

CONTRACT NO. 53A0104

INNOVATIVE PROCUREMENT PRACTICES

**ALTERNATIVE PROCUREMENT AND CONTRACTING METHODS
TASKS 3.2 AND 3.3**

PREPARED FOR:

CALIFORNIA DEPARTMENT OF TRANSPORTATION



Submitted By:

Trauner Consulting Services

Approved By:

Innovative Contracting Steering Committee

MAY 9, 2007



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INTRODUCTION

The traditional procurement system involving the separation of design and construction services has served the public well over the past century. The foundation of this system is the principle of awarding contracts to the lowest responsible bidder, based on 100-percent-complete plans, specifications, and estimates. This system has provided taxpayers with an adequate, safe, and efficient transportation facility at the lowest price that responsible, competitive bidders can offer. For the most part, it has resulted in a reasonable degree of quality, and has effectively prevented favoritism in spending public funds, while stimulating competition in the private sector.

In the traditional system, this separation of design and construction services can foster adversarial relationships between the agency, designers, and contractors, can restrict innovation, and result in high cost and time growth. The traditional system may therefore not necessarily provide the best value to the Department for all project types. In recent years, this issue has become a more pressing concern, as California's deteriorating infrastructure and increasing population have created tremendous pressure to move critical projects quickly through the planning stage and into design and construction, without a commensurate increase in available funding. Underlying these external pressures is the basic requirement to include quality concepts in all phases of the highway program. Thus, there is a continuing need for the Department to review and evaluate procurement and contracting procedures that promote improved efficiency and quality.

The Department already includes in its Project Delivery Acceleration Tool Box techniques designed to yield time savings during the procurement and/or construction phase of a project. These techniques include the use of design sequencing as an alternative project delivery system and the use of A+B bidding, incentive/disincentive provisions, lane rental, and flexible notice-to-proceed dates as alternative procurement and contracting methods. The Department has also experimented with the use of warranties for HMA pavements, chip seals, and microsurfacing projects.

In addition to the practices identified in the Department's Tool Box, other innovative project delivery, procurement, and contracting techniques are gaining acceptance in the highway construction industry to accelerate project delivery, reduce initial or life-cycle costs, and improve quality.

This report evaluates selected innovative contracting strategies. Each evaluation consists of a description, objective, summary of past and ongoing DOT experience, performance outcomes to the extent documented in the literature, and project selection criteria. A qualitative assessment of the advantages and disadvantages of each particular method is also provided. The advantages and disadvantages are based in part on reported performance outcomes, which are supplemented by the perceptions of agencies, contractors, and other experienced practitioners. To provide a baseline for comparison, an evaluation of the advantages and disadvantages of the traditional design-bid-build approach has been prepared as well.

The innovative techniques considered in this report are identified below, organized into categories of delivery systems, procurement practices, and contract management methods. The procedures that Caltrans currently uses are identified and evaluated in this report as well.





Summary of Caltrans Current Experience and Additional Methods for Consideration

Project Delivery Systems	
<p><u>Current Caltrans Experience</u></p> <ul style="list-style-type: none"> • Design-Bid-Build (low bid) • Design Sequencing 	<p><u>Additional Methods for Consideration</u></p> <ul style="list-style-type: none"> • Indefinite Delivery/Indefinite Quantity ² • Agency-CM ² • CM at-Risk ^{1,2} • Design-Build ¹ • Early Contractor Involvement/Target Pricing ^{1,2} • Project Alliancing ^{1,2} • Contract Maintenance ²
Procurement Practices	
<p><u>Current Caltrans Experience</u></p> <ul style="list-style-type: none"> • Cost-Plus-Time Bidding (A+B) • Low Bid 	<p><u>Additional Methods for Consideration</u></p> <ul style="list-style-type: none"> • Lump Sum Bidding ² • Multi-Parameter Bidding (A+B+C) ² • Alternate Design ² • Alternate Bid ² • Additive Alternates ² • Best-Value Procurement ^{1,2} • Reverse Auction Bidding ³ • Bid Averaging ³
Contract Management Methods	
<p><u>Current Caltrans Experience</u></p> <ul style="list-style-type: none"> • Incentives/Disincentives • Lane Rental • Flexible Notice to Proceed Dates ² • Warranties 	<p><u>Additional Methods for Consideration</u></p> <ul style="list-style-type: none"> • Liquidated Savings ² • Active Management Payment Mechanism ² • No Excuse Incentives ² • Shared-Risk Contingency Fund ²

¹ Statutory authority required

² FHWA SEP-14 approval required

³ Not allowed on Federal-Aid projects

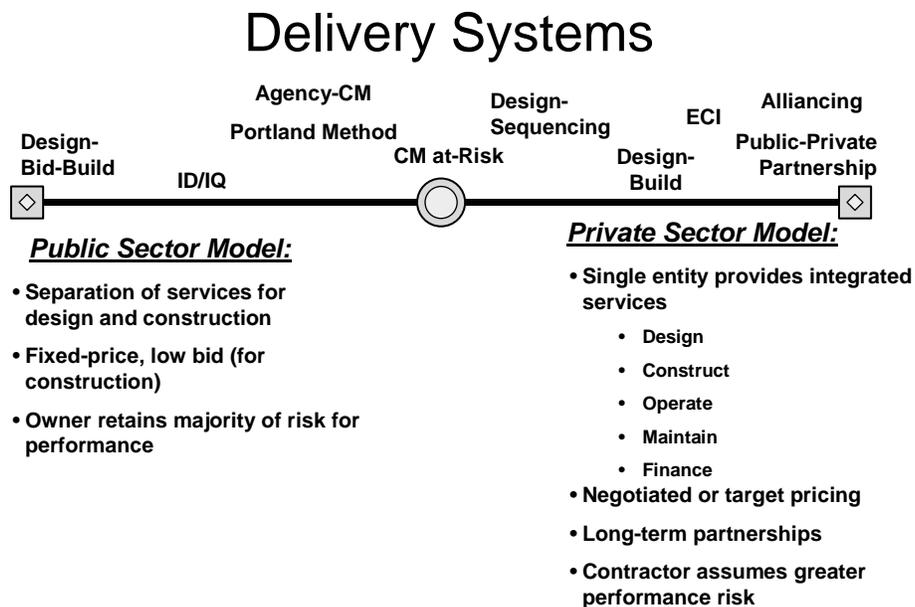




PROJECT DELIVERY SYSTEMS

Project delivery systems refer to the overall processes by which a project is designed, constructed, and/or maintained. In the public sector, this has traditionally entailed the almost exclusive use of the design-bid-build system, involving the separation of design and construction services and sequential performance of design and construction. In recent years, however, the highway industry has begun experimenting with alternative methods to improve the speed and efficiency of the project delivery process.

These alternative systems move closer to the integrated services approach to project delivery favored in the private sector. To illustrate this concept, the innovative delivery systems have been arranged below on a continuum, with the traditional design-bid-build approach appearing on the left and the more innovative systems arranged from left to right according to increasing similarity to the private sector model in terms of greater responsibility and risk shifted to the constructor, and less separation between design and construction services.





Design-Bid-Build

Description

Design-Bid-Build (DBB), or design then bid then build, is the traditional delivery system for the public sector, in which an agency will use in-house staff (or, alternatively, use consultants) to prepare fully completed plans and specifications that are then incorporated into a bid package. Contractors competitively bid the project based on these completed plans and specifications. The agency evaluates the bids received, awards the contract to the lowest responsible and responsive bidder, uses prescriptive or method specifications for construction, and retains significant responsibility for quality, cost, and time performance.

Advantages

- Applicable to a wide range of projects
- Well established and easily understood
- Clearly defined roles for all parties
- Provides the lowest initial price that responsible, competitive bidders can offer
- Extensive litigation has resulted in well established legal precedents
- No legal barriers in procurement and licensing
- Insurance and bonding are well defined
- Discourages favoritism in spending public funds while stimulating competition in the private sector
- As construction features are typically fully specified, DBB provides agencies with significant control over the end product (however, this may come at the expense of increased agency-inspection efforts)

Disadvantages

- Tends to yield base level quality
- Least-cost approach requires higher level of inspection by the agency
- Initial low bid might not result in ultimate lowest cost or final best value
- Designers may have limited knowledge of the true cost and scheduling ramifications of design decisions
- Lack of input from the construction industry during the design stage exposes the agency to claims related to design and constructability issues
- Tends to create an adversarial relationship among the contracting parties, rather than foster a cooperative atmosphere in which issues can be resolved efficiently and effectively
- Agency bears design adequacy risk
- No built-in incentives for contractors to provide enhanced performance (cost, time, quality, or combination thereof)
- Greatest potential for cost/time growth (in comparison to other delivery methods)
- Often prone to adversarial positions that lead to disputes and claims





Project Types/Selection Criteria

- Project scope can be best defined using prescriptive specifications
- Significant third-party issues (ROW, utility, environmental) that can be best resolved or managed by the agency
- Agency can most effectively manage risks





Indefinite Delivery/Indefinite Quantity (ID/IQ)

Description

With ID/IQ contracting (also referred to as job order, task order, area-wide, county-wide, city-wide, and open-ended contracting), the agency will identify and develop specifications for task items. Contractors then competitively bid these task items based on unit prices for task items for a specific contract term. The total quantity and exact location of the work are not provided at the time of bid. After awarding the contract, the agency will issue individual work orders as services are needed at specific locations.

The uncertainty associated with the scheduling of the work and the quantity of work that will ultimately be let has led some agencies to guarantee a minimum value of work to ID/IQ contractors.

Objective

- Time savings in engineering and procurement

Past Experience

Several DOTs have used ID/IQ contracts for maintenance activities and relatively standardized work items.

- Michigan DOT has used ID/IQ contracts for traffic signal installation, issuing a separate work order for each location.
- DelDOT uses open-ended contracts for its roadway rehabilitation program, letting one-year or multi-year hot-mix overlay contracts in various locations throughout Delaware.
- Florida DOT uses ID/IQ contracting for maintenance and traffic operations activities.

Project Types/Selection Criteria

- Clearly defined, standardized, or repetitive work items
- Minor construction, maintenance, pavement marking, signing, and repair contracts that can be classified into small task orders





Advantages

- Reduces overall procurement time by allowing agencies to eliminate separate bid processes for repetitive work items
- Structuring work in small tasks may offer increased opportunities for smaller or disadvantaged businesses
- Provides flexibility in when to let portions of an overall construction program
- Awarding multiple ID/IQ contracts will ensure competitive pricing of work orders
- Long-term contracts can foster a spirit of cooperation/partnership between contractors and the agency

Disadvantages

- Large packages could exclude smaller contractors from bidding
- Without minimum work guarantees, the possibility that selection for award orders may discourage potential bidders
- Without advance knowledge of the timing and duration of task orders, it is more difficult for ID/IQ contractors to manage resources





Agency-Construction Manager (Agency-CM)

Description

Agency-CM (also known as Program Management for multiple contracts or programs) is a fee-based service in which the construction manager (CM) is exclusively responsible to the agency and acts as the agency's representative at every stage of the project. The CM is selected based on qualifications and experience, similar to the selection process for design services. CM responsibilities may include providing advice during the design phase, evaluating bids from prime contractors, overseeing construction, and managing project cost, schedule, and quality. The CM may work with the designer or contractor to reduce the cost, but does not guarantee price or take on the contractual responsibility for design and construction.

Objective

- Supplement in-house staff with independent professionals having expertise in project management, scheduling, and cost control
- Time savings by fast-tracking construction

Past Experience

Agency-CM, a commonly used construction delivery approach in the vertical construction industry, has made inroads in the highway industry for agencies in need of professional managers for large, complex projects or programs. For example, the Massachusetts Turnpike Authority used a CM to coordinate and manage the multiple design and construction contracts required to complete Boston's Central Artery/Tunnel Project, also known as the Big Dig.

Project Types/Selection Criteria

- Agency must supplement its internal resources and management expertise given the project's size or complexity
- Large, complex (multi-season) projects with multiple phases or contracts
- Fast-tracked construction (using phased packages) is possible





Advantages

- Earlier involvement of CM bridges design and construction phases
- Furnishes construction expertise to designer
- Provides the opportunity to “fast-track” early components of construction prior to completion of design
- Augments the agency’s own resources to help manage cost, time, and quality
- Procuring separate design and construction contracts is less change for agency
- Provides an independent point of view (No inherent bias towards design or construction)
- Can provide value engineering suggestions, constructability reviews, and cost estimates
- Reduces the agency’s general management and oversight responsibilities
- Valuable in mitigating disputes that could lead to claims

Disadvantages

- Added project management cost for CM services
- Agency cedes much of the day-to-day project management to the CM, but not necessarily the decision-making responsibility
- CM not at risk for construction cost
- Agency continues to hold construction contracts and retains contractual liability
- Unlike CM at-Risk, Agency-CM services are not regulated by state licensing laws for contractors or A/E firms
- Relatively higher agency involvement (in comparison to other innovative delivery systems) because agency retains contractual liability





Construction Manager at Risk (CM at-Risk)

Description

With CM at Risk, the agency engages a construction manager (CM) to act as the agency's consultant during the pre-construction phase and as the general contractor (GC) during construction.

During the design phase, the CM acts in an advisory role, providing constructability reviews, value engineering suggestions, construction estimates, and other construction-related recommendations. At a mutually agreed upon point during the design process, the CM and the agency will negotiate a Guaranteed Maximum Price (GMP). The GMP is typically based on a partially completed design and includes the CM's estimated cost for the remaining design features, general conditions, a CM fee, and construction contingency. For CM at-Risk, the FHWA requires a fixed-fee structure for federal-aid projects.

The construction contingency can be split into CM and agency components. The CM contingency will cover increased costs due to unavoidable circumstances, for example material escalation. The agency contingency would cover cost increases from agency-directed or agency-caused changes. The construction contingency can be handled in different ways under the contract. Unused CM contingency can be returned to the agency, shared by the agency and CM, or given to the CM.

Agencies are increasingly experimenting with sharing the contingency pool with the CM to provide the CM with an incentive to control cost growth associated with change orders to meet the GMP. The agency may elect to remove pricing of some material or work items as part of the GMP if pricing of these items results in an excessively high CM contingency or GMP. For example, if the price of steel were too volatile to achieve an acceptable GMP, the agency could establish a separate bid item and pre-pay or pay for the steel directly under this item at actual cost.

After the GMP is established, the CM can begin construction, allowing for the overlap of the design and construction phases to accelerate the schedule. Once construction starts, the CM assumes the role of a GC for the duration of the construction phase. The CM holds the construction contracts and the risk for construction costs exceeding the GMP.

Objective

- Time savings by fast-tracking design and construction in phased packages
- Transfer performance risk to CM

Past Experience

Although some states have enacted statutes authorizing the use of CM at-Risk contracting in the public sector, CM at-Risk has not been commonly used on transportation projects. Approval from FHWA is necessary to use CM at-Risk contracting on federal-aid highway construction projects. The Florida DOT is using CM at-Risk contracting in combination with traditional design-bid-build on the \$1.349 billion Miami Intermodal Center, a large parking/transit/roadway project in Miami.

Practitioners have recommended that the GMP is more accurate when certain design elements are completed to 100 percent, rather than having all design elements partially completed, allowing the CM to lock in subcontractors and reduce the estimation involved in the developing the GMP.





Performance Outcomes

According to a CII/Penn State University comparison of delivery systems for buildings used in the U.S., CM at-Risk costs 1.5% less than DBB, completes 5% faster than DBB, and performs equal to or better than DBB in most quality measures. (Sanvido and Konchar 1999)

Project Types/Selection Criteria

- Large projects with multiple phases and contracts
- Fast-tracking – Staged construction
- Limited internal agency management resources and expertise
- Limited time or funding constraints
- Minimal public controversy
- Complete or obtainable environmental documents and permits for the entire project
- Established project footprint
- Acquired right-of-way

Advantages

- Allows for innovation and constructability recommendations in the design phase, yet the agency still retains significant control over design
- CM holds construction contracts, transferring performance risk to GC
- GC puts more investment in cost engineering and constructability review than with CM-Agency
- Fixes project cost and completion responsibility earlier than Design-Bid-Build
- Potential to fast-track early components of construction prior to complete design
- Reduces agency’s general management and oversight responsibilities
- Use of a GMP with a fixed-fee and opportunity for shared savings provides an incentive for CM to control costs and work within funding limits

Disadvantages

- Once construction begins, the CM assumes the role of a general contractor, leading to possible tensions with the agency over project quality, budget, and schedule
- Use of a GMP may lead to disputes over the completeness of the design and what constitutes a change to the contract
- Agency retains design liability
- CM input may not be included by designer
- Incentive split of savings scheme may create perception of inflated GMP
- GMP approach may lead to a large contingency to cover uncertainties and incomplete design elements





The Portland Method

Description

The Portland Method, named after the City of Portland, Oregon where it was used, is a hybrid CM at-Risk delivery method using a cost-reimbursable, fixed fee approach to compensation. The delivery is structured into three phases, procurement, pre-construction, and construction.

In the first phase, the agency procures the contractor using a best-value process. The proposer is selected based on qualifications and a fixed fee “bid” covering the contractor’s off-site and onsite overhead, including superintendents, management staff, other general conditions costs, and profit, for the life of the project. In the event that differing site conditions increase overall contract time or extra work is ordered in writing by the agency, this fixed fee may be renegotiated accordingly.

During the pre-construction phase, the contractor provides design reviews and construction planning, with a focus on constructability, value engineering cost and time reductions, and joint risk assessments. These efforts culminate in the development of an estimated reimbursable cost (ERC). The intent is to establish reasonable construction costs for labor, equipment, and materials, which factor in the costs of unknowns without establishing a separate contingency. After comparing the ERC with the “Engineer’s Estimate,” the contractor and agency negotiate a final ERC and combine this with the fixed fee to establish the contract amount. Finally, the contractor will submit a cost control program and subcontracting plan for construction. In the final phase, the general contractor will construct the project by self-performing work on a reimbursable basis and sub-contracting work using firm-fixed-price agreements.

The Portland Method differs from conventional CM at-Risk in that it uses an ERC instead of a GMP. The ERC shifts less risk to the contractor to meet set funding limits. Also, the Portland Method places no limits on the amount of work that the prime contractor may self-perform, a common restriction found in CM at-Risk contracts.

Objective

- Early contractor involvement (design and planning) to reduce cost and schedule.
- Time savings by fast-tracking construction

Past Experience

There are no known applications of the Portland Method on transportation projects documented in the literature. This approach was developed by the City of Portland’s Bureau of Environmental Services (BES) for the West Willamette River Combined Sewer Overflow (CSO) project. The project consisted of constructing a combination of near surface pipelines, a soft ground tunnel, and a pump station to transport CSO flow to the City’s existing wastewater treatment plant. The selected contractor worked closely with the BES to develop a baseline project cost, which included both the fixed fee and an estimated reimbursable cost. The contractor was also tasked with developing a project cost control program to track actual costs against budget and to make projections based on learned history. BES had review and approval authority over subcontracts and subcontract modifications, and of all purchases over \$50,000. BES also conducted periodic field audits of contractor activity and biweekly audits of cost reimbursement requests. (Gibbon et al. 2003)





Performance Outcomes

The City of Portland reported that the contractor’s early involvement with design review, value engineering, and risk analysis prior to design completion (tunnel and pipelines were 85% complete; pump station was 50% complete) contributed to significant cost and schedule savings on the West Willamette River project. (Gribbon et al. 2003)

Project Types/Selection Criteria

- Large, complex projects that would benefit from joint risk analysis by the agency and contractor
- Projects involving significant elements of subsurface work with a high degree of risk:
 - Tunnels
 - Deep Foundations
 - Environmental Remediation

Advantages

- Allows for innovation and constructability recommendations in the design phase, yet the agency still retains control over the design
- Fixes project cost earlier than Design-Bid-Build
- Potential to fast-track early components of construction prior to complete design

Disadvantages

- Once construction begins, the CM assumes the role of a general contractor, setting up traditional contractual relationships with agency and designer, and potential for disputes over project quality, budget, and schedule
- Best suited to specialized work (e.g. tunneling) with significant risk of cost and time growth
- Agency retains design liability and greater risk of differing site conditions
- In comparison to CM at-Risk with a GMP, reimbursable cost basis shifts less performance risk to the contractor
- Provides no added incentive to motivate contractors to control costs
- Need detailed audit of reimbursable costs





Design Sequencing

Description

With design-sequencing, the agency sequences design activities in a manner that will allow the start of each construction phase when the design for that particular phase is complete, instead of requiring the design for the entire project to be complete before allowing construction to begin. The agency delivers the remainder of the design by predetermined dates after construction has started.

To implement design-sequencing, the agency develops plans and an estimate to a level sufficient to define the project scope and to allow the contractor to select anticipated subcontractors. The bid documents must contain all anticipated items necessary for the complete design, regardless if final quantities have been determined.

Due to the potential for agency-caused delays in releasing subsequent design sequences, design-sequenced projects typically do not incorporate other time-saving contracting techniques, such as A+B bidding or Incentive/Disincentive provisions.

Objective

- Accelerate project delivery by allowing the agency to award a project based on plans that are, on average, 30 percent complete

Past Experience

In 1999, Caltrans received authorization through Assembly Bill 405 to conduct a pilot program with six projects to evaluate the design-sequencing method of construction as a tool to accelerate project completion. The program was expanded to twelve projects in 2000, and a second phase was approved in 2004.

Performance Outcomes

For the seven pilot projects completed as of February 2006, Caltrans reported an average time savings of four months when compared to control projects of similar size and scope delivered using Design-Bid-Build. Capital costs for the pilot projects were reported to be about the same, with support costs ranging between two to six percent higher than the control projects (McKim 2006).

Project Types/Selection Criteria

According to the guidelines developed for its pilot program, Caltrans only considers as candidates for design-sequencing proposed projects that meet the following criteria (Caltrans 2004):

- Minimal public controversy
- Complete or obtainable environmental documents and permits for the entire project
- Established project footprint
- Acquired right-of-way for the initial sequence (thereafter, right-of-way must be cleared for a particular project sequence prior to beginning construction on that sequence)





Project Delivery Systems

- Identification of all possible utility conflicts
- Project lends itself to concurrent design and construction with potential for significant time savings

Advantages

- Faster project delivery

Disadvantages

- The agency retains the risk for variations in the bid quantities
- Potential for construction inefficiency due to conflicting or overlapping work between the initial sequence and subsequent sequences
- Unanticipated site conditions or third party conflicts during construction may impact ability of a design-sequenced project to generate time savings





Design Build

Description

Design-build is a project delivery system involving a single contract between the project owner and a design-build contractor covering both the design and construction of a transportation project. The design-builder performs design, construction engineering, and construction according to design parameters, performance criteria, and other requirements established by the agency.

Design-Build has been implemented in the highway construction industry in a variety of ways based in part on how the state statutes are written and on how much responsibility is transferred to the design-builder for the design and other aspects of project performance.

Several highway agencies have used an approach called *Modified Design-Build*, also called Low Bid design-build or Draft/Detail-Build, where the agency completes a significant portion of the design before selecting the contractor using a low bid solicitation or qualified low bid process. The design-builder then completes the remainder of the design work and constructs the project under a single contract. Modified Design-Build is primarily used in cases where state law prohibits the procurement of construction services using a method other than low bid or before the design is substantially complete, and the agency administers the project using traditional practices and retains greater responsibility for project performance.

Highway agencies with statutory authority and more experience have increasingly implemented design-build consistent with approaches recommended by the Design-Build Institute of America (DBIA) and other practitioners, where the agency completes the conceptual design to a lower level and then procures the design-builder under a two-step best-value proposal process. This two-step best-value approach allows for much earlier involvement by the design-builder and shifts greater control and responsibility for the design and project performance to the design-builder.

A design-build contract may also include responsibilities that extend beyond the design and construction phases of a project, shifting more performance risk to the private sector. These have included:

- *Design-Build-Warranty.* A single entity designs, constructs, and warrants specified highway components over a prescribed time period (e.g., 5, 10, or 20 years). Warranty requirements shift quality responsibility to the design-builder and reduce the agency's need to inspect during construction and maintain the facility during its service life.
- *Design-Build-Maintain.* A single entity designs, builds, and maintains the project works for a specified period of time under a single contract. Payment beyond completion of construction is typically tied to meeting certain prescribed performance-based standards for a period of years.
- *Design-Build-Operate.* A single entity designs, builds, and operates the project (e.g., a toll road) for a specified period of time under a single contract.

Design-build delivery has been expanded to a Public-Private Partnership concept, where a private entity or developer takes part in financing and leasing a transportation project in return for monetary compensation based on contractual authorization to collect toll revenues, or pursue development rights with the contracting agency. The private entity will be responsible for financing, design and construction,





and often will operate and maintain the roadway or bridge for a specified duration. The public-private contract may give full or partial contracting authority to the private entity.

Objective

Streamline and enhance project delivery by contracting with one entity to provide design, construction, and other pre or post-construction services.

Past Experience

Forty-four states allow the use of design-build on public works projects. The states that have most actively use design-build include Florida, Michigan, Ohio, and Pennsylvania.

Performance Outcomes

There have been multiple studies on the effectiveness of using design-build as a delivery method. However, due to variations in project scope and difficulty in identifying comparable design-bid-build projects for use as baselines, these studies have produced highly variable results.

A recent and fairly comprehensive study on design-build effectiveness focusing on design-build projects completed under SEP-14 reported the following (SAIC, AECOM, and University of Colorado 2006):

- An average 14 percent time savings for design-build projects when compared to design-bid-build schedule estimates and a 3 percent reduction in total cost (based on survey respondent estimates).
- An average reduction of 1 percent between planned and actual construction duration based on actual data for the surveyed design-build projects. In contrast, comparable design-bid-build projects showed an average increase of over 11% in actual construction duration.
- A comparable level of quality to design-bid-build delivery. For agency satisfaction as a quality measure, the use of best-value procurement, lower level of design, and larger projects with design-build yielded higher satisfaction ratings.

The Construction Industry Institute (CII) and Penn State University found a 33 percent project delivery time savings and a 12 percent construction time savings for design-build versus design-bid-build projects based on data obtained from 351 projects delivered in the building sector using design-build, design-bid-build, and CM at-Risk techniques. (Sanvido and Konchar 1999)

Project Types/Selection Criteria

FHWA's Design-Build Effectiveness Study identifies the following project features or circumstances as being conducive to a successful design-build project (SAIC, AECOM, and University of Colorado 2006):

- Medium to large projects that are more complex in nature and that can derive benefit from innovation in design or construction
- Projects having a high sense of urgency (due to natural disaster, facility failures, or user impacts) that would benefit from an expedited project delivery

In terms of project types, respondents to the survey effort coordinated in support of FHWA's Design-Build Effectiveness Study rated the following as being the most suitable for design-build project delivery (with road resurfacing rated as the least suitable):





- Road widening or new construction
- Road rehabilitation or reconstruction
- Bridge and tunnel projects

For Modified Design-Build projects, the following additional criteria should also be considered:

- Minimal public controversy
- Complete or obtainable environmental documents and permits for the entire project
- Established project footprint
- Acquired right-of-way

Advantages

- Single point responsibility for design and construction
- Accelerated project delivery by:
 - Fast-tracking design and construction
 - Close coordination between designer and contractor
 - Early contractor involvement to enhance constructability of plans
- Cost containment and reduction in claims associated with design errors and omissions
- Earlier schedule and cost certainty
- Innovation and quality improvements through:
 - Alternative designs and construction methods suited to the contractor's capabilities
 - Flexibility in the selection of design, materials, and construction methods

Disadvantages

- Reduced opportunities for smaller, local construction firms
- Fewer competitors and increased risk may result in higher initial costs
- Elimination of traditional checks and balances. Designer is no longer agency's advocate. Quality may be subordinated by cost or schedule considerations.
- Less agency control over final design
- Higher procurement costs, which may include stipends for proposers
- Traditional funding may not support fast-tracking construction or may require accelerated cash flow.
- Accelerated construction can potentially overextend the workforce.





Early Contractor Involvement (ECI) and Target Pricing

Description

Early Contractor Involvement (ECI) is a hybrid design-build project delivery method from England involving qualifications-based design-builder selection and an open-book target pricing system.

With the ECI delivery method, the agency uses a qualifications-based approach to select a contractor early in the project development process, when the agency has only conceptual plans and an approved budget price. Once the contractor has been selected, additional design and planning is performed with the input of the entire delivery team to establish a target price for the project from that point forward. Various mechanisms are incorporated throughout the design and construction process for the contractor to share in savings, and participate in any losses, realized when actual costs are compared to the target price.

The agency compensates the contractor for actual costs, based on open-book accounts and records, plus a fee. In addition, an incentive structure, similar to that described below, is established to motivate the contractor to design and construct the project within budget.

Design Bonus – If the contractor designs the project within the project budget, as indicated by comparing the forecast total project cost to the project budget, the contractor is paid a design bonus. If the forecast costs are greater than the project budget, the contractor does not receive a bonus, but likewise does not suffer any reduction in payment. If the agency elects to proceed with the project, the contractor still has the opportunity to earn incentives during the construction phase of the project.

Construction Bonus – During the construction phase, the contractor is paid actual construction costs plus a percent fee. If, at the end of construction, the total of actual costs plus the contractor's fee is less than the estimated cost (i.e., initial target price adjusted for any additional compensation paid out during design and construction), the contractor is paid a share of the savings, as calculated using a formula set out in the contract. Similarly, the contractor would pay a share of any cost overruns.

Final Bonus – At the completion of the project, the agency will calculate a final bonus based on a comparison of the contract budget to the total project expenditures incurred by the agency, including any design and construction bonuses already paid to the contractor, as well as an estimate of future costs not yet incurred. If the total expenditure is less than the contract budget, the contractor is paid a bonus percentage of the savings achieved on the contract budget. If the contract budget is exceeded, no final bonus is payable to the contractor; however, the contractor does not share in any additional cost overruns (other than what they may have already incurred in the construction cost share).

Objective

- Align team goals through the early establishment of the contractor's role in the project development process and through the rational and equitable sharing of project risks

Past Experience

ECI was first developed and used by the Highways Agency in England. The Highways Agency now recommends use of ECI on all publicly funded major projects (i.e., contracts valued at over £5 million) as a standard procurement strategy.





Project Delivery Systems

Washington DOT (WSDOT) used a form of target pricing to resume work on the \$204 million construction project to reconstruct and widen the SR 104 Hood Canal Floating Bridge, after the discovery of unexpected tribal burials interrupted construction. WSDOT proceeded with an altered project scope using the original contractor, with which it negotiated a target price for the remaining project work. The target price included the estimated construction cost plus the contractor’s fixed fee, with the potential for shared savings to reward good performance. Note that this project did not embody pure target pricing techniques because the target price had to be negotiated in response to an emergency condition, when all subcontractors and suppliers were already engaged on the project. The project also lacked a formal partnering process (although the agency and contractor are working collaboratively) and a specific assessment of major risks and associated contingency budgeting. (Molenaar et al. 2007)

Project Types/Selection Criteria

- Large complex projects that would benefit from early contractor involvement

<u><i>Advantages</i></u>
<ul style="list-style-type: none"> • Allows contractor’s expertise to be introduced earlier in the project development process • Bonus structure provides an incentive for contractor to control costs and work within the target price established for the project • Open book target pricing system requires contractor to operate in an open and collaborative way • Potential for overlapping design and construction phases may allow for faster project delivery • Encourages better communication between contractor and agency

<u><i>Disadvantages</i></u>
<ul style="list-style-type: none"> • Absence of direct price competition can lead to overly conservative and easily achievable performance targets • Open-book accounting structure and the risk of sharing in cost overruns may deter potential bidders • Increased procurement costs





Project Alliancing

Description

Under project alliancing, an agency and one or more service providers (constructors, consultants, designers, suppliers, or a combination thereof) collaborate on the delivery of a project. In contrast to partnering, another relationship-based approach to project delivery, alliancing uses contractually established financial incentives to encourage superior project performance and cooperation among the alliance participants.

Typical characteristics of a project alliance include the following:

- The alliance team members jointly develop and agree to a target cost, which is then verified by an independent estimator.
- At project completion, the target cost is then compared to the final cost, and the under-runs or overruns are shared equitably (through pre-agreed ratios) among the participants based on their relative contributions to the leadership, performance, outcomes, and overall success of the alliance. In this manner, all participants have a financial stake in the overall project performance.
- Project risk and responsibilities are shared and managed collectively, rather than allocated to specific parties.
- All participants have an equal say in decisions for the project, with decisions made unanimously on a “best-for-project” basis, rather than to further individual interests.
- All participants provide “best-in-class” resources. Full access is provided to the resources, skills, and expertise of all participants.
- The alliance agreement creates a no-fault, no-blame, and no-dispute culture. No legal recourse exists except for the limited cases of willful default and insolvency.
- All transactions are open-book.

The use of project alliancing to establish and deliver a project generally entails four phases, with the alliance remaining intact until the end of the final phase. A practitioners’ guide published by the State of Victoria, Australia (2006) describes these phases as follows:

- ***Alliance Establishment Phase*** – The agency will select project participants on the basis of non-cost criteria, such as technical expertise and experience, financial and management resources, quality and time record, and willingness to commit to a cooperative relationship with the agency. The agency may either select each of the key participants (e.g., designer, contractor, supplier, etc.) in separate selection processes, or allow industry to establish its own teams and submit proposals as an integrated team or consortium. Although conducting separate selection processes allows the agency to select the best individual companies, this approach can be time consuming and may not necessarily yield the best overall team. For such reasons, agencies more commonly choose the integrated team approach to alliance participant selection.

Following participant selection, the agency will conduct a series of meetings and workshops with the selected participants to establish the commercial framework and primary alliance parameters, including the compensation structure, fees for overhead and profit, and the gainshare/painshare arrangement, which are then formalized in an alliance agreement.

- ***Project Development Phase*** – The agency and the selected alliance participants will work together as an integrated team to develop and agree to a target cost and other performance targets (e.g., timely completion, maintenance costs, quality, etc.).





Project Delivery Systems

In response to concerns that the absence of direct price competition leads to overly conservative and easily achievable performance targets, an alternative participant selection model has been developed, although used only sparingly at this time. In this model, the agency enters into interim project alliance agreements with two groups selected on the basis of non-cost criteria. The agency will then work with each group to develop separate costs and other performance targets. The agency selects the winning team based on the lowest or best target cost and other performance criteria. This approach can be particularly useful in cases where the choice of technology can have significant effect on the capital or operating cost of the project.

- **Implementation Phase** – Once the targets are established and agreed to, the alliance team works together to deliver the project with the objective of achieving or exceeding the agreed-to targets.
- **Defects Correction Period** – The participants remain collectively responsible for addressing any defects in the work (typically for a period of about 24 months).

Compensation to the non-agency members of the alliance team is typically based on a “3-limb model” that compensates each participant as follows:

- **Limb 1 Fees** consist of all direct project costs and project-specific overhead incurred by the alliance team members. These fees are viewable by all contracting parties using 100-percent open book accounting.
- **Limb 2 Fees** consist of corporate overhead and profit. These fees were determined during the Alliance Establishment Phase through a series of financial audits of the participants.
- **Limb 3 Fees** are based on a predetermined gainshare/painshare arrangement that is dependent on how the actual cost (Limb 1 fees) compares to the target cost. Losses are capped at Limb 2 fees; therefore, participants are at least guaranteed to recover all direct costs (Limb 1 fees).

Objective

- Encourage cooperative behavior among project participants by tying compensation to the final project outcome
- Better value for the money and improved project outcomes through collaboration and “best-for-project” decision making

Past Experience

Project alliancing was first used in the early 1990’s by British Petroleum (BP) to develop its North Sea oil and gas reserves. Project alliancing has since been used on multiple public infrastructure projects in Australia and New Zealand.

Performance Outcomes

In its initial project delivered using project alliancing, BP realized a £30 million cost reduction in comparison to the target cost and completed the project 6 months ahead of schedule. (Sakal 2005)

Transit New Zealand used project alliancing to deliver its \$68 million Graft Gully motorway improvement project well ahead of schedule and under budget. (Transit New Zealand 2006)





Project Types/Selection Criteria

- Project alliancing should be used to deliver complex, high-risk projects, where risks are unpredictable, inherent to the nature of the project (rather than due to inadequate planning, scoping, or time), and best managed collectively. The project should also derive significant benefit from the involvement of both the owner and non-owner participants in all aspects of project development and implementation.
- Alliancing is not as beneficial for projects having clearly defined and allocable risks.

Advantages

- Improved ability to manage risks due to the sharing of responsibility and incentive for all participants to proactively mitigate risks
- Earlier involvement of construction and cost planning expertise in the project development phase
- Reduced need for contract administration (i.e., inspection, dispute resolution) allows resources to be focused on achieving project objectives
- Less adversarial system
- Transparent pricing of the project, including contingencies
- Increased efficiency provided by a well-functioning team

Disadvantages

- Absence of direct price competition can lead to overly conservative and easily achievable performance targets
- Absence of legal recourse (with the exception of willful default and insolvency)
- Participants are exposed to a broader range of risks than on a traditional project
- Participants are liable for the performance of other team members
- Requires high level of involvement from senior management to establish and maintain alliances
- Agency's ability to make unilateral decisions is severely restricted
- Increased procurement costs
- Contractors may be hesitant to enter into a arrangement where risks are shared and selection occurs prior to target pricing





Contract Maintenance (performance-based or traditional)

Description

In Contract Maintenance, the agency will outsource maintenance or rehabilitation tasks to contractors, either through traditional or performance-based contracting methods.

In traditional maintenance contracting, the agency will direct the contractor to perform specific tasks. The agency specifies what work will be done and how it will be done, providing little or no flexibility to the contractor in its selection of means and methods.

In performance-based maintenance contracting, the agency will specify performance standards, and the contractor will select the means and methods that will best ensure that these standards are met. The contractor manages and directs the work, and the agency monitors progress to ensure that the contractor is achieving the desired performance and system conditions.

Objective

Proponents cite numerous objectives for using contract maintenance, including reducing costs, increasing efficiency, improving quality, promoting innovation, enhancing risk management, and overcoming a lack of in-house expertise.

Past Experience

NCHRP Synthesis 313 reported that 21 state DOTs have outsourced some maintenance activities (Warne 2003).

Massachusetts has had experience with traditional maintenance contracting since the early 1990s.

Virginia DOT also has a long history of maintenance contracting, reporting that for fiscal year 2005 it planned to spend 73 percent of its maintenance dollars on private vendors (Virginia DOT 2005).

With regard to the performance-based approach, the District of Columbia Department of Transportation (DDOT) engaged a private contractor to maintain and rehabilitate over 75 miles of the National Highway System in the District for a over a 5-year period. DDOT established 170 performance measures, each of which could either be characterized as a condition performance measure (e.g., pothole size) or a time critical measure (e.g., duration to patch the pothole). Based on the improvements made to the conditions of the National Highway System within the District, DDOT plans to expand its contract maintenance program (Robinson et al. 2006)

Project Types/Selection Criteria

Examples of maintenance activities that agencies have outsourced include mowing, snow and ice removal, sweeping, catch basin cleaning, sign installation, fence and guardrail repair, pothole repair, and roadway patching and sealing.





Advantages

- Potential to provide cost savings*
- Supplements agency resources or provides specialty skills or equipment not otherwise available in-house
- Promotes efficiency, optimization of resources, and innovation (if performance-based)
- Competing with private sector firms can increase the efficiency and effectiveness of agency's own staff
- In contrast to ID/IQ maintenance contracts, the contractor can respond immediately to safety-critical items (e.g., fallen trees, displaced light poles, large potholes) without having to wait for a task order.
- Provides a planned spending schedule for the agency

Disadvantages

- Agency must actively monitor the contract, requiring allocation of appropriate personnel and monitoring equipment
- For performance-based contracts, the desired results might not be achieved if performance criteria are not fully or adequately described
- Long-term contract awarded to just one contractor forces the agency to put "all of its eggs in one basket"
- Outsourcing maintenance may be met with resistance from agency personnel
- Political motivations could turn maintenance contracting into a contentious issue
- Potential for negative publicity if the public's expectations regarding levels of service are not met

* Difficulty in calculating the true overhead burden borne by agencies for in-house maintenance staff makes it difficult to obtain an objective and appropriate comparison of the cost of doing the work in-house versus using private contractors.



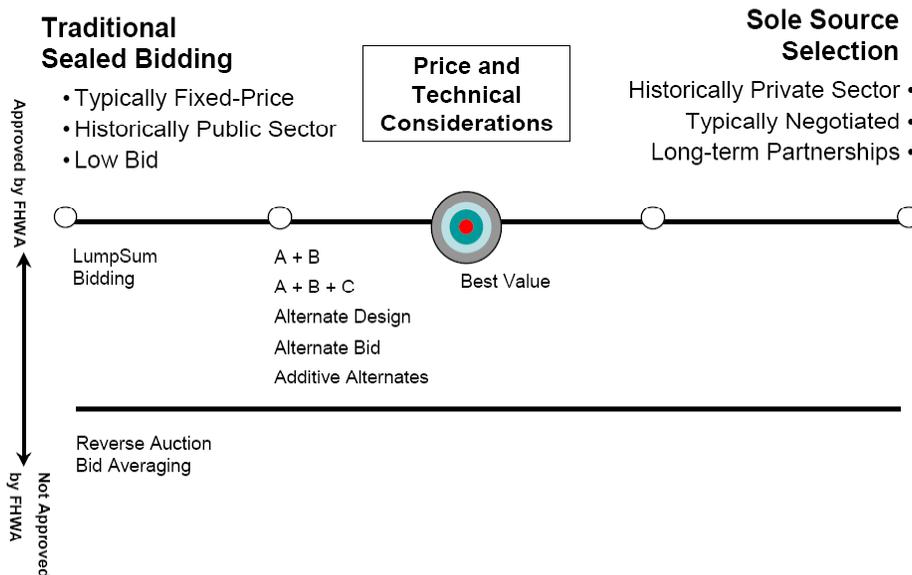


PROCUREMENT PRACTICES

Procurement practices are the procedures agencies use to evaluate and select designers, contractors, and various consultants. Evaluation and selection can be based solely on price, solely on technical qualifications, or on a combination of price, technical qualifications, time, and other factors.

An alternative procurement method uses a method other than the traditional fixed-price, sealed bid procurement process to award a construction contract. By considering factors other than cost alone, the alternative procurement practices move closer to the qualifications-based selection and negotiated procurement process used in the private sector. To illustrate this concept, the alternative methods considered in this section are arranged below on a continuum, with the public sector model (i.e., fixed price sealed bidding) and the private sector model (i.e., sole-source selection) located at the two extremes. As one moves from the public toward the private sector model, additional factors, other than cost alone, are considered in the evaluation and selection process to improve the long-term performance and value of construction.

Procurement Methods





Lump Sum Bidding

Description

In lump sum bidding, a contractor is provided with a set of bid documents that do not contain detailed quantity tables. The contractor develops quantity take-offs from the plans and estimates a lump sum price based on this take-off.

Objective

- Reduce costs design and contract administration costs associated with quantity calculation, verification, and measurement
- Reduce quantity overruns due to errors in quantity calculations or changed field conditions

Past Experience

DOTs have been increasingly applying lump sum payment, a commonly used payment mechanism in design-build contracts, to traditional low-bid highway contracts for various bid items, and to contracts involving categories of work that lend themselves to lump sum pricing (e.g., maintenance of traffic, paint, lighting, and landscaping).

According to a 35-state survey of contracting techniques for work zone traffic control conducted in 2000 by Montana DOT and FHWA, a significant percentage of the states surveyed had moved to lump sum pricing or a combination of lump sum and unit prices for traffic control items. Some agencies have standardized the use of lump sum payment for traffic control. For example, Washington State DOT has developed criteria, procedures, and special provisions for lump sum traffic control. Florida and Alaska DOTs have moved even further towards lump sum payment, developing guidelines for lump sum projects for various types or items of work.

Performance Outcomes

Based on total actual expenditures on lump sum contracts completed statewide between fiscal years 1997 and 2001, Florida DOT reported a 2.2 percent cost increase with respect to original lump sum contract amounts, in comparison to a 12.9 percent cost increase reported for all contracts completed statewide during the same time period. (Florida DOT 2006a)

Project Types/Selection Criteria

Lump sum payment methods are appropriate for relatively simple projects having a well-defined scope, low risk of unforeseen conditions (i.e., minimal underground utility issues, low likelihood of quantity variations), and low possibility for changes in scope during design and construction (i.e., limited possibility for added driveways, median modifications, or changes due to political involvement). Based on these considerations, project types that would and would not make suitable candidates for lump sum bidding techniques are summarized below.





Good Candidates

Projects having a well-defined scope, with few design uncertainties. For example:

- Fencing or guardrail installation
- Landscaping
- Lighting
- Signing
- Signalization
- Bridge painting

Poor Candidates

Projects involving the following:

- Urban construction/reconstruction
- Projects with subsoil earthwork
- Concrete pavement rehabilitation
- Major bridge rehabilitation/repair projects with many unknown quantities and conditions

Advantages

- During design development, reduces the effort spent by design staff on obtaining detailed computations or quantity take-offs
- During construction, reduces the time spent by field inspectors on measuring quantities and preparing invoices, allowing staff to concentrate on monitoring the quality of the work
- Streamlines unit items into bundled items, reducing the administrative burden (e.g., traffic control can be a single pay item, rather than multiple items that must be priced and tracked separately)
- Creates a built-in incentive for contractors to control costs and work more efficiently
- Eliminates requirements for detailed quantity measurements by the DOT, allowing for faster processing of payments, which can lead to improved coordination and cooperation among all the project parties

Disadvantages

- Contractors may add more contingency to bid prices, particularly if there is uncertainty in the estimated quantities for the lump sum items
- Potential that the agency will pay the lump sum price when total quantities under run estimated amounts
- For contracts with multiple lump sum items, there is the potential for front-end loading
- The contractor's focus on cost and schedule may compromise quality.
- Changes that affect lump sum price require more effort than simply adjusting the quantity of a unit-priced item.*

* Florida DOT (2006b) has developed internal guidelines for contract modifications on lump sum projects. These guidelines require that the contractor submit a detailed estimate for the additional work and caution that the engineer should not rely on the contractor's schedule of values, but should rather develop an independent estimate based on historical data or statewide averages, and conduct an entitlement analysis before issuing a contract modification.





Cost-Plus-Time Bidding (A+B)

Description

Cost-Plus-Time Bidding uses a cost parameter (A) and a time parameter (B) to determine a bid value. The cost component (A) is the traditional bid for the contract items and is the dollar amount for the work to be performed under the contract. The time component (B) is the total number of calendar days required to complete the project, as estimated by the bidder, multiplied by an agency-determined daily road user cost (RUC) to translate time into dollars.

$$A + B(\text{RUC}) = \text{Total Bid}$$

The total bid value is used only to evaluate bids. The contract amount is based on the bid price (A), not the total bid value. The number of days bid (B) becomes the contract time. Note that the lowest combined bid may not necessarily result in the shortest B time. A+B bidding relies on the contractor to provide the optimal combination of cost and time.

Many states use A+B bidding with incentive/disincentive (I/D) provisions as an additional motivation for contractors to save time.

Objective

- Provide the optimum tradeoff between time and cost (if schedule is critical, use an incentive clause along with A+B)

Past Experience

In 1995, A+B bidding was approved by FHWA for use without SEP-14 approval. About two-thirds of the state transportation agencies have some experience with A+B bidding. Of these, Missouri, Florida, and New York have been the most active users.

Caltrans used A+B bidding to reconstruct critical bridges damaged and destroyed in the Northridge earthquake. Since September 2002, Caltrans has routinely used A+B bidding or I/D provisions on projects with an estimated cost of \$5 million or more and daily road user costs of \$5,000 or more (Caltrans 2005).

Performance Outcomes

An FHWA-sponsored report summarized various findings on the use of A+B bidding (Trauner 1996):

- A study of 101 projects that used A+B bidding with I/D provisions indicated that for 91 percent of the projects, the time bid by the contractor was less than the engineer's estimate. Of the 40 projects completed at the time of the study, 82.5% were completed ahead of the B bid time, with the contractor earning the maximum incentive in many cases
- A 1992 evaluation of 11 A+B projects conducted by North Carolina DOT found that 8 of 11 projects finished earlier than the engineer's estimate.
- In 1995, NYSDOT evaluated 24 projects that used A+B bidding with I/D provisions. The B bid times were 30 percent below the engineer's maximum B estimate. Of the nine projects completed





at the time of report publication, contractors earned incentives on eight of the nine projects. On five of these eight projects, the contractor earned the maximum incentive.

- Caltrans reported an average time savings of 24 percent of the contract time for the ten Northridge A+B projects. Contractors earned incentives for all but one project.
- Caltrans reported that contract prices for the ten emergency Northridge A+B bid projects averaged 13.2 percent *above* the engineer's estimate, while similar conventional projects averaged 0 to 10 percent *under* the engineer's estimate. This increase was likely due to a combination of the emergency nature of the work, the cost of acceleration, the lack of detail in the contract documents, and the limited availability of materials and equipment immediately following the earthquake. However, even given these obstacles, Caltrans still estimated a \$19.5 million savings in highway user costs for these projects after factoring in the estimated value of time savings less the incentives paid to the contractor for early completion.
- Caltrans allocated extra resources to administer the Northridge earthquake A+B contracts; however, North Carolina has reported lower administrative costs for A+B projects than for conventional projects.

Project Types/Selection Criteria

- Reconstruction, rehabilitation, and remediation projects in urban settings where high traffic volumes exist and road user costs are high. Some agencies specify a minimum threshold RUC level (\$2,000 - \$3,000 per day). The monetary benefit to the highway user equals or exceeds the Contractor's costs to finish early and earn the maximum incentive.
- Safety concerns, or significant impacts to the local community or economy during construction warrant expediting the project.
- Traffic control phasing can be structured to maximize a contractor's ability to reduce the duration of construction.
- The project has limited design complexity and is relatively free of utility conflicts, design uncertainties, or right-of-way issues that may impact the bid letting date or the critical project schedule.
- A+B bidding is often used with I/D provisions. The inclusion of I/D provisions with A+B bidding would NOT be necessary for projects that are not required to finish by a specific completion date.





Advantages

- High likelihood of reducing contract time
- Minimizes time/cost impacts to traveling public for projects with high ADT and traffic impacts during construction
- Promotes innovative scheduling on projects that do not require all work to be completed sequentially
- Encourages contractors to maximize efficiency of crews and equipment
- Typically encourages greater coordination between the prime bidders and their subcontractors prior to bid to develop an achievable time component estimate

Disadvantages

- Potential for increased costs and delay claims due to utility and third party coordination problems or lack of timely agency reviews
- Contractors may sacrifice quality and safety to meet an unreasonably low time component bid to win the contract. Some practitioners recommend specifying a minimum B duration to avoid excessively low bids.
- Without factoring in the potential savings to road users, bid prices and other direct project costs may be higher for A+B projects when compared to conventional projects.
- Administrative and inspection costs may be higher as a result of accelerated schedules that increase demands on construction personnel (however, such costs may be offset by the shorter construction duration)





Multi-Parameter Bidding (A+B+C)

Description

Multi-Parameter bidding extends the A+B bidding concept to include an additional cost parameter (C) that may include a quality or warranty parameter. The total bid value is used only to evaluate the low bidder. The contract amount is based on the bid price (A), not the total bid value (A+B+C). The “C” component can increase or decrease the bid value. For example, if “C” is a bid warranty period, a higher “C” value should result in a lower bid value to reflect the added benefit to the agency.

To date, multi-parameter bidding has only been used in conjunction with a warranty parameter (C), which is converted to an equivalent annual cost for bidding purposes. The multi-parameter concept has been more widely implemented in a best-value procurement process using a point-scored, weighted criteria formula. The formula calculates a total technical score (TS) as the summation of technical scores and an equivalent price score as follows:

$$TS = W_1S_1 + W_2S_2 + \dots + W_iS_i + W_{(i+1)}PS$$

Where: TS = Total Score
 W_i = Weight of Factor i
 S_i = Score of Factor i
 PS = Price Score

To incorporate a quality parameter into the bidding process, NCHRP Report 451 (Anderson and Russell 2001) suggests using the multi-parameter equation in the form of (A+B)C, where C is a quality factor used to adjust the contractor’s bid based on anticipated or bid quality levels. For example, if the agency collects contractors’ historical quality data, this past performance on agency projects could be used with the pay factor equation to determine the quality factor for bid evaluation. Calculating the quality factor as the inverse of the pay factor equation (1/PF) would reduce bids from contractors with high quality levels on past projects (i.e., pay factors exceeding 100 percent), while increasing bids from contractors with poor quality on past projects (i.e., pay factors less than 100 percent). This approach would thus reward contractors for higher levels of quality delivered on previous projects for the agency. Note that under this approach, the “C” quality parameter would only be used to determine the low bidder. Once the project is underway, the agency would assess the quality level actually achieved on the project for payment purposes.

Alternatively, the agency could allow contractors to estimate and bid their own “C” quality value. The contractor would then be held to achieving the quality level bid, or risk receiving reduced payment. This approach could be implemented by applying a factor of C_{actual}/C_{bid} to the results of the pay factor equation. For example, if the contractor were to exceed the quality level bid (C_{actual}/C_{bid} > 1), payment would be increased. If the contractor could not meet the quality level bid (C_{actual}/C_{bid} < 1), payment would be decreased.

Objective

- Incorporate the value of quality in the bidding and contractor selection process
- Achieve equal or better quality than specified, at optimal cost and time





Past Experience

Kentucky and Maryland have used multi-parameter bidding to bid the length of a project warranty.

On the I-275 project, Kentucky used an A+B-C approach, where C was a warranty credit that was to be subtracted from the bid for warranties of more than the five-year prescribed minimum. All of the contractors included a ten-year warranty period in their bid (five years longer than the minimum specified), which meant that although warranty length was ultimately not a factor in final contract award, the State received a longer warranty period than would have otherwise been the case. (D’Angelo et al. 2003)

Maryland SHA similarly used an A-C approach on a bridge painting project, where “A” was the cost of the project and “C” was the credit (\$35,000) for each year that the contractor bid beyond the minimum five-year warranty period up to a maximum of ten years. Maryland determined the \$35,000 credit amount by estimating the cost to repaint the structure and dividing it by the ten-year warranty period (AASHTO 2005)

Project Types/Selection Criteria

- Time critical projects that can incorporate QA specifications and/or warranty items with measurable performance criteria
- Projects for which there is a low risk that external factors not within the control of the contractor will affect quality items

<p><u><i>Advantages</i></u></p> <ul style="list-style-type: none"> • Encourages improved end-product quality • Achieves multiple goals by lowering life-cycle costs while saving time • Encourages innovative construction that can improve quality and timely delivery • Balances the risk between the agency and the contractor from an acceptance standpoint • Could allow the turn over of more testing and inspection responsibility to the contractor, thus reducing demands on agency personnel

<p><u><i>Disadvantages</i></u></p> <ul style="list-style-type: none"> • Possible reduction in open competition • Accelerated schedules could result in increased demands on agency personnel • Difficult to determine appropriate quality parameters and associated measurement methods • Difficult to translate a level of quality into a dollar value and determine an appropriate weighting to combine with other factors • Depending on the “C” component, may add subjectivity to the selection process





Alternate Design

Description

Alternate design is a bidding technique where contractors may propose and submit a bid on an alternate design that is equivalent to the design specified by the agency. Typically, alternates involve pre-engineered features or products.

Alternates are more commonly used in a design-build framework, but have also been applied within a low-bid design-bid-build framework.

Objective

- Stimulate contractor innovation
- Provide equal or improved performance at equal or lower cost
- Reduce initial costs or life-cycle costs

Past Experience

Since 1980, PennDOT has allowed contractors to submit optional alternate designs for structures. PennDOT's alternate bridge design policy allows contractors at the time of bid submission to propose an alternate bridge design equivalent to the "as-designed" structure (e.g., a redesigned superstructure, substructure, span length).

Performance Outcomes

Through its alternate structure design program, PennDOT has realized cost savings of 10 percent for major structures and 7.2 percent for non-major structures (AASHTO 2005).

Project Types/Selection Criteria

Projects involving the construction of unique structures, with which contractors may have more experience than the agency, are good candidates for alternate design. Examples include the following:

- Retaining walls
- Bridges or other structural components
- Traffic signs or control devices





Advantages

- Potential for lower initial costs or life-cycle costs
- Promotes innovation
- Encourages contractors to price time saving methods, techniques, and designs

Disadvantages

- Risk of not receiving the desired end-product if minimum requirements are not clearly and completely stated
- Review of alternate design submissions may be time consuming
- Difficulty evaluating costs of alternates
- Potential for bid protests





Alternate Bid

Description

With Alternate Bids, the agency asks for alternate bids on specified designs. At some point before awarding the contract, the agency will decide which alternate provides the best value.

Objective

- Provide equal or improved performance at lower cost
- Reduce initial costs or life-cycle costs

Past Experience

The FHWA's traditional pavement policy discourages the use of alternate pavement type bidding on the basis that it is difficult to develop truly equivalent alternate designs for portland cement concrete pavement and asphaltic concrete pavements. However, the FHWA has allowed states to evaluate the use of alternate pavement type bidding with bid adjustments to account for differences in life-cycle-costs under SEP-14. The Michigan DOT and the Louisiana DOT&D have used life-cycle cost estimates to determine the successful lowest bidder (AASHTO 2005). Louisiana has developed and published a process for competing pavement types through the solicitation of alternative bids (Temple et al. 2004).

In 1996, Missouri experimented with five competitively bid pilot projects using portland cement concrete and asphaltic concrete pavement alternates. The specifications for these projects included an adjustment factor added to each asphalt concrete bid to reflect higher future rehabilitation costs during the chosen 35-year design period. Missouri reported that alternate bids were in line with comparable projects and engineering estimates and provided a savings through increased competition.

The alternate bid concept has also been applied to bridge construction in both the Europe and the United States.

Project Types/Selection Criteria

- Projects where the competition will drive the most cost effective material choice or design approach (e.g. asphalt vs. PCC, steel vs. concrete)
- Standardized projects that do not require a large design effort
- Projects that are small enough to attract a large pool of bidders, but for which the potential cost savings are significant enough to justify the additional costs to develop plans and specifications for multiple design alternates
- Projects having a well-defined scope, for which viable alternates exist (e.g., asphalt vs. PCC pavement, steel vs. concrete bridges)





Advantages

- Potential for lower initial costs or life-cycle costs
- Allows agencies to select the alternate that offers the best cost-to-quality ratio
- Allows competition between products with different maintenance and service life expectations

Disadvantages

- May increase the risk of bid protests if bid documents do not clearly state instructions regarding the alternates (e.g., are bids for all alternates required)
- May reduce the number of capable bidders if the alternates are outside the average contractor's capabilities
- Life-cycle costing to determine low bid is difficult to determine
- Requires development of full plans and specifications for each alternate, increasing the agency's engineering costs
- Multiple designs increases the potential for conflicting details, specifications, and quantities





Additive Alternates/Tied Bids

Description

Additive Alternates is a bidding technique that may be used when it is necessary to keep the awarded contract amount within budget. With this procedure, the agency will include most of the project scope in base-bid items, while also specifying additive alternates that may be selected if the base-plus-alternates price is within budget. The bid documents should specify the priority in which the additive alternates will be considered. The contract is awarded to the lowest responsive bidder that is within budget, considering the sum of the base bid and additive alternates.

Objective

- Include as many scope items as possible while remaining within budget

Past Experience

Washington DOT and Federal Lands Highways have used the Additive Alternates technique.

Using a concept similar to the Additive Alternates technique, some agencies have experimented with the idea of Tied Bids, allowing contractors to submit bids on individual contracted portions of an overall construction project or program. The agency then selects the lowest overall cost, whether it be a tied bid or the sum of the individual bids. The idea behind the Tied Bids approach is that the agency could realize cost savings in reduced mobilization and general conditions costs. As implemented by WisDOT on the Marquette project, bidders specified an amount that would be deducted from the Mobilization bid item in the event that the bidder was awarded the Tied Bid. WisDOT determined the apparent low bidder by comparing the lowest individual bid amounts for the base work and the adjacent follow-on work to the lowest Tied Bid for both segments. In this way, bidders did not necessarily have to submit a Tied Bid to win a portion of the work.

Project Types/Selection Criteria

- Projects having limited budgets

Advantages

- Allows agencies to tailor project scopes to include as many items as possible within a fixed or limited budget
- Allows agencies to bid all work in the initial procurement process, and thus ensure competitive bidding on the entire project, rather than increase work using the change order process

Disadvantages

- May increase the risk of bid protests or contract disputes if bid documents do not clearly state instructions regarding the alternates (e.g., are bids for all alternates required, priority with which the alternates will be evaluated, etc.)





Best-Value Procurement

Description

Best-Value procurement allows agencies to consider price and other key factors (e.g., cost, time, qualifications, quality, and design alternates) in the evaluation and selection process to minimize impacts and enhance the long-term performance and value of construction.

The traditional low-bid procurement is typically a one step process. Under best-value, DOTs may use either a one-step or two-step procurement process. In a one-step best-value procurement, price, qualifications, and other criteria are evaluated to determine the best value in a single step. One-step involves the issuance of an RFP requesting the submission of a two-part bid, composed of a technical proposal and a price for construction. The agency selects a bid based on a technically qualified low bid or a formula combining price and technical score.

In two-step best-value, step 1 involves the issuance of an RFQ in a short-listing process. Step 2 involves the issuance of an RFP to the short-listed contractors. The agency then evaluates the contractors' proposals and awards the contract based on a technically qualified low bid or through a combination of price and technical score, using a formula to calculate an adjusted price or score, or using a trade-off analysis to determine the most advantageous combination of price and technical score or ability.

Objective

- Incorporate into the bid evaluation process parameters considered important to the success of the project

Past Experience

NCHRP Report 561 on best-value procurement methods reported that 66 percent of 44 highway agencies surveyed had some experience with best-value selection, albeit very limited in nature and primarily with design-build projects. For those agencies using best-value procurement, there was significant variation in selection strategies, selection criteria, method of combining factors for award, and relative weightings of price and other technical factors (Scott et al. 2006).

Performance Outcomes

NCHRP Report 561 (Scott et al. 2006) concluded, based on a sample of 119 best-value projects, that agencies may realize both cost and time savings as a result of implementing best-value procurement.

The FHWA study on design-build effectiveness reported that agency satisfaction with project quality was higher on projects procured using a best-value approach (SAIC, AECOM, University of Colorado 2006).

Project Types/Selection Criteria

- Highly complex or unique projects that would receive measurable benefit from using an alternative form of procurement
- Projects that required specialized equipment, knowledge of construction, or exclusive technology





Note that an automated web-based project selection tool can be found on the University of Colorado's website at <http://construction.colorado.edu/best-value>.

Advantages

- Encourages contractor innovation with respect to quality, cost savings, and time savings
- Ensures that the agency can select a capable, qualified contractor
- Allows for project schedule, quality, and/or other parameters to be competitively bid
- May achieve higher quality by open competition
- May result in lower life-cycle costs

Disadvantages

- Can be administratively burdensome for both the agency and contractors
 - Requires additional staff time and a different level of training to evaluate best-value proposals
 - Preparing a best-value proposal will likely require a high level of effort, which may discourage smaller or DBE contractors with limited resources from bidding
- Potential for a higher initial cost
- Subjectivity of the evaluation process may result in protests





Reverse Auction Bidding

Description

Under this bidding technique, also called “ebay for construction,” contractors use an online bidding process, incrementally decreasing their bids until all reach their lowest offer.

A typical format for this process is as follows:

- Potential bidders obtain documents electronically.
- A third party conducts the auction online with all bidders participating simultaneously.
- Bid amounts are disclosed to all bidders, but the identity of bidders remains anonymous.
- Bidders can resubmit lower bids until the specified auction closing time.
- Contract is awarded to the lowest bid at the specified auction closing time.

Objective

- Achieve the lowest competitive bid price

Past Experience

Reverse auctions were originally designed to procure commodities and other manufactured goods. It has not gained widespread acceptance in the construction industry.

In 2003, Minnesota considered expanding public bidding laws to allow the use of reverse auction bidding in all applications; however, Minnesota revised the law to exclude public construction contracts due to strong opposition from the construction community. Arizona, Kansas, and Pennsylvania also allow reverse auction bidding in certain public applications, but exclude construction.

Project Types/Selection Criteria

Reverse auction bidding is best suited for small, repetitive, “cookie-cutter” jobs that do not allow much opportunity for bidders to sacrifice quality, supervision, or other costs in order to meet a low bid price.





Advantages

- Allows owners to use internet technology to reach a broad pool of potential bidders
- Repetitive auction process drives bids down
- Provides an even playing field for bidders
- Reduces administrative effort associated with the bidding process

Disadvantages

- No opportunity for bidders to seek clarification or confirmation
- May encourage imprudent bidding if bidders are forced to quickly react to decreasing bids without fully analyzing the consequences
- Without some type of pre-qualification procedure to ensure that the participating bidders are qualified to perform the work, the bidders' work history, experience, and related qualifications cannot be taken into account.
- Even though bidders are anonymous, the practice may violate Federal Acquisition Regulations, which include a policy of not disclosing contractor price information.
- Many contractors refuse to participate in this type of bidding because it is viewed as a form of bid shopping.





Bid Averaging

Description

Bid averaging is a procurement method that awards the contract to the bidder closest to the numerical average of the bids submitted, typically after the highest and lowest bids have been eliminated. After contract award, normal contract administration processes are used.

Objective

- Encourage contractors to submit reasonable bids

Past Experience

FHWA does not allow the use of bid averaging for federal-aid transportation projects. Florida DOT has used this method on state-funded maintenance and construction projects.

Project Types/Selection Criteria

Ideally, bid averaging should be used for projects that attract at least 5 bidders.

Advantages

- Provides a balance between cost and quality
- Eliminates low bidders with unrealistically low bids buying the project
- Does not award to contractors below the competitive range

Disadvantages

- Could eliminate viable low bids if the competitive range is narrow





CONTRACT MANAGEMENT METHODS

Contract management methods refer to the procedures and contract provisions used to manage construction projects on a daily basis to ensure control of costs, timely completion, and quality of construction. Alternative contract management methods are defined as any method other than traditional method specifications and standard administrative procedures for control of cost, time, and quality.

In contrast to the project delivery systems and procurement methods discussed earlier, the range of available contract management methods is very broad, and the agency can use any number of these methods in a single contract to achieve desired goals.

The contract management methods evaluated in this section include the following:

- Incentive/Disincentive (I/D) Provisions for Early Completion
- Liquidated Savings
- Flexible Notice to Proceed Dates
- Lane Rental
- Active Management Payment Mechanism (AMPM)
- No Excuse Incentive
- Shared Risk Contingency Management
- Warranties





Incentive/Disincentive (I/D) Provisions for Early Completion

Description

Incentive and disincentive (I/D) provisions for early completion provide incentive payments to contractors for completing work on or ahead of schedule, or impose disincentive payments for failure to meet the specified completion date. The daily I/D rate is based on considerations such as traffic safety, traffic maintenance, and road user costs.

Objective

- Minimize delays or inconvenience to the public by motivating contractors to complete a project on or before a specified I/D completion date

Past Experience

In 1984, FHWA rescinded its policy of prohibiting Federal participation in bonus payments for early completion. Since this policy change, the use of I/D provisions has grown and is now widely accepted by both agencies and contractors. A 1990 survey conducted by Iowa DOT showed that 35 states have used I/D provisions.

Performance Outcomes

- Michigan DOT (MDOT) evaluated the use of I/D clauses on 26 projects let and completed between 1998 and 1999. MDOT reported that 65% of these I/D projects were completed early, 12% were completed on time, and 23% were completed late (AASHTO 2005).
- A 1986 study regarding the use of I/D provisions on 58 projects in 30 states reported that approximately 95 percent of the projects finished on time or sooner. The report also indicated that contract prices for I/D projects ranged from 10 to 20 percent higher than conventional projects (Trauner 1996).
- A 1990 survey conducted by Iowa related to the use of I/D provisions in 35 states indicated that most I/D projects resulted in some incentive payments to the contractor, and for many projects, the contractor earned the maximum incentive (Trauner 1996).

Project Types/Selection Criteria

- Projects requiring traffic restrictions, lane closures, or detours that would otherwise result in high user impacts (e.g., construction on major roadway, bridge, or interchanges having a high ADT; projects involving temporary lane, ramp, or bridge closures; emergency repair work).
- The project is relatively free of third party coordination concerns (e.g., utility, railroad, environmental issues, public opposition) that could affect the bid letting date or the project schedule.
- The I/D amount results in a favorable cost/benefit ratio to the traveling public (i.e., the benefit to the highway user exceeds the I/D amount, and this amount is high enough to motivate a contractor to accelerate).





Contract Management Methods

- The agency has the ability to estimate the I/D time based on expedited production rates for similar work, historical records, or CPM scheduling.
- Emergency contracts

Advantages

- Significant reduction in project time
- Encourages contractors to use time-saving means and methods to accelerate construction
- Minimizes cost and time impacts to the traveling public for projects having high ADT
- Shifts more risk to the contractor for providing the optimum combination of time, cost, and efficient planning and management of the work

Disadvantages

- Higher bid costs and project costs
- Acceleration may over-extend agency and contractor personnel (however, the associated costs may be offset by the overall shorter construction duration).
- Acceleration could compromise project quality. However, I/D projects may also motivate contractors to perform work correctly the first time to avoid time-consuming rework efforts.
- The agency bears the risk of accurately estimating the critical I/D time and not delaying the I/D date. Agencies have reported that contractors may complete the I/D work and earn an incentive without expending extra effort and that contractors have earned incentives even when the project has been delayed.
- Agencies have reported that disincentive payments are difficult to recover.





Liquidated Savings

Description

Liquidated savings is a process by which the agency pays the contractor a modest incentive for each calendar or working day that the contract is completed ahead of schedule. Liquidated savings tend to be used on projects with limited scope and budget, for which other incentive methods would not be justifiable or affordable. The incentive amount is based on the direct savings to the agency in inspection and contract administration costs.

Objective

- Ensure the project or milestone is completed on or before the specified date

Past Experience

Florida DOT, Minnesota DOT, and Colorado DOT include liquidated savings in their alternative contracting toolkits. Ohio has incorporated the liquidated savings concept in resurfacing and bridge repair projects.

Project Types/Selection Criteria

- Smaller reconstruction and rehabilitation projects (on larger or more complex projects, the cost to accelerate will likely exceed the liquidated savings amount)
- Limited-scope projects in high traffic areas or with high road-user or business impacts (e.g., fencing, pavement marking, signalization, and guardrail)

Advantages

- Encourages contractors to reduce construction time
- Reduces contract administration costs
- Reduces contract administration time, allowing transfer of staff to other projects

Disadvantages

- Contract changes can lead to disputes regarding incentive payments
- Incentive amount may not be significant enough to motivate contractors to accelerate





Flexible Notice to Proceed Dates

Description

A Flexible Notice to Proceed Date provision allows the contractor some discretion in establishing when the project’s working days are going to start, within some specified criteria (e.g., the latest allowable start date to ensure project completion within the scheduled construction season). The contractor can use this flexibility to mobilize subcontractors, coordinate with utilities, submit shop drawings, acquire materials and equipment, and optimize its resources for the project.

The agency will typically establish the number of calendar days to complete the project once work starts. Alternatively, if used with A+B bidding, the Contractor will bid the number of days, with the provision that once work starts, it must continue without interruption to project completion.

Objective

- Allow the contractor more flexibility in scheduling the work with the intent that this will yield a more efficient use of the contractor’s workforce, equipment, and subcontractors

Past Experience

Flexible Notice to Proceed Dates may be used under SEP-14.

Washington State DOT and North Carolina DOT have used Flexible Start Date provisions.

Project Types/Selection Criteria

- Projects requiring extensive offsite preparatory work or small single-season projects. For example, North Carolina DOT has used this concept for small, non-critical projects such as rural bridge replacement projects and guardrail projects.
- Projects where there is no significant public impact associated with delaying the start date of construction
- Projects that have a fast track schedule, requiring completion as soon as possible, or where there is little likelihood of efficiencies being realized from this method, should NOT be considered for this provision.

Advantages

- By controlling the project start date, the contractor can optimize its resources, which may result in a lower cost and a more efficient use of the specified contract time.

Disadvantages

- Relinquishes control over the schedule to the contractor
- Adds difficulty in scheduling agency resources





Lane Rental

Description

Lane rental provisions assess contractors a rental fee for occupying lanes or shoulders to perform contract work. The fee is based on the estimated cost of delay or inconvenience to the road user during the rental period. The fees for each lane, shoulder, or combination thereof, can vary depending on the time of day and the amount of traffic. Lane rental provisions encourage contractors to devise innovative traffic control plans to minimize road user impacts during construction. They also allow the costs associated with delays, detours, and accidents to be considered in the contract price.

Lane rental is typically set up as a bid item, with the contractor calculating the total amount of time in days or hours that a lane, shoulder, or combination of lanes and shoulders, will be out of service. The lane rental fee is provided by the agency in terms of dollars per lane per time period.

Objective

- Encourage contractors to limit road closures and interruption to drivers during construction (Note that the intention of lane rental is not to reduce overall time for completion, but rather to reduce the time of road user impact.)

Past Experience

At least nine highway agencies have experimented with or implemented lane rental, including New York, Arizona, North Carolina, Colorado, Indiana, Maine, Oklahoma, Oregon, and Washington. In 1995, the FHWA removed restrictions regarding the use of lane rental and raised it from an experimental to operational procedure.

Project Types/Selection Criteria

- Major roadways, bridges, and interchanges with high ADT counts, for which alternate routes or detours would not be feasible
- Lane rental is also more successful when applied to smaller, shorter jobs, because it is difficult to estimate the required lane closures on a job that is large, complex, or runs for a long time.
- The project is relatively free of third party conflicts (right of way, utility, environmental)
- Design uncertainties have been resolved
- A reasonable contractor can accurately schedule the amount of necessary lane closures to complete the work as described
- Lane “closures” can be well defined
- Opportunities exist to reduce closure times
- Road user costs are substantial enough to offset potentially higher construction costs





Performance Outcomes

- An evaluation of 39 lane rental contracts let between 1984 and 1987 in the United Kingdom indicated that the use of lane rental provided times savings that ranged from 2 to 58 percent, with an average savings of approximately 30 percent.
- This same study also indicated that the use of lane rental increased overall costs, including bonus payments, by 3 percent when compared to conventional projects

Advantages

- Encourages contractors to schedule work to minimize traffic restrictions and impacts to road users
- Encourages innovative contractor-initiated traffic control plans
- May also result in overall project time savings

Disadvantages

- Can result in higher bids if contractors plan on applying more resources or accelerating work
- Extra effort by the agency to monitor lane rentals
- Smaller contractors may have difficulty in obtaining bonds if the lane rental bid item is included in the bonded amount of the project
- May discourage contractors from closing lanes or shoulders, which could compromise the safety of workers and the traveling public





Active Management Payment Mechanism (AMPM)

Description

This concept, developed in the United Kingdom for use on design-build-finance-operate contracts, involves a contractual provision that provides contractors with an incentive to minimize travel time through the work zone or maximize the availability of open lanes. The agency measures average speed through the work zone and the actual traffic flow. Incentives are based on the measured travel speed and the measured volumes in comparison to theoretical percentages of roadway capacity.

Typically to implement such a system, the contractor is required to install traffic monitoring equipment to measure traffic performance through the work zone. Possible performance measurements include travel time through the work zone, queue length, traffic volume, delay time, and crash analyses.

Objective

- Minimize travel time through the work zone

Past Experience

The AMPM concept may be used with SEP-14 approval. Arizona DOT implemented a form of AMPM on the State Route 68 design-build project. A similar system was used on the Coolidge Bridge Reconstruction Project in Massachusetts.

Project Types/Selection Criteria

- Arizona DOT successfully implemented this concept in a rural setting
- Urban settings can also be appropriate if traffic flow can consistently be measured. For example, projects in urban settings with multiple access points might NOT be good candidates due to monitoring difficulties





Advantages

- Encourages the contractor to schedule work at the times least disruptive to motorists
- Using real-time data obtained from the travel-time system, the contractor can adjust work operations to reduce congestion
- Seamlessly aligns the needs of the traveling public with the goals of the contractor through directly correlating incentives to throughput

Disadvantages

- Negative public reaction to the monitoring system (privacy concerns, monitoring system distracting drivers)
Note that ADOT resolved this issue via an extensive public outreach program that educated the public on the monitoring system.
- Time consuming review of monitoring data by the agency to determine if incentives or fines are due
- Unreliable monitoring equipment could result in inconclusive data or downtimes during which the agency would be unable to assess compliance with the travel time provision. Due to its experience with prolonged downtimes on the SR 68 project, ADOT recommends that future contracts penalize the Contractor if the system is down for more than 48 hours.
- Unless costly solar-powered equipment is employed, monitoring locations will likely be limited by the availability of public power utilities (could be an issue in remote locations)





No Excuse Incentive

Description

No excuse incentive provisions use monetary incentives to motivate contractors to complete the contract work on time. The contractor is given a “drop-dead date” for completion of a phase of work or for the entire project. If the work is completed on or in advance of this date, the contractor will receive the full incentive. Short of a natural disaster, the contractor has no excuses for not meeting the completion date. On the other hand, the contractor is assessed no disincentives, aside from liquidated damages, for not meeting the completion date. The incentive amount is based on road user costs and other costs reflecting the value to the agency and the public for finishing the project by a certain date.

Objective

- Motivate the contractor to complete the work on time (but not necessarily ahead of schedule)

Past Experience

Florida, Iowa, Virginia, and New Mexico have used no excuse incentive clauses.

Project Types/Selection Criteria

A no excuse incentive provision might be applied where it is extremely beneficial to finish a project by a certain date but not necessarily beneficial to finish early. The following examples illustrate this concept.

- If an overall construction program or large project entails the sequencing of multiple contracts, it may not be advantageous or practicable to accelerate the start date or traffic phasing of follow-on contractors if a preceding contractor finishes early. However, the possibility of a particular contract or phase finishing late would impact succeeding contractors and the overall project completion.
- If the opening of a bridge or roadway is needed to accommodate holiday traffic or a major event, finishing early would provide some benefit, but finishing late would severely impact the traveling public.

Advantages

- Increased contractor concern for maintaining the project schedule
- Ease in the measurement and award of incentive

Disadvantages

- Increased costs (Florida has reported an average 9 percent increase)
- Quality may be compromised in a rush to meet the incentive date
- May strain agency-contractor relations
- The fixed schedule may make negotiation of agency-initiated changes difficult





Shared-Risk Contingency Management

Description

Contingency management can be used as an innovative technique to manage possible project risks that have the potential to result in higher bids, cost overruns, and scope and schedule growth.

The Federal Highway Administration has developed guidance for estimating costs, assessing risk, and managing contingency for major projects. This guidance includes setting up contingency pools for major cost items, such as construction, design (based on different levels of design completion), and management of third parties, environmental issues, right-of-way and other unanticipated changes during construction.

Contingency funds have also been set up as incentives for timely completion or quality. By allowing the contractor to share in any unused portion of the contingency fund at the end of the project, contingencies can be used to motivate contractors to minimize the cost and time impact of changes.

Objective

- Manage risks and encourage contractors to minimize cost and time impacts of changes

Past Experience

The use of shared risk contingency as a risk management strategy was used recently on the \$330 million Atlantic City-Brigantine Connector Project, a four-lane design-build connector highway and tunnel project in New Jersey. The project capped construction costs at \$190 million and included a \$28 million contingency fund, 80% of which would revert to the contractor in the event of early completion.

The \$750 million Hiawatha Light Rail Transit Project, a 12-mile design-build light rail project connecting downtown Minneapolis with the airport and Mall of America, established a \$5.5 Million shared-risk contingency fund based on 19 risk items. In the event that any of the 19 risk items are realized, the contractor could choose to bill against the contingency fund or decide to not charge against the fund and absorb the cost to maximize its share in the contingency fund at the end of the project. At the end of the project, the contractor was eligible to keep 91% of the unused contingency amount (Allen 2004).

Project Types/Selection Criteria

- Projects with significant uncertainty involving environmental mitigation, utility or other third party issues, or that otherwise have a high likelihood of scope changes and cost growth
- Contingency incentives are especially applicable for major or mega-projects, particularly using design-build delivery, because early estimates have greater uncertainty, there is a higher potential for cost and time growth, and the level of risk often yields fewer proposals to affirm the accuracy of the owner's estimate





Contract Management Methods

Advantages

- Motivates contractors to minimize cost of changes
- Can be used to create incentives for timely completion
- Encourages innovative solutions to maintain the schedule and minimize cost
- Funds are available to resolve issues in a timely manner

Disadvantages

- Difficulty in establishing an appropriate contingency amount
- Existence of a contingency fund may be seen as a “cushion,” creating a relaxed approach towards cost containment





Warranties

Description

Warranties are used to guarantee the integrity of a product and the contractor's responsibility to repair or replace defects for a defined period. Two general types of warranties are common in highway construction: material and workmanship warranties and performance warranties.

Material and workmanship warranties hold contractors responsible for correcting short-term problems that result from defective materials and workmanship, but not from those associated with design.

With performance warranties, the contractor guarantees that the work will perform at the desired quality level during a longer-term warranty period (5 to 10 years), with quality measured by actual performance as opposed to material properties and methods of construction. For pavements, more responsibility for mix design shifts to the contractor, as innovative designs or techniques are used to ensure performance throughout a long-term warranty period.

Objective

- Increase quality
- Lower life-cycle costs
- Reduce DOT inspection costs
- Shift greater responsibility for performance to contractor

Past Experience

Although a long-standing practice in Europe, the use of warranties, particularly those guaranteeing long-term pavement performance, has been met with resistance by some DOTs and the construction industry in the U.S. For the most part, the U.S. experience has been with limited 1 to 3-year material and workmanship warranties. However, use of longer term warranties is increasing, with 6 DOTs (Colorado, Mississippi, Kentucky, Missouri, Virginia, and New Mexico) indicating that they have used pavement warranty periods of ten years or longer (in response to a survey effort conducted in support of NHCPR Project 10-68, Guidelines for use of Pavement Warranties in Highway Construction). Other states, including Wisconsin, Michigan, Florida, and Ohio, also have extensive experience with warranty contracting.

For the past 5 years, Caltrans has been using 1-year HMA pavement warranties. Four years ago, Caltrans expanded its warranty program to include 1-year warranties for chip seal projects and has recently begun requiring 1-year warranties for microsurfacing projects.

Performance Outcomes

State DOTs have used warranties for asphalt concrete and portland cement concrete with varying degrees of success. Some states that use pavement warranties have reported a reduction in costs and an improvement in quality, while others have not. For example, the Wisconsin DOT has reported significant quality increases and overall internal cost reductions through the use of 5-year performance warranties for asphalt concrete pavements. However, an evaluation of 3-year workmanship and materials warranties completed by the Colorado DOT showed no discernible impact on quality or cost.





Contract Management Methods

Michigan has been using 3- to 5-year warranties for approximately ten years. Although Michigan has not formally evaluated quality data, they report that contractors appear to pay more attention to quality issues during construction as a result of warranty provisions. Michigan has also reported that small and medium sized firms are not bidding on warranty projects. In contrast, Indiana DOT, which has been using HMA warranties for the past ten years and PCC warranties for the past 5, received industry buy-in before letting its first warranty project and has not seen a reduction in open competition. Indiana DOT has reported the following performance results based on 15 projects constructed:

- Warranty HMA has a lower and more consistent IRI than non-warranty HMA. The mean value of the warranty projects is not only significantly lower, but the standard deviation is also significantly lower.
- Warranted HMA sections have less rutting than non-warranty sections. Also, rut depths are less variable.
- Performance of the HMA warranty projects exceeds that of the non-warranted projects
- Using warranted HMA as a pavement construction strategy requires less demand on budget and provides a smoother pavement (lower IRI).
- Predicted 25-year cost to maintain network smoothness at a constant 2002 value is \$1.08 Billion dollars using a warranty strategy, and \$1.47 Billion dollars using a non-warranty.
- Initial capital costs for HMA warranty projects are approximately 10 percent higher than for non-warranty projects.
- Use of warranties for HMA projects as a pavement preservation strategy can produce a cost savings of 27 percent.

Project Types/Selection Criteria

Selection criteria include:

- Projects for which there is a low risk that external factors not within the control of the contractor will affect warranted work
- Projects for which measurable performance criteria can be developed

Warranties have been used for HMA and PCC rehabilitation, HMA overlays, pavement surface treatments, bridge painting, deck joints, pavement markings, ITS components, and others.





Advantages

- Potential to increase quality, lower life-cycle costs, and reduce premature failures
- May result in less testing and inspection by agency personnel during construction
- Raises awareness on how material and workmanship decisions can affect long-term performance

Disadvantages

- Potential for higher initial cost
- Agency staff must monitor performance during the warranty period
- External factors, such as preexisting conditions or inaccurate traffic prediction, may affect quality
- May be difficult to attribute the cause of failure to the contractor versus other external factors
- Difficult to link measurable quality attributes to long-term performance
- Warranty period may be insufficient to detect deficiencies caused by poor material or workmanship
- Contractors have expressed concerns that warranty projects will tie up funds and reduce bonding capacity for extended durations





SUMMARY

The preceding pages identified and evaluated several innovative practices currently being used by state highway agencies to accelerate project delivery, reduce initial or life-cycle costs, and improve quality. The following matrix has been prepared to summarize and compare the considerations and conditions appropriate for implementing the techniques discussed in this report.

To create a project selection tool, the next step would involve developing a process to align project goals and objectives with the alternative delivery, procurement, and contracting methods that would most likely achieve these objectives. As part of this process, analysis of the advantages and disadvantages of the methods is necessary to determine which alternative methods are the most appropriate contracting tools given specific project objectives and characteristics. Finally, analysis is needed to determine if implementation of any of these methods would require statutory authority. For example, based on the experience of other agencies, design-build, best-value procurement, and CM at-Risk would likely require legislative changes.



Summary of Alternative Delivery, Procurement, and Contract Management Methods

Project Objectives, Types, and Selection Criteria	Project Delivery Methods										Procurement Practices								Contract Management Methods									
	Design-Bid-Build	ID/IQ	Agency-CM	CM at-Risk	Portland Method	Design Sequencing	Design Build	ECI and Target Pricing	Project Alliancing	Contract Maintenance	Lump Sum Bidding	A+B Bidding	A+B+C Bidding	Alternate Design	Alternate Bid	Additive Alternates	Best-Value	Reverse Auction	Bid Averaging	I/D	Liquidated Savings	Flexible Notice to Proceed	Lane Rental	AMPM	No Excuse Incentives	Shared-Risk Contingency Funds	Warranties	
Project Objectives																												
Accelerate Delivery		X	X	X	X	X	X					X	X							X	X					X		
Reduce Procurement Time		X								X																		
Promote Innovation			X	X	X		X	X	X	X		X	X				X											X
Enhance Quality/Performance			X	X	X		X	X	X	X		X		X		X										X	X	
Early Cost Certainty				X	X		X	X	X																			
Staffing Considerations		X	X	X			X			X	X																	
Single Point of Responsibility							X																					
Reduce Construction Cost/Improve Cost-Benefit Ratio										X			X	X	X	X	X	X	X							X		
Reduce Life-Cycle Cost												X	X	X		X												X
Minimize road user impacts																						X	X	X				
Minimize disputes							X	X	X																X	X		
Project Types/Selection Criteria																												
Small to medium size jobs	X	X				X				X								X	X	X	X							
Large project with multiple phases			X	X	X		X	X	X						X	X				X						X		
Emergency project		X					X													X					X			
Repetitive/well-defined work item	X	X				X				X										X								
Time sensitive project			X	X		X	X					X	X							X	X				X			
Local community/political interests												X	X							X	X	X	X	X	X			

Project Objectives, Types, and Selection Criteria	Project Delivery Methods										Procurement Practices								Contract Management Methods								
	Design-Bid-Build	ID/IQ	Agency-CM	CM at-Risk	Portland Method	Design Sequencing	Design Build	ECI and Target Pricing	Project Alliancing	Contract Maintenance	Lump Sum Bidding	A+B Bidding	A+B+C Bidding	Alternate Design	Alternate Bid	Additive Alternates	Best-Value	Reverse Auction	Bid Averaging	I/D	Liquidated Savings	Flexible Notice to Proceed	Lane Rental	AMPM	No Excuse Incentives	Shared-Risk Contingency Funds	Warranties
Flexible traffic management																							X	X			
High traffic volumes/high RUC											X	X					X			X	X		X	X	X		
Specialized resources or expertise required			X	X	X		X	X	X	X			X	X			X										
Significant risks or unknowns remain					X			X	X																	X	
Performance criteria can be developed						X				X			X														X
Well-defined project conditions, with minimal third party conflicts/uncertainties	X			X	X	X					X	X	X	X	X	X		X	X	X	X				X		X



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