Available online at www.sciencedirect.com

ScienceDirect

Procedia Engineering 123 (2015) 308 – 315

Procedia Engineering

www.elsevier.com/locate/procedia

Creative Construction Conference 2015 (CCC2015)

Application of Relationship Diagramming Method (RDM) for resource-constrained scheduling of linear construction projects

J. Uma Maheswari[a], V. Paul C. Charlesraj[b]*, Anshul Goyal[a] & Purva Mujumdar[a]

[a]*Department of Civil Engineering, Indian Institute of Technology Delhi, New Delhi, 110016, India*
[b]*School of Construction, RICS School of Built Environment, Delhi NCR, 201313, India*

Abstract

The traditional techniques for project scheduling such as Arrow Diagramming Method (ADM) and Precedence Diagramming Method (PDM) are continuously undergoing improvisation in order to replicate real-time construction scenario. Quite often, these methods are criticized for their limited information capturing ability. Relationship Diagramming Method (RDM) proposed by Plotnick in the recent past, is an improved variant of PDM, which can store additional information on relationships that would improve the scheduling process. In addition to basic data on the activities, additional information can be represented through five codes in RDM. Sequencing of activities in a construction project is primarily driven by the construction logic and/or the availability of resources. There is scope for arriving at alternate sequences with varying availability of resources to achieve the objectives of project scheduling as long as the construction logic is preserved. In order to achieve such a resource-constrained project scheduling, additional information on the restraints of the activities are necessary, which can be modelled using RDM through one of the five codes of RDM. The objective of this paper is to explore and exploit the Reason/Why code of RDM. The Reason and Why codes are associated with a restraint and for recording the description respectively. An activity's dependence on a resource has been captured using Reason/Why code in this study. It has been attempted to understand the impact of varying resource availability using an empirical equation on sequencing such resource dependent activities and its effect on critical path. The proposed concept is tested with data from a repetitive high rise construction project. The preliminary results have been well received.

Peer-review under responsibility of the organizing committee of the Creative Construction Conference 2015

Keywords: critical path; reason/why code; relationship diagramming method; repetitive construction projects; resource-constrained project scheduling

* Corresponding author. Tel.: +91-9717356536 Fax: +91-120-6673050
E-mail address: paul.iit@gmail.com, vpcharlesraj@rics.org

Peer-review under responsibility of the organizing committee of the Creative Construction Conference 2015
doi:10.1016/j.proeng.2015.10.095

1. Introduction

Execution sequence of activities involved in a construction project is primarily driven by the construction logic and/or the availability of resources such as manpower, equipment, material [1-3]. The sequence of activities, which are logic dependent cannot be altered but the sequence of resource dependent activities can be altered primarily based on the availability of resources at any instance using any of the resource constrained project scheduling methods [4-12]. The traditional scheduling techniques such as ADM (Arrow Diagramming Method) and PDM (Precedence Diagramming Method) cannot distinguish this variations and both the constraints are generally applied together [13-16].

RDM (Relationship Diagramming Method) is a variant of PDM and it can store more information compared to other traditional methods [17]. Fig. 1 shows the comparison of PDM and RDM [18]. In addition to basic data on the activities, additional information can be represented through five codes namely, Event Codes, Reason/Why Codes, Expanded Restraint or Lead/ Lag Codes, Duration Codes and Relationship Codes. The reason/why code of RDM can be associated with a restraint. Primary choices for reason/why code are either "P" for "physical" or "R" for "resource" as presented in Fig. 1. Generally, a physical reason indicates that activity is dependent based on logic and the FS (Finish-to-Start) relationship cannot be violated, whereas the resource reason states that activity are dependent on resource and the FS relationship depends on the resource availability at site [18]. The Why code further describes the Reason code and answers the question of "why" the specific Reason has been chosen. But, the critical path computations based on varying resource availability has not been adequately investigated [19].

Planning for appropriate resources especially the labor has always been a great challenge for project managers. The main objective of this paper is to execute 'what-if' scenarios for several resource combinations using the RDM reason/why code on repetitive construction projects. Sharing common resources is the most predominant challenge in repetitive construction projects. Through pattern analysis on several test cases and trial and error methodology, an empirical equation for computing the EF (early finish) of an activity has been determined [19]. Other calculations for network analysis such as ES (early start), LS (late start) and LF (late finish) have been performed in the same way as of ADM. This proposed network analysis was applied on a construction data and the initial findings has been reported.

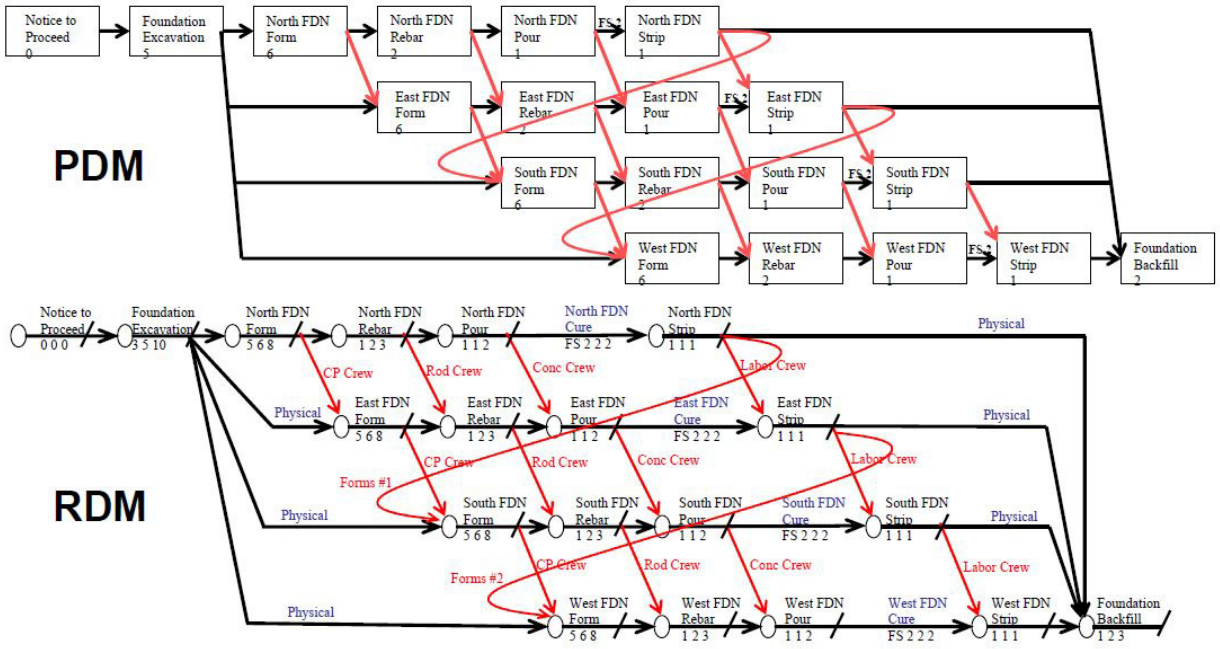

Fig. 1. Comparison of PDM and RDM network representation *(source: [18])*