Model Development of Constructability

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Abstract: The choice of the construction system is a multivariate decision making with criteria that vary from one project to the other, depending on the particularities and constraints imposed on the builder. This research develops a tool that measures the constructability of various construction projects. The decision making logic is based on fuzzy set theory (FST). FST is used to address uncertainties in decision making. The tool is generic enough to allow the user to encompass the criteria of the project at hand and to select the construction system best suited for its execution. The objective of this research is the development of the decision support model and the demonstration of its use. This research also furnishes an extensive environment for further development. It provides the blueprint to achieve the overall goal of assessing the project constructability and smooths the path for further refinement of the rules to be used at each step of the overall model. Through this model users are able to predict the feasibility of a project, and determine the most advantageous system to be used for its implementation. An analysis of the model illustrates that the results are accurate and the system demonstrates utility for practical use.

Key words: Fuzzy Set Theory; Constructability; Modus Ponens

INTRODUCTION

One of the earliest definitions but yet a succinct one of constructability is: the general meaning of constructability involves construction-oriented input into the planning, design and field operations of a construction project (Pepper, 1994).

The major criteria in constructability include cost, scheduling, quality and safety. The success and importance of the constructability review team is measured by the extent to which they anticipate construction problems and their ability to solve them at the onset. The project constructability is measured by the extent to which the execution and the construction are facilitated.

CURRENT METHODS FOR ASSESSING CONSTRUCTABILITY

Previous approaches that attempted to quantify constructability include; regression, simulation and expert systems:

The Regression Analysis Approach. As an example of constructability measure, the cost of the concrete can be estimated using this technique as follows: Due to the substantial impact of the formwork on the cost of a concrete structure, which sometimes exceeds the cost of the concrete and reinforcement, it is a logical

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Design of a Solar Power System

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ABSTRACT: This document describes the design of a Photo Voltaic (PV) system to be used for powering a refurbished container for habitat use. This solar power system design is primarily used for research within the University of North Florida. The design requirements for this solar power system are specific to a refurbished freight container which would be suitable for human habitation. The electricity generated by the solar power system is stored in batteries which provide an uninterruptable power source for operation of lighting and use of small appliances for a full day. The design addresses such parameters as electrical load requirements, site assessment, component sizing, safety considerations, and system cost.

Keywords: Uninterruptable Power Source, Photovoltaic, Grid-tied, Maximum Power Point, Tracking, Ampacity.

INTRODUCTION

The Solar Power System for a Habitat Container is an initiative by the College of Computing, Engineering & Construction (UNF). In an effort to deviate from conventional non-renewable methods of supplying electricity, a solar photovoltaic system was designed and installed on a potentially habitable structure, reincarnated from a decommissioned shipping container. As part of UNF's transformational and community based learning mission, the Department of Construction Management now offers a course on Industrial Construction. This new course allows students to utilize construction techniques and practices taught in the classroom and simultaneously get a hands-on application in a real environment while refurbishing the steel containers.

The first step in restoring the shipping container to its original state was to thoroughly assess its existing condition. Students did research on previous construction projects involving these containers. Preceding the research, it was decided that the finished product would have universal properties, allowing for a broad range of possible uses. The Habitat Container design accommodates many uses such as a mobile office space, disaster relief shelter; simple storage shed, or school room. Students were responsible for delegating tasks, maintaining proper job-site and tool safety, and meeting all intended deadlines. Along with these essential skills came many other considerations such as ethical construction practices and customer satisfaction.

Figure 1. Shipping Container Restoration

While designing the Solar Power System for the Habitat Container, it was decided that it would be used as a computer lab. To the agreement of most, there would be no better ending to an educational legacy then to provide and enhance the education abroad. Centro Educativo Pananao, the educational institution of an impoverished village in the Dominican Republic, was selected as the final residence of the Habitat Container.

Figure 2. UNF Habitat Container

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Overview of Emerging Technological Innovations in Construction Management.

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ABSTRACT: It is probably fair to say that most construction companies persist in relying on traditional methods for construction management. However, economic downturn and the ever changing nature of the construction industry necessitated innovations in computer technologies in order to be financially sound and to maintain a competitive advantage in the market. Currently, the most prominent technologies can be categorized as: 3-D modeling programs, 4-D scheduling packages, 5-D modeling, on-line program-management systems, surveillance systems, and software that integrates data systems.

Despite the industry's past reluctance to incorporate these advanced practices, there are many proven benefits to these technologies. Some of the most prominent areas benefiting from these emerging technologies include procurement policies and the investment risk that traditionally relied on heuristic approaches and subjective assessments. Although experience is valuable, it is not infallible. Computers can offer a more analytical and often more accurate assessment. This document provides a description of these innovative technologies, their benefits, the resistance to implement them, and strategies to build a technologically innovative construction company.

Keywords:
Construction Management, 3-D Modeling, 4-D scheduling, 5-D Modeling, Building Information Modeling, BIM, Data Integration, Online Program Management, surveillance systems and decision support systems (DSS), IT Strategy, Technological innovation in construction.

INTRODUCTION

Building construction has traditionally been viewed as a relatively immutable process with little change in techniques or administrative procedures. Fortunately, innovations in computer technologies for construction management have emerged. This emergence of technology is due to advances in computers and society’s views shifting towards a more economical and technology-driven world. Cost is the driving factor in most major decisions for construction companies. Therefore, these innovations have been created with specific goals of cost reduction, improved building quality, and enhanced productivity.

The limitation imposed on this study is the deliberate attempt to focus on only those technologies that, in the authors’ view, directly affect the management process. Numerous innovations in construction management computer technologies have become prominent in the industry. These technologies include 3-D modeling programs, on-line project-management programs, surveillance systems, and software that integrate data systems. These technologies increase construction performance and enhance the quality.

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CONSTRUCTION PROJECT CASH FLOW PLANNING USING THE PARETO OPTIMALITY EFFICIENCY NETWORK MODEL

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Abstract. Cash flow is crucial for ensuring the viability of a project. It consists of a complete history of all cash disbursement, cash shortage, loans, cost of money, and all earnings received. Although significant research work has been conducted on cash flow forecast, planning, and management, the objective is constantly the maximization of profit/final cash balance, or minimization of total project cost. Moreover, cash flow forecasting needs to be effective and fast. The paper develops multiple-objective cash flow planning model – Pareto optimality efficiency network model, which considers typical banking instruments, the constraints of the financial market, the budget constraints, and retention of money. A case study illustrates the multi-objective project cash flow management approach by applying the proposed model to a real world problem. A what-if-analysis depicts the tradeoff between profitability and loan interests, which are major issues in project cash flow planning and management. The model presents an effective decision making tool to be used by industry practitioners with reasonable accuracy.

Keywords: cash flow planning, pareto optimality, network model, multiple-objective

1. Introduction

Cash is the most important resource for a construction company, because more companies become bankrupt due to lack of liquidity for supporting their day-to-day activities, than because of inadequate management of other resources (Singh, Lakanathan 1992). Many construction projects have negative net cash flows until the very end of construction when the final payment is received or advanced payment is received before starting the project. It is very difficult to convince creditors and potential lenders that these inadequacies in cash flow are only temporary. Perhaps this is one of the main reasons that insolvency is more likely to occur in this industry than any other (Kaka, Price 1993). Moreover, the construction industry is a sector where significant uncertainties arise in many aspects of the problem, including the business and the financial environments. The financial risks come from several sources, encompassing the need for intensive capital, cash retainage from clients, the exposure to interest rate changes during the period between the contract closing and the end of the payment plan, leading to difficulties in good cash flow forecasting (Barbosa, Pimentel 2001). Inaccurate cash forecasts and inadequate cash flow management incurs financial stress (Kaka, Price 1991). Companies of different sizes face this kind of problem which requires distinct approaches and proper tools according to the nature and complexity of the operations (Barbosa, Pimentel 2001).

Cash flow at the project level consists of a complete history of all cash disbursement, cash shortage, loans, cost of money, and all earnings received as a result of project execution. A firm with higher cash flow variability increases the level of expected external financing costs, which incurs high cost of money and accordingly high project cost. Although significant research work has been conducted on cash flow forecast, planning, and management, the objectives of most of research is to maximize profit/final cash balance, or minimizing total project cost, or more accurately forecast the cost-in flow or cost outflow. Furthermore, cash flow forecasting needs to be effective and fast, considering the short time available and the associated cost at the tendering stage. Contractors rarely prepare a detailed construction plan at this stage, and usually wait until being awarded the contract. Therefore an effective and fast technique for forecasting cash flow is required, which is with reasonable accuracy and which takes into consideration the tradeoff of greater profitability and the cost of money.

This paper addresses cash flow management at the project level for the tendering and construction stages. The proposed model considers the typical instruments and constraints of the financial market, including earnings from depositing excess cash, long term and short term loans from banks. The budget constraints and minimum cash reserves for a project are also taken into account. The significance and useful potential attributed to the proposed Pareto optimality efficiency network model