

Submittal-Approval Processes: Scheduling and Submittals-Approval Performance Index (SAPI)

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Abstract—Portion of the project delay coming from construction materials submittal and shop drawing approval process presents that must be clearly managed, as problems during submittal review can lead to incorrect product installations, and other costly mistakes. So there is a need to establish a material submittal and approval performance index which able to determine and clear the progress of consultant, contractors, and owners from the first step of submittal (input) to the last step of the process either accept or reject (output). The objective of this paper is to identify and provide the proper material submittal approval performance index (SAPI) to follow the progress of the project and been able to allocate the responsibility of contractor, consultant and owner to finish the process according to the project specification.

Index Terms—submittals, approval, performance, schedule, index.

I. INTRODUCTION

In Saudi Arabia the construction industry is the second after Oil industry and plays an important role in the country's economy. In 2012 alone, the Construction Industry contributed with 4.6% of the Saudi Arabia Gross Domestic Product, and accounted for more than 9.2% of Non-Oil Sector (NAI 2012). However, the lack of efficiencies of the construction industry which affecting the submittals-approve process are well known and includes: low productivity rates, poor quality of work [1], cost overruns, delays, constant changes, rework and claims [2]. During construction projects, contractors and suppliers provide submittal documents to the architect and engineers in order to document the exact materials and components that will be used in the building. Submittal review is a critical check-and balance during construction to ensure that the end result conforms to the design intent reflected in the architect and engineers' drawings. Also submittals are required because many times the specifications allow the contractor the option of using one of several competing products, or the specified system may need to be fabricated. The submittal allows the owner or architect engineer (A/E) to ascertain that the product or fabricated system meets the requirements of the contract documents. The most common form of submittals is shop drawings, but submittals can also be product data sheets, samples and quality

assurance/quality control information. The following paper addresses the submittal-approval process and the performance measure of the process. The research question is therefore: How submittal-approval process can be formulated to get better performance, and how the performance of the process can be measured?

II. METHODOLOGY

To properly address the subject of submittal-approval process in construction contracts this research investigated both technical and theoretical approaches since the problem is a hybrid of these two fields. The technical materials researched include: technical papers and articles, construction and engineering textbooks, critical path method _CPM_ scheduling manuals, specifications for public and private construction projects, papers presented at conferences, and mathematical formulas for computing performance. Theoretical materials researched included performance, project management textbooks, treatises on construction submittals approval, articles and papers written by specialist in construction, and proceedings of construction conferences and seminars. By researching the technical and theoretical aspects of submittal-approval process, extensive information regarding practices in the engineering and construction industry were reviewed and analyzed. This paper presents a discussion of these findings and offers recommendations for improvement.

III. NATURE OF SUBMITTAL-APPROVAL PROCESS

In construction processes, time is a valuable commodity and owners ordinarily require projects to be completed within a stipulated time frame, or by a specified date. Issues and problems do arise during the review process, and careful planning is necessary to ensure that the products are ordered and delivered within the construction schedule, to avoid delaying any activity. Organizational issues that cause problems are a lack of a clear schedule for submittals or too many submittals arriving on the architect's or engineer's desk at the same time, lack of a clear logging and tracking process [3], or submittals not being reviewed and returned in a timely manner [4]. The review is a mundane and uninspiring task in a design office [5] and is sometimes assigned to low-level personnel. Adding to the complexity of the

submittal process is the liability risk that all participants assume. As one of the areas of construction practice and law where all disciplines converge, the submittal process poses risks that must be carefully managed.

IV. TYPES OF CURRENT AND SUGGESTED SUBMITTAL-APPROVAL PROCESS

Different submittal-approval processes are under use and others were suggested. Many organizations do not have a basic construction integrated plan on which to have submittal-approval processes and the performance measure. Having successful submittal-approval processes is hard work that requires dedicated input from all functional and sub-contractor representatives. Some of these submittal-approval processes are logical and easy to follow, coming with supporting documents that outline assumptions and constraints. However, most processes are incomplete. These processes usually are not developed around a WBS (Work Breakdown Structure) of deliverables and do not include activity resource loading and scheduling nor activity earnings loading. Many teams do not have the core competencies needed to plan and develop construction submittal-approval processes. Nor do many construction companies have these planning skills available in the company to support project teams. There are generally three types of submittal-approval processes on construction projects which can be categorized and described, in actual practice submittal-approval processes and suggested by literature submittal-approval processes. The types of submittal-approval processes have been labelled as: Manual process, semi digitalized process, and Web based process,

A. Manual Submittal-Approval Processes

Manual submittal-approval processes is a paper-base process depends on sort of written forms and regulations describes the method of handling shop drawings and samples of materials. Of significant note is that the design information being passed from the A/E to the subcontractor is typically through paper-based drawings drawn by hand. Interpretation is done at each level to determine the intent of the individual and then redrawn by the subcontractor in the shop drawing production process. As interpretation is made at each level, the process is susceptible to human error in transferring design information and intent [6].

B. Semi Digitalized Submittal-Approval Processes

One of the most popular solutions to integrating all necessary design information into the shop drawings, allowing total design realization and limiting the iterations of the submittal process, is the use of CAD. The use of CAD versus hand drawing does not change the overall submittal process. The only change in the process is the actual format used to create and transfer the drawings by substituting CAD files for paper-based drawings when transferring information to the subcontractor. This assumes that the CD's were produced using CAD. During the production of shop drawings, it is

common for a materials fabricator who uses CAD to ask the architect for the electronic drawing files so that they can prepare their shop drawings more economically [7].

C. Web based Submittal-Approval Processes

The whole process of submittal-approval is through the internet web eliminating the use of paper work as Constructware which is Web-based project management tool that connects different business operations and information in order to standardize business processes. The software monitors work orders by providing communication and visibility throughout the various aspects of a construction project, such as documentation, design and cost. Tracking submittals in Constructware is one of the most challenging processes that clients face [8]. A malleable frame can be implemented as a Web-based neutral document format. The technology for developing such a neutral document format, such as the XML (eXtensible Markup Language) schema, is now available [9].

V. ANALYSIS

From the previous review of the nature of the submittal-approval processes and different types of processes we can notice that most of the literatures were discussing the way of review, the flow of the documents and the communication system to do the process of approval and avoiding two main things: 1) Lack of appropriate Scheduling of submittals. The scheduling of submittals for approval was mentioned as an important step but the way of doing the schedule has not been explained, on other word what about the influence of the cost of submittals on schedule? . 2) The measuring of the performance of the submittal-approval processes was not mentioned, the contractor can do the submittals schedule for approval but how can we measure the progress in the schedule?

VI. RECOMMENDATIONS

The recommendation to cover these problems is by doing two things as follow:

- 1) Loaded the schedule of the submittals for approval by the cost of the submittals according to budget cost of items related to these materials to obtain related S-Curve, which will allow us to measure the performance of the process.
- 2) Measuring the performance of the submittal-approval process by using Submittals-Approval Performance Index (SAPI) according to the following formula:

$$SAPI = BCAS/BCAS$$

where:

BCAS = Budget Cost of Approved Submittals

BCAS = Budget Cost of Approved Submittals as Schedule

If the value of SAPI is grater or equal 1.0 (SAPI \geq 1.0) the performance of the Submittals-Approval process is good. If the value of SAPI

is less than 1.0 (SAPI < 1.0) the performance of the Submittals-Approval process experiencing delayed so the owner has to make action to investigate the problem and correct the situation.

VII. CONCLUSION

The previous recommended two steps providing baseline and performance index to the owner and the contractor allowing them to control the Submittal-Approval process. Further study and investigations are needed to link SAPI index with the Cost Performance Index (CPI) and Schedule Performance Index (SPI) of the whole project to allow the owner and the contractor to have total integrated picture about the performance of the project.

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