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COMPARISON AMONG PROJECT DELIVERY METHODS FOR SCATTERED REHABILITATION PROJECTS

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Abstract: Public-Sector organizations such as School Boards and Universities administer a large number of facilities that involve thousands of assets at various ages and require extensive yearly rehabilitation and capital renewal programs. Since these rehabilitation programs involve hundreds of small repetitive works that are scattered in many locations, organizations are struggling to deliver these programs on time and on budget, to keep their facilities operational, despite suffering from billions of dollars in rehabilitation backlog. While significant efforts in the literature have been dedicated to decide the components to include in rehabilitation projects, fewer efforts address the delivery phases of such projects. Existing project management systems exhibit serious drawbacks, not only in considering the scattered multi-location nature of the work, but also in scheduling and tracking the progress of the large number of small subprojects involved. Moreover, existing delivery methods consider each subproject separately and deprive owner organizations from benefiting from repetition to achieve significant cost savings. In an effort to improve the project delivery practices of infrastructure rehabilitation projects, this paper investigates the most suitable project delivery method that suits scattered repetitive projects. The paper highlights the drawbacks of common delivery methods and suggests specific requirements for an efficient project delivery method for scattered rehabilitation projects. The guidelines suggested in the paper supports decision makers at public organizations to optimize the contractual and execution environments of the costly and very constrained infrastructure rehabilitation programs.

1 INTRODUCTION

Delivery of construction projects involves assigning roles and responsibilities to the parties that design, procure, and construct a project. The project delivery method (PDM) defines the contractual relationships among the project parties and the distribution of delivery risks among them. A proper PDM is needed to achieve successful completion of a project from inception to completion. It describes the project execution framework, incorporating project scope, execution and risk management procedures, and the schedule and budget control (Williams, 2003; Mahdi and Alreshaid, 2005; Oyentunji and Andrson, 2006; Touran et al., 2011; Shrestha et al., 2012; El-Asmar et al., 2013; Carpenter and Bausman 2016).

Over the years, the continuous sophistication of building materials, design procedures, and construction technologies required the division among design and construction services. This separation complicated the communication between parties and led to the development of the traditional Design-Bid Build (DBB) delivery system. However, because of the widely recognized limitations of DBB, more integrative project delivery methods, such as Design-Build (DB) and Construction Management (CM), have evolved to suit modern sophisticated projects and changing owner needs. All delivery methods, however, involve three main players: Owner, Consultant and Constructor. The suitability of the project delivery method selected for a project is an important decision that significantly impact the effectiveness of the project execution as the roles, responsibilities of project parties vary under different project delivery methods. Each PDM has its advantages and disadvantages, and the selection of an appropriate PDM for a project should be carefully evaluated (Konchar and Sanvido, 1998; Oyentunji and Andrson, 2006; Mafakheri et al., 2007; BCCA, 2012; Liu et al., 2016; Sullivan et al., 2017).

Significant efforts in the literature (e.g., Sullivan et al. 2017) provided some performance comparisons among the most common project delivery methods (i.e., DBB, DB, and CM) using key metrics that include:

1. Cost Growth compared to contract price;
2. Schedule Growth compared to the intended schedule;
3. Delivery Speed;
4. Unit Cost; and
5. Quality and client satisfaction.

Other efforts in the literature focused on studying generic factors affecting the selection of suitable project delivery methods. Alkhalil (2002) used the Analytical Hierarchy Process (AHP) to select the proper project delivery method considering several influential factors such as schedule, scope, cost, and owner's needs. The AHP technique was also used by Mahdi and Alreshaid (2005) to develop Decision Support System to select the suitable project delivery method considering similar factors. Liu et al. (2016) used more detailed list of possible factors that affect the PDM selection such as complexity of the project and the confidentiality protection. Mafakheri et al. (2007) used AHP under uncertainty to select the proper PDM. Oyetunji and Anderson (2006) utilized Simple Multi-tribute Rating Technique with Swing Weights (SMART) to provide quantitative method to determine the most suitable PDM. Chen et al. (2011) used Artificial Neural Network (ANN) technique to develop project delivery selection model considering 16 generic project and owner indicators.

Most public-sector organizations leave the execution phase of infrastructure rehabilitation projects to the experience of the in-house management team, with limited decision support regarding the execution planning and the project delivery methods. These organizations usually have large asset management departments that, on a yearly basis, decide on the list of projects to be delivered in the upcoming year (Figure 1). An example is a municipality fixing a subset of its large number of road sections, or bridges. With these projects being primarily repetitive but scattered along a large geographic area, the understanding of the unique characteristics of these scattered infrastructure rehabilitation programs becomes essential to an effective delivery. Therefore, efficient support for organizations like municipalities, school boards, and universities, in the selection of appropriate PDM, is lacking. This represents a major challenge that leads to cost overruns, schedule delays, and incomplete implementation of the infrastructure rehabilitation/renewal programs. Having an effective project delivery method would improve the chances of completing projects successfully and thus reducing the ever-increasing backlog.

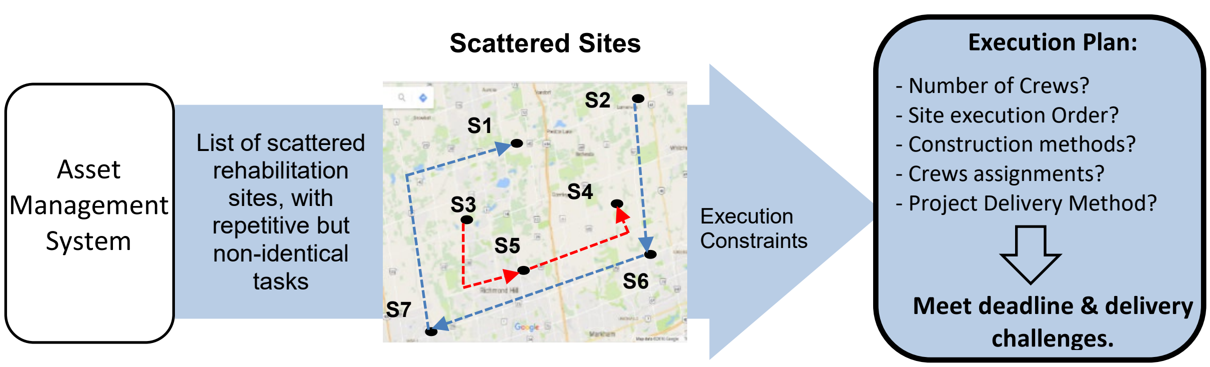

Figure 1: Execution Planning for Scattered Repetitive Projects

2 Drawbacks of Common Project Delivery Methods

Based on several years of experience and extensive hands-on study of several infrastructure renewal projects and delivery methods, the following is description of two common project delivery methods and their documented advantages and disadvantages.

2.1 Design-Bid-Build (DBB)

This project delivery method is the "traditional" and the most frequently used method for delivering construction projects. DBB creates a clear separation between the design and construction and clearly defines the roles of parties involved. When DBB is utilized, the owner hires a consultant (Architect/Engineer firm A/E) to prepare the project design, drawings and specifications. Upon completion, these documents are presented to contractors to evaluate, and submit lump-sum prices. The A/E team is responsible for answering bidders' questions during the tender and assisting the owner in evaluating received bids. The owner selects a construction firm, typically, the one who submitted the lowest compliant bid (for most public-sector projects). The successful bidder then hires suppliers and sub-contractors to construct various components of the project (Alkhalil, 2002; Mafakheri et al., 2007; Hale et al., 2009; CMAA, 2012).

The owner reduces its risk by having a single point of contact with respect to the project design and the project construction. The A/E is responsible to the owner for the design and the contractor is responsible to the owner for the construction. This independent relationship between the A/E and the contractor allows the A/E team to properly monitor the quality of work and advise the owner and the contractor of any deficiencies that need to be rectified. Furthermore, owners, consultants, and contractors are familiar with their contractual roles and responsibilities in DBB arrangement. Most public owners developed standard contracts to simplify and standardize the process. In addition, the completion of the design before the tender allows the owner full control over the design and provides contractors sufficient information to submit competitive bids and commit to fixed price. This provides the owner with preliminary competitive and reliable cost information for the project before construction starts which helps the owner to plan the project finance. Despite such long history and extensive implementation, the drawbacks of this delivery method are widely recognized in the literature and in the industry (Hegazy 2002; Alkhalil 2002; Mahdi and Alreshaid 2005; Becker and Murphy, 2008; Rajos and Kell 2008; Ghavamifar, 2009; Rosner et al., 2009; Culp, 2011; CMAA, 2012; Shrestha et al. 2012).

To clearly illustrate the major disadvantages of DBB, a real-world case study to deliver a large non-repetitive building project, with a budget of about $70M, is discussed. The owner posted a Request For Proposal (RFP) on the online MERX site to attract interested qualified architectural firms. The proposals were evaluated by the owner and interviews were conducted with top candidates, and the successful proponent was awarded the contract. The architect subcontracted portions of its scope of work to specialized consulting engineers, including structural, mechanical, electrical, and specialized architects such as landscaping architect, who worked collaboratively to complete the design. The architect's contract was a fixed price contract and was based on Ontario Association of Architects (OAA) contract, Document 600 for 2008. Once the design was completed, the bid package was presented to several previously short-listed contractors, who submitted lump sum prices for the work. The bidding period was approximately four weeks. The owner and the A/E team reviewed the received bids, then awarded the contract to the general contractor (GC) who was the lowest compliant bidder, and the contract followed the Canadian Construction Document Committee (CCDC2)-Stipulated Price Contract.

Despite all the due diligence done by the owner to ensure successful project delivery, the project suffered significant delays that caused adversarial relationships between the owner, consultants, the GC, and the sub-contractors. This resulted in a series of delay claims, disputes, and litigations among all parties. These problems can be attributed mainly to the nature of the DBB method and could have been avoided if another collaborative delivery approach had been utilized. The encountered problems were as follows:

Inability to Fast Track: Due to the separation between the design and construction, fast tracking construction couldn't be done since the whole design and bidding stages had to be fully complete before the start of construction, as DBB dictates, and this took a long time. Early during construction, the shoring and excavation took much longer than anticipated, which caused significant project delays. This was, partially, because the shoring was scheduled in the winter and was caught in a very tough weather. If the project was fast-tracked, the shoring and excavation could have started earlier while the A/E team was working on completing the design. This could have saved the project several months of delay.

Lack of Constructability Feedback during Design: The A/E team produced a design that perfectly met the aspirations and needs of the users, however, the absence of constructability input into the design (due to the separation between design and construction) caused constructability issues. Alternate structural systems for example, could have been utilized to simplify the construction process and save the project significant amount of time. A curtain wall system that is fabricated overseas was specified. The shop drawings approval process, the transportation, customs clearing, and the fluctuation in currency exchange rate caused significant delays to the project. Alternative local materials and systems could have saved the project several weeks. These constructability issues could have been avoided if the constructor has participated and provided feedback during the design process.

High Potential for Disputes: In this project, there were several scope disputes between the GC and the sub-contractors which caused significant delay to the project. Often, sub-contractors claimed that certain portions of the work were not included in their scope and they are entitled for extra compensations to complete this work. These disputes have occurred because the GC usually receives the bids from the sub-contractors few hours, sometimes few minutes, before the tender closing and the GC does not have enough time to analyze these bids and review what the sub-contractors included and excluded from their scope. This led to disputes and claims during construction. This lack of transparency in DBB delivery method was a major obstacle for the owner to resolve and move the project forward.

Large Number of Change Orders: Similar to most projects delivered using DBB delivery method, this project was exposed to a large number of change orders and claims by the GC and the sub-contractors over design coordination and constructability issues since the owner in DBB contracts holds liability for all the design details. As such, the number and cost of change orders could have been less if other collaborative forms of delivery method were used.

Lack of Control over Sub-Contractor Selection: Some sub-contractors who were recruited by the GC did not perform as expected. For example, the shoring, roofing, cladding, and sprinklers sub-contractors performed poorly. The shoring equipment were outdated, and not enough resources were used to timely complete the shoring. The sprinkler sub-contractor declared bankruptcy and replacing the company took several weeks. The delay of roofing and cladding also caused delays in the interior finishes such as dry wall, flooring, and painting. This bad selection of sub-contractors was due to the GC focus on the lowest price and ignoring other sub-contractor reliability and quality factors. The owner had limited input to the retention of the sub-contractors as they were selected by the GC during the tender phase. Had these sub-contractors gone through pre-qualification process, most of these delays could have been avoided.

2.2 Construction Management Delivery

Construction Management (CM) delivery system is two broad approaches. At one end is Construction Manager Agent (CMA) where the owner hires a project manager as its agent for managing the construction project and is sometime called Construction Management/Project Management (CM/PM). The CM mainly provides advisory services to the owner regarding the project scope, schedule, budget and procurement. The CM risk is limited as the CM does not contract with sub-contractors, does not perform actual construction, and is not responsible for the construction cost or meeting the project deadline. As a result, this delivery method is commonly known as Construction Manager “Not-at-Risk”. It is argued by some researchers and industry experts that CMA is not an actual project delivery method and it is only a form of consulting services to owner organizations. At the other end is Construction Manager at Risk (CMR) where the CM contracts with the subcontractors and is responsible for the construction cost and meeting the project deadline, similar to the GC role in DBB (Alberta Infrastructure, 2001; Mahdi and Alreshaid, 2005; Becker and Murphy, 2008; Ghavamifar, 2009; Minchin, 2009; Friedlander, 2011).

Construction Manager at Risk (CMR) is a comprehensive approach to complete construction projects and minimizes the owner risk exposure. Under CMR, the owner selects an Architect/Engineer to prepare the design and separately retains CM to construct the project. Both are selected based on their qualifications to provide quality design and construction services, and competitive fees. The design and construction teams are contractually independent and are responsible to the owner. This separation provides the owner full control over the project design, budget, and schedule. During the design phase, the CM provides real-time data input with respect to most feasible and constructible materials and equipment, realistic schedule, and conducts value engineering when needed to maintain the project budget. Once the design is close to completion, the CM often agrees with the owner on Guaranteed Maximum Price (GMP) for the project. The GMP usually consists of the cost of the work performed by the CM own-forces, and the cost of work performed by sub-contractors hired by the CM. During construction, the roles and responsibilities of the CM become similar to the General Contractor in DBB. Thus, in many literatures, the CMR is referred to as Construction Manager/General Contractor (CM/GC). This delivery method enables the owner to minimize its risk exposure by contracting only with the CM, and benefits from having a single point of contact. Most of construction risks are transferred to the CM who is responsible for the work performed by own forces and by other sub-contractors to achieve the project goals, to meet the project deadline, and to complete the project within established GMP. Key advantages of this delivery method are as follows (Williams, 2003; Mahdi and Alreshaid, 2005; Becker and Murphy, 2008; Minchin, 2009; CMAA, 2012; Carpenter and Bausman 2016; Farnsworth et al., 2016):

Best Value Approach to Construction Manager (CM) Selection: The CMR selection process is based on the best value as opposed to the low bid in traditional DBB. The CM is selected for its experience with similar projects in size and complexity, qualification of the proposed team, technical and financial capacity, litigation history, health and safety records, references and fee. This approach improves the quality of the selection process, eliminates poor performers, and allows the owner to hire the best qualified CM to deliver the project and form a reliable partnership.

Constructability Feedback during Design: The CM is engaged early and work collaboratively with the owner and consultant to develop the design. The CM suggests more feasible materials and equipment, more constructible building systems, provides real-world data for the project cost, conducts accurate constructability reviews, and performs value engineering when necessary to ensure the project stays on budget. This collaborative process should reduce the number and the value of change orders during construction and enables the owner to make informed decisions during both design and construction.

Ability to Fast-Track: CMR facilitates fast-tracking construction for projects with challenging schedule. Because of the CM early involvement in the project, portions of the work, such as shoring, excavation, and foundation work, can be tendered and commenced while the balance of the design is being completed. This overlapping of the design and construction activities provides significant schedule advantage to complete construction projects on time.

Collaborative Atmosphere: The CMR arrangement fosters the culture of collaboration among the project parties rather than common adversarial environment usually dominates the DBB atmosphere. This collaborative process leads to early problem solving and reduce disputes and claims, through the development of trust and focusing on common goals. This atmosphere enables the project team to make informed design and procurement decisions to enhance the quality of the facility in a transparent and productive environment.

Despite the advantages of the current CMR delivery method, it has several shortcomings that are recognized in the literature and expressed by the industry experts. While most of them agree that CMR provides a schedule advantage, they pointed out that projects delivered using CMR tend to cost more than projects delivered using the traditional DBB. This serious disadvantage could be attributed to the following (Konchar and Sanvido 1998; Alberta Infrastructure, 2001; Williams 2003; Rajos and Kell 2008; CMAA, 2012; Farnsworth et al. 2016):

Work Is Not Competitively Priced: One of the typical CMR most noticeable disadvantages is the lack of comprehensive competitive bidding procedures. Owner organizations representatives and architects have expressed the need to enhance CMR procurement arrangements to ensure competitive-market bidding procedures because the current procurement practices are not comprehensive enough to ensure the owners obtain the best value. Typical CMR process doesn't provide specific instructions to limit the work performed by the CM's own-force and allows the CM to perform portions of the work using own-forces without being subject to proper competitive bidding. Furthermore, the current process permits large portion of the CM services to be included in the "General Conditions", without being competitively priced. The General Conditions include all the fixed and variable indirect costs such as CM staff salaries, bonding and insurance, temporary site facilities, security, power consumption, hoisting, traffic control, temporary roads, small equipment, general labor, etc. These costs represent significant percentage of the project cost and could account for approximately 8-10% of the total construction cost. Owners under typical CMR have little means to ensure they are charged the most competitive market value for these services.

Contract Forms: Several contract forms between owners and constructors are used to facilitate CMR projects. The most commonly used contract forms in Canada are developed by Canadian Construction Document Committee (CCDC)-Construction Management for Services and Construction and is usually referred to as CCDC-5B. The contract forms include terms and conditions that determine the roles and responsibilities of all project parties. Some of the contract forms expose the owner to additional expenses that increase the project cost. The CM is not encouraged to minimize the project costs or complete projects on time because the CM is compensated for change orders and additional time spent on the project. Some owners mitigate these risks by establishing Guaranteed Maximum Price (GMP) at a certain point (usually toward the end of the design phase) to provide certainty to the project budget. However, this certainty comes at a significant cost to the owner because the CM usually includes contingencies to account for risks that may not occur, which are premium costs and increase the total project cost.

Inefficient Sub-Contractors Selection Process: Typical CMR does not have comprehensive procedures to procure the sub-contractors in a competitive fashion to ensure the owner obtains the most competitive market prices. Typical CMR practices request the CM to present a minimum of three prices to the owner for each package. However, it does not provide consistent and specific instructions to the CM on how to develop the list of bidders to ensure the bidding process is open for wide pool of qualified sub-contractors. Furthermore, the tendering process is usually managed entirely by the CM without sufficient involvement from the owner and the consultant to ensure transparency and competitiveness.

3 Components of an Efficient Delivery Method for Infrastructure Rehabilitation Projects

Infrastructure rehabilitation projects are scattered in nature and delivered mainly based on a version of DBB, and its disadvantages when used to deliver this type of projects are even more apparent. The typical DBB implementation is discussed below and the nature of scattered projects are highlighted. The utilized project delivery method may vary slightly from one organization to another. The typical DBB implementation for infrastructure scattered repetitive projects at many school boards and universities can be summarized as follows:

- The owner assigns each individual project at any specific site to one of the in-house Design Project Manager (DPMs). This means that in a boiler replacement program for 20 schools, and with two DPMs assigned to boiler work, each DPM is in charge of 10 separate boiler projects, which is a large administrative work to manage at the same time;
- The DPM develops the scope and preliminary budget for each project at each site;

- The DPM retains a consultant (10 for the assigned 10 boiler projects) to develop the design, drawings, and specifications for each project at each site. Once the design is complete, the DPM turns over the 10 projects to an in-house Construction Project Manager (CPM) to manage the delivery phase;
- The CPM tenders each of the 10 projects individually to contractors, which is also a large administrative work. The CPM receives, reviews, analyzes all the individual bids, and then awards each contract to the lowest compliant bidder (10 contracts);
- The CPM coordinates the construction activities with each consultant and contractor teams for each project at each site, monitors project progress, ensures RFI are answered and shop drawings are approved in a timely fashion, reviews and negotiates change orders, process progress draws, resolves disputes, and coordinates with the operation staff of each facility to minimize the interruption to the facility operation, which is significant administrative efforts to manage at the same time; and
- Once the work on site is complete and the consultant issues the Certificate of Substantial Completion, the CPM processes the final payments, collects the closeout documents (i.e., as-built drawings, manuals, and warranties) and transfers the facility to the operation team.

The above DBB approach imposes several challenges that lead to project overruns, delays, and disputes, as shown in Figure 2. In addition, it deprives public-sector organizations from potential benefits and efficiencies that could be realized to help renew and maintain their deteriorated infrastructure. The necessary requirement of an effective project delivery method for these types of projects are as follows:

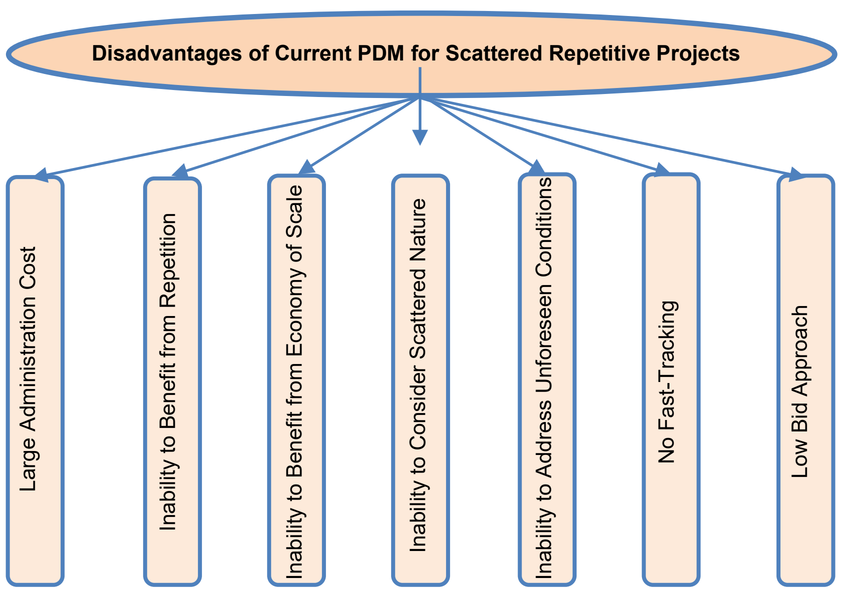

Figure 2: Disadvantages of Current PDM for Infrastructure Scattered Repetitive Projects

Reduce Administrative Costs: Infrastructure renewal projects require extensive level of control regarding scope development, design, tendering, supervision, change orders management, dispute resolution, and cash flow management. Typical DBB requires significant coordination efforts to implement the annual programs since every project at each site has a separate team, i.e., the owner team (DPM and CPM), the constructor team (project manager, site superintendent, project coordinator etc.), and the consultant team (architects, engineers, site supervision etc.). This necessitates the owner organizations to have a large qualified and costly management team to ensure the annual infrastructure renewal program is properly implemented.

Benefit from Repetition: A major advantages of repetitive projects is the ability to move crews between units (sites in case of scattered projects) in a synchronized fashion and benefit from the learning curve the trades develop. Such utilization improves productivity and reduces crew's utilization costs. In current practices, sub-contractors complete their tasks and leave without using the knowledge they acquired from completing the work. This deprives infrastructure renewal programs the benefits of the learning curve effect that would otherwise result in cost savings. The proper project delivery method should maximize the benefits of learning curve effect, eliminate unplanned work interruption and facilitate work continuity of working crews along scattered sites in a synchronized manner. Accordingly, projects at multiple sites must be under the command of one management entity as opposed to separate contractor for each project at each site.

Benefit from Economy of Scale: Infrastructure renewal projects are large size investments that could create opportunities to benefit from the economy of scale. The current project delivery method at many public organizations divides the entire infrastructure rehabilitation program into small projects. Each project is procured separately, which denies these organizations from realizing the benefits of economy of scale in procuring the materials, equipment, and services necessary to complete these projects. The ideal project delivery method should enable public-sector organizations to capitalize on this characteristic and maximize the benefits of such large investments to realize maximum possible efficiency.

Consider the Scattered Nature: Infrastructure renewal projects are scattered across large geographical areas at multiple sites (buildings, bridges, buildings, etc.). As such, local conditions, such as level of use, union jurisdictions, weather conditions, and municipalities by-laws may vary from one site to another. The current delivery method doesn't recognize this unique challenge and limits the project team ability to consider the impact of these conditions and to schedule the work at each site when it has the highest possible productivity. As such, efficient project delivery method should place infrastructure renewal projects at multiple sites under the control of one constructor to properly plan and lead this dynamic process.

Address Unforeseen Condition: Most of the infrastructure scattered renewal projects take place at old facilities with inaccurate as-built drawings. Coupled with the lack of constructability feedback during the design, this results in inaccurate design that leads to excessive number of change orders as shown in Figure 3. The process of initiating, pricing, negotiating, and approving change orders is lengthy, disruptive and promotes adversarial relationships among the project parties. The ideal project delivery method should provide the project team with tools to minimize the number of change orders, and the impact they may have on the project cost and schedule.

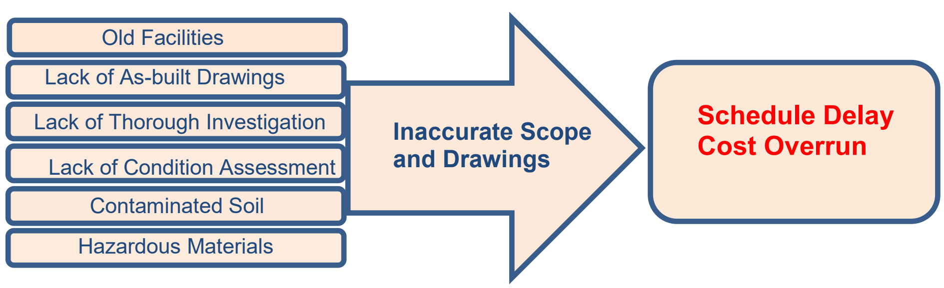

Figure 3: Causes of Unforeseen Conditions

Fast-Track Projects with Tight Deadlines: Most of infrastructure renewal projects at universities and school boards are executed during the summer where classes are not in session to minimize interruption. This imposes challenging deadlines that require fast tracking and overlapping between different phases of the project. Typical DBB doesn't allow fast-tracking approach which cause delays to most of the infrastructure renewal projects. An effective project delivery method should enable fast-tracking construction for projects with challenging deadline in a cost-efficient manner.

Best Value Approach: Public-sector organizations adhere to stringent procurement regulations to ensure fairness, openness, consistency and transparency in procuring goods and services. In Ontario, for example, all publicly funded organizations must follow the Broader Public-Sector Procurement Directive (BPSPD). It establishes the rules that must be followed in terms of number of quotes required, the process, the analysis and the award of contracts. To ensure full compliance with the BPSPD, most of these organizations prefer to use DBB which dictates the use of lump-sum prices and award the contract to the lowest compliant bidder. The lowest bidder approach may not bring the best value as contractors might try to lower their cost. In addition, these projects are likely to have large number of change orders, disputes, and claims which lead to delays and adversarial relationships between the project parties. Project management teams usually allow for up to 15% contingency to account for potential change orders cost for infrastructure renewal projects. An effective project delivery method should ensure owner organizations obtain the best value for their investments and promote more collaborative delivery environment.

4 Concluding Remarks

Current DBB delivery method exhibits serious drawbacks when used to deliver repetitive and non-repetitive projects alike. The lack of constructability feedback to the design, the inability to fast-track projects with tight deadline, the excessive number of change orders, and the adversarial relationship between parties usually associated with DBB are among those drawbacks. Most projects under this delivery methods are experiencing delays, cost overruns, costly claims and disputes. CMR was developed to alleviate some of the DBB shortcomings. CMR facilitates fast-tracking, allows constructability feedback, and promotes collaboration between parties. Projects delivered using CMR, however, experiences serious disadvantages. Most notably, the concern raised by the public-sector administrators that using CMR results in additional costs as sizable portions of the project scope is not competitively priced and they may not be obtaining the most competitive market value for their projects. This paper discusses the factors that should guide the selection of proper project delivery method for infrastructure rehabilitation scattered repetitive projects. This type of projects is repetitive in nature and scattered across large geographical area. They take place in old facilities and often unforeseen conditions are encountered during construction. These projects are procured and implemented separately which requires large administrative efforts and deprive owner organizations from cost saving opportunities. Modifications to the current project delivery methods to improve their efficiency when applied to this type of projects are needed. The required project delivery method should benefit from the repetitiveness, minimize the impact of the scattered nature, effectively address unforeseen condition, lower the administrative cost, and benefit from economy of scale.

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