CURRENT PRACTICES, OPPORTUNITIES & CHALLENGES

PROVISION OF ENGINEERING SERVICES ON A LUMP SUM BASIS



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Foreword

This study has a foreword written by Javier A. Baldor, Chief Executive Officer at BST Global.

A series of system-level disruptions are taking shape that will transform the consulting engineering industry and the world as we know it. The impact of this transformation will surpass that of the automobile, electricity, internet and personal computing as we are propelled into the Fourth Industrial Revolution — the Data Revolution.

In this new world, the future of work will be unlike anything we have ever seen before. In fact, McKinsey estimates that generative AI (gen AI) alone will add \$4.4 trillion to the global economy annually, and along with other emerging technologies, it has the potential to automate work activities that consume up to 70% of an employee's time every single day.

gen AI is fantastic at predicting patterns found in natural language and using it dynamically, which makes it perfectly suited for knowledge-based industries like consulting engineering. Think about the roles of an architect, engineer and designer — not just what they do, but how they do it. Now, imagine that architect, engineer and designer with a companion, a co-pilot called gen AI that takes their productivity to the next level. According to McKinsey, gen AI could automate up to 50% of work tasks between 2030 and 2060.

"This industry's underlying business model, which has remained unchanged for decades, is going to be upended."

- Javier A. Baldor, Chief Executive Officer, BST Global

Unlocking that kind of productivity creates a world of difference between the architect and engineer of today and those of tomorrow. In the future, architects and engineers will also be software engineers, leveraging low-code and no-code development tools and platforms. And they are going to be data scientists, bringing high-end data analysis to projects.

Your business will be transformed too. This industry's underlying business model, which has remained unchanged for decades, is going to be upended. Where the consultancy of today is a pure-play architectural and engineering firm that operates largely on a time and materials basis, the consultancy of tomorrow will be a data first company operating on a value-based model.

Arguably, clients in our industry will also face disruption and transformation with the advent of AI and emerging technologies. At a time when private and public sector budgets are stretched and resources constrained, CivicPlus suggests that AI and big data could:



Enable smarter management of city infrastructures and optimize energy consumption



Unleash the productivity of client professionals and teams through gen Alenabled 'agents'



Increase asset resiliency and extend the lifespan of public assets by modeling past data and usage patterns to proactively predict emerging infrastructure needs and maintenance



Optimize the allocation of scarce resources in public works through predictive analytics



Enhance public communication and boost engagement with Al-powered chatbots that answer questions and generate content

That is why this study is so important right now. Consulting engineering firms will need to make massive investments in new and emerging technologies (gen AI, machine learning, big data) while re-training and upskilling their professionals if they hope to prosper or even just survive in the future.

The consulting engineering firm leaders who successfully navigate this journey will undoubtedly witness significant efficiency and productivity gains. However, if the underlying business model does not evolve and change to one that is value-based (lump sum, gain share or otherwise), the entire industry will arguably be at risk. You see, if a consulting engineering firm can deliver the same work product 30% to 50% more efficiently in the future but still charges for its services by the hour, it is fundamentally in a race to the bottom. This is a business model that is unequivocally unsustainable by any business, let alone one where project and delivery risk is largely transferred to the consulting engineering firm.



The solution lies where consulting engineering firms can suitably invest in innovation for the future and achieve healthy, sustainable returns for their long-term business prosperity and viability. In return, clients will receive the full force of value that the latest technologies afford by unlocking and freeing up the capacity of the consulting engineering industry's brightest minds. This will result in creative, innovative and truly valuable solutions to clients' pressing challenges as they look to realize their ambitions and serve their stakeholders. In the future, the industry business model should be one that is value-based (lump sum), rewards innovation, mitigates risk and delivers valuable outcomes for clients. Such a model will be supported and embraced by clients who understand and appreciate that what is most important is achieving their desired outcome at a fee that is fair for the value created.

Autodesk's Vice President of AEC Strategy, Nicolas Mangon, adds that "for the AEC industry to truly benefit from new and emerging digital technologies at the same rate as peer industries, we must reduce friction throughout the project delivery lifecycle. The industry must encourage the adoption of more incentive-based contracts, like lump sum, so that firms can invest in their ability to leverage digital technology to deliver better project outcomes for their clients. Lump sum contracts will enable the AEC industry to realize the promise of emerging technologies like AI so that better decisions are made earlier, resulting in better, more sustainable and resilient assets. This will also allow owners to maximize taxpayer dollars by optimizing their long-term operating costs while improving the world we live in."

In closing, as you read this study and look to the future, I invite you to simply open your mind. Open your mind to the possibilities and think differently. Think differently about how you work. Think differently about your business. And think differently about your future.

"The industry must encourage the adoption of more incentive-based contracts, like lump sum, so that firms can invest in their ability to leverage digital technology to deliver better project outcomes for their clients."

– Nicolas Mangon, Vice President of AEC Strategy, Autodesk

The ACEC Research Institute commissioned this study – in partnership with Virginia Tech – to enhance awareness of the potential opportunities and challenges of lump sum structures for engineering and design services in the transportation sector.

Executive Summary

Background and Purpose

Recent decades have seen a gradual transition by public agencies in the use of lump sum contractual arrangements for the provision of engineering and design services. The federal government has largely embraced the use of lump sum contracts, and a growing number of state agencies have employed this contracting structure with success. For instance, the US Army Corps of Engineers has effectively used lump sum as its preferred structure for professional engineering services for many years. Agencies cite a variety of benefits with lump sum contracts, including cost savings stemming from a reduction in administrative effort – allowing agency staff to focus on managing project delivery — as well as the shifting of risk to consultants. Consultants favor lump sum contracts because they provide added flexibility to manage human resources effectively while still delivering the service and value that their clients contractually specify.

The following excerpt from the Indiana Department of Transportation's Professional Services Contract Administration Manual (2020) succinctly describes lump sum arrangements:

Lump sum is a payment method whereby a consultant is paid a specified sum of money for a specific service in the contract. With this payment method the compensation is not subject to any adjustment due to cost changes that the consultant encounters in performance of the work unless substantive changes occur in the scope of services. Because the consultant assumes full financial responsibility in the form of profits or losses, this method provides a maximum incentive for effective cost control in contract performance. This type of payment method imposes the minimum administrative burden on both the consultant and INDOT. This method should only be used when the estimate, duration of effort and project scope is defined to the extent that fair and reasonable compensation can be determined. (Section 6.1.4, p. 18)

Yet, many public agencies, particularly state Departments of Transportation (DOTs), use lump sum arrangements sparingly. Instead, DOTs often use cost-plus-fixed-fee (CPFF) contracts with a not-to-exceed (NTE) price limit that are typically based on negotiated levels of effort and duration and established pricing regimes for specified services, but they do not necessarily incentivize innovation, efficiency and cost-effective service provision and their administration is costly and time-intensive.

The ACEC Research Institute commissioned this study – in partnership with Virginia Tech – to enhance awareness of the potential opportunities and challenges of lump sum structures for engineering and design services in the transportation sector. Interviews were done to provide a rich data set, and 14 client organizations (nine DOTs, three federal agencies and two public transportation authorities) and nine engineering firms (six national, two regional and one state-level) were deliberately selected for semi-structured interviews to:



Characterize the current landscape for the contracting of engineering and design services

Capture current practices associated with the use of lump sum commercial structures



Determine the advantages and disadvantages of lump sum arrangements



Identify opportunities and challenges for increased implementation of lump sum arrangements

Further, the increasing proliferation of big data, machine learning and generative artificial intelligence (gen AI) will continue to transform the engineering and design services industry. The longstanding business model that typically compensates consultants by the level and duration of effort of assigned and approved staff provides limited incentives for firms to adopt these emerging tools and technologies. Hence, this study is timely since it also explores the impacts of advanced computing tools and technologies on service provision and fair compensation.



Current Use and Practices



Client organizations' use of lump sum arrangements varied primarily from the exception (less than 10% of engineering and design contracts) to the rule (more than 80% of contracts) – although a few organizations employ them modestly (between 25-50% of contracts).



Engineering firms' experience with lump sum contracts ranged from approximately 20-80%. This experience was very dependent on firm size and geographic markets.

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All interviewees agreed that defining the scope of services as well as any assumptions and exclusions is paramount in lump sum contracts. This scope definition process becomes the basis for pricing services and managing the work over the course of the agreement; it also helps to create stronger relationships among the contractual parties.

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Oftentimes, the essential steps to define and price the scope of services for lump sum arrangements are similar to reimbursable arrangements such as CPFF.

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Experienced client organizations have developed welldocumented guidelines and procedures for scope development and definition. However, such tools should be crafted and used sensibly to prevent unnecessary administrative effort or restriction of novel resource allocation strategies.



Most interviewees indicated that lump sum contracts are suitable for detailed design services, but some indicated that any services such as planning/ project development and construction engineering & inspection (CEI) services are also candidates for lump sum arrangements. The latter perspectives were shared by participants from organizations with significant experience with lump sum structures.



Several client organizations use hybrid contracts where services with adequate scope definition are treated as lump sum and services with less certainty or scope definition such as geotechnical investigation are handled via reimbursable structures.



Implementing lump sum arrangements is considered less costly and simpler since invoicing and administration are far less arduous for both clients and firms. Further, the focus of a lump sum services agreement shifts to the contract's deliverables instead of billing and auditing for allowable costs and expenses.



Phasing services is another strategy for addressing scope uncertainty since a scope can be written for scoping/planning and then adjusted to advance the design through preliminary/ conceptual design or detailed design by a modification or a new task order.



Staffing flexibility allows firms to make adjustments in personnel as long as changes in key staff are properly communicated to clients. Client organizations should limit required notifications about staffing adjustments to key personnel only to avoid infringement of the staffing autonomy granted to engineering firms.



Project types cited as more suitable for lump sum contracts include resurfacing, restoration and rehabilitation (3R projects) and interchange/ intersection improvements whereas complex projects and projects with significant third-party engagement were cited as less suitable. More complex project types such as roadway widening are not implausible, but these will require greater attention to scope definition. Similarly, coordination with third-parties may be handled with lump sum structures so long as the scope, assumptions and exclusions are quite clear; the utilization of lump sum for CEI services is evidence of this.



Impacts of Technology such as gen AI

Interviewees addressed the impacts of technologies such as machine learning and gen AI. These technologies are expected to increasingly influence how engineering and design services are conducted. Tools to automate or enhance design activities are increasingly used and continue to evolve. Yet, effective utilization of these platforms and emerging AI tools will require significant investment of resources by engineering firms – as well as client organizations. Moreover, they are semi-automated since input and review by professionals from engineering firms and client organizations are still necessary. Exactly how technologies like gen AI will be addressed in the delivery and pricing of engineering and design services remains unsettled. What is clear, though, is that the investment in both financial and human capital for firms to adopt and sustain such technologies is considerable. As adoption increases, costs do not rapidly decline since the pace of production efficiencies gained is at least matched (if not outpaced) by technological advancement – this is a continuous cycle.

Hence, the industry must adopt a sustainable pricing model if it expects to remain healthy as a source of engineering creativity and innovation and an attractive sector for top talent.

Advantages of Lump Sum Contracts

Interviewees noted a variety of advantages associated with lump sum contract structures. Notably, most advantages were identified by both client organization and engineering firm representatives with strong alignment among multiple advantages.

 Both client organizations and engineering firms frequently cited reduced administrative burden and effective cost management. One client organization representative commented:

Once a contract is in place, the focus is on oversight and quality of the deliverables and whether they are meeting contract requirements. This facilitates easier contract administration. In a cost-plus contract, we have a higher administrative burden to not only make sure scope and contract requirements are being met, but also in auditing charges and invoices to ensure that we are reimbursing for allowable costs.

- Clients and firms were also comparably aligned on well-defined scope & price and increased focus on deliverables while increased profit margin was noted slightly more by firms. One client organization representative noted:
- Having a detailed scope of work with documented project assumptions is critical in executing fixed-price contracts. This level of detail and mutual agreement at the time of execution eliminates disagreements as the project progresses, makes determination of out-of-scope work very clear, and results in a better partnership across the parties.
 - Some clients noted the **transfer of risk to a consultant** and **suitability for smaller projects** as benefits whereas firms did not explicitly draw these distinctions.
 - Engineering firms cited **staff flexibility** most highly and some clients recognized this benefit as well. Engineering firms seek this flexibility to allocate the most suitable resources available to achieve the required outcomes, which results in reduced administrative effort and improved cost management.
 - A few engineering firms distinguished **incentivizing innovation** and some clients also identified this possibility. An engineering firm representative stated:

It gives [engineering firms] the opportunity to be more efficient. Ingenuity. How can we get things done quicker so that the client gets the same product deliverable, and we get paid for value.

Certainly, ingenuity may also drive better solutions, so a client may receive a higher value product sooner than originally contemplated.



Lump Sum Contract Limitations

Interviewees also identified circumstances where the use of lump sum contracts may not be ideal, where concerns from client organizations and their industry partners are predominantly focused on scope-related issues.

• By far, client organizations cited **inadequately defined or uncertain scope** as the top issue for lump sum contracting with several engineering firms also recognizing this challenge. One engineering firm representative commented:

You need to have a clearly defined scope and make sure those unknowns are minimal. Here's what we're doing, here's what we're not doing. And in my mind, that's not really any different than a cost-plus project. But I think maybe it's just kind of thought of differently just because [a consultant] is only charging [the client] for what you actually spend in [CPFF], as opposed to tying it to agreed upon deliverables [in lump sum].

 Response levels for clients and firms were consistent for the potential for scope creep, less transparency about services and familiarity and experience of personnel with lump sum, but the response frequency was slightly higher for firms than clients. An engineering firm representative commented about scope creep:

You can manage [the scope] as well as you want, but sometimes you can end up doing free rework when the owner or others - a utility, a third party - change their mind, and the owner feels like that's part of the design process.

While a client organization and an engineering firm representative noted the following respectively about familiarity and experience of personnel:

Client: We do use [lump sum], but not to the extent that we should be using it. And I would say a big piece of that is just the lack of experience of our project managers using lump sum. It's different, it's new.

Engineering Firm: The risk for us is having the right management mindset to manage a lump sum job. If you take somebody who is used to cost plus and you put them on a lump sum job, you better have a deputy project manager who's used to lump sum because cost plus thinking is risky in lump sum delivery. So, where you plan two or three cycles and you take four or five, you're now going to eat into your profit margin.

- Some clients and firms noted the **negotiation effort** necessary to agree on the scope of work and price. This is somewhat surprising since many interviewees described a process for reaching agreement that is comparable to that followed for CPFF arrangements. This issue appears to stem from either misalignment between the counterparties about pricing the scope of services or the emphasis placed on refining and tightening the scope of work. Regardless of whether the effort is actually different or greater, this front-end effort should reduce issues during implementation, for instance, when determining whether work is in-scope or out-of-scope.
- A limited number of clients noted the **potential for excessive profit margins** as a concern, stemming either from uncertainty in negotiating scope and pricing or the fact that consultants are competing for services on the basis of qualifications-based selection and not on the lowest price. Many more agencies, however, reported satisfaction with fee arrangements, which were based on a competitive and negotiated process. Some agencies also cited the assumption of risk by consultants, as well as reduced administrative costs on their part. Profit margins for consultants in the transportation sector have historically lagged industry medians.
- A very small number of firms in the sample expressed concerns over a **potential** reduction in the quality of work, although this issue is strongly mitigated by the standards of care that engineering and design services firms are obligated to follow and the qualifications-based, repeat business environment prevalent in the industry.



Advice from Interview Participants

Representatives from client organizations and engineering firms provided key suggestions for the industry based on their experiences with lump sum contracting for engineering and design services:



Be open to using lump sum arrangements; start incrementally and consider phasing services



Select a lump sum structure when a project or services are suitable and both parties can fully agree on a scope of work



Recognize that lump sum contracting is not a loss of control for the owner since scope is mutually agreed at the start



Bear in mind that consultants are agents of their clients, so the shift to lump sum does not change the standard of care or liability



Keep communication channels open and transparent



Create processes for handling unforeseen issues or outcomes



Recognize the incentives created for cost effectiveness and creativity



Promote knowledge exchange among agencies to share lessons learned and best practices



Organize records and data so an agency has a basis for negotiating effort and pricing of lump sum tasks and deliverables





Key Findings

The interviews lead to several important findings.

Lump sum contracts promote a sharp focus on a project's deliverables rather than its administration.

I think our industry should consider paying for an outcome, not how to get there.

Establishing the scope of work for services and clearly identifying assumptions and exclusions sets the stage for effective use of lump sum structures.

> Having a detailed scope of work with documented project assumptions is critical in executing fixed-price contracts. This level of detail and mutual agreement at the time of execution eliminates disagreements as the project progresses, makes determination of out-of-scope work very clear, and results in a better partnership across the parties.

Lump sum contracts open up the opportunity for engineering and design service firms to autonomously and optimally employ human, technological and financial resources to deliver value and fulfill contractual obligations to client organizations.

> The firm fixed price really makes your project more predictable. You're spending more time, I think, getting on the same page upfront through the negotiations, but then you're locked in. So that's the benefit to [clients]. The benefit to the firms is if they've evaluated the project, there's room for them to be efficient, to be creative, and to probably make some extra profit. So, I think it's a good balance.

Federal client organizations have successfully implemented lump sum contracting for engineering and design services for decades now.

> We started our investment in project control systems some time ago, and we have refined them over the years. But it has probably been at least a 20 plus year journey.

The transition to lump sum arrangements is not a "quantum leap" from reimbursable/costplus fixed fee arrangements.

> I still have to figure out all the parameters that go into it and the different disciplines and aspects. So, I'll develop and estimate the effort level as I would on a typical cost-plus project. And then when I present the fee, I don't present it to [the client] in this hourly breakdown as we would normally. So, I can roll it up and just give them round numbers on each phase of the work rather than a hundred hours. I don't have to show [the client] that on a lump sum.

Qualifications-based selection and the repeat business work environment should reduce client concerns about lump sum contracting outcomes such as less control, reduced quality or unreasonable profit margins.

> If [consultants] don't perform and are out just for a quick win, they will lose in the long haul, and that's not in their best [interests]. So, they really want to make sure that they satisfy the agency and especially the project manager and that they can't do that despite making an extra 5% or 10%. Because [the agency] will end up making sure that's one of the last projects they perform.

Lump sum contracts can accommodate uncertainty in the scope of services through approaches such as the use of hybrid structures or the phasing of services.

> We tend to be fonder of those instances where we've carved out a portion of the work such as geotechnical, surveying and mapping where that may not be paid in accordance with lump sum. That might be what we refer to as a limiting amount, which is cost reimbursement, and then the rest of it is lump sum.

If you're at the outset of a project and there are a lot of unknowns, don't try to shoehorn in a full design task order going from scoping to a hundred percent. Most of our work, we do a scoping only task order and then we sit down with the team, we reevaluate, we come up with a plan of attack, and then we'll do either a task order modification or a new task order to go from post scoping to either 30% or 100%.



Higher, but reasonable, profit margins indicate healthy and effective implementation of lump sum arrangements for engineering and design services.

> There was a timeframe when our Office of Inspector General would audit these contracts and people would be appalled at the level of profit that might have been ultimately made by a consultant. But that's actually a good thing because that's what we want them to do is to be cost efficient. As long as we negotiated the contract and we believe the cost to be reasonable and competitive during negotiations and the department is content with that fee, then I think second guessing, oh well, they made way more profit than I thought they would, is unnecessary because the method of compensation is lump sum, so it changes how they approach the project. So ultimately, I think it's a win-win scenario. And whenever we have done lump sum contracts, we're basing it on information that we feel reasonably comfortable with, historical information, then you just keep moving. And I think it's a positive.

Our goal for lump sum is a 15% profit that's built into those contracts...Over the past, those rates or those average percentages have been 17%, 16%. They're right there in line. And if we're losing a percent or two, I'm totally fine with that. If we're nailing it down that closely, we're doing an excellent job. And I think that far outweighs the time and effort that it would take any of our staff to go back in and track those monthly invoices. Minimal use of lump sum arrangements by a client organization is NOT necessarily a sign of opposition or resistance to them but rather the impact of other factors such as the lack of staff awareness and familiarity with lump sum contracting.

> We would need to hear from our engineering community why they think [lump sum] would be more beneficial. We haven't heard that yet, but it's not something that we feel is necessary or have felt is necessary or else we would've initiated this change a long time ago.

> I'm sure if we asked some of our agency project managers, they may not even know that lump sum contracting is a tool that they can use. So that education awareness within the agency is not quite there yet.

> We do use [lump sum], but not to the extent that we should be using it. And I would say a big piece of that is just the lack of experience of our project managers using lump sum. It's different, it's new.

The strong relationships between client organizations and engineering firms observed suggests that the industry can work together to expand the contracting options employed for engineering and design services.

> We work really well with our engineering community. They know we're trying to do things the right way, and I think they truly know that we're trying to make sure they can be profitable, but just reasonably profitable. And that's best for the firms, but it's also best for the DOT. The consultant doesn't want the DOT to go broke and only get a few jobs out. They want the DOT to be sustainable as well.

There is a clear need for a national and continuing dialogue about balancing the costs of technology adoption and efficiencies of technology implementation to find a sustainable pricing model.

> We've shared the draft of the Al policy with our [ACEC Member Organization] as well as the proposed changes to the standard professional services agreement to solicit their input...So we're scrambling to catch up with the technology and we recognize that even this will be a snapshot in time and will undoubtedly have to change as the technology emerges and becomes more ubiquitous.





Introduction

Background, Motivation and Purpose

Over the past few decades, some public agencies have adopted lump sum arrangements for the provision of engineering and design services, but a widespread transition towards its use has been slow. Federal and state agencies alike have employed this commercial structure with success. For instance, **the US Army Corps of Engineers has effectively used lump sum as its predominant commercial structure for professional services for many years.** Additionally, ACEC members report that lump sum commercial terms provide them more flexibility to manage organizational resources while still delivering the services and value that their clients expect. Additional reported benefits for lump sum arrangements include heightened incentives to develop and leverage current and emerging technologies, reduction in administrative burden and cost for both clients and engineering firms and attainment of a fair and reasonable price for services when the scope of work is well-defined. Indeed, the following excerpt from the Indiana Department of Transportation's Professional Services Contract Administration Manual (2020) succinctly describes when and why lump sum arrangements are appropriate:

Lump sum is a payment method whereby a consultant is paid a specified sum of money for a specific service in the contract. With this payment method the compensation is not subject to any adjustment due to cost changes that the consultant encounters in performance of the work unless substantive changes occur in the scope of services. Because the consultant assumes full responsibility in the form of profits or losses, this method provides a maximum incentive for effective cost control in contract performance. This type of payment method imposes the minimum administrative burden on both the consultant and INDOT. This method should only be used when the estimate, duration of effort and project scope is defined to the extent that fair and reasonable compensation can be determined. (Section 6.1.4, p. 18)

Yet, many public agencies, particularly state Departments of Transportation (DOTs), make limited use of lump sum arrangements. Instead, DOTs often use cost-plus-fixed-fee (CPFF) contracts with a not-to-exceed (NTE) price limit, which are typically based on a negotiated level of effort and duration and an established pricing regime for the specified services, but they do not necessarily incentivize efficient and cost-effective service provision and their administration is costly and time-intensive. Moreover, such arrangements may actually disincentivize improvements in productivity by engineering firms. For instance, if a firm increases productivity through technology, then firms stand to lose revenue since the effort charged is reduced and they may be unable to recoup the costs of technology adoption in overhead charges. Consequently, the ACEC Research Institute commissioned this study, in partnership with Virginia Tech, to characterize the current landscape for the contracting of engineering and design services to: (a) capture current practices associated with the utilization of lump sum commercial structures; (b) determine the advantages and disadvantages of lump sum arrangements from client organization and engineering firm perspectives, particularly for services in the transportation sector; and (c) identify opportunities and challenges for increased implementation of lump sum arrangements.

Further, the increasing proliferation of big data, machine learning and generative artificial intelligence (gen AI) will continue to transform the engineering and design services industry. The longstanding business model that typically compensates consultants by the level and duration of effort of assigned and approved staff provides limited incentives for firms to adopt these emerging tools and technologies. Hence, this study is timely since it also explores the impacts of advanced computing tools and technologies on service provision and fair compensation.

Overview of Research Approach

The research was conducted by completing a review of existing literature and in-depth interviews with representatives of client organizations and engineering firms. Interviews provide a source of rich data and allow the interview participants to engage in a structured but flexible dialogue about commercial structures for engineering and design services.

The participants in the interviews were deliberately selected. Representatives from client organizations came from agencies with little to no experience with lump sum arrangements to some experience to extensive experience. Representatives from engineering firms came from organizations of varying sizes from small regional firms to large national/international firms. Each interview lasted approximately one-hour, and interviewees were asked various questions ranging from their experience with lump sum contracts for engineering and design services to when to use such arrangements (or not) to specific advantages and disadvantages of lump sum contracts. Each interview was then transcribed for subsequent analysis of its content.



Study Participants

Client Organizations

Representatives from 14 client organizations were interviewed. The majority of the interviews had a single client representative present, but several involved multiple representatives. In total, 22 representatives participated in the interviews. Figure 1 depicts the client organizations by type. Nearly two-thirds of the representatives interviewed were from DOTs since the study was focused on the transportation sector. However, perspectives were also obtained from federal agencies that had significant experience with lump sum contracts for engineering and design services as well as two large public authorities that had some experience with such arrangements.



CLIENT ORGANIZATION TYPES

Current roles of client organization representatives included: Chief Engineer, Chief Procurement Officer, Director of Professional Services Procurement Office, Project Management Branch Chief and Manager of External Audits. All client representatives have 20 or more years of experience in the industry with many having 30 years or more. Several had worked in both the public and private sectors.

Engineering Firms

Representatives from nine engineering firms were interviewed. Every interview had a single engineering firm representative present. Table 1 depicts the size of the engineering firms involved in the interview process. Representatives from large firms were two-thirds of those interviewed, so they generally were able to provide a broad perspective of the use of lump sum contracts since their firms operate in multiple regions or nationally. The representatives from the small and medium-size firms supplied state and regional perspectives respectively.

Firm Size	Number	Firm Size Description
Large	6	Employees > 200
Medium	2	25 < Employees ≤ 200
Small	1	Employees ≤ 25
Total	9	

Table 1. Engineering Firms Interviewed by Firm Size

Current roles of engineering firm representatives included: Chief Executive Officer, Chief Operating Officer, Transportation Business Group Lead and Senior Project Manager. All engineering firm representatives have 20 or more years of experience in the industry with many having 30 years or more.

Summary

The interview participants had significant experience in the engineering and design services industry with many having worked in both the public and private sectors. Client organizations varied by type while engineering firms varied by size and geographic market reach. Overall, the interviewee participants provided a reasonable representation of both client organizations and engineering firms. Moreover, their experience with lump sum contracting for engineering and design services varied.



Discussion of Results

Findings from the Literature

A search for literature (such as journal or conference papers and trade articles) addressing the use of lump sum or fixed price commercial structures for engineering and design services did not yield many results, which highlights the need for this study. Literature found did emphasize the importance of well-defined scopes of work and the potential benefits of simplified invoicing and accounting under lump sum arrangements (ASCE Task Committee 2012). However, an article by Sturts and Griffis (2005) focused primarily on the need for a new approach for pricing engineering services since the compensation system for design/ engineering firms was not correlated with the value these firms provided. In particular, the influence of technology was recognized:

Technology has an incredible impact on the pricing and profitability of engineering services. Historically, pricing for engineering services has been based on labor-hours. However, some in the industry have experienced at least a tenfold increase in efficiency because of computer-aided design and the development of three-dimensional computer models. Consequently, the labor-hours spent on a project no longer adequately represent the value of the engineering services rendered. There is a need for engineers, designers, and consultants to revise old, and develop new, pricing strategies.

Sturts and Griffis advocated for a transformation to a "value-based pricing" methodology where services are determined by the market value rather than a markup on the costs involved (Nagle and Holden 1995). They further argued that reimbursable or cost of effort pricing methods do not incentivize engineers to improve or optimize designs and engineering-related services. Interestingly, this article was published when the engineering and design services industry had transitioned through the implementation of computer-aided design and was in the early stages of three-dimensional modeling. Today, the industry is witnessing the proliferation of big data, machine learning and generative artificial intelligence (gen AI) that will further transform how services are performed as well as their efficiency and cost. Yet, many pricing approaches within the industry remain effort based. The current and future impacts of such tools and technologies on firm costs and production rates coupled with existing and pending workforce challenges suggest that the industry's longstanding pricing model is unsustainable. Consequently, the influence of these tools and technologies on contemporary practices and pricing of engineering and design services was explored during the interviews conducted.

Lump Sum Arrangements for Engineering & Design Services

USE AND EXPERIENCE

Representatives from client organizations were asked approximately what percentage of their engineering and design services work was done on a lump sum basis. Figure 3 illustrates the approximate amount of work done on a lump sum basis: 5 of 14 (36%) indicated less than 10%, 6 of 14 (43%) revealed 80% or more, and 3 of 14 (21%) indicated somewhere between 25-50%.¹ Consequently, the vast majority of the client organizations interviewed either make limited to no use or extensive use of lump sum contracts while the balance employs them moderately.



PERCENTAGE OF SERVICES ON LUMP SUM BASIS

Figure 3. Client Organizations' Percentage of Services on Lump Sum Basis

The representatives of engineering firms indicated that lump sum arrangements ranged from approximately 20% to 80% of their business. The level of use was very dependent on firm size, geographic regions served and client types. Generally, larger firms with a national market had lower percentages of their business conducted on a lump sum basis while smaller firms with regional markets had higher percentages.²

² The small and medium-sized firms included in the study were in regions where DOTs tend to employ lump sum arrangements more frequently. Larger firms are also often engaged in large-scale transportation program management or comparable services that use reimbursable structures, which further reduces the amount of their work on a lump sum basis.



¹ Interviewees provided approximate estimates of lump sum use rather than exact figures.

APPROPRIATE USE

All representatives interviewed indicated that lump sum arrangements are appropriate or suitable when the scope of work is clear and well-defined, regardless of whether their agency uses or their firm has experience with this structure. The excerpt from the INDOT Professional Services Contract Administration Manual (2020) cited previously highlights two key benefits, effective cost control and minimum administrative burden, but it emphasizes the significance of project scope definition that enables the determination of fair and reasonable compensation.³

While interviewees agreed generally on the appropriate use of lump sum, perspectives regarding the extent of its potential utilization varied substantially. One engineering firm representative commented:

[Lump sum] can be used throughout a project or a program's life cycle. I think it's a matter of how you define the work and I think regardless of what the work is, there is a way to define it using lump sum by setting either logical beginning and endpoints to the projects or by stating assumptions and exclusions and then being willing to change those things if the project is not the same.

This comment reflects a perspective that essentially any engineering and design services work can be done on a lump sum basis since there are means available to define such work like milestones for work and to clarify assumptions and exclusions.

Alternatively, one client organization representative noted:

It's not something that we have internally said, hey, it would make more sense for us to do this lump sum. We would need to hear from our engineering community why they think it would be more beneficial. We haven't heard that yet, but it's not something that we feel is necessary or have felt is necessary or else we would've initiated this change a long time ago.

Here, the client organization representative does not express an inclination for or against lump sum arrangements, but rather the lack of a need for a change from the commercial structures currently in use (i.e. cost-plus) by the agency or a demand for change from its engineering community. The comment also suggests that **benefits to the client**, such as cost certainty and risk transfer possible with a clearly defined scope in a lump sum arrangement, **are not widely recognized** within the industry.

³ Interviewees addressed these factors when discussing the specific advantages and the pricing of services of lump sum contracting; details are given subsequently.

SUITABLE SERVICES FOR LUMP SUM

Figure 4 illustrates the perspectives of both client organization and engineering firm representatives regarding the types of engineering and design services suitable for lump sum contracts. Notably, client organizations and engineering firms with more extensive lump sum experience indicated applicability to a broader range of services.



FREQUENCY OF RESPONSES

Figure 4. Types of Engineering and Design Services Suitable for Lump Sum

As depicted, nearly all of the representatives interviewed indicated that detailed design services are suitable for lump sum. One client organization representative commented that they start negotiations for design services presuming a direct labor multiplier structure,⁴ but the agency is open to considering lump sum:

We start with a direct labor multiplier, but if you want to consider lump sum, let's talk about it and let's see if there's a good fit here. And we both agree that this method could work, but we go in with a scope. So, we know we need design services for a bridge or design services for a roadway reconstruction project. We don't necessarily go in with a predetermined contracting method, but we just open it up for that discussion with the consultant after they're selected.

⁴ The direct labor multiplier is a reimbursable structure where compensation is salary/wage costs times a multiplier plus allowable expenses; a not to exceed (NTE) limit may or may not be used.



Yet, a few interviewees felt that all engineering-related services were suitable for lump sum. For instance, one client organization representative noted that planning and project development work was suitable:

Essentially, it boils down to two things. Everybody knows what the scope is, everybody knows what the agreed upon price is. And essentially, you're shifting much of the liability to the [consultant]. But honestly, I just always felt like it says right here what I'm going to pay you and what I'm asking you to do. And to me, it protects us both...We'd say, we want three alternatives. We want a 15% development of each of those alternatives and to list out the deliverables. And if we got those three deliverables, and one of them, if that really didn't stand us where we needed to be or maybe we need to go back and take a look at this. We would make a modification.

Here, the client organization representative indicates strong reliance on a clearly defined scope of services for planning/project development (three alternatives at 15% development with specific deliverables) and a willingness to issue a modification if a deliverable, supplied as specified, proves insufficient.

Several client organizations and engineering firms mentioned the use of or experience with reimbursable structures within an overall lump sum contract for design services for specific disciplinary areas such as geotechnical investigations and survey & mapping for particular projects when too much uncertainty in these areas exists. Consequently, hybrid structures where some items of work are done on a reimbursable basis are not uncommon.

Very few interviewees indicated that project development/planning or construction engineering and inspection (CEI) services were suitable since these phases are difficult to sufficiently define. One client organization representative commented:

Construction almost exclusively goes cost plus fixed fee. The designer nor the department are really driving the schedule. It's the contractor. So, it's negotiated out on a schedule that's all done cost plus fixed fee.

Yet, perspectives regarding these types of services were not unanimous. One engineering firm representative indicated that the **"vast majority of NEPA⁵ services** in the transportation space **are pretty predictable."** Hence, such services could be priced lump sum using alternative strategies such as defining tasks and agreeing on prices per task; if the scope of a task exceeds expectations, then a modification is issued. Another approach described was to negotiate a lump sum price for CEI services based on historical data from comparable projects as long as the extent, scope, complexity and character of the work are established. Oftentimes, the price is a percentage of the construction cost; this approach is not without its issues, particularly during periods when construction pricing is affected by high rates of inflation.

While detailed design services were uniformly viewed as suitable for lump sum contracting, a diversity of perspectives existed regarding other types of services. This is not surprising given the range of use and experience among client organizations and engineering firms with lump sum arrangements. Some agencies and organizations have years of experience with lump sum structures and have extended their utilization to services that are not as easily applicable. Notably, the hybrid contract mentioned previously has a lump sum structure as its base, and areas of work with less scope definition are structured uniquely on a reimbursable basis to better align risks with pricing strategies.

PROJECT SUITABILITY

Interviewees noted that some projects **are more suitable** than others for lump sum contracts for engineering and design services; examples include:

- · Resurfacing, restoration and rehabilitation projects, i.e. 3R projects
- Interchange/intersection improvements
- Bridge inspection
- Culvert replacement

Alternatively, interviewees indicated that some projects are less suitable:

- Complex projects with "unknown unknowns"
- Projects involving significant engagement with third parties
- Projects with complex maintenance of traffic (MOT) requirements

In such cases, cost-plus (time and materials) structures are typically used.

These perspectives reflect the consensus that well-defined scopes of work are necessary for lump sum arrangements. Typical roadway resurfacing or restoration projects may include the repair of joints, the addition of underdrains and pavement undersealing, grinding and/ or grooving where the nature of the work is usually quite clear. Certainly, other project types such as roadway widening and interchange design are plausible, but they will require more attention to scope definition. Alternatively, a project that requires substantial coordination with utilities, right-of-way acquisition and/or approvals from local agencies or municipalities will reduce the control that both owners and consultants have over the effort and time involved, which can complicate upfront definition and pricing of the work necessary. However, this does not necessarily preclude employing lump sum structures so long as the scope of services, assumptions and exclusions are very clear; the utilization of lump sum for CEI services by some clients is evidence of this possibility.

⁵ Interviewees addressed these factors when discussing the specific advantages and the pricing of services of lump sum contracting; details are given subsequently.



Approaches for Procurement of Engineering Services

All of the client organizations select engineering firms on the basis of qualifications – per federal and state procurement regulations – through well-established qualifications-based selection (QBS) methods. In QBS, client organizations competitively select engineering and design firms on the basis of expertise and experience.

The vast majority of the client organizations interviewed select or qualify a pool of engineering firms periodically and execute a base agreement with each firm such as a master services agreement or an indefinite delivery, indefinite quantity (IDIQ) contract. Subsequently, client organizations will then issue a task order to a firm, and this initiates the scope development and pricing of services. Some design projects will have their own specific contract. On these occasions, clients will conduct a QBS for the project, which typically is larger and more complex, and the client seeks to qualify a specific firm for engineering and design services.

Establishing a Scope of Work & Lump Sum Price

Following the selection of a consultant based on qualifications, the parties will establish a scope of work for services. The approaches within client organizations are either clientdriven or consultant-driven. Client-driven approaches were more common among the client organizations interviewed.

CLIENT-DRIVEN PROCESS

One example of a client-driven process involves the client developing a scope of work document and key milestone dates as well as an independent estimate of the price for the services. Subsequently, an RFP is issued to the consultant, and the consultant prepares its response including its proposed fee based on expected tasks, effort and staffing. Negotiations then occur to: (a) discuss and finalize the scope, (b) modify and clarify any assumptions and requirements, (c) adjust the schedule if necessary, and (d) determine a mutually agreed on effort and pricing for the work.

A client organization representative commented:

One of the keys to success with firm-fixed price contracting is to develop a detailed scope of work that relays the government's assumptions along with all required elements of work and that the [consultant] is given the opportunity to review and weigh in on the requirements and assumptions. This provides a documented, agreed upon approach that will be the baseline for deciding when we have a scope change.

Another client organization representative noted:

So, we negotiate the contract as best we can based on the proposed level of effort from the consultant and the department's independent staff hour estimate [based on proprietary historical data for risk management]. Once we arrive at a lump sum fee, you shake hands, and then you let the consultant actually drive and take control of the wheel.

⁶ For more details about QBS, see ACEC Research Institute's QBS resources portal: https://program.acec.org/qbs-resources-portal

CONSULTANT-DRIVEN PROCESS

An example of a consultant-driven process starts with a kick-off meeting between the client and consultant where information about the services required is exchanged and dialogue between the parties occurs. Subsequently, the consultant drafts the scope of work statement for the client to review. Negotiations then occur to finalize the scope, and both parties develop level of effort and staffing matrices. Once scope, effort and staffing are agreed, then appropriate rates for staffing are applied, which determines the lump sum price.

A client organization representative stated:

We sit down with the engineer, have a kick-off meeting and tell them basically what we're looking for and they take the first stab at writing a scope. We give them as much information as we can, but it [falls on] the consulting engineer to come back and give us a scope.

STANDARD PROCEDURES AND TEMPLATES

Many client organizations have well-established and documented guidelines for professional services procurement and management that include procedures for establishing scopes of work and negotiating engineering and design services. For instance, Florida DOT has both a professional services procurement procedure and manual and a negotiation handbook for professional services contracts. An excerpt from the negotiation handbook that addresses negotiation of work effort follows:

The objective of this process is to ensure that the proposed staff hours are reasonable for the specific project. It is also critical to determine if a reasonable distribution of work among various levels of staff is proposed to ensure the most economical staffing commensurate with the complexity of the project.

Upon receipt by the Department of the Consultant's staff hour estimate, the Department's estimate shall be provided to the consultant. The Consultant's staff hour estimate should be compared with the Department's and the differences evaluated. Discussions will be conducted with the Consultant to resolve differences between the Department and consultant staff hour estimates. As with the entire negotiations process, a record should be kept of the key points discussed and the resulting resolution. (Section 3 – Negotiation of Work Effort, p. 3)



Similarly, many client organizations have detailed templates for defining the scope of work. A client organization representative commented:

We have scope of work templates that we have refined over the years, and they are **mind-numbingly specific** (emphasis added) about the deliverables at each stage. And I mean, literally, they go into each discipline and exactly what needs to be shown, exactly what needs to be developed.

Clearly, defining the scope of work is critical for any engineering and design services contract. In many respects, the processes commonly followed for establishing a lump sum scope and price are similar to those in CPFF arrangements since the effort and duration of staffing for the specified services are negotiated and agreed; subsequently, a price for the services is negotiated. However, this process is somewhat amplified for lump sum arrangements since the agreed upon scope becomes not only the basis for fixing the price for the totality of the work, but also the foundation for monitoring progress and determining if a change or modification is necessary. Either counterparty can bear unanticipated risks and commensurate cost and/or schedule impacts when the scope for services lacks adequate clarity. For instance, an engineering firm may conduct unnecessary design iterations, respond to multiple rounds of client comments or participate in extra client meetings if the specified scope does not make the extent of such tasks clear. Consequently, experienced client organizations have well-established polices and processes for scope development.⁷ However, such processes and templates, if overly prescriptive and meticulous, may increase administrative burdens to complete these actions and deter creativity and innovation since deviations such as the introduction of new resources for the work may become problematic.

Implementation and Management of Lump Sum Contracts

Interviewees provided various insights regarding the implementation and management of engineering and design services under lump sum structures ranging from a shift of focus to staffing adjustments.

SHIFT OF FOCUS

A majority of the client organizations and engineering firms interviewed indicated that the focus when using lump sum shifts towards the deliverables for services. This is not to say that deliverables are not important under reimbursable structures, but engineering firms have now assumed the risk of providing the agreed services for the total price and the agreed schedule, absent any modifications. A client organization representative indicated:

As long as [consultants] provide the deliverables in accordance with the contract scope of services requirements and the deliverables are acceptable, you let them manage the project, which is what they want to do, and they can be as efficient as they need to be. And the department still gets the deliverables.

⁷ Clearly, the same could be said for CPFF arrangements; however, interviewee comments indicate that the clarity of the agreed scope for services in lump sum structures is necessarily greater. Subsequent sections of this report will address this issue further.

While consultants still must provide services and deliverables as specified for the agreed fees within the not to exceed price in a CPFF arrangement, this shift in lump sum structures is notable since it can empower the engineering or design services firm to allocate the personnel and technological resources available and warranted to fulfill its contractual obligations. An engineering firm representative commented: "I think our industry should consider paying for an outcome, not how to get there."

Another client organization representative noted this shift towards the quality of deliverables as well as relief from the administrative burden required in a reimbursable structure:

Once a contract is in place, the focus is on oversight and quality of the deliverables and whether they are meeting contract requirements. This facilitates easier contract administration. In a cost-plus contract, we have a higher administrative burden to not only make sure scope and contract requirements are being met, but also in auditing charges and invoices to ensure that we are reimbursing for allowable costs.

INVOICING AND PAYMENT

The vast majority of client organizations and engineering firms that had experience with lump sum arrangements indicated that payment is based on meeting identified milestones and/ or percent complete for services. Typically, a progress report and any required deliverables accompany a payment invoice. A few client organizations have adopted earned value methods to track progress and make payments where planned progress is forecast and actual work is compared to the forecast. If expectations are not met, then clients typically withhold a portion or all of a payment until requirements are fulfilled.

PHASING SERVICES

Some client organizations described an incremental or phasing strategy for addressing uncertainty or unknowns under a lump sum structure. For instance, a client can issue a scoping task order for planning/project development phase services (0-10%) to advance a project's concept. Subsequently, a client can issue a modification or new task order to further advance the design (i.e. 10-30% or 10-100%). A client organization representative commented:

If you're at the outset of a project and there are a lot of unknowns, don't try to shoehorn in a full design task order going from scoping to a hundred percent. Most of our work, we do a scoping only task order and then we sit down with the team, we reevaluate, we come up with a plan of attack, and then we'll do either a task order modification or a new task order to go from post scoping to either 30% or 100%.



STAFFING ADJUSTMENTS DURING IMPLEMENTATION

During negotiations to establish a scope of work and lump sum price, client organizations and engineering firms normally negotiate and agree on staffing and level of effort. Representatives from both parties indicated that staffing adjustments are typically easier to implement during execution of the work. However, the notification requirements for such adjustments varies. In some cases, an engineering firm is contractually required to notify the client and receive approval of key staff adjustments. In other instances, clients expect communication of any key staffing changes such as a new project manager. A client organization representative noted:

They have to identify [key personnel] when they respond to the solicitation. Once [the consultant] has been selected, they provide a list of all the people on the project so that they can swap those in and out. But if they want to replace a key person, they actually have to send us a formal letter, with a resume attached, to make sure they're qualified.

Whether specified or not, the vast majority of interviewees indicated that engineering firms commonly notify clients of any changes in key staff. However, several interviewees recommended that client organizations should limit such notification expectations to key staff members and not extend such notification to any supplemental staffing that engineering firms deem necessary (such as the addition of an engineer with specialized expertise). Otherwise, the autonomy granted the engineering firm is compromised and unnecessary administrative requirements are imposed.

Management of a lump sum contract is **not vastly different** from a reimbursable arrangement, but greater attention is given to deliverables and whether they meet client expectations. If not, payment is deducted or withheld. Some clients address uncertainty by phasing services, and engineering firms have flexibility to make staffing adjustments. However, notification of changes in key personnel is either required or good practice to maintain client relationships.

One of the keys to success with firm-fixed price contracting is to develop a detailed scope of work



Impacts of Technology on Engineering & Design Services

Engineering firms and client organizations also provided insights into how the increased use of 3D models and the emergence of big data, machine learning and gen AI will impact the delivery of engineering and design services. The integration of data-driven technology for engineering and design services has the potential to enable innovation and improve value. For instance, gen AI can enable consideration of more plausible technical solutions for a given problem. Several interviewees noted that lump sum contracts offer advantages for implementing technology since they provide more flexibility for resource allocation and focus attention on effective delivery of outcomes. One engineering firm representative commented:

Anything that improves the efficiency of delivery for us, whether AI or a better idea from somebody, is very advantageous in a lump sum because you're not looking to recover hours; you're looking to deliver a solution.

Technology can improve the efficiency of engineering services by optimizing available resources. Tools to automate or enhance design activities are increasingly used and continue to evolve. For instance, the design of roadway, drainage, and grading work is significantly augmented by platforms such as Bentley OpenRoads or Autodesk Civil 3D, which are leveraging AI.⁸ Client organizations are likely to benefit from gen AI as well through applications such as automated review of an engineering firm's price proposal and subsequent comparison against the client's independent estimate. Yet, effective utilization of these platforms and emerging AI tools will require significant investment of financial and human resources by engineering firms – as well as client organizations. Moreover, they are semi-automated since input and review by professionals from engineering firms and client organizations are still necessary. Plus, such tools and their application will require validation and integration into regular business processes. One client organization representative noted:

Just because you have a model or some technology to help you do something, you still have to validate it. You can't just press the button and say that's done. I don't think there's going to be an appreciable savings in the short term because there's still got to be a lot of validation to make sure [a technology] works.

An engineering firm representative provided this perspective of where the industry stands with respect to AI integration:

Our team has developed custom subroutines for reviews and common adjudication for collapsing plan sets ... I mean, to me, that's step one ... Al is probably step four or five. Because you're not going to get there overnight. It's not a technological solution. The whole business process has to change.

⁸ Current AI tools are used for object identification and classification. gen AI will be increasingly used in automation, reuse and generating design alternatives.

Exactly how technologies like AI will be addressed in the delivery and pricing of engineering and design services remains unsettled. This is not surprising since this is uncharted territory for client organizations and engineering firms alike. One of the client organizations interviewed has a draft AI policy and proposed changes to their standard professional services agreement under review, but the vast majority of client organizations have not specifically addressed this issue yet. Several engineering firm representatives viewed the **lump sum structure as very suitable for incorporation of technology**. One firm representative noted:

We all have to figure out how to address the AI component of [engineering services]. And lump sum seems to be a very good solution to address the commercial arrangement that is going to be needed as we move into more automation, AI type delivery, because there's still human intervention in this. Somebody still has to select, somebody still is going to come up with ideas that haven't been thought of, things like that. And that's where the real value gets created.

To leverage big data, machine learning and gen AI, engineering and design services firms will incur additional technology, staffing, training, licensing and software, and maintenance costs, particularly in the short-term. The standard staffing tables or matrices used to establish levels of effort and subsequent pricing in CPFF structures do not currently reflect such efforts and costs; moreover, they tend to incentivize effort over optimal resource allocation and value. Engineering firms can wrap some of these costs into their overhead rates, but capturing them this way has regulatory (what's allowed by FAR or state regulations) and practical (what's realistically acceptable to clients) limits. Moreover, CPFF arrangements typically have capped profit margins. Hence, engineering and design service firms that have made commitments to technological advancement and tools could be caught in a circumstance where they cannot afford to work for public agencies since their overhead rates are too high and the allowable profit margins are too low. This situation could lead to a public sector market where primarily labor intensive and less efficient and innovative engineering firms are available for service provision at a time when engineering workforce challenges are guite high. However, client organizations do recognize that engineering services have and will continue to rely on existing and emerging technologies, and the vast majority expressed their commitment to fair and reasonable pricing of technologyenabled or augmented services. Yet, many indicated that efficiencies gained should translate into benefits for their agencies, particularly since they are stewards of the public. One client organization representative noted:

We just always want to be able to compensate the consultant fairly for what the effort is that it's costing them to do the work. So, whether that consultant is buying into a new technology like subsurface utility engineering, and they've got equipment that it took them a lot of money to acquire, we'll pay them as a direct cost for that, make sure that they're whole if they use it. If not, obviously that's an expense that they have to take on the chin themselves. If a consultant can be efficient in delivering something, we want them to then translate those efficiencies over to us and we don't want to have to pay as much for it.



Over time, this translation of the efficiencies and cost savings afforded by advanced computing and technology tools will occur, but near-term effort and costs to initiate, establish and optimize these tools will most certainly increase. Yet, once adoption and maturation of a particular technology has occurred, new technological advancements ensue – so the cycle continues. Consequently, many engineering firm and client organization representatives noted that the impact of technology – particularly gen AI – is an issue that will take time for the industry to address sufficiently. One client organization representative stated:

Genuinely, our commitment is to be fair and reasonable in that we're not looking for bargain basement prices. We want our state to be competitive among the transportation agencies. And we know that a lot of firms work in multiple states, so we want our policies and our approaches to these issues to be fair and reasonable so that [firms] can be competitive, and we can be competitive. [This commitment] would be the same [when considering pricing and the impact] of evolving technologies such as AI, or whatever other opportunities we have to embrace technology, by looking at the benefits for all involved. There could be some capital investment for [firms] in those types of technologies, but over a period of time is there a reduction in cost and a reduction in time as well? Is there a reduction in delivery complexities or things of that nature? So, I think this is a topic that evolves over time as we understand the potential impacts and benefits to both parties. There are going to have to be some interactive discussions about this issue.

Certainly, client organizations and engineering firms alike have much to consider as technologies such as 3-D modeling and gen AI continue to evolve and impact how the industry conducts its business. An increased level of dialogue between client organizations and engineering firms is necessary to address the opportunities and issues raised to identify a sustainable pricing model as the variety and pace of technological change increases.

Advantages and Disadvantages of Lump Sum Contracts

During the interviews, representatives of engineering firms and client organizations were asked to identify specific advantages and disadvantages of lump sum contracts for engineering and design services. Specific responses were grouped into common thematic areas to facilitate a frequency analysis. For example, a client representative's response about the advantage "creates incentives for consultants to better control and manage their costs" was included in the "effective cost management" thematic area. Frequency was calculated by dividing the number of responses in a thematic area by the total number of responses. Appendices 1 and 2 present multiple interviewee comments about lump sum contracting advantages and disadvantages respectively.

Figure 5 presents the frequency of responses by thematic area for advantages of lump sum contracting; the figure is ordered from highest to lowest frequency of responses by client organization representatives.



FREQUENCY OF ADVANTAGES IDENTIFIED

Figure 5. Comparative Response Frequency for Advantages



A variety of advantages were noted by representatives of client organizations and engineering firms, and most were identified by both parties with strong alignment among multiple advantages. Both client organizations and engineering firms frequently cited reduced administrative burden and effective cost management. These are characteristic effects of the lump sum structure since invoicing is based on deliverables and not effort, and consultants are incentivized to optimize resource allocation and costs during service delivery. For instance, one client organization representative commented:

Once a contract is in place, the focus is on oversight and quality of the deliverables and whether they are meeting contract requirements. This facilitates easier contract administration. In a cost-plus contract, we have a higher administrative burden to not only make sure scope and contract requirements are being met, but also in auditing charges and invoices to ensure that we are reimbursing for allowable costs.

Clients and firms were also comparably aligned on well-defined scope & price and increased focus on deliverables while increased profit margin was noted slightly more by firms. Scope development and definition was identified often by interviewees while the attention paid to deliverables and increased profit margins are additional inherent effects of the lump sum structure. One client representative noted:

Having a detailed scope of work with documented project assumptions is critical in executing fixed-price contracts. This level of detail and mutual agreement at the time of execution eliminates disagreements as the project progresses, makes determination of out-of-scope work very clear, and results in a better partnership across the parties.

Consequently, the emphasis on scope definition results in a shared understanding of the project that likely aids in implementation and promotes stronger project relationships.

Some clients noted the transfer of risk to a consultant and suitability for smaller projects as benefits whereas firms did not explicitly draw these distinctions. Under a lump sum contract, clients have a known price for the work and have transferred the risk of the cost for service delivery to engineering firms. Smaller projects will often have more easily defined scopes of work. **Engineering firms cited staff flexibility most highly** (slightly more than administrative burden and cost management) and some clients recognized this benefit as well. Engineering firms seek this flexibility to allocate the most suitable human resources available to achieve the required outcomes, which results in reduced administrative effort and improved cost management. Finally, a few engineering firms distinguished incentivizing innovation and some clients also identified this possibility. The lump sum structure affords firms the opportunity to discover better solutions through more effective and/or efficient resource allocation.

An engineering firm representative stated:

It gives you the opportunity to be more efficient. Ingenuity. How can we get things done quicker so that the client gets the same product deliverable, and we get paid for value.

Ingenuity may also drive better solutions, so a client may receive a higher value product sooner than originally contemplated.

Figure 6 presents the frequency for disadvantages by thematic area; the figure is ordered from highest to lowest frequency of responses by client organization representatives.



FREQUENCY OF DISADVANTAGES IDENTIFIED

Figure 6. Comparative Response Frequency for Disadvantages



Responses from client representatives indicated that they are predominantly concerned about scope-related issues in lump sum arrangements. Other issues were also cited, but far less so. Alternatively, engineering firms identified several disadvantages at comparable levels.

By far, **client organizations cited inadequately defined or uncertain scope as the top issue** for lump sum contracting with several engineering firms also recognizing this challenge. Possibly, this concern is related to the relative inexperience of the client organizations interviewed with lump sum arrangements since approximately 36% use lump sum in less than 10% of their overall contracts. Hence, the level of comfort with scope definition and development remains relatively low. However, several representatives from clients and firms with greater experience with lump sum contracting also pointed out this issue; this reinforces the importance of a sufficiently defined scope and the problems encountered if scope ambiguity exists.⁹ An engineering firm representative commented:

It becomes a risk to do a lump sum [contract] when you don't know the scope very well ... If you don't know and then you've tied yourself to a price that is woefully short, then that's hard to come back from.

Another engineering firm representative commented:

You need to have a clearly defined scope and make sure those unknowns are minimal. Here's what we're doing, here's what we're not doing. And in my mind, that's not really any different than a cost-plus project. But I think maybe it's just kind of thought of differently just because [a consultant] is only charging [the client] for what you actually spend in [CPFF], as opposed to tying it to agreed upon deliverables [in lump sum].

These comments not only highlight the risks and importance of scope definition but also recognizing when work is outside the agreed scope, particularly if project managers or staff are more accustomed to reimbursable structures. Alternatively, uncertain scopes are commonly a challenge for lump sum or fixed pricing. As noted previously, though, client organizations have employed methods such as phasing services to address this challenge.

⁹ Certainly, lack of clarity in scope will cause issues in reimbursable schemes; however, the emphasis that interviewees placed on a definitive scope in lump sum arrangements suggests a higher threshold than reimbursable arrangements.

Response levels for clients and firms were consistent for the potential for scope creep, less transparency about services and familiarity and experience of personnel with lump sum, but the response frequency was slightly higher for firms than clients. Firms may have identified scope creep more prominently because they may inadvertently complete additional work or need to confront a client that maintains that a particular design activity is part of the normal design process. An engineering firm representative noted:

You can manage [the scope] as well as you want, but sometimes you can end up doing free rework when the owner or others - a utility, a third party - change their mind, and the owner feels like that's part of the design process.

Reduced transparency about services is another characteristic effect of the lump sum structure; clients are not contractually entitled to the details about staffing and effort levels during service provision. While clients not only require these details but are also accustomed to them in CPFF, its necessity is very questionable in lump sum contracts when consultants are providing deliverables as agreed. The concern over familiarity and experience with lump sum stems from two sources: (I) a lack of awareness or expertise with lump sum contracting, and (2) a more general lack of experience in the workforce. The former is potentially a distinct concern for lump sum arrangements while the latter is a broader issue that the industry is facing. A client organization representative stated:

We do use [lump sum], but not to the extent that we should be using it. And I would say a big piece of that is just the lack of experience of our project managers using lump sum. It's different, it's new.

While an engineering firm representative noted:

The risk for us is having the right management mindset to manage a lump sum job. If you take somebody who is used to cost plus and you put them on a lump sum job, you better have a deputy project manager who's used to lump sum because cost plus thinking is risky in lump sum delivery. So, if you plan two or three cycles and you take four or five, you're now going to eat into your profit margin.



Some clients and firms noted the negotiation effort necessary to agree on the scope of work and price. This is somewhat surprising since many interviewees described a process for reaching agreement that is comparable to that followed for CPFF arrangements. Scrutiny of interviewee comments reveals that this issue stems from either misalignment between the counterparties about pricing the scope of services or the emphasis placed on refining and tightening the scope of work. Regardless of whether the effort is actually different or greater, this front-end effort should reduce issues during implementation, for instance, when determining whether work is in-scope or out-of-scope. One client organization representative commented:

Negotiations take a longer lead time to get the contract executed. On average, it takes 40-60 days for most contracts to reach a settled negotiation on scope and pricing. But taking more time upfront has resulted in fewer amendments throughout the project lifecycle.

A limited number of clients noted the potential for excessive profit margins as a concern. This issue is linked to negotiating scope and pricing where clarity of effort is insufficient or the fact that consultants are not competing for services based on price. For example, a client organization representative noted:

If [engineering firms] were to somehow innovate and require less effort throughout the life of the project than what had originally been negotiated, then obviously profits could go up. Being a steward of the taxpayer dollars, I don't see how that's fair, simply because they're not competing in a low bid environment. Consultants are selected based on quality, and then a fee is negotiated that represents a fair and reasonable cost for the effort.

Notably, several client organizations indicated that higher profit margins are expected and acceptable in lump sum arrangements. Further, they are oftentimes offset by the reduced costs of administration by clients, as well as the assumption of risk by the consultant. A client organization representative commented:

As long as we negotiated the contract and we believe the cost to be reasonable and competitive during negotiations and the department is content with that fee, then I think second guessing, oh well, they made way more profit than I thought they would, is unnecessary because the method of compensation is lump sum, so it changes how they approach the project. So ultimately, I think it's a win-win scenario. Interestingly, firms identified the potential reduction in the quality of work more often than clients – although the frequency of this response from both was very low. This response is likely the consequence of firms assuming the schedule and cost risk in a lump sum arrangement and pressing to meet a deliverable milestone or to maintain a project's budget, which might cause errors or omissions. Regardless, **this issue is strongly mitigated** by the standards of care that engineering and design services firms are obligated to follow and the qualifications-based, repeat business environment prevalent in the industry; these circumstances were noted by several client and engineering representatives. An engineering firm representative stated:

I don't know if [quality control] is a bigger issue. It's definitely something that can be a challenge because on a design project, we always have to have a 'pencils down' date so that we can go through our internal quality control process. And that always gets pushed. It's just incumbent on the consultant to manage that. The best marketing that we can do is to deliver projects that the client is happy with, can put out on the street and get good bids. I think most consultants [are like us] where 80% of our business is repeat business, and it only takes one really bad project. And unfortunately, or fortunately, depending on how you look at it, clients talk to each other.

Clients or firms that lack experience with lump sum or that are reticent about using this structure can review the advantages and disadvantages identified as well as the accompanying interviewee comments to better understand the benefits as well as the potential costs of lump sum contracting. More broadly, the industry can explore how to expand or capitalize on the advantages while examining how to address the disadvantages. For instance, the challenges of inadequately defined or uncertain scopes and negotiation effort may be overcome through dissemination of practical tools such as templates for scope development and definition or policy guidelines for negotiating the pricing of services.



Advice from Interview Participants

Near the conclusion of the interviews, representatives from client organizations and engineering firms were asked to provide any key suggestions for the industry based on their experiences with lump sum contracting for engineering and design services. Salient suggestions included:

- Be open to using lump sum arrangements; start incrementally and consider phasing services
- Select a lump sum structure when a project or services are suitable and both parties can fully agree on a scope of work
- Recognize that lump sum contracting is not a loss of control for the owner since scope is mutually agreed at the start
- Bear in mind that consultants are agents of their clients, so the shift to lump sum does not change the standard of care or liability
- Keep communication channels open and transparent
- · Create processes for handling unforeseen issues or outcomes
- Organize records and data so an agency has a basis for negotiating effort and pricing of lump sum tasks and deliverables
- · Promote knowledge exchange among agencies to share lessons learned and best practices
- · Recognize the incentives created for cost effectiveness and creativity

Lump sum contracts promote a sharp focus on a project's deliverables rather than its administration.



Key Findings

This study produced a number of key findings related to current practices, opportunities and challenges for providing engineering and design services on a lump sum basis:

Lump sum contracts promote a sharp focus on a project's deliverables rather than its administration. This emphasis on the deliverables necessary to meet contractual obligations is beneficial to both client organizations and engineering firms since the value of the services provided becomes the centerpiece of client and firm interactions. Attention shifts to the outcomes not the process.

I think our industry should consider paying for an outcome, not how to get there.

Lump sum contracts open up the opportunity for engineering and design service firms to autonomously and optimally employ human, technological and financial resources to deliver value and fulfill contractual obligations to client organizations. In both reimbursable and lump sum structures, consultants assume the responsibility and the risk for delivering the value and services expected by clients. Unlike reimbursable structures, however, the lump sum arrangement can empower the consultant to allocate the resources appropriate for these purposes without incurring unnecessary administrative obligations to notify and inform the client of staffing changes or production methods – effectively a consultant takes control of the "means and methods." A by-product of this empowerment is that consultants are incentivized to uncover better outcomes and more cost-effective and faster ways of producing them.

The firm fixed price really makes your project more predictable. You're spending more time, I think, getting on the same page upfront through the negotiations, but then you're locked in. So that's the benefit to [clients]. The benefit to the firms is if they've evaluated the project, there's room for them to be efficient, to be creative, and to probably make some extra profit. So, I think it's a good balance.

Both client organizations and engineering firms frequently cited **reduced administrative burden and effective cost management.**

"The contracts tend to be simpler, so payment terms can be very simple. Invoicing is very simple compared to cost plus from the owner's side, and it is administratively easier as well. So that's a benefit to both parties." Establishing the scope of work for services and clearly identifying assumptions and exclusions sets the stage for effective use of lump sum structures. This effort creates a baseline of understanding among the involved parties for the services under contract. Consequently, variances from the baseline are both easier to spot and manage. More importantly, the shared understanding establishes a foundation for a strong relationship between the contractual parties.

Having a detailed scope of work with documented project assumptions is critical in executing fixed-price contracts. This level of detail and mutual agreement at the time of execution eliminates disagreements as the project progresses, makes determination of out-of-scope work very clear, and results in a better partnership across the parties.

Federal client organizations have successfully implemented lump sum contracting for engineering and design services for decades now. Three federal clients and several engineering firms with significant federal experience were interviewed in this study. The federal clients indicated that lump sum contracts were their predominant and preferred commercial structure for engineering and design services. Plus, they have well-developed project development and control processes. Reaching this level of use and sophistication started as a "journey."

We started our investment in project control systems some time ago, and we have refined them over the years. But it has probably been at least a 20 plus year journey.

The transition to lump sum arrangements is not a "quantum leap" from reimbursable/cost-plus fixed fee arrangements. Generally, the processes followed to establish the scope and pricing for lump sum services are similar to cost-plus where tasks, levels of effort and pricing regimes are used. Hence, agencies with limited to no lump sum experience can transition toward their utilization without a significant transformation in their processes and policies. However, this suggests that the prospect of value-based pricing encouraged by Sturts and Griffis (2005), where clients pay for the market value of services, remains somewhat notional at this point in time. Perhaps more investigation of how other industries employ this pricing model is warranted.

I still have to figure out all the parameters that go into it and the different disciplines and aspects. So, I'll develop and estimate the effort level as I would on a typical cost-plus project. And then when I present the fee, I don't present it to [the client] in this hourly breakdown as we would normally. So, I can roll it up and just give them round numbers on each phase of the work rather than a hundred hours. I don't have to show [the client] that on a lump sum.



Lump sum contracts can accommodate uncertainty in the scope of services through approaches such as the use of hybrid structures or the phasing of services. Contrary to conventional wisdom that reimbursable structures are typically best when uncertainty in scope is present, the interviews identified two strategies for handling uncertainty in the scope of services in lump sum arrangements. The first is the hybrid structure where particular items with more uncertainty such as geotechnical investigation are handled on a reimbursable basis while the majority of the items are handled via lump sum. The other is the phasing of services on a lump sum basis where a lump sum arrangement with clear tasks and deliverables is defined for scoping/planning and subsequent design development is structured in a similar fashion. Alternatively, some interviewees expressed that the contractual counterparties should clearly define the scope, assumptions and exclusions based on the best information available and then be willing and committed to issue amendments when unanticipated conditions, events or outcomes materialize.

We tend to be fonder of those instances where we've carved out a portion of the work such as geotechnical, surveying and mapping where that may not be paid in accordance with lump sum. That might be what we refer to as a limiting amount, which is cost reimbursable, and then the rest of it is lump sum.

If you're at the outset of a project and there are a lot of unknowns, don't try to shoehorn in a full design task order going from scoping to a hundred percent. Most of our work, we do a scoping only task order and then we sit down with the team, we reevaluate, we come up with a plan of attack, and then we'll do either a task order modification or a new task order to go from post scoping to either 30% or 100%.



Higher, but reasonable, profit margins indicate healthy and effective implementation of lump sum arrangements for engineering and design services. Lump sum arrangements are likely to result in higher profit margins for engineering firms, which might startle some client organizations at the outset. However, this should occur since engineering firms are taking on more risk. Additionally, experienced client organizations recognize that proper due diligence keeps these margins, on average, at reasonable levels.

There was a timeframe when our Office of Inspector General would audit these contracts and people would be appalled at the level of profit that might have been ultimately made by a consultant. But that's actually a good thing because that's what we want them to do is to be cost efficient. As long as we negotiated the contract and we believe the cost to be reasonable and competitive during negotiations and the department is content with that fee, then I think second guessing, oh well, they made way more profit than I thought they would, is unnecessary because the method of compensation is lump sum, so it changes how they approach the project. So ultimately, I think it's a win-win scenario. And whenever we have done lump sum contracts, we're basing it on information that we feel reasonably comfortable with, historical information, then you just keep moving. And I think it's a positive.

Our goal for lump sum is a 15% profit that's built into those contracts ... Over the past, those rates or those average percentages have been 17%, 16%. They're right there in line. And if we're losing a percent or two, I'm totally fine with that. If we're nailing it down that closely, we're doing an excellent job. And I think that far outweighs the time and effort that it would take any of our staff to go back in and track those monthly invoices.

Qualifications-based selection and the repeat business work environment should reduce client concerns about lump sum contracting outcomes such as less control, reduced quality or unreasonable profit margins. The vast majority of the client organizations and engineering firms interviewed indicated that they do repeat business with their clients/firms. Further, qualificationsbased selection remains the standard within the industry. Hence, lack of performance or failure to meet expectations can have significant consequences – from a damaged relationship to failure to be selected for future work. While this is true regardless of contracting structure, these circumstances should temper client agency concerns such as loss of control or influence in a lump sum arrangement compared to a reimbursable one.

If [consultants] don't perform and are out just for a quick win, they will lose in the long haul, and that's not in their best [interests]. So, they really want to make sure that they satisfy the agency and especially the project manager and that they can't do that despite making an extra 5% or 10%. Because [the agency] will end up making sure that's one of the last projects they perform.



Minimal use of lump sum arrangements by a client organization is NOT necessarily a sign of opposition or resistance to them, but rather the impact of other factors such as the lack of staff awareness and familiarity with lump sum contracting. The interviews conducted revealed that the client organizations making limited use of lump sum structures is a consequence of: (a) current commercial structures being employed (i.e. CPFF or direct multiplier) for engineering and design services are viewed as sufficient for the types of services required, (b) other current agency or organizational priorities have taken precedence over adopting a different pricing structure, and/or (c) a lack of awareness, familiarity and experience of staff about implementing lump sum contracts acts as a deterrent to using a new commercial structure.

We would need to hear from our engineering community why they think [lump sum] would be more beneficial. We haven't heard that yet, but it's not something that we feel is necessary or have felt is necessary or else we would've initiated this change a long time ago.

I'm sure if we asked some of our agency project managers, they may not even know that lump sum contracting is a tool that they can use. So that education awareness within the agency is not quite there yet. And then getting them interested in understanding the benefits and then being able to provide the infrastructure such as training and support. So not a lot of that exists. It would be transitioning that body of work and program to a place where we now have a program that supports lump sum. We just haven't taken that step yet.

Taking on a new type of approach, again, it's about educating the task managers, educating the project managers, and you really have to be prepared for that type of approach. It's something that we would not take lightly.

We do use [lump sum], but not to the extent that we should be using it. And I would say a big piece of that is just the lack of experience of our project managers using lump sum. It's different, it's new. The strong relationships between client organizations and engineering firms observed suggests that the industry can work together to expand the contracting options employed for engineering and design services. The interviews made it evident that strong relationships exist among most client organizations and engineering firms. Members from both communities are seeking win-win outcomes. Moreover, client organizations have consistent engagements with industry groups such as ACEC state Member Organizations to discuss issues and opportunities to find paths to resolve and capitalize on them respectively.

We work really well with our engineering community. They know we're trying to do things the right way, and I think they truly know that we're trying to make sure they can be profitable, but just reasonably profitable. And that's best for the firms, but it's also best for the DOT. The consultant doesn't want the DOT to go broke and only get a few jobs out. They want the DOT to be sustainable as well.

There is a clear need for a national and continuing dialogue about balancing the costs of technology adoption and efficiencies of technology implementation to find a sustainable pricing model. Interviews made it clear that most client organizations and engineering firms are starting to contemplate the impacts of gen AI. Engineering firms foresee opportunities to invest in technology to enhance efficiency and effectiveness and would like to be compensated for this additional value. Client organizations are committed to fair and reasonable pricing. However, compensation remains driven primarily by effort, so seemingly this should lead to a reduction in effort and costs over time. However, this perspective is at odds with sustaining technological advances since efficiencies gained with time are countered by the need to keep pace with technological change. Reconciling this dilemma will require an industry-based solution rather than one crafted from jurisdiction to jurisdiction – essentially creating numerous micro-markets.

We've shared the draft of the AI policy with our [ACEC Member Organization] as well as the proposed changes to the standard professional services agreement to solicit their input ... So we're scrambling to catch up with the technology and we recognize that even this will be a snapshot in time and will undoubtedly have to change as the technology emerges and becomes more ubiquitous.

There is a clear need for a national and continuing dialogue about balancing the costs of technology adoption and efficiencies of technology implementation to find a sustainable pricing model.

Conclusion

The engineering and design services industry finds itself confronting a variety of challenges including increased workloads, staffing shortages and pending technological advances. This study is a first step toward increasing awareness of lump sum contracting, which may provide the industry with a means to address these challenges. The report has examined when, why and how client organizations and engineering firms might employ lump sum contracting. By interviewing a variety of client organization and engineering firm representatives, it has characterized the state of practice for lump sum contracting, primarily in the transportation sector. Lump sum contracting's use, suitability for services and project types, processes for establishing scopes of work and pricing, implementation and management, and advantages and disadvantages are more fully documented and understood.

The study also made it clear that lump sum contracts can provide the industry with multiple benefits and opportunities such as shifting the focus to deliverables for services rather than their administration. Lump sum contracts can also provide firms with the opportunity to allocate and utilize human, financial and technological resources to deliver the services and outcomes specified. This increase in autonomy opens up the possibility for better and more creative solutions to engineering/design problems, and this autonomy appears increasingly important as the industry moves into an era where technological changes are mounting, and qualified personnel are scarcer. Client organizations less experienced with lump sum contracting can consider its use for well-defined services such as detailed design in projects like 3R whereas client organizations with more experience with lump sum contracting can consider expanding its use into other types of services/project types and can employ phasing or hybrid structures in situations where they would normally avoid lump sum due to uncertainty.

The study also revealed some significant barriers to the expansion of lump sum contracting. Several client organizations interviewed make limited to no use of lump sum arrangements; this is primarily the result of the lack of a perceived need to change, the lack of familiarity and experience with lump sum contracting and/or other agency priorities. The first two issues are addressable through education and training programs as well as knowledge exchange within the client and engineering community. While templates and processes in place in experienced client organizations are beneficial for scope development and pricing, these may limit engineering firm autonomy over resource allocation and utilization if they are not used judiciously or limit the flexibility needed to adapt to the context and circumstances of a specific contractual agreement. Additionally, the advent of gen AI and the increasing use of technological tools such as machine learning pose significant pricing challenges within the industry. The reliance by many client organizations on CPFF or other reimbursable structures makes it difficult for engineering firms to recoup the full costs

of implementing such technologies. Lump sum structures have the potential to better promote the necessary initial investments and recovery of long-term costs to develop and exploit these technologies. The industry must establish sustainable pricing models to accommodate the range and pace of the inevitable technological change that will impact the industry. Further, it should explore value-based pricing strategies by studying other professional service industries or industry sectors that have had success with this pricing approach.

Finally, the existing relationships between client organizations and engineering firms suggest that working together to capitalize on the opportunities and to address the barriers present is both attainable and worthwhile. Client organizations in the transportation sector should leverage the lump sum commercial structure to focus on deliverables, transfer risks, achieve cost certainty and reduce administrative effort. Given current and future challenges, clients need to utilize all of the tools available in their toolbox to increase throughput and reduce delivery times. Engineering and design services firms should embrace the opportunity that lump sum arrangements provide to push the profession towards delivering creative and innovative solutions that clients need and technologies enable. Embracing this opportunity will better position the industry to address increasing challenges in the built environment and within the engineering and design services profession.



Research Team

ACEC Research Institute

The ACEC Research Institute's mission is to deliver knowledge and business strategies that guide and elevate the engineering industry and to be the leading source of knowledge and thought leadership for creating a more sustainable, safe, secure, and technically advanced built environment. The ACEC Research Institute is an independent 501(c)(3) nonprofit organization.

Virginia Tech

The core research team from Virginia Tech is comprised of Dr. Michael J. Garvin and graduate students Sherlock Banks II and Sarah Helms.

Michael J. Garvin served as the principal investigator. Dr. Garvin has over 35 years of experience as a professor of civil engineering, consultant, practicing civil engineer, and Army officer. His research has focused on project delivery and contracting. In addition, he has participated in numerous consulting projects and professional committees. Currently, Dr. Garvin is the David H. Burrows Professor of Construction Engineering and the program coordinator for the Vecellio Construction Engineering & Management Program in the Charles E. Via, Jr. Department of Civil & Environmental Engineering at Virginia Tech.

Sherlock Banks II and Sarah Helms are graduate students at Virginia Tech pursuing an MS in Civil Engineering with a concentration in construction engineering and management. They both have field experience in design and construction gained through internships with engineering consultants and construction companies.

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Appendix 1 – Interviewee Comments about Lump Sum Advantages

Source	Theme(s)	Comment
Engineering Representative	Reduced Administration	The contracts tend to be simpler, so payment terms can be very simple. Invoicing is very simple compared to cost plus from the owner's side, and it is administratively easier as well. So that's a benefit to both parties.
Client Representative	Reduced Administration and Deliverable Focus	Once a contract is in place, focus is on oversight and quality of the deliverables and whether they are meeting contract requirements. This facilitates easier contract administration. In a cost-plus contract, we have a higher administrative burden to not only make sure scope and contract requirements are being met, but also in auditing charges and invoices to ensure that we are reimbursing for allowable costs.
Engineering Representative	Innovation and Deliverable Focus	It gives you the opportunity to be more efficient. Ingenuity. How can we get things done quicker so that the client gets the same product and we get paid for value.
Engineering Representative	Deliverable Focus	I think our industry should consider paying for an outcome, not how to get there.
Client Representative	Defined Scope	Having a detailed scope of work with documented project assumptions is critical in executing fixed-price contracts. This level of detail and mutual agreement at the time of execution eliminates disagreements as the project progresses, makes determination of out-of-scope work very clear, and results in a better partnership across the parties.
Client Representative	Increased Profits and Reduced Administration	Our goal for lump sum is a 15% profit that's built into those contracts. Over the past, those rates or those average percentages have been 17%, 16%. I mean, they're right there in line. And if we're losing a percent or two, I'm totally fine with that. If we're nailing it down that closely, we're doing an excellent job. And I think that far outweighs the time and effort that it would take any of our staff to go back in and track those monthly invoices.
Engineering Representative	Staff Flexibility	Lump sum allows you to bring in and utilize whatever workforce you have available. Shift the resources to meet the project, particularly the project schedule, because resources always affect that.



Appendix 2 – Interviewee Comments about Lump Sum Disadvantages

Source	Theme(s)	Comment
Engineering Representative	Inadequate or Uncertain Scope	It becomes a risk to do a lump sum [contract] when you don't know the scope very well If you don't know and then you've tied yourself to a price that is woefully short, then that's hard to come back from.
Engineering Representative	Inadequate or Uncertain Scope	You need to have a clearly defined scope and make sure those unknowns are minimal. Here's what we're doing, here's what we're not doing. And in my mind, that's not really any different than a cost-plus project. But I think maybe it's just kind of thought of differently just because [a consultant] is only charging [the client] for what you actually spend in [CPFF], as opposed to tying it to agreed upon deliverables [in lump sum].
Engineering Representative	Scope Creep	You can manage [the scope] as well as you want, but sometimes you can end up doing free rework when the owner or others - a utility, a third party - change their mind, and the owner feels like that's part of the design process.
Engineering Representative	Scope Creep and Familiarity with LS	It depends on your contract and the wording in your contract, which you have to on cost plus too, if [clients] ask for extra work, [consultants] have to be able to recognize that's not in the scope that [was] agreed to. This is an extra, here's our fee for that. From the DOT's perspective, on a cost plus in their mind, 'Hey, if you completed this other thing a little bit less, and if I ask you to do a couple of these extra things, you've still got money in the contract to do that.' Well, some firms [in a lump sum] may just agree to do that rather than address the issue.
Engineering Representative	Less Transparency	I think [clients] are open to [lump sum], but I think it's the way [CPFF] they've always done it, and I think they feel like they might lose some control.

APPENDIX 2 - INTERVIEWEE COMMENTS ABOUT LUMP SUM DISADVANTAGES

Source	Theme(s)	Comment	
Engineering Representative	Less Transparency	There's generally less documentation required to support how we got to the price. Although certain clients treat lump sum negotiations as if it's cost plus and then we're calculating a lump sum from it and they still want to see all the hours and things like that. We're like, no, this is lump sum contracting. So, you don't get that level of detail necessarily in lump sum.	
Client Representative	Familiarity with LS	We're not opposed to lump sum. In fact, we think it's a powerful tool and we should use it more, but we're also seeing a transition in agency staff and competency and not having that experience. There's risk to the agency in terms of a project manager's readiness, so getting them trained up. Then, we have to strengthen our procurement and contracting processes to support lump sum.	
Client Representative	Familiarity with LS	I'm sure if we asked some of our agency project managers, they may not even know that lump sum contracting is a tool that they can use. So that education awareness within the agency is not quite there yet. And then getting them interested in understanding the benefits and then being able to provide the infrastructure such as training and support. So not a lot of that exists. It would be transitioning that body of work and program to a place where we now have a program that supports lump sum. We just haven't taken that step yet.	
Client Representative	Familiarity with LS	We could be overpaying if we don't have a knowledgeable project manager in there doing the negotiations. They could be paying for things that they maybe don't need, or they don't know the right questions to ask. That's probably the biggest one. You've just got to, once you've signed that contract, we got to make sure we're right. So I've got to make sure I've got savvy people.	
Engineering Representative	Familiarity with LS	The risk for us is having the right management mindset to manage a lump sum job. If you take somebody who is used to cost plus and you put them on a lump sum job, you better have a deputy project manager who's used to lump sum because cost plus thinking is risky in lump sum delivery. So, where you plan two or three cycles and you take four or five, you're now going to eat into your profit margin.	



APPENDIX 2 - INTERVIEWEE COMMENTS ABOUT LUMP SUM DISADVANTAGES

Source	Theme(s)	Comment
Engineering Representative	Familiarity with LS	I suppose there's a risk in being complacent about project management and budget management. "Oh, it's just a lump sum." Well, you still have to know where you're at, understand your earned value compared to how much time has been charged to the job, and understand that. So, I think there's a risk in being complacent about that.
Engineering Representative	Negotiation Effort	I think that negotiating [lump sum contracts] certainly can make for additional work at the beginning. And I think that might be why some organizations steer away from them in some cases.
Client Representative	Negotiation Effort	Negotiations take a longer lead time to get the contract executed. On average, it takes 40-60 days for most contracts to reach a settled negotiation on scope and pricing. But, taking more time upfront has resulted in fewer amendments throughout the project lifecycle.
Engineering Representative	Negotiation Effort	Sometimes the time to get from selection to contract execution is a disadvantage. And that's particularly true if the owner's fee and scope don't line up with what the consultant feels like the fee should be.
Engineering Representative	Excessive Profits and Negotiation Effort	If [the DOT] bases its budget on historical information I think that establishing a lump sum and negotiating a lump sum from that basis removes a little bit of the risk that [the DOT] might be overpaying.
Client Representative	Excessive Profits	If they were to somehow innovate and require less effort throughout the life of the project than what had originally been negotiated, then obviously profits could go up. Being a steward of the taxpayer dollars, I don't see how that's fair, simply because they're not competing in a low bid environment. Consultants are selected based on quality, and then a fee is negotiated that represents a fair and reasonable cost for the effort.
Engineering Representative	Reduction in Quality	There's a possibility of cutting corners, let's say on quality control because it's lump sum. But if it's time charged, you're getting paid to do all that quality control, so you may tend to spend more time with quality control.

Federal client organizations have successfully implemented lump sum contracting for engineering and design services for decades now. The transition to lump sum arrangements is not a "quantum leap" from reimbursable/cost-plus fixed fee arrangements.

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