Transportation Project Delivery

Alternative Contracting Methods Research

MOUNIR EL ASMAR

The author is Co-Director, National Center of Excellence on SMART Innovations, and Senior Sustainability Scientist, Global Institute of Sustainability, School of Sustainable Engineering and the Built Environment, Arizona State University, Tempe.

A score of D+ on the American Society of Civil Engineers' (ASCE's) *2017 Infrastructure Report Card* is not exactly stellar (*1*). Transportation infrastructure grades for the United States include a D for roads and aviation, a B for rail, a C+ for bridges and ports, and a D− for transit. A tremendous amount of work is needed from all stakeholders to renew the nation's transportation systems.

Tragic failures, like the I-35W bridge collapse in Minnesota in 2007 (*2*), underscore the need to renew transportation infrastructure; this momentous objective will require technological solutions, workforce solutions, procurement solutions, and more. Alternative contracting methods (ACMs)—also referred to as alternative delivery methods or alternative project delivery methods—is an area that has experienced continuous innovation since the 1990s.

A contracting method defines the roles, responsibilities, and timing of the engagement of project stakeholders—including owners, design engineers, and constructors—working together to design and build a facility. The traditional design–bid–build contracting method offers limited opportunities for collaboration between project stakeholders. Such ACMs as design–build (DB) and construction manager–general contractor (CM/GC) evolved over past decades to allow more collaboration and innovation in designing and building a facility.

ACMs rely heavily on early contractor engagement to inform design. In 1990, the Federal Highway Administration (FHWA) established Special Experimental Project 14 (SEP-14): Innovative Contracting to encourage and enable state transportation agencies to test and evaluate these methods on an experimental basis (*3*). With the success of SEP-14 pilot projects, the methods were no longer deemed experimental; in 2012, the next transportation authorization bill strongly promoted the use of "innovative contracting methods, including the design–build and the construction manager–general contractor contracting methods" (*4*).

Research funded by many organizations—including TRB's Cooperative Research Programs, the U.S. Department of Transportation, FHWA, the Charles Pankow Foundation, the Design–Build Institute of America, and several state and local transportation agencies—played a considerable role in the national rise of ACMs. This research was supported strongly

Photo: Kevin Rofidal, U.S. Coast Guard

The collapse of the I-35W Mississippi River Bridge in Minnesota magnified the critical need for infrastructure improvements.

by government, industry, and academic stakeholders over the past two decades, resulting in the discovery of new knowledge and its widespread implementation, and is gaining national visibility, with many organizations benefiting from various types of delivery methods. Projects and research findings are featured regularly in diverse venues, conferences, and publications by such organizations as ASCE, TRB, the American Bar Association, and others.

Among the local and national committees dedicated to ACM is TRB's Standing Committee on Project Delivery Methods, which is supporting this special issue of *TR News*. This issue will highlight ACM innovations and case studies taking place across the country and internationally, covering the most prominent ACM methods through the eyes of practitioners and researchers.

Performance, Performance, Performance

ACM performance research results have been overwhelmingly positive, with many distinguished researchers contributing to this literature from the United States and abroad. Ample empirical performance data support ACMs as effective methods; a team from Arizona State University (ASU) recently conducted a meta-analysis to combine and compare the quantitative results of 30 project delivery performance studies over the past two decades and collectively analyzed data from thousands of projects (5). This technique presents a significant aggregate sample to even out the effects of different research methods and project samples, producing more representative results and further confidence in the published performance studies.

The results show that some ACMs—particularly DB—are more effective at controlling cost and schedule growth than the traditional design–bid–build method. Interestingly, no delivery system was significantly superior in terms of unit cost, but the data showed that, on average, ACM projects were delivered 35 percent faster. A recent FHWA Tech Brief shows even better performance of ACMs on

Photo: Washington State DOT

During a project to widen Washington State's Snoqualmie Pass, the design–bid–build contractor proposed an alternative design, called a value engineering change proposal, to replace the avalanche snowshed structure with two elevated bridges. Washington State DOT approved this as an "equal or better" alternative, which reduced operations costs.

federally funded highways (*6*).

It is worth noting, however, that these reported values are based on averages. Some agencies did not have the same experiences with ACM, especially when trying a new project delivery method for the first time. Some pitfalls include not working closely with industry partners on these new methods or not training or preparing internal agency staff for the new processes. These and other lessons learned point to prospective research areas to ensure ACMs are used to their full potential.

Record of Growth

Many project successes have fueled ACMs' growth in popularity. In fact, revenue growth of ACM firms has increased significantly on a yearly basis for the past decade, according to *Engineering News Record*'s (ENR's) annual "Top 100 Construction Project Delivery Firms" list as well as a recent study that statistically analyzed published ENR data over the past decade (*7–8*).

Some of the latest research investigates whether ACMs can affect the quality and performance of a facility itself over its life cycle. Designing and building a highway faster is significant, but it would be even more powerful if the pavement itself were to show improved performance and require less maintenance—saving more cost, time, fuel, and materials over its life. To that end, the ASU team investigated the effect of delivery systems on the operational performance of highways built in the past 10 years (*9*). Early findings show a significant improvement in pavement life-cycle performance for DB projects.

Recently, research investigating the efficacy of ACM for transportation projects has included public–private partnerships (PPP) in the mix. A system that allows public agencies to attract private financing to fund the capital needs of a project, with repayment over the life of the facility, PPPs were shown to provide superior project cost and schedule performance—even compared to other ACMs (*10*).

This specific result is in line with literature about ACMs and was expected, given the increase in team integration inherent in PPPs. What was surprising, however, was the extent of funding invested in PPPs. Recent findings disclosed a one-to-one ratio of public and private funds used in some types of PPP transportation projects (*11*). This means that leveraging private funds using PPP can nearly double the amount of infrastructure delivered.

Delivering a Brighter Future

Many ACM research studies focus on specific methods and their variations, performance, and implementation. These ongoing studies are charting new territory, providing the evidence for practitioners to make the case for effective employment of ACMs on their projects. One example is National Cooperative Highway Research Program Project 08-104, which is developing new FHWA guidebooks for ACM post-award contract administration (*12*).

Proponents of ACM have been changing national and state legislation to allow ACMs on a greater number of public projects. The transportation industry is well aware of labor shortages and needs at all levels and so is helping to expose students to ACMs through national competitions and ACM student chapters. Students also are assisting faculty members with ACM research and are offered new ACM courses at universities and by professional organizations. Certifications have emerged as a training and education tool to ensure that experienced ACM professionals are recognized and can pursue education to stay current in the field.

With the current administration's support of a

Photo: Thomas Hawk, Flickr

The replacement of the Willamette River Bridge was Oregon DOT's first CM/GC venture. The project was completed four months early and $18 million under budget.

Photo: NAParrish, Flickr

On average, ACM projects are delivered faster than traditional methods. Alaska's Whittier Tunnel, a 2.5-mile, one-lane tunnel that serves both cars and trains, was a DB project. It was completed two months ahead of schedule and $2.6 million under budget.

Utah's Pioneer Crossing bridge project was a DB venture that used accelerated bridge construction techniques, reducing onsite construction by four months.

Photo: Utah DOT

potential infrastructure package and the possibility of broader PPP use in delivering infrastructure projects, ACMs offer proven alternatives to enhance and optimize prospective investments. The economic impact of improved infrastructure for industry and business is crucial in a competitive global market.

ACM research helped fuel innovative practices for delivering infrastructure faster and with improved cost certainty—resulting in facilities that can last longer—and helped to identify new funding resources. This line of research strengthens transportation infrastructure with novel integrated and efficient methods to deliver projects. Together with technological, labor, and other solutions, ACMs will continue to support the renewal of the nation's transportation infrastructure. The timing for successful implementation of ACM could not be any better.

References

1. American Society of Civil Engineers. ASCE's 2017 Infrastructure Report Card. www.infrastructurereportcard.org. Accessed Feb. 7, 2018.
2. Minnesota Department of Transportation. I-35W St. Anthony Falls Bridge: Mississippi River Crossing in Downtown Minneapolis. www.dot.state.mn.us/i35wbridge/collapse.html. Accessed Feb. 7, 2018.
3. Federal Highway Administration. Special Experimental Project No. 14: Alternative Contracting (Formerly Innovative Contracting). www.fhwa.dot.gov/programadmin/contracts/sep_a.cfm. Accessed Feb. 7, 2018.
4. Moving Ahead for Progress in the 21st Century Act of 2012, Pub. L. No. 112-141, 126 Stat. 405 (2012).
5. Sullivan, J., M. El Asmar, J. Chalhoub, and H. Obeid. Two Decades of Performance Comparisons for Design–Build, Construction-Manager-at-Risk, and Design–Bid–Build: Quantitative Analysis of the State of Knowledge on Project Cost, Schedule, and Quality. *Journal of Construction Engineering and Management*, Vol. 143, No. 6, 2017.
6. *Alternative Contracting Method Performance in U.S. Highway Construction*. Report FHWA-HRT-17-100. FHWA, U.S. Department of Transportation, 2018.
7. *Engineering News Record*. Engineering News Record Top Lists. www.enr.com/toplists. Accessed Feb. 7, 2018.
8. Vashani, H., J. Sullivan, and M. El Asmar. DB 2020: Analyzing and Forecasting Design–Build Market Trends. *Journal of Construction Engineering and Management*, Vol. 142, No. 6, 2016, pp. 04016008-1–04016008-12.
9. Sanboskani, H., N. Cho, M. El Asmar, and S. Underwood. Evaluating the Ride Quality of Asphalt Concrete Pavements Delivered Using Design–Build. In *Construction Research Congress 2018: Infrastructure and Facility Management* (C. Wang, C. Harper, Y. Lee, R. Harris, and C. Berryman, eds.), American Society of Civil Engineers, 2018, pp. 424–433.
10. Ramsey, D. W., and M. El Asmar. Cost and Schedule Performance Benchmarks of U.S. Transportation Public–Private Partnership (PPP) Projects: Preliminary Results. *Transportation Research Record: Journal of the Transportation Research Board*, No. 2504, 2015, pp. 58–65.
11. Ramsey, D. W., and M. El Asmar. Funding Streams of Design–Build–Finance–Operate-Maintain (DBFOM) Public–Private Partnerships (PPP) in the U.S. Transportation Sector. Presented at Engineering Project Organization Conference, Edinburgh, Scotland, 2015.
12. National Cooperative Highway Research Program. A Guidebook for Post-Award Contract Administration for Highway Projects Delivered Using Alternative Contracting Methods. http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4032. Accessed Feb. 7, 2018.

Note: The *TR News* Editorial Board thanks Mounir El Asmar, Nelson Gibson, and the TRB Standing Committee on Project Delivery Methods for their work in assembling and developing this issue.