AECOM

Construction Cost Assessment

Final Report

State of Washington, Office of Financial Management

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Delivering a better world

Prepared for:

State of Washington, Office of Financial Management

Prepared by:

Peter Morris
Americas Practice Leader, PCC
T: (916) 414 5857
M: (916) 825 4045
E: peter.morris@aecom.com

AECOM
1111 Third Avenue
Suite 1500
Seattle, WA 98101
aecom.com

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Executive summary

Goal of the study

The goal of the construction cost assessment is to provide recommendations to ensure cost estimates accurately reflect project costs for both standard and alternative public works projects. The study is required by Washington state's 2021-23 Capital Budget (Sec. 1099, Chapter 223, Laws of 2021) and must result in recommendations, contained in this report, and updated draft files to include an Excel project cost estimator, architectural and engineering fee (A/E) guidelines, and an architectural and engineering fee schedule.

The recommendations must identify how best to set and manage capital budgets for projects while meeting the following criteria:

1. **Value for money**: The project must meet the defined objectives for the facility at a cost that is fair and reasonable, both for hard (construction) cost and soft (owner costs/fees/services) cost. "Fair and reasonable" means that the state pays an appropriate price to deliver the mission of the building, one that is in line with comparable facilities.

2. **Cost confidence**: The budget must be sufficient that the projects can be completed as proposed within the available funds and address reasonably foreseeable risks without requiring additional funding.

3. **Cost control**: Any contingencies or allowances for risk must be minimized, clearly identified, and managed to avoid inappropriate expenditure or inefficient use of funds.

4. **Cost effective**: The process must be cost effective, and achievable within the resources of the proposing agency and the Office of Financial Management.

The budget estimates must meet these objectives even though estimates are typically generated 2 – 3 years before construction starts (at times as early as five years before a project is completed) and are generated well before design starts. This means the estimating practices must be sophisticated enough to work with high levels of uncertainty – both the scope and design uncertainty that will be addressed by the agency and project team through design, and the escalation and market risk.

This final report follows the preliminary report dated January 31, 2022, and is focused on specific recommendations for:

- A/E Fee guidelines and services, including recognition of alternative delivery structures
- Agency PM Fee allocation
- Escalation allowances
- Risk management and market studies
- C-100 changes
- Long-term transparency and budget tracking
- Intelligence gathering

These recommendations are focused on improving the quality and accuracy of the initial cost models and improving transparency and data accessibility, all with the overarching goal of improving project delivery success and ensuring that the state gets the maximum value for every dollar invested in its capital infrastructure.

A/E fee guidelines

Current state practices

Currently the state has fee tables based on conventional Design/Bid/Build (DBB) delivery. There are no tables or guidelines for alternative delivery methods, in particular for two statutorily authorized, and commonly used alternatively delivery approaches, General Contractor/Construction Manager (GC/CM) and Design/Build (DB).

There are three DBB fee tables based on level of complexity of the building. The levels of complexity are:

Schedule A - Facilities with more than average design difficulty
Schedule B - Facilities with average difficulty
Schedule C - Projects with less than average design difficulty

The fee guidelines are for basic services, which are defined in the document “Guidelines for Determining Architect/Engineer Fees for Public Works Building Projects” dated July 1, 2015.

The guideline percentages are based on inverse geometric formulas, which generate a curve with higher fee percentages for smaller projects and decreasing fee percentages as projects grow. For example, Schedule A gives a fee of 11.75% for a project with a construction budget of $1,000,000, a fee of 9.35% for a project with a construction budget of $10,000,000, and a fee of 6.27% for a project with a construction budget of $100,000,000.

We reviewed published fee schedules from several public agencies, the majority of which were state funded public universities, and found that the Washington state approach is similar to the approach taken by many other public agencies around the country. While some use inverse geometric formulas, and others inverse logarithmic formulas, most seek to create a fee curve that has decreasing percentages as the MACC increases. Most agencies we reviewed also use multiple schedules reflecting overall complexity. The number of schedules commonly ranged from three to five, with some having six or seven.

One consequence of the inverse geometric formula is that A/E fees do not automatically escalate, over the long term, at the same rate as construction cost. For example, the current fee schedule was established in 2015. Using that schedule, a $20 million project in 2015 would have fees of 8.45%, or $1,690,684. In the seven years since the current fee schedule was implemented, construction costs have risen by roughly 50%. Using that escalation, the construction cost of an identical project in 2022 would be $30 million, giving a fee of 7.91%, or $2,372,800. The new fee is only a 40% increase over the prior fee of $1,690,684. Were the A/E fee to be escalated by the same 50%, it would be $2,536,026, or $163,000 more than the fee based on the A/E table. While this is a concern identified by the A/E community in Washington, we have not found any other public agency which is addressing the concern by routinely or periodically adjusting its fee table. Most fee tables have been fixed for very long periods. It is also important to note that construction cost escalation has risen by significantly more than general wage escalation and professional services escalation.

Our review of the fee guidelines found:

1. The Washington state fee guidelines are broadly similar to other public agency guidelines, both in the recommended percentage fee and in the type of work included within basic services.

2. The fee percentages in Washington state are generally higher than in other agencies we reviewed, as can be seen in the sample data below:

Schedule A (Complex) Fees – Representative Sample						
Construction Cost	Washington	University of New Mexico	Utah	University of Mississippi	Washington University in St. Louis	California State University
$1,000,000	11.75%	9.50%	8.91%	8.20%	9.50%	8.68%
$10,000,000	9.35%	7.50%	7.29%	7.00%	7.80%	7.26%
$25,000,000	8.16%	7.14%	6.48%	6.30%	7.30%	6.70%

Figure 1: Comparison of A/E fees with comparable institutions

3. The budget for basic services is calculated as the fee percentage multiplied by the Maximum Allowable Construction Cost (MACC), plus construction contingency (5% for new construction and 10% for remodel). A further contingency of 5% or 10% is added on the total consultant fees, effectively duplicating the contingency on basic services. The negotiated fee for basic services does not include these contingencies, and so the contingencies flow to the benefit of the project, not directly to the A/E.

4. Basic services do not include all scope required by Washington state statute, policy or code. For example, services related to Leadership in Energy and Environmental Design (LEED) are currently considered additional services, as is completion of the required life cycle cost analyses. From our experience with other states, basic sustainability design is often viewed as part of standard architectural services, but work related to LEED certification and documentation is not, nor is life cycle costing.

5. Based on our review of the population of C-100 forms from 2021, additional services make up a significant portion of the total consultant fee across the population of projects. In many cases the additional fees are greater than the basic services.

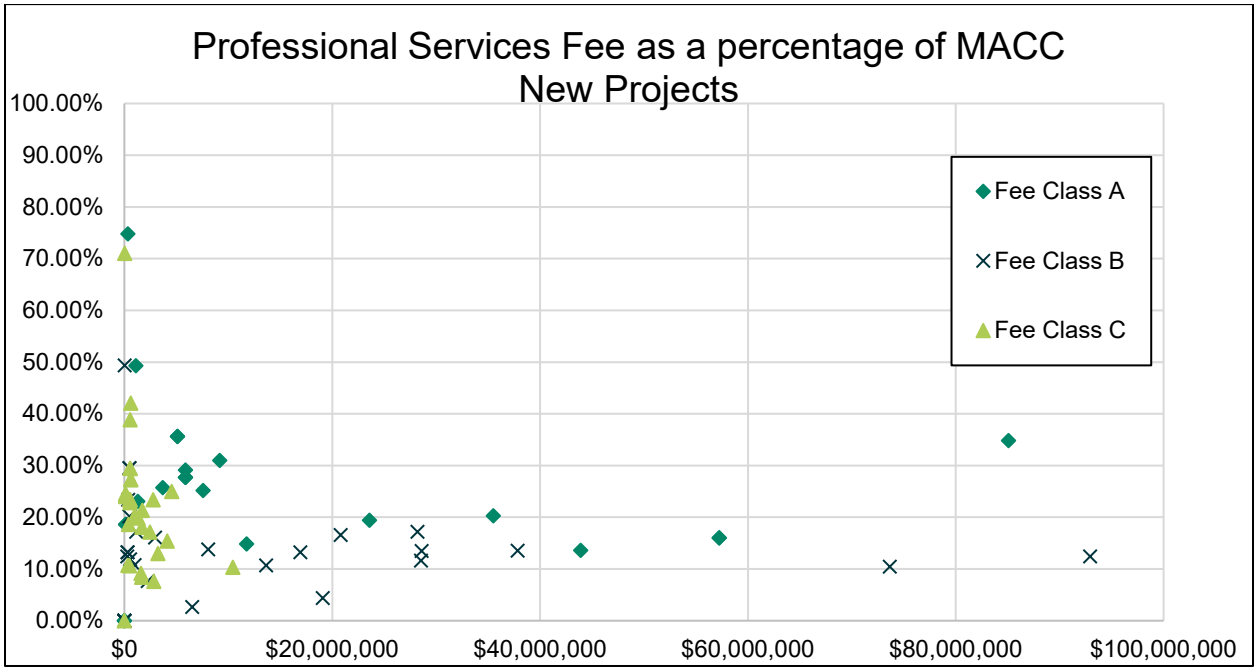

Figure 2: Scatter plot of fees as a percentage of MACC for 2021 C-100 population

6. There is a wide variation in the way agencies submit fee budgets, particularly for additional services. Some C-100s have long lists of added services, and no supporting documents are provided to show the basis for the scope. From the review of the C-100 population, we found over 100 different categories of additional services listed in the forms. Some were highly specific, such as invasive species plans or hydrology studies, while others were simply listed as "other" or "additional services". The scatter plot in Figure 2 above shows the spread of total fees as a percentage of cost.

7. Overall, the basic fee guidelines and C-100 form do not currently provide meaningful cost control or allow for transparent analysis of the total cost for consultant services.

8. For projects below $2,000,000, the fee tables provide little meaningful value. While the percentages are large, the overall fee amount remains small, and there is very little correlation between size and effort of work at these smaller scopes. The scatter shows total fees ranging from 10% to over 70%.

9. There is no mechanism for addressing the impact of construction cost escalation on fee percentages, or for systematically escalating the maximum hourly rates.

Recommended actions

1. Modify the scope required under basic services to incorporate mandated services, including:
    a. Life cycle cost studies (LCCM, LCCT and ELCCA).
    b. Sustainability and LEED services as mandated by code or policy. This would include all services related to LEED silver certification, and any code required analysis, including energy modeling.
    c. Services related to use of Building Information Modeling (BIM) throughout the life of the project.
    d. Services related to artwork coordination.
    e. Services in support of required independent commissioning (excluding the commissioning services themselves). This would include, for example, coordination with commissioning agents and incorporation of recommendations. Independent commissioning would remain as a separately contracted service by the agency, distinct from the basic A/E services.
    f. Services related to independent constructability reviews (excluding the reviews themselves), including coordination and incorporation of comments. Independent constructability reviews would remain as a separately contracted service by the agency, distinct from the basic A/E services.

2. Modify the scope required under basic services to incorporate proposed new basic services for risk management and market analysis as described in the Risk Management and Escalation and Market Study sections below.

3. Group additional services by primary category to provide greater transparency and review capability and introduce a ‘soft cap’ guidance on maximum additional services for certain categories. Categories we recommend are:
    a. Special consultants. Recommended not to exceed 30% of basic services.
    b. Added services for specifically required scopes, such as additional civil work, landscaping, additional sustainability services or pursuit of higher certification levels, workshops and charettes, etc. This would include value engineering (VE) studies, which are mandated, but not readily included in basic services.
    c. Surveys, condition assessments, etc.
    d. Entitlements and environmental or similar permitting, including any EIR/EIS analysis, special services related to wetlands, historic resources, etc.
    e. Reimbursable expenses. Recommended not to exceed 20% of basic services.

4. Increase the basic services fee structure to accommodate the increased scope for basic services (items 1 and 2 above).

5. Calculate the budget for the basic services on MACC only, not MACC plus contingency to eliminate duplicated contingency allowances in the budget.

6. Establish fee tables, including cost distributions for GC/CM and DB delivery methods. In conjunction with this, we recommend that the construction budget be evaluated based on the delivery method. A major premise of the GC/CM and DB delivery methods is that they may have higher fees, but they result in lower construction costs due to improved design coordination and constructability. Increased fee percentages should be offset by reduced MACC allowances in the C-100.
    a. GC/CM Fees have an increase in the basic service design fees for the design team to reflect the additional coordination during the design phase with the GC/CM. The recommended increase follows the A/E fee curve, and ranges from around 1% for projects with a construction cost of $5,000,000, to around 0.5% at $50,000,000. This should be offset by a reduction in construction contingency and overall construction cost.

   b. DB Fees have an increase in the basic service design fees, split between the design team and the DB contractor to reflect the additional effort and coordination during the design phase. The recommended increase follows the A/E fee curve and are typically in the 0.5% to 1% range depending on size and methodology, but do get as high as 5% for very small progressive design build projects (construction cost of $5,000,000). This should be offset by a reduction in construction contingency and overall construction cost.

7. Establish separate fee tables for civil, parks, and other horizontal infrastructure projects.

8. Allow greater flexibility in the fee tables for minor work projects (below $2,000,000). The guidelines currently allow for negotiations, but stakeholder comments indicate that the fee tables are still largely used to establish basic service fees. Alternatively develop new fee tables for these smaller projects.

9. Develop a protocol for routinely adjusting both the fee table and the maximum hourly rates for escalation.

Since these recommendations are substantial, we are recommending that adoption of the new fee tables and basic services be delayed by one year, to allow for further clarification, exploration and discussions with the broader community of stakeholders. Our recommended language modifications for the "Guidelines for Determining Architect/Engineer Fees for Public Works Building Projects" and fee tables are provided for consideration under separate cover, with the understanding that work will continue to finalize and ultimately publish these documents.

Agency PM fee allocation

Current state practices

The Agency PM fees are set in relation to the A/E Fees. The current formula takes the A/E fee percentage for basic services less 4%, applied to the construction cost. In previous biennia, the formula took the A/E fee percentage for basic services, less 3%, applied to the total project cost.

Based on the analysis of the 2021 C-100s, the total project cost was typically around 1.6 times the maximum allowable construction cost (MACC).

These two formulas yield significantly different results. For example, a Schedule A project with a MACC of $10,000,000 would yield a PM allocation of $630,000 under the current formula and an allocation of $1,173,000 under the new, assuming a total project cost at 1.6 times the MACC.

We did not find consistent reliable data for agency PM fees across peer organizations, since the approach to project management and project management budgeting varies significantly across the organizations. For Washington, where project management is generally fully charged to projects, the higher fee is more appropriate. In the example above, assuming a $10,000,000 MACC, it is reasonable to expect that the design and construction will take around 3 years overall. $1,173,000 spread over three years is $390,000 per year, which translates into roughly 2.5 to 3 FTE for the management of the project.

For minor work the current formula is 4% of total project cost. This can result in very low PM fees. For example, a $1,000,000 project would have a PM allocation of $40,000, which amounts to approximately 150 to 200 hours of a PM. For some simple projects this would be adequate, but for others, it is significantly too low. Complicating this is that some agencies have multiple small projects and can share PM time across projects, while others may only have one or two, and so have, in effect, part-time PMs.

Recommended actions

1. Largely revert to the prior formula using A/E basic service fee percentage, less 3%, calculated on the total project cost.
2. Modify the basis of calculation to limit total project cost to construction related project costs by excluding any acquisition costs.
3. Develop alternative pricing for minor works projects that allow for an agency to build up a specific project justification based on anticipated hours expended. Retain the 4% as a guidance.

We are recommending that this change be implemented in the current biennium, even if the A/E fee structure changes are delayed by one year.

Maximum allowable construction cost (MACC) in alternative delivery

Current state practices

The MACC is defined in the A/E Fee schedule as the total sum available to the general contractor for construction purposes, including all alternates. The MACC excludes Washington state sales tax, professional fees, project contingency funds, or other charges that may not be under the scope of the general contractor.

The MACC is used in the fee tables to establish the basis for fee calculations.

In discussions with agencies and CPARB, concern was expressed regarding the applicability, and even the ability to establish a MACC, for alternative delivery projects.

Recommended actions

We recommend that the definition of MACC remain as written. Even with alternative delivery, it is still possible to establish a MACC based on the current definition, recognizing that the eventual contract sum may include scope and cost in addition to the MACC.

For Design Build projects, the contract sum will include costs for design and preconstruction services, and for GC/CM it will include costs for construction management services, but these should be able to be isolated, both at the budget stage, prior to contract, and at the award stage.

It is important to keep the MACC as the cost of construction during the budgeting stage in order to allow for benchmarking and cost comparison, and to be able to evaluate the direct cost of construction and cost of fees across multiple procurement options.

We also recommend that all bid breakdowns and contractor proposals maintain this cost segregation in the proposal stage in order to maintain cost records and support good decision making related to procurement.

A more comprehensive definition of MACC which is valid for all procurement approaches is as follows:

1. Direct cost
    a. Direct cost includes all physical elements of the construction
        i. All labor, material and equipment costs for permanent components of the physical construction and associated temporary construction directly related to permanent components, such as concrete formwork. Sitewide temporary facilities are typically included with field overhead.
        ii. Field supervision directly related to permanent construction, such as working supervisors. General superintendents and sitewide management are typically included with field or home office overhead.
        iii. Subcontractor field and home office overhead cost and profit.
        iv. Allowances related to permanent construction elements, such as an allowance for miscellaneous metals.
        v. Sales and use taxes paid by the contractor or vendors on construction inputs. Washington sales tax on the completed project is excluded.
2. Design contingency
    a. The design contingency is an allowance to cover expected, but undefined permanent construction elements.
    b. Design contingencies are an integral part of the total estimated costs of a project and cover costs that may result from incomplete design, unforeseen and unpredictable conditions, or uncertainties concerning project scope. The amount of the contingency will depend on the status of design, procurement, and construction, as well as the complexity and uncertainties of the component parts of the project.

3. General conditions and profit

    a. General Conditions and Profit are defined in ASTM E2083 Standard Classification for Building Construction Field Requirements, and Office Overhead & Profit. ASTM does not define or use the term “General Conditions.”

    b. Building construction field requirements, and office overhead and profit include:

        i. All costs incurred by the prime contractor in managing and running the site, whether in the field or home office, including:

            1. Field/site set-up and accommodation
            2. Management, supervision, and field engineering
            3. Personnel travel and lodging
            4. Safety and protection
            5. Construction aids, equipment, and tools
            6. Temporary construction
            7. Environmental requirements
            8. Quality control, inspection, and testing
            9. Maintenance and housekeeping

        ii. Bonds, permits, fees and insurances.
        iii. The portion of the contractor’s home office costs and corporate overhead allocated to the construction contract. This includes:

            1. Office expenses
            2. Office staff not assigned to a specific project
            3. Business operations
            4. Insurance
            5. Financing

        iv. Any fee or profit mark-up applied by the prime contractor as compensation for undertaking the work.
        v. For GCCM projects, the General Conditions and Profit related to the construction work should be included with the construction work as part of the MACC

The **MACC** excludes:

- Washington state sales tax
- Professional fees, including any services provided by or retained under the general contractor, such as design services or professional construction management services
- Project contingency funds
- Other charges that may not be under the scope of the general contractor

Escalation allowances

Current state practices

Currently capital budgets are escalated by an escalation rate set by OFM based on the IHS Global Insights State and Local Construction Index. The rate is based on the average forecast escalation of the three years from issuance of budget instructions to the end of the upcoming biennium.

Index Source

The IHS Global Insights index is a widely used national index, particularly among public agencies, and is one of very few that publishes a forecast of escalation. It has, however, tended to run somewhat below the escalation experienced in the Washington state market according to other well-regarded indexes, such as the Mortenson index. In the ten years prior to the pandemic (2010 to 2020), the Mortenson index shows an overall 46.4% increase, which translates to 3.8% per annum, while IHS Global Insights shows a 30.2% increase, which translates to 2.7% per annum.

Escalation is currently running significantly higher than the forecasts generated for use in the current biennium. In consequence many projects are experiencing substantial loss of purchasing power within their budgets, leading to reductions in scope and/or program.

The IHS Global Insight index is forecasting a rapid decrease in escalation and, effectively, an immediate return to trend of between 3 and 4% per annum. Following current practice, this would result in an escalation budget of 3.66% per annum. Mortenson does not publish a forecast, but states "*Based on AGC data and observations and our insights, we see persistent cost fluctuations, supply-chain disruptions and workforce shortages continuing in the near term. A resilient approach working to respond to and minimize these ongoing impacts during project planning and execution will continue to be paramount over the coming months*."

There is significant concern, which we share, that the IHS Global Insights forecast will yield an inadequate allowance for inflation in the coming biennium.

Escalation Calculation

Within the C-100, escalation is applied to the current cost estimates to all cost items except for acquisition and artwork.

Escalation is calculated from the baseline date of the estimate to the mid-point of the respective budget category. Design is escalated to mid-point of design. Construction phase A/E services, construction, equipment and project management are escalated to the mid-point of construction, and other costs to the start of construction.

In the preliminary report we noted that another time-based cost change is the increase in cost due to changes in code or practice. International codes are updated triennially. However, the underlying reference material, such as ASHRAE and ASCE standards, can change more frequently. Building codes and practice generally increase costs over time.

There is no structured mechanism for adjusting budgets to address escalation that differs from the budgeted escalation, short of requesting additional legislative funding or reducing the project scope.

The escalation calculation relies on the baseline estimate being current, since it only escalates from the date of estimate. In periods of high inflation, as currently, it can be easy for estimates to lag the market by a few months. Many times, estimates are prepared in predesign, or in budget preparation which may happen some time before the final submission. Also, estimate pricing, particularly if using benchmarking, can lag simply by virtue of pricing practice, which may be using unit prices from older sources, pricing books, or price lists.

Recommended actions

1. Modify the approach to establish a more widely acceptable allowance for escalation. There are several mechanisms for accommodating this.

    a. One option, which would also address the estimate data lag, would be simply to use a “three forward, and one back” calculation. This would capture some of the recent sharp increases, which may not yet be fully bedded into the estimates, and so make for more accurate forecast models. If that were to be adopted, the escalation allowance would change to 4.9% in the C-100 for the 2023-25 biennium requests.

    b. A second option is to simply add an allowance over and above the baseline index. This could be straight line, say add 1% per annum, or an average of a graduated adjustment, say 3% for the next 12 months followed by 2%, followed by 0%. A flat increase of 1% per annum would yield an annual escalation rate for the C-100 projects of 4.66% per annum. The graduated one noted would yield an annual rate of 5.32% per annum in the C-100 for the 2023-25 biennium requests over a three-year time horizon.

    c. A third option would be to decouple from IHS Global Insights entirely and introduce an alternative indexing methodology. While Global Insights is widely used and is objective, it appears to be systematically understating inflation in the Washington market, at least by some measures. Some agencies use “expert judgment” approaches to forecasting escalation, typically by soliciting input from a wide group of industry professionals and aggregating the opinions. Decoupling in this manner runs the risk of introducing a degree of subjectivity into the process, but it does provide a much higher degree of local knowledge into the process.

    For the upcoming biennium, we recommend the first option using the extended IHS Global Insights range for the C-100. We also recommend subsequently establishing a forum or other approach for gathering expert input from the broad construction community. This would not be in place for the upcoming biennium, but would provide supporting advice for future escalation evaluation.

2. Make sure that cost estimates are current at the time of submission. This is essentially the responsibility of the submitting agencies, but it is important to emphasize this to the agencies, and, potentially, introduce mechanisms to help agencies confirm their costs. Strategies could include:

    a. Ensuring agencies use a “cost data date” in their estimates, and use that as the “Base Month” in the C-100. If, for example, an agency starts its budget planning several months before filling out their forms, they should establish the date of their source material, which may differ from the date of the publication of the estimate, particularly if it goes through reviews and multiple iterations.

    b. Making sure that old estimates are comprehensively updated. Of significant concern are projects which have been carried forward from previous budget years. These should be reviewed, not simply adjusted using an index.

3. While code and practice escalation is a time-based cost change, it should be addressed separately from the general market escalation. Known changes in code should be addressed within the body of the estimate, and potential changes should be addressed within the risk management section. In order to make sure this is not missed, however, we recommend including specific instructions in the budget instructions to ensure agencies address code and practice changes that may impact their project. Consider adding active escalation management processes to the funding process. Any long-range forecasting in a time of high volatility has a high likelihood of error. Too high an allowance leads to excess funds within the project, creating a potential for unapproved enhancements which may not bring full value to the project. Too low an allowance risks reduction in program, quality, or overall value delivered. Active escalation risk management requires targeted contingencies, which can be applied if needed, and removed if not. This would require additional legislative authority and creates implementation challenges, and so would need careful evaluation and incorporation.

Risk management

Current state practices

The state currently does not have formal risk management protocols or requirements.

Recommended actions

Introduce concepts of risk management to the budget process. Since these are new, and agencies are not familiar with the requirements, we recommend introducing these progressively by project scale.

Risk management is focused on getting better performance by:

- Incorporating uncertainty into planning and decision making
- Establishing mitigation and recovery plans
- Managing behaviors

While risk management is commonly seen as addressing cost risk, it is fundamentally about reducing all risk, including cost, schedule, safety, quality, performance, and even, reputational risk.

Risk management is fundamentally application of qualitative/expert judgment: the quantitative analysis supports this judgment, but does not replace it. It is also important to note that, while this is focused on negative consequences, the risk process can also be used to identify opportunities.

The risk management should, at a minimum, be developed to encourage teams to identify and explicitly address key risks on projects. For larger projects, the risk management should be used to inform contingency allocations and establish a process for routinely re-evaluating risks or uncertainties on projects. It is not intended that this would require hiring of additional risk consultants, although a team may choose to bring on that expertise if preferred.

This recommendation should also not significantly increase total consultant costs. We would anticipate that a structured, formal risk assessment and management process, of the scale we are recommending, should cost in the range of $50,000 to $100,000 at most. We are recommending that these be added only for projects over $50,000,000, where the percentage of the total consultant fee is extremely small. The increased fee is captured in our recommended fee schedule. The cost for this work is incorporated into our recommended fee tables. If this recommendation is not implemented, the proposed fee table should be adjusted accordingly.

We recommend that the initial risk assessment be undertaken during the predesign phase of the work. This would take the form of identifying and documenting key risks, characterizing their impact, and describing the planned approach to mitigating them. For smaller projects, this would be a qualitative assessment. The risk documentation would be adjusted regularly throughout the life of the project.

Recommended risk process

1. Initial risk register

   The initial risk register is a simple listing of potential risk issues facing the project. It does not assess or evaluate the magnitude or likelihood of the risks. It simply documents the issues facing the project in a systematic manner. Preparation of the risk register is typically done through a risk workshop, although it can also be undertaken through a mixture of individual interviews and small group discussions. The latter is not uncommon in projects with large teams and short time frames, where it is difficult to get the full group together for two to three days.

   For a small project, the risk workshop may take no more than half a day. Larger projects may extend to a day or more.

Following the workshop, the risks should be documented and structured into the risk register. Typical columns in the initial risk register would include:

- Risk name
- Risk description
- What are the consequences/impacts of the risk if it occurs?

2. Risk quantification

Adding risk quantification and evaluation greatly improves the value of the Risk Register. The quantification adds assessments of the magnitude of the risk and the likelihood. This will help identify key risks, either because they are high probability, or because they are high impact. This can then direct the project team in focus and attention to key concerns for the project.

The quantification is usually undertaken at the same time as the Risk Register, again either in workshops or interviews, and, if performed as part of the Risk Register process, adds little to the overall cost or duration. The quantification can be based on broad categories as shown in the figure below, or on quantitative analysis. We would not recommend quantitative analysis except for the largest projects.

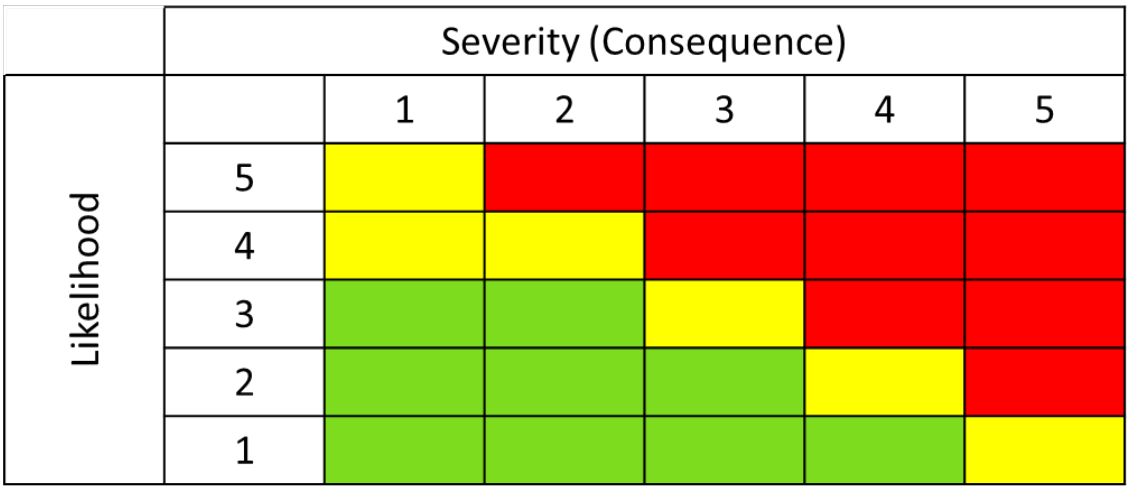

Figure 3: High-level risk quantification matrix

Within this high-level quantification matrix, the values of each category are determined by the project team, relative to the project scale. For example, a loss of $100,000 may be viewed as a level 4 severity for a small project, while it may be level 1, for a large one.

3. Preparation of a risk management plan

Once the risks have been documented and quantified, it is possible to develop a plan of action by adding management and mitigation strategies. The plan can vary in depth of assessment.

At the simplest level, it includes documentation of:

- Anticipated best practice: Assumed baseline behavior
- Risk management target: What is the desired level of risk reduction?
- Planned mitigation strategies to reduce or eliminate risk element

- Residual risk with and without mitigation action
- Risk tracking framework: Documenting how compliance with the planned strategies will be tracked
- Risk owner

The plan can also include probabilistic calculation of contingency amounts.

At a deeper level, the Risk Management Plan can be developed into a living tool for ongoing risk management, including development of a structured Risk Database using an Enterprise Risk tool such as Active Risk Manager (ARM). This would provide for ongoing risk refinement and management as the program develops. We are not recommending that within this process.

4. Execution of the risk management plan

The Risk Management Plan should provide a roadmap for the ongoing risk management for the project, but it needs to be followed and updated as the project progresses.

Execution of the plan should include, at a minimum:

- Regular and frequent review of the plan. Typically, monthly reviews are adequate. These can be done in the routine project meetings, much as any other item of the project plan.
- Tracking of progress on planned actions. Are mitigation strategies being implemented? Are they effective? Has a new risk arisen? Has a current risk expired (for example, unknown soil conditions can expire after soil surveys are complete)? Can contingency be released?

For larger projects using a quantitative risk management approach, the execution may include revising and re-running the Monte-Carlo models, and recalibrating contingencies.

Recommended application of risk practices

For projects valued over $50,000,000, the risk management process should include a formal quantitative risk register and risk based contingency valuation.

For projects valued between $10,000,000 and $50,000,000, the risk management process should include a formal qualitative risk register.

For projects under $10,000,000, the risk management process may be an informal qualitative risk documentation.

Since these recommendations involve new scopes and concepts for agencies and A/E teams, we are recommending that adoption of the new risk practices be delayed by one year.

Escalation and market study

Current state practices

The state currently does not have formal escalation and market study requirements.

Recommended actions

Introduce concepts of escalation and market study to the budget process. Since these are new, and agencies may not be familiar with the requirements, we recommend introducing these progressively by project scale.

The escalation and market study process is focused on getting better performance by:

- Addressing and incorporating market uncertainty into planning and decision making
- Establishing appropriate escalation and market adjustment factors
- Identifying best procurement methods suited to the expected market conditions

The escalation and market study should, at a minimum, be developed to encourage teams to identify and explicitly address key market issues related to a project. Identification of the issues will help guide the project planning and the development of procurement strategies.

Escalation and market studies can also play a key role in supporting the state's goals for equity in contracting for diverse business inclusion by identifying opportunities for outreach and procurement early in the process and guiding the selection of procurement options that maximize the use of such firms. This may include assessing how projects are bundled or packaged, scaling the project to suit the market capacity in a given location.

Our proposed escalation and market study scope should be within the capability range of current project team members. It is not intended that this recommendation would require hiring of additional consultants, although a team may choose to bring on that expertise if preferred.

This recommendation should also not significantly increase total consultant costs. We would anticipate that a structured, formal market study, of the scale we are recommending, should cost in the range of $15,000 to $25,000 at most. We are recommending that these be added only for projects over $25,000,000, where the percentage of the total consultant fee is extremely small. The increased fee is captured in our recommended fee schedule. Should this not be included, the recommended fees should be reduced accordingly.

We recommend that the initial escalation and market study be undertaken during the predesign phase of the work.

Recommended escalation and market study process

1. Data gathering

   Data should be gathered by interviewing local firms with knowledge of the construction activity in the area and the skills/capacity to complete the respective project.

   Possible sources include but are not limited to:

   - General and subcontractors,
   - Builder's associations,
   - Local government officials,
   - Local and statewide small/MWBE/VBE business forums,
   - Architectural and engineering firms,
   - Builders' exchange and construction-reporting firms.

2. Data evaluation

   Evaluate recent and potential future bidding conditions that may influence the cost of the project. Address both the general construction market and project specific market.

   Evaluate labor supply, strike possibilities, and availability of skilled labor covering all major sub trades.

   Evaluate material availability: shortages, oversupplies, or normal market conditions.

   Evaluate project readiness among general and sub-contractors, including their willingness to bid on state projects. Identify the anticipated number of bidders (both general and sub-contractors), and their respective experience on similar projects.

   Identify projects in the market area currently in the planning, design, bid, and construction phase.

3. Develop escalation and market strategies

   Based on the information gathered, develop strategies to optimize procurement for the project and match the market capacity.

   Potential strategies may include:

   - Scaling the project to match market capacities – bundling multiple small projects, or dividing large projects
   - Timing project procurement to suit market capacity, or to coordinate with other significant projects
   - Selecting materials or components best suited to local resources
   - Developing plans for procurement of key or strategic materials
   - Developing workforce hiring/development strategies
   - Increasing escalation reserves

4. Document the findings, including recording sources

5. Manage to plan

Recommended application of escalation and market study practices

For projects valued at over $25,000,000, the escalation and market study should include structured research and documentation of local market conditions that will affect the bid cost.

For projects valued below $25,000,000, the escalation and market study may be an informal assessment identifying the key market readiness for the project, and major escalation or market risks.

Since these recommendations involve new scopes and concepts for agencies and A/E teams, we are recommending that adoption of the new escalation and market reports be delayed by one year.

C-100 changes and long-term transparency and budget tracking

Current state practices

As noted in the preliminary report, the C-100 budget submission process is working well and effectively in supporting the budget proposals from agencies but is not in a form that readily supports transparency or data management. The result is that, while individual projects can be reviewed and evaluated on their own merits, there is not systematic data mining to support improvements in the process.

1. Data quality

   The data mining challenge was evident in our data sweep across the population of C-100 forms from 2021. We were able to create a single excel data mining worksheet, which aggregated data from the collected C-100 workbooks. This showed that mining is readily possible but because of the way agencies have modified the forms, or even just added rows, and because of a lack of naming conventions, the data extract required fairly extensive mapping to match rows of data across the population. For example, while each form had a cell that represented the total consultant fees, or the total Maximum Allowable Construction Cost (MACC), the cell addresses or names were not uniform.

   In a similar vein, agencies are required to submit data documenting actual costs, both during and at the completion of projects through the major project status report, but these forms do not tie back to the C-100 line items, and also do not have uniform cell addresses or names.

2. Comprehensiveness

   The C-100 forms are currently used to document the funds requested in a given biennium. In many cases this may not reflect the total project. A C-100 may be asking for funds for a predesign study or may be for a phase of a project. In consequence, it is often not possible to see what the total project is. This can then distort the costs that are percentage based, such as A/E fees and agency PM allocations. A/E fees may be significantly in excess of the stated percentage of MACC, simply because the requested funds do not include the full MACC. This makes it very difficult to track and analyze the requested budget in the light of the total project value.

   In contrast, when agencies submit a C-100 with the total project cost but are only requesting one phase of funding, it is challenging to understand the amount requested with the current format.

3. Level of information

   The C-100 forms document the costs for a project, but do not contain much information regarding the planned scope. There is a tab for summary data, and a tab for other information, but these are not always filled out in an informative way.

   For larger projects that have a predesign study, the scope is well-defined, both quantitatively and qualitatively, but there is no direct link from the predesign study to the C-100, nor, in fact, any requirement that the C-100 be related to the specifics of the predesign study. For projects without a predesign study, there is no systematic documentation of the scope specifics.

Recommended actions

1. Modify the C-100 document to include a “Basis of Estimate” tab in the C-100 to capture the following information.

   For large projects, much of this will typically be included in a predesign study. This recommendation is to create a linkage to the predesign study, where one exists, and to require smaller projects to use a systematic and consistent submission framework documenting the key scope elements. The minimum requirements should include the following:

- Clear scope of work: Agencies should submit a qualitative and quantitative project description, including space programming, key functional elements, and performance standards. Room data sheets are desirable, but not necessary.
- Cost-influencing ground rules and assumptions. This includes:
  - Anticipated delivery/procurement methodology
  - Schedule
  - Site conditions and constraints
  - Operational considerations (occupied site, congestion, accelerated schedule, logistics challenges)
  - Anticipated architectural expression/materials/appearance
- Life Cycle Costing. Include any Total Cost of Ownership information developed in other required studies to document expected operational costs.
- Narrative documentation of identified risk and market condition.

The basis of estimate should not be extensive. It should be in the range of 2 – 3 pages at most, and should follow accepted best practices for documenting basis of estimate, such as AACE International Recommended Best Practice No 35R-05 (10/5/2021), "Basis of Estimate."

2. Modify the C-100 to support data analysis
   a. Add named fields and address consistency to allow for data mining
   b. Create naming conventions where possible, for example, grouping consultant services as noted above
      i. Special consultants
      ii. Added services for specifically required scopes
      iii. Surveys, condition assessments, etc.
      iv. Entitlements and environmental or similar permitting
      v. Reimbursable expenses
   c. Create a master analysis file with the ability to read-up primary data fields and provide real-time data aggregation and analysis
3. Modify the C-100 to accommodate alternative delivery

   Where a user selects one of the alternative delivery approaches, trigger the opening of specific fields in the form. For example, where a user selects DB, the model will calculate the total A/E fee for basic services, and allocate that between consultant and construction contractor, and make other modifications, such as assigning contingency between the project and the DB entity.

   The forms will allow for collection of data both by function and by provider, so it will be able to see total amount budgeted by category (for example, design services, regardless of who is providing them), and also the total amount to be paid to external consultants as opposed to the contractor.
4. Modify the C-100 to show both the scope to be funded in the current biennium and the total project cost, regardless of phasing. This may not be possible to incorporate in the current budget cycle, since it would require changes at the agency level, and may take time to adopt. If so, it may be possible to include the total project cost as an informational tab for the current cycle.
5. Modify the Major Project Status Reports (MPSR) forms to support cost and program capture at construction award and completion.

   Add fields to the MSPR and close-out documentation that align costs with the C-100 line items for selected data points. In our conversations with agencies, there was a concern that actual costs are not captured in a manner consistent with the C-100 budget line items, and that this change may be challenging. We believe, however, that this is a very important process and needs to be incorporated. Developing this and creating crosswalks for the cost data that satisfy the data analysis needs while not overburdening the agencies may take time, and so our recommendation is that the process be started and tested over the current biennium, with a goal of full implementation in succeeding budget cycles.

6. Develop a C-100 database.
7. Create a database of C-100 submittals and MSPRs to support consistency and establish easy data retrieval for benchmarking and comparison. This will be started with the C-100 analysis tool noted above which will allow for testing of data extracts internally to OFM, with a view to creating sharable data in the longer term.

Intelligence gathering

Suggested actions

Several aspects of our recommendations above would be enhanced by establishing a “community of practice” group that could act as a source of information on such matters as inflation, market conditions, fee structures, diverse business inclusion, changes in delivery and procurement methods, changes in code or practice, etc. Many other public entities will call together ad hoc groups as needed. For example, the city of San Francisco canvasses a broad group of industry practitioners each year to seek opinions on escalation.

This suggested “community of practice” group differs from established advisory groups such as CPARB in that it is intended to be for gathering of a broad range of views and opinions without evaluation or analysis, as opposed to being an advisory or approvals council. Typically, information is gathered using a Delphi approach, where participants are asked to provide thoughts or suggestions in response to specific questions individually, in order to avoid groups being dominated by more powerful voices. Opinions are public, and shared, but only after each participant has contributed, so each voice has equal weight.

Because opinions are explicitly solicited, it also reduces the selection bias inherent in responding to unsolicited comments. For example, while there may be strong, unsolicited comments on a particular topic, indicating that it needs to be addressed, it may be that the broader community does not perceive a problem.

We suggest that the state establish an informal, but structured group of interested parties as a way of gathering broad opinion on construction related issues as they may impact construction budgets. This would not need to have a budget, or to meet in person, but it could create a very valuable way to gather the sense of the construction community in the state quickly and dispassionately on matters of importance to the budgeting process.