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Rapid Construction Criteria and Its Implementation in Construction Industry

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ABSTRACT

There is a need to take a holistic approach to reviewing the factors impacting the construction industry performance. Improvements need to be implemented by all parties along the entire construction flow for lasting transformation to occur. Therefore, advanced construction methods have to be considered for this new era in delivering projects. Enhance the speed of the construction process flow is the vital to build a sustainable local or foreign construction industry that is poised to compete with the global players. In 2007, Construction Industry Development Board of Malaysia (CIDB) has identified one of the key failures of project delivery which is inefficient and ineffective methods and practices. CIDB also have stated the need of innovation through research and development to be adopted in new construction methods as their strategic thrust to improve the delivering method. Simultaneously with the requirements and specification will drive for rapid construction. This methodology in construction sector can give a change in project delivery methods within the contract period. With the basic definition of enhancing the speed of construction, this paper introduces four criteria of rapid construction and nine effective means to achieve it.

Keywords: Rapid construction, construction flow, improvement.

1. INTRODUCTION

Construction industries face an ongoing challenge of maintaining, rehabilitating, expanding and constructing, using innovative ways of construction method (KTC, 2005). The new approach to construct a building or infrastructure has been to perform faster construction to save money and increase the quality of work. In order to accomplish this, the rapid construction method has to be introduced that allow the policy of get in, get out and stay out. This approach relies on the use of innovative rapid construction methods to complete the work in a quality manner and in a timeframe that will have a minimal impact on the public. There are many advantages to using innovative rapid construction methods. By reducing construction time, these methods can minimize delays, mitigate congestion, save money and improve the safety aspect without sacrificing quality (Goodrum et.

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al., 2005). Rapid construction provides a significant opportunity to reduce congestion associated with the construction flow. These methods will lesson project durations while retaining quality. Opportunities for innovative methods of rapid construction are numerous. For example, pre-cast/modularization, alternative contracting strategies and project incentives have shown that alternative methods can work (KTC, 2005).

2. RESEARCH OBJECTIVES

The need to place a greater emphasis on achieving a better construction technology, which meets the needs of the end user at the earlier processes, will make this research flow by the objective of:

1. Identifying the criteria of the rapid construction project
2. Integrating rapid construction criteria into construction industry
3. Identifying the benefits and the way to achieve rapid construction

3. METHODOLOGY

Research methodology as defined in the research method will be carried out in this study. The cost-effective usage of the revenue will only be achieved using the suitable method. Therefore, it is crucial to ensure data and information gathered to be exact and in line with the information and objectives of the study. This research methodology will touch on the aspects of procedure in the implementation of this study to ensure that the findings can be operated more orderly and effectively. This matter aims to ensure all data gathered are based upon valid sources and it is in accordance with objective of the study. The procedure will be starting with understanding the construction problem and the elements of rapid construction.

4. LITERATURE REVIEW

The chronic problems of construction are well known such as low productivity, are well known such as low productivity, poor safety, inferior working conditions and insufficient quality (Koskela, 1993) and the phenomenon of the poor performance and conditions in construction had long been witnessed and recorded by academics and practitioners throughout the world regardless in developed countries (Eaton, 1994) or in developing countries (Serpell et. al., 1995). Production weaknesses and problem of the industry have to be redefined and reassessed in order to reformat a new strategy and plan for productivity improvement in the construction practices (Tan, 2004). Sir John Egan in his

report of "Rethinking Construction" mention that the UK construction industry at its best and is excellence. Its capability to deliver the most difficult and innovative projects matches that of any other construction industry in the world. So, to get better performance in the construction industries, rapid construction have to be introduced widely as one of the methods in accelerating change of project delivery. Rapid construction is a systematic approach to deliver a one kind project with complexity in construction due to limited time schedule, contract agreement, approved construction method and meets client satisfaction (Yahya, 2009). This definition seems comprehensive and it is covered on the construction physic itself. Kobayashi, Osamu (2005), defines rapid construction as a method of construction technology to solve the chronic congestion which decreases construction time. According to Chris Llewellyn Smith (2005) from United Kingdom Atomic Energy Authority (UKAEA), rapid construction involving major step in the development of fusion as a potential large scale sources. Kentucky Transportation Center (2005), in their report of "Innovative Rapid Construction/ Reconstruction Methods" briefly describe that rapid construction is a construction project due to limited schedule by using such methodology of construction method and shorter time. Rapid construction is a terminology to enhance the construction process flow and to ensure the successes of project delivery in a chronicle time of contract. Most of the field of rapid construction is initiated by the contractor on the project that contains unique design restrictions such as time constraints, project obligations or monetary provision. These factors encourage the construction players to develop innovative rapid construction methods, especially when accurate project durations are established. From the statement and definition of rapid construction, it is a process of stabilization and improvement of construction process flow. Koskela (2005) made the observation that any construction work package (task) has seven preconditions in order to be sound as construction project and delivered without any delay. The preconditions are:

1. Construction design (information)
2. Components and materials
3. Workers
4. Equipment
5. Space
6. Connecting (previous) work
7. External conditions

These preconditions looks that the rapid construction projects have to concentrate in the precondition to set up and launch the project. Another model of flows in the construction process was introduced by Ballard et. al. (2002), who looked at the nature of the prerequisites for the process and found three types which are:

1. Directives
2. Previous work
3. Resources

Directives provide guidance according to which output is to be produced or assessed. Examples are assignments, design criteria and specifications. Previous work is the substrate on which work is done or to which work is added. Examples include materials, whether [et al tak ada titik] ess, information that is input to a calculation or decision. Resources are either labour, instruments of labour or conditions in which labour is exercised. Resources can bear load and have finite capacities. Consequently, labour, tools, equipment's and space are resources (Ballard et. al., 2002).

According to Kentucky Transportation Center (2005), rapid construction provides a significant opportunity to reduce the congestion associated projects (highway). This process will lessen project durations while retaining the necessary quality. Based on that statement, by selecting the most appropriate method to expedite construction, this method attempts to efficiently utilize available funds and to minimize project life cycle while also maintaining value and quality of the project. Life cycle includes such factor as:

1. Construction time
2. Delay
3. Expected accident
4. Business impact
5. Environmental impact such as pollution and run-off
6. Maintenance and rehabilitation
7. Minimum performance levels

Paul et. al. (2005) have performed the literature on the innovative rapid construction methods in America and identifies the successful methods used to expedite construction projects. From that literature review, it became possible to identify numerous rapid construction methods that had proven successful around the country. Some of the more popular methods, including:

1. Scheduling calendar day projects
2. Using pre-cast component
3. Using contractor milestone incentives
4. Pavement type selection
5. Standardizing planning approach
6. Evaluating multiple approaches to traffic control plans

5. ANALYSIS AND DISCUSSION

According to the application of rapid construction in construction process flow, there are four criteria to be considered as a rapid construction project which are:

1. Unique restriction of time constraint
2. Using the innovative construction method
3. Scheduling approaches
4. Contract strategy

Many reasons are given as to why construction projects are often completed late and significantly over budget (Bourn, 2000). The needs to be a greater concentration on achieving a better construction which meets the needs of the end user drive for rapid construction. The entire supply chain, including clients, professional advisers, contractors, subcontractors and suppliers of materials must be integrated to manage risk and apply engineering techniques for driving waste out of the process. The process should reduce through life and operational costs, lead to greater certainty of project time and budgeted costs, fewer accidents and more sustainable construction. According to Saad and Alan (2005), for producing a quality product which meets capital cost, life cycle cost, and time expectations, two very important challenges need to be addressed:

1. How do firms gather and manage knowledge pertaining to new concepts and technologies for design and construction in terms of materials, equipment, information systems, procurement systems, and construction methods in a way that makes it readily accessible to designers and constructors alike; and
2. What factors must be considered on an international basis (e.g. production, logistics, etc.) when assessing the suitability of these concepts and technologies for a specific building project and geographical context.

Construction is the final component in manufacturing's product development process (Ballard and Howel, 1994). Construction is complete before manufacturing's productions begin. Consequently, it is misleading to conceive construction as analogous to factory production (although some aspects of construction fit better in that analogy such as fabrication. Construction uncertainty is a necessary component in construction conceived as a product development process. The very purpose of the process is to surface and resolve trade-offs between means and ends, all the way from product design through facility construction. Rapid construction must have four main criteria which are unique restriction of time constraint, using innovative construction method, scheduling approaches and contract strategy. To achieve rapid construction, there are few ways can be implemented to make a successful project delivery such as:

1. Automation equipment or construction technology;
   - Avoid the need to relocate many utility lines by obtaining information earlier,
   - Maturity testing,
   - Perform faster inspection and construction monitoring (software),
   - The use of automated construction technology: Geographical Positioning System or Laser based positioning systems,
   - Innovative plant and machineries,
   - Hydraulic Jack-In Piling,
   - Sleeve forming formwork, and
   - Application of 3D automation.

2. Information technology;
   - Application of intelligent design and monitoring software,
   - Using electronics mechanism and work-zone traffic control,
   - Using the E-commerce system: Project specific web site,
   - Exploit web-based team collaboration and project management system: Common E-rooms and web-based central project databases,
   - Use pilot demonstration projects for introducing new methods for expediting schedules,
   - Train selected field personnel in scheduling methods and scheduling claims, and
   - Inform the public before and during construction for publicity.

3. Innovative management;
   - Designated a single individual as Project Manager from early planning to completion of construction,
   - Formal partnering with design consultants, contractors, local authorities and regulatory agencies,
   - Used pilot demonstration projects for introducing new methods for expediting schedules,
   - Study optimal approaches to crew shifts and scheduling, and
   - Applying and emerging new product philosophy, such as lean, just-in-time, total quality management, value based management, concurrent engineering, supply chain management, Kanban or time based competition.

4. Innovative materials;
   - Industrialize Building System,
   - High performance materials,
   - Pavement and concrete selection, such as rapid hardening,
   - Curing compound and anti-crack agent,

- Using geosynthetic, earth reinforcement and pile supported earth platforms for embankments, and
- Lightweight composites.

5. Innovative Software or Database;
   - Using the E-commerce system such as project specific web sites,
   - Exploit web-based team collaboration and project management system,
   - Change management practices, and
   - Software used to perform faster inspection and construction monitoring.

6. Innovative financing;
   - Alternative funding methods, and
   - Financial management.

7. Public involvement;
   - Public input on phasing of construction,
   - Work zone,
   - Traffic control, and
   - Information to public.

8. Relocation of utilities;
   - Frequent coordination, corporation and communication between each party to expedite utility relocation work,
   - Establish utility corridors and systematically locate facilities,
   - Minimize relocation utilities by including incentives or disincentives in design and build contracts,
   - Utilized master agreement with the utility companies, and
   - Avoid the need to relocate many utility lines by obtaining information using subsurface utility engineering (SUE) early in the design phase.

9. Work zone traffic control;
   - Using lane shifts when doing road works or highway projects,
   - Generate and evaluate multiple traffic and safety control plans,
   - Employ methods for continuous work zones, and
   - Improve traffic flow in work zone under law enforcement.

6. CONCLUSION

The decomposition strategy led to some selections and simplifications from the viewpoint of alternative processes such as rapid construction. In practice, the model adheres to something that can be called the traditional building process. Rapid construction introduces a few interchangeable ways to carry through some

parts of the process. Have to notice that the traditional flow represents only cases where the division of labour and organisational relations between the parties are alike. While in the traditional design process the detailed solution is a result of straightforward design that, stage by stage, become more accurate, the other process concentrates initially on defining the clear functional requirements, pet ideas of the designer and unambiguous selection criteria for the comparison of tender solutions. However, the solution is not that clear. In the case of similar kinds of processes, the different order of activities is likely to cause some differences in those similar activities. On the other hand, also the activities of extremely different processes should have many common components since the aim to "build a building" is the same.

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