NCHRP 20-07, Task 407
Utility Coordination Efficiency, Safety, Cost, and Schedule Impacts using various Contracting Methods

Prepared for:

AASHTO Committee on Right of Way, Utilities, and Outdoor Advertising Control (CRUO)

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February 2021

The information contained in this report was prepared as part of NCHRP Project 20-07, Task 407, National Cooperative Highway Research Program.

Acknowledgements

This study was conducted for the AASHTO Standing Committee on Planning, with funding provided through the National Cooperative Highway Research Program (NCHRP) Project 20-07, *Utility Coordination Efficiency, Safety, Cost, and Schedule Impacts using various Contracting Methods*. The NCHRP is supported by annual voluntary contributions from the state Departments of Transportation. Project 20-07 is intended to fund quick response studies on behalf of the Standing Committee on Planning. The report was prepared by Dr. Timothy Taylor, University of Kentucky Research Foundation. The work was guided by a technical working group that included:

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ABSTRACT

The utility coordination process is part of both project development and delivery, and can be fundamentally influenced by the contracting process used. It is necessary to coordinate the process from inception to completion to provide efficient accommodation of utilities and minimize delays at all phases of a project. Effective utility coordination can improve the delivery of transportation and other capital facility projects and reduce project risks posed by delays, safety hazards, and cost overruns. State Transportation Agencies (STAs) are implementing many strategies to rapidly address road conditions. One approach has been the use of various contracting methods to speed project delivery, improve quality and constructability, or address other resource constraints. These Alternative Contracting Methods (ACMs) have various impacts within the delivery of the project, and utility coordination is one process where these impacts and implications have received little investigation. This study investigates these impacts along the criteria of efficiency, safety, cost, and schedule. The study completed a literature review, a survey of STAs, and interviews with STA utility personnel. These resources highlight utility coordination variations from traditionally delivered (Design-Bid-Build) projects with projects delivered through ACMs. These differences are summarized along with noted effective practices within infographics prepared as part of the research project. This research also highlighted knowledge gap in that there are still relatively few documented procedures for utility coordination within projects delivered through ACMs. This study provides summarized findings to guide readers through the expected utility coordination impacts in using ACMs and works toward that guidance. A final highlight of this effort is in STAs needing improvement in utility related data collection and management with ACM projects. This improvement will set the stage for developing utility coordination guidance for ACM projects.

S U M M A R Y

Executive Summary

This research set out to document the expected utility coordination impacts of using specific ACMs with regard to efficiency, safety, cost, and schedule. Two fundamental principles in understanding these impacts are to 1) understand the objectives of utility coordination and 2) understand the project development processes of the ACMs, why they are used, how risk is allocated within them, and how they relate to utility coordination processes. The study objectives were examined using a literature review, two survey of STAs, and interviews with STA utility personnel. Although quantitative data is not currently available to explicitly identify the impacts of ACMs on utility coordination efficiency, safety, cost, and schedule, qualitative data is available to offer insight into the relationship between ACMs and utility coordination.

The key findings are summarized below.

1. *ACM Impact on Utility Coordination Process:* There are indeed differences perceived in utility coordination on ACMs when compared to DBB projects and there is a difference perceived in consultant-led utility coordination versus in-house utility coordination. To a degree, oversight from in-house staff will always be needed to ensure compliance with state and federal regulations. Also, some permitting processes require STA involvement. In these instances, there can be some loss of efficiency. There can also be perceived differences in that in-house staff with experience will likely have established relationships with the utility companies in their area, a consultant may or may not. These relationships have been seen to have significant impact on project utility coordination.
2. *Data Collection Requirements:* To quantify the impact of ACM's on utility coordination there is a need for improved data collection in regard to utility coordination and relocations on all projects, particularly on ACM delivered projects. The use of lump sum payment terms for utility coordination and adjustments does not allow performance measurement or thorough evaluation. This is in alignment with a recent FHWA Utility Program Review.
3. *Utility Coordination Training for Consultants:* Utility coordination is often viewed as a trivial task capable of being completed by contractors or consultants. Being that several instances were noted of consultant-led utility coordination requiring substantial assistance from STA in-house staff, it is clear that the practice takes regulation familiarity and local relationships. This has led several states to develop utility coordination training programs for their consultants, though only time will assist in building the important relationships.
4. *Consultant Utility Coordination:* There is substantiation that consultants conducting utility coordination for ACM projects have more resources, or at least time, to conduct the coordination efforts. Some have experience from multiple STAs exposing them to an assortment of tools and effective practices. It has also been noted from utility companies that consultants at times communicate more frequently and professionally that STAs. While possible, this is likely the result of a small number of projects within their utility coordination case load compared to a typical STA in-house utility coordinator.
5. *ACM Impact on Utility Coordination Cost:* The use of ACMs regarding costs of utility coordination is viewed as likely being higher typical DBB projects. There can be many reasons

for this but one of the most likely reasons is due to contractors having to include added costs for risk into their lump sum prices. There could be some cases of incentives being issued for timely relocations but until better data collection and tracking are in place that is difficult to substantiate.

6. *ACM Impact on Contractor Risk Management:* Risk passed through ACMs can be substantial, especially within DB projects. Contractors therefore must incorporate costs into the prices to cover those risk. Wherever possible risk involving utility coordination should be tamed by conducing thorough utility investigations and pre-procurement relocations. All utility related data should be provided to the contractors within the contract documents.
7. *Early Utility Coordination on ACMs:* While the STA in-house utility coordination staff typically carry large workloads, it is crucial to the success, reduced risks, and improved costs and schedule of a project to practice early utility coordination especially on ACM projects. The in-house design phase of ACM projects is typically abbreviated and the project development staff need a solid understanding of any critical utility issues (substantial facilities, long-lead items, etc.). Additionally, a detailed utility investigation plan can be developed early to determine the information that can be collected and provided to contractors to minimize risks. This early coordination effort is also critical to appropriately aligning the project schedule with needed relocation efforts.

Decision support infographics developed based on the findings of this research are offered at the end of Chapter 4 to aid STAs in managing utility risks for ACM projects. One fundamental point to note, is that the predominant ACMs used, construction manager/general contractor (CMGC) and design-build, provide time savings by shrinking the window of time commonly used to conduct utility coordination and relocations in traditionally delivered projects. Guidance for adapting to these changes is minimally available. This study points out the needs for that guidance and attempts to present basic effective practices in the infographics provided in the conclusions. These graphics are summarized in the following:

- *Design-build*—DB drastically reduces or even eliminates the typical time used for utility coordination and relocation activities. In this method some portion of design is handed off to the design-build team typically including responsibilities for utility coordination. This coordination effort entails the design-build team taking on risk that recent trends suggest are costly to projects. STAs should attempt to perform as much utility coordination as possible prior to award of the project to the design-build team and it is suggested that agreements be initiated or in place. These practices will aid in reducing risk transfer. Though STA policies differ, it should be expected that the STA will play a role in the utility coordination process even after award for at least oversight to ensure policy, regulation, and safety of utility relocations. Early utility coordination, strong communication and information transfer, utility conflict management, and utility coordination training are among the effective practices noted for effective utility coordination on design-build projects.
- *Public-Private Partnerships*—P3 is similar to DB in many regards, one of which being utility coordination. P3 adds the components of finance, operation, and maintenance to DB in some arrangement. These added components create few utility coordination related differences from DB and thus the same effective practices are noted.
- *Construction Manager/General Contractor*—CM/GC unlike P3 and DB, is more similar to traditional project delivery yet still compresses the window of time where STAs would typically conduct utility coordination and relocations. The benefits offered are in the method's encouragement of early utility coordination and having a contractor consultant onboard during design to give the constructor's perspective of design related impacts. This is especially beneficial in regard to utility related impact but having utility records and location information early in design stages is imperative. The is also the benefit of early

construction packages such as clearing and grubbing that can not only be useful for the highway project but in assisting utility companies for relocation work. Having a contractor onboard during design also facilitates discussions with utility companies and coordinators regarding schedules, costs, and risk allocation and management. Facilitating these type of discussions takes effort but they can be very impactful to project understanding, risk management, and therefore, cost management.

While the study was hampered by a lack of quantifiable evidence available, one of the most relevant and pressing findings of the research was in the identification of needed research in utility related data collection and management. The adage, “You can’t improve what you don’t measure,” is certainly a valid point in utility coordination. Research is needed to determine what data should be collected within utility coordination processes, how that data should be organized to be useful in future evaluation, and how that data can be managed so that it remains relevant. A system or approach to this data collection effort would not only be useful in this and other research efforts, but would be extremely useful to STAs as well.

CHAPTER 1

Background & Introduction

The highway construction sector annually develops and builds billions of dollars of complex projects in order to repair, improve, and expand road infrastructure throughout the United States. The 2017 American Society of Civil Engineers Infrastructure Report Card evaluated Roads as having a "D" grade. They further indicate there is a substantial need for investment in America's roadways. (1) STAs are implementing many strategies to address these road conditions. One approach has been the use of various contracting methods to speed project delivery, improve quality and constructability, or address other resource constraints. These alternative contracting methods (ACMs) have various impacts within the delivery of the project and utility coordination is one process where these impacts and implications have received little investigation. The coordination of accommodated utility services within highway and road projects is an integral factor in project planning, design, construction, operation, and maintenance. To provide for efficient accommodation of utilities and minimize delays at all phases of a project, it is necessary to coordinate the process from inception to completion. While the co-location of utilities within and near road rights-of-way presents challenges to state transportation agencies (STAs), these accommodations are actually in the best interest of the public for accessibility and lower rates. The utility coordination for these accommodations, therefore, becomes an integral process to the delivery of transportation construction and maintenance projects. Utility coordination for these projects is a complicated effort between multiple agencies that have different missions, funding sources, and stakeholders. STAs have documented procedures to navigate utility coordination according to traditionally delivered (Design-Bid-Build) projects yet many do not document specific utility related procedures for projects delivered through ACMs.

The utility coordination process is an element of both project development and delivery that can be fundamentally influenced by the contracting methods used. Effective utility coordination can improve the delivery of transportation and other capital facility projects and reduce project risks posed by delays, safety hazards, and cost overruns. This research represents an early opportunity to investigate these impacts along criteria of efficiency, safety, cost, and schedule for better alignment of utility coordination practices to particular delivery methods or even in the selection of a project delivery method given potential utility impacts. The ACMs investigated include design-build (DB), public-private partnerships (P3, as a special case of DB), construction manager/general contractor (CM/GC), and the use of alternative technical concepts (ATCs).

The following definitions, specifically tailored to utility coordination, are provided to standardize the areas of interest within this study:

- **Efficiency:** in regard to utility coordination on highway projects would entail a streamlined, procedural, and communicative approach to identifying, managing, mitigating, and resolving any utility interaction or impacts with minimal waste of resources. Examples of inefficiencies would include multiple project team members contacting utility representatives, rework of utility designs or agreements, second move relocations, etc.
- **Safety:** is the control of recognized hazards to attain an acceptable level of risk. Examples of utility-related safety concerns would involve utility damages due to construction, the location of facilities longitudinally under the roadway, or appurtenances such as a gas valve located in the roadway.

- **Cost:** in the context of this project, are costs that are associated with the utility agreements and relocations for a project. These costs are those incurred to the public agency as a result of the required relocations of reimbursable facilities.
- **Schedule:** is also strictly in the context of the utility coordination and relocation process for a project. It is the amount of time required to reach utility clearance or coordination with the highway contractor's work.

These impacts of interest for this study (efficiency, safety, cost, and schedule) are the central comparisons to be made between a traditional design bid project and the alternative contracting methods discussed above.

Introduction to ACMs in the Transportation Construction Sector

The predominant delivery method for transportation projects is design-bid-build (DBB). However, DB has been gaining ground and according to a recent study, DB will represent 43% of the construction put in place from 2018 to 2021.(2) DB is also seeing an annual growth rate of 7%. (2) However, as of 2019, DB is still not a legislatively approved method in five states. STAs are using DB in many cases for "mega" projects and therefore the number of projects delivered by DB is much less than 43% from a project volume standpoint. P3 is typically viewed as a special case of DB and therefore utilization of these two approaches may at times be skewed. Though, as will be seen, there are many more states that do not allow P3s but who allow DB.

CM/GC is a much less used approach in the transportation sector though it too is gaining popularity. Contractor involvement in horizontal built projects is a much slower moving trend than in vertical construction. Utility coordination on a CM/GC project follows closely that of a DBB project. Typically, the STA will maintain responsibility for the utility coordination process and will use typical DBB process to coordinate or relocate utilities. The main difference is that a contractor as part of the early CM/GC process is able to provide input on project changes or impacts that utility scenarios may have.

Within DB projects, there is a substantial change in the utility coordination of the project. These changes are predominantly about risk and responsibility. Selecting who is responsible for utility coordination of the project at what stages and there would often be a transition of these responsibilities from the STA to the design-build team (DBT) once selected.

Lastly, the use of alternative technical concepts (ATCs) is simply the pre-award approach allowing the contractor to propose and bid money saving alterations to the projects. ATCs have been used as part of both DB (more frequently) and DBB. With ATCs, the main impacts to utility coordination, whether within a DB or DBB project, are that the changes could completely negate or cause substantial utility coordination rework if a particulate ATC involves impacts. When utility impacts are possible in an ATC, utility coordinators should be involved in the review and approval process. More details on all of these issues will be further discussed in Chapter 3 and Chapter 4.

Overview of Need, Objectives & Approach

This research set out to document the expected utility coordination impacts of using specific ACMs with regard to efficiency, safety, cost, and schedule. Previous research has documented that the use of ACMs will have an effect on utility coordination for a project. However, there is little documentation of those effects in detail. This research provides further information on these effects in as much detail as possible along the lines of efficiency, safety, cost, and schedule. The outcomes provided may affect STA decisions in use of specific ACMs or at the very least provide STAs an expectation of the impacts of using a particular ACM relative to the utility coordination of that project.

The use of ACMs is predominantly driven by the anticipated benefits of early contractor involvement and a speedy delivery process. These benefits are not without their challenges. Notably, early contractor involvement inserts an additional stakeholder into the utility coordination process. In some cases, this additional stakeholder takes on an unfamiliar managerial role in the utility coordination process; the role is unfamiliar to the construction contractors as well as the utility companies. Many STAs do not have documented procedures for the utility coordination of projects delivered through ACMs. NCHRP 20-07 Task 373 Utility Coordination Best Practices for Design-Build and Alternative Contracting Projects, provided guidance associated with utility coordination in ACMs. However, ACMs are not used extensively and often vary in delivery approach. This enhances the difficulty in providing standard guidance. The NCHRP 20-07 Task 373 project also detailed the alignment of utility coordination tasks to project delivery stages yet the scope of the project was not able to document the implications ACMs have on the efficiency, safety, cost, and schedule of the utility coordination. (3)

NCHRP 20-07 Task 373 did present that utility coordination among ACMs varies according to the timelines, roles, risks, and alignment of utility coordination tasks relative to overall project delivery tasks. (3) This is extremely significant when considering the selection and use of utility coordination best practices or perhaps even in selecting the ACM for the project. A Kentucky Transportation Cabinet funded study on design-build, and subsequent case study of utility coordination of design-build projects, (KTC-SPR15-501) identified that utility coordination is heavily impacted by contracting method and it was shown that best practices are not universally applicable across varying contract delivery mechanisms. (4) In other words, there is a difference perceived in utility coordination on a design-bid-build project versus a design-build project. The Kentucky study captured the findings of the utility coordination involved on the construction of two bridges located within 15 miles of each other in Louisville/Southern Indiana across the Ohio River. One bridge was overseen by the Kentucky Transportation Cabinet using a DB delivery system. The other bride was overseen by the Indiana Department of Transportation using a P3 delivery method. This project involved two river-crossing bridges and significant grade work in a mainly urbanized area. The $2.3 billion project involved 133 relocations using multiple utility coordination approaches and involving a design-build team and public-private partnership developer in the process of coordination. In polling utility companies and STA representatives, a clear distinction was noticed in the perception of utility coordination on traditional projects versus the design-build and public-private partnership delivered projects, as seen in Figures 1.1 and 1.2. (4)

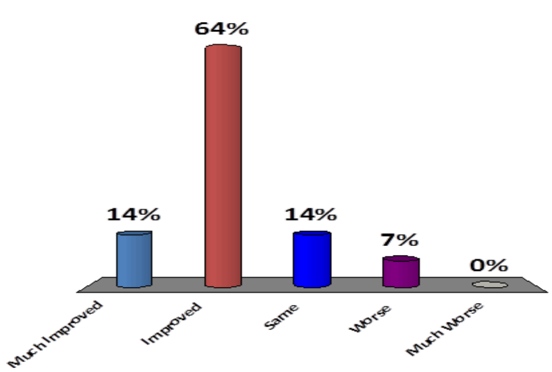


Figure 1.1: Utility Coordination in Design-Build versus Traditional Delivery

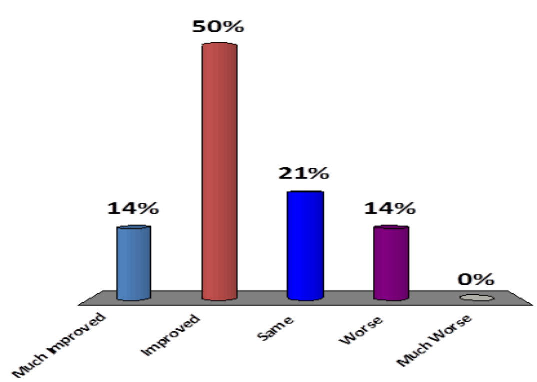


Figure 1.2: Utility Coordination in Public Private Partnership versus Traditional Delivery

There have been many successful research projects identifying best practices for utility coordination, such as those in the second Strategic Highway Research Program (SHRP 2), specifically SHRP 2 R15B, which presented STAs best practices related to identifying and managing highway project utility impacts. One product of this effort is the Utility Conflict Matrix (UCM), a tool that is on the rise in usage and presents a real opportunity for STAs to track, manage, and resolve utility conflicts within their projects. (5) There have also been efforts to synthesize practices into collections for STAs. One effort is NCHRP synthesis 405 that identifies the need to increase designers' attention to utilities earlier in the design process. This report highlights early communication and involvement as beneficial utility coordination practices. (6) Another synthesis has looked to collect strategies for accommodating utilities into the right-of-way of highway projects. These location strategies and installation methods vary across states and this synthesis sought present possibilities for standardization and efficiency. (7) States have also conducted their own studies, such as Florida DOT procuring a study to review industry best practices to avoid and mitigate utility impact delays. (8) A last resource of note is a study entitled, *Methods to Expedite and Streamline Utility Relocations for Road Projects*. This resource presented, analyzed, and organized a large range of best practices for STA applications. The project was specifically conducted for the Kentucky Transportation Cabinet but entails many strategies that are generally applicable for utility coordination and relocation efforts. The project was also able to develop a risk analysis strategy to gauge utility risks according to project characteristics. (9)

All of these resources are extremely valuable yet they are catered to utility coordination within traditional (design-bid-build) project delivery and some are catered to specific STA approaches. STAs are adopting or trying several alternative delivery mechanisms for various reasons such as expediting delivery, innovative financing, minimizing traffic impacts, risk sharing, and more. Specifically, these alternative delivery methods (such as DB and CM/GC) present new challenges to utility coordination efforts. Some research and resources illustrate where supplemental guidance is provided for utility relocation specific to design-build procured projects but these are minimally available. This illustrates that delivery specific guidance is needed and though design-build has been the most adopted alternative delivery method, many other ACMs are beginning to see use. (10,11) There is little published documentation and support for utility coordination within and specific to ACMs and there is a void of documentation relative to the impacts of these ACMs on the efficiency, safety, cost, and schedule of utility coordination. This supports the need for this research effort.

The fact remains that the traditional, design-bid-build, delivery method has been used by STAs for many decades. The best practices for utility coordination within traditional delivery has only recently come to the forefront given newly placed emphasis on utility coordination. (12) Many would associate this emphasis with the increasing demand for ROW accommodation by utilities. The use of ACMs is much newer and less practiced within STAs. This research collected information from ACM delivered projects as available, not to standardize a utility coordination process, but to present the impacts to utility coordination realized in using ACMs. The results are largely qualitative as STAs are still determining how to best collect ACM related data and document the projects delivered in these methods. This research began by conducting a literature review to achieve and understanding of the previous effort related to utility coordination within alternatively delivered projects. The research team then set out to collect data for quantitative analysis only to find sources lacking. The research approach was altered to survey subject matter experts to gain a qualitative perspective on the impacts of ACMs to utility coordination. The following will elaborate on this approach and the outcomes but the research itself highlighted the fundamental need for improved data collection in regard to utility coordination on ACM projects.

CHAPTER 2

Research Approach

The central deliverables of this research project effort are this final report documenting the project findings and a presentation of these findings to be delivered at the next AASHTO Committee on Right-of-Way, Utilities, and Outdoor Advertising Control Annual Meeting. Additionally, proposed in this research project was a decision support tool that would present the findings of the research in a straightforward, practitioner-centric approach specific to an ACM used and project characteristics. The original concept of this tool, as a device to present the potential impacts of ACMs to the utility coordination of a project in a quantitative manner, was not feasible given the data available. In lieu of the tool presenting quantitative impacts, a lesser detailed tool was developed to present the impacts in a more qualitative manner to assist STAs in selecting ACMs and understanding the utility coordination related implications of those ACMs. More detail on the approach to develop these research products is provided in the following.

The objective of this research project was to document the expected utility coordination impacts of specific ACMs in reference to efficiency, safety, cost, and schedule as previously defined. As mentioned, there is previously completed research that documents using ACMs as having an effect on utility coordination for a project. The research herein attempted to capture the magnitude of these effects. Initially, the aim was to capture these effects in detail if not by quantifiable reference along the lines of efficiency, safety, cost, and schedule. While the data available was very limited to reach these aims, the outcomes of this research project nonetheless provides information that may affect STA decisions in the use of specific ACMs, or at the very least provides STAs an expectation of the utility related impacts of using a particular ACM.

The initial tasks for this research effort were as follows:

1. Prepare an amplified work plan, draft interview tool, initial list of ACMs to investigate, and initial list of STAs to interview; a web/teleconference with research panel was used to discuss these items
2. Conduct a literature review and initial project data collection
3. Conduct STA interviews to collect and document:
    a. Utility damages, construction hazards, and other safety concerns occurring due to ACM usage in-lieu of design-bid-build, and potential solutions;
    b. Inefficiencies of the utility coordination process imparted by ACM usage and potential solutions;
    c. STA policies for selecting ACMs;
    d. STA expected and actual utility coordination schedule and cost on ACM projects;
    e. Baseline case studies of utility coordination efficiency, safety, cost, and schedule on design-bid-build projects of varying characteristics;
    f. ACM case studies of utility coordination efficiency, safety, cost, and schedule with consideration of variance in project characteristics.
4. Prepare an interim technical memorandum to summarize study findings and present to the research panel for feedback
5. Use collected data, case studies, and research panel feedback to develop a decision support tool

6. Prepare a final report documenting the research and findings including background, objectives, research approach, findings, and conclusions. The final report will also present the decision support tool and guidance for its application
7. Present the project findings to the AASHTO Committee on Right of Way, Utilities, and Outdoor Advertising Control

These initial tasks are further detailed in the following section.

Task 1: Prepare an amplified work plan, draft interview tool, initial list of ACMs to investigate, and initial list of STAs to interview; a web conference with research panel will be used to discuss these items.

The initial task for the project served several purposes and decisions critical to the research process. The research panel's input delivered from this task set the path for the initial research approach. The most critical decision was the identification of the ACMs and STAs for study. The research team proposed a slight narrowing of the scope as identified in the request for proposals (RFP). As mentioned in the RFP, the study would entail up to five of the most commonly accepted ACMs. As outlined by the Federal Highway Administration and also by state legislation, the ACMs applicable to transportation projects entail design-build (DB), construction manager/general contractor (CM/GC), or alternative technical concepts (ATCs) applied to these ACMs or to traditional design-bid-build delivery. This list is also inclusive of public-private partnerships (P3) as they are viewed as a special case of DB delivery. Further, based on using these ACMs for the study, the potential STAs for interview were narrowed to those legislatively able to procure projects using these ACMs. Figures 2.1 through 2.3 below illustrate the STAs and their ability to use these ACMs.

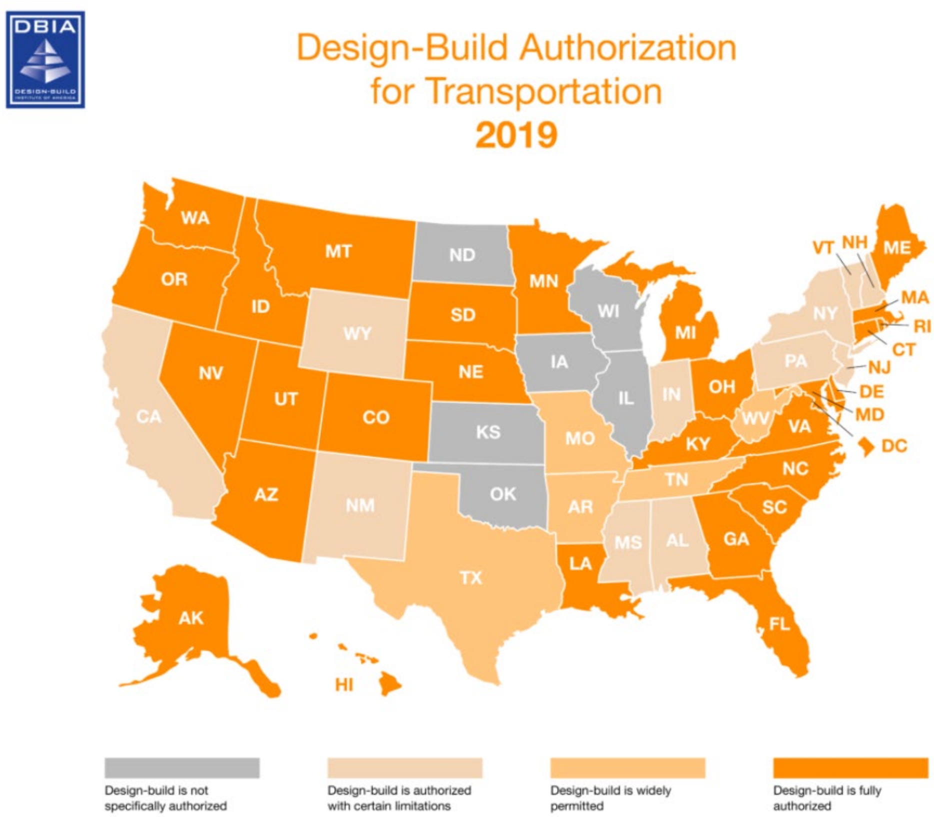


Figure 2.1: STAs with Design-Build Authorization (Design-Build Institute of America) (13)

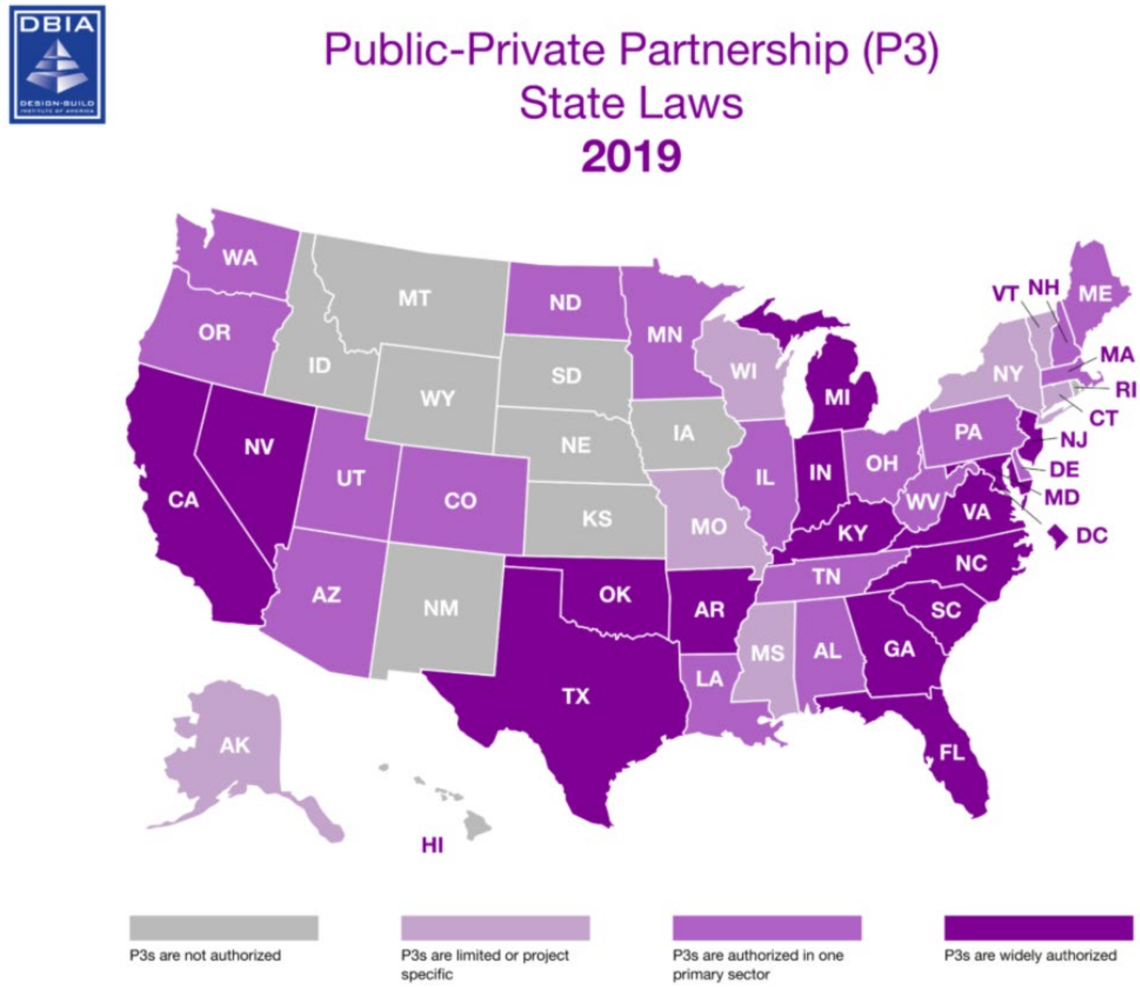


Figure 2.2: STAs with Public-Private Partnership Authorization (Design-Build Institute of America) (13)

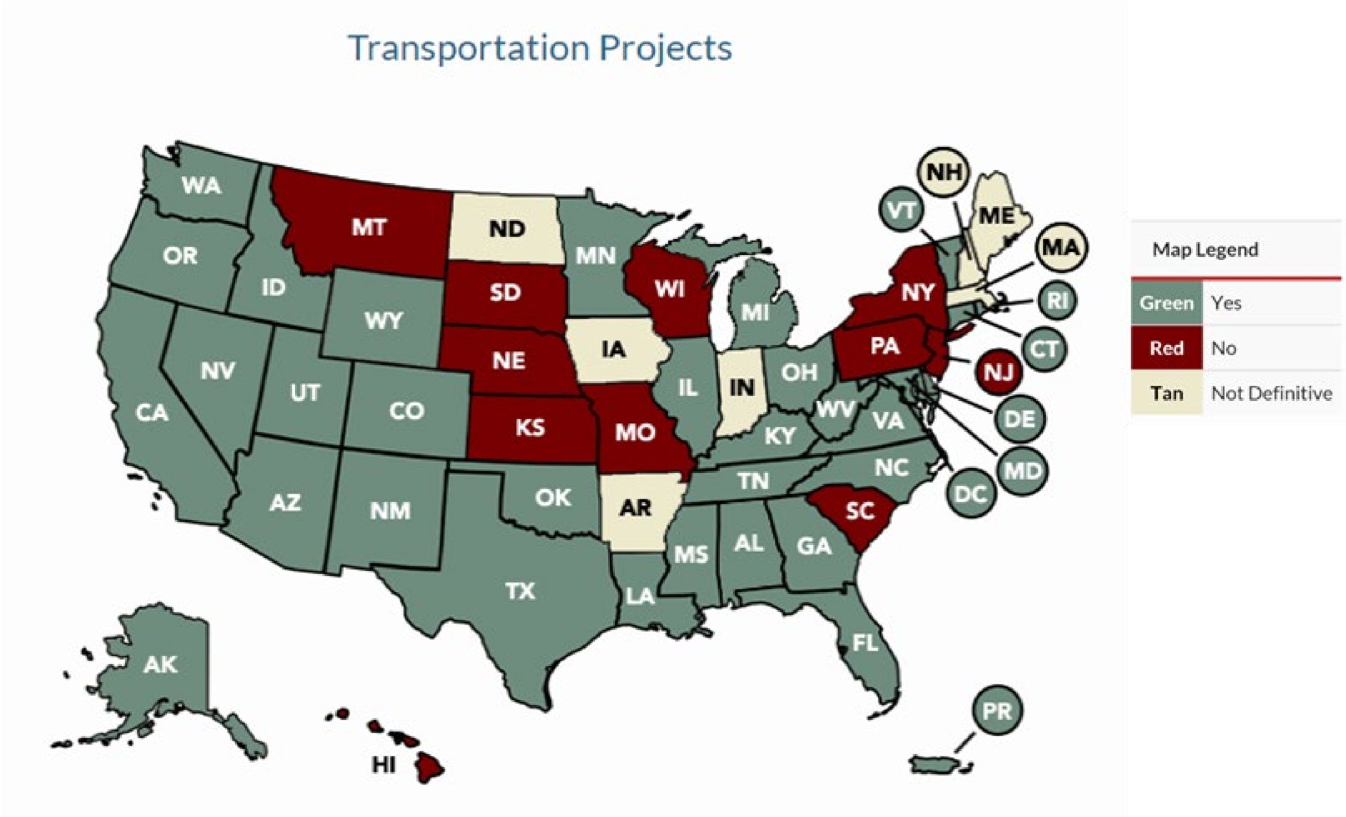


Figure 2.3: STAs with CM/GC Authorization (14)

Further, the data needed to delve into quantitative aspects of utility coordination efficiency, safety, cost, and schedule would require that a STA have advanced systems for tracking and documenting this information. It was reasoned that the states implementing the SHRP2 R15B products for the Utility Conflict Matrix (UCM) would be prime candidates. Therefore, the starting list of STAs involved the "Lead Adopters" for the SHRP2 R15B product. Those included California, Delaware, Indiana, Iowa, Kentucky, Maryland, Michigan, New Hampshire, Oklahoma, Oregon, South Dakota, Texas, and Utah (15). The final list of STAs was made through the presentation of the amplified work plan and feedback from the NCHRP research panel. The states contacted for interview for quantifiable evidence included Delaware, Georgia, Kentucky, Pennsylvania, Texas, and Utah.

In addition to selecting ACMs and STAs, this task involved the development and submission of several preliminary documents serving to guide the research effort. The first of these documents was the amplified work plan. This document encapsulated the required work plan elements from the proposal and incorporated feedback from the research panel's review of the proposal. Another draft document submitted to the review panel was the draft interview instrument. While not as critical as other elements of this task, the research team also submitted outlines and expected submission dates for the deliverables of the project.

The final aspect of this task was the kick-off web/teleconference. This meeting was an opportunity for the research panel to provide input to the research team during the project's formative stages. At the meeting, the research team presented the amplified work plan, the draft interview tool, a preliminary list of participants, the research deliverables packet, and discussed highlights from literature previously reviewed. The objective of the meeting was in refining the scope of work for the project, finalizing the ACMs and STAs to investigate, and discussing the elements of data and information that are relevant to utility coordination efficiency, safety, cost, and schedule.

Task 2: Conduct a literature review and initial project data collection.

Stemming from research panel guidance, the research team conducted a review of relevant domestic research, guidelines, and current practices to identify and describe current alternative contracting methods, and identify elements of utility coordination that may be impacted by such methods. This review involved several reliable sources of information such as academic publications, STA/national research reports and manuals, and the Transportation Research Information Service (TRIS). The ACM focus for this review was identified from Task 1 and tailored to utility coordination within design-build (and P3), CM/GC, and the use of ATCs for public transportation agencies.

While a portion of the literature review was necessary for the development of the deliverables in Task 1, a further detailed review was conducted within this task for analysis of the information and data relevant to utility coordination efficiency, safety, cost, and schedule in associated ACMs. The detailed review included NCHRP 20-07 Task 373 *Utility Coordination Best Practices for Design-Build and Alternative Contracting Projects (3)* and TPF 5-260 *Guidebook for Selecting Alternative Contracting Methods for Roadway Projects: Project Delivery Methods, Procurement Procedures, and Payment Provisions (16)*.

Also within this task, the research team began connecting with STAs for interviews to investigate and collect the project data they had available regarding utility coordination on ACM projects. It was important to begin to collect this data as soon as possible such that the research team could determine the suitability of the data for assessing the utility coordination along efficiency, safety, cost, and schedule. The results of the reviews of this task are detailed in Chapter 3 of this report.

Task 3: Conduct STA interviews to collect and document information and data relevant to utility coordination efficiency, safety, cost, and schedule when using ACMs.

Following the kick-off web conference and the literature review, the research team finalized the interview tool in order to collect information for assessing utility coordination efficiency, safety, cost, and schedule in using ACMs and when compared to traditional delivery. The sections below highlight the areas of focus for the interviews.

Utility damages, construction hazards, and other safety concerns occurring due to ACM use in-lieu of design-bid-build, and potential solutions.

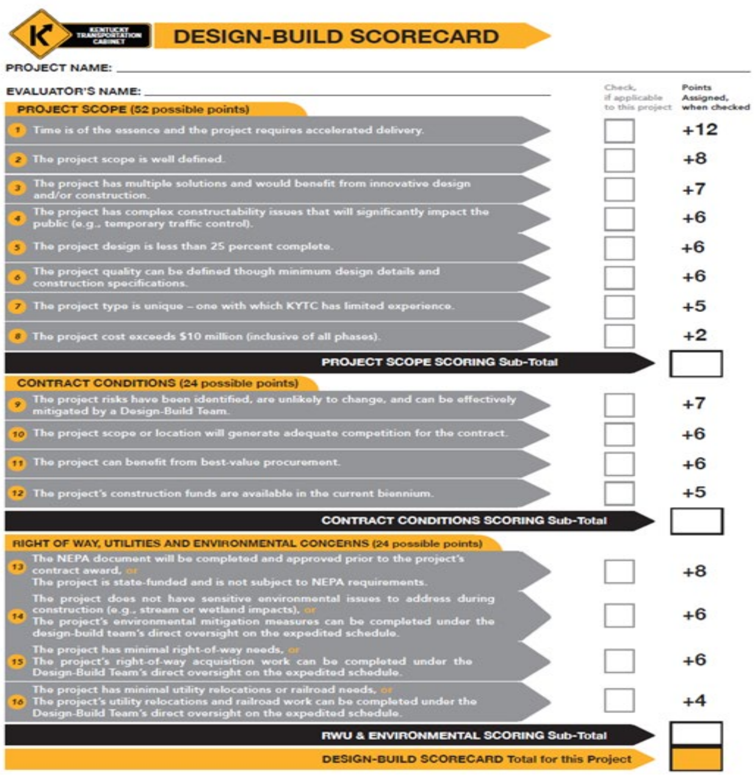
A first area for discussion during the interviews was on damage, hazards, and safety concerns regarding utility coordination practices when using ACMs. The events, when mentioned, were not quantifiable and few damages have been documented. Often when contractors damage utility facilities, they coordinate the repairs themselves. This is especially the case within ACM contracts where the construction contractor, such as the design-build team, is already functioning in the role of the utility coordinator. The research team was unable collect quantifiable evidence regarding safety and hazard lessons learned. Often to illustrate the definition of a safety concern, the example of a valve or other appurtenance within the driving lanes of the roadway was mentioned. While some of the interviewees shared these concerns, an effective practice mentioned was enhancing the detail of the project specific specifications to control for those concerns to the extent they were foreseeable. It was noted that these types of practices are often avoided in traditional procurement due to the level of STA coordination, yet within ACMs, rapid design changes can lead to these and other safety issues.

Inefficiencies of the utility coordination process imparted by ACM usage and potential solutions.

Another area for discussion was the efficiency of the utility coordination process. The research team has captured previous cases from utility companies who were dissatisfied working with STAs on ACM projects due to the lack of efficiency and rework in utility coordination. The utility coordination of an ACM project can become less linear and more iterative creating a source of confusion and inefficiency. Further, there are instances where the ACM contractor has a role in utility coordination and their inexperience in that role or the resistance of utility companies to work with them in that role can lead to inefficiency. Typically, these inefficiencies are presenting themselves in multiple moves for the utilities or in the STA having to get more involved in utility coordination than the original contract terms outlined. Again, inefficiencies were impossible to quantify through data available or in discussions with the interviewees.

STA policies for selecting ACMs.

Another area of interest in discussing ACM use with the interviewees was in how STAs select a project for a particular ACM. The research team were familiar with this process from previous research and were involved in an effort to develop a process and scorecard for use in Kentucky, seen in Figure 6. Many STAs have these procedures developed and documented the research team investigated these prior to the interviews as a point for discussion. While some STAs did not explicitly mentioned utilities in their ACM selection process, many did. The research team accounted for utility issues in the Kentucky scorecard and this practice is recommended by the Design Build Institute of America (DBIA).



KENTUCKY TRANSPORTATION CABINET — DESIGN-BUILD SCORECARD

PROJECT NAME:

EVALUATOR'S NAME:

	Check, if applicable to this project	Points Assigned, when checked
PROJECT SCOPE (52 possible points)		
1 Time is of the essence and the project requires accelerated delivery.		+12
2 The project scope is well defined.		+8
3 The project has multiple solutions and would benefit from innovative design and/or construction.		+7
4 The project has complex constructability issues that will significantly impact the public (e.g., temporary traffic control).		+6
5 The project design is less than 25 percent complete.		+6
6 The project quality can be defined though minimum design details and construction specifications.		+6
7 The project type is unique – one with which KYTC has limited experience.		+5
8 The project cost exceeds $10 million (inclusive of all phases).		+2
PROJECT SCOPE SCORING Sub-Total		
CONTRACT CONDITIONS (24 possible points)		
9 The project risks have been identified, are unlikely to change, and can be effectively mitigated by a Design-Build Team.		+7
10 The project scope or location will generate adequate competition for the contract.		+6
11 The project can benefit from best-value procurement.		+6
12 The project's construction funds are available in the current biennium.		+5
CONTRACT CONDITIONS SCORING Sub-Total		
RIGHT OF WAY, UTILITIES AND ENVIRONMENTAL CONCERNS (24 possible points)		
13 The NEPA document will be completed and approved prior to the project's contract award, or The project is state-funded and is not subject to NEPA requirements.		+8
14 The project does not have sensitive environmental issues to address during construction (e.g., stream or wetland impacts), or The project's environmental mitigation measures can be completed under the design-build team's direct oversight on the expedited schedule.		+6
15 The project has minimal right-of-way needs, or The project's right-of-way acquisition work can be completed under the Design-Build Team's direct oversight on the expedited schedule.		+6
16 The project has minimal utility relocations or railroad needs, or The project's utility relocations and railroad work can be completed under the Design-Build Team's direct oversight on the expedited schedule.		+4
RWU & ENVIRONMENTAL SCORING Sub-Total		
DESIGN-BUILD SCORECARD Total for this Project		

Figure 2.4: Kentucky Transportation Cabinet Design-Build Scorecard

STA expected and actual utility coordination schedule and cost on ACM projects.

The central point for discussion in the interviews was regarding schedule and cost. The research team made requests for cost and schedule related data for as many ACM projects (and baseline projects) as possible but found that this data was not readily available. In most circumstances within ACM projects, the construction contractor or their team plays a role in the utility coordination and relocation process within the project. Another approach is for all utility relocation efforts to be completed to the extent possible such that utilities pose little or no risk. If utility coordination and relocation is included within the ACM, the work is typically priced in a manner (bundled) such that the breakdown of costs (utility coordination costs versus utility relocation costs) are not available. The same is said for the collection of utility schedule data. If the records existed, they would likely only be available from the contractors typically are not willing to share that information as part of a research study due to risking their competitive advantage. It was at this phase of the study where the research team realized the original approach to data collection was not feasible. The research team began considering a plan of using a survey approach to collect data for the following cases.

Baseline case studies of utility coordination efficiency, safety, cost, and schedule on design-bid-build projects of varying characteristics.

The research team attempted to collect information for traditionally procured projects in a qualitative manner and quantitatively as possible through the surveys. In this way, for each STA analyzed the research team would have a baseline with which to compare ACM projects. This was believed to be the only way to have a true comparison of ACM projects to traditional design-bid-build projects due to the intricacies of each STA and their unique utility coordination procedures. Because Federal requirements allow some flexibility to the STAs in their utility coordination practices, each STA needed its own baseline set.

ACM case studies of utility coordination efficiency, safety, cost, and schedule with consideration of variance in project characteristics.

Additionally, as each project presents its own unique challenges in regard to utility coordination the research team attempted to collect project characteristics as available for the ACM projects in hopes to create a meaningful comparison tool that could be useful for STAs in selecting ACMs based on utility coordination impacts.

As previously mentioned, preliminary discussions with Delaware, Georgia, Kentucky, Pennsylvania, Texas, and Utah led the research team to believe an altered data collection plan was necessary. The data collection and interviews were originally considered the bulk of the research effort. The proposed shift would add conducting surveys to that effort but only after communication of this plan with the study advisory panel.

Task 4: Prepare an interim technical memorandum to summarize study findings and present to the research panel for feedback.

The research team prepared an interim technical memorandum to encapsulate the findings of tasks one through three. The report provided the research panel an opportunity to provide feedback on project progress, findings, and provide feedback on the altered research approach. The next segment of the report provides details on the alteration.

Altered Research Approach

In the midst of Task 3, significant issues became apparent in the availability of data to complete the work as initially defined. In consultation with panel members and as documented in the interim technical memorandum, the research approach was modified to conduct a pair of surveys following Task 4. This modification was due to the lack of evidence available in consultation with interviewees.

The research team conducted literature review, attempted data collection, and conducted interviews to interpret the impacts ACMs have on utility coordination. Through several preliminary interviews, it was discovered that quantifiable evidence to validate impacts of utility coordination efficiency, safety, cost, and schedule on ACM delivered projects was nearly non-existent. The reasoning for this lack of data is discussed further in the interview summaries.

It was originally believed that a series of case studies could collect quantitative evidence to distinguish variations between alternative contracting methods and traditional contracting methods. Unfortunately, when speaking with Pennsylvania, Utah, Delaware, and other STAs, we were advised that such evidence would be difficult if not impossible to collect. The research team then developed two surveys for a new approach to collect relevant information.

The first survey was intended for the STA lead for utility coordination and asked for qualitative comparisons of alternative contracting methods and traditional contracting methods. The second survey was another attempt for quantitative information seeking to build a database of projects, both ACM and traditional delivery, inclusive of costs, time, efficiency, and safety data. The research team received minimal results from the second survey, however the survey of STA utility coordination leaders provided good qualitative feedback. This data along with the literature and STA ACM delivery manual reviews was completed to compare practices to traditional methods.

The research team altered the research plan as presented within the interim technical memorandum. With consultation with the research panel, the research team began to conduct surveys in an attempt to gather information to gauge utility coordination impacts resulting from the use of ACMs. These impacts were organized and reviewed by practitioners to ensure accuracy. The results are presented in Chapter 3 herein.

Task 5: Use collected data, case studies, and research panel feedback to develop a decision support tool.

Given the difficulties in data collection, the development of a robust, quantitatively backed decisions support tool was not possible. With the more qualitative data collected, the research team developed a decision support tool providing quick information on how the selection of an ACM might impact the utility coordination of a project along the metrics of cost, schedule, efficiency and safety. The resulting tool is presented in Chapter 4.

Task 6: Prepare a final report documenting the research and findings including background, objectives, research approach, findings, and conclusions. The final report will also present the decisions support tool and guidance for its application.

The research team will began developing a final report documenting the entire research effort concurrently with other tasks. The draft final documents include this final report, inclusive of the decision support tool, and a presentation of the findings suitable for an AASHTO Committee of Right of Way, Utilities, and Outdoor Advertising Control Annual Meeting presentation. The remaining report presents the research findings.

Task 7: Present the project findings to the AASHTO Committee on Right of Way, Utilities, and Outdoor Advertising Control

Due to the timing of the project and restrictions, the research team is unsure when the presentation for the next AASHTO Committee of Right of Way, Utilities, and Outdoor Advertising Control Annual Meeting might occur. The research team is committed to presenting the study results as desired at the next Annual Meeting.

The upcoming chapters present the research findings and conclusions of this effort.

CHAPTER 3

Findings and Applications

The research findings and applications were produced through the use of the following research methodologies — literature review (inclusive of research reports, policy manuals, and other references), survey of subject-matter experts, formal and informal interviews, and the analysis of openly available datasets. Information from the literature review informed the development and finalization of the two survey instruments distributed to the State Utility Leads, or engineers, at State Transportation Agencies (STAs). The second survey was further distributed by the State Utility Leads to their utility coordinators. While the survey response rate was much lower than hoped for, the information collected proved useful in preparing the outcomes of the research. Results and findings from each activity are individually presented in the following sections.

Prior to delving into the findings, it is important to understand the generalized impacts alternative contracting methods (ACMs) have within the utility coordination and relocation processes. This generalization is specific to the ACMs of this study (Design-Build, Public-Private Partnerships, Construction Manager/General Contractor, and Alternative Technical Concepts). The traditional approach of design-bid-build would typically involve the STA completing or attempting to complete most of both utility coordination and relocations prior to awarding the project to a construction contractor. The timings of ACMs impacts the ability to do this. Design-build, and pubic-private partnerships as a special variation of design-build, involve bringing on the design-build team to complete the design and construct the project. The full understanding of utility impacts would not be known since the design is not complete. The design-build team (DBT) is therefore very much involved if not responsible for utility coordination and relocations. Construction Manager/General Contractor involves a partnership between a contractor, who may eventually become the constructing contractor, and the STA. In this scenario the STA is able to coordinate and relocate utilities more closely aligned with the traditional approach but with valuable input from a construction contractor. The final ACM discussed is the alternative technical concepts (ATCs). ATCs are a contracting tool used in both design-build and design-bid-build to garner ideas from the contracting community prior to award or selection of a final design-build team. ATCs will impact utility coordination and relocation when the ATC is directly related to utility relate work or involves a change that impacts the project's utility coordination and relocation. The following presents the data collected to understand more details about these practices and impacts.

Review of Literature on Utility Coordination in ACMs

Utility coordination is becoming a more important aspect of the project development and delivery process as utility infrastructure advances and occupies more space in public rights-of-way. This has been a recent topic of interest for STAs as well as academic researchers. This study began with a review of research reports primarily prepared by academic researchers and focused on current ACMs identifying elements of utility coordination that may be impacted by such methods. Table 3.1 presents a summary of the literature collected along four contracting methods as part of this project (Design-Bid-Build, Design-Build, Public-Private Partnership, and Construction Manager/General Contractor). Each contracting method is then

Table 3.1: Summary of Past Literature Reviewed

Sources	Design-Build (DB)				Design-Bid-Build (DBB)				Public-Private Partnership (P3)				Construction Manager/General Contractor (CM/GM)			
	Efficiency	Safety	Cost	Schedule	Efficiency	Safety	Cost	Schedule	Efficiency	Safety	Cost	Schedule	Efficiency	Safety	Cost	Schedule
Transportation Association of Canada, (2019)										√	√	√				
Sturgill, Taylor, & Dadi, (2018)							√	√			√	√				
Gransberg, Pittenger, & Chambers, (2017)	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Sturgill, Taylor, & Li, (2017)		√	√	√		√	√	√								
Yakowenko, (2017)		√	√	√												
Loulakis, et al., (2016)			√	√												
KYTC Partnering Conference, (2014)	√		√	√	√		√	√								
Molenaar, Harper, & Yugar, (2014)	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Anspach, (2010)		√	√	√												
Moeller, et al., (2002)		√	√	√												

divided into four topic subcategories (Efficiency, Safety, Cost, and Schedule) such that the referenced literature could be reviewed across these subcategories as it relates to utility involvement. In order to assess the impact of using specific ACMs on utility coordination in regard to efficiency, safety, cost, and schedule the researchers conducted a thorough review of available project documentation. Resources used included the TRID database associated with the Transportation Research Board (TRB), Internet and web searches, and resources of professional associations. The goal of this review was to identify utility coordination impacts resulting from ACM usage as well as identifying various strategies and techniques used to combat or alleviate any negative impacts.

Unfortunately, there are limited resources for reference within this research area. Within what little published documentation and support does exist for utility coordination specific to ACMs, there is a void of documentation relative to the impacts these ACMs have on the efficiency, safety, cost and schedule of utility coordination. Moeller, et al., evaluated foreign technologies and innovations that could significantly benefit United States highway systems to minimize the complexity and delays in projects. The researchers conducted a study of processes and procedures in England, Germany, Norway, and the Netherlands to review and identify best practices in right-of-way and utility services. This study outlined guidelines and best practices in project development, appraisal and appraisal review, acquisition, relocation, property management, utilities, management practices, and training. Highway agencies in these countries reduce the time needed to provide acquisition offers to property owners by limiting the need for appraisal reviews and through passage of special enabling legislation to streamline the acquisition process. They use mediation and quick payment processes to facilitate settlements and payments to property owners. In England, they use Design/Build practices extensively in their program. Moeller, et al., believed that Design-Build (DB) in England is advantageous to highway agencies because there is potential for delegating some or all of the acquisition activities to the contractors, eliminating many procedural procurement processes, as well as transferring the risk of utility-related delays to the highway contractors and thereby reducing claims for delays and cost overruns. (17) This transfer is also a contributing mechanism to the lack of quantitative data for completing this research. Nonetheless, the researchers developed a list of practices to implement in the United States to ensure timely procurement and clearance of highway right-of-way or adjustment of utilities. Both Anspach and Moeller et al., identify the need to increase designers' attention to utilities earlier in the design process. These reports highlight early communication and involvement as beneficial utility coordination practices. (2, 17)

Anspach presents that the fundamental challenge associated with utility coordination and highway design revolves around STA procedures for involving, locating, and resolving conflicts with utilities based on the types and severity of those utility impacts. (2) While this synthesis relays that little standardization exists as to how this process should occur, it does provide a succinct list of best practices employed by STAs to mitigate utility and highway conflicts. The study explores five specific practices: (1) consideration of utilities during design, (2) philosophies regarding design versus relocation, (3) knowledge of designers in utility issues, (4) procedures and practices for decision making, and (5) utility mapping. (2) This synthesis report also provides guidance and tools associated with utility coordination in ACMs as well as a detailed alignment of utility coordination tasks to project delivery stages. The scope of these project implications with ACMs is limited specifically in regard to efficiency, safety, cost, and schedule of the utility coordination. This report, among other research efforts, demonstrates a needed understanding of the applicability and effectiveness of utility coordination practices specific to given project conditions.

To overcome the shortcomings of available resources, STAs are adapting by using ACMs and contracting strategies to design and build major road infrastructure projects. The difficulty that STAs face is in understanding what impacts these approaches have on their processes that they adapt from their traditional delivery approach and in determining if the ACM is still the optimal choice. Further it can be difficult to choose among the different ACMs versus a more traditional approach for a specific project. In fact, no one method is optimal for all projects and determining an appropriate method needs to be done on a project-by-project basis. Most STAs lack a tool or even formal guidance on how the selection of contracting strategies from the various delivery methods, procurement procedures, and payment methods available. A contracting strategy is the combination of three components: the delivery method, the procurement procedure, and the payment provision. Molenaar, Harper, & Yugar, prepared a guidebook and comprehensive list of contracting strategies and tools for STAs along with an approach for selecting the various contracting strategies available based on the known specifics of a highway or road project. Most roadway projects use the traditional contracting strategy of design-bid-build (D-B-B) delivery method, low bid procurement, and unit price payment provisions to contract a project though variations exist. In thinking of delivery method alone, most roadway projects use one of three approaches: Design-Bid-Build, Design-Build (D-B), and Construction Manager / General Contractor (CM/GC). Other delivery methods are also available such as multiple prime, design sequencing, public-private partnerships as well as other variations of D-B and CM/GC. (16) This guidebook provides an exhaustive and comprehensive list of the contracting strategies in use by STAs across the United States and describes each strategy. However, there are minimal details in regard to utility coordination impacts through use of these approaches.

The Kentucky Transportation Cabinet (KYTC) studied the effective practices of utility coordination on several projects delivered through traditional procurement and ACMs. The Ohio River Bridges entailed two bridges with one delivered through DB (managed by KYTC) and the other by P3 (managed by Indiana Department of Transportation). In these approaches a design consultant managed utility coordination in the design phase. The study highlighted the benefits of this approach as being early coordination with utility companies enabled utilities to plan ahead for relocations and not delay the project due to lack of resources. The cost of relocations were minimized by roadway design considerations made to avoid utilities as possible. Review and coordination with utilities resulted in accurate utility locations on plans. Another project, KY 61 Sections 1&2 in Bullitt County, delivered using traditional DBB, separated the utility design and construction/relocation phases. The construction contractor managed utility relocation coordination in the highway construction phase with KYTC and/or consultant oversight. The challenges highlighted involved easement needs requiring KYTC involvement and a general lack of utility cooperation with the contractor. These situations impacted the schedule which already entailed an extremely tight timeline. However, it was noted that utility coordination assistance prior to construction and project costs were minimized due to a higher level of coordination during the road work and utility construction, which was occurring simultaneously. KY 914 in Pulaski County, delivered using a design-build approach, involved the contractor and design build team managing utility coordination from beginning to end of the project. The benefits cited were in the risk transfer to contractor but it was stated that the utility construction cost were not recorded on a keep cost basis. (18)

It is important to note that implementation of the same ACM, for instance DB, occurs with variation across STAs. Loulakis, et al., identified best practices for design-build delivery to maximize efficiencies in cost and schedule. The study identified a broad cross-section of STAs and their implementation of design-build. Among others, they evaluated Washington State Department of Transportation’s current use of design-build project delivery and proposed improvements to maximize cost and schedule efficiencies while ensuring project risk is borne by the appropriate party. (19) Sturgill, et al., developed design-build guidance including project selection and utility coordination implications for the Kentucky Transportation Cabinet. Their study included a case study and analysis of utility coordination impacts on the design-build (DB) and public-private partnership (P3) portions of the $2 billion Louisville-Southern Indiana Ohio River Bridges project previously mentioned. This detailed study provided a unique perspective of how two different STAs approached utility coordination within two subprojects using two different contracting methods. The project involved two river-crossing bridges and significant grade work in a mainly urbanized area. The $2.3 billion project involved 133 relocations using multiple utility coordination approaches and involving a design-build team and public-private partnership developer in the process of coordination. The researchers presented support for the argument that the delivery method affects the utility coordination process and that best practices are not universally applicable across delivery methods. (4) Finally, the data from this case study illustrates that there are differing opinions and levels of satisfaction among STA representatives and utility owners regarding utility coordination on design-build projects. This is also supported by the national synthesis conducted by Sturgill et. al. (12)

Yakowenko, investigated utility coordination in terms of safety, cost, and schedule in using design-build on two projects of the South Carolina Department of Transportation (SCDOT). SCDOT has utilized design-build on several major highway projects. Their design-build program has utilized both the adjusted bid method and the highest composite score (combination of cost and qualifications) to select successful contract teams. Yakowenko notes that the design-build concept gives the contractor the maximum flexibility for innovation in the selection of design, materials and construction methods. Since both design and construction are performed under the same contract, claims for design errors or construction delays due to design errors are not possible and the potential for other types of claims is greatly reduced. In the same manner, utility relocations can begin at any time the contractor desires, but the contractor is responsible for any utility-related construction delays that may occur. Yakowenko, also mentions that while many STAs have used design-build, only a few have included utilities coordination within the contract. SCDOT is one of those few. Two of the first design-build projects in South Carolina where utilities were included were the Conway Bypass and the Greenville Southern Connector. The two projects were built as P3s and the prime contractors/concessionaires were responsible for all utility work, including contacting all affected utilities, determining prior rights, entering into agreements, coordinating the work, and paying for eligible relocations. The first project involved a bypass highway near Myrtle Beach that was opened to traffic on May 4, 2001, ahead of schedule (seven months early), well under budget (saving $303,438), with an industry-leading safety record, and with a refund to SCDOT. The P3 project began in March of 1998 with eight utility companies affected and an estimated cost to relocate those utilities of $14 million. The second project was the Greenville Southern Connector. It was opened to traffic on February 27, 2001, nearly 8½ months ahead of schedule and under budget. The This project began in February 1998 and affected utilities including Duke Power, BellSouth, Western Carolina Regional Sewer Authority, Greenville Water System, several cable TV companies, and several small water and sewer companies. Using design-build allowed the project team to coordinate closely with the utility companies with the goal of minimizing impacts and indicate clear areas where construction could begin. The utility construction also went smoothly for both projects because the contractors brought the utility companies into the project development process at the very beginning as active members of the team. They also financed some of the necessary utility relocation activities upfront, thus ensuring cooperation, coordination, and communication. (20)

There is substantial guidance, policy, and legislation regarding utility accommodation, relocation, and coordination, however these vary from state to state. There is currently very little documentation, guidance, and support for utility coordination within and specific to contract delivery methods. Some issues facing effective utility coordination for STAs include a lack of staffing resources, standard terminology, as well as application of research, technology, and coordination practices in general. As Sturgill, et al., in their national synthesis, found there is a need for utility coordination guidance within alternative delivery methods due to the unique challenges this methods present. The study concluded there is a notable difference between utility coordination in design-build versus design-bid-build. There were also notable differences in utility coordination between using STA in-house coordinators, stand-alone utility consultant coordinators, and project design consultants as utility coordinators. Finally, the researchers integrated multiple resources of value about effective utility coordination practices. (12) Gransberg, Pittenger, & Chambers, provided guidance and tools associated with utility coordination in various types of ACMs including specific task assignments of responsibility based on the type of contracting method and means of project execution. This project also detailed the alignment of utility coordination tasks to project delivery stages, yet the scope of the project was not able to document the implications ACMs haves specific to the efficiency, safety, cost, and schedule of the utility coordination. The study presented that utility coordination among ACMs varies according to the timelines, roles, and alignment of utility coordination tasks relative to overall project delivery tasks. This is extremely significant when considering the selection and use of utility coordination best practices or perhaps even in selecting the ACMs for the project. The researchers provided guidance and tools associated with utility coordination using ACMs such as P3. Figures 3.1, 3.2, and 3.3 provided a flowcharts that document the major utility coordination decisions and tasks within P3 projects. These figures provide the basis for the approach to utility coordination within a P3 project. The flowcharts are divided into three stages; Pre-Letting stage, Procurement stage, and Post-Award stage. (3)

Effective utility coordination can improve the delivery of transportation and other capital facility projects and can reduce project risks. As mentioned, there is little guidance for utility coordination with ACM projects. Within ACM projects, the coordination of project owners, public land authorities and utility service providers is an integral factor in project planning, design, and construction. A list of utility coordination guideline best practices were developed by the Transportation Association of Canada for P3 projects. This guideline is designed to act as a template that can be referred to by public and/or private agencies for developing a process for utility coordination on P3 projects. The objective of the guideline is to assist various P3 owners, ROW owners, and utility agencies to develop or enhance their utility coordination processes when utility relocation is required. The Transportation Association of Canada developed a flow chart intended as an overall summary of the utility coordination process used on P3 projects as shown in Figure 3.4. The flowchart illustrates the coordination steps required to successfully navigate from the Planning Phase of a project to the final Post Construction Phase and gives an in-depth description of each phase found on the flowchart. (21)

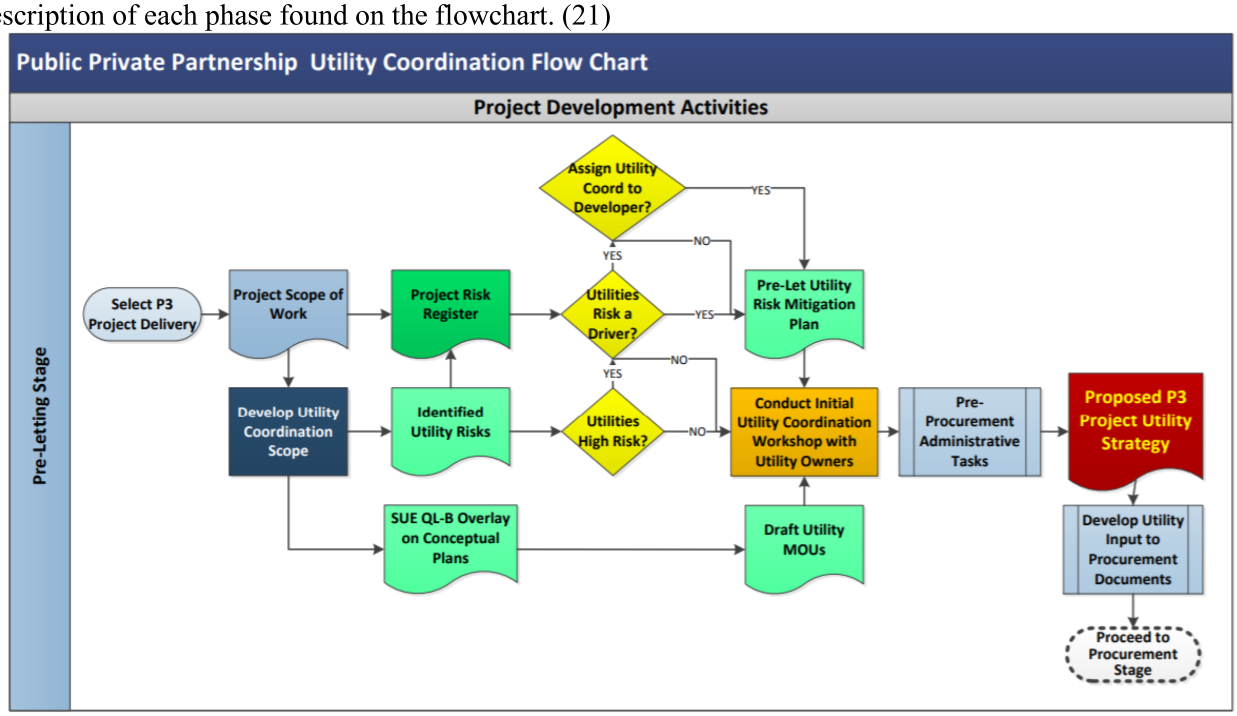


Figure 3.1: P3 Utility Coordination Pre-Letting Stage

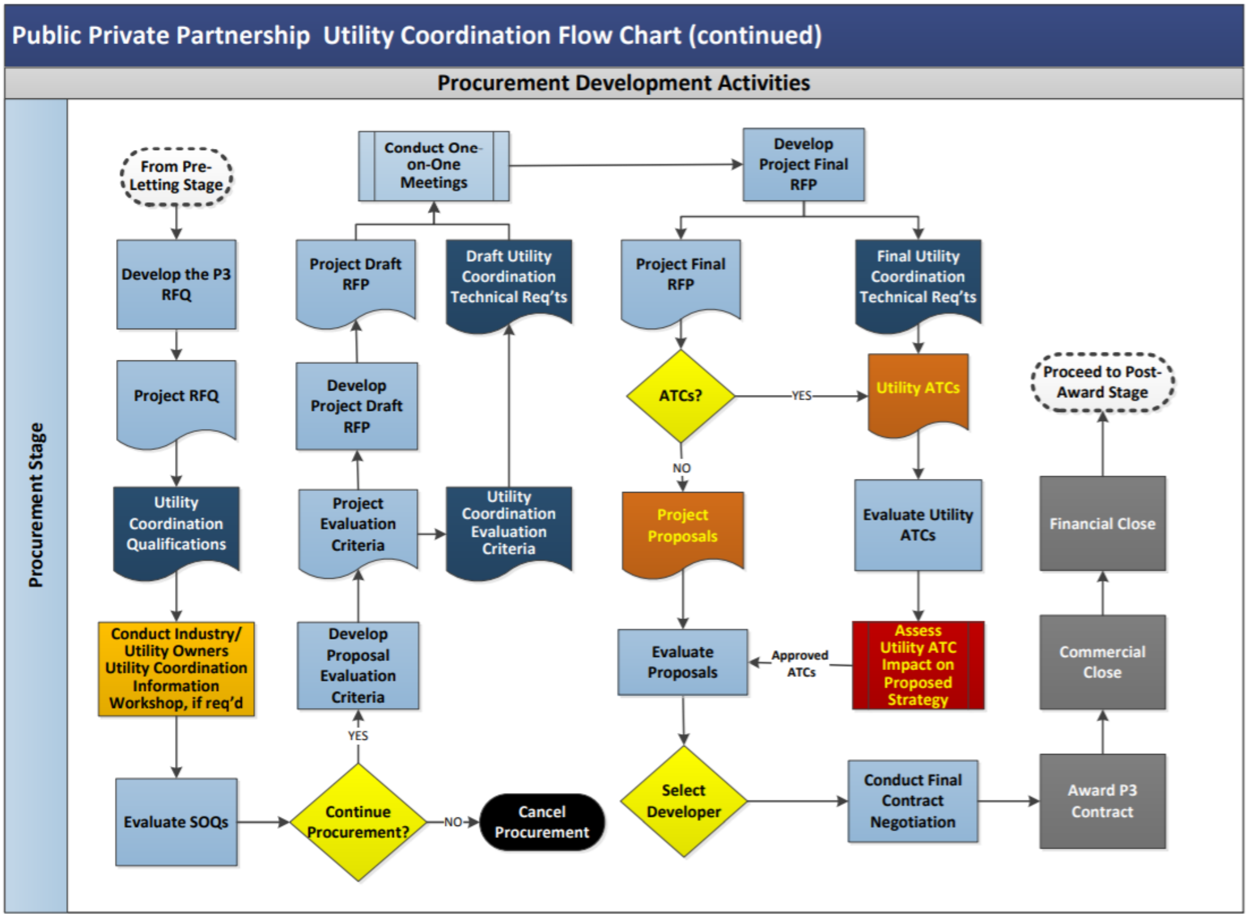


Figure 3.2: P3 Utility Coordination Procurement Stage

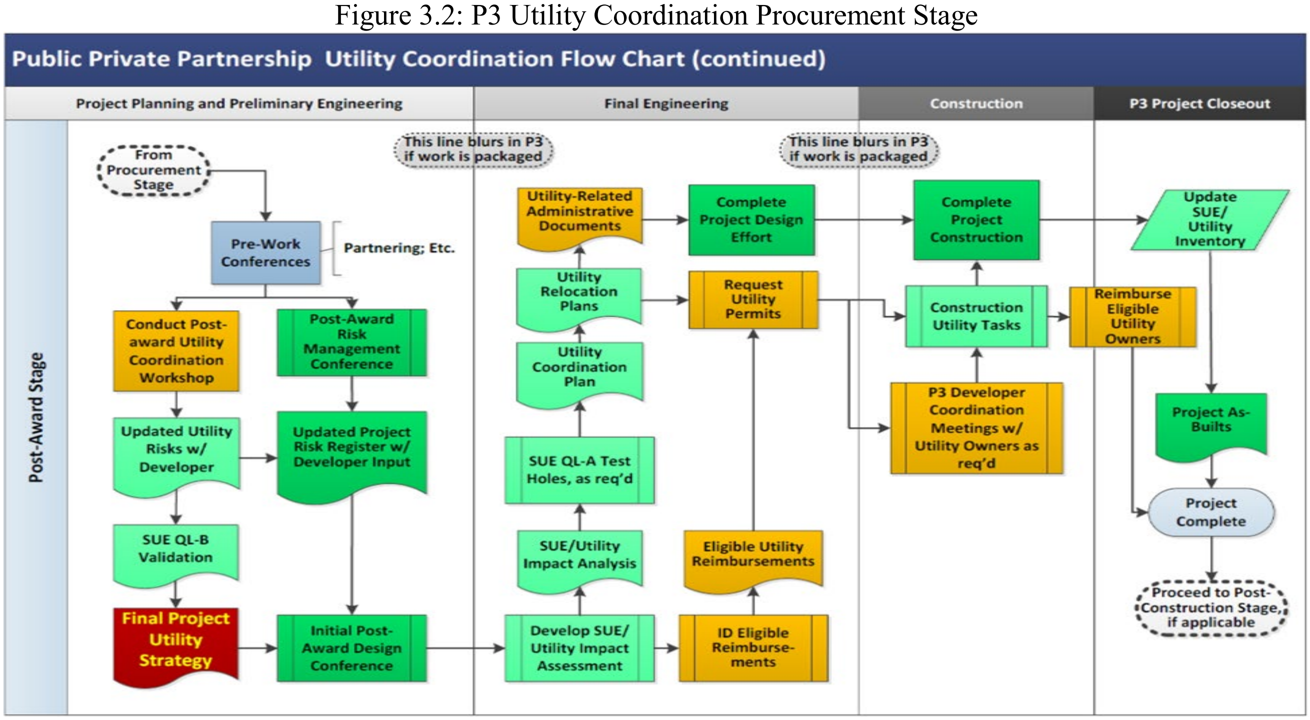


Figure 3.3: P3 Utility Coordination Post-Award Stage

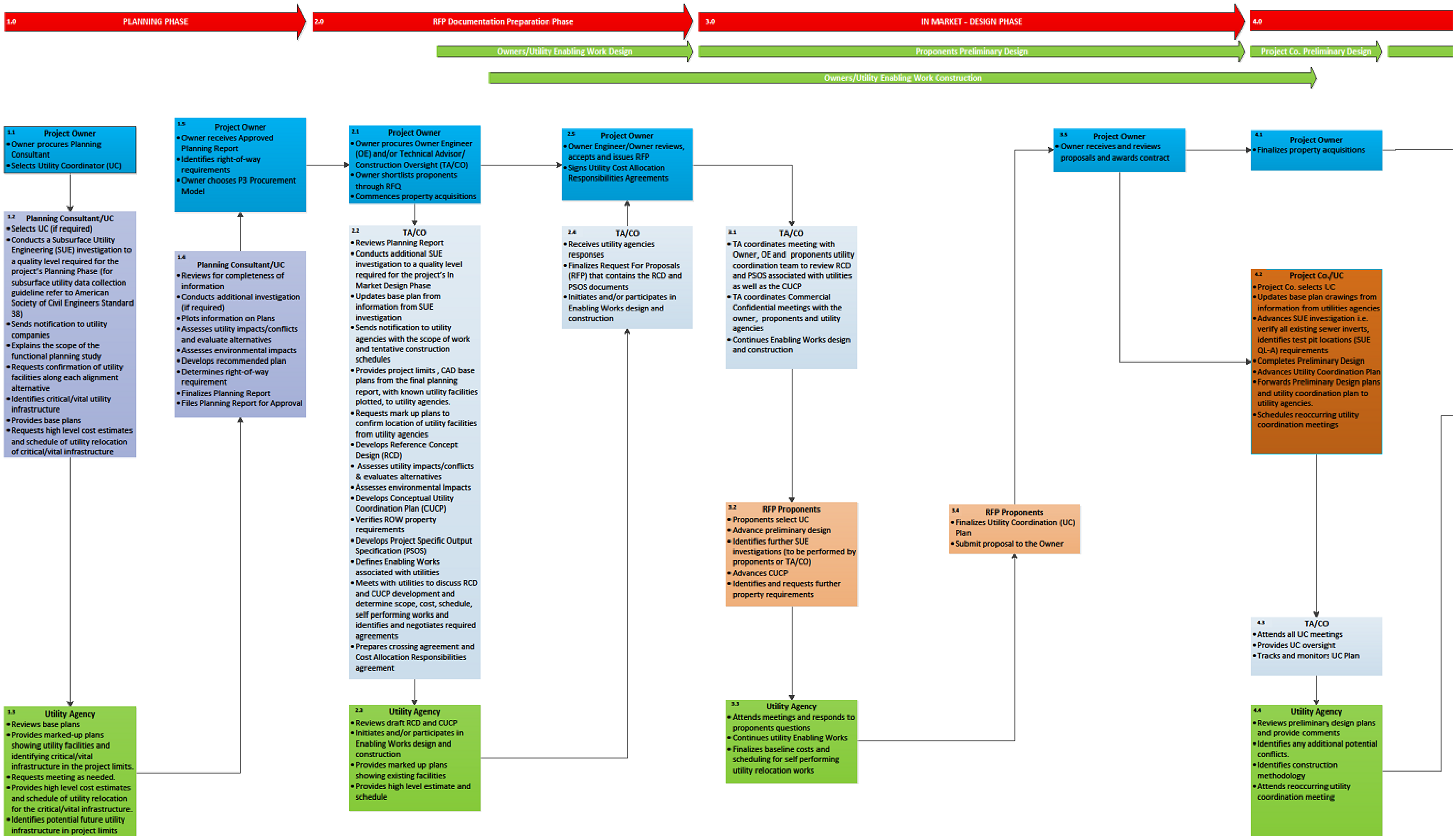


Figure 3.4: Guideline for Utility Coordination on Public-Private (P3) Projects—P3 Project Utility Coordination Process Map

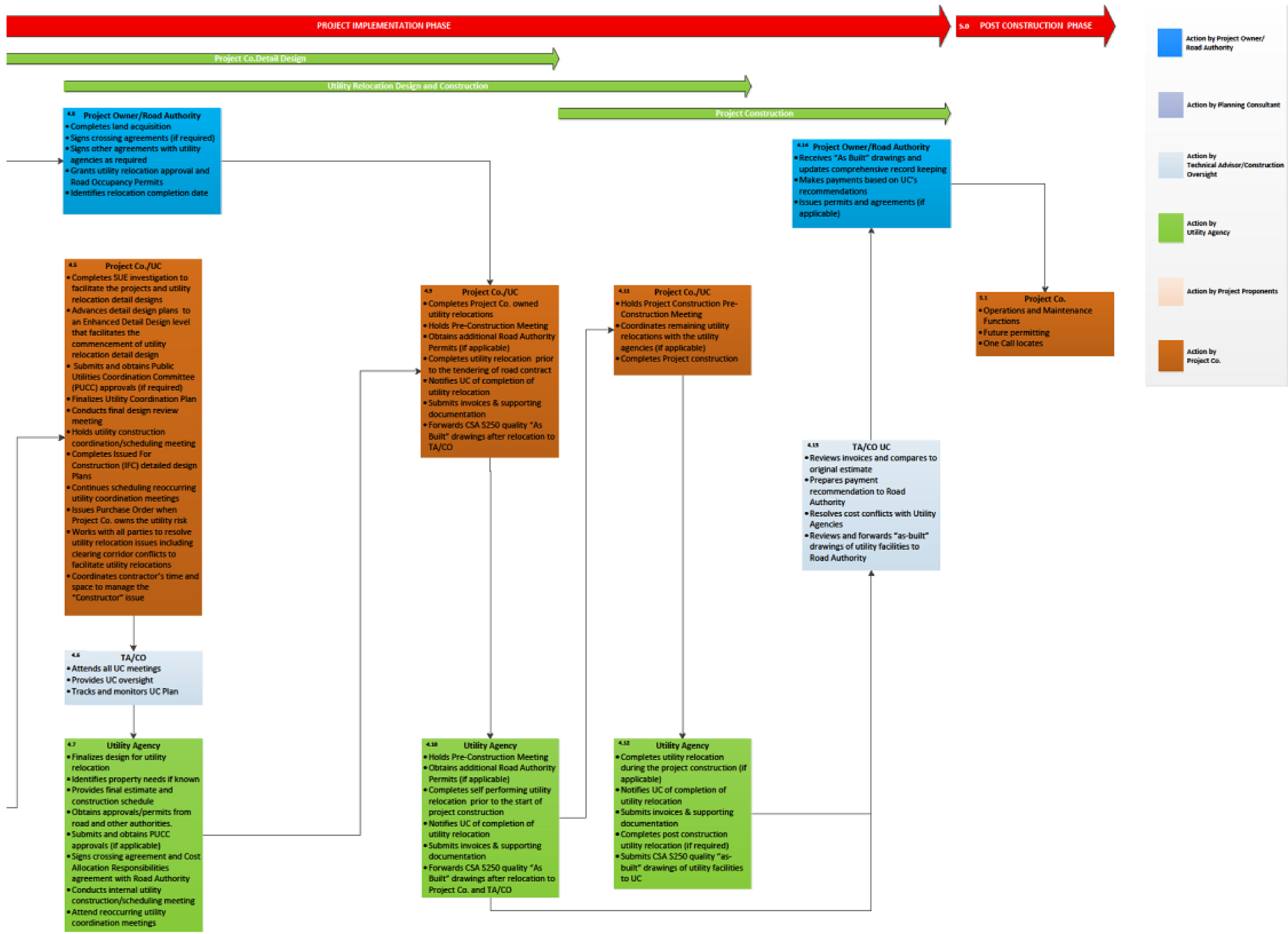


Figure 3.4 (continued) Guideline for Utility Coordination on Public-Private (P3) Projects—P3 Project Utility Coordination Process Map

ACMs in Transportation Agency Policy Manuals

As previously mentioned, few resources are available to standardize and assist in utility coordination efforts on alternatively delivered projects. Many STAs use or have tried design-build contracting including Alaska, Arizona, Arkansas, Colorado, Kentucky, Louisiana, Minnesota, Montana, Nevada, New York, Tennessee, Virginia, and Washington, among others. (22) Others such as Arizona, Massachusetts Bay Transit Authority, and Montana have used Construction Manager/General Contractor (CM/GC). California, Kentucky, and Missouri among others, have used Alternative Technical Concepts (ATCs). (22) The utility coordination among these approaches and across these STAs is not standardized though some have developed their own policy manuals specific to ACMs. Several of these were reviewed for documentation specific to utility coordination.

According to the available policy manuals for Design-Build contracting, the typical approach is for STAs to obtain most of the project agreements with utility companies, either formally or informally, for relocation of their facilities prior to advertisement. Sometimes the arrangement of these agreements is within the design builder's scope of work. The design-build team (DBT) coordinates arrangements for the actual construction work associated with the relocations to match the intended work program. When the construction work/coordination is allocated to the DBT, the control of the work also lies with the DBT as well as the associated risk. However, utility companies are not always keen to work with contractors and the non-STA utility coordinators are not always fully knowledgeable of policies or regulations. In other works, there are benefits and challenges.

The STA of Colorado has extensive information on ACMs. They use three types of project delivery methods: (1) traditional Design-Bid-Build, (2) Design-Build (DB), and (3) Construction Manager/General Contractor (CMGC). The delivery methods differ in the contractual relationship between the STA, the contractor, and the designer and Colorado does a great job of representing this in Figure 3.5.

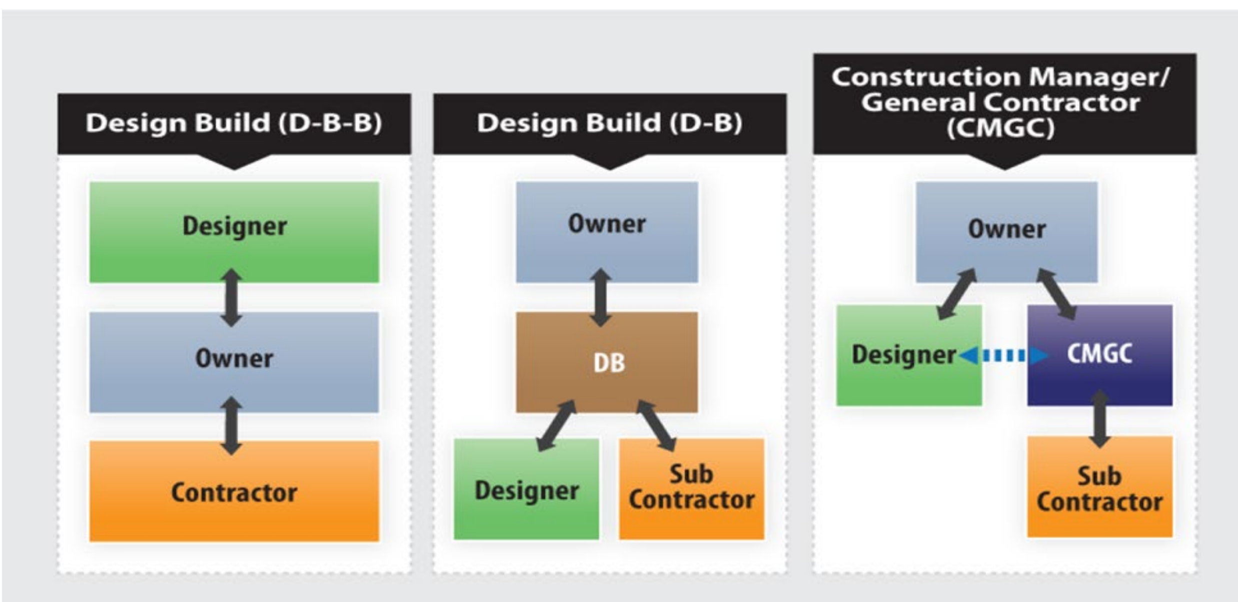


Figure 3.5: Project Delivery Methods Contractual Relationships (Colorado STA)

The delivery methods differ in the timing of the design, procurement, and construction phases of a project as Colorado represents in Figure 3.6. DB and CMGC are often used to advance the construction phase of a project or accelerate the total project delivery schedule. Although project schedules are still controlled by items such as right-of-way acquisition, environmental permitting, utility coordination, and funding availability, both DB and CMGC offer opportunities to accelerate the project delivery time. This is accomplished by having overlapping design, procurement, and construction phases. The contractor also has greater control over project phasing and construction methods that can accelerate the project schedule, but they need to be knowledgeable of the topics previously mentioned as schedule controlling items. The designer and contractor collaborate to develop the design, construction methods, and phasing in support of an efficient construction schedule. Schedule and budget certainty are also obtained sooner in DB, as the DBT commits to a construction schedule earlier in the procurement process.

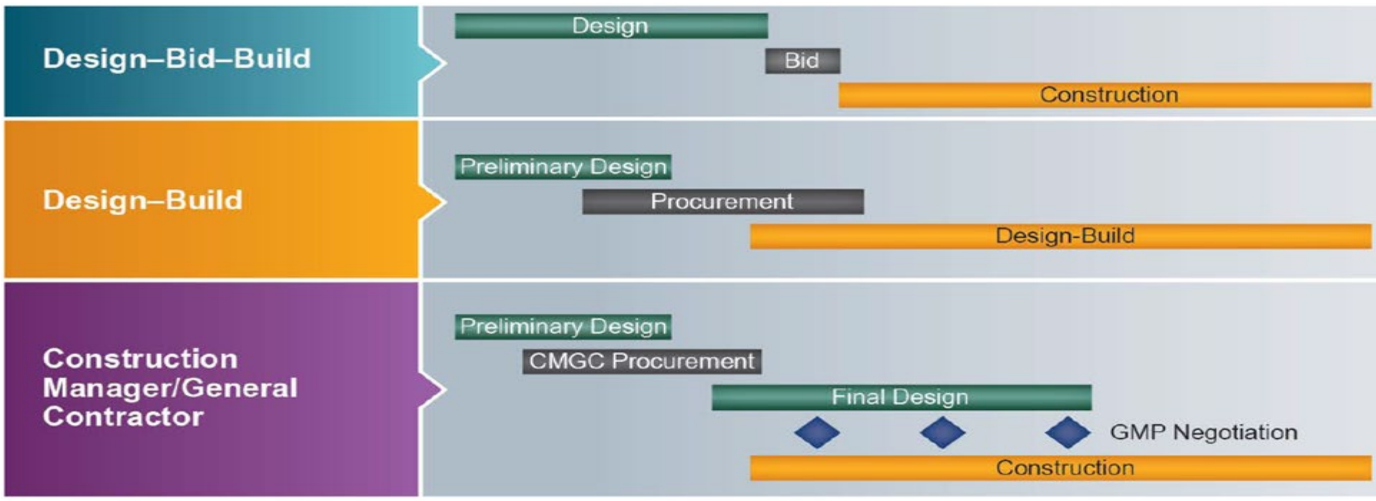


Figure 3.6: Project Delivery Methods Schedule (Colorado DOT)

While Figure 3.6 illustrates a large overlap in design and construction within CMGC, the actuality is that the overlap would typically be for small construction packages, such as demolition, clearing and grubbing, work zone setup, etc. The CMGC process is likely better represented, for STAs and transportation projects that is, by a Figure 3.7 from the STA in Nebraska.

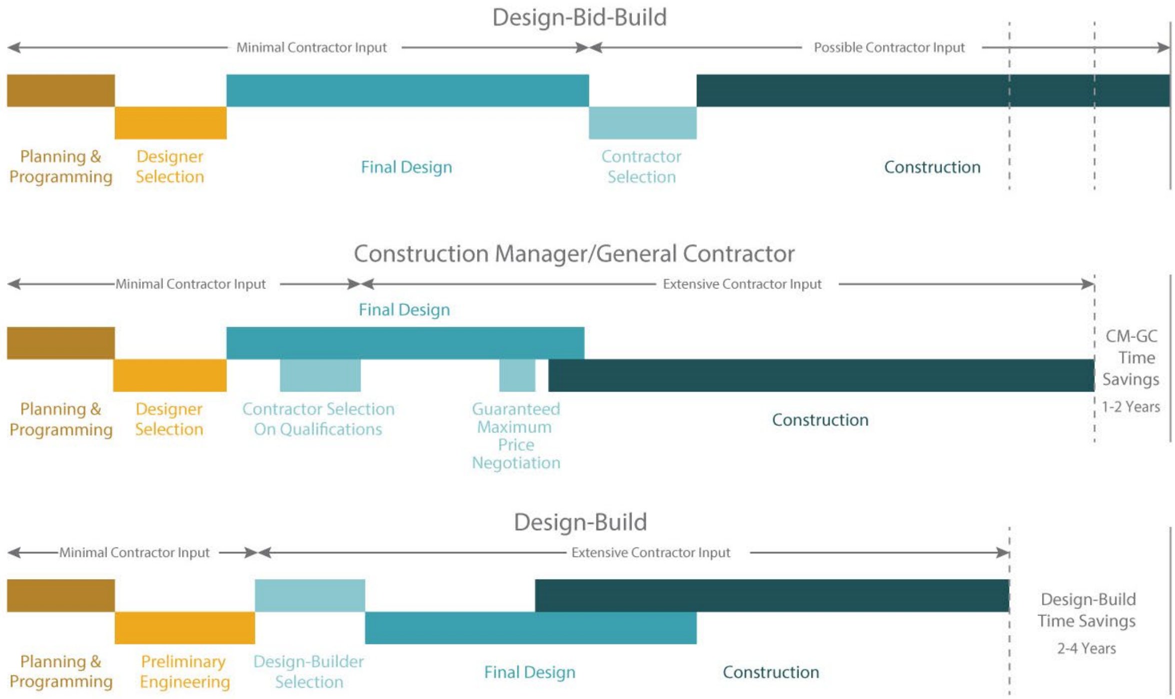


Figure 3.7: Project Delivery Methods Schedule (Nebraska DOT)

From Figure 3.7, one can notice that there is typically substantial more overlap in design and construction in DB than CMGC. In essence the CMGC overlap is minimal and in regard to utilities, can be akin to letting a demolition or clearing contract while any needed relocation is ongoing. This timeline, along with the results from the study survey, indicates that CMGC and DBB allow for similar handling of utility coordination and relocation. This is also evident in few STA manual references to utility coordination or relocation procedures in CMGC projects.

STA Policy Manual Practices on Utility Coordination in Design-Build (DB) Projects

The next sections highlight the findings for utility coordination and utility relocation as part of DB projects. In review of STA policy manuals for utility coordination in DB projects several useful tools were discovered and shared in the following. This tools may help other STAs plan and manage utility coordination within their DB projects.

Utility impacts exist in most projects, especially when defining impact as any potential conflict. Utility coordination and relocations almost always have the potential to develop into significant risks for a transportation project, including when delivered by ACMs such as DB. A thorough investigation should be performed by the owner in advance of procurement and stands to significantly reduce risk potential while helping the proposers give STAs the best technical and price proposals possible. Using DB for the utility coordination Alaska STA and Washington State STA assign responsibility for each of identified risk (including utilities) to either the STA or DBT. They mention that risks can be transferred to the DBT in DB contracting much easier than within DBB contracting. The risk allocation matrix is shown in Table 3.2. is an example of a tool that can be used to map risk assignments. This risk allocation matrix is not intended to be all-inclusive; the project team must carefully review the elements that could impact the specific project and tailor the matrix to fit the project. Utilizing the risk allocation matrix throughout the development and implementation of the project will not only govern which party is responsible for a given risk, but will also help the project team determine how far to advance each technical element within the preliminary design and scope during the development of the RFP. Since the DBT is responsible for the design and construction, Alaska and Washington State prefer that the DBT communicate and coordinate directly with local agencies, utility companies, and railroads. It must be realized that this comes with a costs, and contractors have expressed concerns in regard to the ability accurately estimate the costs of these risks.

Table 3.2: Risk Allocation Matrix (Alaska DTPF & Washington State DOT DB Manuals)

RISK	Design-Bid-Build			Change	Design-Build Process	
	Owner	Shared	Contractor		Owner	Design Builder
Local Agency, Utility, Railroad Issues						
Identification of initial local agency impacts	X				X	
Obtaining Initial local agency permits	X				X	
Establishing initial local agency requirements	X				X	
Establishing final/actual local agency impacts	X			→		X
Modifications to existing local agency permits	X			→		X
Identification of initial utility impacts from conceptual design	X				X	
Establish initial Utility Locations / Conditions	X				X	
Defining required utility relocations from conceptual design	X				X	
Relocation of utilities prior to contract	X				X	
Relocation of utilities under agreement during contract			X			X
Modified agreement with private utility based on final design	X			→		X
Modified agreement with public utility based on final design	X			→		X
Damage to Utilities under Construction			X	→		X
Verification of Utility Locations/Conditions	X			→		X
Coordination with Utility Relocation Efforts during contract		X		→		X
Unforeseen delays - Utility/thirdparty	X				X	
Utility/Third Party Delays resulting from proposal/modified design	X					X
Identification of RR impacts based on conceptual design	X				X	
Obtaining initial RR agreement based on conceptual design	X				X	
Coordinating with RR under agreement	X			→		X
Other work/Coordination		X		→		X
Third Party Agreements (Fed, Local, Private, etc.)	X				X	
Coordinating with Third Parties under agreement		X		→		X
Coordination/collection for third party betterments		X		→		X
Coordination with Other Projects		X		→		X
Coordination with Adjacent Property Owners		X		→		X

Utilities have historically represented one of the most significant risks in transportation projects, especially in regard to schedule risks. The risk is a result of the difficulty in fully define existing subsurface utilities conditions combined with the need to coordinate conflict relocation work that is often performed by third-party utility agencies or even their subcontractors. DB provides the opportunity to share the risk between the owner and the contractor in a manner that better manages the overall risk, but care must be exercised to properly allocate the risk and to minimize it through advanced coordination and design development. The STA in Colorado provided a summary template for a DB project risk allocation matrix as shown in Table 3.3. It is important to note that Colorado DB regulations authorize their STA to perform utility relocations (both private and public) to eliminate delays and the STA can assess delay damages to utility companies that are not responsive. Colorado DB regulations define *Reasonable Accuracy* of utility investigations provided by the Colorado STA. The STA accepts the risk of providing horizontal locations of existing utilities and to a limited extent, the size of the utilities. Their contractor accepts the risk of the vertical depth of the utility. Utility Relocation Agreements (URAs) define both the design and construction cost responsibilities as well as the process and schedule. Typically, utilities are required to relocate at their own expense unless they have exclusive utility easements or permits within the STA right-of-way (ROW).

Table 3.3: Design-Build Project Risk Allocation Matrix (Colorado DOT)

Table 3-1. Example of Design-Build Project Risk Allocation Matrix

	Design-Bid-Build		Design-Build	
Risk	**Agency**	**Contractor**	**Agency**	**Contractor**
Design Issues				
Project scope definition	X		X	
Design criteria	X		X	
Geotech investigation – Initial borings on preliminary design	X		X	
Geotech investigation – Initial borings on Proposal	X			X
Plan conformance with regulation/guide/RFP	X			X
Environmental				
NEPA/SEPA	X		X	
Environmental Mitigation Commitments[1]	X		X	X
Final Design Environmental Approvals[1]	X		X	X
Permitting	X		X	X[2]
Right-of-Way				
Establishing right-of-way limits	X		X	
Acquire right-of-way	X		X	
Local Agency				
Identification of initial local agency impacts	X		X	
Establish final/actual local agency impacts	X			X
Modifications to existing local agency permits	X			X
Utility				
Establish initial utility locations/conditions	X		X	
Relocation of utilities under agreement during contract		X		X
Modified agreement with private utility based on final design	X			X
Railroads (RR)				
Obtain initial RR agreement based on preliminary design	X		X	
Coordination with RR under agreement	X			X
Public Relations				
Community relations	X		X	
Public safety		X		X
Construction				
Initial performance requirements	X		X	
Final construction/materials QA/QC Plan	X			X
Material quality		X		X
Construction quality and safety		X		X
Force Majeure				
Natural hazard (tornado, earthquake, etc.)	X		X	
Change in law	X		X	
Differing Site Conditions				
Changed and differing site conditions	X		X	
Warranty				
Long-term ownership/final responsibility	X		X	
Insurance		X		X

Most DB projects entail major risks or unknowns due to the project design not being finalized. These risks include issues associated with the relocation of existing utilities, subsurface conditions, and hazardous materials remediation, among others. While preliminary information regarding utility relocations and site conditions may be gathered as part of DB scoping phases, it is frequently beneficial to perform additional, more detailed investigations (such as geotechnical investigations, subsurface utility engineering, and pavement subgrade investigations) to provide more information to proposers regarding the existing conditions to lessen uncertainty and reduce contingency amounts included in proposal prices. Risks can be reduced as the owner further advances the design and continues efforts in utility and other third-party coordination and agreements and in permitting and environmental clearances. These efforts should be guided by risk mitigation and management considerations. The STA in Colorado provided a summary comparison of the project risks for the utility coordination of a Construction Manager/General Contractor (CM/GC), Design-Build, and DBB delivery methods as shown in Table 3.4. The level of design development required prior to issuing the project RFP should flow out of a risk assessment and the initial completion of the Risk Register. Some common design elements that often need to be advanced such as utility coordination and agreements are based on the minimization of significant risks associated with utility relocation schedules and costs.

Table 3.4: Comparison of Project Risks for Delivery Methods (Colorado DOT)

Project Risk	D-B-B	Design-Build	CMGC
General Characteristics	• Requires that most design-related risks and third-party risks be resolved prior to procurement to avoid costly contractor contingency pricing and change orders and claims	• Provides opportunity to properly allocate well-defined and known risks to the parties best able to manage them • Risks allocated to Design-Builder must be well defined to minimize contractor contingency pricing of risks	• Provides opportunity for the owner, designer, and contractor to collectively identify and minimize project risks and either allocate risk to the appropriate party or share risk • Has potential to minimize risks associated with innovative and complex design and construction
Site Conditions and Investigations	• Site condition risks are generally best identified and mitigated during the design process prior to procurement to minimize the potential for change orders and claims	• Certain site condition risks can be allocated to the Design-Builder provided they are well defined and associated third-party approval processes are well defined • Unreasonable allocation of site condition risk results in high pricing due to risk • Site investigations by owner should include but are not limited to: 1. basic design surveys 2. hazardous materials 3. geotechnical investigations 4. utilities investigations	• CDOT, the designer, and the contractor can collectively assess site condition risks, identify the need to perform site investigations in order to reduce risks, and properly allocate or share risk prior to CAP
Utilities	• Utilities risks are best allocated to the owner and are mostly addressed prior to bid to minimize potential for claims	• Utilities responsibilities need to be clearly defined in the contract requirements and appropriately balanced between Design-Builder and owner Private utilities: Need to define coordination and schedule risks as they are difficult for Design-Builder to price. Best to have utilities agreements before procurement. Note: By Colorado regulation, private utilities have schedule liability in Design-Build projects, but they need to be made aware of their responsibilities Public Utilities: Design and construction risks can be allocated to the Design-Builder, if properly incorporated into the contract requirements	• Can utilize a lower level of design prior to contracting and joint collaboration of CDOT, the designer, and the contractor in the further development of the design
Environmental	• Risk is best mitigated by obtaining all environmental clearances prior to bid	• Certain environmental approvals and processes that can be fully defined can be allocated to the Design-Builder. Agreements or memorandums of understanding (MOUs) with approval agencies prior to procurement are best to minimize risks	• Environmental risks and responsibilities can be collectively identified, minimized, and allocated by the owner, the designer, and the contractor prior to the negotiation of the construction agreed price (CAP)
Right-of-Way (ROW)	• ROW clearances are best obtained before bid	• ROW clearance commitments can be defined to allow Design-Build before completing all acquisition • ROW acquisition responsibilities and risks can be shared if well defined	• ROW risks and responsibilities can be collectively identified, minimized, and allocated by the owner, the designer, and the contractor prior to the CAP
Drainage and Water Quality	• Drainage and Permanent Water Quality (PWQ) systems are designed prior to bid	• Generally, the owner is in the best position to manage the risks associated with third-party approvals regarding compatibility with off-site systems and should pursue agreements to define requirements for the Design-Builder	• The owner, the designer, and the contractor can collectively assess drainage risks and coordination and approval requirements, minimize and define requirements, and allocate risks prior to the CAP
Third-Party Involvement (FHWA, railroads, Public Utilities Commission [PUC], funding partners, adjacent jurisdictions, etc.)	• Third-party risk is best mitigated through the design process prior to bid to minimize potential for change orders and claims	• Third-party approvals and processes that can be fully defined can be allocated to the Design-Builder • Agreements or MOUs with approval agencies prior to procurement should be obtained to minimize risks	• Third-party approvals can be resolved collaboratively by the owner, designer, and contractor

A Colorado STA example Risk Register is provided in Table 3.5. The example shows a typical Risk Register in the early design phases of a project. As the project design becomes more advanced, the Risk Register becomes more detailed and assigns specific costs and schedule impacts to risks such to help inform mitigation decisions and to determine contingency pricing needs for the project.

Table 3.5: A Sample Risk Register (Colorado DOT)

RISK REGISTER Project Name: Example Project Name						Project Number: XX-XXXX		
Risk Identification			Risk Assessment		Risk Response		Allocation	
ID #	Status	Identified Risk	Potential Impact (cost, schedule, etc.)	Risk Level	Strategy	Response Actions	Risk Owner	Updated
14	Active	Dry utility relocation delays	Project has a number of telecommunication lines that are running the full length of the roadway that will have to be relocated by private utility company, which could substantially impact the project schedule	High	Mitigate	• Work with private utilities up front to develop utilities agreements that include relocation schedule commitments • Remind utility agencies of their regulatory schedule responsibilities (C.R.S. § 43-1-1412)	CDOT	11/24/2014

Utility risks can be substantially reduced if the project team performs comprehensive utility investigations during initial design development. This effort can extend into the procurement process, and up to the issuance of the final RFP. At the very least utilities should be well defined relative to their horizontal locations, and all surface features should be located on plans. Ideally, the investigations should extend to the pot-holing of utilities at key locations to identify vertical depth, confirm horizontal location, and confirm the character of the facility. The Colorado STA defines utility responsibilities and allocates the risk for existing utilities in terms of a defined "Reasonable Accuracy." Reasonable Accuracy is typically defined as the utility horizontal location to within 10 feet, size to within 12 inches, and no depth accuracy. When the utility data meets the Reasonable Accuracy limits, the Contractor is responsible for resolving conflicts. However, when the data does not meet the Reasonable Accuracy limits, the Colorado STA is responsible for the impacts of the conflicts.

The New York STA addresses the utility risks during the risk identification and assessment process. The responsibility for location and accuracy of utility information is addressed as follows:

- Horizontal location (different limits are usually specified for underground and overhead utilities and for projects involving deep trenches or tunnels it may be appropriate to allow a change if the facility has moved inside or outside of the trench or tunnel area);
- Vertical location (usually only warranted at the actual location of the measurement);
- Size of the utility; and
- Type of material.

The New York STA uses the phrase *Order-on-Contract* to describe a written order issued to cover increases or decreases, alterations or omissions to the contract. Within their DB projects there are many situations they highlight where Orders-on-Contract may be required where normally they would not occur in design-bid-build contracts. This is due to the limited scope of design completed by the New York STA and the likelihood that some utility relocation design and/or construction will be performed by the DBT.

The following highlights the New York STA DB Procedure Manual segments relating to the utility related changes:

I. Accuracy of Existing Utility Locations, Size, and Type

The Contract Documents will specify the accuracy limits of the location, size, and type of Material for existing Utilities. If the actual conditions encountered are outside those specified limits of accuracy, the provision will apply for increases and decreases in the scope of work. For example, presume the RFP Plans show a 250 mm steel water main below a road centerline. The Contract Documents state that the horizontal location is accurate within +/- one meter and the size is accurate within 25% of the stated diameter. If the actual pipe is 375 mm in diameter and located one meter to the left of centerline, a significant change in the character of work may result because the actual pipe diameter was off by more than 67.5 mm (25% of 250 mm).

II. *Changes in conflict/no conflict status represented on the RFP Plans and Design Plans or As-built Plans for existing Utilities will qualify for an Order-on-Contract only if the change in status is the result of an inaccuracy outside the specified limits.*

III. *An Order-on-Contract will be required if the responsibility for the design and/or construction of a given Utility Relocation changes from the Design-Builder to the Utility Owner or vice versa.*

IV. *Since the Design-Builder will be designing and constructing the Project, it may have a significant opportunity to change the cost of the Utility Relocation Work. In the course of its design and/or construction of the entire project, the Design-Builder may increase or decrease the cost of Utility Relocation Work without any adverse impacts to itself, in the case where the Design-Builder is not responsible for designing and constructing Utility Relocations. The Design-Builder is required to consider and minimize the impacts on Utility Relocations as the work progresses.*

V. *The Design-Builder is not entitled to an Order-on-Contract if it incurs increased costs to facilitate the avoidance of a Utility Relocation (perhaps the Design-Builder avoided the Relocation so as to avoid adverse schedule impacts, to its benefit).*

VI. *The Design-Builder will be required to reimburse the Department if its design increases Department costs related to Utility Relocations. For example, if the RFP identifies known conflicts and the Design-Builder's design results in more avoidable conflicts than represented in the RFP, the Design-Builder may be held responsible for time and cost impacts associated with the additional utility relocations.*

VII. *The Design-Builder is not obligated to give the Department a credit if it reduces its cost by avoiding a Utility Relocation.*

VIII. *Delays: It should be noted that the contract provides for sharing the risk of delays associated with the discovery of Utilities not identified in the Contract Documents. The Design-Builder is required to assume the time and cost impacts of the first 30 days of delay. Thereafter, the Department is responsible for the time and cost impacts of the delay.*

IX. *It may be desirable to establish a contract contingency to cover relocation of utilities that are not shown on the RFP Plans or described in the scope of work.*

Table 3.6 shows how the New York STA might define the risks for utility relocations along with responsibility and mitigation strategies for the utility relocations within a DB project.

Table 3.6: Risk Identification, Assessment, and Allocation (New York State DOT)

Risk	Description /Effect	Probability	Impact	Rating[1]	Mitigation/Responsibility
Utility Relocations	Time (schedule); cost (who pays)				Get funding for utility relocation; D/B contractor can construct for utilities;
Public		3	3	9	D/B contractor constructs and responsible.
Private		3	3	9	MOU w/ utilities; Early Utility Action contract (i.e. Verizon) may be constructed by D/B contractor using 100% plans; Utilities and D/B responsible.

New York STA, in their Design-Build Procedures Manual, provided a case study of a Utah STA Design-Build project. The project was on Utah's I–15 near Salt Lake City. The utility relocation in the project contained 1500 Crossings, 600 potential Conflicts/Relocations and 40 Utility Owners. Table 3.7 provides the risk allocation regarding the utility coordination for the I–15 project and compares approaches in using DB versus traditional Design-Bid-Build. Table 3.8 provides a responsibility breakdown for each of the 40 utility owners impacted and when the impacts would be mitigated, during design or construction of the DB contract.

Table 3.7: Risk Allocation (New York State DOT)

Risk/Responsibility Category	"Traditional" Design-Bid-Build		Typical Design-Build		I-15 Design-Build	
	Owner	Designer or Constructor	Owner	Design-Builder	Owner	Design-Builder
Final Alignment Geometry	X			X		X
Geotechnical Data	X			X	X	
Environmental Permits	X	X		X	X	
Design Criteria	X		X		X	
Design Defects	X			X		X
Constructibility of Design	X			X		X
Obtaining ROW	X			X	X	
Coordinating with Utilities & Railroads				X	Agreements	Coordination
Quality Control and Quality Assurance	Significant inspection and testing	Quality of Workmanship	Oversight only	X	Oversight Only	X
Coordination with other work	X			X		X

Table 3.8: Utah's I-15 Project - Design and Construction of Utility Work (New York State DOT)

Design and Construction of Utility Work

Utility Owner			Who Does the Work?	
Number	Name	Type	Design	Construction
1	Cahoon & Maxfield Irrigation Company	Irr	DB	DB
2	Insight Cable Television	CTV	DB	DB
3	Midvale City	SS, SD, WTR	DB	DB
4 (&5)	Mountain Fuel Supply Company	Gas	DB	DB
6	Murray City Sewer / Water	SS, SD, WTR	DB	DB
7	Murray City Power - Operations	EL	Utility	Utility/DB
8	Salt Lake City - Dept. of Public Utilities	SS, SD, WTR	DB	DB
9	Salt Lake City Suburban Sanitary Dist. #1	SS	DB	DB
10	Salt Lake City Suburban San. Sewer Dist. #2	SS	Utility	DB
11	Salt Lake County	SD	DB	DB
12	SL County Sewer Imp Dist No. 1	SS	Utility	DB
13	SL County Water Conservancy District	SS	DB	DB
14	Sandy City	SS, SD, WTR	DB	DB
15	Sandy Suburban Imp. District	SS	Utility	DB
16	City of South Jordan	SS, SD, WTR	DB	DB
17	South Salt Lake City	SS, SD, WTR	DB	DB
18	TCI Cablevision	CTV	Utility	Utility
19	US West Communications	Tel	DB	DB
20	Utah Power	EL	Utility	Utility
21	AT&T	No utility conflicts identified at this time.		
22	MCI	FO	DB	DB
23	US Sprint	FO	DB	DB
24	Bell Canyon Irrigation Company	No utility conflicts identified at this time.		
25	Big Ditch Irrigation Company	Irr	DB	DB
26	East Jordan Irrigation Company	Irr	DB	DB
27	Murray Irrigation Company	Irr	DB	DB
28	Union & East Jordan Irrigation Company	Irr	DB	DB
29	Qwest	FO	DB	DB
30	AMOCO OIL Company	Oil	DB	DB
31	Electric Lightwave	FO	DB	DB
32	Brooks Fiber Properties	FO	DB	DB
33	Teleport Communications Group	No utility conflicts identified at this time.		
34	Greenstar Telecommunications	No utility conflicts identified at this time.		
35	Cottonwood Improvement Dist	SS	Utility	DB
~~36~~	~~Union Jordan Irrigation Co.~~ (Combine w/#14)	~~Irr~~	~~DB~~	~~DB~~
40	World Com	FO	DB	DB
41	NextLink	FO	DB	DB
42	Central Valley Water Reclamation	SS	DB	DB

The Washington STA also provides a case stating minor utility conflicts may best be handled by the DBT. For their case project, they conducted a risk assessment physically identifying all existing utilities within the right-of-way, anticipated the effects on utilities, and discussed significant impacts and relocations with utility companies. Washington STA specified all utility efforts required including utility concerns, relocation arrangements, constraints, temporary power needs, and agreements included in the Scope of Work. If the use of the Regional standard practices in coordinating with utility companies were required, the requirements were detailed in the scope of work. In responding to the RFP, the proposers addressed utility impacts, relocations, and coordination activities with the affected parties as part of their proposed approach. Washington STA described the coordination and construction needs involving the impacted utilities in their generic Scope of Work. The intent was to have the DBT contract with the utilities to perform the work. Using this approach, the cost of relocating the utility would be paid by the utility directly to the DBT. However, other approaches were considered including the following:

- Determine how and who will pay for the work, either passing the money through the Washington STA or paid directly to the DBT by utility;
- If by or through the STA, the utility costs must be included in the Proposal, whether in the bid list or in the Schedule of Values by each individual utility;
- The DBT must inform the utilities that they have the option to perform their own solicitation if the DBT prices are too high; and
- If Washington STA is maintaining control and responsibility for the utility relocations, a time frame for utility relocation must be included in the Contract Provisions with schedule impacts then negotiated with the DBT.

STA Policy Manual Practices on Utility Relocation in Design-Build (DB) Projects

It is important to share utility location data with DBT's even during RFP stages of procurement. Unless otherwise stated, it is likely that the DBT will assume all existing utilities are clear of the project. For some states using DB procurements, the STA and utilities will already have an existing agreement prior to award. During the preliminary site investigation, the location and condition of utilities will be determined. In preliminary design, any utilities impacted and requiring relocation will, whenever possible, be relocated prior to the DBT beginning work. Many STAs give the DBT the responsibility for and control of the relocation itself, either directly or through coordinating with the utility. This is when relocation is done in conjunction with the DB contract. Many STAs also mention in their DB manuals that if the preliminary agreement or memorandum of understanding with a utility (public or private) requires modification as a result of the DBT final design, the risk and responsibility for any delays should rest with the DBT.

The DBT also determines the need for utility relocations that are dependent on the design and/or construction activities. Thus, these risks are also under the control of the DBT. The DBT is responsible for the coordination of any necessary relocations. Some investigations conducted by STAs during project development identify significant utility conflicts and address the utilities' special concerns. For example, New York STA mentioned they hold the responsibility to investigate and indicate in the RFP the locations of all potentially affected utilities. They also aim to execute and provide utility agreements covering the design requirements and construction requirements for each utility facility. Past experiences of the New York STA notes distinct advantages to the STA and the project when utility owners allow the DBT to design and construct any required relocations. If the DBT is given the responsibility to design and construct the utility relocations, the DBT has better control of the work and schedule therefore significantly reducing the risks of delay and interruptions. The utility agreements between the New York STA and the utilities should address the following:

- Responsibilities for design and construction of the utility facilities;
- Responsibilities for payment;

- Applicable utility design requirements and construction specifications applicable to each specific utility;
- Utility impact point(s);
- Utility process requirements and time allowance needed for design reviews or construction inspection;
- Any required use of utility-designated designers or construction contractors;
- Identification and scope of required or desired betterments and how payment for betterments will be handled; and
- Any limitations regarding service interruptions.

It is likely that the approach to utility relocations and installations will be markedly different within DB projects compared to those of design-bid-build projects. In DB there may be significantly more DBT involvement in the design and construction of utilities than typical for a contractor. In the design-bid-build process, usually the utility self-performs relocations but there are circumstances where the contractor relocates utilities as part of the contract. These are often services provided by smaller companies or municipalities. Because the Washington STA typically determines the extent of utility impacts during the final design stage of a project and requests relocations, this cannot be accomplished in the same manner in a DB project. Existing utilities within the project limits are identified and their location data is collected to provide to the DBT. Washington STA does not guarantee the accuracy of this information. This requires the information to be confirmed by the DBT through site investigations. Utility and DBT responsibilities need to be clearly defined in the contract requirements and should be allocated between the DBT and STA.

Colorado STA has DB legislation that should any utility choose not to enter into a project-specific relocation agreement with the STA for the performance of utility relocation work, the following may occur:

- The STA may direct the utility to perform or allow the performance of the relocation work within the performance schedule for the DB project.
- The utility company is responsible for damages caused by delays in the utility relocation work or interference with the performance of the DB project by other contractors This includes payments made by the STA to any third parties based on claims that performance of the DB project was delayed or interfered with as a direct result of the utility company's failure to perform the utility relocation work. There is an exception for delays caused by a force majeure.
- The STA may withhold the issuance of a permit for the location or installation of other facilities to a utility company until the company pays the damages caused by the company's delay within the DB project. However, there is an appeal procedure to seek the permit.

It is important to define utility locations within the project scope. This establishes an equal baseline for all proposing DBTs. The Colorado STA follows their standard utility investigation procedures during the initial design development of the DB project. This includes identifying utility owners, utility locations, and anticipated conflicts and relocation requirements. The STA project team provides a utility conflict matrix for the project, which is an excellent tool for communicating such information. The matrix is continuously updated throughout the procurement of the project. Once a DBT is selected, they are required to take over responsibility for the matrix, continuously updating it throughout the project. The Colorado matrix includes the following:

- Identification of existing utilities within the project limits
- Identification of utility owners
- Identification exclusive utility easements and permits
- Potential conflicts, adjustments, and relocations
- Status of utility relocations agreements with costs and work responsibilities
- Anticipated schedules for utility work.

During the planning and development of any roadway project, early utility contact and involvement is advisable, especially if the utility is impacted by the project. This early coordination is likely done in any procurement method by the STA. This not only can save time and money ensures that the DBT has the proper contacts for the project and allows the utilities to plan and budget for the project. Theses contacts are beneficial even when relocations are unnecessary as the DBT is responsible for protecting any utilities within the project limits. During the project development phase, coordinating with the utilities on the project design and construction is critical. The DBT should assemble all information that may have a bearing on the utilities within the project limits. This information includes the following:

- Existing location of each utility, based on survey as possible;
- Proposed location of each utility, for those requiring relocations. Initially, this could be based on relocation maps prepared by the utilities. The DBT will need to coordinate with the utilities and propose new locations if the proposed relocations do not fit with one another;
- Location and identity of any utility easements planned;
- A description of any timing and sequencing requirements in relation to the relocations;
- Coordination processes and end results considering all utilities;
- Relocation schedule as agreed to and documented with all utilities.

The New York STA indicates that agreements with utilities should cover issues that may arise during a DB project. Design-bid-build projects may involve similar issues, but the differences in the timing of design and construction in a DB project necessitates different solutions. Documentation should address issues including the following:

- Responsibility for the design and construction of the utilities with the preferred approach being that the DBT designs and constructs the relocations;
- Design requirements and construction specifications;
- Identification of items for betterments;
- Notifications to the involved parties;
- Review of designs, schedules, and cost estimates by the utility or the DBT;
- Emergency response actions and timing;
- Limitations on timing of construction or interruption of service;
- Damage repair guidelines;
- Inspections and testing by the utility and/or the DBT;
- Approvals (including provisions for early start of construction); and
- Payment approach for relocations.

Many STAs provide available information relative to the location and ownership of existing utilities to DBTs. In consultation with the utility companies, the DBT should determine the specific utility conflicts as the project design is finalized and make arrangements for the utility relocations or adjustments as required.

STA Policy Manual Practices on Utility Coordination and Relocation in Other ACMs

As previously mentioned, few resources are available specifically discussing the utility coordination or relocation efforts on Construction Manager/General Contractor (CM/GC) projects or projects using Alternative Technical Concepts (ATCs). Both of these ACMs align well with using practices involved in traditional DBB procurement.

The STAs in Arizona, Massachusetts, and Montana have policy manuals discussing CM/GC project management. These manuals broadly discuss the following with few details concerning utility coordination. The main highlights regarding utilities are that the CM/GC request for qualifications should include criteria relating to the selection process, the preconstruction scope of work, general construction requirements, and project constraints related to traffic, utilities, environmental issues, permitting, and right-of-way. The manuals also note that the CM/GC should monitor and document changes in the design as well as note their impacts on cost, schedule, and as applicable to laws, utilities, communications, and other related infrastructure issues.

As for ATCs, California's STA has a manual on ATC use containing general rules and regulations. The California manual does not address utility coordination as it may related to the use of ATCs. They do mention that all utility conflicts should be identified and along with having relocation plans. Any relocation of utilities not completed should be addressed in the bid package indicating the date such utilities will be cleared. Any coordination required between the contractor and the utility company must also be shown in the Bid Package. These requirements are the same as if the project was procured through DBB.

Interviews and Discussions with State Department of Transportation Survey Results

It was originally believed that a series of case studies could collect quantitative evidence to distinguish variations between alternative contracting methods and traditional contracting methods. These case studies were going to be collected through two levels of interviews with STAs. Unfortunately, when speaking with selected STAs, the research team was advised that such evidence would be difficult if not impossible to collect. To overcome this challenge, the research team then developed surveys for a new approach to collect relevant information discussed in the next section. In the interviews conducted there were points of value to highlight herein.

In discussions with Delaware, Georgia, Texas and Utah, it was noted that there is often benefit realized in the collaboration of designers, construction contractors, and utility companies in terms of time and cost savings on projects. The majority of the discussion and comments made were about DB projects, some of which were discussed in previous sections. Unfortunately, when asked about the details of costs and schedules, these became less clear. Discussions with the Texas STA perhaps highlighted the reasoning best.

The STA in Texas (TxDOT) arguably has one of the most advanced DB programs within the United States. Their DB program is larger in dollar value than most STA's entire program budget. They have notably been doing DB projects for decades and while the need to collect more accurate cost and schedule data regarding utility coordination and relocation within DB projects has been on their radar, they are just currently emphasizing focus on this task. The topic has come to the forefront as construction contractors and DBT's are requesting that the Texas STA takeback some of the responsibilities for utility coordination and relocation. The contracting community is stating that the pricing of this work is too varied and dependent on third parties to adequately price and feel comfortable taking on the risk.

This discussion of risk is akin to informal discussions the research team held with construction contractors who have done a significant number of DB transportation projects. Compared to the project design teams in DBB projects, DBTs are conducting significantly more Subsurface Utility Engineering and they are seeking higher quality levels. One contractor noted that the majority of their expected budget for utility coordination was expended on potholing alone. DBTs are finding that there are few incentives available to attempt to speed the progress of utility companies when relocations are necessary. This is not meant to be a disparaging comment towards utility companies, as it is understood that there business model does not always allow the prioritization of their relocations to match that of the DBT. Nonetheless, the risk remains and it can entail costly delays.

The question becomes, "How can an STA limit the risk of utility delays in a project where design and construction have become the responsibility of the DBT?" It is easy to see the potential for the DBT to emphasize utility impact areas to promote claims against the STA. However, the DBT's discomfort in managing the utility coordination and relocation process is also a source for increased project cost in the form of risk. In the opinion of the Texas interviewee, this is the investigation that is needed before truly understanding the cost and schedule impacts of utility coordination and relocation within DB projects. The procedures and approaches within DB continue to evolve and change with utility related issues only now getting much needed attention. In the opinion of the interviewee, they noted that just as NCHRP 20-07 Task 373 was ahead of its time given that there was much to figure out in terms of utility coordination in ACMs, this project in evaluating costs and schedules was also ahead of the current practice. That said, it was noted that in the research simply highlighting the issues, it was very much of value.

As for analysis of DB costs and schedules, current practice has been for Texas STA to assign to lump sum line items within their DB schedule of values (DB pay-item approach). One line item is for coordination and one is for adjustment. Since these items are not actual costs and are paid on a percent completion basis, it is very difficult to understand the true cost for either item. In terms of schedule, it is difficult tom make comparisons between a DB and DBB project since within DB projects the design is evolving and all of the needed relocations may not be known when the utility coordination and relocation process begins. While this may happen in DBB, it is much more of an issue in DB projects. In terms of safety and efficiency there is also not much available to compare. Texas STA expects the DBT to abide by their accommodations requirements and Texas STA staff are still reviewing individual agreements. While there is certainly duplication of effort, it is difficult to value and given the nature of a DB project it is required for execution of permits and assurance of compliance with policies and regulations.

Texas STA is beginning to make changes in their utility coordination and relocation approach for DB projects. They are beginning to push more utility coordination in early design by the STA so they limit the amount taken on by the DBT. They are breaking utility coordination into three phases: pre-procurement, during procurement, and post-procurement. They expect this will help to move some of the non-construction utility related costs prior to procurement of the DBT. It will also allow them to provide much more information to the potential DBT's during procurement in order to limit risk. In the during procurement information, Texas is attempting to establish and inform the DBT of available master agreements, desired relocation approaches of utility companies (in contract versus self-performed), long-lead relocation items, etc. Additionally, moving forward, Texas STA is establishing new practices to capture specific details on cost of utility coordination and relocations within their DB projects.

In terms of CMGC and ATCs, the interviewees had fewer experiences with these types of projects but the consensus was that the CMGC projects align well with DBB practices. The discussions revolving around ATCs were that they were only impactful if the ATC involved utilities directly or indirectly by proposed changes creating or modifying utility impacts of the project. In these cases, the project teams should involve the STA utility experts.

State Transportation Agency Survey Results

The central objective of this research was to document reasonably expected outcomes in terms of efficiency, safety, cost, and schedule associated with utility coordination when using various contracting methods (ACMs) on public transportation projects. With the no data available with which to accomplish this objective from a quantitative approach, a more qualitative approach was used in surveying subject matter experts at STAs.

The following definitions, tailored explicitly to utility coordination, are provided to standardize understanding within this research and to standardize responses within a survey. The following definition were provided to survey respondents:

- **Efficiency**: in regard to utility coordination on highway projects would entail a streamlined, procedural, and communicative approach to identifying, managing, mitigating, and resolving any utility interaction or impacts with minimal waste of resources. Examples of inefficiencies would include multiple project team members contacting utility representatives, rework of utility designs or agreements, second move relocations, etc.
- **Safety**: is the control of recognized hazards to attain an acceptable level of risk. Examples of utility-related safety concerns would involve utility damages due to construction, the location of facilities longitudinally under the roadway, or appurtenances such as a gas valve located in the roadway
- **Cost**: in the context of this project, are costs that are associated with the utility agreements and relocations for a project. These costs are those incurred to the public agency as a result of the required relocations of reimbursable facilities
- **Schedule**: is also strictly in the context of the utility coordination and relocation process for a project. It is the amount of time required to reach utility clearance or coordination with the highway contractors work

The following section discusses the findings of a survey conducted. The impacts of interest for the study (efficiency, safety, cost, and schedule) are the central points of comparison made between traditional design bid build projects and the ACMs investigated in the study. The focus areas for investigation within the survey were as follows:

- Identify any utility damages, construction hazards, and other safety concerns occurring due to ACMs compared to Design-Bid-Build
- Identify any inefficiencies in the utility coordination process concerns occurring due to ACMs compared to Design-Bid-Build
- Identify any utility coordination schedule and cost concerns occurring due to ACMs compared to Design-Bid-Build
- Identify any efficiency, safety, cost, and schedule concerns occurring due to Design-Bid-Build

There were two survey questionnaires developed to investigate these questions. One survey was provided to the State Utility Lead, or engineer, at each STA. The second survey was also sent to the State Utility Lead who was asked to forward the survey to their utility coordinators. This second group of respondents was predominantly STA staff though there was a response also from a consultant utility coordinator. The content from the consultant coordinator was used judiciously so the study focus remained on the STA responses. While both questionnaires were designed to collect qualitative data, the second survey included a final attempt to collect quantitative data as well.

The research team developed a list of questions for the online surveys and then vetted those questions with members of the research panel. The questionnaires included 39 questions for the State utility leads and 66 questions for the utility coordinators. The questionnaires were prepared and distributed using Qualtrics survey software. To reduce the overall time needed to complete the survey, the research team added several Yes/No, multiple-choice, and matrices questions that allowed the use of question logic and the ability to skip questions to streamline use by survey respondents. The surveys are included in Appendices A and B with a report of responses in Appendices C and D. Researchers contacted STAs with a short explanation of the project and followed up with a phone call as needed. The survey questionnaire was sent with a detailed explanation of the project, deadline, and contact information for any questions regarding the project. The online survey was open for respondents on November 25th, 2019, and closed on February 1st, 2020. A summary of the received responses is presented in the following section.

State Transportation Agency Utility Lead Survey Responses

To understand the utility coordination impacts of efficiency, safety, cost, and schedule, the research team used the survey responses of the STA utility leads, and made comparisons between traditional DBB projects and those by ACMs. First, it is important to note the origins of the STA responses. The survey questionnaire was distributed to the AASHTO Subcommittee on Right-of-Way. Because of turnover and the breadth of this group, additional contact was made to STAs to ensure the survey reached the proper personnel in all 50 states. Upon closure of the survey, responses were collected from 15 states for a 30% response rate. The STAs responding included Alabama, Arizona, California, Delaware, Kentucky, Georgia, Missouri, New Hampshire, Pennsylvania, South Carolina, Texas, Vermont, and Wisconsin. There were two state responses who did not indicate their STA. Figure 3.8 represents the geographic trends of the respondents.

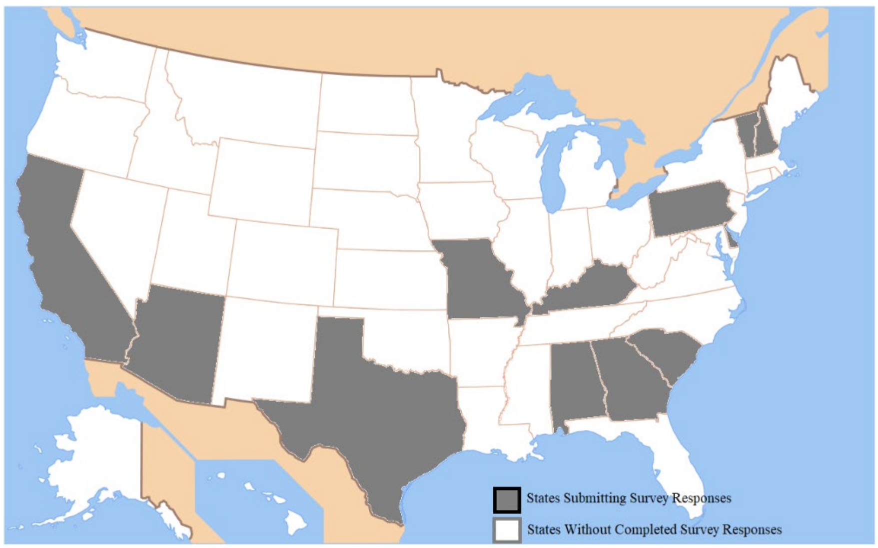


Figure 3.8: Geographic Map of STA Utility Lead Survey Respondents

The survey began by asking which ACMs had been used by their STA. As Figure 3.9 shows, based on the responses received, around 29% of respondents answered that STAs had used Design-Build (DB) and Public-Private Partnerships (P3). About 16% of the respondents had used Construction Manager/General Contractor (CM/GC), and about 19% had used Alternative Technical Concepts (ATCs). The remaining 8% of respondents are not using any alternative contracting methods (ACMs). Additionally, it is important to note that DBB is still the predominant procurement method for all STAs and most ACM guidance suggests caution in ACM use where significant utility impacts might be encountered.

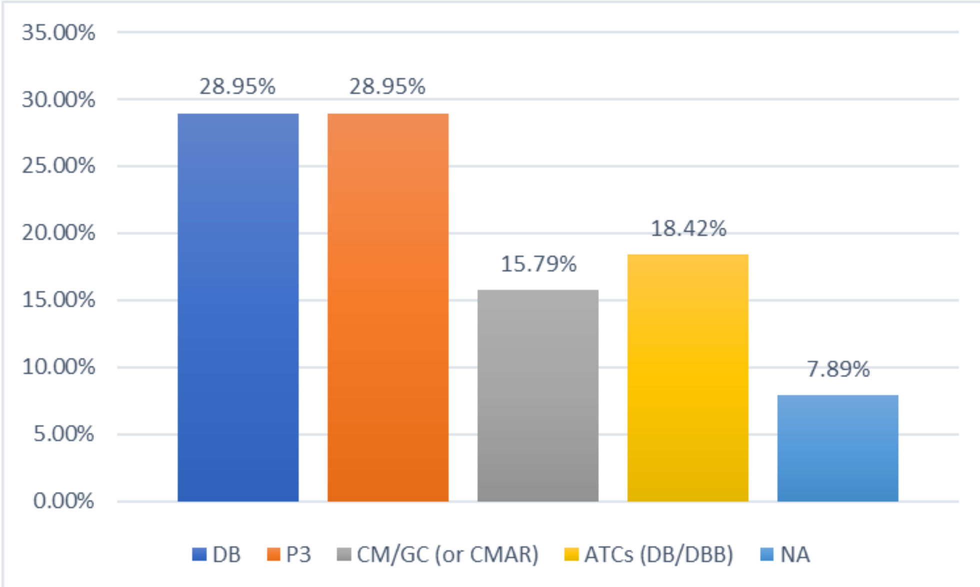


Figure 3.9 ACMs used by STA Respondents

Alternative Contracting Methods compared to Design-Built-Bid (DBB)

Another series of questions asked respondents to identify the impact of the utility coordination process stemming from ACM usage. The impacts investigated included utility damages, construction hazards, and other safety concerns, as well as the inefficiencies, schedule, and cost concerns occurring due to the ACMs compared to Design-Bid-Build projects. A description of the responses received is described in the following figures. Figure 3.10 includes the qualitative responses to the overall rating of efficiency, safety, cost, and schedule for the utility coordination when using Design-Build (DB). Survey participants were asked to compare utility coordination on Design-Build projects and Design-Bid-Build projects for efficiency, safety, cost, and schedule. Regarding efficiency, a significant number of respondents (50%) indicated that DB is worse than DDB. In comparison, 40% answered that both DB and DBB are the same in process efficiency, and a smaller number of respondents (10%) indicated improved efficiency when using DB rather than of DBB.

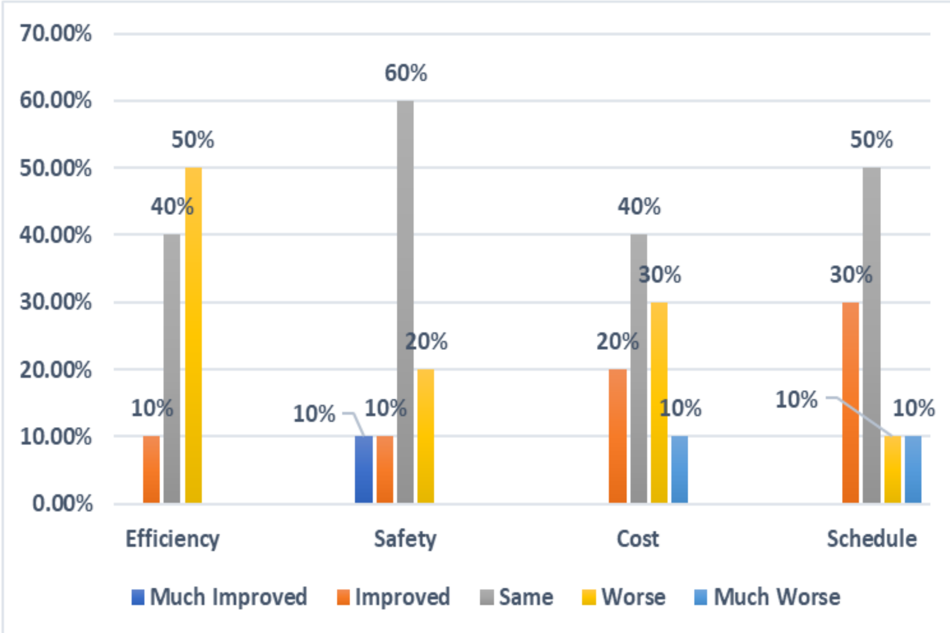


Figure 3.10 Utility Coordination on DB Compared to DBB

When asked about comparisons along utility damages, construction hazards, and other safety concerns, the results indicate that 60% believed these are the same and 20% believed these are worse on DB projects versus DDB projects. When looking at impacts to utility coordination related to cost, the respondents answered that STAs face significant impacts, 30% worse and 10% much worse, for DB versus DBB. Regarding utility coordination schedule concerns, 70% of the respondents believe the impacts are either the same, worse or much worse on DB projects versus DBB, while 30% of respondents answered there was improvement in the project schedule. These responses seem to indicate that DBB has better efficiency, safety and cost, due to on-going relationships, processes, and experience of STAs utility staff, while there are slightly improved or same in schedule for DB projects versus DBB approaches.

Respondents were asked similar questions to compare the utility coordination of Public-Private Partnership (P3) projects and Design-Bid-Build (DBB) projects. Figure 3.11 includes presents responses to the overall rating of efficiency, safety, cost, and schedule for the utility coordination of P3 projects compared to DBB projects. Most of the respondents indicated some level of improvement in efficiency, safety, and schedule, while 43% indicated that the costs were the same or worse compared with DBB. The comparisons of Figures 3.10 and 3.11 would seem to indicate that the P3 team performs better than the DBT. This may be an indication of longer project responsibility typically involved with P3 projects.

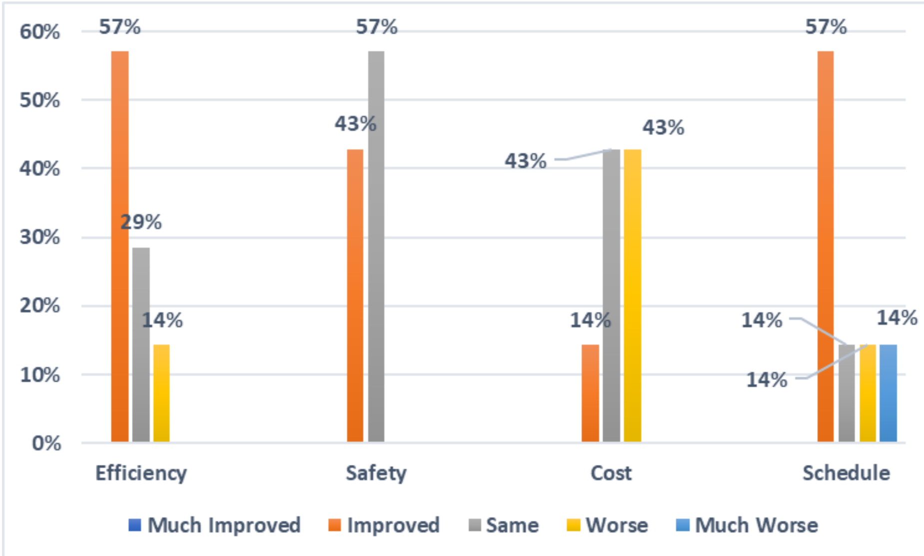


Figure 3.11 Utility Coordination on P3 Compared to DBB

Figure 3.12 shows a breakdown of the overall rating of efficiency, safety, cost, and schedule for utility coordination when using CMGC compared to DBB. From Figure 3.12, there are no noted improvements in efficiency, safety, cost, and schedule when using CMGC relative to utility coordination. The majority of the participants, 60% to 80%, feel CMGC utility coordination has the same results as DBB. There was also no difference in the relative ranking of the respondents on efficiency, safety and schedule compared to DBB. This supports previous discussion that the utility coordination and relocation efforts for CMGC projects can be handled in much the same way as DBB projects.

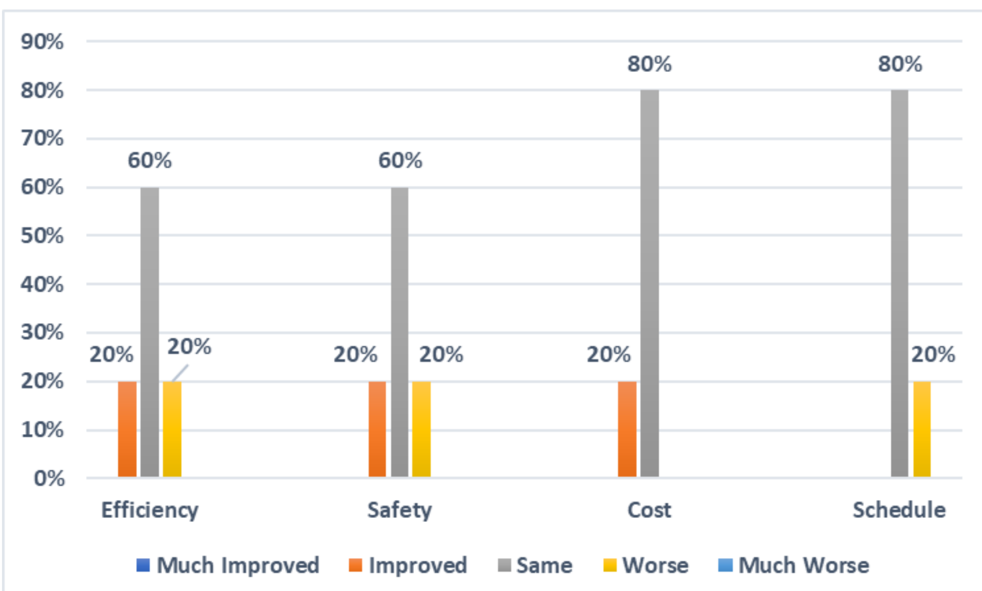


Figure 3.12 Utility Coordination on CMGC Compared to DBB

Responses on the overall efficiency, safety, cost, and schedule for the utility coordination when using ATCs (with either DB or DBB) compared to traditional DBB, are shown in Figure 3.13. Over 50% of respondents from state utility leads said their states did not indicate any change in safety and cost and 75% felt there were no schedule effects when using ATCs. While 25% indicated much improve schedule when using ATCs compared to DBB. In comparison to efficiency, all participants respond equally, 25% answered that both ATCs and DBB are the same in process efficiency, and 25% of respondents indicated improved and much improved in process efficiency when using ATCs rather than of DBB. Also, 25% indicated that the efficiency were worse compared with the DBB. The dispersion of responses may indicate there is some uncertainty about this line of questioning. Similar feedback of confusion regarding the use of ATCs was heard in the interview discussion. Most felt that if utilities were involved in the ATC, STA or consultant utility experts should also be involved. The use of ATCs is more of an additional contracting tool than an actual procurement method.

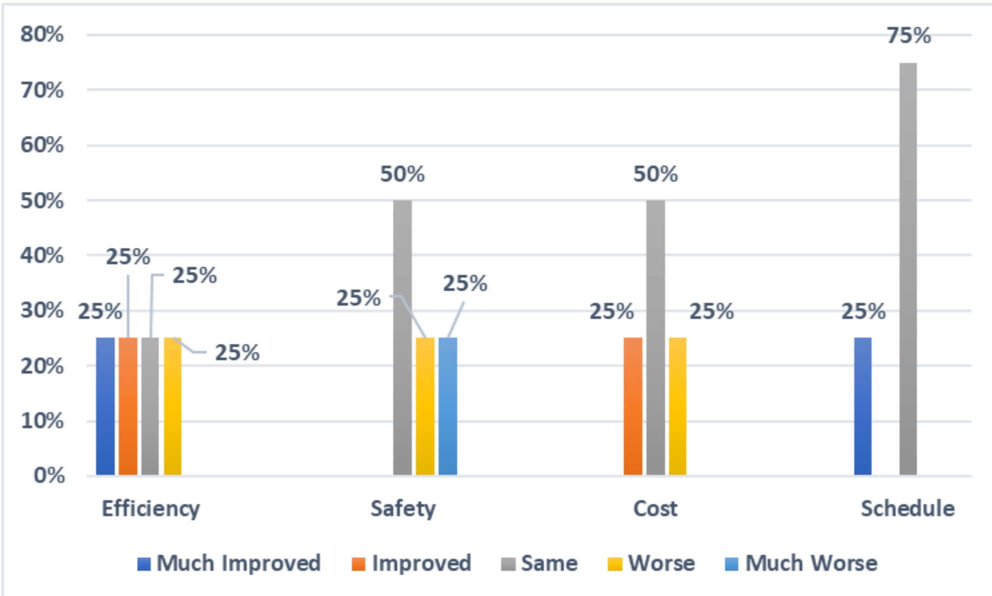


Figure 3.13 Utility Coordination on ATCs (DB/DBB) Compared to DBB

General Comparison of ACMs to DBB

Survey participants were also asked if using ACMs, DB, P3, CMGM and, ATC (DB/DBB), contributed positively or negatively to the utility coordination and relocation processes compared to traditional DBB projects. These comparisons were asked along the criteria of cost, schedule, safety and efficiency. Figure 3.14 shows that 50% of the respondents indicated that the various delivery methods contributed somewhat positive and neither positive nor negative compared to traditional DBB projects. An indication of no extreme changes or impacts either positively or negatively. Some of the respondents (25% relative to efficiency and cost, 33% relative to schedule, and 17 % for the overall project) indicated somewhat negative changes compared to traditional DBB projects.

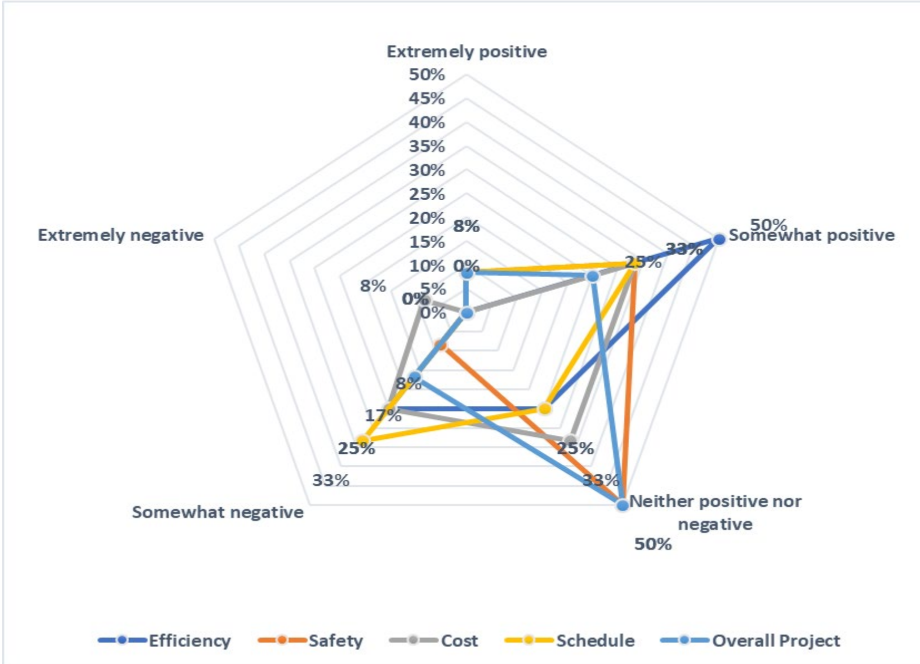


Figure 3.14 ACMs General Comparison to DBB

Survey participants were also asked about the satisfaction level in utility coordination on ACM delivered projects. Figure 3.15 presents the level of satisfaction in using ACMs in utility coordination. The figure shows the responses in 5 categories, where each color represents the responses for a particular ACM. Respondents were allowed to rank one or more types of the ACMs. All the applicable respondents selected somewhat satisfied or neither satisfied nor dissatisfied in describing the success of ACMs within their states relative to utility coordination on ACM projects. Only 20% using ATCs (DB/DBB), 11% using P3, and 18% using DB were somewhat dissatisfied using these ACMs in their states.

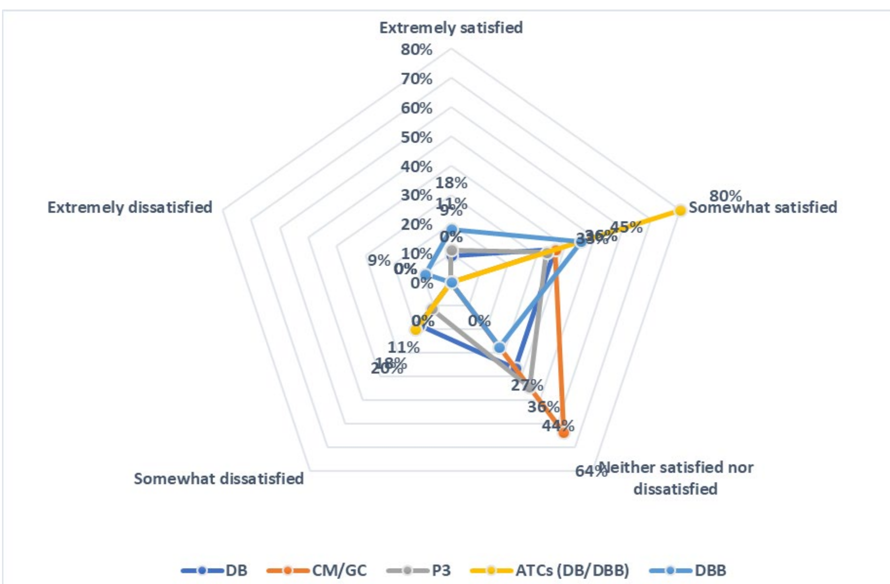


Figure 3.15 Level of Satisfaction in Utility Coordination process using ACMs

Comparison of Utility Coordination by Provider

The survey respondents were also asked about the providers of utility coordination services that had been used on ACM and DBB projects at the STAs. Respondents were allowed to select none, one, or more than one type of utility coordination method for each contract method. As seen in Figure 3.16, based on the responses received, around 36% of the respondents answered that STAs had used in-house or consultant utility coordination when using DBB. The 13% stating that the P3 Concessionaire/DBT conducted utility coordination for DBB projects is believed to reference the construction contractor. About 38% of respondents indicated using the P3 Concessionaire/Design Built Team when using DB, and about 50% have used other types (assumed hybrid approaches) when using DB. The responses would seem to indicate, as expected, that more of the consultant forces and construction contractors are more involved in utility coordination within DB and P3 projects.

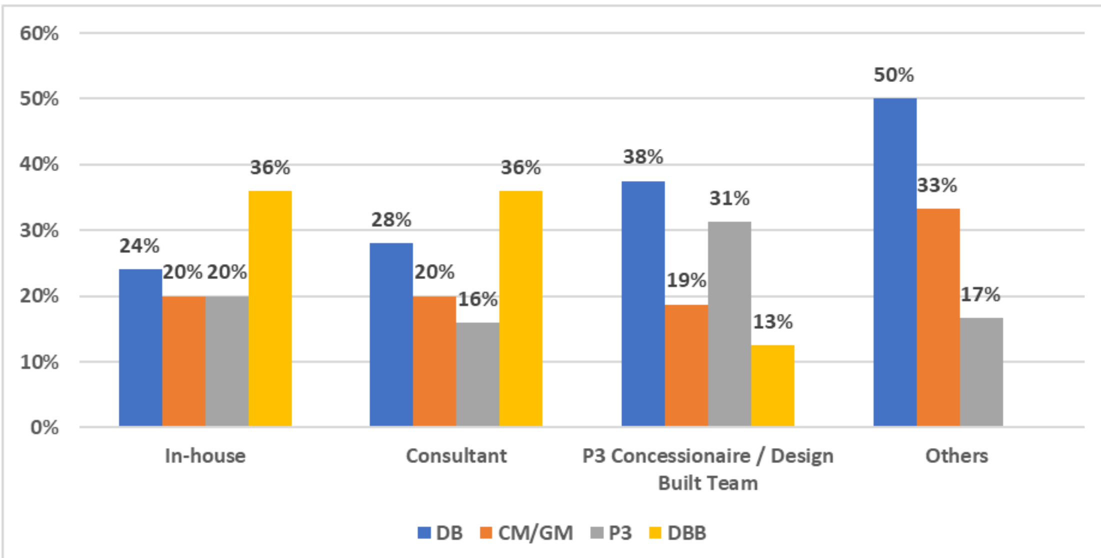


Figure 3.16 Providers of Utility Coordination in ACM and DBB Projects

Figure 3.17 presents the level of satisfaction in efficiency, safety, cost, and schedule on utility coordination when performed by the STA in-house. The figure shows that most of the applicable respondents selected somewhat satisfied (71% efficiency, 43% safety, 57% cost and 43% schedule) and neither satisfied nor dissatisfied (21% efficiency, 29% safety, 36% cost and 36% schedule) while only 7% and 21% selected somewhat dissatisfied in cost and schedule respectively. Some respondents, 7% and 29%, selected extremely satisfied with efficiency and safety, respectively. Additional comments to support their feedback was also provided. STAs mentioned some of the dissatisfaction is related to challenges in staff turnover, lack of experience when performing in-house of utility coordination services, and that some in-house managed projects find more difficulty in securing final plans leading to longer schedules and frustration with coordination.

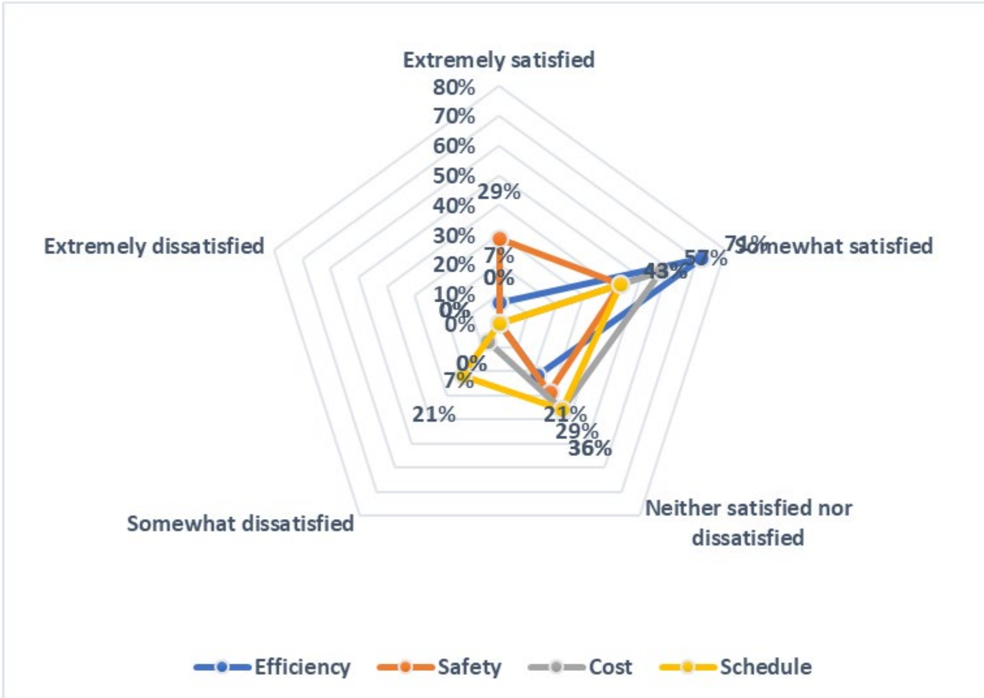


Figure 3.17 Overall Satisfaction in Utility Coordination when Performed In-House

A similar question was asked of the state utility engineers and leads, but in regard to utility coordination performed by consultants. Figure 3.18 presents the level of satisfaction provided by the respondents. The figure shows that most of the respondents selected somewhat satisfied (27% efficiency, 64% safety, 18% cost and 36% schedule) and neither satisfied nor dissatisfied (55% efficiency, 27% safety, 45% cost and 55% schedule). Only 18%, 27% and 9% of the respondents selected somewhat dissatisfied in efficiency, cost and schedule respectively. Some additional feedback was received from the utility leads according to consultant led utility coordination. One respondent noted that final plans and decisions to relocate facilities occur more quickly when using consultants and the engineering required to avoid utility conflicts is often overlooked. Another respondent noted that performing the utility coordination through in-house staff is better than consultant-led utility coordination and they do not plan to use consultants in future projects. Reasoning for this decision was that there procedures require the agreements for utility relocations to go through the same approval process as when using in-house staff and there is no improvement when using consultants.

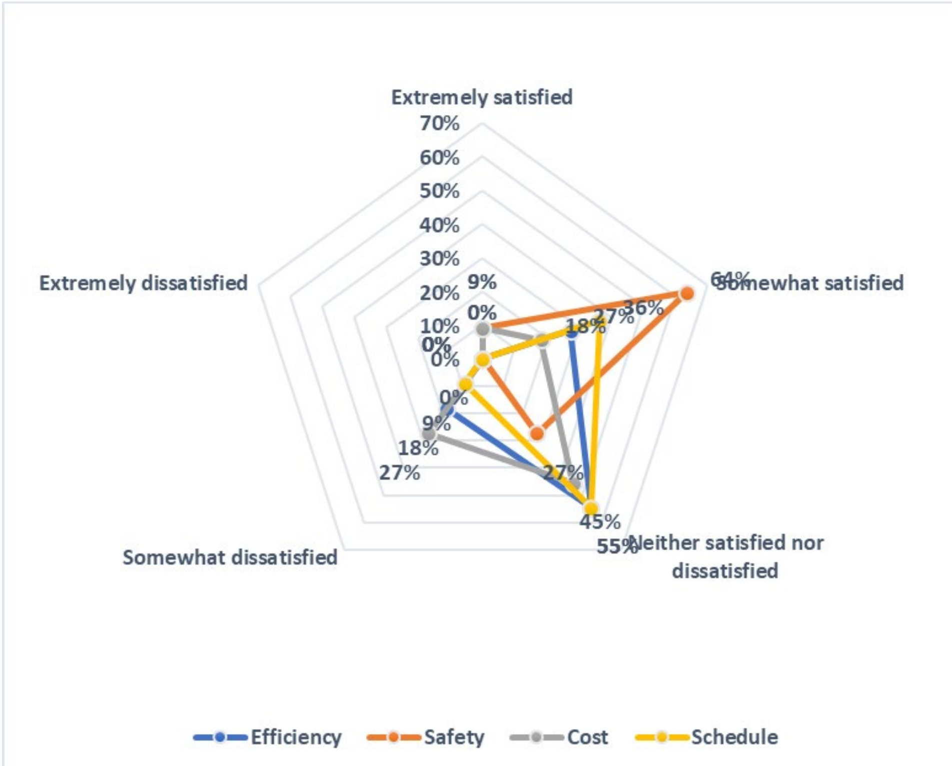


Figure 3.18 Overall Satisfaction with Utility Coordination Performed by Consultants

The utility leads were also asked how they would rate the overall impact areas (efficiency, safety, cost, and schedule) on utility coordination when performed by the P3 Concessionaire or the Design Build Team. Figure 3.19 shows that the responses indicate most of the respondents found more satisfaction in efficiency, no strong feelings on safety and costs, and were more dissatisfied in terms of cost. While only 20% of the respondents selected extremely satisfied related to efficiency of utility coordination performed by the P3 Concessionaire or Design Built Team, one respondent noted that performing the utility coordination in this approach could lead to project delays due to the difficulty in working with conceptual plans and the lack of experience of the DBT and P3. The same respondent noted their STA is new to using DB and P3 and these project methods are seeing many delays working with the utility companies.

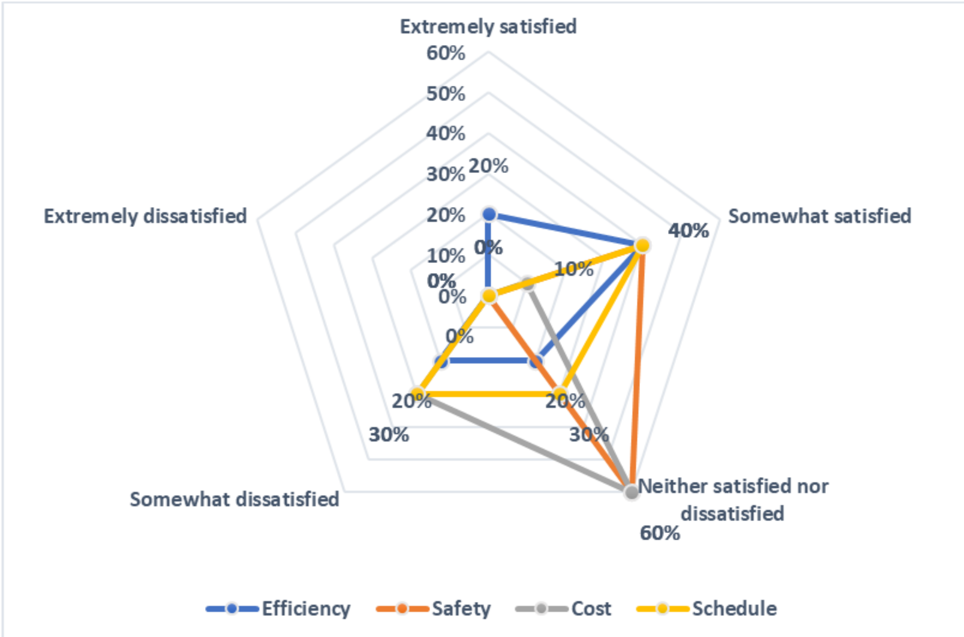


Figure 3.19 Overall Satisfaction in Utility Coordination when Performed by the P3 Concessionaire/Design Built Team

Availability of Utility Coordination Data

When the state utility leads were asked about quantifiable data for comparing the utility coordination efficiency, cost, safety, and schedule between a DBB project and projects delivered by ACMs, all of the respondents noted they were not able to quantify their claims or provide data to do so. All respondents indicated that they had issues with utility data collection. One respondent noted they tended to work most issues out in meetings. While another responded that they did not feel there was enough experience with ACM delivered projects to make quantifications. The responses seem to indicate that a needed area of research and attention is in better methods for record keeping and recording project impacts associated with utility coordination and relocations regardless of project delivery method but certainly according to specific delivery methods.

State Transportation Agency Utility Coordinator Survey Responses

To further understand utility coordination impacts of within ACM projects, the research team also conducted a survey of STA utility coordinators. A request was made to submit data relating to traditional Design-Bid-Build (DBB) projects and alternative contracting methods (ACMs) projects. The requested data for both DBB and ACMs projects included project descriptions, project start and end dates, project costs and number of utility companies impacted or potentially impacted, etc. In this way, it was hoped that there would be cases collected of both DBB projects and those delivered using ACMs. Unfortunately few cases were received and responses were only collected from 5 STAs and one consultant. The responses were pooled for analyzing results. Those responding included Arizona, South Carolina, Wisconsin, Virginia, Pennsylvania, and T2 Utility Engineers, Inc. as shown in Figure 3.20.

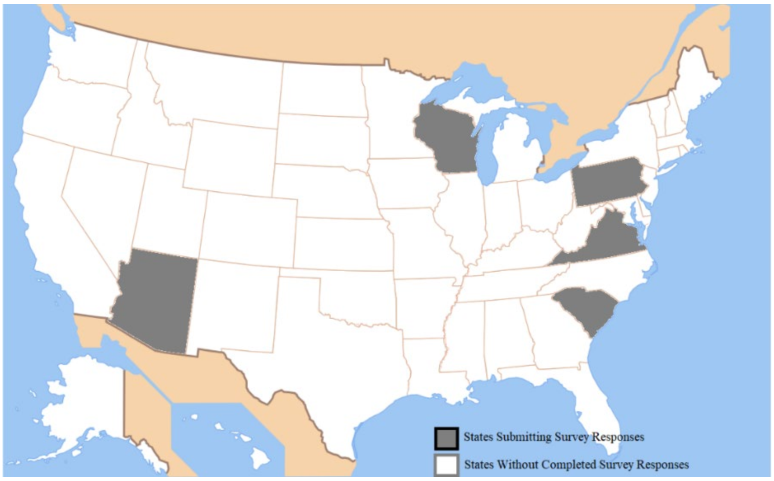


Figure 3.20: Geographic Map of STA Utility Lead Survey Respondents

Feedback from State Transportation Agency Utility Coordinators on DBB Projects

Several questions were asked to attempt to collect utility coordination data relative to the efficiency, safety, cost, and schedule in DBB projects. First, the utility coordinators were asked if the utilities were clear prior letting/construction. All of the utility coordinators reported that the utilities were not clear prior letting/construction for the submitted example projects. Respondents noted several reasons for this. One respondent note that the utilities were not clear prior letting/construction due to the project being constructed in phases allow for business access. Another noted non-clearance of the utilities prior letting/construction was due to a special provision to allow time and space for on-going utility relocations to occur simultaneously with project construction. This response was also similar to a response noting utilities, such as deep sewers, were to be constructed concurrently with some roadway work. Still other respondents noted less positive reasoning such as weather with one stating they believed that the majority of the delays encountered during a project were the result of utilities not being relocated in advance of the project.

Utility coordinators were asked about the type of utility coordination approach used for their submitted DBB projects. Figure 3.21 indicate 50% of the respondents used in-house utility coordination, 37% used consultant-led utility coordination, and 13% of respondents replied to having used other types of utility coordination.

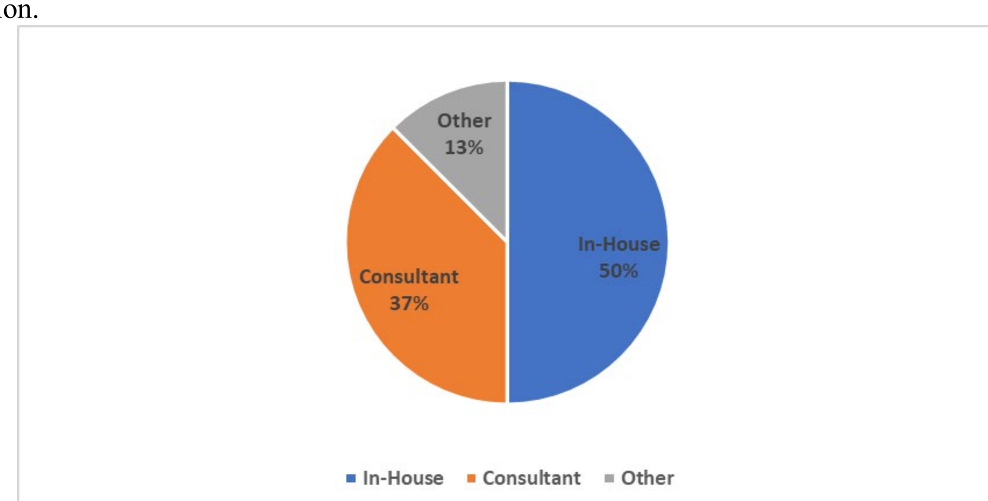


Figure 3.21: Utility Coordination Approach on Submitted DBB Projects

The utility coordinators also commented on the overall efficiency, safety, cost, and schedule of the DBB projects compared to what they viewed as typical utility coordination of a DBB project. The results are shown in Figure 3.22. Over 67% of respondents submitted a project they considered to be better than average on efficiency and average in safety and cost while worse than average in the schedule. The utility coordinators presented reasoning for these impacts. One respondent noted in regard to efficiency, that it had to be efficient as the utility coordinator picked up the project at 95% design complete and had to clear the project and coordinate the utility relocations very expeditiously. This was due to shortages in staffing. Another noted multiple meetings were held with utilities prior to the project letting but utilities did not prioritize their relocations until the last minute leading to delays and, in turn, added construction costs. Also, in terms of efficiency a respondent stated that using consultant-led utility coordination can also cause problems if the utility is getting conflicting information from the STA and consultant on the same utility impacts or agreements.

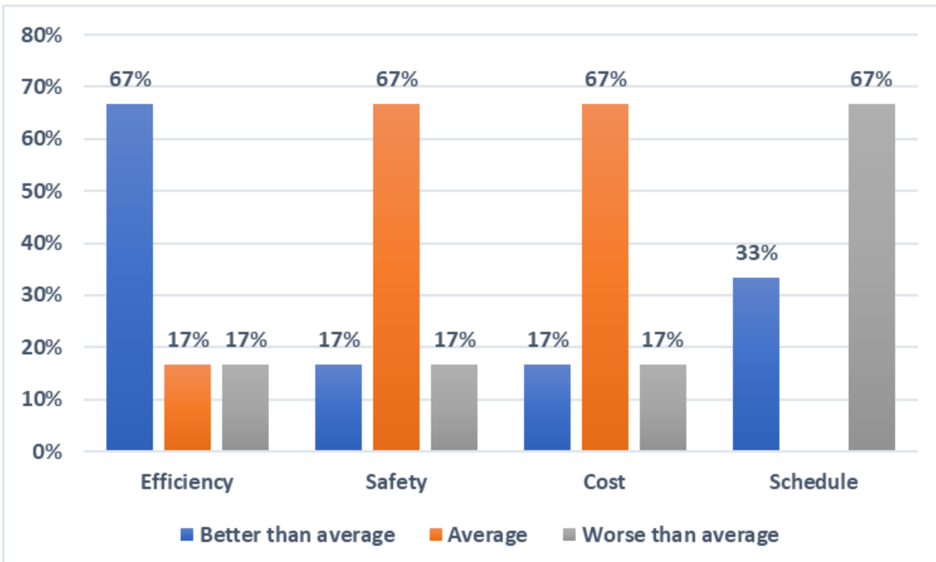


Figure 3.22 Utility Coordinators Project Rating Compared to a Typical DBB Project

Feedback from State Transportation Agency Utility Coordinators on ACM Projects

Researchers also asked the utility coordinators to submit ACM example projects. As Figure 3.23 shows, 80% of the ACM submitted projects were Design-Build (DB) and 20% were Public-Private Partnerships (P3). No respondents provided examples of Construction Manager/General Contractor (CM/GC) or Alternative Technical Concepts (ATCs) projects.

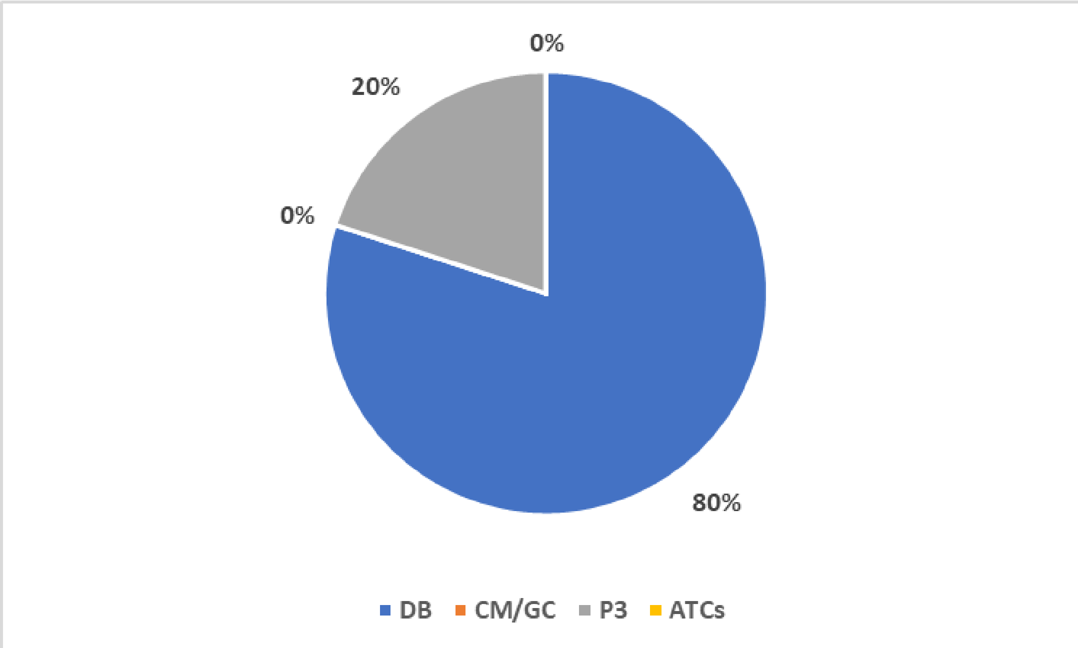


Figure 3.22 Utility Coordinators Use of ACMs

Utility coordinators were asked if utility coordination was provided by in-house or consultant involvement in their submitted projects. The respondents, indicated that utility coordination entailed in-house involvement even when utility coordination was provided by a consultant. Respondents went on to note that they ensure the Design-Build Team follows state and federal regulations regarding the utility coordination effort. Therefore, there is some loss in efficiency. Another respondent, from a STA with an advanced ACM program, noted that they relocated utilities in a certain phase of the project in advance in order to accelerate construction and provide a working area for the contractor while finalizing the design of other phases of the project. Another respondent noted their original contract intent was for the P3 concessionaire to handle all utility coordination and the STA to only provide administrative support for utility reimbursements. This evolved into a year and a half contract including STA staff assisting with the coordination effort.

In regard to consultant-led utility coordination, and for comparison to ACM projects, the respondents were asked if in-house utility coordination involvement was still required to assist consultant-led efforts on DBB projects. Figure 3.23 shows the majority (75%) of the STAs see their in-house staffing being called in to assist consultant utility coordination on DBB projects. About 25% of respondents noted that their consultant-led utility coordination on DBB projects could occur without significant DOT input. When asked for additional details, one respondent felt consultant utility coordination provided an improvement. Another noted that STA oversight is part of the consultant utility coordination agreement as the STA is held accountable if the consultants do not follow their prescribed utility coordination process. Another STA assigns in-house utility coordinators to assist with DB projects and involvement is dependent on the DBT responsible for the utility coordination as well as the reaction from utilities. Another respondent handles the reimbursement process for all projects irrespective of contract method type.

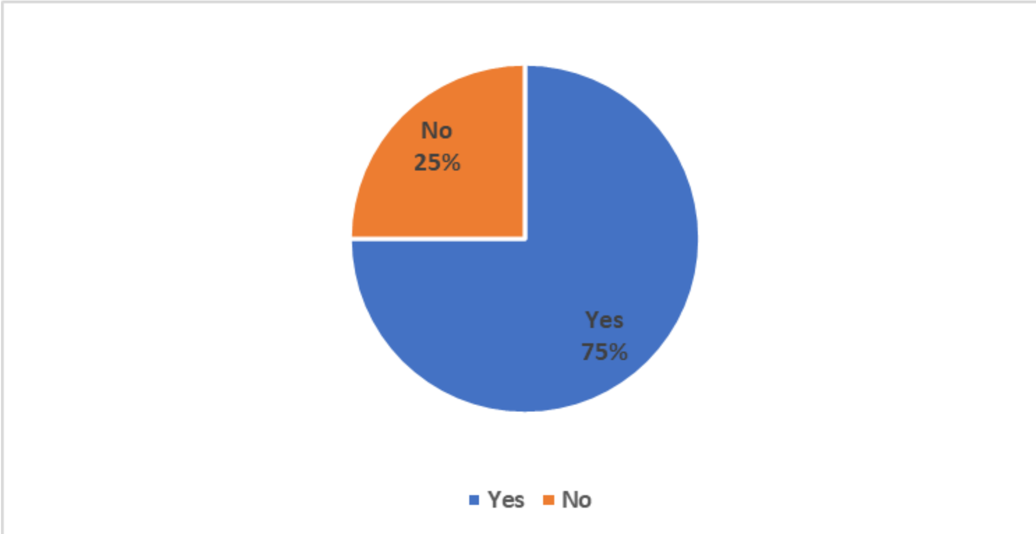


Figure 3.23: STA Assistance on Consultant/other Utility Coordination Involvement on DBB Projects

Utility coordinators were asked their feelings on the overall efficiency, safety, cost, and schedule of the utility coordination when using DB in their submitted example project. As shown in Figure 3.24, over 67% of respondents reported better than average results in efficiency and safety, while results were split for cost and schedule. When asked for additional details, one STA noted the DBT communicated more frequently, held recurrent meeting, and had better tools than those used by the STA. Others noted that contractor involvement in the utility coordination process led to avoidance of fragile or long-lead apparent utility relocations. Also noted by one STA, was that in their provided example the DBT ensured all accommodation policies were met.

Regarding the impacts to cost during DB projects, it was again noted that determine cost impacts is difficult as items are paid by the lump sum. One respondent did speculate that the DBT lost money due to the level of utility coordination performed by their consultant.

Concerning schedules, it was noted that limited designation of utilities early in order to allow the DBT the opportunity to select locations for pot-holing can lead to unknown conflicts that can be very difficult to resolve. The level of utility investigation to be completed in early phases of the DB project should be done so with care. The more information provided to the DBT the better prepared they can be for design and the less risk they assume.

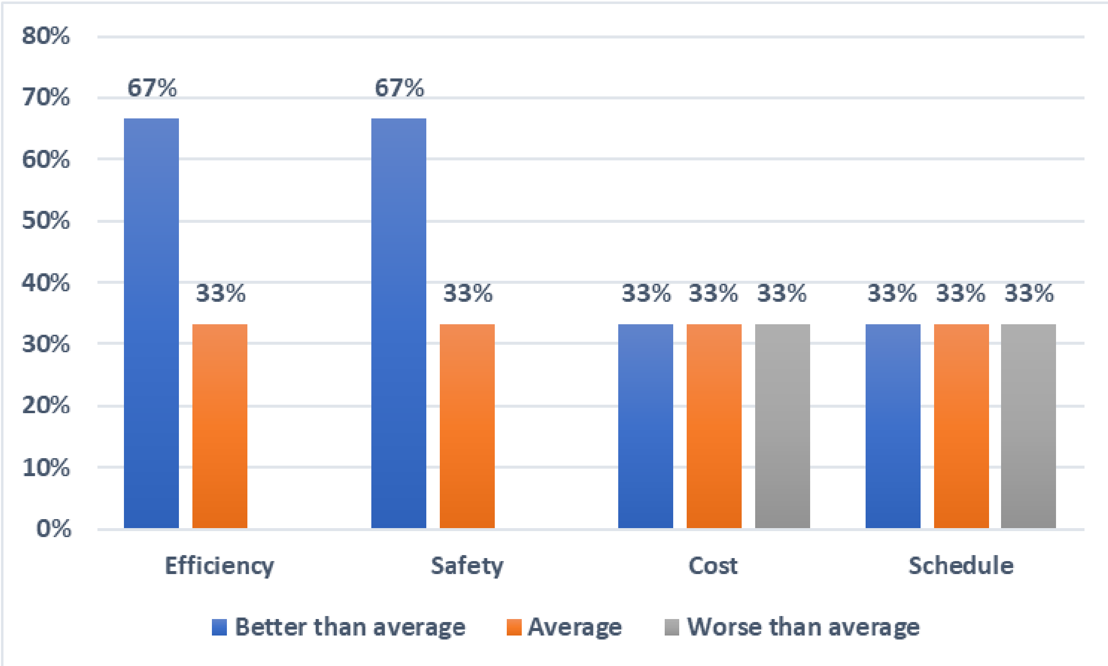


Figure 3.24 – Utility Coordination Rating in Submitted DB Projects

Utility coordinators were also asked for the overall efficiency, safety, cost, and schedule of the utility coordination when using P3. Figure 3.25 shows a summary of the responses received. The responses indicate better than average in efficiency and schedule while only average in safety and cost. When asked for additional details, a respondent mentioned that they were able to accomplish a significant amount of utility relocation work in a short amount of time when using P3. The project management approach allowed the team to be more agile then what they typically seen on non-ACM projects. Standard safety and review processes were well established during the procurement. Regarding the impact of cost during the P3 projects, a respondent mentioned that the rates of pay for utility coordination were similar to what they see on non ACM projects. These rates on a P3 project are by lump sum so they are difficult to accurately track. At the same time and regarding the schedule, the coordination pace was aligned with the intent of the project; fast-paced.

Figure 3.25: Utility Coordination Rating in Submitted P3 Projects

Researchers finally asked if there were any delays or change orders due to utility-related issues when using ACMs. All respondents noted there were delays and change orders in the projects identified using ACMs due to utility-related issues. When asked for additional details, the respondents collectively indicated that delays existed even with extensive support by the contractors to assist the utilities in conflict. The consensus was that unforeseen circumstances exist, especially with underground utilities.

From these surveys, the literature review and interviews, the research team had a solid basis of qualitative information with which to present findings and conclusions. These are highlighted in the following chapter.

CHAPTER 4

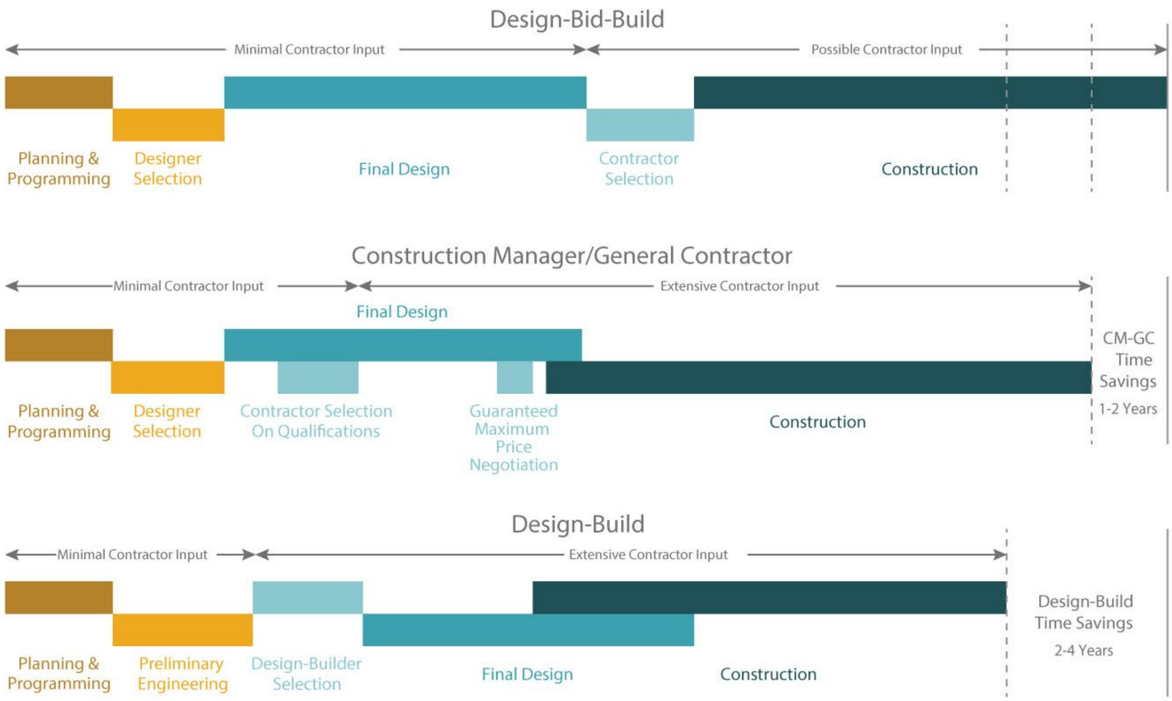
Conclusions and Suggested Research

Utility Coordination Impacts Related to Using ACMs Overview

This research set out to document the expected utility coordination impacts of using specific ACMs with regard to efficiency, safety, cost, and schedule. Two fundamental principles in understanding these impacts are to 1) understand the objectives of utility coordination and 2) understand the project development processes of the ACMs, why they are used, how risk is allocated within them, and how they relate to utility coordination processes.

First, the utility coordination process is an element of both project development and delivery of transportation projects that can be fundamentally influenced by the contracting methods used. This influence has much to do with the time and effort allotted to conduct utility investigations, identify and potentially avoid conflicts between utility infrastructure and the proposed project design, and the collaboration with utility companies for any needed relocations. Effective utility coordination can improve the delivery of transportation and other capital facility projects and reduce project risks posed by delays, safety hazards, and cost overruns. Utility coordination is a term often used to discuss both the coordination of the project design and construction with potential and actual utility conflicts as well as mitigating and resolving these conflicts through relocation of utility facilities. Beyond the state and federal statutes governing these processes, a third party, the utility company, is not going to prioritize relocation over their business purpose when they must expend resources that in some cases are not reimbursed to resolve conflicts. Utility coordination is largely a collaboration effort built on relationships and communication between the STA, potentially consultant utility coordinators, and the utility companies.

Second, a great graphical representation of ACMs and their timeline was provided earlier from the Nebraska STA. Figure 4.1 presents the general process timeline for design-bid-build (DBB), construction manager/general contractor (CMGC), and design-build (DB) projects. The two other ACMs identified for investigation within this study are public-private partnerships (P3) and alternative technical concepts. As will be defined in the following, P3 is not separately broken out since it is considered a special case of DB. Also within this study was the investigation of alternative technical concepts (ATCs). This is also not included in Figure 4.1, as it is a contracting tool used in addition to a contracting method. Definitions of these methods and tools follow but what is also important to note is the window of time available to conduct utility coordination, specifically for utility investigation (potentially beginning in early design or planning) and utility relocation (typically occurring toward the end of final design and into construction). The time savings noted in both CMGC and more so in DB, are occurring by reduced windows of time where STAs would typically conduct utility coordination and relocations.



- **Design-bid-build:** is referred to as the traditional contracting method for transportation projects. The approach involves the completion of the project design, a selection process of a construction contractor through a bid letting, and followed by construction of the project.
- **Construction Manager/General Contractor:** consists of a design phase where the STA brings on a contractor acting as a consultant to the design process reviewing and making recommendations on risks, constructability, and other issues such that the design team is able to make use of contractor expertise. When design is complete, the consultant contractor from design has the opportunity to bid on the project and may be awarded the project as the general contractor if the owner, designer and independent cost estimator agree that the contractor has submitted a fair price. If the price is not agreed upon, the project may be put out to letting. (22)
- **Design-build:** combines some level of the project design phase (varies, STAs typically complete early stages of design) and the construction phase into a single contract. The contracted design-build team is responsible for both completing the project design and construction activities. This approach can reduce delivery time and reduce the potential for cost increases due to design errors or discrepancies between design plans and construction activities. DB projects can be award as “low bid” or “best-value.” (22)
- **Public-Private Partnerships:** are an innovative delivery model building upon design-build delivery. The approach entails early collaboration in the design and construction and it can take on many forms regarding the finance and maintenance of the project. Some examples are Design-Build-Operate, Design-Build-Operate-Maintain, Design-Build-Finance, Design-Build-Finance-Maintain, and Design-Build-Finance-Operate-Maintain. (23) As noted, the design and construction aspects of a P3, which involve utility coordination, will very much follow the design-build method of delivery.
- **Alternative Technical Concepts:** are noted as an alternative contracting method by the Federal Highway Administration. While this is somewhat a misnomer as ATCs are tool that can be applied to multiple delivery methods to seek contractor provided innovative solutions promoting

efficiencies, reduced risks, accelerated project delivery schedules and reduced project costs. Within this tool, contractors submit innovative, cost-effective solutions that are equal to or better than the STA's design and/or construction criteria. STAs have used ATCs within DBB, DB, and CMGC. (22)

As can be inferred from these ACMs, they entail some similar goals in garnering early contractor involvement, thorough evaluation of project risks, and condensed project development and delivery. In terms of their use, the predominant delivery method for transportation projects is design-bid-build (DBB). DB has been gaining ground and according to a recent study, DB will represent 43% of the construction put in place from 2018 to 2021. (2) However, as of 2019, DB is still not a legislatively approved method in five states. CM/GC is a much less used approach in the transportation sector though it too is gaining popularity.

This research represents an early opportunity to investigate ACM impacts along criteria of efficiency, safety, cost, and schedule for better alignment of utility coordination practices to particular delivery methods. The following definitions, specifically tailored to utility coordination, were used within this study to standardize these areas of impact:

- **Efficiency:** in regard to utility coordination on highway projects would entail a streamlined, procedural, and communicative approach to identifying, managing, mitigating, and resolving any utility interaction or impacts with minimal waste of resources. Examples of inefficiencies would include multiple project team members contacting utility representatives, rework of utility designs or agreements, second move relocations, etc.
- **Safety:** is the control of recognized hazards to attain an acceptable level of risk. Examples of utility-related safety concerns would involve utility damages due to construction, the location of facilities longitudinally under the roadway, or appurtenances such as a gas valve located in the roadway.
- **Cost:** in the context of this project, are costs that are associated with the utility agreements and relocations for a project. These costs are those incurred to the public agency as a result of the required relocations of reimbursable facilities.
- **Schedule:** is also strictly in the context of the utility coordination and relocation process for a project. It is the amount of time required to reach utility clearance or coordination with the highway contractor's work.

These impacts of interest for this study (efficiency, safety, cost, and schedule) are the central comparisons to be made between a traditional design bid project and the alternative contracting methods discussed above. While the data was not available to make quantitative comparisons across these impacts the qualitative comparisons presented in Chapter 3 along with the literature and policy reviews and interviews are very insightful to improving utility coordination within these ACMs.

Highlighted Conclusions & Recommendations

The data presented within Chapter 3 serves as the supporting background for the following highlighted conclusions of this research study.

1. *ACM Impact on Utility Coordination Process:* There are indeed differences perceived in utility coordination on ACMs when compared to DBB projects and there is a difference perceived in consultant-led utility coordination versus in-house utility coordination. To a degree, oversight from in-house staff will always be needed to ensure compliance with state and federal regulations. Also, some permitting processes require STA involvement. In these instances, there can be some loss of efficiency. There can also be perceived differences in that in-house staff with

experiences will likely have established relationships with the utility companies in their area, a consultant may or may not. These relationships have been seen to have significant impact on project utility coordination.

2. *Data Collection Requirements:* To quantify the impact of ACM's on utility coordination there is a need for improved data collection in regard to utility coordination and relocations on all projects, particularly on ACM delivered projects. The use of lump sum payment terms for utility coordination and adjustments does not allow performance measurement or thorough evaluation. This is in alignment with a recent FHWA Utility Program Review.
3. *Utility Coordination Training:* Utility coordination is often viewed as a trivial task capable of being completed by contractors or consultants. Being that several instances were noted of consultant-led utility coordination requiring substantial assistance from STA in-house staff, it is clear that the practice takes regulation familiarity and local relationships. This has led several states to develop utility coordination training programs for their consultants, though only time will assist in building the important relationships.
4. *Consultant Utility Coordination:* There is substantiation that consultants conducting utility coordination for ACM projects have more resources, or at least time, to conduct the coordination efforts. Some have experience from multiple STAs exposing them to an assortment of tools and effective practices. It has also been noted from utility companies that consultants at times communicate more frequently and professionally that STAs. While possible, this is likely the result of a small number of projects within their utility coordination case load compared to a typical STA in-house utility coordinator.
5. *ACM Impact on Utility Coordination Cost:* The use of ACMs regarding costs of utility coordination is viewed as likely being higher typical DBB projects. There can be many reasons for this but one of the most likely reasons is due to contractors having to include added costs for risk into their lump sum prices. There could be some cases of incentives being issued for timely relocations but until better data collection and tracking are in place that is difficult to substantiate.
6. *ACM Impact on Contractor Risk Management:* Risk passed through ACMs can be substantial, especially within DB projects. Contractors therefore must incorporate costs into the prices to cover those risk. Wherever possible risk involving utility coordination should be tamed by conducing thorough utility investigations and pre-procurement relocations. All utility related data should be provided to the contractors within the contract documents.
7. *Early Utility Coordination on ACMs:* While the STA in-house utility coordination staff typically carry large workloads, it is crucial to the success, reduced risks, and improved costs and schedule of a project to practice early utility coordination especially on ACM projects. The in-house design phase of ACM projects is typically abbreviated and the project development staff need a solid understanding of any critical utility issues (substantial facilities, long-lead items, etc.). Additionally, a detailed utility investigation plan can be developed early to determine the information that can be collected and provided to contractors to minimize risks. This early coordination effort is also critical to appropriately aligning the project schedule with needed relocation efforts.

Concluding Summary & Suggested Research

In conclusion, the use of surveys and interviews, did highlight perceived impacts in utility coordination as a result of using ACMs. Additionally, there were notable effective practices and recognize project needs in conducting utility coordination on ACMs projects. Future STA data collection efforts could provide a means to quantify these impacts beyond perception.

One of the most relevant and pressing findings of the research was in the identification of needed research in utility related data collection and management. The adage, "You can't improve what you don't measure," is certainly a valid point in utility coordination. Research is needed to determine what data should be collected within utility coordination processes, how that data should be organized to be useful in future evaluation, and how that data can be managed so that it remains relevant. A system or approach to this data collection effort would not only be useful in this and other research efforts, but would be extremely useful to STAs as well.

Implementation

As previously mentioned, few resources are available to standardize and assist in utility coordination efforts on alternatively delivered projects. Implementation of this effort will occur through one or more presentations to the AASHTO Committee of Right of Way, Utilities, and Outdoor Advertising Control. In presenting to these agency leaders in the area of utility coordination, this will immediately put them on notice of this report, the tools, and practices offered from this research. The topic will also be submitted to the Transportation Research Board as a potential presentation. The research team will also be willing to present at other venues as requested by the research panel. The following Decision Support Tools are viewed as practical implementation resources.

Decision Support Tools

The following decision support infographics for DB, P3, and CM/GC, are intended to provide utility coordinators or project designers with information to consider and effective practices regarding utility coordination on ACM project. These tools are simplistic but offer valuable basics. It is anticipated that STAs can use or adapt these tools to include with these existing guidance.

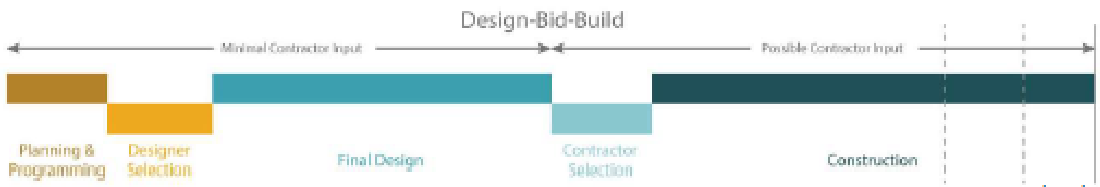
Utility Coordination for Design-Build at a Glance

What is Design-Build…

The D-B projects combine the design and construction phases of a project into a single contract. This reduces costs without reducing quality, since construction can begin while the plans are still being developed. Since the Design-Builder is responsible for both design and construction activities, this reduces the potential for cost increases due to design errors, and/or for discrepancies between design plans and construction activities.

A D-B contract can be awarded as either "low-bid" or "best-value," which is an important advantage. While low-bid is used for most traditional contracts, best-value selection permits the consideration of additional factors, such as experience, qualifications, innovation, technical approach, quality control methods and project management. Often this can reduce costs as well as increase quality.

Source: FHWA



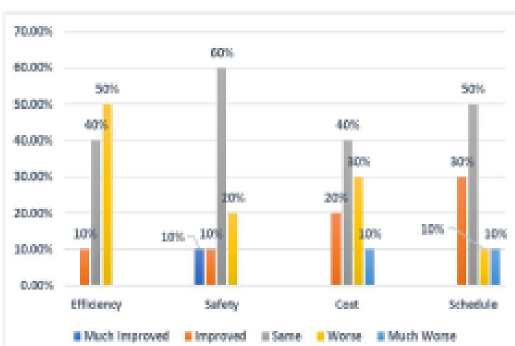
Source: Nebraska DOT

Utility Coordination Considerations of:

Schedule & Cost—with the transfer of the design process to the design-build team, some aspect of utility coordination will also transfer. The more utility coordination efforts completed prior to this transfer reduces the level of risk transfer. This has become such an issue in D-B projects that contractors are requesting less utility coordination responsibility. Where possible, agreements and clearance dates should be achieved for known needed relocations

Efficiency & Safety—there will be some duplication of effort once utility coordination is handed off. There must be assurance of compliance to federal and state regulations and accommodations policies. In regard to safety and accommodation, these requirements must be stated or referenced in the contract documents and as detailed as possible.

Utility Coordination experts from transportation agencies across the United States were asked to compare utility coordination on D-B projects to that of design-bid build projects. The figure to the below presents the findings across the areas of efficiency, safety, and schedule.



Effective Practices:

- Prepare an early investigation plan with aligning SUE quality levels in early design
- Use a Utility Conflict Matrix to assist in the transfer of coordination efforts from the transportation agency to the contractor
- Emphasize avoidance
- Hold a pre-procurement meeting with utility companies and potential D-B teams to encourage communication
- Include detailed specification, policies, and requirements within contract documents
- Transfer known utility information to the D-B team
- Offer utility coordination training
- Expect to remain engaged for oversight
- See FHWA's Sample Scope of Work

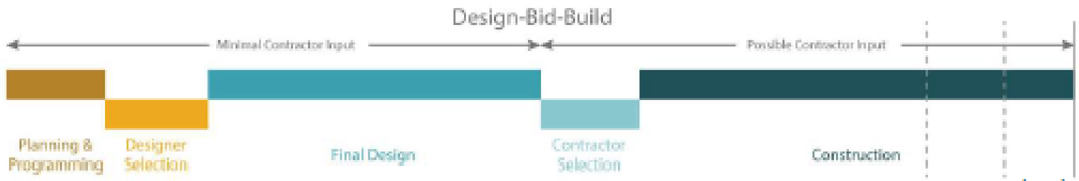
Design-Build

Utility Coordination for P3 at a Glance

What is Public-Private Partnership (P3)…

P3 projects are a combination of design-build (DB) contracting with the addition of some combination of operations, maintenance, or finance. Just as with DB, these projects combine the design and construction phases of a project into a single contract. This reduces costs without reducing quality, since construction can begin while the plans are still being developed. Since the P3 contractor is responsible for both design and construction activities, this reduces the potential for cost increases due to design errors, and/or for discrepancies between design plans and construction activities. Some examples of P3 arrangements include Design-Build-Operate, Design-Build-Operate-Maintain, Design-Build-Finance, Design-Build-Finance-Maintain, and Design-Build-Finance-Operate-Maintain. P3's can be viewed as a special circumstance of DB. Since there is little change in the design and construction phases from a DB, utility coordination can be treated similarly.

Source: FHWA & DBIA



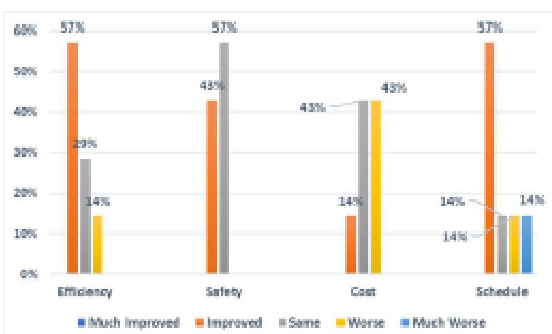
Source: Nebraska DOT

Utility Coordination Considerations of:

Schedule & Cost—with the transfer of the design process to the P3 contractor, some aspect of utility coordination will also transfer. The more utility coordination efforts completed prior to this transfer reduces the level of risk transfer. This has become such an issue in D-B projects that contractors are requesting less utility coordination responsibility. Where possible, agreements and clearance dates should be achieved for known needed relocations

Efficiency & Safety—there will be some duplication of effort once utility coordination is handed off. There must be assurance of compliance to federal and state regulations and accommodations policies. In regard to safety and accommodation, these requirements must be stated or referenced in the contract documents and as detailed as possible.

Utility Coordination experts from transportation agencies across the United States were asked to compare utility coordination on P3 projects to that of design-bid build projects. The figure to the below presents the findings across the areas of efficiency, safety, and schedule.



Effective Practices:

- Prepare an early investigation plan with aligning SUE quality levels in early design
- Use a Utility Conflict Matrix to assist in the transfer of coordination efforts from the transportation agency to the contractor
- Emphasize avoidance
- Hold a pre-procurement meeting with utility companies and potential P3 contractors to encourage communication
- Include detailed specification, policies, and requirements within contract documents
- Transfer known utility information to the P3 contractor
- Offer utility coordination training
- Expect to remain engaged for oversight
- See FHWA's Sample Scope of Work for DB

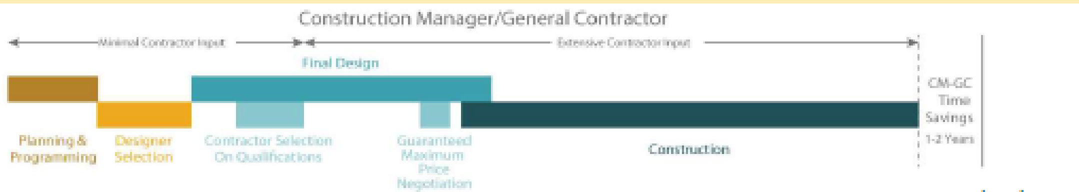
Public-Private Partnership

Utility Coordination for CM/GC at a Glance

What is Construction Manager/General Contractor (CM/GC)…

CM/GC projects entail a design phase where the STA brings on a contractor acting as a consultant to the design process reviewing and making recommendations on risks, constructability, and other issues such that the design team is able to make use of contractor expertise. When design is complete, the consultant contractor from design has the opportunity to bid on the project and may be awarded the project as the general contractor if the owner, designer and independent cost estimator agree that the contractor has submitted a fair price. If the price is not agreed upon, the project may be put out to letting. Small work packages such as clearing could be completed before the design is complete but the overlap of design and construction is not near the degree of which for design-build projects. As such many of the practices for design-bid-build projects will be transferable to CM/GC projects.

Source: FHWA



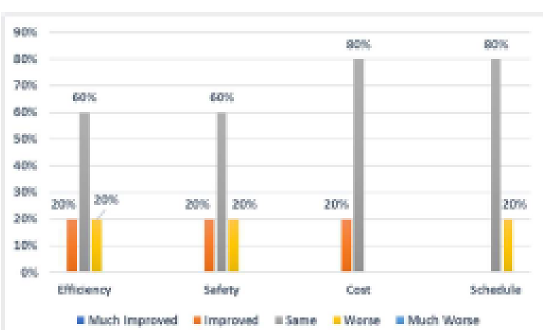
Source: Nebraska DOT

Utility Coordination Considerations of:

Schedule & Cost—while the utility coordination process is similar to that of traditional design-bid-build, CM/GC projects do entail the advantage of having a contractor on board during design to make recommendations regarding utility relocations, constructability concerns, and delay or other risk concerns. While this is clearly a positive, a challenge comes when the project transitions from design to construction as there is not the letting window in which many relocations take place. There is the potential to save time however in completing clearing or other utility needed prep work prior to design completion.

Efficiency & Safety—there will could be some loss in efficiency as CM/GC projects tend to be more iterative in the design process. This could lead to additional effort in utility coordination. Because the transportation agency maintains control of the utility coordination, there is little concern in violating regulations or policies.

Utility Coordination experts from transportation agencies across the United States were asked to compare utility coordination on CM/GC projects to that of design-bid build projects. The figure to the below presents the findings across the areas of efficiency, safety, and schedule.



Effective Practices:

- Gather utility related records and location information as early as possible so the CM can make recommendations on constructability given utility locations
- Emphasize avoidance
- Use multiple construction packages to facilitate operations such as clearing and grubbing to assist utility relocations
- Include the CM in discussion with utility companies to facilitate discussions of risk, constructability, and schedule
- Emphasize utility coordination to the CM so expectations are understood before construction begins

Construction Manager/General Contractor

References

1. American Society of Civil Engineers. 2017 Infrastructure Report Card: Roads. March 2018. https://www.infrastructurereportcard.org/wp-content/uploads/2017/01/Roads-Final.pdf
2. FMI Corporation. Design-Build Utilization: Combined Market Study. June 2018. https://dbia.org/wp-content/uploads/2018/06/Design-Build-Market-Research-FMI-2018.pdf
3. Gransberg, D., Pittenger, D., and Chambers, G. NCHRP 20-07 Task 373: Utility Coordination Using Alternative Contracting Methods. November 2017.
4. Sturgill, R., Taylor, T., & Dadi, G. A case study of Utility Coordination within a Major Design-Build Transportation Project. Construction Research Congress 2018, (pp. 619-628). New Orleans Louisiana. doi:10.1061/9780784481295.062. 2018
5. Quiroga, C., Kraus, E., Scott, P., Swafford, T., Meis, P., and Monday, G. Identification of Utility Conflicts and Solutions. SHRP2 Report S2-R15B-RW-1, Transportation Research Board of the National Academies, Washington, D.C., 2012.
6. Anspach, J.H., Utility Location and Highway Design. NCHRP Synthesis 405. Transportation Research Board of the National Academies, Washington, D.C., 2010.
7. Kraus, E., Managing Longitudinal Utility Installations on Controlled Access Highway Right-of-Way. NCHRP Synthesis 462. Transportation Research Board of the National Academies, Washington, D.C., 2014.
8. Ellis, R. Development of Improved Strategies for Avoiding Utility Related Delays During FDOT Highway Construction Projects. University of Florida, FDOT Contract Number FL DOT BC 354-52 Final Report. July, 2003.
9. Sturgill, R., Taylor, T., Ghorashinezhad, S., Zhang, J., Methods to Expedite and Streamline Utility Relocations for Road Projects. University of Kentucky, Kentucky Transportation Center Report KTC-14-15/SPR460-13-1F. Lexington, Ky., December, 2014.
10. Guide for Reducing Contractor Risk Associated with Utilities on Design Build Projects. FDOT. September, 2015. http://www.dot.state.fl.us/construction/DesignBuild/DBRules/DB%20Utility%20guidelines.pdf
11. Design-Build Utility Coordination. White Paper. Georgia DOT. September, 2015. http://www.dot.ga.gov/PartnerSmart/DesignManuals/DesignBuild/10-DesignBuild%20Utility%20Coordination%20White%20Paper.pdf

12. Sturgill, R., Taylor, T., & Li, Y. NCHRP Synthesis 506: Effective Utility Coordination: Application of Research and Current Practices. Transportation Research Board of National Academies. Washington, DC: The National Academies Press. doi:10.17226/24687. 2017.
13. Design-Build Institute of America. Legislation Authorization Maps. September 2019. https://dbiasc.org/legislation/
14. Associated General Contractors. September 2019. https://www.agc.org/cs/industry_topics/project_delivery/cmatrisk
15. FHWA/AASHTO Implementation Assistance Program State Participation in Rounds 1-7. June 2018. http://shrp2.transportation.org/Documents/home/SHRP2_Round_1-7_IAP_Recipients_05.13.18_508.pdf
16. Molenaar, K., Harper, C., & Yugar, I. (2014). Guidebook for Selecting Alternative Contracting Methods for Roadway Projects: Project Delivery Methods, Procurement Procedures, and Payment Provisions TPF-5 (260). Boulder, Colorado.
17. R. Moeller, J. Pestinger, M. Frierson, W. Kennedy, A. McCormick, C. Colan Muth, J. Myers, P. Scott, and S. Waymack. European Right-of-Way and Utilities Best Practices. FHWA-PL-02-013. Federal Highway Administration, Washington, DC, August 2002.
18. KYTC Partnering Conference. Non-Traditional Utility Coordination on KYTC Projects. KYTC Partnering Conference, (pp. 1-16). 2014.
19. Loulakis, M., Tran, D., Njord, J., Parkinson, R., & Henk, G. Review of WSDOT's Implementation of Design-Build Project Delivery - Task 2: Best Practices in Design-Build Project Delivery. Hill International Inc., Philadelphia, Pennsylvania. 2016.
20. Yakowenko, J. Utility Involvement in South Carolina Design-Build Projects. 2017. Retrieved October 11, 2019, from U.S. Department of Transportation Federal Highway Administration: https://www.fhwa.dot.gov/programadmin/contracts/scdb.cfm
21. Transportation Association of Canada. Guideline for utility Coordination on Public-Private Partnership (P3) Projects. 2019.
22. Federal Highway Administration. US Department of Transportation. Alternative Contracting Methods (ACMs) Library. Website: https://www.fhwa.dot.gov/construction/contracts/acm/ Accessed: September 2019.
23. Design-Build Institute of America. Public-Private Partnerships: A Design-Build Done Right Primer. 2016. https://dbia.org/wp-content/uploads/2018/05/Primer-Public-Private-Partnerships.pdf

Appendices

Appendix A: Survey Questionnaire State Utility Leads

NCHRP 20-07/Task 407 Interview Questionnaire State Utility Lead

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Start of Block: NCHRP 20-07/Task 407

Intro
NCHRP 20-07/Task 407 Interview Questionnaire
State Utility Lead **Introduction:** The objective of NCHRP 20-07/Task 407 is to document reasonable expected outcomes in terms of efficiency, safety, cost, and schedule associated with utility coordination when using various contracting methods on public transportation projects. The alternative contracting methods (ACMs) of focus for this study include design-build (DB), public-private partnerships (P3, viewed as a special case of DB delivery), construction manager/general contractor (CM/GC), and the use alternative technical concepts (ATCs) applied to these ACMs or to traditional design-bid-build delivery. (For the purposes of this study, if you use construction manager at risk (CMAR), answer as though it is CM/GC) The following definitions, specifically tailored to utility coordination, are provided to standardize responses within this survey: **Efficiency:** in regard to utility coordination on highway projects would entail a streamlined, procedural, and communicative approach to identifying, managing, mitigating, and resolving any utility interaction or impacts with minimal waste of resources. Examples of inefficiencies would include multiple project team members contacting utility representatives, rework of utility designs or agreements, second move relocations, etc. **Safety:** is the control of recognized hazards to attain an acceptable level of risk. Examples of utility-related safety concerns would involve utility damages due to construction, but also the relocated/accommodation of facilities in safe locations (i.e. relocating facilities from outside of pavements to provide safety for long-term maintenance). **Cost:** in the context of this research, are costs that are associated with utility agreements and relocations for a project. These costs are those incurred to the public agency as a result of the required relocations of reimbursable facilities. **Schedule:** is also strictly in the context of the utility coordination and relocation process for a project. It is the amount of time required to reach utility clearance or coordination with the highway contractor's work. The impacts of interest for this study (efficiency, safety, cost, and schedule) are the central comparisons to be made between a traditional design bid project and the alternative contracting methods discussed above. To the extent possible, this study seeks to quantify these impacts requiring access to project data as available for both traditional design-bid-build projects and projects using ACMs.

End of Block: NCHRP 20-07/Task 407

Start of Block: Information

Info Please provide your identifying information below.

Info 1 **Name:**

____

Info 2 **Position/Title:**

____

Info 3 **Agency:**

____

End of Block: Information

Start of Block: ACMs

Q6 **Which of the following ACMs has your DOT used? (Mark all answers that apply**Once you answer this question you will not be able to return to it without restarting the survey!**)**

- ▢ DB (1)
- ▢ P3 (2)
- ▢ CM/GC (or CMAR) (3)
- ▢ ATCs (DB/DBB) (4)
- ▢ None of the Above (5)

End of Block: ACMs

Start of Block: DB

Q7 This study seeks to compare utility coordination of ACM's to that of design-bid-build. As a base case for comparison, consider a traditional Design-Bid-Build (DBB) roadway project with utility coordination conducted by in-house staff and compare it against design-build (DB) projects in the questions below.

X→

Q8 **How would you rate the overall efficiency for the utility coordination when using DB compared to DBB?**

	Much Improved (5)	Improved (4)	Same (3)	Worse (2)	Much Worse (1)
Efficiency (1)	○	○	○	○	○

X→

Q9 **How would you rate the overall safety for the utility coordination when using DB compared to DBB?**

	Much Improved (5)	Improved (4)	Same (3)	Worse (2)	Much Worse (1)
Safety (1)	○	○	○	○	○

X→

Q10 **How would you rate the overall cost for the utility coordination when using DB compared to DBB?**

	Much Cheaper (5)	Cheaper (4)	Same (3)	More Expensive (2)	Much More Expensive (1)
Cost (1)	○	○	○	○	○

X→

Q11 **How would you rate the overall schedule for the utility coordination when using DB compared to DBB?**

	Much Shorter (5)	Shorter (4)	Same (3)	Longer (2)	Much Longer (1)
Schedule (1)	○	○	○	○	○

End of Block: DB

Start of Block: P3

Q12 This study seeks to compare utility coordination of ACM's to that of design-bid-build. As a base case for comparison, consider a traditional Design-Bid-Build (DBB) roadway project with utility coordination conducted by in-house staff and compare it against public-private partnership (P3) projects in the questions below.

X→

Q13 **How would you rate the overall efficiency for the utility coordination when using P3 compared to DBB?**

	Much Improved (5)	Improved (4)	Same (3)	Worse (2)	Much Worse (1)
Efficiency (1)	○	○	○	○	○

X→

Q14 **How would you rate the overall safety for the utility coordination when using P3 compared to DBB?**

	Much Improved (5)	Improved (4)	Same (3)	Worse (2)	Much Worse (1)
Safety (1)	○	○	○	○	○

X→

Q15 **How would you rate the overall cost for the utility coordination when using P3 compared to DBB?**

	Much Cheaper (5)	Cheaper (4)	Same (3)	More Expensive (2)	Much More Expensive (1)
Cost (1)	○	○	○	○	○

Q16 **How would you rate the overall schedule for the utility coordination when using P3 compared to DBB?**

	Much Shorter (5)	Shorter (4)	Same (3)	Longer (2)	Much Longer (1)
Schedule (1)	○	○	○	○	○

End of Block: P3

Start of Block: CM/GC

Q17 This study seeks to compare utility coordination of ACM's to that of design-bid-build. As a base case for comparison, consider a traditional Design-Bid-Build (DBB) roadway project with utility coordination conducted by in-house staff and compare it against construction manager/general contractor (CM/GC) projects in the questions below.

Q18 **How would you rate the overall efficiency for the utility coordination when using CM/GC compared to DBB?**

	Much Improved (5)	Improved (4)	Same (3)	Worse (2)	Much Worse (1)
Efficiency (1)	○	○	○	○	○

Q19 **How would you rate the overall safety for the utility coordination when using CM/GC compared to DBB?**

	Much Improved (5)	Improved (4)	Same (3)	Worse (2)	Much Worse (1)
Safety (1)	○	○	○	○	○

Q20 **How would you rate the overall cost for the utility coordination when using CM/GC compared to DBB?**

	Much Cheaper (5)	Cheaper (4)	Same (3)	More Expensive (2)	Much More Expensive (1)
Cost (1)	○	○	○	○	○

Q21 **How would you rate the overall schedule for the utility coordination when using CM/GC compared to DBB?**

	Much Shorter (5)	Shorter (4)	Same (3)	Longer (2)	Much Longer (1)
Schedule (1)	○	○	○	○	○

End of Block: CM/GC

Start of Block: ATCs (DB/DBB)

Q22 This study seeks to compare utility coordination of ACM's to that of design-bid-build. As a base case for comparison, consider a traditional Design-Bid-Build (DBB) roadway project with utility coordination conducted by in-house staff and compare it against projects using alternative technical concepts (ATCs) in the questions below.

X→

Q23 **How would you rate the overall efficiency for the utility coordination when using ATCs (DB/DBB) compared to traditional DBB?**

	Much Improved (5)	Improved (4)	Same (3)	Worse (2)	Much Worse (1)
Efficiency (1)	○	○	○	○	○

X→

Q24 **How would you rate the overall safety for the utility coordination when using ATCs (DB/DBB)** compared to traditional DBB**?**

	Much Improved (5)	Improved (4)	Same (3)	Worse (2)	Much Worse (1)
Safety (1)	○	○	○	○	○

X→

Q25 **How would you rate the overall cost for the utility coordination when using ATCs (DB/DBB)** compared to traditional DBB**?**

	Much Cheaper (5)	Cheaper (4)	Same (3)	More Expensive (2)	Much More Expensive (1)
Cost (1)	○	○	○	○	○

X→

Q26 **How would you rate the overall schedule for the utility coordination when using ATCs (DB/DBB)** compared to traditional DBB**?**

	Much Shorter (5)	Shorter (4)	Same (3)	Longer (2)	Much Longer (1)
Schedule (1)	○	○	○	○	○

End of Block: ATCs (DB/DBB)

Start of Block: Compared to DBB projects

X→

Q27 **In your opinion, do you believe that the utility coordination using DB, P3, CM/GM and, ATCs (DB/DBB) delivery methods contributed positively or negatively compared to traditional DBB projects in the following metrics?**

	Extremely positive (5)	Somewhat positive (4)	Neither positive nor negative (3)	Somewhat negative (2)	Extremely negative (1)
Efficiency (1)	○	○	○	○	○
Safety (2)	○	○	○	○	○
Cost (3)	○	○	○	○	○
Schedule (4)	○	○	○	○	○
Overall project (5)	○	○	○	○	○

End of Block: Compared to DBB projects

Start of Block: Coordination Process

X→

Q28 **How satisfied are you with the utility coordination process used for the following ACMs in your state?**

	Extremely satisfied (5)	Somewhat satisfied (4)	Neither satisfied nor dissatisfied (3)	Somewhat dissatisfied (2)	Extremely dissatisfied (1)
DB (1)	○	○	○	○	○
CM/GC (2)	○	○	○	○	○
P3 (3)	○	○	○	○	○
ATCs (DB/DBB) (4)	○	○	○	○	○
DBB (5)	○	○	○	○	○

End of Block: Coordination Process

Start of Block: Type of utility coordination

Q29 **What type of utility coordination do you use? (Mark all answers that apply)**

	DB (1)	CM/GM (2)	P3 (3)	DBB (4)
In-house (1)	▢	▢	▢	▢
Consultant (2)	▢	▢	▢	▢
P3 Concessionaire / Design Built Team (3)	▢	▢	▢	▢
Others (please specify) (4)	▢	▢	▢	▢

End of Block: Type of utility coordination

Start of Block: In-House

X→

Q30 **How would you rate the overall study impact areas (efficiency, safety, cost, and schedule) on utility coordination when performed In-House?**

	Extremely satisfied (5)	Somewhat satisfied (4)	Neither satisfied nor dissatisfied (3)	Somewhat dissatisfied (2)	Extremely dissatisfied (1)
Efficiency (1)	○	○	○	○	○
Safety (2)	○	○	○	○	○
Cost (3)	○	○	○	○	○
Schedule (4)	○	○	○	○	○

Q36 Comments:

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End of Block: In-House

Start of Block: Consultant

X→

Q31 **How would you rate the overall study impact areas (efficiency, safety, cost, and schedule) on utility coordination when performed by the Consultant?**

	Extremely satisfied (5)	Somewhat satisfied (4)	Neither satisfied nor dissatisfied (3)	Somewhat dissatisfied (2)	Extremely dissatisfied (1)
Efficiency (1)	o	o	o	o	o
Safety (2)	o	o	o	o	o
Cost (3)	o	o	o	o	o
Schedule (4)	o	o	o	o	o

Q37 Comments:

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End of Block: Consultant

Start of Block: P3 Concessionaire / Design Built Team

X→

Q32 **How would you rate the overall study impact areas (efficiency, safety, cost, and schedule) on utility coordination when performed by the P3 Concessionaire / Design Built Team?**

	Extremely satisfied (5)	Somewhat satisfied (4)	Neither satisfied nor dissatisfied (3)	Somewhat dissatisfied (2)	Extremely dissatisfied (1)
Efficiency (1)	o	o	o	o	o
Safety (2)	o	o	o	o	o
Cost (3)	o	o	o	o	o
Schedule (4)	o	o	o	o	o

Q38 Comments:

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End of Block: P3 Concessionaire / Design Built Team

Start of Block: Records

Q34 **Do you have any quantifiable records to backup the responses provided in the previous questions (i.e. data to compare efficiency, cost, safety, and schedule between a DBB and ACMs)?**

○ Yes (1)

○ No (2)

Q39 Comments:

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End of Block: Records

Start of Block: Quantifiable Impacts

Q35 **We are interested in obtaining quantifiable data for cost and schedule comparisons of utility coordination between ACM and traditional DBB projects. Could you provide us with access to such a data set?**

○ Yes (1)

○ No (2)

○ Unsure (3)

Q40 Comments:

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End of Block: Quantifiable Impacts

Appendix B: Survey Questionnaire Utility Coordinators

NCHRP 20-07/Task 407 Interview Questionnaire Utility Coordinators

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Start of Block: NCHRP 20_07/Task 407 Introduction

Intro **NCHRP 20-07/Task 407 Interview Questionnaire Utility Coordinators** **Introduction:** The objective of NCHRP 20-07/Task 407 is to document reasonable expected outcomes in terms of efficiency, safety, cost, and schedule associated with utility coordination when using various contracting methods on public transportation projects. The alternative contracting methods (ACMs) of focus for this study include design-build (DB), public-private partnerships (P3, viewed as a special case of DB delivery), construction manager/general contractor (CM/GC), and the use alternative technical concepts (ATCs) applied to these ACMs or to traditional design-bid-build delivery. (For the purposes of this study, if you use construction manager at risk (CMAR), answer as though it is CM/GC) The following definitions, specifically tailored to utility coordination, are provided to standardize responses within this survey: **Efficiency**: in regard to utility coordination on highway projects would entail a streamlined, procedural, and communicative approach to identifying, managing, mitigating, and resolving any utility interaction or impacts with minimal waste of resources. Examples of inefficiencies would include multiple project team members contacting utility representatives, rework of utility designs or agreements, second move relocations, etc. **Safety:** is the control of recognized hazards to attain an acceptable level of risk. Examples of utility-related safety concerns would involve utility damages due to construction, but also the relocated/accommodation of facilities in safe locations (i.e. relocating facilities from outside of pavements to provide safety for long-term maintenance). **Cost**: in the context of this project, are costs that are associated with the utility agreements and relocations for a project. These costs are those incurred to the public agency as a result of the required relocations of reimbursable facilities. **Schedule**: is also strictly in the context of the utility coordination and relocation process for a project. It is the amount of time required to reach utility clearance or coordination with the highway contractor's work. The impacts of interest for this study (efficiency, safety, cost, and schedule) are the central comparisons to be made between a traditional design bid project and the alternative contracting methods discussed above. To the extent possible, this study seeks to quantify these impacts requiring access to project data as available for both traditional design-bid-build projects and projects using ACMs. We are interested in understanding quantifiable impacts regarding the efficiency, safety, cost, and schedule of utility coordination on these ACMs projects versus traditional DBB projects.

Please share this survey with utility coordination staff statewide to help us compile data for further analysis.

End of Block: NCHRP 20_07/Task 407 Introduction

Start of Block: Information

Info Please provide your identifying information below.

Info 1 **Name:**

____

Info 2 **Position/Title:**

____

Info 3 **Agency:**

____

End of Block: Information

Start of Block: Project Information - DBB Project

BDD Project Please complete the following project information request for one DBB project and one project by ACM (if possible).

DBB 1 **I.** **DBB Project:** Contracting Method: **Design-Bid-Build**

DBB 2 Project Name:

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DBB 3 Project Description:

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DBB 4 Project Length (miles):

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DBB 5 Design Start (MM/DD/YYYY):

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DBB 6 Design Complete (MM/DD/YYYY):

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DBB 7 Design Cost / Budget ($):

____

DBB 8 Construction Cost / Budget ($):

____

DBB 9 Utility Cost / Budget ($):

____

*

DBB 10 Utility phase authorization / start Date (MM/DD/YYYY):

____

*

DBB 11 Utility clearance date (known/expected) (MM/DD/YYYY):

____

Q52 Number of utility companies impacted or potentially impacted:

____

*

DBB 12 Construction project start / letting date (MM/DD/YYYY):

____

*

Q51 Construction completion date (known/expected) (MM/DD/YYYY)

____

End of Block: Project Information - DBB Project

Start of Block: DBB Project Questions Continued

Q56 Information for DBB project

Q69 **Were the utilities clear prior letting / construction?**

○ Yes (1)

○ No (2)

Q133 Provide comments if desired

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End of Block: DBB Project Questions Continued

Start of Block: DBB Continued 2

Q86 **What utility coordination approach was used?**

○ In-House (1)

○ Consultant (2)

○ Other (Please specify) (3) ____

End of Block: DBB Continued 2

Start of Block: DBB Continued 3

Q92 **How would you rate the efficiency of the utility coordination?**

○ Better than average (1)

○ Average (2)

○ Worse than average (3)

Q93 Explanation

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End of Block: DBB Continued 3

Start of Block: DBB Continued 4

Q98 **How would you rate the safety of the utility coordination?**
Safety: is the control of recognized hazards to attain an acceptable level of risk. Examples of utility-related safety concerns would involve utility damages due to construction, but also the relocated/accommodation of facilities in safe locations (i.e. relocating facilities from outside of pavements to provide safety for long-term maintenance).

○ Better than average (1)

○ Average (2)

○ Worse than average (3)

Q99 Explanation

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Q53 **How would you rate the costs of the utility coordination?**

○ Better than average (1)

○ Average (2)

○ Worse than average (3)

Q54 Explanation

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Q56 **How would you rate the schedule of the utility coordination?**

- ◯ Better than average (1)
- ◯ Average (2)
- ◯ Worse than average (3)

Q57 Explanation

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End of Block: DBB Continued 4

Start of Block: DBB Continued 5

Q49 Were there any delays or change orders due to utility related issues?

- ◯ Yes (1)
- ◯ No (2)

Q50 Provide comments if desired

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End of Block: DBB Continued 5

Start of Block: Alternative Contracting Method Project

ACM
Please complete the following for an ACM project

Information for ACM project:

Q112 **Alternative Contracting Method Used:**

- ○ DB (1)
- ○ CM/GC (2)
- ○ P3 (3)

ACM 3 Project Name:

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ACM 4 Project Description:

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ACM 5 Project Length (miles):

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ACM 6 Design Start (MM/DD/YYYY):

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ACM 7 Design Complete (MM/DD/YYYY):

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ACM 8 Design Cost / Budget ($):

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ACM 9 Construction Cost / Budget ($):

____

Q60 Construction Cost / Budget ($):

____

Q58 Number of utility companies impacted or potentially impacted:

____

ACM 10 Utility Cost / Budget ($):

____

*

ACM 11 Utility phase authorization start Date (MM/DD/YYYY):

____

*

ACM 12 Utility clearance date (known/expected) (MM/DD/YYYY):

____

*

ACM 13 Construction project start / letting date (MM/DD/YYYY):

____

*

Q59 Construction completion date (known/expected) (MM/DD/YYYY)

____

End of Block: Alternative Contracting Method Project

Start of Block: ACM Project 2

Q123 **Utility Coordination Approach:**

- ◯ In-House (1)
- ◯ Consultant (2)
- ◯ Other (Please specify) (3) ____

Display This Question:

If Q123 != 1

Q65 If utility coordination was provided by consultant/other, was in-house involvement still required?

- ◯ Yes (1)
- ◯ No (2)

Display This Question:

If Q65 = 1

Q66 If yes, please elaborate on the response.

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Display This Question:

If Q65 = 1

Q67 If in-house utility coordination involvement was still required to assist the consultant/other utility coordination, does this also occur for consultant/other utility coordination on DBB projects?

○ Yes (1)

○ No (2)

Display This Question:

If Q65 = 1

Q68 If yes, please elaborate on the response and explain if you feel consultant/other utility coordination is better on DBB or ACM projects.

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End of Block: ACM Project 2

Start of Block: ACM Project 3

Q137 **How would you rate the efficiency of the utility coordination?**

○ Better than average (1)

○ Average (2)

○ Worse than average (3)

Q138 Explanation

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End of Block: ACM Project 3

Start of Block: ACM Project 4

Q142 **How would you rate the safety of the utility coordination?** Safety: is the control of recognized hazards to attain an acceptable level of risk. Examples of utility-related safety concerns would involve utility damages due to construction, but also the relocated/accommodation of facilities in safe locations (i.e. relocating facilities from outside of pavements to provide safety for long-term maintenance).

○ Better than average (1)

○ Average (2)

○ Worse than average (3)

Q144 Explanation

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End of Block: ACM Project 4

Start of Block: ACM Project 5

Q61 **How would you rate the costs of the utility coordination?**

○ Better than average (1)

○ Average (2)

○ Worse than average (3)

Q62 Explanation

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Q63 **How would you rate the schedule of the utility coordination?**

- ○ Better than average (1)
- ○ Average (2)
- ○ Worse than average (3)

Q64 Explanation

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Q157 Were there any delays or change orders due to utility related issues?

- ○ Yes (1)
- ○ No (2)

Q158 Provide comments if desired

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End of Block: ACM Project 5

Start of Block: Block 13

Q68 Please provide any comments you may have regarding your opinion of whether utility coordination is better on DBB or ACM and an explanation of why you hold that opinion.

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End of Block: Block 13

Appendix C: Survey State Utility Lead Responses

States Completing the Survey:
Alabama,
Arizona,
California,
Delaware,
Kentucky,
Georgia,
Missouri,
New Hampshire,
Pennsylvania,
South Carolina,
Texas,
Vermont,
Wisconsin,
Two state unknowns

Default Report

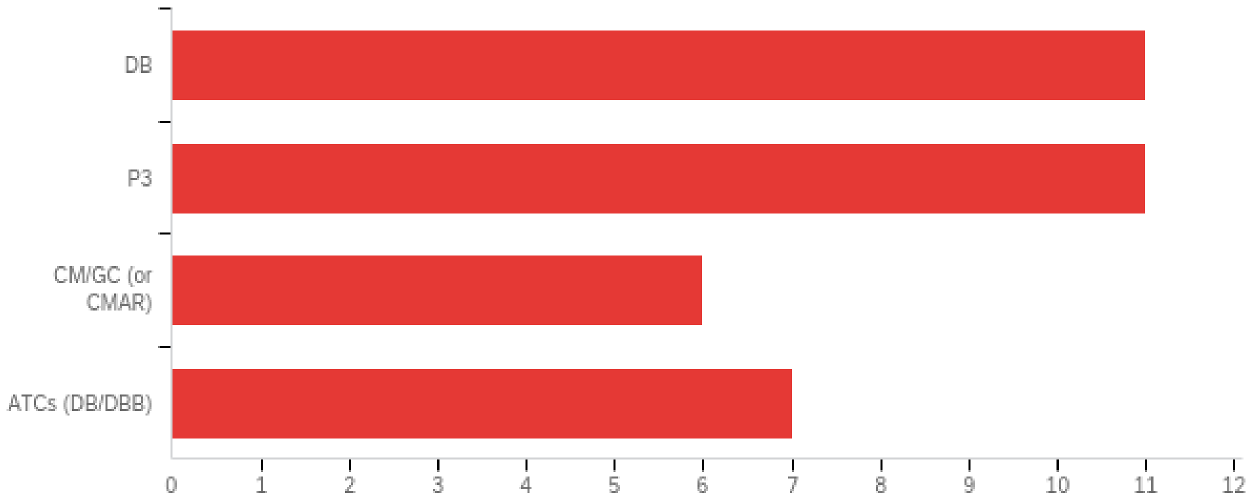
NCHRP 20-07/Task 407 Interview Questionnaire State Utility Lead

February 2nd 2020, 7:32 pm CST

Info 3 - Agency:

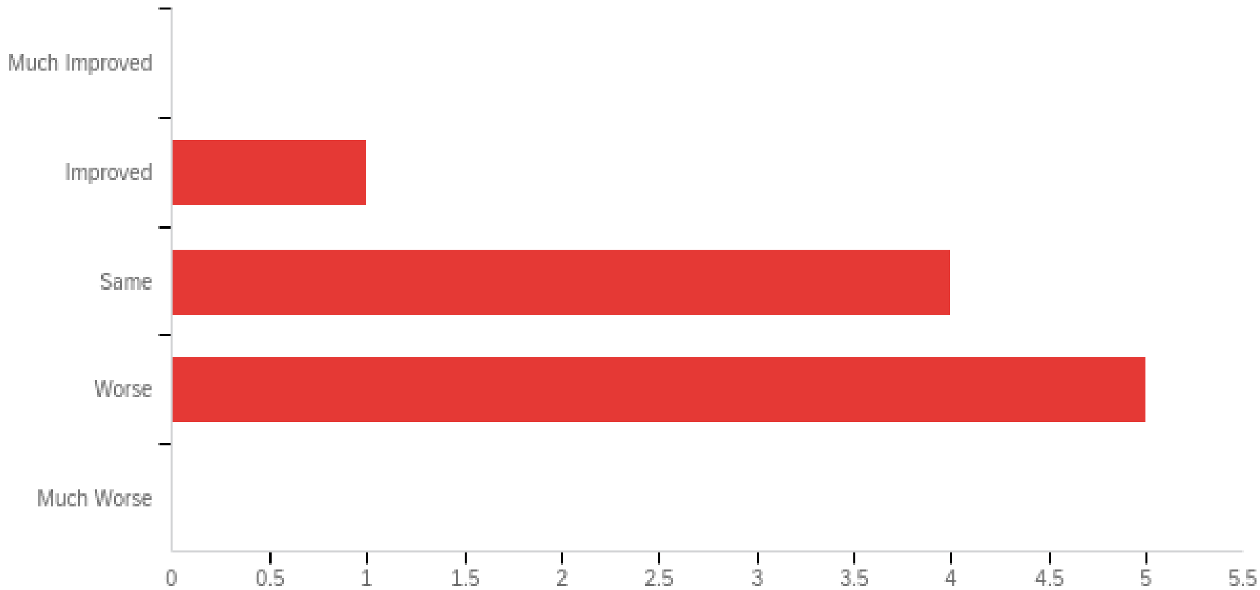
Agency:
Wyoming DOT
KYTC
Caltrans
Georgia DOT
TxDOT
Pennsylvania Department of Transportation
Delaware Department of Transportation
Pennnsylvania Department of Transportation
New Hampshire Department of Transportation
SCDOT
Arizona DOT
Missouri Department of Transportation
Wisconsin Department of Transportation
Alabama DOT

Q6 - Which of the following ACMs has your DOT used? (Mark all answers that apply**Once you answer this question you will not be able to return to it without restarting the survey!**)



#	Answer	%	Count
1	DB	31.43%	11
2	P3	31.43%	11
3	CM/GC (or CMAR)	17.14%	6
4	ATCs (DB/DBB)	20.00%	7
	Total	100%	35

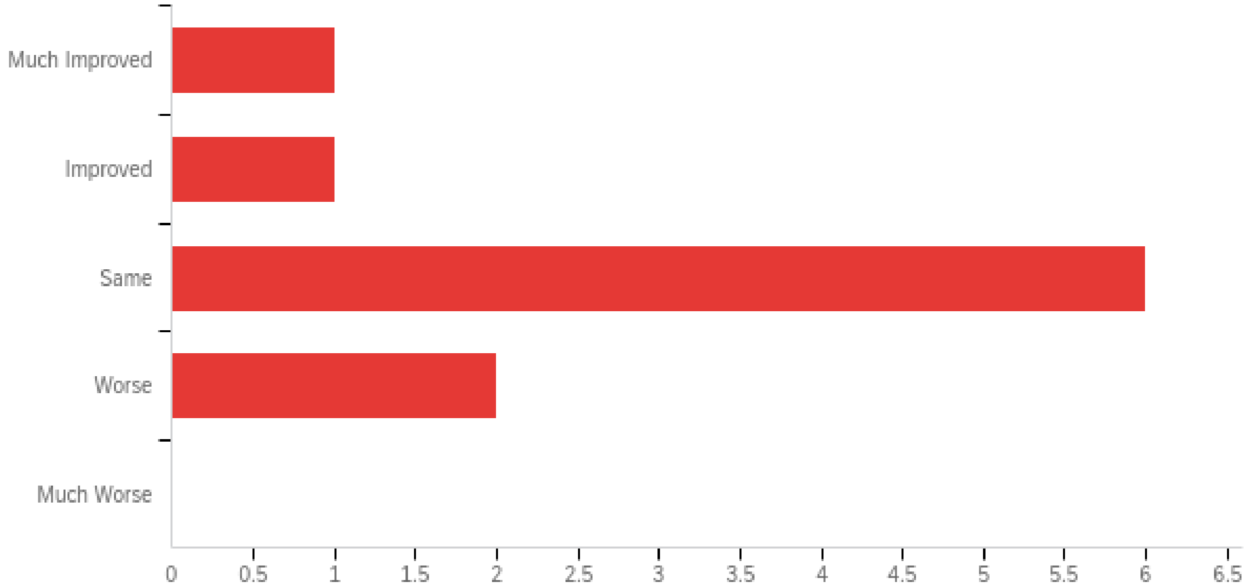
Q8 - How would you rate the overall efficiency for the utility coordination when using DB compared to DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Efficiency	2.00	4.00	2.60	0.66	0.44	10

#	Answer	%	Count
5	Much Improved	0.00%	0
4	Improved	10.00%	1
3	Same	40.00%	4
2	Worse	50.00%	5
1	Much Worse	0.00%	0
	Total	100%	10

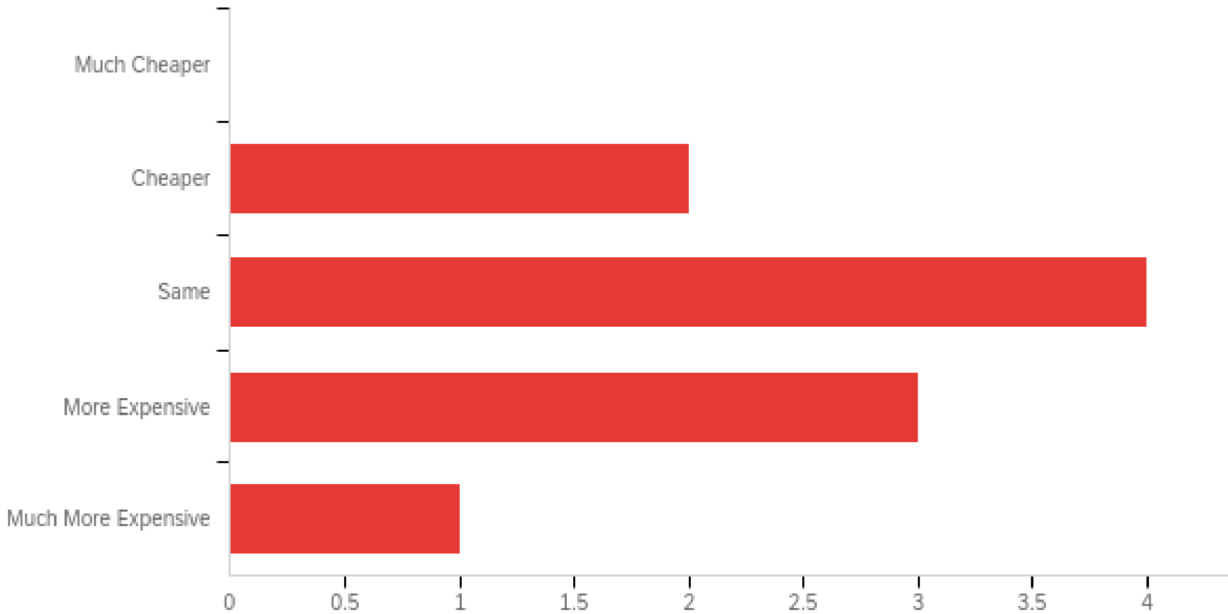
Q9 - How would you rate the overall safety for the utility coordination when using DB compared to DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Safety	2.00	5.00	3.10	0.83	0.69	10

#	Answer	%	Count
5	Much Improved	10.00%	1
4	Improved	10.00%	1
3	Same	60.00%	6
2	Worse	20.00%	2
1	Much Worse	0.00%	0
	Total	100%	10

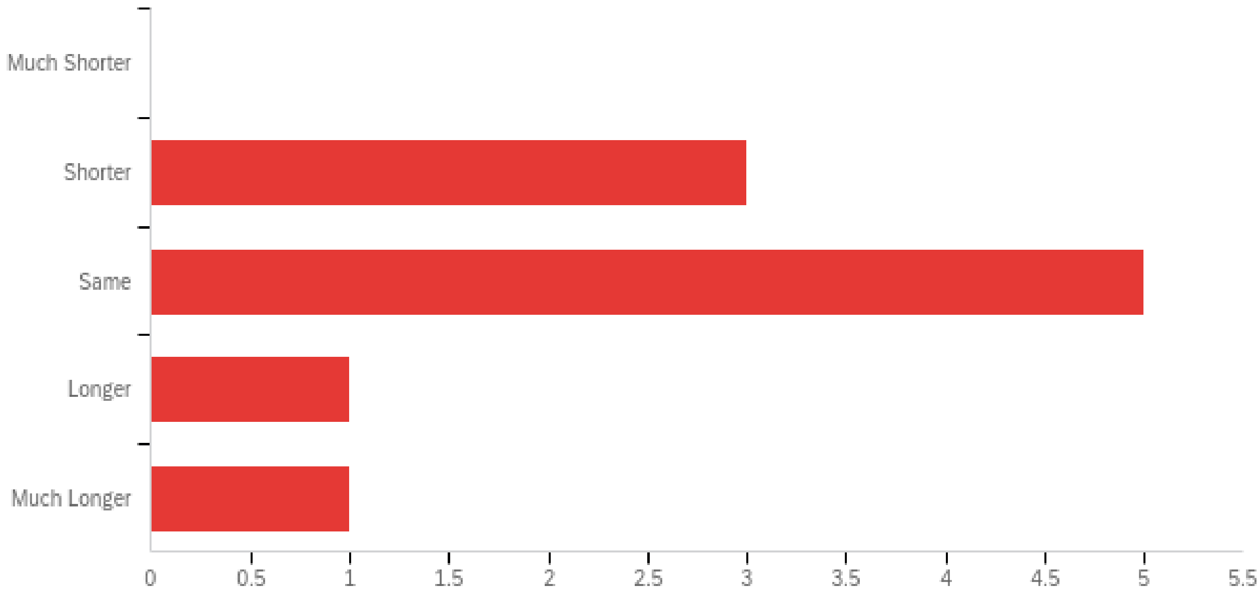
Q10 - How would you rate the overall cost for the utility coordination when using DB compared to DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Cost	1.00	4.00	2.70	0.90	0.81	10

#	Answer	%	Count
5	Much Cheaper	0.00%	0
4	Cheaper	20.00%	2
3	Same	40.00%	4
2	More Expensive	30.00%	3
1	Much More Expensive	10.00%	1
	Total	100%	10

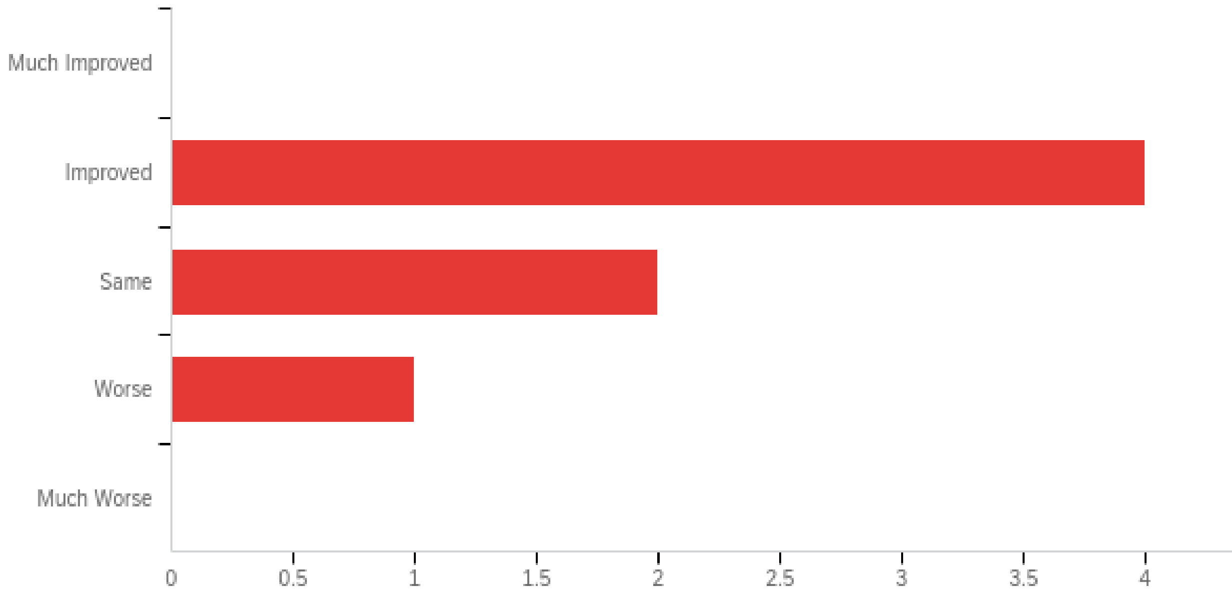
Q11 - How would you rate the overall schedule for the utility coordination when using DB compared to DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Schedule	1.00	4.00	3.00	0.89	0.80	10

#	Answer	%	Count
5	Much Shorter	0.00%	0
4	Shorter	30.00%	3
3	Same	50.00%	5
2	Longer	10.00%	1
1	Much Longer	10.00%	1
	Total	100%	10

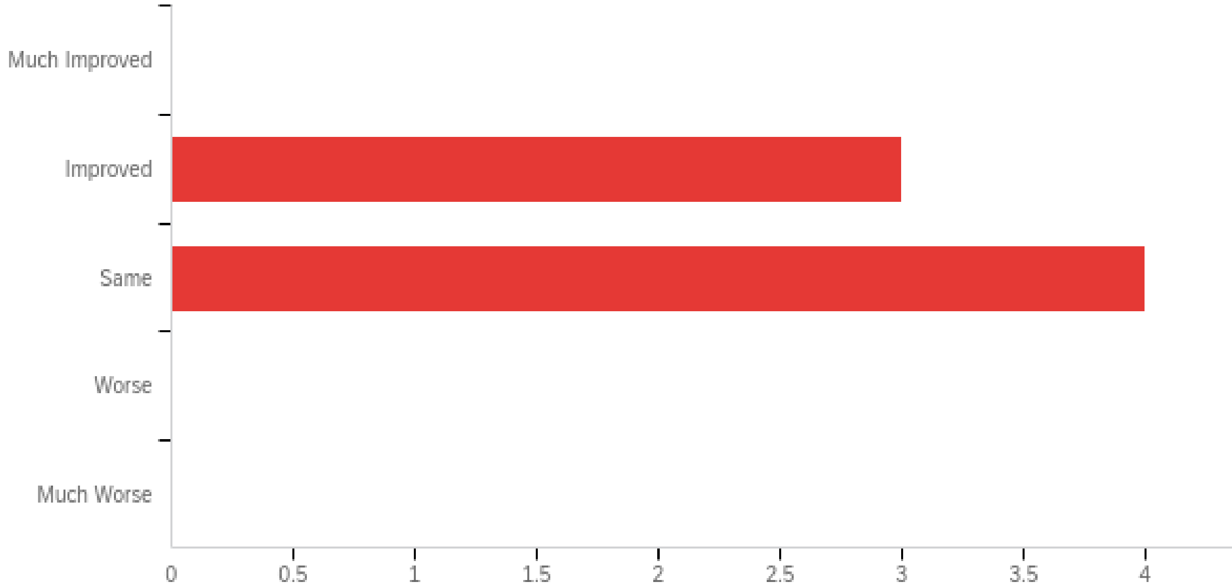
Q13 - How would you rate the overall efficiency for the utility coordination when using P3 compared to DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Efficiency	2.00	4.00	3.43	0.73	0.53	7

#	Answer	%	Count
5	Much Improved	0.00%	0
4	Improved	57.14%	4
3	Same	28.57%	2
2	Worse	14.29%	1
1	Much Worse	0.00%	0
	Total	100%	7

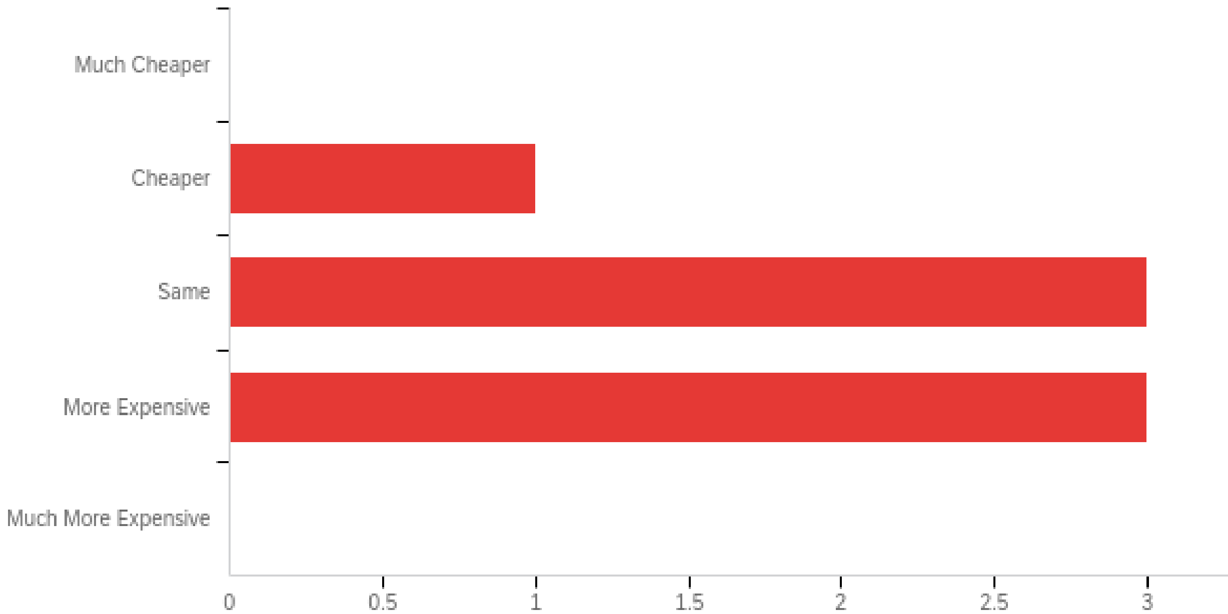
Q14 - How would you rate the overall safety for the utility coordination when using P3 compared to DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Safety	3.00	4.00	3.43	0.49	0.24	7

#	Answer	%	Count
5	Much Improved	0.00%	0
4	Improved	42.86%	3
3	Same	57.14%	4
2	Worse	0.00%	0
1	Much Worse	0.00%	0
	Total	100%	7

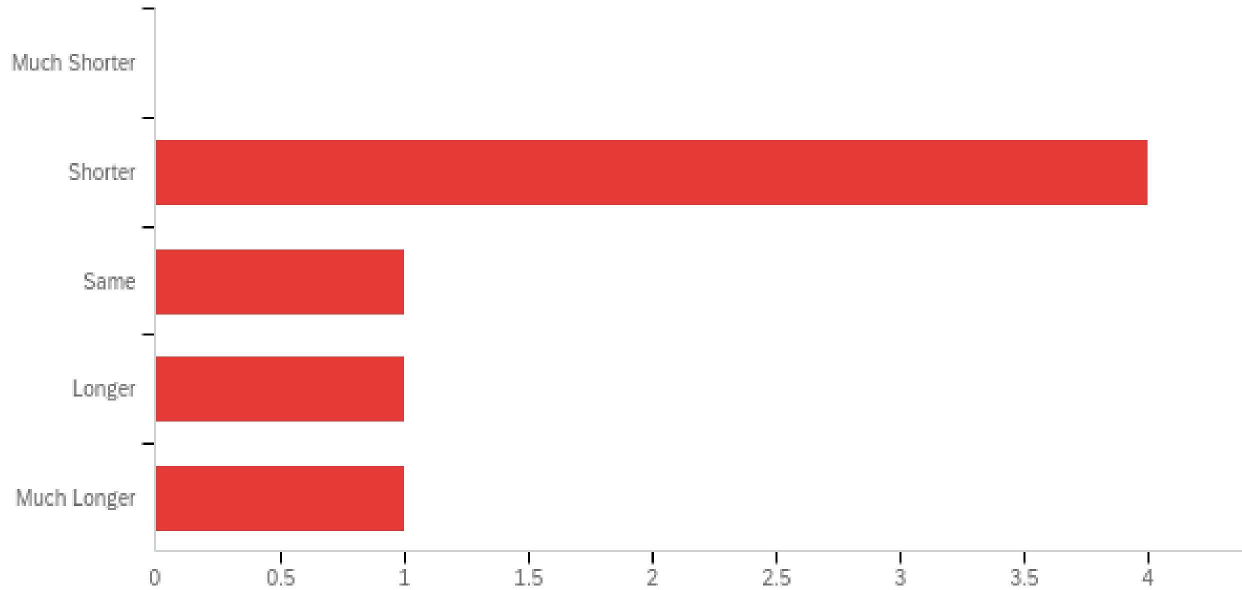
Q15 - How would you rate the overall cost for the utility coordination when using P3 compared to DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Cost	2.00	4.00	2.71	0.70	0.49	7

#	Answer	%	Count
5	Much Cheaper	0.00%	0
4	Cheaper	14.29%	1
3	Same	42.86%	3
2	More Expensive	42.86%	3
1	Much More Expensive	0.00%	0
	Total	100%	7

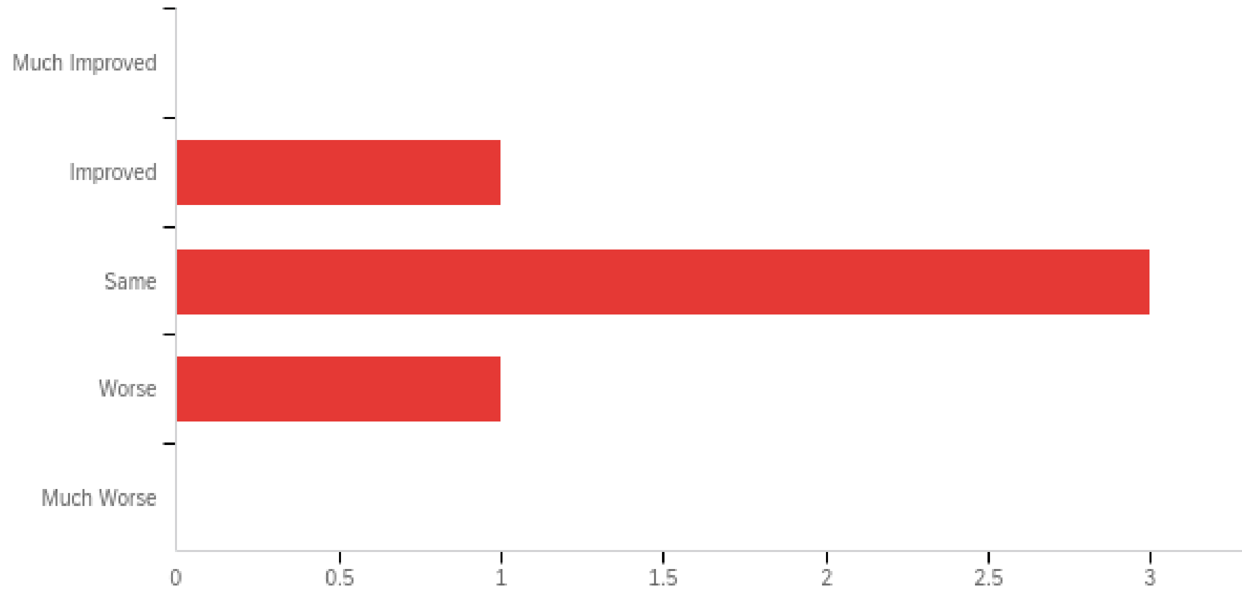
Q16 - How would you rate the overall schedule for the utility coordination when using P3 compared to DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Schedule	1.00	4.00	3.14	1.12	1.27	7

#	Answer	%	Count
5	Much Shorter	0.00%	0
4	Shorter	57.14%	4
3	Same	14.29%	1
2	Longer	14.29%	1
1	Much Longer	14.29%	1
	Total	100%	7

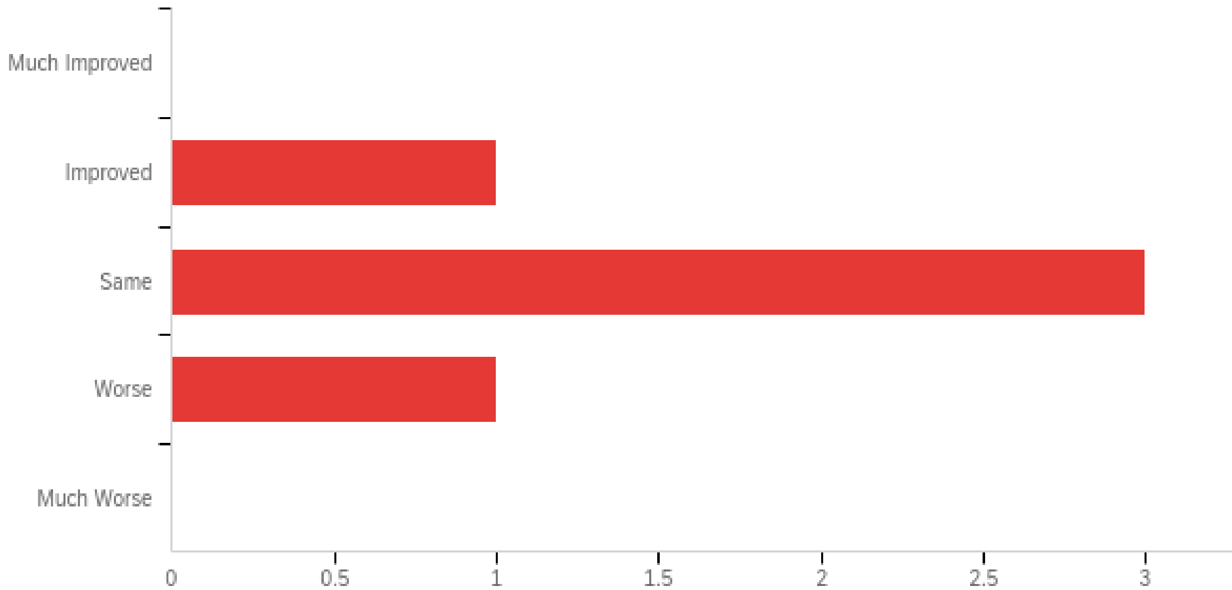
Q18 - How would you rate the overall efficiency for the utility coordination when using CM/GC compared to DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Efficiency	2.00	4.00	3.00	0.63	0.40	5

#	Answer	%	Count
5	Much Improved	0.00%	0
4	Improved	20.00%	1
3	Same	60.00%	3
2	Worse	20.00%	1
1	Much Worse	0.00%	0
	Total	100%	5

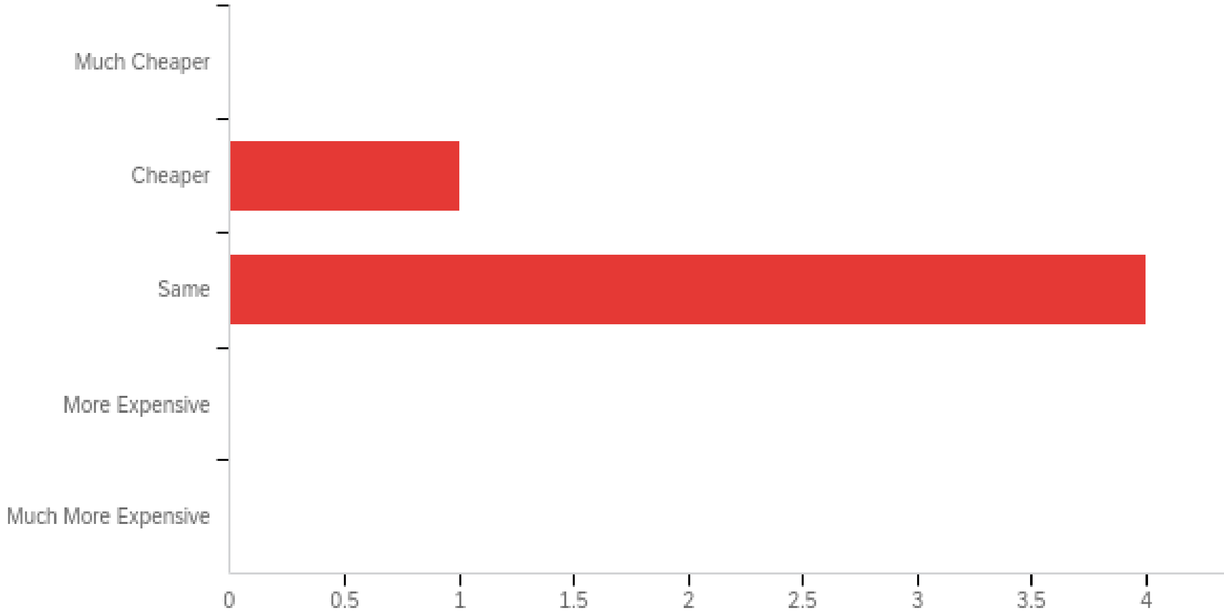
Q19 - How would you rate the overall safety for the utility coordination when using CM/GC compared to DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Safety	2.00	4.00	3.00	0.63	0.40	5

#	Answer	%	Count
5	Much Improved	0.00%	0
4	Improved	20.00%	1
3	Same	60.00%	3
2	Worse	20.00%	1
1	Much Worse	0.00%	0
	Total	100%	5

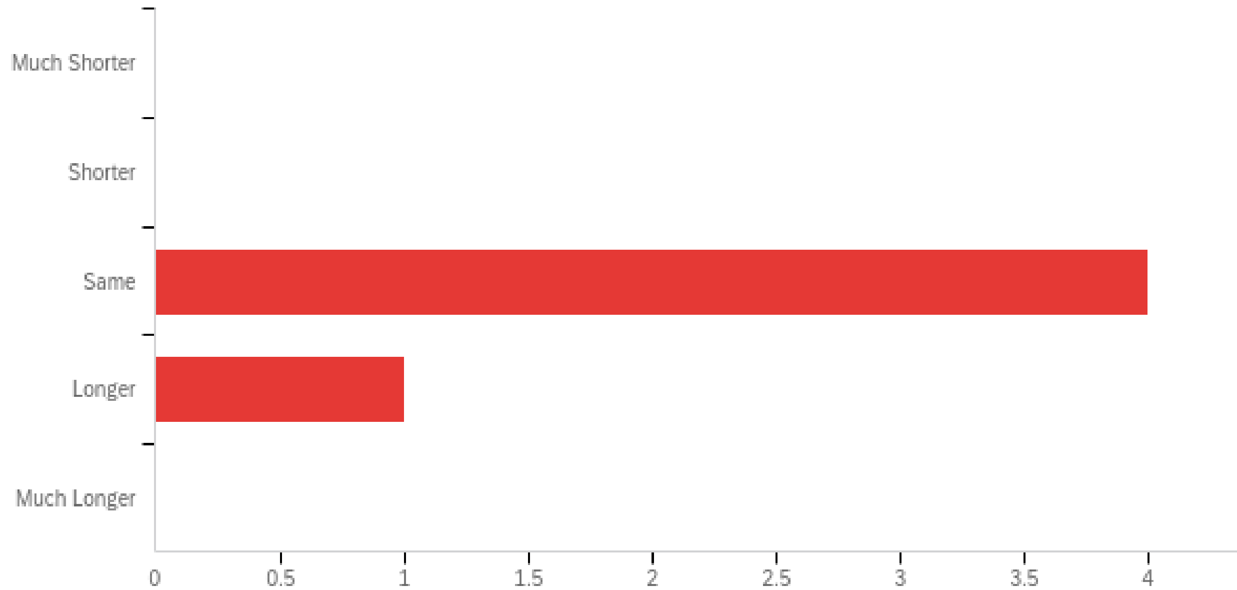
Q20 - How would you rate the overall cost for the utility coordination when using CM/GC compared to DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Cost	3.00	4.00	3.20	0.40	0.16	5

#	Answer	%	Count
5	Much Cheaper	0.00%	0
4	Cheaper	20.00%	1
3	Same	80.00%	4
2	More Expensive	0.00%	0
1	Much More Expensive	0.00%	0
	Total	100%	5

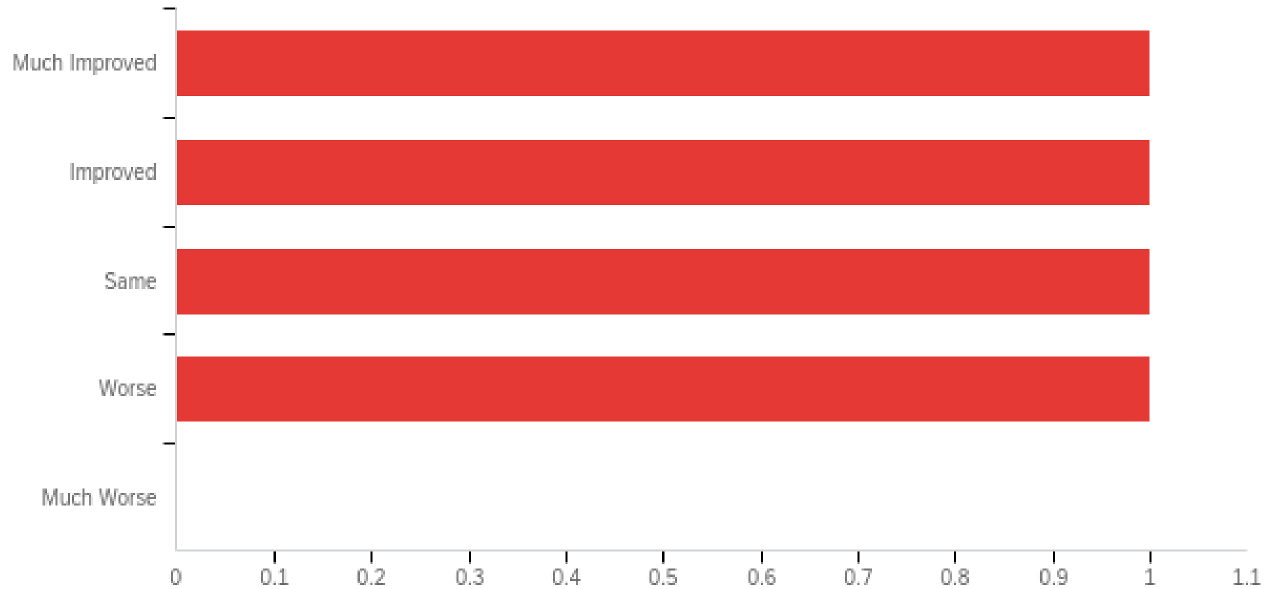
Q21 - How would you rate the overall schedule for the utility coordination when using CM/GC compared to DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Schedule	2.00	3.00	2.80	0.40	0.16	5

#	Answer	%	Count
5	Much Shorter	0.00%	0
4	Shorter	0.00%	0
3	Same	80.00%	4
2	Longer	20.00%	1
1	Much Longer	0.00%	0
	Total	100%	5

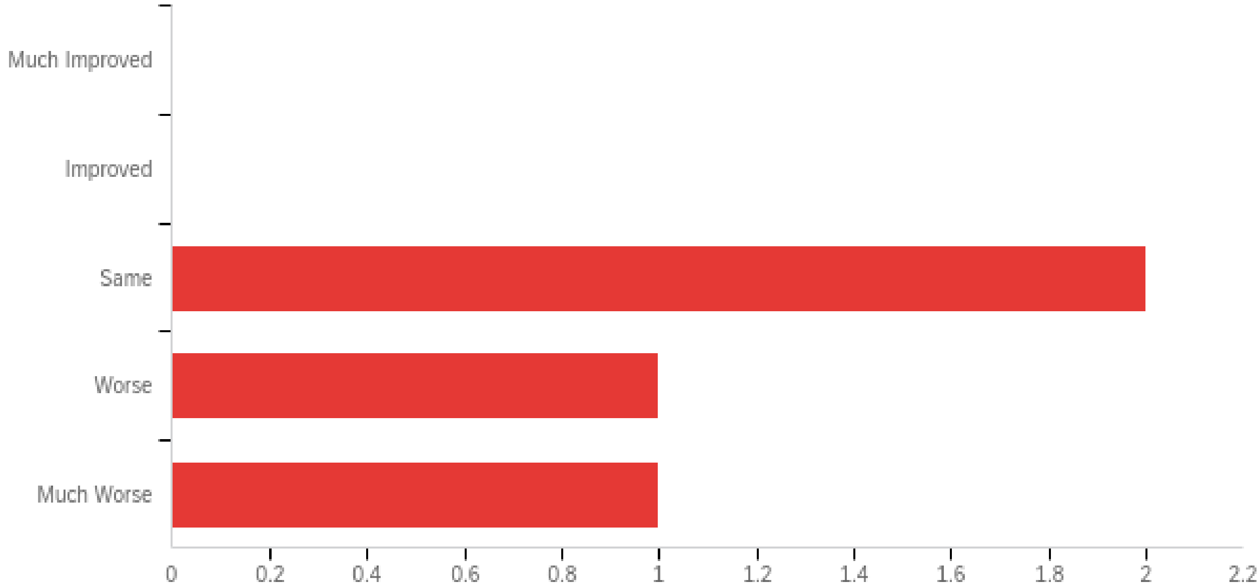
Q23 - How would you rate the overall efficiency for the utility coordination when using ATCs (DB/DBB) compared to traditional DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Efficiency	2.00	5.00	3.50	1.12	1.25	4

#	Answer	%	Count
5	Much Improved	25.00%	1
4	Improved	25.00%	1
3	Same	25.00%	1
2	Worse	25.00%	1
1	Much Worse	0.00%	0
	Total	100%	4

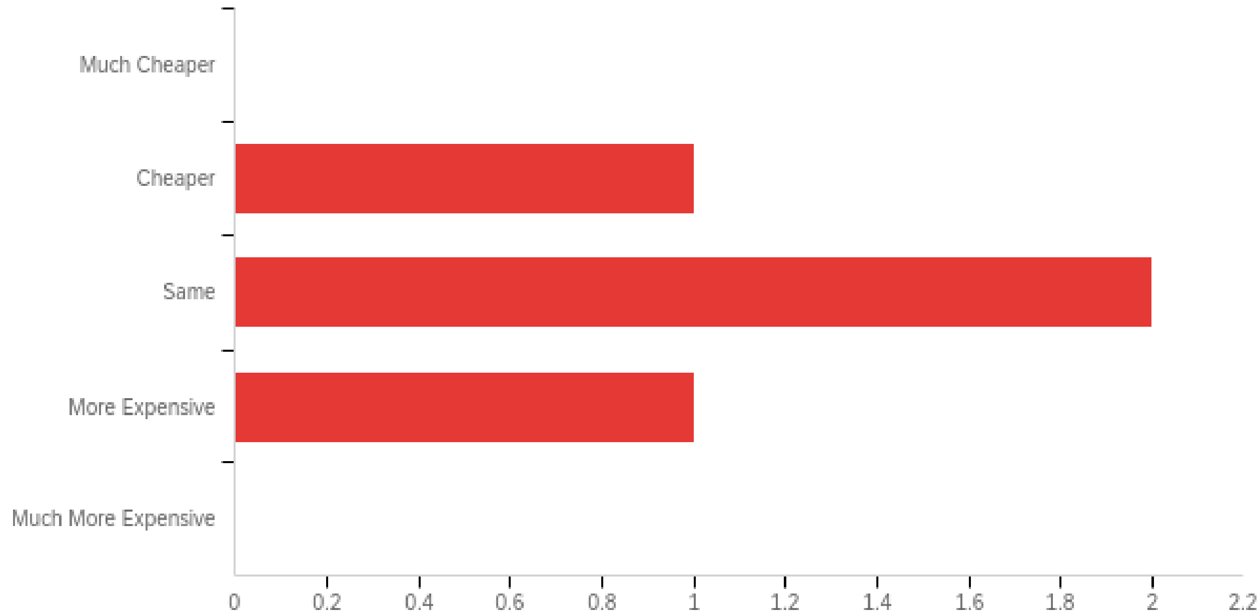
Q24 - How would you rate the overall safety for the utility coordination when using ATCs (DB/DBB) compared to traditional DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Safety	1.00	3.00	2.25	0.83	0.69	4

#	Answer	%	Count
5	Much Improved	0.00%	0
4	Improved	0.00%	0
3	Same	50.00%	2
2	Worse	25.00%	1
1	Much Worse	25.00%	1
	Total	100%	4

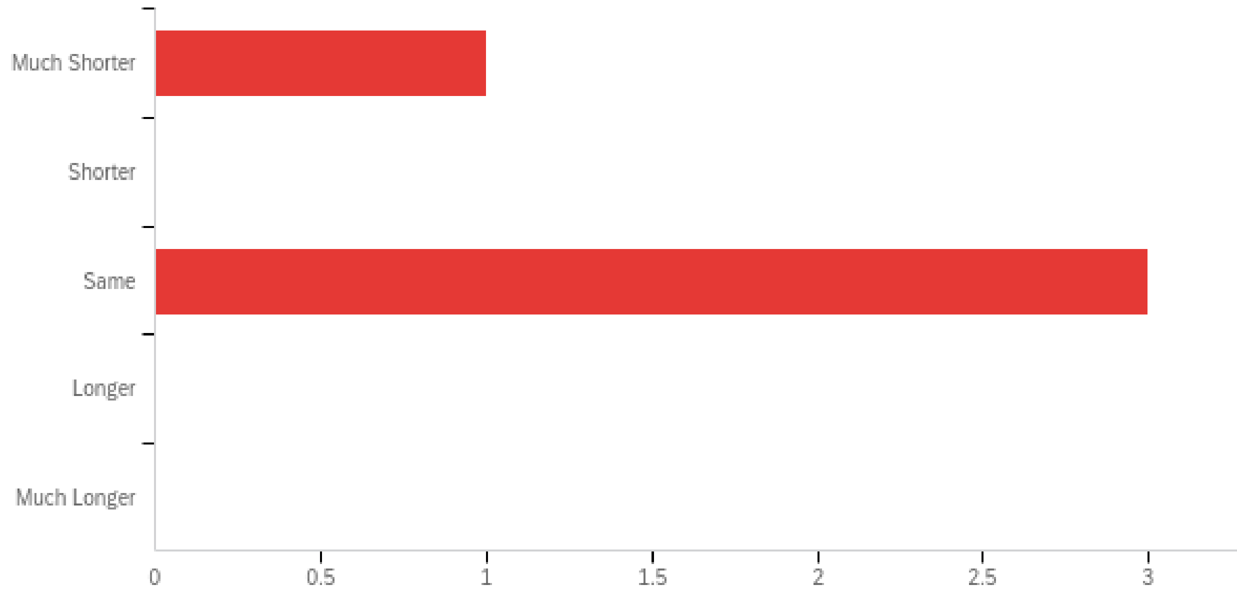
Q25 - How would you rate the overall cost for the utility coordination when using ATCs (DB/DBB) compared to traditional DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Cost	2.00	4.00	3.00	0.71	0.50	4

#	Answer	%	Count
5	Much Cheaper	0.00%	0
4	Cheaper	25.00%	1
3	Same	50.00%	2
2	More Expensive	25.00%	1
1	Much More Expensive	0.00%	0
	Total	100%	4

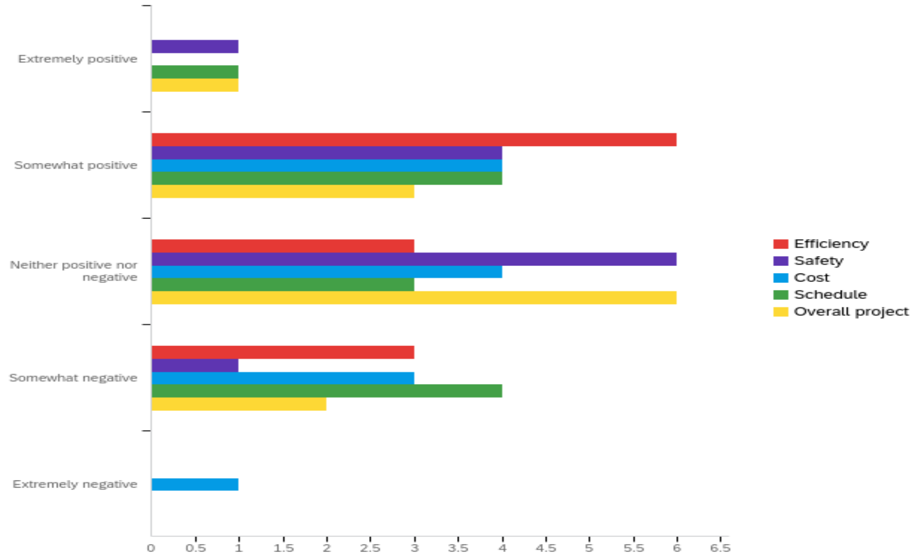
Q26 - How would you rate the overall schedule for the utility coordination when using ATCs (DB/DBB) compared to traditional DBB?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Schedule	3.00	5.00	3.50	0.87	0.75	4

#	Answer	%	Count
5	Much Shorter	25.00%	1
4	Shorter	0.00%	0
3	Same	75.00%	3
2	Longer	0.00%	0
1	Much Longer	0.00%	0
	Total	100%	4

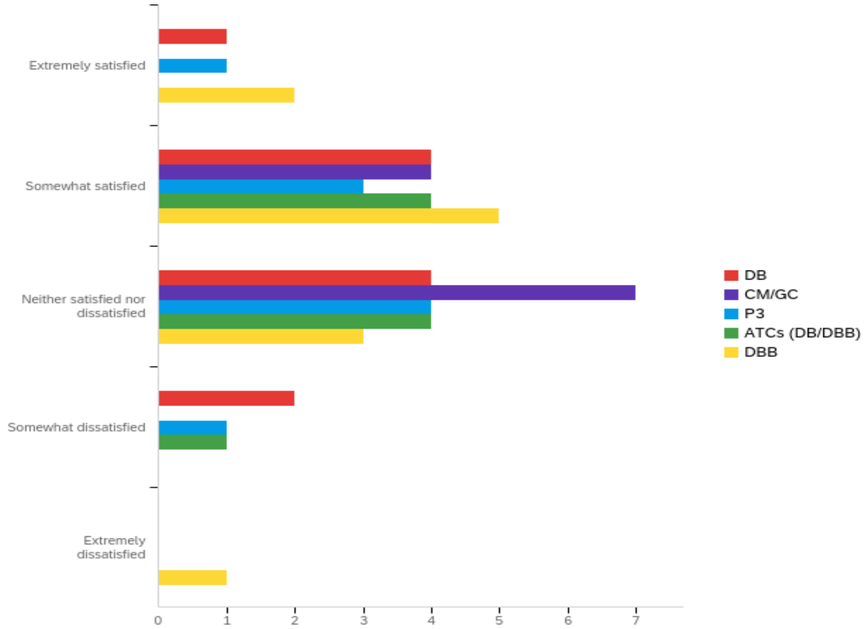
Q27 - In your opinion, do you believe that the utility coordination using DB, P3, CM/GM and, ATCs (DB/DBB) delivery methods contributed positively or negatively compared to traditional DBB projects in the following metrics?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Efficiency	2.00	4.00	3.25	0.83	0.69	12
2	Safety	2.00	5.00	3.42	0.76	0.58	12
3	Cost	1.00	4.00	2.92	0.95	0.91	12
4	Schedule	2.00	5.00	3.17	0.99	0.97	12
5	Overall project	2.00	5.00	3.25	0.83	0.69	12

#	Question	Extremely positive		Somewhat positive		Neither positive nor negative		Somewhat negative		Extremely negative		Total
5	Efficiency	0.00%	0	50.00%	6	25.00%	3	25.00%	3	0.00%	0	12
4	Safety	8.33%	1	33.33%	4	50.00%	6	8.33%	1	0.00%	0	12
3	Cost	0.00%	0	33.33%	4	33.33%	4	25.00%	3	8.33%	1	12
2	Schedule	8.33%	1	33.33%	4	25.00%	3	33.33%	4	0.00%	0	12
1	Overall project	8.33%	1	25.00%	3	50.00%	6	16.67%	2	0.00%	0	12

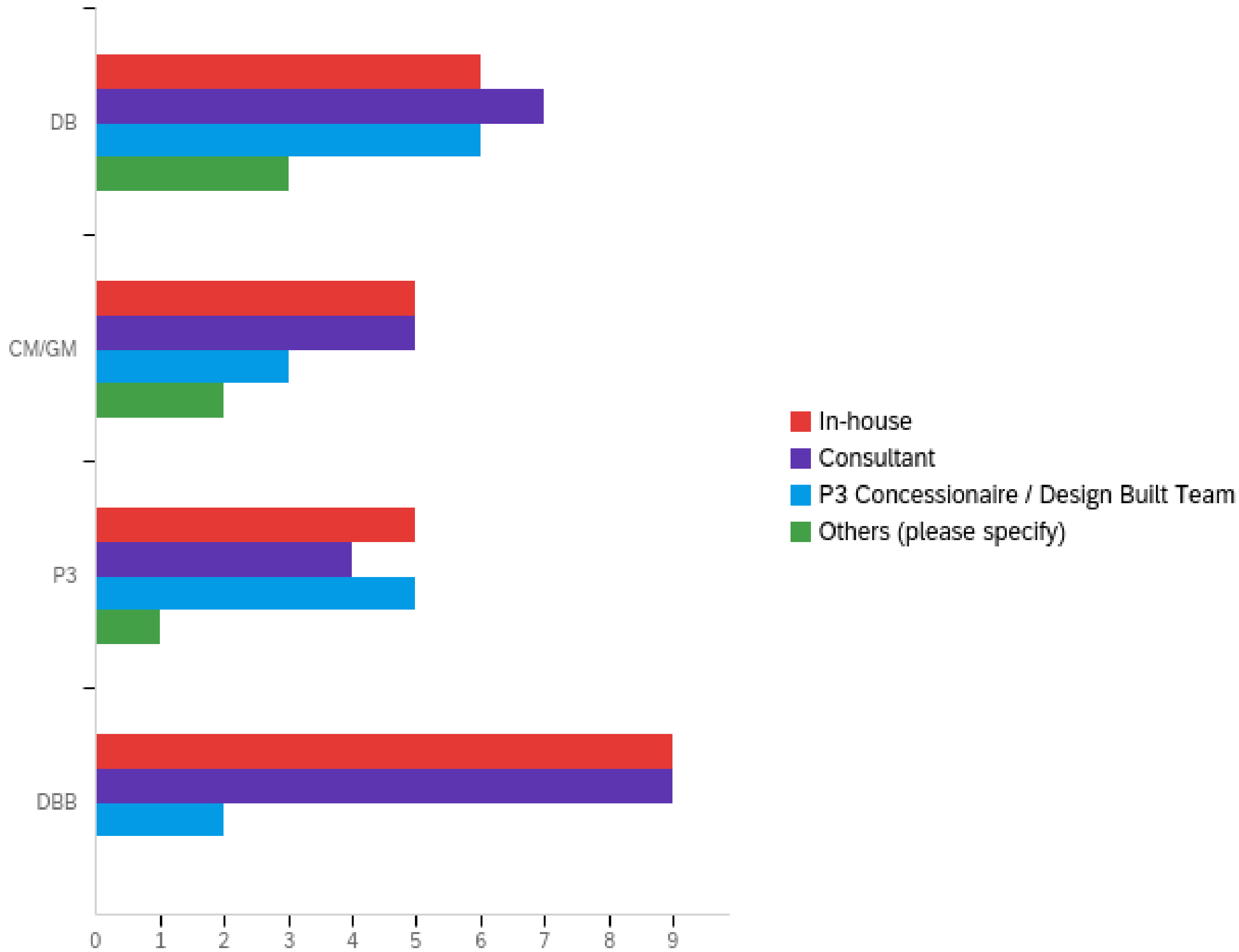
Q28 - How satisfied are you with the utility coordination process used for the following ACMs in your state?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	DB	2.00	5.00	3.36	0.88	0.78	11
2	CM/GC	3.00	4.00	3.36	0.48	0.23	11
3	P3	2.00	5.00	3.44	0.83	0.69	9
4	ATCs (DB/DBB)	2.00	4.00	3.33	0.67	0.44	9
5	DBB	1.00	5.00	3.64	1.07	1.14	11

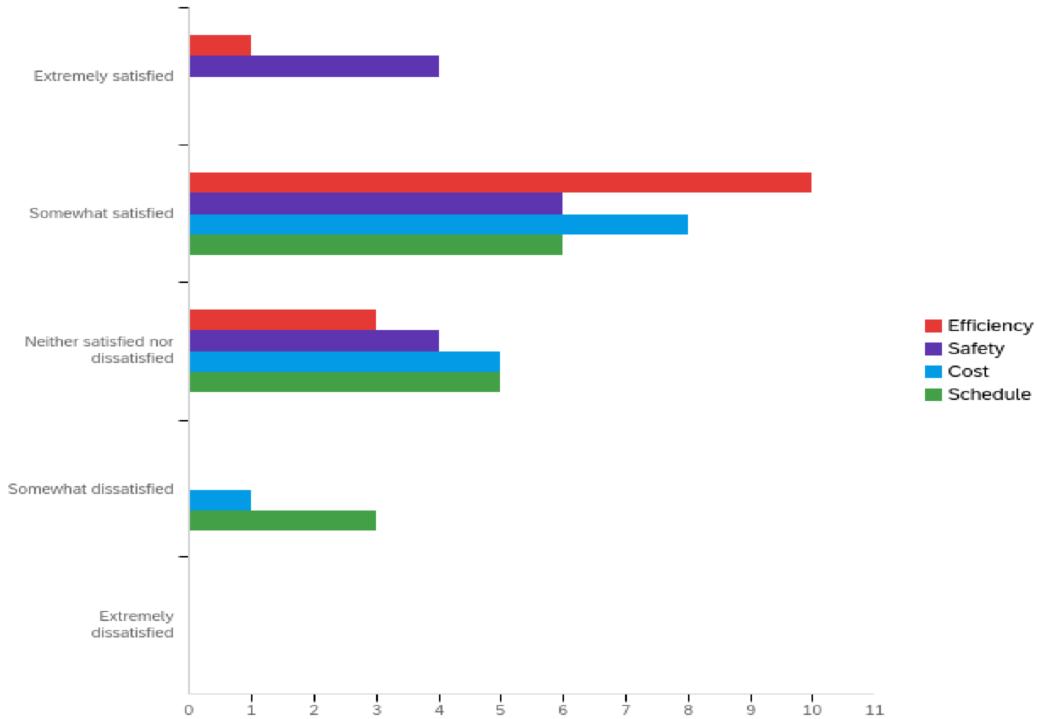
#	Question	Extremely satisfied		Somewhat satisfied		Neither satisfied nor dissatisfied		Somewhat dissatisfied		Extremely dissatisfied		Total
5	DB	9.09%	1	36.36%	4	36.36%	4	18.18%	2	0.00%	0	11
4	CM/GC	0.00%	0	36.36%	4	63.64%	7	0.00%	0	0.00%	0	11
3	P3	11.11%	1	33.33%	3	44.44%	4	11.11%	1	0.00%	0	9
2	ATCs (DB/DBB)	0.00%	0	44.44%	4	44.44%	4	11.11%	1	0.00%	0	9
1	DBB	18.18%	2	45.45%	5	27.27%	3	0.00%	0	9.09%	1	11

Q29 - What type of utility coordination do you use? (Mark all answers that apply)



#	Question	DB		CM/GM		P3		DBB		Total
1	In-house	24.00%	6	20.00%	5	20.00%	5	36.00%	9	25
2	Consultant	28.00%	7	20.00%	5	16.00%	4	36.00%	9	25
3	P3 Concessionaire / Design Built Team	37.50%	6	18.75%	3	31.25%	5	12.50%	2	16
4	Others (please specify)	50.00%	3	33.33%	2	16.67%	1	0.00%	0	6

Q30 - How would you rate the overall study impact areas (efficiency, safety, cost, and schedule) on utility coordination when performed In-House?



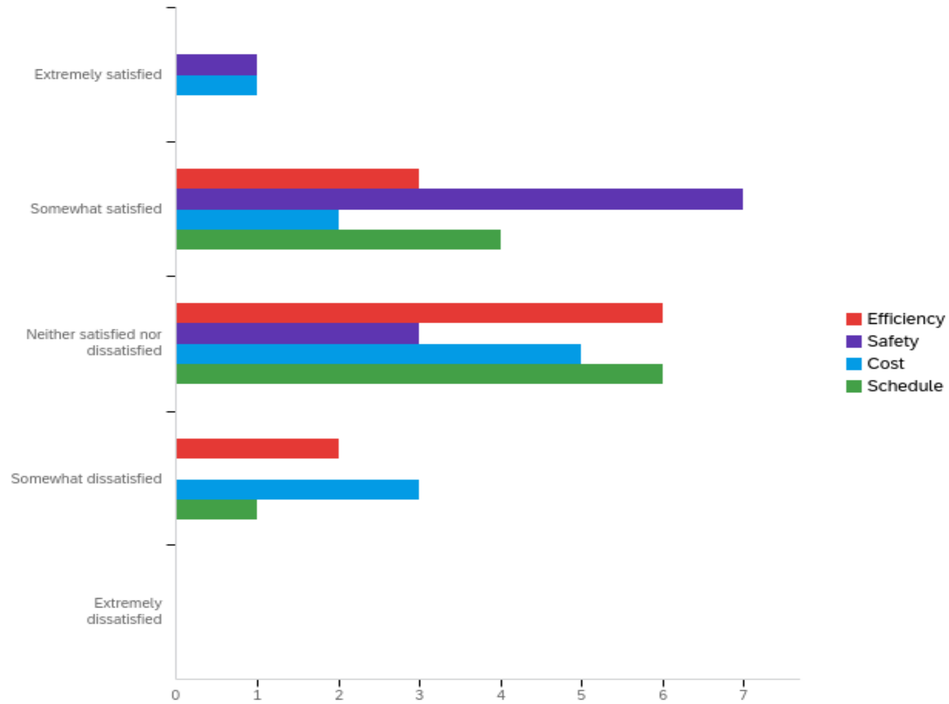
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Efficiency	3.00	5.00	3.86	0.52	0.27	14
2	Safety	3.00	5.00	4.00	0.76	0.57	14
3	Cost	2.00	4.00	3.50	0.63	0.39	14
4	Schedule	2.00	4.00	3.21	0.77	0.60	14

#	Question	Extremely satisfied		Somewhat satisfied		Neither satisfied nor dissatisfied		Somewhat dissatisfied		Extremely dissatisfied		Total
5	Efficiency	7.14%	1	71.43%	10	21.43%	3	0.00%	0	0.00%	0	14
4	Safety	28.57%	4	42.86%	6	28.57%	4	0.00%	0	0.00%	0	14
3	Cost	0.00%	0	57.14%	8	35.71%	5	7.14%	1	0.00%	0	14
2	Schedule	0.00%	0	42.86%	6	35.71%	5	21.43%	3	0.00%	0	14

Q36 - Comments:

Comments:
An in-house project is more difficult to secure plans that are final. Therefore, more, longer and some frustration with coordination.
staff turnover and inexperience have led to challenges
Since we don't use DB or P3, Many of the questions do not apply and were not answered. Looks like you needed another column with N/A.

Q31 - How would you rate the overall study impact areas (efficiency, safety, cost, and schedule) on utility coordination when performed by the Consultant?



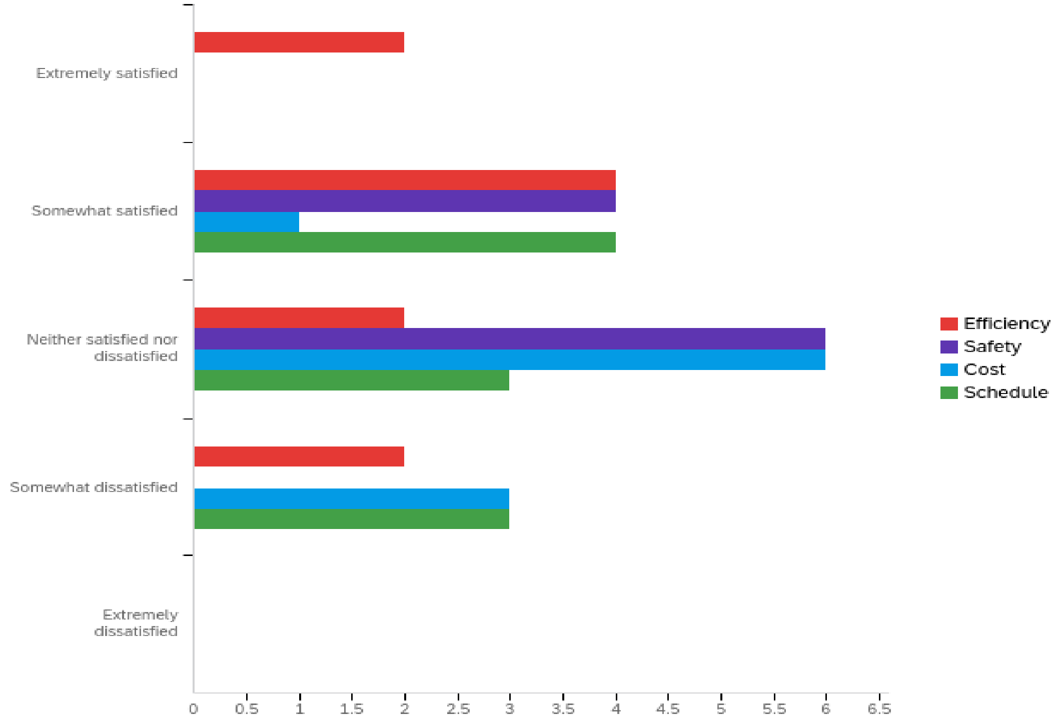
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Efficiency	2.00	4.00	3.09	0.67	0.45	11
2	Safety	3.00	5.00	3.82	0.57	0.33	11
3	Cost	2.00	5.00	3.09	0.90	0.81	11
4	Schedule	2.00	4.00	3.27	0.62	0.38	11

#	Question	Extremely satisfied		Somewhat satisfied		Neither satisfied nor dissatisfied		Somewhat dissatisfied		Extremely dissatisfied		Total
5	Efficiency	0.00%	0	27.27%	3	54.55%	6	18.18%	2	0.00%	0	11
4	Safety	9.09%	1	63.64%	7	27.27%	3	0.00%	0	0.00%	0	11
3	Cost	9.09%	1	18.18%	2	45.45%	5	27.27%	3	0.00%	0	11
2	Schedule	0.00%	0	36.36%	4	54.55%	6	9.09%	1	0.00%	0	11

Q37 - Comments:

Comments:
Final plans and decisions for coordination are more timely. However, the engineering thought required to avoid a utility conflict is often over looked.
We have only used a consultant once to coordinate the utility relocation. It did not advance the work any better than with DOT personnel and didn't completely relieve DOT staff from their duties. The agreements to allow the utility relocation still had to go through the same approval process. The consultant treated every request as a crisis, so that nothing really became a crisis. Maybe there was a learning curve, but we did not think that it worked well enough to use it again.

Q32 - How would you rate the overall study impact areas (efficiency, safety, cost, and schedule) on utility coordination when performed by the P3 Concessionaire / Design Built Team?



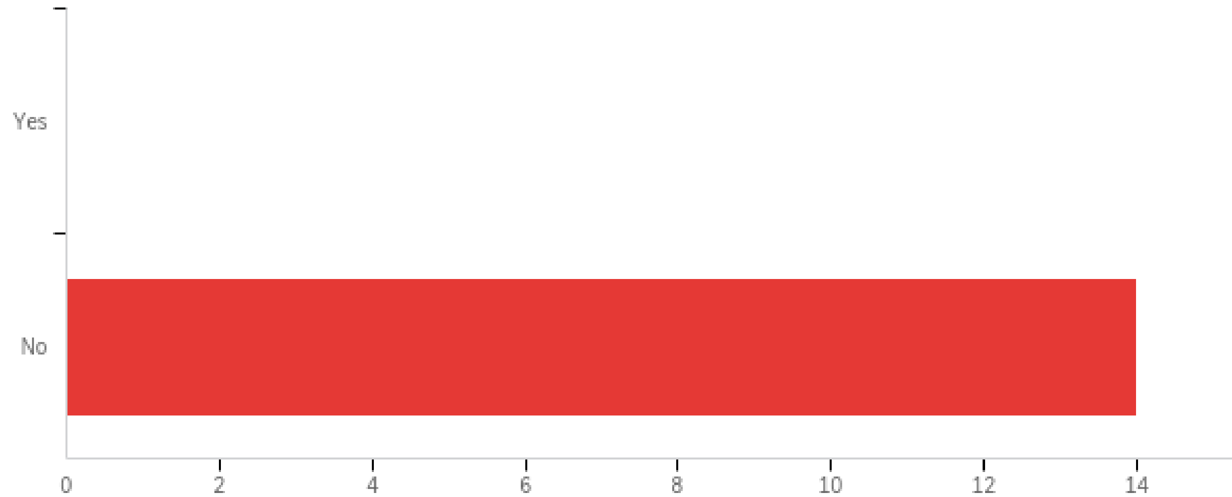
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Efficiency	2.00	5.00	3.60	1.02	1.04	10
2	Safety	3.00	4.00	3.40	0.49	0.24	10
3	Cost	2.00	4.00	2.80	0.60	0.36	10
4	Schedule	2.00	4.00	3.10	0.83	0.69	10

#	Question	Extremely satisfied		Somewhat satisfied		Neither satisfied nor dissatisfied		Somewhat dissatisfied		Extremely dissatisfied		Total
5	Efficiency	20.00%	2	40.00%	4	20.00%	2	20.00%	2	0.00%	0	10
4	Safety	0.00%	0	40.00%	4	60.00%	6	0.00%	0	0.00%	0	10
3	Cost	0.00%	0	10.00%	1	60.00%	6	30.00%	3	0.00%	0	10
2	Schedule	0.00%	0	40.00%	4	30.00%	3	30.00%	3	0.00%	0	10

Q38 - Comments:

Comments:
DB and P3; want to work with conceptual plans. Utility company really wants final elevations and location prior to their design effort. The effort is to supply information and two weeks later the utility should be out of the way. It really doesn't work; so a lot of delay and threats of delay. All impacts working relationship for all other projects. In fairness, we are pretty new to having DB and P3 projects with a lot of utility impacts.

Q34 - Do you have any quantifiable records to backup the responses provided in the previous questions (i.e. data to compare efficiency, cost, safety, and schedule between a DBB and ACMs)?



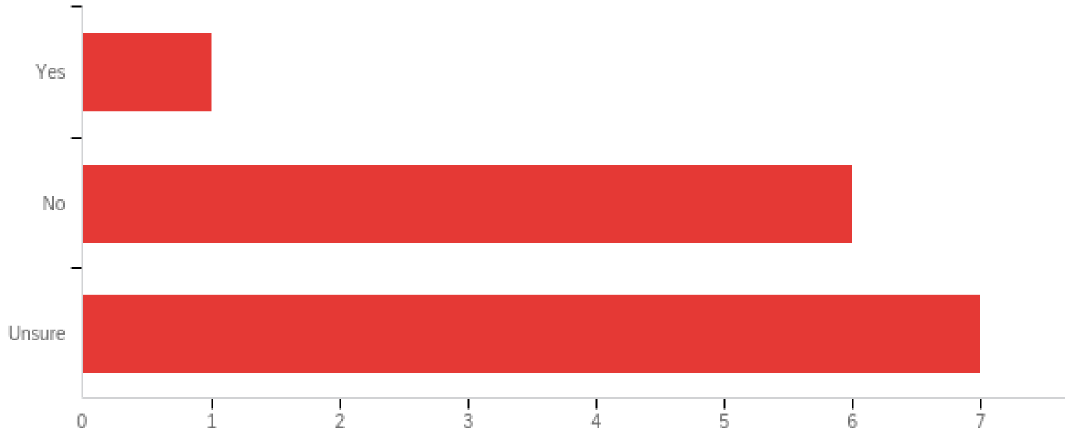
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Do you have any quantifiable records to backup the responses provided in the previous questions (i.e. data to compare efficiency, cost, safety, and schedule between a DBB and ACMs)?	2.00	2.00	2.00	0.00	0.00	14

#	Answer	%	Count
1	Yes	0.00%	0
2	No	100.00%	14
	Total	100%	14

Q39 - Comments:

Comments:
We do not have enough experience with alternative bid projects.
Not really. Most things get worked out in meetings and escalations.

Q35 - We are interested in obtaining quantifiable data for cost and schedule comparisons of utility coordination between ACM and traditional DBB projects. Could you provide us with access to such a data set?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	We are interested in obtaining quantifiable data for cost and schedule comparisons of utility coordination between ACM and traditional DBB projects. Could you provide us with access to such a data set?	1.00	3.00	2.43	0.62	0.39	14

#	Answer	%	Count
1	Yes	7.14%	1
2	No	42.86%	6
3	Unsure	50.00%	7
	Total	100%	14

Q40 - Comments:

Comments:
We do not have enough experience with alternative bid projects

Appendix D: Survey Utility Coordinators Responses

States Completing the Survey:
Arizona,
South Carolina,
Wisconsin,
Virginia,
Pennsylvania,
T2 Utility Engineers Inc as Consultant company

Default Report

NCHRP 20-07/Task 407 Interview Questionnaire Utility Coordinators
February 2nd 2020, 7:35 pm CST

Info 3 - Agency:

Agency:
Iowa Department of Transportation
Surveying and Mapping, SAM, LLC
T2 Utility Engineers
T2 Utility Engineers
PennDOT 12-0
Alabama DOT
T2 Utility Engineers Inc.
Florida Department of Transportation
Georgia DOT
TxDOT
KYTC
SCDOT
Pennsylvania Department of Transportation
Arizona Department of Transportation
SCDOT
Virginia Department of Transportation
ADOT
Delaware DOT
Virginia Department of Transportation
Wisconsin Department of Transportation
Missouri Department of Transportation
SCDOT

MoDOT
Wisconsin Department of Transportation
Arizona Department of Transportation
Alabama DOT
Massachusetts Department of Transportation (MassDOT)
ADOT

DBB 2 - Project Name:

Project Name:
Iowa does not utilize DBB methods.
Yellowhead Trail Freeway Conversion; City of Edmonton
I26 Port Access
I-64/I-264 Interchange Improvements Project
Wales Road (STH 83)
SC-302 (Silver Bluff Road) Corridor Improvements from S-81 (Richardson's Lake Road) to S-1849 (Indian Creek Trail) - Aiken County
I-8/Araby Road TI Reconstruction
H8485 01C Bell Road TI - Design-Bid-Build

DBB 3 - Project Description:

Project Description:
Converting Yellowhead Trail from a major arterial into a freeway, with 3 lanes of free flowing traffic in each direction travelling at a target speed of approximately 80 km/hr. Current signalized intersections and access on or off Yellowhead Trail will to be removed. Due to the overall size of the freeway conversion, it has been broken into 6 segments.
The SC Port Access Road will connect Interstate 26 to the South Carolina Ports Authority's Hugh K. Leatherman Sr. Terminal in North Charleston, SC. Scheduled to be finished prior to the opening of the new terminal, the SC Port Access Road will provide two inbound and two outbound lanes for port related traffic. The new fully directional interchange with I-26 will also serve local and commercial vehicles with a connector road to Bainbridge Avenue, an extension of Stromboli Avenue, as well as associated roadway improvements to surface streets.
The I-64/I-264 Interchange Improvements Project, over two phases, will provide approximately 4 miles of interstate improvements from the Twin Bridges in Norfolk to the Witchduck Road interchange in Virginia Beach. The improvements will provide additional capacity, reduce daily congestion and improve safety and traffic operations in the corridor. Phase 1 used for this survey 2 phases of construction
Urban reconstruction project from Perkins Road to Glacier Pass. Going from 2 lane undivided to 4 lane undivided, with a roundabout at USH 18/STH 83.
Roadway widening and installation of turn lanes, removal and disposal of asphalt and concrete, milling, HMA Base Course A, Intermediate B, and Surface B, 6" and 8" Full Depth Patching, grading, drainage structure and pipe installations, curb and gutter, detention ponds, retaining walls, traffic signal installations at Town Creek Road/Woodside Plantation Drive/Richardson's Lake Road, signage, permanent pavement markings, and permanent stabilization.
Construct Roundabouts
Installing new bridge over the railroad tracks, utility relocation(Gas, Power, Water, Telecommunication).

DBB 4 - Project Length (miles):

Project Length (miles):
18 miles
2.2 miles & Interchange
2.58
2.137 Miles
1.14
2

DBB 5 - Design Start (MM/DD/YYYY):

Design Start (MM/DD/YYYY):
01/02/2019
12/01/2008
01/25/2009
07/01/2005
09/05/2013
01/16/2016

DBB 6 - Design Complete (MM/DD/YYYY):

Design Complete (MM/DD/YYYY):
12/31/2023
09/01/2016
08/01/2013
09/01/2015
03/27/2017
01/15/2015

DBB 7 - Design Cost / Budget ($):

Design Cost / Budget ($):
$100,000,000
13,882,900 PE cost
$1,353,739.01
$930,000.00
504,569.00
20

DBB 8 - Construction Cost / Budget ($):

Construction Cost / Budget ($):
$1 Billion
107,400,000
$16,255,731.47
$6,675,157.97 to date
8,045,000.00
20

DBB 9 - Utility Cost / Budget ($):

Utility Cost / Budget ($):
Estimated at $40,000,000
13,818,538
$360,000 (amount WisDOT reimbursed for 2 utils - there was additional non-reimbursable utility work)
$73,781.97 (one utility agreement)
194,069.00
20

DBB 10 - Utility phase authorization / start Date (MM/DD/YYYY):

Utility phase authorization / start Date (MM/DD/YYYY):
05/01/2020
03/18/2016
06/01/2013
05/15/2013
01/05/2016
01/15/2016

DBB 11 - Utility clearance date (known/expected) (MM/DD/YYYY):

Utility clearance date (known/expected) (MM/DD/YYYY):
05/01/2024
02/15/2018
05/01/2015
01/02/2018
04/13/2017
01/15/2016

Q52 - Number of utility companies impacted or potentially impacted:

Number of utility companies impacted or potentially impacted:
12
11
10
7
4
5

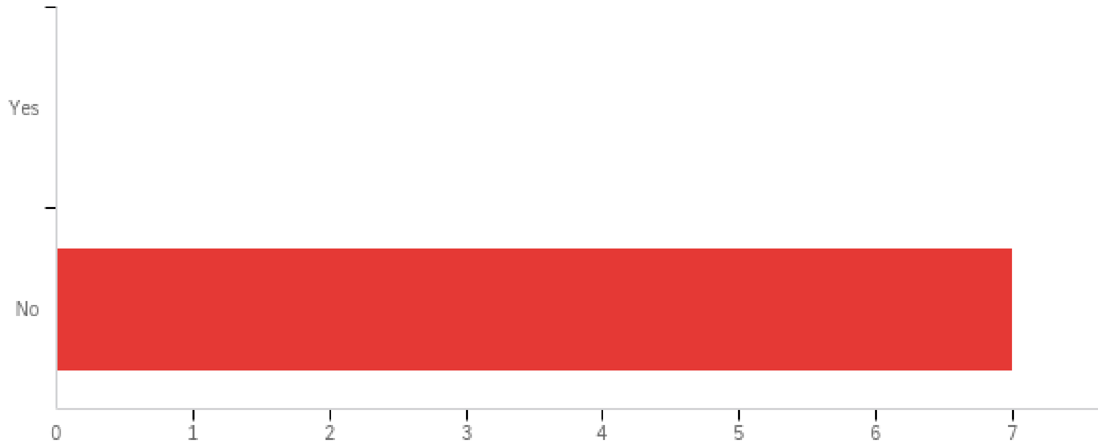
DBB 12 - Construction project start / letting date (MM/DD/YYYY):

Construction project start / letting date (MM/DD/YYYY):
05/01/2019
11/11/2016
12/10/2013
03/29/2016
03/27/2017
01/15/2016

Q51 - Construction completion date (known/expected) (MM/DD/YYYY)

Construction completion date (known/expected) (MM/DD/YYYY)
12/31/2026
10/30/2019
05/25/2016
09/12/2019
10/31/2018
03/07/2017

Q69 - Were the utilities clear prior letting / construction?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Were the utilities clear prior letting / construction?	2.00	2.00	2.00	0.00	0.00	7

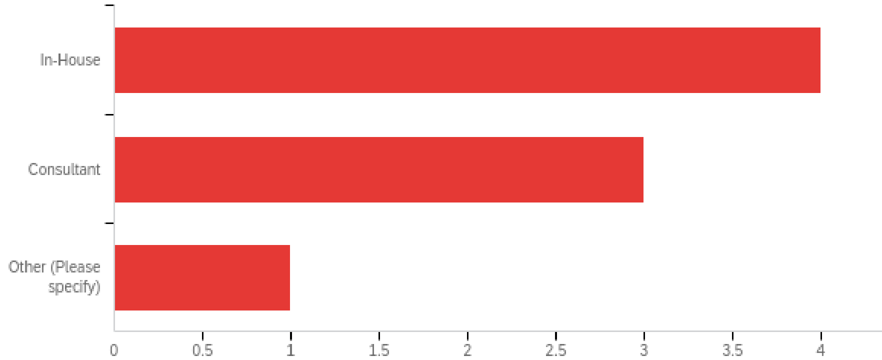
#	Answer	%	Count
1	Yes	0.00%	0
2	No	100.00%	7
	Total	100%	7

Q133 - Provide comments if desired

Provide comments if desired
Not applicable.
Some utilities, such as deep sewers, while be constructed concurrent with some roadway work.
Special provisions for limitation of construction to allow time and area for on-going utility relocations to occur simultaneously with project construction
Most utilities were planning to be substantially clear prior to construction beginning in early spring 2014 - Wisconsin dealt with extreme cold/polar vortex that affected both utility company relocations and road contractor work.
Majority of delay during construction was due to utilities not being relocated in advance of the project.
The project was constructed in two phases allowing the impacted utilities more time to relocate. The phasing of the project was not done in order to accommodate the utilities, it was to prevent a major impact to a business in the area.

project was DB , utility relocation during construction by DB.

Q86 - What utility coordination approach was used?



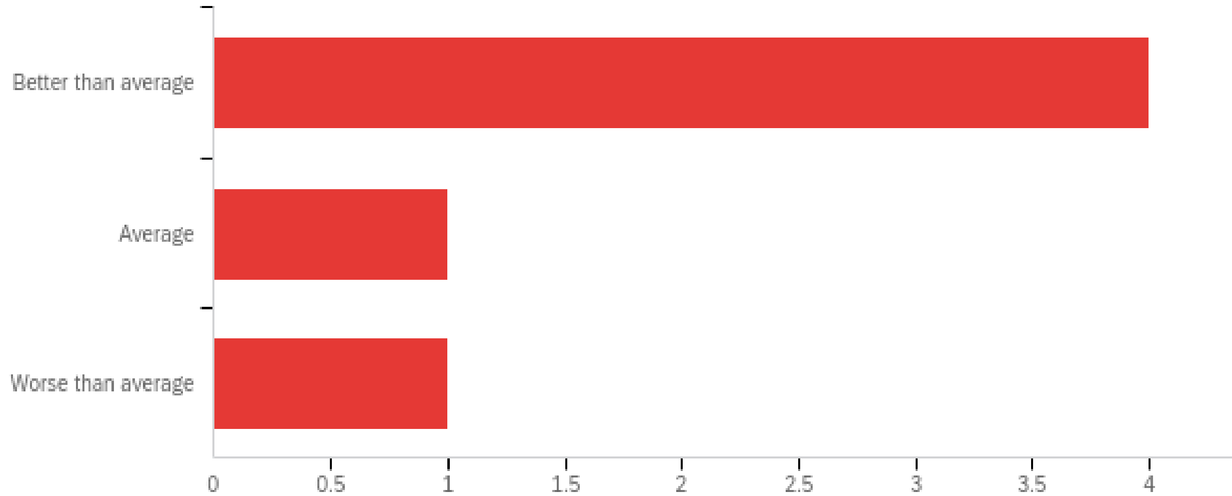
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	What utility coordination approach was used? - Selected Choice	1.00	3.00	1.63	0.70	0.48	8

#	Answer	%	Count
1	In-House	50.00%	4
2	Consultant	37.50%	3
3	Other (Please specify)	12.50%	1
	Total	100%	8

Q86_3_TEXT - Other (Please specify)

Other (Please specify) - Text
Not applicable.

Q92 - How would you rate the efficiency of the utility coordination?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How would you rate the efficiency of the utility coordination?	1.00	3.00	1.50	0.76	0.58	6

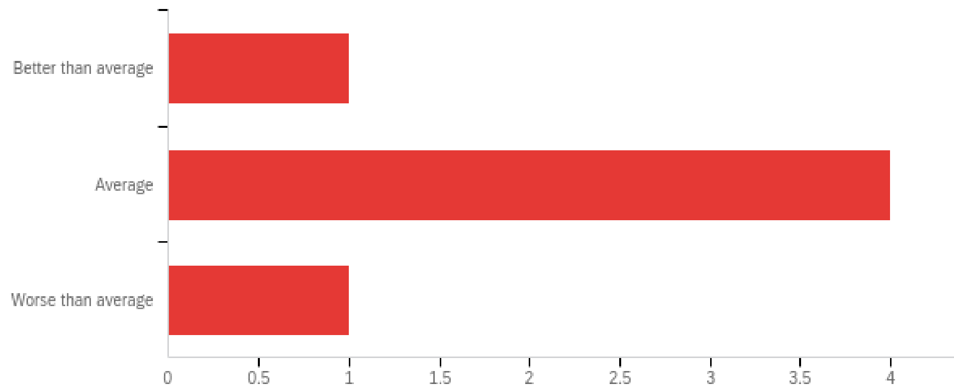
#	Answer	%	Count
1	Better than average	66.67%	4
2	Average	16.67%	1
3	Worse than average	16.67%	1
	Total	100%	6

Q93 - Explanation

Explanation
Not applicable.
Duplication of efforts, conflicting directions, and lack of action are hindering this project.
Relocation's met provision time frames with no delays to contractor
Multiple meetings were held prior to the project letting, after the project let, and after the project was awarded. Most utilities simply placed no priority on relocating their facilities until the absolute last minute, which in turn, added to the construction cost of the project.

I picked up the project at 95% complete and had to clear the project and coordinate the utility relocations. Due to staffing shortages the utility coordination on the project was not where it should have been at 95%.

Q98 - How would you rate the safety of the utility coordination? Safety: is the control of recognized hazards to attain an acceptable level of risk. Examples of utility-related safety concerns would involve utility damages due to construction, but also the relocated/accommodation of facilities in safe locations (i.e. relocating facilities from outside of pavements to provide safety for long-term maintenance).



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How would you rate the safety of the utility coordination? Safety: is the control of recognized hazards to attain an acceptable level of risk. Examples of utility-related safety concerns would involve utility damages due to construction, but also the relocated/accommodation of facilities in safe locations (i.e. relocating facilities from outside of pavements to provide safety for long-term maintenance).	1.00	3.00	2.00	0.58	0.33	6

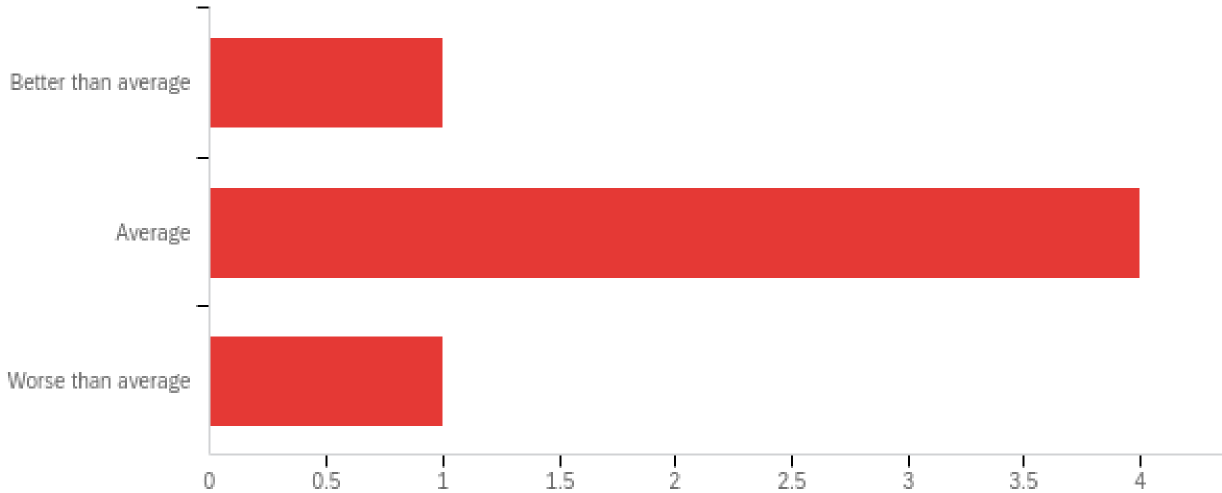
#	Answer	%	Count
1	Better than average	16.67%	1

2	Average	66.67%	4
3	Worse than average	16.67%	1
	Total	100%	6

Q99 - Explanation

Explanation
Not applicable.
UC is being based on only ASCE 38-02 Quality Level D information. The consultants hesitate to perform SUE investigations, hence the UC efforts are based on unreliable records.
Working during roadway construction causes multiple work zones and traffic controls
In this case the power utility found plenty of room to relocate safely but had to contend with a major railroad to do so. We also had to pay a gas company to hire someone to observe all of the work our contractor performed over their existing gas line. Fortunately there was no direct conflict with that gas line.

Q53 - How would you rate the costs of the utility coordination?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How would you rate the costs of the utility coordination?	1.00	3.00	2.00	0.58	0.33	6

#	Answer	%	Count
1	Better than average	16.67%	1
2	Average	66.67%	4
3	Worse than average	16.67%	1
	Total	100%	6

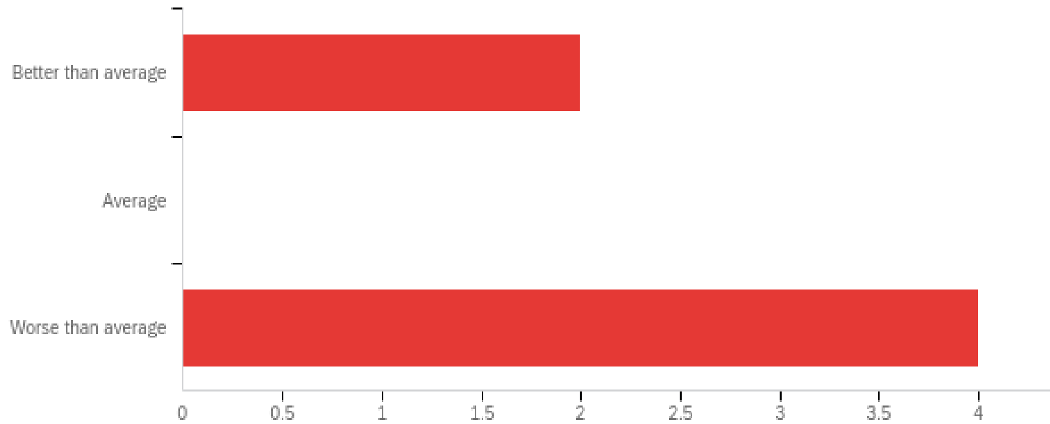
Q54 - Explanation

Explanation
Not applicable.
The client (the City) has placed limits on UC costs.

ususal costs per unit cost..congested urban area with many utilites

It was very difficult to get the utility coordination effort up to the level where it needed to be.

Q56 - How would you rate the schedule of the utility coordination?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How would you rate the schedule of the utility coordination?	1.00	3.00	2.33	0.94	0.89	6

#	Answer	%	Count
1	Better than average	33.33%	2
2	Average	0.00%	0
3	Worse than average	66.67%	4
	Total	100%	6

Q57 - Explanation

Explanation

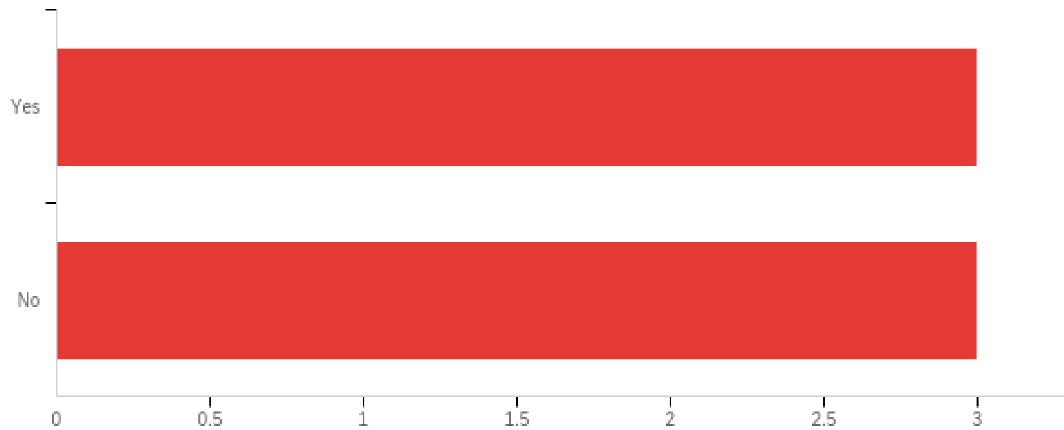
Not applicable.

Due to 6 project teams working on different segments, conflicts are causing the schedule to be negatively affected.

Utility companies provided additional resources and crews

For the extensive relocations required in this tight corridor, utilities should have started relocations earlier - design schedule often does not allow adequate time for utilities to plan and perform relocations prior to letting
Again, utilities never placed a priority on relocating until the last possible minute.
It was very time consuming for me to work with utility reps I wasn't familiar with and had to do a lot of hand-holding because of the low level of expertise in ADOT projects.

Q49 - Were there any delays or change orders due to utility related issues?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Were there any delays or change orders due to utility related issues?	1.00	2.00	1.50	0.50	0.25	6

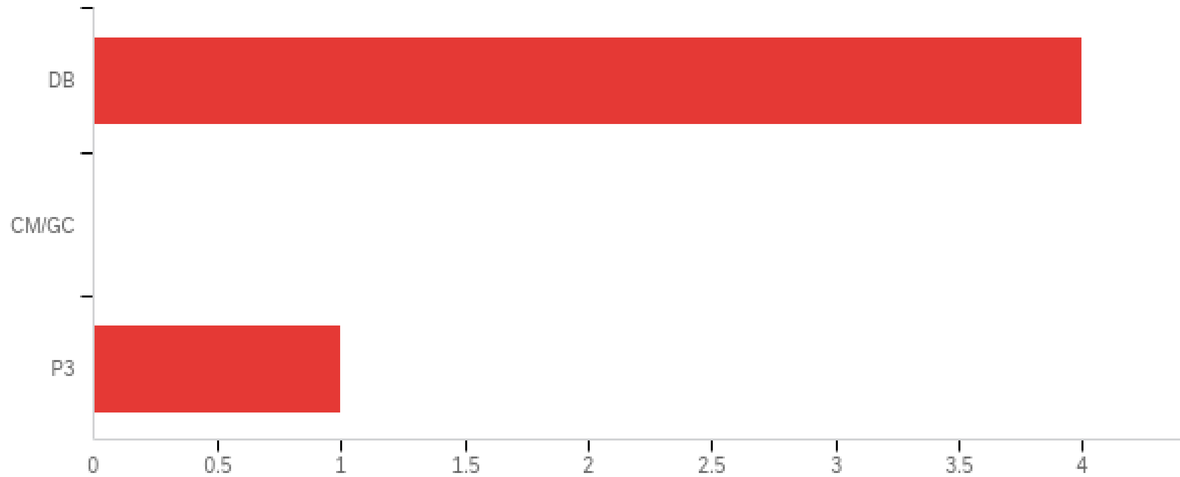
#	Answer	%	Count
1	Yes	50.00%	3
2	No	50.00%	3
	Total	100%	6

Q50 - Provide comments if desired

Provide comments if desired
Not applicable.
Not yet -- but delays are expected.
cleared areas of utility conflicts in accordance with schedule in special provisions

As noted before, significant weather delays - also some overhead utilities that were not identified during design that required coordination during construction and caused some delays.
Project completion date was required to be extended (Approximately 22 months) Change order to account for inflation was approved following an abnormal, lengthy delay.
we had some Ghost utility which was discovered during construction, that triggered change order.

Q112 - Alternative Contracting Method Used:



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Alternative Contracting Method Used:	1.00	3.00	1.40	0.80	0.64	5

#	Answer	%	Count
1	DB	80.00%	4
2	CM/GC	0.00%	0
3	P3	20.00%	1
	Total	100%	5

ACM 3 - Project Name:

Project Name:
Pennsylvania Rapid Bridge Replacement

Interstate 95 / Route 630 (Courthouse Road) Interchange Relocation and Route 630 Widening
N/A
SR 101L, I-17 to Pima Road
H848501C

ACM 4 - Project Description:

Project Description:
Iowa does not utilize ACM.
Multi asset, P3 project. 558 individual bridge replacements statewide.
Rebuilding the Interstate 95 interchange at Exit 140 (Route 630/Courthouse Road) in Stafford County as a diverging diamond interchange (DDI). The new Exit 140 interchange is located slightly south of the existing interchange, with new overpasses carrying Courthouse Road traffic over the interstate. The new Courthouse Road aligns with an extended Hospital Center Boulevard, which connects with Route 1 directly across from Stafford Hospital. West of I-95, Courthouse Road is being widened to four lanes as far west as Ramoth Church Road and Winding Creek Road.
General Purpose Lanes
installing new bridge over the RR.

ACM 5 - Project Length (miles):

Project Length (miles):
N/A
1.79 miles & interchange
13.3
1

ACM 6 - Design Start (MM/DD/YYYY):

Design Start (MM/DD/YYYY):
01/02/2014

10/20/2016
02/22/2019
01/15/2015

ACM 7 - Design Complete (MM/DD/YYYY):

Design Complete (MM/DD/YYYY):
11/15/2019
02/15/2015

ACM 8 - Design Cost / Budget ($):

Design Cost / Budget ($):
N/A
N/A
20

ACM 9 - Construction Cost / Budget ($):

Construction Cost / Budget ($):
N/A
195,000,000 - final design, r/w, utilities, construction
184,835,000.00
20

Q60 - Construction Cost / Budget ($):

Construction Cost / Budget ($):
900 million
20

Q58 - Number of utility companies impacted or potentially impacted:

Number of utility companies impacted or potentially impacted:
Approx: 1513 utilities across all 558 bridge locations
8
8
5

ACM 10 - Utility Cost / Budget ($):

Utility Cost / Budget ($):
Approx: 25 million (utility reimbursements)
2,795,000 + unknown being design build (Bids are lump sum for all projects facets)
Not yet available
20

ACM 11 - Utility phase authorization start Date (MM/DD/YYYY):

Utility phase authorization start Date (MM/DD/YYYY):
01/01/2014
03/15/2018
01/15/2015

ACM 12 - Utility clearance date (known/expected) (MM/DD/YYYY):

Utility clearance date (known/expected) (MM/DD/YYYY):
04/04/2018
01/15/2015

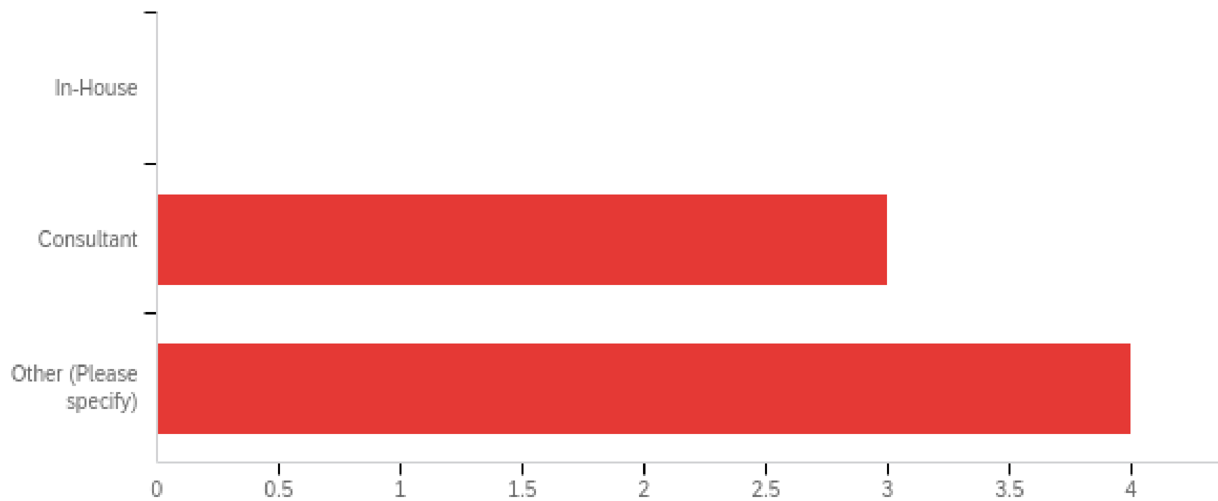
ACM 13 - Construction project start / letting date (MM/DD/YYYY):

Construction project start / letting date (MM/DD/YYYY):
10/20/2016
02/22/2019
02/15/2015

Q59 - Construction completion date (known/expected) (MM/DD/YYYY)

Construction completion date (known/expected) (MM/DD/YYYY)
07/31/2020
11/27/2020
03/07/2017

Q123 - Utility Coordination Approach:



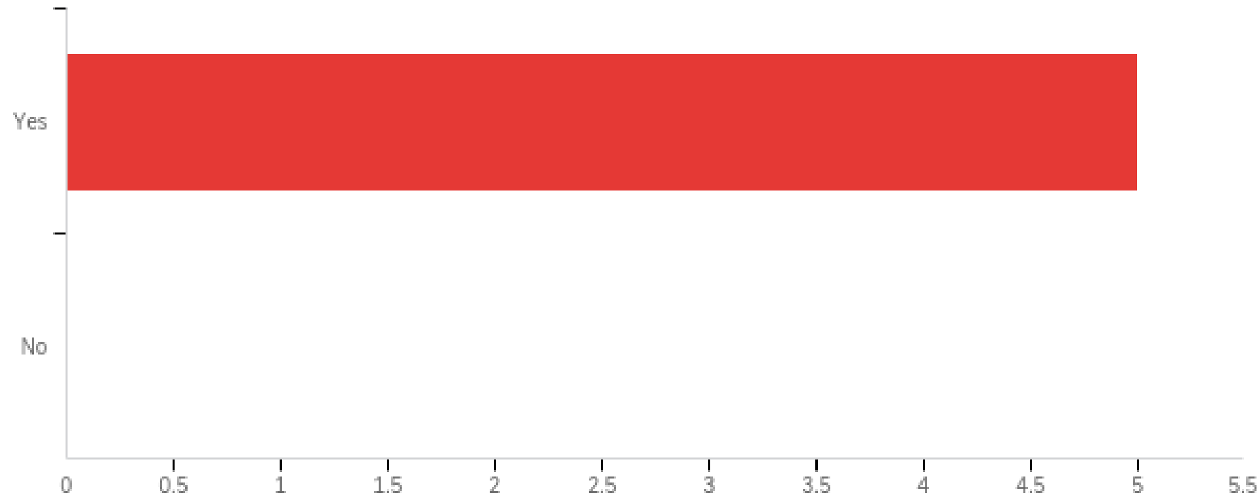
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Utility Coordination Approach: - Selected Choice	2.00	3.00	2.57	0.49	0.24	7

#	Answer	%	Count
1	In-House	0.00%	0
2	Consultant	42.86%	3
3	Other (Please specify)	57.14%	4
	Total	100%	7

Q123_3_TEXT - Other (Please specify)

Other (Please specify) - Text
Not applicable.
combo of in house staff and p3 team members
630 widening in house, other phases by Design Builder
N/A

Q65 - If utility coordination was provided by consultant/other, was in-house involvement still required?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	If utility coordination was provided by consultant/other, was in-house involvement still required?	1.00	1.00	1.00	0.00	0.00	5

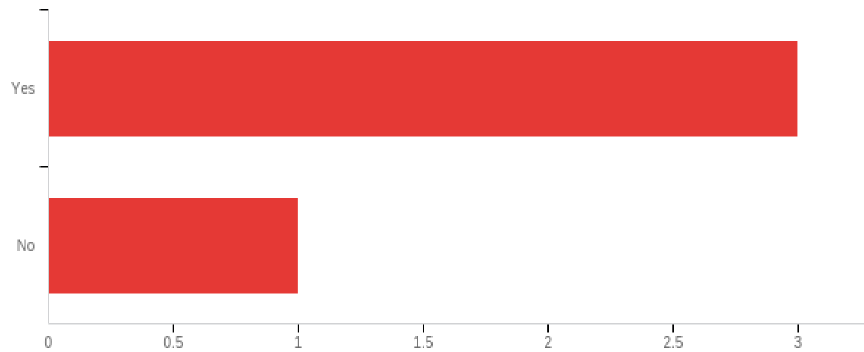
#	Answer	%	Count
1	Yes	100.00%	5
2	No	0.00%	0
	Total	100%	5

Q66 - If yes, please elaborate on the response.

If yes, please elaborate on the response.
The contract intent was for the P3 team to handle all utility coordination and the DOT only provide administrative support for utility reimbursements. This evolved 1.5 years into the contract to include DOT staff assisting with the coordination efforts.
VDOT relocated utilites on the widening phase of the project in order to accelerate construction and provide working area for contractor while finalizing design on other phases @ I-95 interchange

I made sure the Design Builder followed state and federal regulations regarding the utility coordination effort.

Q67 - If in-house utility coordination involvement was still required to assist the consultant/other utility coordination, does this also occur for consultant/other utility coordination on DBB projects?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	If in-house utility coordination involvement was still required to assist the consultant/other utility coordination, does this also occur for consultant/other utility coordination on DBB projects?	1.00	2.00	1.25	0.43	0.19	4

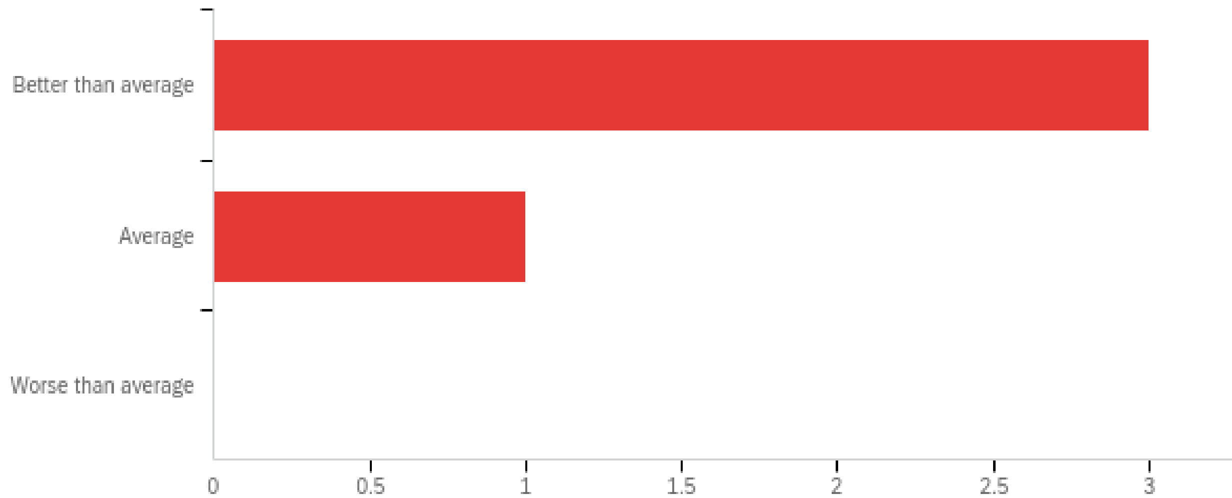
#	Answer	%	Count
1	Yes	75.00%	3
2	No	25.00%	1
	Total	100%	4

Q68 - If yes, please elaborate on the response and explain if you feel consultant/other utility coordination is better on DBB or ACM projects.

If yes, please elaborate on the response and explain if you feel consultant/other utility coordination is better on DBB or ACM projects.
Our DOT handles the reimbursement process for all projects irrespective of contract type.
VDOT has assigned utility coordinators to assist with design build projects.....involvement is dependent on the DB contractor, who they use for utility coordination and reaction from utilities

Oversight is part of our utility coordination responsibility. We are the ones held accountable if the consultants don't follow our prescribed utility coordination process. Based on my one design build project, it seemed that the consultant utility coordination worked better.

Q137 - How would you rate the efficiency of the utility coordination?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How would you rate the efficiency of the utility coordination?	1.00	2.00	1.25	0.43	0.19	4

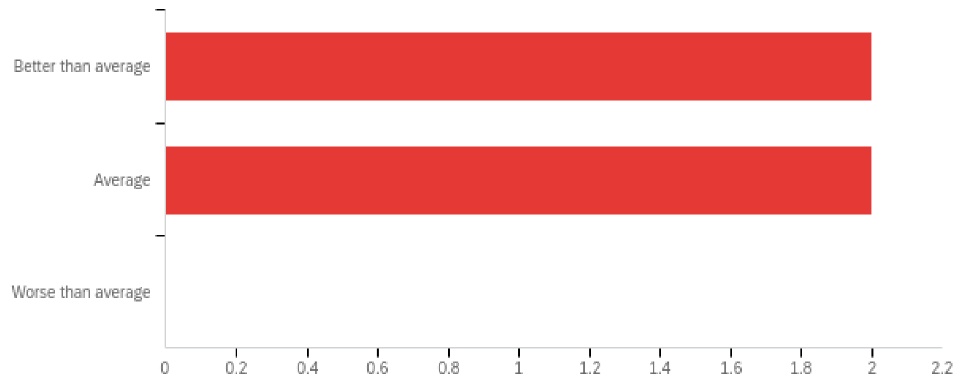
#	Answer	%	Count
1	Better than average	75.00%	3
2	Average	25.00%	1
3	Worse than average	0.00%	0
	Total	100%	4

Q138 - Explanation

Explanation
Not applicable.
Relative to our normal letting program, the RBR team, including DOT staff, were able to accomplish a significant amount of utility relocation work in a short amount of time. Project management, more specifically, data management, and schedule management allowed the team to be more agile then what we typically see on non-ACM projects.
Some issues experienced and VDOT assistance was needed

The design builder's utility coordinator had utility coordination meetings every two weeks and kept in almost constant contact with the utilities to keep them informed on the project. The consultant also had much better tools than what the DOT provides me with.

Q142 - How would you rate the safety of the utility coordination? Safety: is the control of recognized hazards to attain an acceptable level of risk. Examples of utility-related safety concerns would involve utility damages due to construction, but also the relocated/accommodation of facilities in safe locations (i.e. relocating facilities from outside of pavements to provide safety for long-term maintenance).



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How would you rate the safety of the utility coordination? Safety: is the control of recognized hazards to attain an acceptable level of risk. Examples of utility-related safety concerns would involve utility damages due to construction, but also the relocated/accommodation of facilities in safe locations (i.e. relocating facilities from outside of pavements to provide safety for long-term maintenance).	1.00	2.00	1.50	0.50	0.25	4

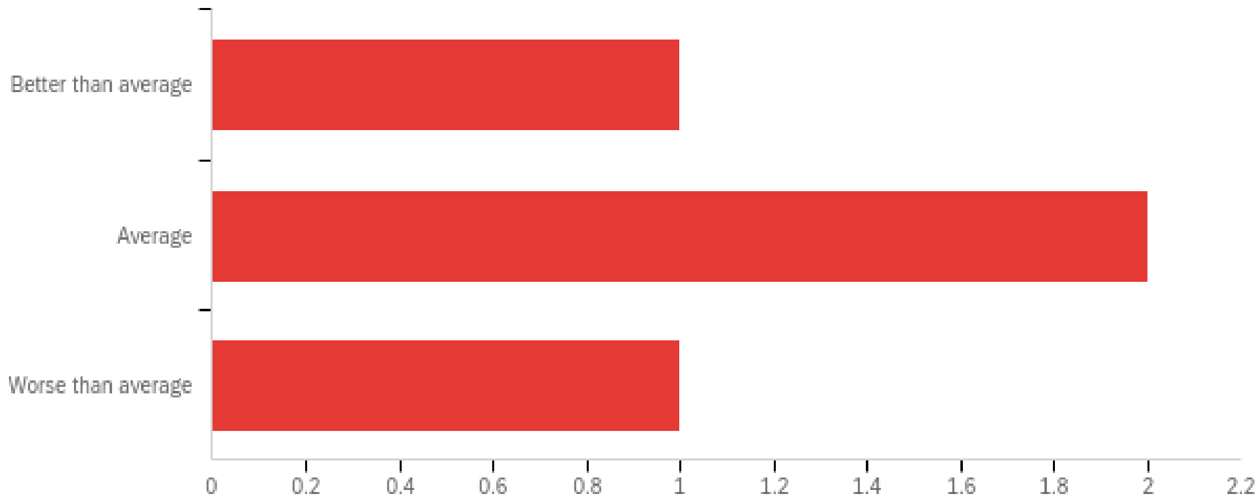
#	Answer	%	Count
1	Better than average	50.00%	2
2	Average	50.00%	2

3	Worse than average	0.00%	0
	Total	100%	4

Q144 - Explanation

Explanation
Not applicable.
standard safety review processes were established for the project.
All Accommodation Policy requirements met...
The design builder was able to come up with an alternate design for a bridge pier to prevent the relocation of a large and fragile water line along with saving the department over a million dollars in relocation costs.

Q61 - How would you rate the costs of the utility coordination?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How would you rate the costs of the utility coordination?	1.00	3.00	2.00	0.71	0.50	4

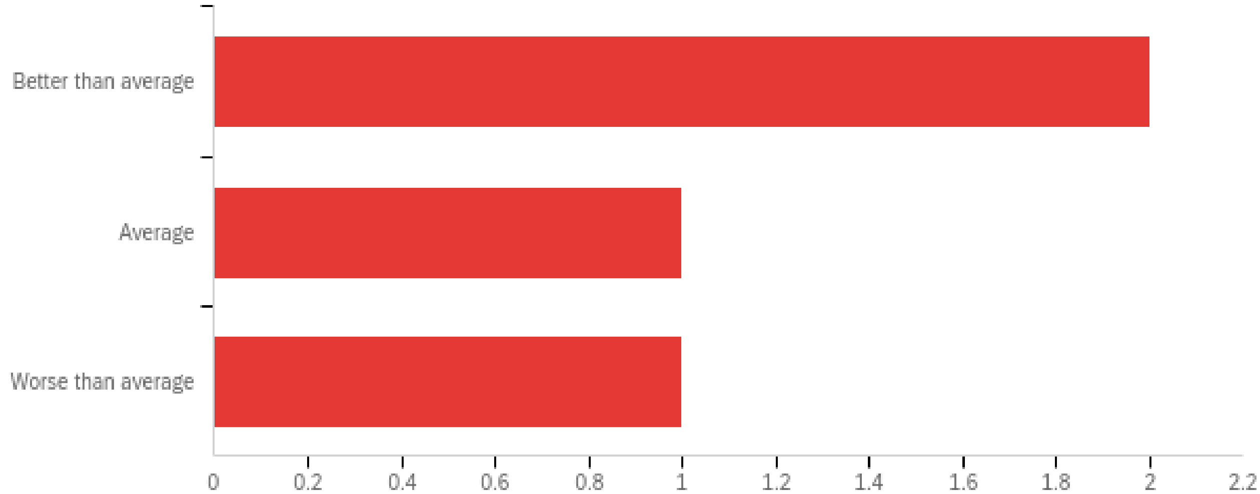
#	Answer	%	Count
1	Better than average	25.00%	1
2	Average	50.00%	2
3	Worse than average	25.00%	1
	Total	100%	4

Q62 - Explanation

Explanation
Not applicable.
Rates of pay for utility coordination were similar to what we see on non ACM projects.
No way of knowing..Design Build contracts are lump sum or total cost for all eforts

Due to the level of involvement of the design builder's utility coordinator the DB probably lost some profit there.

Q63 - How would you rate the schedule of the utility coordination?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How would you rate the schedule of the utility coordination?	1.00	3.00	1.75	0.83	0.69	4

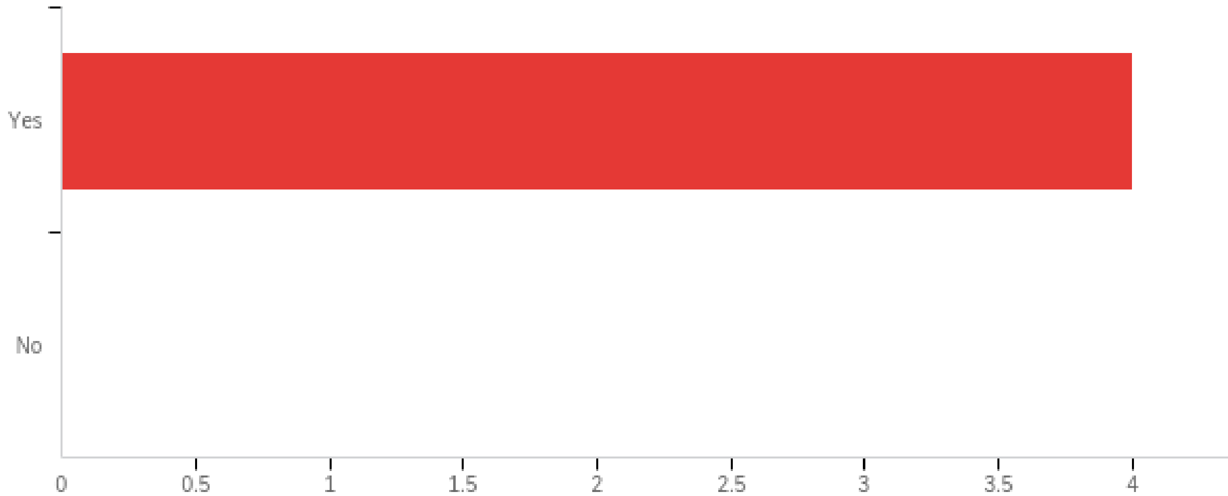
#	Answer	%	Count
1	Better than average	50.00%	2
2	Average	25.00%	1
3	Worse than average	25.00%	1
	Total	100%	4

Q64 - Explanation

Explanation
Not applicable.
The coordination pace was aligned with the intent of the project. It was rapid.

Some issues experienced with a utility changing their standards
Because the project was design build ADOT only performed designating for the project and left any pot-holing up to the contractor. That resulted in some unknown conflicts which were very difficult to deal with during construction.

Q157 - Were there any delays or change orders due to utility related issues?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Were there any delays or change orders due to utility related issues?	1.00	1.00	1.00	0.00	0.00	4

#	Answer	%	Count
1	Yes	100.00%	4
2	No	0.00%	0
	Total	100%	4

Q158 - Provide comments if desired

Provide comments if desired
Not applicable.
Across the 558 project sites there were many unforeseen circumstances that arose.

see above
Delays yes, and a major effort by the DB to assist the utilities in conflict.

Q68 - Please provide any comments you may have regarding your opinion of whether utility coordination is better on DBB or ACM and an explanation of why you hold that opinion.

Please provide any comments you may have regarding your opinion of whether utility coordination is better on DBB or ACM and an explanation of why you hold that opinion.
I submitted a survey even though Iowa does not participate in DBB or ACM.
Its difficult to say if it was better or worse. The multi asset aspect of this project puts it into its own category. One of the potential savings I often ponder is related to our P3 contractor approach to contracting the individual bridges on the project. On many of the bridges the P3 contractor sub contracted the bridge construction out to regional bridge builders. The projects were bid on by the regional contractors with the understanding that the project sites were cleared of utilities and were shovel ready to receive a structure (i.e.: all prior utility work). It would be valuable to quantify the savings realized resulting from having no or little utility risk within the contract.
Dependent on the utility coordination manager for design builders. DBB is usually better due to on-going relationships and experience of VDOT Utilities staff
I believe that ACM projects have more resources to throw at the utility coordination efforts.

Appendix E: Case Study Interview Questions

NCHRP 20-07/Task 407 Interview Questionnaire

The objective of NCHRP 20-07/Task 407 is to document reasonable expected outcomes in terms of efficiency, safety, cost, and schedule associated with utility coordination when using various contracting methods on public transportation projects. The alternative contracting methods (ACMs) of focus for this study include design-build (DB), construction manager/general contractor (CM/GC), the use alternative technical concepts (ATCs) applied to these ACMs or to traditional design-bid-build delivery, and public-private partnerships (P3) which are viewed as a special case of DB delivery.

These impacts of interest for this study are efficiency, safety, cost, and schedule. Specific examples include utility damages, construction hazards, or other safety issues that would likely not have occurred in a traditional design bid project or inefficiencies and/or successful practices of the utility coordination process since the concurrent construction activity may involve similar items or materials therefore making it difficult to quantify and determine inefficiencies and cost specific to utility coordination.

The intent is to quantify these impacts to the extent possible which will require access to project data as available for both traditional design-bid-build projects and projects using ACMs.

Please provide your contact information.

Agency: ____

Address: ____

City: ______________________________ State: __________ ZIP: __________

Questionnaire Contact: ______________________________________

Position/Title: ____

In case of questions and for NCHRP to send you a link to the final report, please provide:

Tel: ____________________ Email: ______________________________

Introduction and Baseline Questions

1. Which of the following ACMs has your DOT used?

   ☐DB ☐P3 ☐CM/GC ☐ATCs (DB/DBB)

   Discussion:

2. Does your DOT have good candidate project(s) for case studies in regard to utility coordination using ACMs?

   ☐Yes ☐No

   Discussion:

3. We are interested in understanding quantifiable impacts regarding the efficiency, safety, cost, and schedule of utility coordination on these ACM projects versus traditional DBB projects. Could you provide us access to data to make these quantifications?

   ☐Yes ☐No

   Discussion:

4. What would you consider your baseline (DBB) for utility coordination efficiency (are there quantifiable measures—rework, change orders, schedule changes, etc.)?

   Discussion:

5. What would you consider your baseline (DBB) for utility coordination safety (are there quantifiable measures—contractor dig-in events, utility/contractor/facility damage, injuries, etc.)?

   Discussion:

6. What would you consider your baseline (DBB) for utility coordination costs (are there quantifiable measures—average project percentage costs, typical change order costs, etc.)?

   Discussion:

7. What would you consider your baseline (DBB) for utility coordination schedule (are there quantifiable measures—average clearance times, average agreement times, relocation schedules, etc.)?

   Discussion:

Case Study Specific Questions

Project Name:

Project Desription:

Contracting Method:

Utility Coordination Approach:

1. We are interested in understanding quantifiable impacts regarding the efficiency, safety, cost, and schedule of utility coordination on these ACM projects versus traditional DBB projects. Could you provide us access to data to make these quantifications?

   ☐Yes ☐No

   Discussion:

2. Were there any project impacts in regard to efficiency in the utility coordination process (are there quantifiable measures—rework, change orders, schedule changes, etc.)?

   Discussion and potential solutions:

3. Were there any project impacts in regard to safety as part of the utility coordination process (are there quantifiable measures—contractor dig-in events, utility/contractor/facility damage, injuries, etc.)?

   Discussion and potential solutions:

4. Were there any project impacts in regard to costs of the utility coordination process (are there quantifiable measures—average project percentage costs, typical change order costs, etc.)?

   Discussion and potential solutions:

5. Were there any project impacts in regard to schedule of the utility coordination process (are there quantifiable measures—average clearance times, average agreement times, relocation schedules, etc.)?

   Discussion and potential solutions: