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Fast Tracked Concept Based on DSM Model

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Abstract**:** *The purpose of Fast track project management technique is done to reduce the project time by overlapping the project design and construction phases and thereby by making maximum possible activities run parallel to each other so as to reduce the time. The main aim is to study of fast tracking process of a real estate project. And to evolve fast tracking model based on dependency structure matrix. As engineering activities are interdependent and sequenced based on information flows, modeling information exchange for these activities is impossible with CPM or PERT. Researcher have investigated the dependency structure matrix as a tool to identify and manage information exchange between activities. In the Ahmedabad city, most of the mega infrastructure project are delay due to some technical or financial reason. So that, there are major losses in time and project cannot complete within its time period. For these project, time is real money. So, fast tracking is one of the appropriate options to take project on its proper track. Thus, DSM is very important model to fast track project at any panic Situation. It has also used prediction model to calculate rework of days for succeeding activity.*

Keyword**:** *Delay, Fast tracking, Dependency structure matrix, Activity, Project*

I. INTRODUCTION

1.1. General

Fast tracking means that you look at activities that are normally done in sequence and assign them instead partially in parallel. For instance normally you would not start constructing a building until the design was complete. However, if you were fast tracking, you would start constructing the building in areas where you felt the design was pretty solid without waiting for the entire design to be completed.Fast-tracking always involves risk that could lead to increased cost and some rework later. A good rule of thumb is that sequential activities can sometimes be fast tracked by up to 33%. In other words, if you're fast-tracking, you can start the second of two sequential activities when the first activity is 66% complete [10].A fast-track project delivery strategy is designed to leverage the ability to execute multiple phases like the design, procurementand construction phases simultaneously in order to substantially reduce the overall project duration [1]. The ability to fast track implies that the finish-to-start relationship between the activities was discretionary whereas crashing a project means to throw additional resources at the critical path [7].

As a management tool, DSM is the most commonly applied in a project management, and it provides a project representation that allows for feedback and cyclic task dependencies. This is extremely important since most engineering applications exhibit such a cyclic property. As such, this representation often results in an improved and more realistic execution schedule for the corresponding design activities [2].

Fast tracking are required, when project has delay due to some reason and does not complete within its time period.

- There were many reasons for delay in the activities like:
  - Unavailability of labour
  - Legal issues
  - Changes in guidelines
  - Changes in designs
- The major activities so far which faced delay are:
  - Demolition
  - Excavation
  - Footing
  - Retaining wall
  - Reinforcement and concreting work

1.2 Objective

- To study the fast tracking process in a real estate project.

- To evolve fast tracking model based on Dependency Structure Matrix.
- To reduce completion time of project for delay project at different situation.
- To reduce Amount of rework of days at Critical situation.
- To provide proper Front-end planning for better output.
- To check probability of risk and impact of risk for succeeding activities.

II. LITERATURE REVIEW

2.1. Fast tracking of a project

The term "Fast tracking" indicates that the activities that are normally done in sequence are run in parallel instead. For instance, normally a project will not start until the designs of the entire project are complete. All the activities and phases in the projects will run one after the other. However, in case of fast tracking, the execution of the site will start immediately when the initial construction phase design are ready [5]. Even in the execution phase, many construction activities are run together simultaneously by using fast tracking technique.

Fast tracking is also called phased construction. The pre-arranged phases of the project are stared prior to the main project commencement. The biggest advantage is that the construction can begin before the entire designing stage is completed. The construction can commence with certain activities completed before. This tool is applied by proper use of total and free float as well as proper sequencing of the activities. Fast tracking can reduce the duration of the project and can help the contractor to achieve more profit by early completion.

2.2. Overall Indian scenario

Most of the construction projects in India are suffer from time. As per census data of 2013, around 46.8% (97 of 207) projects classified as mega infrastructure projects costing Rs 1000 crore or more are facing delay [9].

In terms of the average delay in delivering residential projects across India, more than 25 percent of the committed supply has not been able to hit the market as per schedule. Delayed delivery of residential projects has become a significant issue on the real estate market, leading to high levels of irregular among customers [8].

2.3. Scenario of fast tracked project

Conventional tools like the CPM and PERT are not suitable for sequence analysis because they cannot model interdependent activities. Moreover, these tools cannot model information flow. As engineering activities are interdependent and sequenced based on information flows, modeling information exchange for these activities is impossible with CPM or PERT. Researchers have investigated the dependency structure matrix(DSM) as a tool to identify and manage information exchange between activities [4].

Fast track projects started with inadequate front-end planning make execution of design within schedule and budget constraints even more challenging. Fast tracking of the project have received considerable attention in recent years and have been synonymous with the development of new project delivery systems under the professional construction management approach [6].

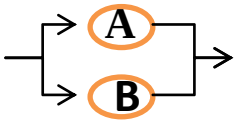
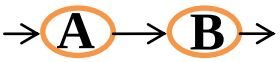
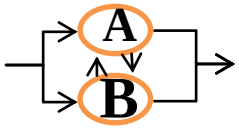
III. DEPENDENCY STRUCTURE MATRIX

The DSM is a simple tool to perform both the analysis and the management of complex systems. It enables the user to model, visualize, and analyze the dependencies among the entities of any system and derive suggestions for the improvement or synthesis of a system [2]. Today, most of the projects are facing the real challenge which is to overcome the tremendous complexity involved in scheduling and executing a large number of interconnected and dynamic tasks. DSM is a powerful tool for project management [3].

DSM is a square matrix, where cells on the upper-left to lower-right diagonal represent the elements of a system and off-diagonal cells represent the relationships among these elements. The dots off the diagonal indicate the presence of a direct relationship among two elements.

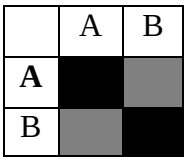
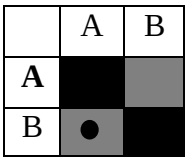
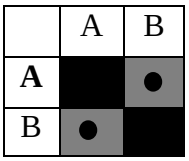
Consider a project that is composed of two elements: element "A" and element "B". A graph may be developed to represent this project pictorially. there are three basic building blocks for describing the relationship among system elements: parallel(or concurrent), sequential(or dependent) and coupled(or interdependent). Here, Graphical Representation of a activity and DSM representation of a activity and its relationship are shown in Table.

"Table 1. Graphical Representation of activity, its relationship"

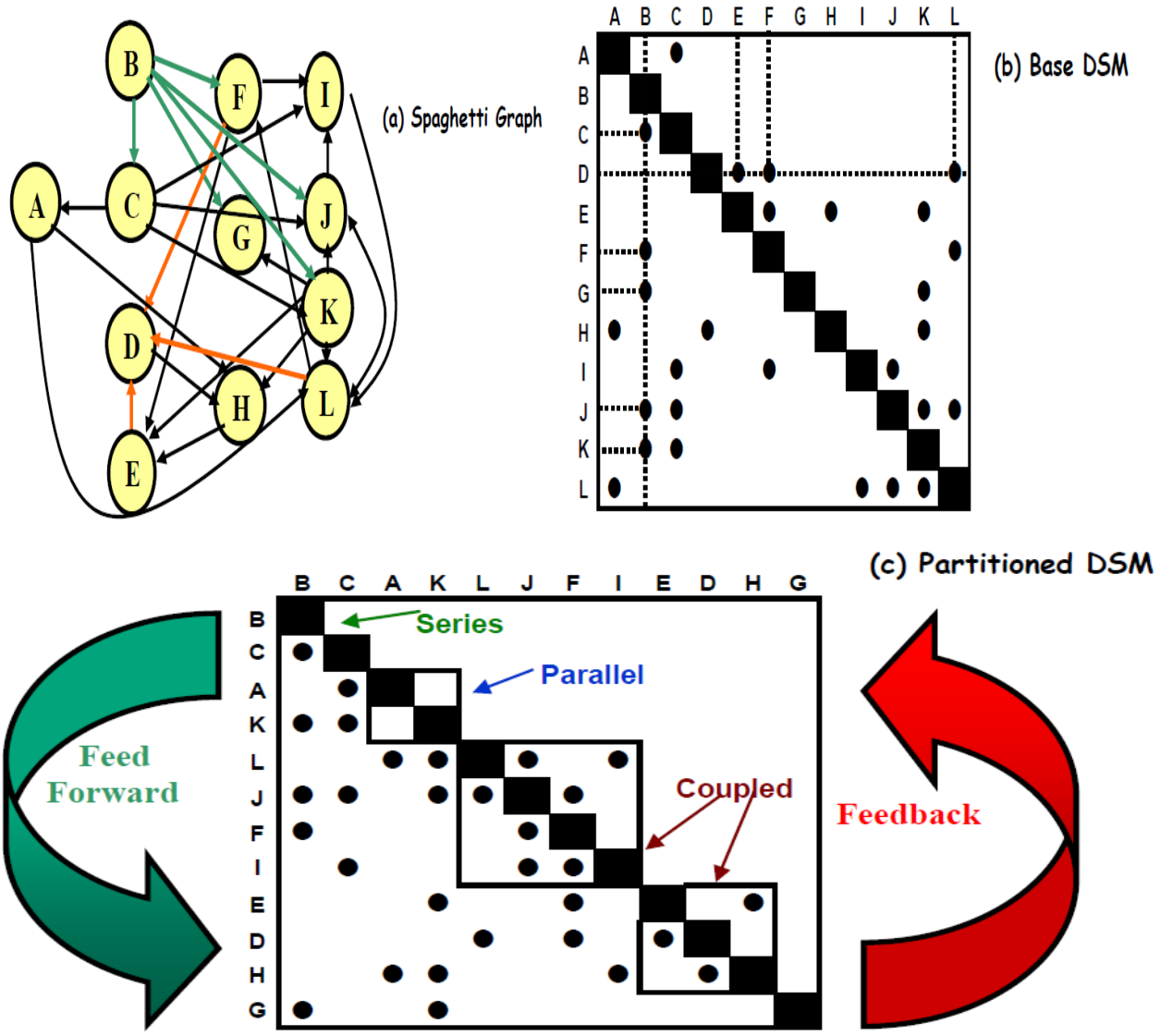
Three Configurations that Characterize a System			
Relationship	Parallel	Sequential	Coupled
Graph Representation			

The matrix representation of a digraph is a binary square(i.e. a matrix with equal number of rows and columns) matrix with m rows and columns. The matrix layout is as follows: the system element names are placed down the side of the matrix as row heading and across top as column heading in the same order. If there exists an edge from node i to node j, the value of element ij(column I, row j) is unity (or "X" or "0"). In the binary matrix representation of a system, the diagonal elements of the matrix do not have any interpretation in describing the system, so they are usually either left empty or blacked out.

"Table 2. DSM Representation of activity, its relationship"

Three Configurations that Characterize a System			
Relationship	Parallel	Sequential	Coupled
DSM Representation			

A DSM is a compact, matrix representation of a project network. The matrix contains a list of all constituent activities and the corresponding information exchange patterns. The DSM provide insights about how to manage a complex project and highlights issues of information needs and requirements, task sequencing, and iterations. Feedback marks correspond to required inputs that are not available at the time of executing a task. The execution of the dependent task will be based on assumptions regarding the status of the input tasks. As the project unfolds these assumptions are revised in light of new information, and the dependent task is re-executed if needed. The feedback relationships are needed to be determined in order to get a better output. The matrix can be manipulated in order to eliminate or reduce the feedback marks. This process is called partitioning. When this is done, a transparent structure for the network starts to emerge, which allows better planning of the project. Once the DSM is partitioned, tasks in series are identified and executed sequentially. Parallel tasks are also exposed and can be executed concurrently. For the coupled ones, upfront planning is necessary [11].



"Figure 1. Partitioned matrix" [11]

- Types of DSM
  - Task-based
  - Parameter-based
  - Team-based
  - Component-based

"Table 3. Different types of DSM, its data required and the application"

DSM Data Types	Representation	Application	Analysis Method
Task-based	Task/Activity input/output relationships	Project scheduling, activity sequencing, cycle time reduction	Partitioning, Tearing, Banding, Simulation and Eigenvalue Analysis
Parameter-based	Parameter decision points and necessary precedents	Low level activity sequencing and process construction	Partitioning, Tearing, Banding, Simulation and Eigenvalue Analysis
Team-based	Multi-team interface characteristics	Organizational design, interface management,	Clustering

		team integration	
Component-based	Multi-component relationships	System architecting, engineering and design	Clustering

The dependency structure matrices were created for the projects in order to simplify the details of the project and the change or the rework can be calculated following the impact of the project. Based on the data collected from the client as well as the contractor, the following risk matrices were being made. These matrices shows the probability of the succeeding activity being delayed due to the delay in any activity. Also, the impact of the delay on the succeeding activity has been shown in the risk impact matrices.

There are four types of DSM created for the project:

1) Work relation matrix
2) Risk probability matrix
3) Risk impact matrix and
4) The final DSM for calculating the impact on the project time.

Work Relation Matrix

A work relation matrix is formed based on the relation of the activities taken into consideration. Based on the relation of finish-to-finish or start-to-finish, it is described as:

"Table 4. Work Relation Scale"

Relation	Rating
Finish to Start	1
Start to Start	2
Start to Finish	3
Finish to Finish	4

Risk Probability Matrix

The risk probability matrix explains the probability of change occurring in the succeeding activity of the project due to some reason or delay of the preceding activity.

"Table 5. Scale for probability of occurrence"

Rating	Indication
0.2	Seldom
0.4	Sometimes
0.6	Often
0.8	Very often
1	Absolutely

Risk Impact Matrix

The risk impact matrix is to calculate the impact of the delay on the succeeding activity. This is calculated in the form of a percentage value. The value is written in the form of percentage of the impact in decimals eg. 20%= 0.2.

Prediction Model For Calculating Effect Of Change[4]

The matrix for calculating the probability and impact of risk was done by the experts handling the project. The data available from the project helps us in determining the impact on delay of the project due to its various reasons. The delay in the work causes the delay in the project. This delay is calculated using the formula derived by Eppinger[4], for calculating the relation between risk impact and risk probability to find out the impact on time delay of the project. The formula is given as:

$$\Delta\mathbf{T}(\boldsymbol{i}, \boldsymbol{j}) = \boldsymbol{f1 f2 T}(\boldsymbol{i}, \boldsymbol{j})\boldsymbol{RI}(\boldsymbol{i}, \boldsymbol{j})\boldsymbol{RP}(\boldsymbol{i}, \boldsymbol{j}) \quad i>j$$

$\Delta\mathbf{T}(\boldsymbol{i}, \boldsymbol{j})$= the delay in the activity caused by an impact of rework or delay at any stage of the project, for the impact of activity i on activity j. Also this is considered only for succeeding activities, hence i>j.

f1= technical complexity of the project= 1.5

f2= organization's capability to reduce the risk= 1

T (i,j) = the duration of the activity under consideration

RI (i,j) = the value of risk impact from the risk impact DSM of i on j

RP (i,j) = the value of risk probability from the risk probability DSM of i on j

The value of $\Delta\boldsymbol{T}$ was calculated for each activity in the DSM to calculate how much the impact will be in the worst case scenario. This value determines whether the impact created can cause how much delay in the project.

IV. CONCLUSION

This work has introduced the term "Fast tracking", its importance and its techniques. For delayed project, Fast tracking is more important technique to complete project within its time period. In real estate project, DSM is important modelfor application of fast tracking. It has useful to reduce duration of project and make better planning of project.The Work relation DSM shows the relation between the activities in consideration. These dependencies were being considered to prepare the new schedule. The risk probability DSM explains the probability of rework or delay that affects the succeeding activity in the project. The risk impact DSM explains the severity of impact of the delay or rework on the succeeding activity. The benefits of using DSM are realized at the end of the project since it leads to efficient application of fast tracking. If followed as per the plan, even the worst kind of situations on the site can be handled and managed efficiently. The effective savings in time achieved is around 25% to 30%, inspite of considering the delays by doing planning using this technique.

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