is ideal for the application of "fast track" construction techniques. Under this method, construction work is allowed to begin in advance of the working drawings being fully completed. The time savings translates into lower costs and earlier utilization of the completed facility.

Potential for Reduced Administrative Burden
Under a streamlined procurement process, the potential exists for design-build to reduce the owner's administrative burden. Initially, preparing RFPs and conducting evaluations can be resource intensive; however, this effort should lessen after an early learning curve. After award of the design-build contract, the owner will not have to invest his time and money coordinating and arbitrating between separate design and construction contracts.

Early Knowledge of First Costs
Because the entity responsible for design is simultaneously estimating construction costs and can accurately conceptualize the completed project at an early stage, guaranteed construction costs are known far sooner than is otherwise possible. This permits early establishment of financing, reduces exposure to cost escalation, and avoids the possibility of committing substantial time and money for design, only to learn that the cost of the project is prohibitive.

Risk Management
Project performance aspects of cost, schedule, and quality can clearly be defined and appropriately balanced (individual risks are managed by the party best able to positioned to manage that risk). Change Orders due to drawing and specification errors are eliminated because the correction of such issues is the responsibility of the design-builder, not the owner. After the owner outlines his needs in the RFP, he will receive different design/cost solutions representing

the best thinking of several design-builders, enabling the owner to better manage the financial risk connected with the project.

These benefits have resulted in D-B being used extensively, if not predominantly, throughout the world. In the United States, the private sector is using D-B with increasing frequency and application during the past 30 years. It is being used in a wide variety of commercial and institutional applications including hospitals, educational facilities, office buildings, retail centers and hotels.

Overview of the D-B Process

The delivery steps and time frames for a "typical" design-build project are described in broad terms below. Each project is unique and accordingly the time required for each step in the process can vary considerably.

1. Strategic Facility Planning
   Analysis of current and future facility requirements, to determine the appropriate facility development plan for the owner/user.
2. Program Definition
   The owner establishes the project "needs" of facility size and performance, finish requirements, codes and regulatory standards, population/capacities, etc. These requirements are defined and articulated in a Request for Qualifications (RFQ), either by in-house professional staff or by an outside consultant ("owner's design-build consultant").
3. Request for Qualifications (RFQ)
   Requirements for offerors are defined and articulated in an RFQ, either by in-house staff or by an outside consultant. Other particulars influencing team formations, such as minority participation goals, are established. These determinations are assembled into the RFQ document.
4. Qualifications Statements
   The project is advertised, qualification proposals are received (response to RFQ), and preferably three, and no more than five, of the most qualified firms are short listed.
5. Request for Proposals (RFP)
   Design and cost proposals are solicited from the short listed design-builders in a Request for Proposal (RFP). Among the items found in a typical RFP are project design criteria, site information, contract requirements, selection procedure and proposal (deliverables) requirements.
6. Proposal Submission and Evaluation
   Once received, proposals are evaluated on the basis of quality of design, price and other factors. Before making final award, the short listed design-builders may be called in to make presentations.
7. Contract Award
   The selected D-B Entity enters into contract(s) with the owner.
8. Documents/Construction
   Upon completion of the design documents for all elements (or for specific phases) of the project, construction commences. Some contracts, particularly those employing fast-track methods, require that construction proceed after logical phases of design are completed,

but prior to completion of the entire body of construction documents. During design and construction, progress payments are made to the Design-Builder in a manner consistent with the contract requirements

What people say about the Public Private Partnership (P3):

The following was taken with permission from John Kelly and Steven Male in their paper "The Application of Value Management to the UK Public Sector Construction Supply Chain" presented at the SAVE International Conference in Reno, May 2000.

The Public Private Partnership (PPP) includes Finance-Design-Build-Operate-Transfer also known as Build-Operate-Transfer (BOT) and Private Finance Initiative (PFI) gives an opportunity to public sector organizations to buy services from the private sector without adding assets to the balance sheet of the public authority and without adding to the national Public Sector Borrowing Requirement (PSBR). In the context of construction a public authority will rent from the private sector a facility, which the public authority has specified, in order to deliver optimum public service. For example the court authority may rent a court facility, which includes the provision of facilities management, in order to facilitate the optimum administration of justice. The private owner of the court, the service provider company, is usually a consortium of a construction company and a facilities management organization and possibly a bank. This type of construction project delivery brings into sharp focus the issues of life cycle costing and facility disposal strategies.

The underlying philosophy of the Private Finance Initiative is that Public Sector organizations are in the business of providing services, not owning assets. The private sector is therefore tasked to furnish the facilities to allow the public sector to provide service. The private sector takes responsibility for the provision of capital projects and their maintenance for a given period of time, usually 25 years. The public sector effectively leases these facilities on an annual rental basis.

The Treasury and the National Audit Office require a privately financed project to demonstrate value for money in respect of the annual rent. Additionally the private sector must genuinely assume risks relating to: design and construction, commissioning and operating (including maintenance), residual value, obsolescence and project financing. In some situations the private sector has to assume the risk of the future demand, for example, the continuing demand for the facilities offered by a leisure center.

The PPP project delivery process has the following steps.

1. Establish business need - this requires public sector organizations to carry out a thorough review of the services offered and the means of their delivery. A strong argument has to be made for a change to the status quo.
2. Appraise the options - if the analysis of the business need results in a decision to invest in new facilities then it is necessary for the public sector authority to determine all of the possible options available and finally to make a convincing argument that the investment is consistent with the strategic objectives of the authority.

3. Business case and the reference project - the option appraisal exercise will result in the preparation of an outline business case involving a clear definition of the service delivery being sought. This is termed the output specification, which is written in performance terms in respect of service delivery and is therefore not a definition of a particular asset. A reference project is prepared as one acceptable way of meeting the performance specification. The reference project is sufficiently detailed to allow an appreciation of the technical and economic investment consequences of this solution to the service requirements. The reference project becomes the public sector comparator used throughout the PPP process as the audit vehicle, representing an affordable solution. At this stage it is normal to insert a prior information notice in the Official Journal of the European Community in order to elicit expressions of interest from potential suppliers of the assets required by the service.
4. Developing the team – the appointment is made of the procurement team, the decision-making body, led by a full-time project manager and a project steering board. It is this team that will steer the project through the PPP procurement process and undertake the negotiations with the successful contractor. One of the primary tasks of the procurement team is the preparation of the information memorandum, which outlines all of the stages of the bidding process from pre-qualification to the signing of the contract.
5. A review of the decisions made to date is undertaken prior to entering the competition stage and the project sponsor makes a formal declaration of commitment to the scheme. An affordable business case is endorsed by an independent adviser, which includes a statement of how the client intends to fund the annual payments stream. Also at this stage the selection criteria of the contractor is determined. A notice is published in the Official Journal of the European Community (OJEC) inviting expressions of interest from suitably qualified contractors.
6. Pre-qualification of bidders - the notice in OJEC will give details of the pre-qualification criteria.
7. Selection of bidders (short listing) - those contractors who satisfy the pre-qualification criteria are invited to confirm their commitment to offer a viable and affordable bid for project through a competition stage often involving outline proposals. The proposals at this stage will include; approach to the project, proposals for the management of risk, innovation strategies and details of the organization of the contractor’s supply chain. Price at this point is not criteria for selection.
8. Following the selection of bidders, there is a further review of the decisions made to date and any necessary revisions are made to the business case and the public sector comparator.
9. Invitation to negotiate - a detailed information memorandum is issued to a short list of up to four bidding contractors. This stage is characteristically quite lengthy, often 3 to 4 months, during which time bidders absorb the information, enter confidential discussions with the procurement team and prepare a formal bid. A negotiation between the procurement team and each bidding contractor concentrates on the commercial terms of the contract, insuring that the contracted outputs will be delivered.
10. Receipt and evaluation of bids - value-for-money is the criterion used to establish the best bid. At this stage one contractor is invited to make a best and final offer (BAFO). Upon

their acceptance of the BAFO the client will continue to negotiate with a single contractor known as the preferred bidder.

11. Final evaluation and contract award. – The final round of negotiation will clarify such items as the risk allocation incorporated in the bid and confirmation that the contractor's funders are comfortable with the risk allocation. On agreement of the contract terms the contract is signed and a contract award notice placed in OJ EC.

PPP has been successfully employed on a range of public sector projects for example, schools, health buildings, police and fire establishments, defense establishments, etc. The provision of private finance has meant that these projects are available for use far in advance of when they would otherwise be if they were to wait for public sector funding. Value for money in these projects has therefore to be determined by reference to the whole package of benefits that the project brings. However, it is always recognized that private finance is more expensive than finance raised by the government.

PPP has demonstrated significant benefits in terms of the innovative delivery approaches taken by contractors to construction and more importantly to the balancing of capital spend and through life cycle costs. These benefits are not available to capital projects delivered in the traditional manner. This dilemma was well understood in Defense Estates, the property arm of the Department of Defense. The question was posed "knowing what we know now about PPP what would be the ideal procurement route using finance raised by government?" The answer came "one organization to take responsibility for the design and the construction of a building and then have to maintain it for long enough to make their eyes water if they got it wrong".

PROJECT DELIVERY CONCERNS

All current project delivery methods do not include a formalized problem solving, decision-making approach to their process. Team building and true team work is not encouraged, resulting in segmented, uni-discipline, sub-optimum decision making. The owner is not usually encouraged to participate in the deliver process other than review and approve the decisions reached by others and of course pay all the bills. Each delivery method seems to focus on only cost, quality or schedule, but never on all three. Little attention is given to the long term life cycle costs or project profitability. No effort is made by any of the methods to find out if the decisions they made during the design and construction were successful after completion. Sustainability is beginning to be addressed but more from a "bragging rights" point of view rather than true sustainability (environment, economic, social). Cost estimating quality varies considerably between approaches. Only one delivery method is addresses project financing. Following is concerns associated specifically with each delivery method.

Traditional, Design-Bid-Build

The two most significant concerns for the traditional method of project delivery are cost and time. Cost estimates may be prepared by the design A/E firm, but often doesn't accurately represent the complete cost of the design. A/E contractual language discourages doing estimates

for fear of being held accountable. Because of this, the managing of cost within the budget becomes a major issue resulting in cost overruns and very disappointed owners. The project schedule is also often not modeled, let alone periodically updated. Missed delivery dates are the result. Issues such as the total cost of ownership (life cycle costs) and project Performa analysis are also not addressed. Finally, constructability of the project and other risks are not addressed since no constructor representation is on the design team. It is not surprising that owners have begun to look at other delivery methods that better look after their interests.

Construction Management (CM)

CM's are often criticized for their lack of concern for project quality. An example is the type of so called VE which is usually a list of items that could be reduced in quality or outright deleted from the project. Following is some examples taken from a CM list of "VE" suggestions for a marine terminal facility received by the authors for comment:

- Delete two vestibules and sliding glass doors
- Delete Sunscreen
- Remove terrazzo and reduce the amount of tile
- Delete fire pumps
- Delete Escalator
- Down-size the Generator
- Delete All Landscaping

Interestingly, the official list of CM tools on the CMAA website does not even list VE. This may have been deleted because they have "stained" the term through their misuse.

The life cycle cost implications of changes to cheapen the initial construction cost are not taken into consideration. This results in an owner paying more in the long run to control capital costs. Ironically LCC is listed as a tool of CM's on the CMAA website. Yet the authors have never received a single LCC analysis from a CM! Constructability and other risks are better addressed than in the traditional delivery method however project financing and the overall project Performa are not addressed.

CM @ Risk

CM's that are offering the owner a guaranteed maximum price (GMP) are putting themselves at risk if the construction cost does exceed this amount. In order to avoid financial loss to the CM the GMP is estimated as high as possible and includes a significant contingency. The owner is essentially paying for the guarantee with this premium contingency. What seems to be a "guarantee" is really not because of each change in the design documents results in added cost to the guaranteed amount. CM's are also often criticized for their lack of concern for project quality. An example is the type of so called VE which is usually a list of items that could be reduced in quality or outright deleted from the project. The life cycle cost implications of changes to cheapen the initial construction cost are not taken into consideration. This results in an owner paying more in the long run to control capital costs. Constructability and other risks are

better addressed than in the traditional delivery method however project financing and the overall project Performa are not addressed.

Design-Build

The D-B project delivery is becoming more popular. The Design Build Institute of America claims as much as 40% of projects are now D-B.

The D-B process creates concerns for an owner and the D-B entity such as:

1. Has adequate project criteria and expectations been defined?
2. Are design-build proposals responsive and cost competitive?
3. Will decisions during design and construction provide optimum value?

The D-B approach does not lend itself to the traditional application of VM since once the D-B entity is selected it is "hand's off" for the owner involvement so the project can be quickly completed. If the project performance criteria have not been clearly communicated in the RFP (request for proposal) document, the owner will not get what they were expecting. Nor is life cycle cost choices considered since the D-B is only interested in meeting the performance criteria at the lowest first cost possible. After all this is their money having agreed to design and construct the price a fixed (guaranteed) price. Quality is only maintained if it is carefully defined in the RFP.

Public Private Partnership (P3)

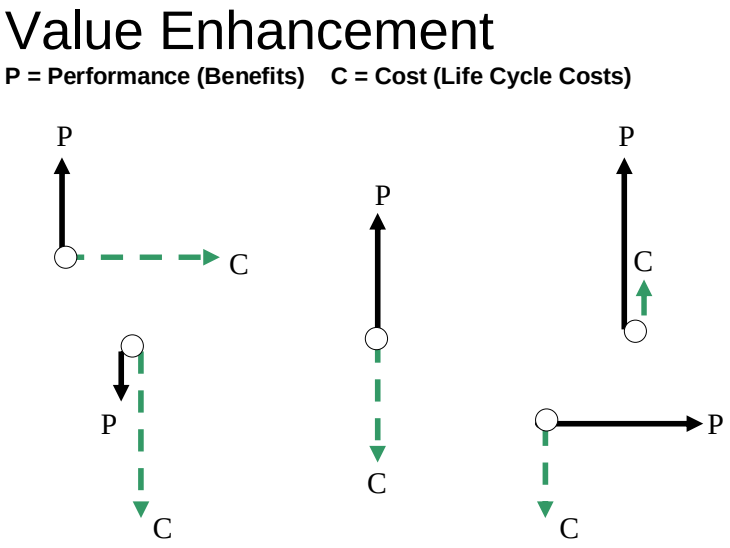
This approach is also gaining ground in other parts of the world. To a limited extent it is used by the US General Building Administration (GSA) to procure courthouses. Just as in the D-B approach, the owner may not be able to fully participate in the design decision-making after the contract is awarded to the PPP Entity (contractor). Concerns exist about adequate project definitions in the RFP regarding performance standards and expectations of the owner. Will the project reflect owner desires for sustainability?

VALUE ADDED STRATEGIES

Done correctly, value based design decision-making is about value over the lifetime of the facility being analyzed. Value management is not simply about money, it is, as the name suggests, about value, which includes important issues such as operational effectiveness, flexibility, comfort, site & architectural image, cultural values, engineering performance, safety & security, environmental sustainability, construction schedule and initial and long term cost effectiveness.

Some claim VM is only for projects over budget. The experienced have found that VM should always be applied whether the project is within budget or not. For example, when a project is within budget the VM team focuses on adding even greater performance while finding cost

savings to pay for the added features to stay within the budget. If over budget, the VM team first focuses on meeting the budget then looks for opportunities to add performance.



The power of value based design decision-making is in the methodology. The six step problem-solving process focuses on increasing value by improving performance (quality) and lowering cost (life cycle cost). The steps of decision-making are:

1. Information gathering and benchmarking, for example creating cost and quality models
2. Function analysis, which is the exercise of stating the project purpose in a verb/noun form
3. Creativity phase, which does not stop with the first workable idea
4. Evaluation of ideas generated using life cycle cost analysis and using benefit cost comparisons
5. Development of those ideas into a workable preferred alternative using "choosing by advantages"
6. Recommendations to the decision-makers balancing benefits and costs

All project delivery methods can take advantage of the use of VM techniques such as:

- Function Analysis, to properly understand the project requirements
- Creativity, to expand the number of ideas considered
- Life Cycle Costing, to understand the long term impacts of ideas
- Value Methodology, for improved problem solving and decision-making
- VM Workshop Setting, for consensus building
- Post Occupancy Evaluation, for feedback on decisions reached

Following are specific strategies associated with each project delivery method. Examples are given to illustrate the benefits of these strategies.

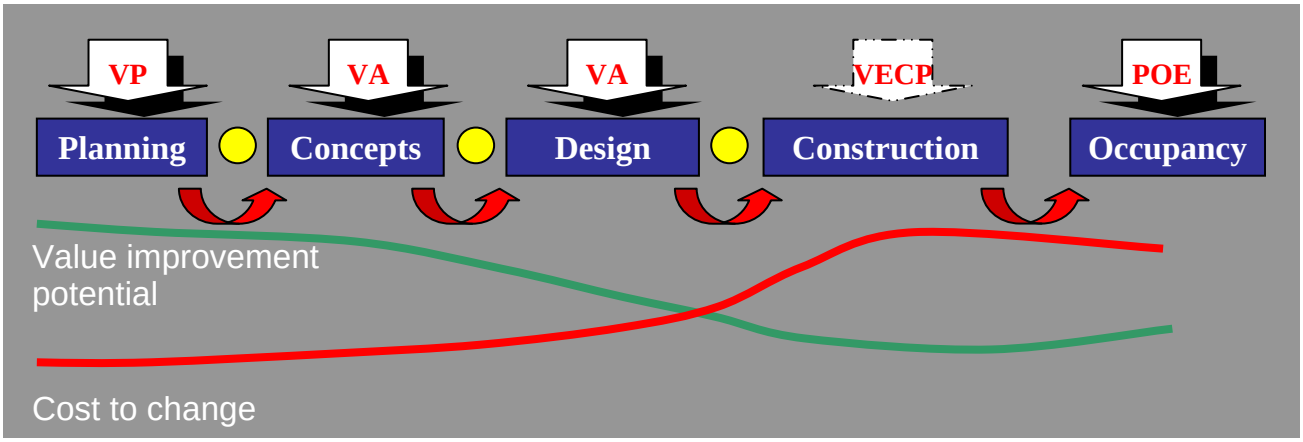
Traditional, Design-Bid-Build

For the Traditional, Design-Bid-Build delivery, VM is resisted by the designer who feels they are in full control of the cost, quality, and schedule. An outside 3rd party (VM team) is unnecessary. As has been demonstrated time and time again, this is not true. Some think you only apply VM if you are over budget. This is just a myth. VM when properly applied following the SAVE methodology not only raises the quality but also lowers the cost of the project (by as much as 10% to 15%). It also addresses schedule, life cycle cost effectiveness, maintainability, and sustainability. In the D-B-B delivery approach, a constructor is not represented during the design process. To off-set this, the VM team includes constructability specialists to review the design for opportunities to improve the buildability of the project. This method requires a very long design and construction schedule because it is a linear progression from early design, to design development, then preparation of construction documents, then bidding, selection of the general contractor and finally completed structure. VM can play a significant roll in schedule modification in order to reduce the delivery time. Most often the VM ideas have to do with simplifying the design in order to reduce the construction time.

Cost estimating and cost control should be the responsibility of the design firm with this delivery method. Unfortunately most designers avoid the responsibility (this is blatantly clear when reading A/E professional liability education programs). VM offers assistance by reviewing the cost estimate of the A/E and comparing costs with other similar projects. This benchmarking sometimes results in discovering cost estimating errors. The VM also provides independent cost estimates to verify the cost of the project prior to VM workshops. From a cost control standpoint, VM offers significant improvements to schedule, cost (both estimating and control), and life cycle quality enhancements. Often forgotten is the benefit of team building and reaching consensus following this value based design decision-making process.

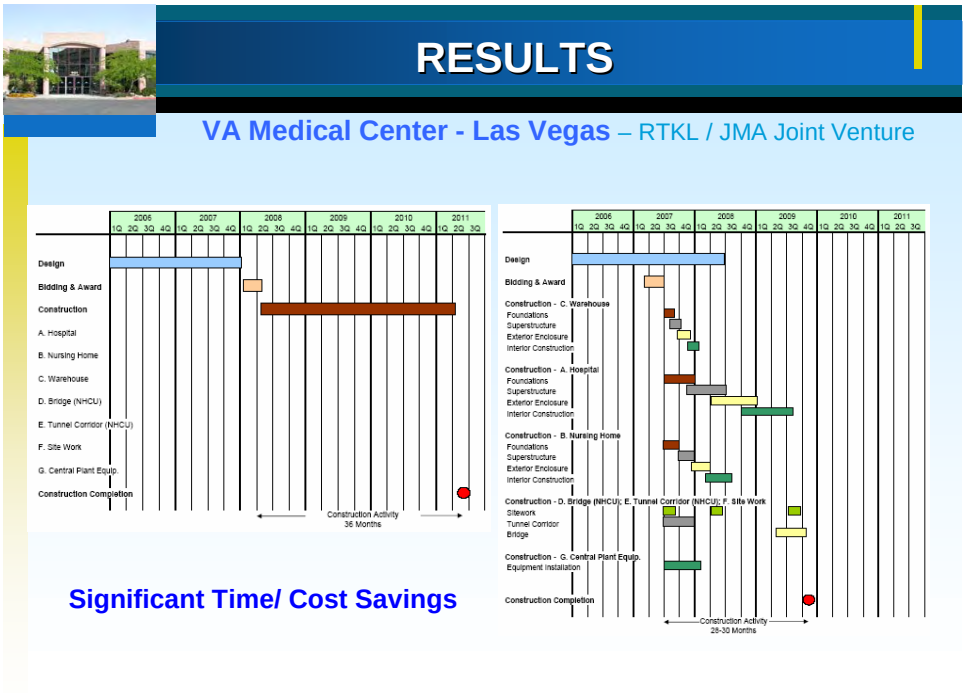
A simple project is usually only studied once, preferably at the conceptual stage. Large/ complex projects may apply VM at several stages of design as illustrated below.

Value Studies at different stages of application



Example 1: Veteran's Administration Medical Center, Las Vegas, NV

The new Veteran's Administration Medical Center in Las Vegas originally had a traditional linear project delivery schedule. The VM team identified an alternate schedule allowing key components of the medical center such as long term care facility to be built early reducing completion time by nearly 3 years. This saved the leasing cost of a temporary facility as well as the cost escalation associated with waiting to construct.



Construction Management (CM)

Use of VM (per the SAVE standard) is of great benefit to projects using the CM approach to project delivery. Without a trained VM facilitator, the CM approach results in VE cost cutting. The use of life cycle costing is also important. Training is requited for CM's to do this analysis or it should be done in the context of the VM workshop. Having an independent cost estimate prepared by a VM specialist in the early stages of design also offers validation of the project cost and identifies potential risks associated with the design.

Example 2: Multi-use Office, Hotel, Shopping Center, State of Kuwait

This multi-use facility called the "Capital Tower Project," was designed by Al Jazeera Consultants. It originally had a curtainwall system that was extremely expensive and potentially not constructible. The VM team identified several modifications to the curtainwall including smaller glass sizes, use of unitized framing system in lieu of stick built, and revised glass orientation. This improved the constructability of the curtainwall, reduced the project schedule and helped bring the project back in budget. Following is the elevation of this 63 story facility. This and other VM recommendations improved the profitability of the project by over 20%.

Capital Tower Project, designed by Al Jazeera Consultants

CM @ Risk

Many CM contracts start with a “friendly” open book arrangement with the owner (as discussed in the CM approach above). Somewhere during design development, such as at 60% stage, the contract changes to a more adversarial relationship. This occurs when a “guaranteed maximum price” is give to the owner. In reality, the CM has provided the owner a sole source price which includes an amount of money to cover their risks. Independent cost estimating services by the VM help to verify the GMP properly represents the value of the project. When value analysis workshops are held, all savings accrue to the CM @ Risk. To avoid this, the owner should us an independent third party value specialist to lead the study and isolate savings that should be shared between the owner and the CM.

Example 3: Airport Operations Center, Anchorage, AK

The new Airport Operations Center, designed by ECI/ Hyer in Anchorage, will consolidate and replace existing facilities at the airport in order to create a more functional facility and meet the growing demands of the airport operation. The Terminal Connector will allow indoor conditioned space for the public between terminals. The operations center includes office space for administration, shop areas, dispatch operations & airport communications, emergency operations center, and police. Total gross area of the operations center is 43,945 GSF. Total gross area of the terminal connector is 9,145 GSF.

Following is a summary of the value objectives set for this study:

- Meet functional needs of airport
- Maintain appearance to north and south terminals
- Meet comfort needs
- Achieve quality environment (air, light, interior aesthetics, convenience)
- Meet airport standards
- Satisfy technology growth/ flexibility
- Seek to improve facility maintainability
- Seek durable, long life systems
- Lower energy use & cost
- Minimize capital construction costs

One recommendation included the use of piling (approximately 50' to 75' deep) in conjunction with grade beams for both the Airport Operations Center in lieu of over excavation and imported fill, spread footings, and a slab on grade. The benefits included reduced schedule and $1.2 million is construction cost savings. This value study was initiated by the CM and performed prior to the CM giving a GMP and therefore all savings accrued to the owner.

Airport Operations Center, designed by ECI/ Hyer

Design-Build

Value Management (VM), as a proven problem solving methodology offers significant benefits for both the owner and the design-build entity when properly applied during the D-B process. Several VM techniques are presented which help overcome some of the concerns about implementing design-build delivery in the design and construction industry.

Value management stages of application and techniques have continued to expand over the past twenty years. Today, VM is highly effective in the early planning stages of a project as well as during various stages of design and construction. Since the design-build process spans from project planning & definition through design and construction, VM offers a variety of unique techniques that improve upon the project's performance. These value enhancements include:

1. Construction cost savings of 5-15%, or more
2. Life cycle cost optimization
3. Function-based project criteria definition
4. Balanced quality, program and cost expectations
5. Project risks identified along with mitigation strategies
6. Improved schedule coordination and project delivery
7. Enhanced business process/operational effectiveness
8. Expanded design alternatives, using "value based design Charrette" approach
9. Design alternative selection, using "Choosing by Advantages" VM technique

Effective application of VM with D-B, results in owner project expectations which are defined, managed and achieved, if not exceeded. For the D-B entity, this means being selected by owners to provide D-B services and, upon project completion, repeat business opportunities. Specific VM techniques, along with example applications, are presented as they relate to the D-B process.

The design-build typical process can be described as consisting of three broad phases:

1. Request for Qualifications/Request for Proposal (RFQ/RFP) preparation by the owner
2. Response to RFQ/RFP by the D-B entity
3. Design and construction by the D-B entity with input from the owner

RFQ/RFP Preparation and VM

The RFQ/RFP preparation stage involves defining owner expectations regarding such things as project size and operational performance, quality of building systems, architectural image, environmental sustainability, flexibility, safety, schedule of completion and cost budget. These criteria are defined in performance terms only, in order to give D-B firms an opportunity to creatively explore alternatives. In many cases however, certain elements of the project can only be described in prescriptive terms, such as the type of mechanical system required. Other data about the project is also presented such as: site information, code and regulatory standards, economic and financial considerations and other restrictions. Some owners also prepare a detailed space program of requirements. Still others may develop conceptual layout designs to begin to understand the consequences of their project requirements as well as to communicate to prospective D-B entities their preferred solution. VM can provide owner assistance with the above.

The VM approach focuses on desired functions of the owner. This is the heart of VM and consists of verb-noun function descriptions. A technique called FAST diagramming (Function Analysis Systems Technique) permits project definition in terms of desired functions. It also helps communicate the higher level business purpose(s) of the project. Asking "how" questions help determine the specific solution to the problem. Asking "why" questions leads to the overall purpose of the project. The FAST diagram, when completed, provides a big picture of the project functions for all concerned.

Another VM technique called "Quality Modeling" assists the owner in carefully defining the quality elements of the project. The major categories consist of the following:

- Operations
- Image
- Technology
- Resources

The quality modeling process assists in the defining, measuring and managing of owner quality expectations. An interactive workshop setting, with owner and user participation, allows project expectations to be brought out, explored and documented. The relative importance between these quality elements is then explored, prioritized and documented with the owner. The quality model consists of narrative descriptions of each quality element and a graphic diagram which shows the relative priorities.

Space Modeling is a third VM technique which is used to assist in documenting space functional requirements. Space technical criteria, relationships and other information are also a part of space modeling. Benchmarking of similar space functions helps to validate overall needs.

Cost Modeling is a formal VM technique which ties quality and space requirements to a realistic cost budget. The cost model is organized into project functional systems. UNIFORMAT is an elemental cost accounting system used by VM specialists to organize costs. Historical project costs, also organized by UNIFORMAT, permit benchmarking comparative information.

Some owners also establish life cycle cost budgets for their projects. For those that do, the VM technique of life cycle cost modeling assists in setting realistic budgets. Normally, cost elements include:

1. Capital costs
2. Staffing costs
3. Energy costs
4. Maintenance costs
5. Replacement costs
6. Associated costs

All costs are converted to an equivalent present worth basis using the owner established economic criteria for discount rate and life cycle.

A time model is also prepared to relate critical scheduling activities with the overall anticipated project completion date. This VM technique permits discovery of potential problems and leads to improvements to the project schedule.

Once the above models are prepared, a value workshop is held to review all criteria for adequacy and completeness. In most cases, the quality and space expectations exceed the cost budgets. The value workshop study team includes participants from the owner, user, designer, constructor and facility manager. They explore a variety of options to get the project in balance. The workshop itself is structured following SAVE International Value Methodology. This methodology consists of the following phases: information, function, creativity, evaluation, development, and presentation.
In addition to the above design criteria, including VM techniques, the owner also identifies the minimum qualifications acceptable for prospective Design-Build firms. This might include:

1. Experience on similar projects
2. Performance in meeting owner budgets, schedules
3. Overall capability and resources
4. Financial strength
5. Previous owner references
6. Management approach and leadership

The above information is assembled into an RFQ document. The project is advertised and qualification proposals are received (in response to RFQ). The owner then shortlists (selects)

preferably three and usually no more than five of the most qualified D-B entities, for further consideration.

The short listed firms are then given a formal request for proposal (RFP). This document seeks a design and cost proposal in response to the design criteria developed earlier. Once these proposals are received, each D-B entity is evaluated on the basis of quality of design, price and other factors. Before making a final award, the short listed firms may be called in to make presentations.

Response to RFQ/RFP and VM

D-B entities interested in responding to owner requests for qualifications prepare appropriate information for consideration. Management strategies are developed by the D-B entities which explore how best to design and construct the facility, should they be selected. The VM technique of function analysis helps identify strategies.

Upon notice of being short listed by the owner, the D-B entity then begins the process of responding to the RFP. Superior creativity and innovation in the preparation of a response is needed in order to satisfy both the quality of design sought as well as to achieve a cost that is competitive. VM can provide terrific assistance in developing a design which is both high quality and lower in cost than the competition.
To gain competitive advantage, the D-B entity uses VM techniques and outside experts. A Value Workshop is held to explore options in satisfying owner criteria. This workshop follows the procedures of SAVE International's "value methodology." The workshop begins with a review of the RFP and VM material including the FAST diagram; quality, space, cost, life cycle cost and time models. The team then explores alternatives which will meet the required functions but at a cost that will be low enough to win the award.

The VM technique of Risk modeling assists in identifying the potential risks involved with the project. These risks range from geotechnical concerns to construction labor and material availability. The VM team creatively explores mitigation strategies for each of the high risk areas.

Upon receipt of proposals from the D-B entities, the owner begins the process of selecting the one that provides the greatest value to the owner. A variety of selection processes are available to public and private sector owners. Each has been used successfully and each has merits. Following is a listing of the most common approaches:

1. Weighted Criteria
2. Adjusted Low Bid
3. Equivalent Design/Low Bid
4. Fixed Budget/Best Design
5. Meets Criteria/Low Bid
6. Emergency (public safety or welfare threatened)

Whatever selection approach is used by the owner, it should be mentioned in the RFP document so as not to cause any possible disputes later. Explicitly describing the approach including any "weighting" of criteria will also help the D-B entity produce a better response. The VM technique of weighted evaluation assists the D-B entity in assessing their own strengths and weaknesses. This analysis helps the firm to identify weaknesses so that they may be strengthened by adding additional consultants, etc.

Several model D-B contract documents exist for owner use. These D-B contract documents can be obtained at the following organizations:

1. American Institute of Architects
2. Associated General Contractors of America
3. Engineers Joint Contract Documents Committee, American Consulting Engineers Council
4. Design-Build Institute of America

Design / Construction and VM

Upon selection and award of the contract with the owner, the D-B entity begins the process of finalizing the design and construction documents. Because there are still a number of decisions yet to be resolved, the owner and the D-B entity must maintain good relations. In many cases a VM "partnering" exercise begins the working relationship. VM can assist both D-B and the owner in continuing to seek best value solutions during the final design stage. Issues about design documentation, constructability, schedule, quality and life cycle cost effectiveness continue to be explored, during value workshops in which the owner and the D-B entity participate. As a further incentive for the team, a sharing of savings between the owner and the D-B entity is suggested. After the project is built, a post-occupancy evaluation is conducted to obtain lessons learned about the relative success of the project.

Significant time savings can result using the D-B method because procurement and construction work can begin before all the construction documents are fully completed. This fast-track construction in time savings translates into lower costs and earlier utilization of the completed facility.

Example 4: U.S. Embassies

Although specific project information is confidential, some general observations can be made about D-B application. The project delivery method used by the US State department for quickly building new embassies around the world id the Design-Build project delivery method. Standard embassy design performance criteria are part of the RFP used to solicit and select D-B entities. When traditional VM was applied to D-B after the D-B entity was selected, the timing was too late for many of the ideas to be incorporated. Shifting the VM to the RFP scoping stage allowed the VM recommendations to be incorporated in the performance criteria.

Public Private Partnership (P3)

VM can offer similar techniques to those listed above to assist in PPP. A very useful tool is life cycle costing since best value decisions are based over the life of the project. PPP has not addressed sustainability. The use of the LCC model would assist in identifying sustainable (green) ideas. LCC would judge if they are cost effective over the long term.

Example 5: Dormitory, Wayne State University, Detroit, MI

State funding for university facilities in Michigan has been significantly curtailed due to the poor state economy. Wayne State sought an alternate delivery method that would provide the funding necessary to build new university facilities. This project addressed the needs of on campus student housing. The Public Private Partnership delivery method allowed project completion very quickly to meet this urgent housing need. Private funding in combination with D-B allowed the dormitory to be funded, designed and constructed in only 24 months. The use of VM early in the process helped explore options for the combinations of types of dormitory rooms, the layout & massing of the building on the site, and the urban setting of the campus. A Value Based Design Charrette was held at the concept stage of the project creatively explore options as well as evaluate and select the preferred alternative. Walbridge Aldinger led the effort and Hamilton Anderson served as the project architect.

Walbridge Aldinger

hamiltonanderson

SUMMARY & CONCLUSION

Figure 1 summarizes the value added strategies for each of the five construction project delivery methods discussed in this paper. Each of the forms of delivery can be enhanced with the value methodology. VM offers significant benefits for both the owner and the delivery partner. VM offers help in:

1. Assuring a cost effective design
2. Meeting the quality expectations of the client, and
3. Achieving the schedule

Construction Project Delivery - Value Added Strategies Figure 1

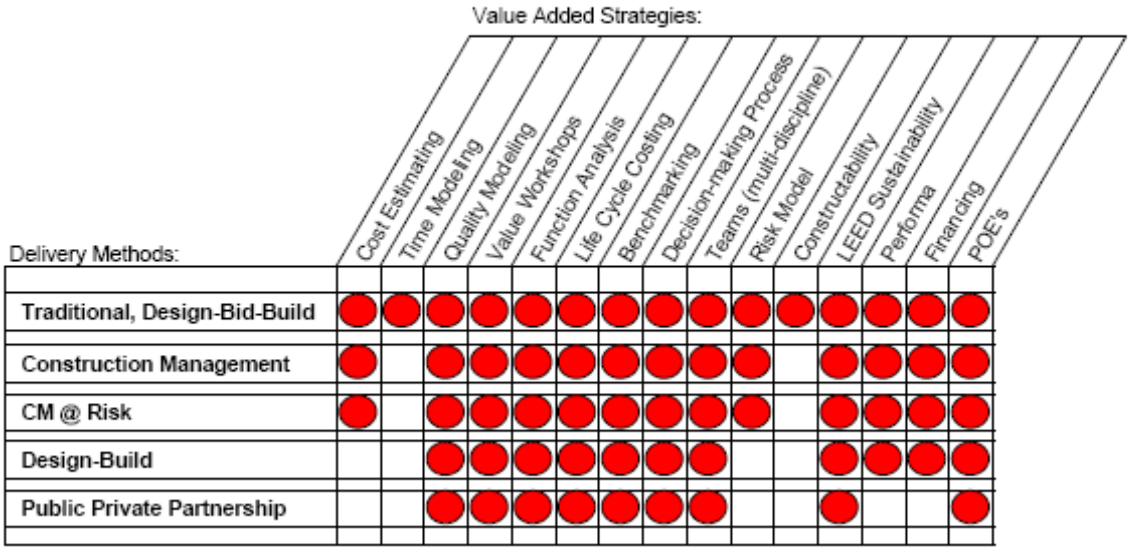
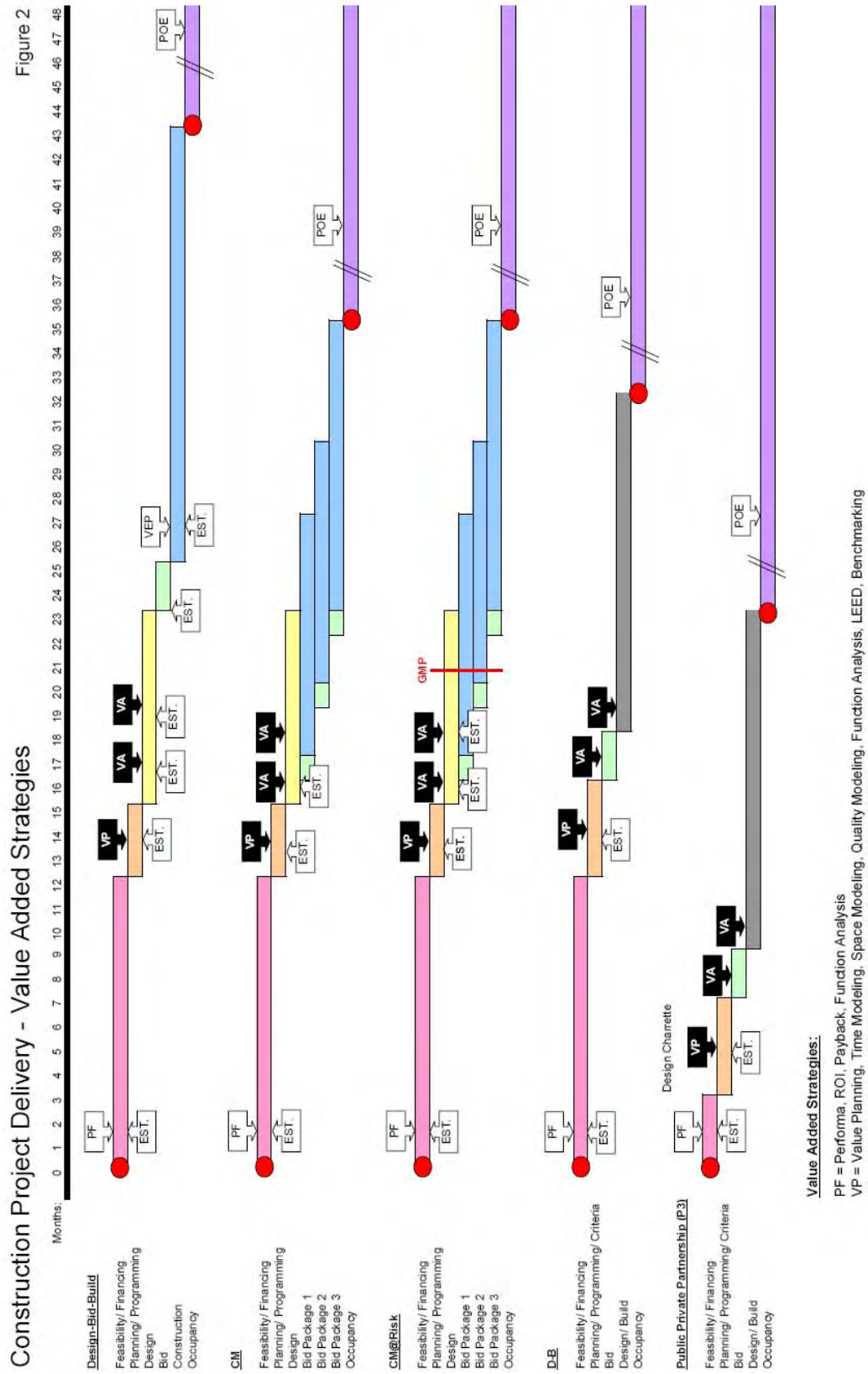


Figure 2 illustrates where the various value added strategies are applied in each of the construction project delivery methods.

Owners, A/E's, CM's, design-builders, and finance-design-construct-operate-transfer entities are encouraged to consider use of value management for their next project in order to improve quality, meet schedule, and reduce costs.

Figure 2


Construction Project Delivery - Value Added Strategies
Months: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48
Design-Bid-Build
Feasibility/ Financing
Planning/ Programming
Design
Bid
Construction
Occupancy
CM
Feasibility/ Financing
Planning/ Programming
Design
Bid Package 1
Bid Package 2
Bid Package 3
Occupancy
CM@Risk
Feasibility/ Financing
Planning/ Programming
Design
Bid Package 1
Bid Package 2
Bid Package 3
Occupancy
D-B
Feasibility/ Financing
Planning/ Programming/ Criteria
Bid
Design/ Build
Occupancy
Public Private Partnership (P3)
Feasibility/ Financing
Planning/ Programming/ Criteria
Bid
Design/ Build
Occupancy
PF
VP
VA
VEP
EST.
GMP
POE
Design Charrette
Value Added Strategies:
PF = Performa, ROI, Payback, Function Analysis
VP = Value Planning, Time Modeling, Space Modeling, Quality Modeling, Function Analysis, LEED, Benchmarking
VA = Value Analysis, LCC, Function Analysis, Cost Modeling, LEED
VEP = Value Change Proposal (by construction contractor)
EST = Cost Estimating
POE = Post Occupancy Evaluation

REFERENCES

American Institute of Architects, 1735 New York Avenue, N.W., Washington, D.C. 20006

The Associated General Contractors of America, 1957 E. Street, N.W., Washington, D.C. 20006

The Construction Management Association of America, Washington, DC, www.CMAA.org

Design-Build Institute of America, 1010 Massachusetts Avenue, NW., Suite 350, Washington, DC 20001 www.DBIA.org

Handbook on Project Delivery, California Council AIA, 1996

HM Treasury CUP Construction Guidance No. 2 Value for Money.
Available at http://www.hm-treasury.gov.uk/pub/html/docs/cup/procurement/guide2.pdf

John Kelly and Steven Male "The Application of Value Management to the UK Public Sector Construction Supply Chain, SAVE International Conference, Reno, May 2000.

Stephen Kirk, "Leadership in Design Team Innovation Using Value-Based Decision-Making Techniques," Harvard University, Harvard Design School, Executive Education Seminars, Cambridge, MA, January 24-25, 2002.

Kirk, Stephen, "Quality Modeling: Defining Project Expectations," 1994 SAVE Proceedings

Stephen J. Kirk and Alphonse J. Dell'Isola, *Life Cycle Costing for Facilities*, R.S. Means Company, Boston, 2005 (Japanese 1st Edition 1985).

Stephen J. Kirk and Alphonse J. Dell'Isola, *"Sustainability/ LEED and Life Cycle Costing ~ Their Role in Value Based Design Decision Making*, SAVE International Conference, Montreal, Canada, July 2004.

Stephen Kirk and Stephen Garrett, "Innovative Application of the Value Methodology (VM) for Large, Complex Facilities," SAVE International Conference, Houston, May 2007.

Stephen J. Kirk and Kent Spreckelmeyer, *Enhancing Value In Design Decisions*, Mereal Publishers, 1994. (also, Van Nostrand Reinhold Edition 1988 and Korean Edition 1997).

Stephen Kirk, Richard Turk, and Richard Hobbs, "Value-Based Design Decision-Making," AIA National Conference, Charlotte, NC, May 2002.

LEED Reference Package Version 2.2, U.S. Green Building Council, Washington, DC, 2005.

SAVE International, "Value Methodology Standard," July 2005