

Analysis of delays on Redevelopment Projects- A case study of Mumbai Residential project

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Abstract : In order to set Mumbai on a path of “world-class” ness, redevelopment schemes have been presented as an innovative and humanitarian effort to remove the disorder and degeneration. In Mumbai, the state which is already debt-ridden have started involving private builders to take over the responsibility of rehabilitation and redevelopment of the buildings that are in dire need of repairs. For this, the state offered the developers a FSI of 2.5, so that the builders can use it to construct profitable projects. But, still today, in India the construction industry lacks complete performance due to poor cost and schedule performance of the construction projects. Therefore, the aim of this study is to fill an important knowledge gap by identifying the various attributes for construction project delay, using the residential building project at Vartak Nagar Bldg No 18 Thane. This paper concentrates on investigating the centre components that are bringing about deferrals and breaking down the everyday records to limit delays. In order to complete the analysis, data collection is done from the case study site such as information about plans, resources, budgets and expenditures etc.

Keywords — Delay analysis, Redevelopment projects, Microsoft Project, Project Management

I. INTRODUCTION

There has been a growing trend of easing various regulations and utilizing private resources since the 1980s, when the central government's approach to urban revitalization was introduced, which led to the growth of large-scale urban redevelopment projects, especially in central Mumbai. And many of those that began in the 1980s are now completed. Furthermore, it can be assumed that the central government's urban revitalization policy since 2002 (again) will accelerate this trend.

Mumbai, one of the most valuable real estate markets in a developing country like India, needs a thoughtful and sustainable development plan to sustain its growth potential. Mumbai development planning works started a few years ago. Large-scale redevelopment projects are not the only goals of urban revitalization policies. Since these large-scale redevelopment projects have a huge impact on a very large area, naturally they become areas of interest. During the project process, stakeholders such as government, private developers, and communities seek to coordinate their interests and form collaborations through various organizations, both formal and informal, although the formation of collaborations sometimes delays the project.

Then, how were those large-scale redevelopment projects completed? How are their processes? How did the shareholders coordinate their interests and form a partnership among them? Since there is no recipe that

applies to every project, it is important to learn from different projects.

Redevelopment Delayed fulfillment of the venture when the delay of the venture conflicts with the established timetable. In addition to the structure, the expression - delay indicates that something will happen later than the actual context when specified, beyond planned, expected. It is too late to say that the effort is worthwhile without actually stopping development. In addition, it may exceed the date of the contract or correspond to the shipment of the project beyond the date of bringing the meetings. Unforgivable delays, unforgivable compensation non-payment delays, unforgivable compensation delays and simultaneous delays.

Unforgivable delays are delays, which accept the risk as an alternative for any reason. Sensitive Compensation Non-payment Delay may be the initial delay Delay in Compensation Reasonable delay Reasonable delay, suspensions or interruptions must be every last bit or bring only the value of effort A performance or disappointment to eventually be implemented by the employer. Pause for an obligation specified as an alternative in the contract. Simultaneous delays occur when both the owner and the contractor are responsible for the delay.

There are three basic ways to classify a type of delay:

- Critical and noncritical
- Forgiven and unforgivable
- Compensation and compensation are unpaid

➤ Redevelopment:

Redevelopment means demolishing the old structure and replacing the new structure with new dimensions and space. According to sub-law no. 77, a structural audit of the building should be conducted when the building is over 30 years old. The report of such a structured audit reveals the condition of the building and indicates whether the Society needs redevelopment. Only a government-approved architect conducts a structured audit. Structural audit is mandatory because structural survey of the building and adjoining structures is required so this is the first and main step in determining redevelopment.

The state government of Maharashtra first recognized the importance of redeveloping in 1971. The Slum Improvement Programme (SIP) of 1972 was intended to provide basic amenities to the slum like water, electricity, latrines and sewage disposal, but could not implement these plans as there was no comprehensive census on the slums of Mumbai.

By-law no. [77] According to the Society, the redevelopment of a building is considered only when it receives a negative structural audit report from an authorized structural auditor appointed by the Society to conduct a structural survey / audit of the building. [77] His report should clearly state the cost of defects / fixes / repairs.

Redevelopment requires written permission from each member of the Society. Unlike the SRA project, in a registered co-operative housing society, 100% consent of all members is required before the community can be redeveloped.

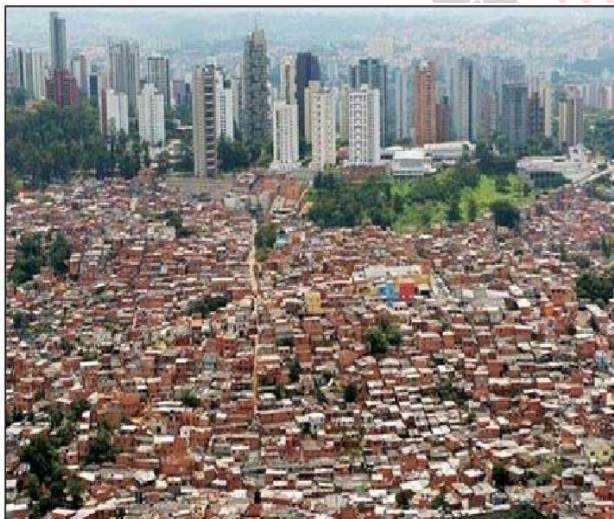


Figure 1 - Mumbai's slum Region prompted for Redevelopment

PROBLEM STATEMENT:

Time overrun is one of the most important issues facing the construction industry today. There are various factors to overcome in time that require serious attention to understand and solve the successful completion of projects

in a timely manner. Obsolescence has a very big impact on construction costs, which can never be recovered. In the construction industry, timely completion of a project is an important criterion for project success (Revlamilla and Hall.1995). Delay beyond the time limit basic construction schedule. The main goal of managing a construction project is to reduce time and cost. However, time delays often occur at all stages of a construction project and result in an increase in the overall length of the project (Yang, 2008 2008). The overall goal of the study was to identify factors that contribute to the overuse of time in a redevelopment project. In addition, it affects some pits where it is not possible to dig the hardware. It seeks to generalize this study.

NECESSARY POINTS TO BE NOTED FOR SUCCESSFUL REDEVELOPMENT:

The offer received from the developer should match the possibilities of the plot taken for redevelopment as per the report of the architect.

2. The manufacturer should be chosen strictly based on his financial capability and track record, not based on the highest offer received.
3. Tenders received should be objectively evaluated by a competent architect appointed by the Society.
4. All members of the Society must agree to avoid disputes.
5. All members of the Society should clearly understand the full details of the offers made by the developer and should be transparent in transactions.
6. To ensure that the Managing Committee of the Society is fully transparent, a Redevelopment Committee of two or three members from the Managing Committee should be set up to oversee the entire redevelopment process.
7. All contracts / documents should be reviewed by a competent lawyer appointed by the Society to ensure that there is no lockuna.
8. The bank guarantee should cover the entire construction period from the developer to the total cost of the redevelopment project.
9. Penalty terms should be included in the redevelopment agreement to ensure proper implementation of the developer plan.
10. The members of the Managing Committee and the Redevelopment Committee should check regularly during construction to ensure that there are no deviations from the plans / offers.

RESEARCH SCOPE AND OBJECTIVES

This research aims at performing the analysis for the factors and effects of delays occurring at redevelopment sites in Mumbai on residential projects

Therefore, objectives of this research to fulfil the above aim are:

- To investigate the existence of time deviation from the original time factors in redevelopment construction projects;
- To understand various methodologies that will help in identifying the factors that lead to time deviation through extensive literature survey
- To undertake a case study to investigate the existence and the reasons of time overrun redevelopment sites in Mumbai;
- To Prepare and schedule the baseline program and update using MS project
- To develop a satisfaction factor for the projects based on data provided in the feasibility reports and completion reports.

II. LITERATURE REVIEW

Miroslavas Pavlovskis, Jurgita Antucheviciene, Darius Migilinskas (2017) Assessment of buildings redevelopment possibilities using MCDM and BIM techniques - This paper deals with abandoned pre-industrial building issues and building redevelopment with a focus on sustainable development. A complex decisive model has been proposed for the redevelopment of abandoned buildings by combining Building Information Modeling (BM) and Multiple Criteria Decision Making (MCDM) methods. Provides a case study of a previous measuring device factory.

Rashmi. M. Bijwar, Prof. Dr. A. B. More (2017) Delay analysis in construction of redevelopment residential project - arious factors that may cause project delays are being studied. The reasons, resources and various methods of delaying the order place are recorded regularly. Daily data is collected regularly from the site.

Vinod Vanvari, Dr. Sumedh Mhaske (2018) Redevelopment of buildings in Mumbai city: risks and challenges - The study revealed various risks and uncertainties related to these projects. This will help prepare the relevant partners to address these. In most cities in developing countries, old buildings are always being redeveloped. There are one or more reasons for this. Buildings such as rental buildings that are in dilapidated condition or unaffordable for repair require more usable floor area.

Minsun KIM (2012) Peri-urbanization and its impacts on rural livelihoods in Mumbai's urban fringe - The aim of this research is to analyze the long-term trends of land use change, clarify the various factors affecting the spatial model of urban development in the Mumbai metropolitan area and discuss the relationship with land use management systems operating in the context of conservation. Main agricultural land. A detailed case study on the access to physical assets of rural and rural border

villages in the Panvel block of Raigad district and the transformation of rural livelihoods revealed urbanization trends in the local community and their impact on the urban-rural relations in the area.

Ramakrishna Nallathig, Prajakta Girkar and Samdisha Sapra (2019) Planning Slum Rehabilitation/Redevelopment Projects: Evaluation and Learning from Mumbai - This paper seeks to assess the impact of such SRS schemes in Mumbai through a Beneficiary Slum Survey. The results indicate that community-level social infrastructure is not integrated with the SRS project plan and that this affects the overall development and living environment of the slums.

Ashwini Arun Salunkhe, Rahul S. Patil (2014) Effect of construction delays on project time overrun: Indian scenario - This paper highlights the types of construction delays, as any project will experience time and expense. Construction delay is considered to be one of the recurring problems in the construction industry, which negatively affects project success in terms of time, cost and quality.

Muhammad Akram Akhund, Ali Raza Khoso, Uroosa Memon , Shabeer Hussain Khahro (2017) Time Overrun in Construction Projects of Developing Countries - This paper provides a theoretical framework for overcoming this problem. In this study, two main types of timelines are considered for developing framework: one is adoption delay and the other is adoption delay. Based on the framework, it identifies the critical factors that cause the time to decrease.

Mulenga Mukuka, Clinton Aigbavboa , Wellington Thwala (2015) Effects of construction projects schedule overruns: A case of the Gauteng Province, South Africa - This paper assesses the consequences of the cancellation of the schedule of construction projects in the South African construction industry. The data used in this paper are taken from primary and secondary sources. To reduce these overlays it is recommended that all members of the construction team be trained and made aware of scheduled overlays.

Tsegay Gebrehiwet, Hanbin Luo (2017) Analysis of Delay Impact on Construction Project Based on RII and Correlation Coefficient: Empirical Study - This study investigates the typical causes of delay at different stages of construction and its effect in the Ethiopian construction projects. Using a questionnaire with 52 causes and 5 effects of delay, data were collected from 77 participants' selected based on purposive sampling from the different contracting organizations. The methodologies used in this research are relative important index (RII) and correlation coefficient

Daniel W M Chan and Mohan M Kumaraswamy (1996) A comparative study of causes of time overruns in Hong Kong construction projects - This paper provides the

results of a survey to determine and assess the relative significance of delays in construction projects in Hong Kong. The survey covered 83 delay factors previously identified and divided them into eight major categories. (A) The main reasons for delays are analyzed and ranked according to the various groups classified according to the role of the parties (i.e. clients, consultants or contractors) in the local construction industry and (b) the type of projects.

III. METHODOLOGY

This project execution follows the flow chart given below:

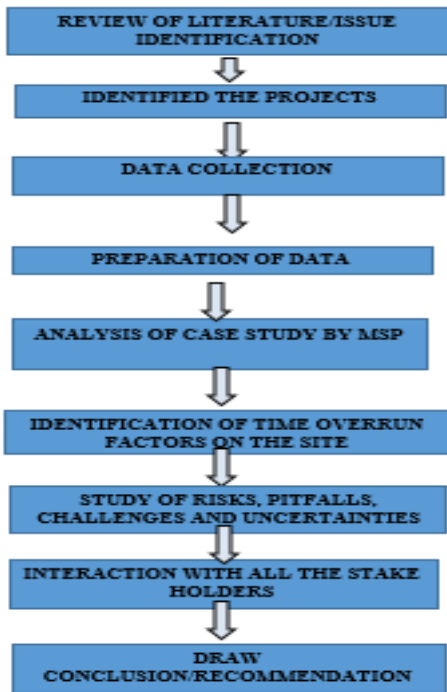


Figure 2. Flow Chart Showing Research Structure.

The data has been collected by interviewing the officials of the construction industry. The study has been broadly undertaken as follows:

- Identified the projects, which are undergoing Redevelopment.
- Studied all the available plans, estimates, schedules and work procedures in detail and collected all the relevant data about the project.
- Analyse the data obtained and compare the estimated and actual schedules and budget to understand the causes and implications of overruns.
- Examined the reasons for the over-runs through either personal interviews or questionnaires.
- Listed out all the shortcomings.
- Identified the reasons of Time overruns through a general survey of opinion from Architects, Consultants and Contractors and suggest the possible remedial solutions.
- The project study involved two stages. The primary data was gathered through a Literature survey targeted by web searches and review of e books, manuals, codes and journal papers. After review the problem statement

is defined and the selected Project Sites of Mumbai region are taken up for detail study and analysis purposes.

Furthermore, the factors impacting each perspective and the criteria to evaluate these factors will be identified in this chapter. Then the study area and the selection reasons will be simply introduced. The fieldwork and data collection will be also explained followed. And the limitations would be indicated finally as well. Current situation analyses will be conducted in this chapter by the collected primary data and information. In the present study, we are going to do detail to investigate the reasons for time overrun in redevelopment projects

CASE STUDY DETAILS:

- Name of project: - Redevelopment of high rise residential building (Grand central building no. 18)
- Developers name: -Puranik Builders Ltd
- Name of contractor: - M/s.Ahluwalia construction ltd.
- Architect:- M/s.Design consortium Architects Pvt Ltd.
- Structural consultant: -Thornton Tomasetti (US based)
- MEP Consultant: -CLANCY GLOBAL
- Site specifications: -

Height of building: 97m

Building configuration: G+30 floors, underground water tanks, service floor, stacked parking at ground level.

Location: Vartak nagar, Thane.

Built up area:1,17,185 Sqft

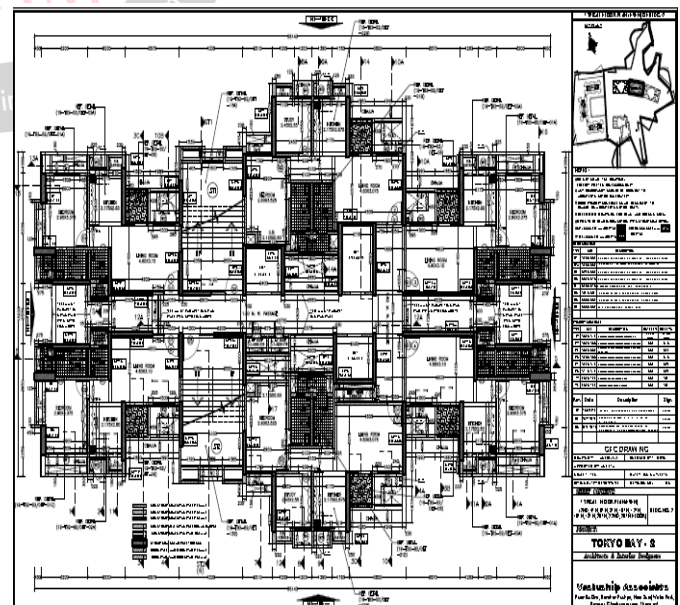


Fig 3: Detailed drawing of the case study project

QUESTIONNAIRE DESIGN AND CONTENTS

An interview is an efficient and useful method to obtain deep insight into the study area. It is also a direct way to

understand the target peoples' ideas. During the fieldwork period, through interviewing, some firsthand information is collected. It provided a wide range of information from government concerns, potential social problems to redevelopment strategies. Table 3.2 gives an overview of interview topics and interviewees. Due to privacy reasons, names of the interviewees are concealed here.

Table 3.2 Interview topics and questionnaire checklist

No.	Position	Organization	Topic	Check points for this research
1	Official	Mumbai Metropolitan Region Development Authority	The compensation and preferential policies of redevelopment in Mumbai	[1] Start point for redevelopment [2] Potential obstacles for redevelopment [3] Aims and objectives of compensation or preferential policies
2	Planner and Researcher	Urban Planning and Design Institute of Mumbai	Development history of Redevelopment in Mumbai	Criteria to decide the key urban buildings needed to be redevelopment
3	Official and researcher	The Renewal Authority	Current situation of redevelopment in Mumbai	Reasons to redevelop Mumbai
4	Planner	Case study	Redevelopment strategies of redevelopment	[1] Principles should be respected in redevelopment process [2] Items generally contained in redevelopment strategies [3] General framework to constituted strategies
5	Researcher	Case study	Related social and culture impacts of redevelopment	[1] Current living state of the people in the old buildings considered for redevelopment [2] Potential social problems aroused by redevelopment

CASE STUDY PLANNING DEVELOPMENTS-

1) Objectives for planning-

Planning comprises defining objectives of the project schedule of works, Construction Methods, Planning of Resources, preparing estimations of duration for various activities to bring about the timely completion of the project.

2) Scope-

The Scope of this Manual includes Macro/Portfolio Schedule, Micro Schedule, Logistic Planning, Delay Analysis, Variance Analysis, Monitoring & Tracking, and activities related with Pre-Construction as well as During-Construction Period. This Manual will give a detailed idea about work process and how other departments are associated with the process to execute the project.



Fig 4.1: Planning process

3) Preparation of schedules:

➤ **Micro Schedule-**

After the collection of data as explained in chapter 3 To estimate detailed schedule based on tender drawing and design development documents following chart is developed

Table 2: Process chart

Input	Accountability	Responsibility	Process Description	Record	Output	Customer	Remarks
1.Tender drawing & initial DSF 2.Schedule of permission/clearance 3.Current site status	AGM Planning	Architecture/Liaisoning/Execution	Obtain all the inputs from respective department to start with schedule preparation.	Soft copy	Micro schedule updated	Planning	Detail process description Is attached in Annexure 7.2

➤ **MSP online:**

To upload and update micro project schedule online in SharePoint platform the following procedure is followed:

Table 3: Process chart (MSP online)

Supplier	Input	Accountability	Responsibility	Process Description	Record	Output	Customer	Remarks
Assistant Manager Planning	1. % Progress update from site team 2.Project review meeting update 3.MIS presentation 4.Major decision from management	AGM Planning	Assistant manager planning/Site planning	Obtain all the inputs through different reports, review and update schedule in MSP online.	MSP online	Online MSP updated	SVP	Detail process description Is attached in Annexure 7.4

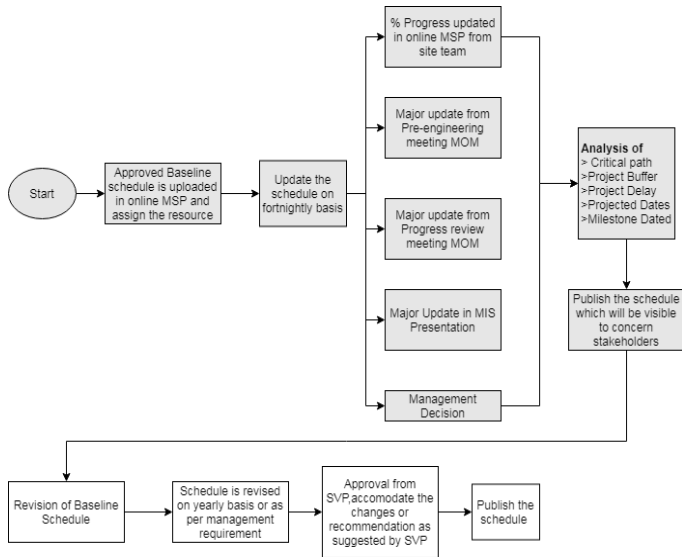


Fig 4.2: Process flow chart

➤ MIS reporting:

After the preparation of MS scheduled Presentation of monthly progress of all projects to higher management is made important and this process will be executed as follows:

Table 3: Process chart (MIS reporting)

Supplier	Input	Account ability	Responsibility	Process Description	Record	Output	Customer	Remarks
Assistant Manager Planning	1. Online MSP 2. Outstanding billing amount 3. Actual cost incurred (SAP) 4. Project progress photograph 5. New project status form liaison 6. Sales booking status	Assistant manager planning	AGM Liaison/Sales/Site planning /Billing	Obtain all the inputs from different department and present the report to higher management on monthly basis	Soft copy	MIS presentation	SVP	Detail process description on Is attached in Annexure 7.5

Table 4: Process chart (Fortnightly progress report)

Supplier	Input	Account ability	Responsibility	Process Description	Record	Output	Customer	Remarks
Site planning	Progress report	Project in charge	Site planning	Obtain all the inputs from different department and present the report to management on fortnightly basis	Soft copy	Progress meeting MOM	SVP	Detail process description on Is attached in Annexure 7.7

KEY MILESTONE'S ANALYSIS – 38-39 BUILDING (RESIDENTIAL)

Task Name	Baseline Start	Baseline finish	Actual Start	Projected Completion	% Completion as on 21.06.19	Slab Cycle
RCC Slab						
15 th Slab @ 46.75 m level	16-02-2019	25-02-2019	14-06-2019 (Projected)	07-07-2019	30%	13 Days
RCC Slab						
14 th Slab @ 43.9 m level	07-02-2019	15-02-2019	18-05-2019	24-06-2019	100%	14 Days
RCC Slab						
13 th Slab @ 41 m level	29-01-2019	06-02-2019	28-04-2019	10-06-2019	100%	17 Days
RCC Slab						
12 th Slab @ 38.1 m level	18-01-2019	28-01-2019	26-03-2019	24-05-2019	100%	30 Days
RCC Slab						
11 th Slab @ 35.2 m level	08-01-2019	17-01-2019	15-03-2019	24-04-2019	100%	20 Days
RCC Slab						
10 th Slab @ 32.3 m level	28-12-2018	07-01-2019	04-03-2019	04-04-2019	100%	21 Days
RCC Slab						
9 th Slab @ 29.4 m level	17-12-2018	27-12-2018	20-02-2019	14-03-2019	100%	16 Days
RCC Slab						
8 th Slab @ 26.5 m level	06-12-2018	15-12-2018	07-02-2019	26-02-2019	100%	13 Days
RCC Slab						
7 th Slab @ 23.6 m level	24-11-2018	05-12-2018	17-01-2019	13-02-2019	100%	19 Days

27.28 - STATUS OF WORKS

LEVELS	FLOOR	SLAB	CORE AREA	TP 1,2	T.P3
32.5	11	25-Jul-19	01-Jul-19	26-Jun-19	28-Jun-19
29.65	10	15-Jul-19	21-Jun-19	7-Jun-19	14-Jun-19
26.8	9	05-Jul-19	29-May-19	20-May-19	25-May-19
23.95	8	21-Jun-19	25-Apr-19	25-Apr-19	07-May-19
21.1	7	02-Jun-19	28-Mar-19	05-Apr-19	18-Apr-19
18.25	6	04-May-19	05-Mar-19	11-Mar-19	19-Mar-19
15.4	5	25-Feb-19	28-Jan-19	11-Feb-19	17-Feb-19
12.55	4	24-Jan-19	31-Dec-18	19-Jan-19	07-Jan-19
9.7	3	02-Jan-19	13-Dec-18	11-Dec-18	10-Nov-18
6.85	2	28-Nov-18	10-Nov-18	29-Oct-18	04-Oct-18
4.8	1	22-Oct-18	29-Oct-18	16-Aug-18	16-Aug-18
1.95	UGF (PART SLAB)	30-Aug-18	15-Sep-18	24-Jul-18	24-Jul-18

Fig 4.4: sample of Fortnightly progress report update charts from the site

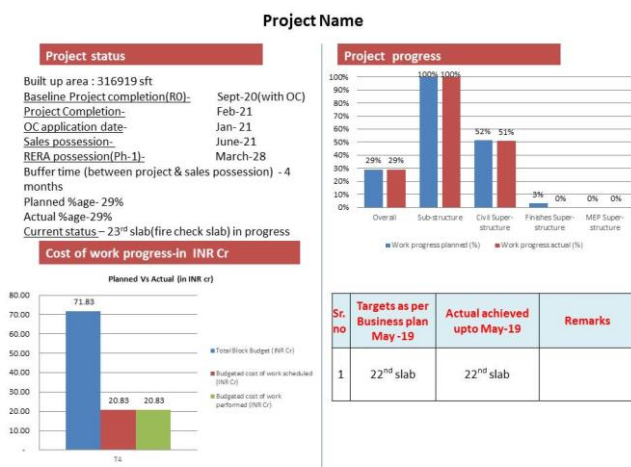


Fig 4.3: MIS report for the case study site

➤ Fortnightly progress report:

For the case study site progress upgrade the progress report will need the following:

➤ Pre-engineering meeting:

The planning is known to improve the performance of the construction project in terms of cost, schedule and quality. However, it often points out that project teams do not have effective planning methods and generally do not have the time or ability to plan in detail. The following refers to a small but rigorous project planning method called pre-engineering meetings, which are conducted exclusively between the owner and selected contractor project teams prior to the commencement of operations aimed at maximizing project team expansion and minimizing the risk of errors.

The pre-engineering meetings will be conducted as follows:

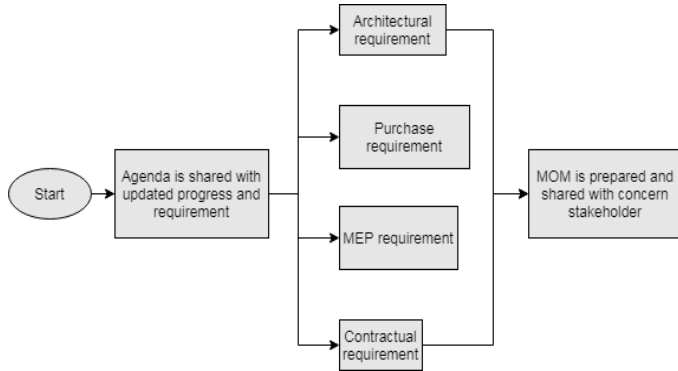


Fig 4.5: Process flow chart (Pre-engineering meeting)

Table 4.5: Process chart (Pre-engineering meeting)

Supplier	Input	Accountability	Responsibility	Process Description	Record	Output	Customer	Remarks
Site planning	Progress report	Project in charge	Site planning	Obtain all the inputs from different department and present the report to management on	File	Progress meeting MOM	SVP	Detail process description Is attached in Annexure 7.8

Purchase Requirements					
Sr.No	Project name	Location	Work Description	Remarks by Pre Engineering	Site Remarks dated 01-07-2019
1	HT	E	Vendor Required for Metal Door Mockup Sample Flat 106		Metal doormockup vendor Required for Sample Flat 106

Architect Requirements					
Sr.No	Project name	Location	Drawing Description	Remarks by Pre Engineering	Site Remarks dated 01-07-2019
1	HT	E	Tower Parking	Nivedita to coordinate with Gokani consultants	Drawings required for RCC & Deck sheet details

MEP Requirements					
Sr.No	Project name	Location	Drawing Description	Remarks by Pre Engineering	Site Remarks dated 01-07-2019
1	HT	E	Commercial MEP drawings	To be confirmed after meeting with Architect	Revised STP and commercial foundation details required

Contracts Requirement					
Sr.No	Project name	Location	Work Description	Remarks by Pre Engineering	Site Remarks dated 01-07-2019
1	HT	E	P.Hoist Maintenance work		WO for P.Hoist maintenance & ancillary work/ Sent on 30-05-19
2	HT	E	Removing of fencing near D.Froad	Fabrication work	
3	HT	E	CCTV Work		Contractor (Hansuja) denied execution the work
4	HT	E	WP-WO Required		Signed Copy of WO For Waterproofing works required

Decisions Required					
Sr.No	Project name	Location	Work description	Remarks by Pre Engineering	Site Remarks dated 03-06-2019
1	HT	E	Tower Parking Work Initiation	Pending due to payment	Initiation for Tower Parking Work

Fig 4.5: sample of Pre-engineering meeting update charts from the site

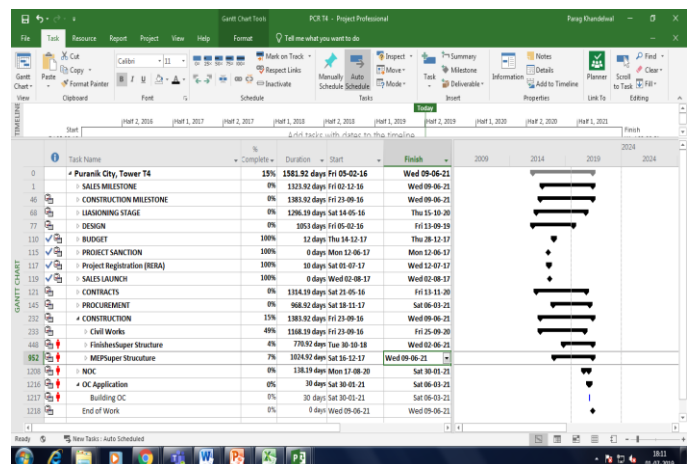
PREPARATION OF MICROSOFT SCHEDULE FOR THE CASE STUDY SITE DELAY ANALYSIS:

➤ MSP online:

Before preparing the schedule, identify the various activities at the beginning and identify the resources needed for the project. The project turned out to require about 160 activities. The project scheduling method used in the MS project to integrate all activities is a complex path method. The total base duration of the project is 432 days.

The list includes all work packages, activities and tasks involved in construction. Demand for materials, manpower, machinery and money will be determined at this stage. Estimates the cost and duration of various activities. The goal of an architectural plan is to complete the tasks that need to be completed and to create a timetable or exact sequence of activities, allowing a start date and end date for each activity and watching the tasks completed. Every activity is available when needed. The steps required to complete such a plan include logic (planning), time, analysis and scheduling. Planning input comes from assessment departments, project managers, field engineers, foremen and contractors. The plan should be based on the project as a whole and on clearly defined goals

The following pictures show the MSP prepared after collection of relevant data-



ID	Resource Names	Task Name	Duration	Baseline Start	Baseline Finish	% Complete/Complete	Target % Complete/Complete	Start	Finish
0		Vartak Nagar Bldg No 18 Thane	1037 days	Fri 27-05-16	Thu 31-10-19	6%	7%	Fri 27-05-16	Wed 04-12-19
1		SALES MILESTONE	947 days	Thu 08-09-16	Thu 31-10-19	0%	7%	Thu 08-09-16	Wed 04-12-19
41		MILESTONE	866 days	Wed 07-12-16	Tue 22-10-19	0%	7%	Wed 07-12-16	Fri 29-11-19
42		Civil Works	713 days	Wed 07-12-16	Tue 23-04-19	0%	7%	Wed 07-12-16	Tue 28-05-19
43		Completion of Substructure	0 days	Wed 07-12-16	Wed 07-12-16	100%	7%	Wed 07-12-16	Wed 07-12-16
44		Completion of RCC Superstruc	0 days	Tue 19-02-19	Tue 19-02-19	0%	7%	Thu 28-03-19	Thu 28-03-19
45		Completion of Block Work	0 days	Tue 26-02-19	Tue 26-02-19	0%	7%	Thu 04-04-19	Thu 04-04-19
46		Completion of Internal Plaster	0 days	Tue 05-03-19	Tue 05-03-19	0%	7%	Thu 11-04-19	Thu 11-04-19
47		Completion of Waterproofing	0 days	Tue 23-04-19	Tue 23-04-19	0%	7%	Tue 28-05-19	Tue 28-05-19
48		Finishing Works	190 days	Fri 01-03-19	Tue 22-10-19	0%	7%	Tue 23-04-19	Fri 29-11-19
57		MEP Services	74 days	Wed 05-06-19	Thu 03-09-19	0%	7%	Mon 15-07-19	Fri 11-10-19
67		LIASONING	932 days	Fri 27-05-16	Tue 25-06-19	99%	7%	Fri 27-05-16	Mon 29-07-19
78		DESIGN	867 days	Thu 30-06-16	Tue 14-05-19	0%	7%	Thu 30-06-16	Mon 17-06-19
126		BUDGET	35 days	Thu 30-09-17	Thu 11-05-17	100%	7%	Thu 30-09-17	Thu 11-05-17
131		PROJECT SANCTION	0 days	Sat 10-06-17	Sat 10-06-17	0%	7%	Sat 10-06-17	Sat 10-06-17
133		PROJECT REGISTRATION (RERA)	0 days	Fri 14-07-17	Fri 14-07-17	100%	7%	Fri 14-07-17	Fri 14-07-17
134		Application & documents upload	0 days	Fri 14-07-17	Fri 14-07-17	100%	7%	Fri 14-07-17	Fri 14-07-17
135		SALES LAUNCH	0 days	Thu 24-08-17	Thu 24-08-17	0%	7%	Thu 24-08-17	Thu 24-08-17
137		CONTRACTS	925 days	Fri 27-05-16	Mon 17-06-19	0%	7%	Fri 27-05-16	Sat 20-07-19
138		Civil	361 days	Fri 27-05-16	Sat 12-08-17	100%	7%	Fri 27-05-16	Sat 12-08-17
146		MEP	524 days	Wed 23-08-17	Thu 09-05-19	0%	7%	Wed 23-08-17	Wed 12-06-19
147		Contract Electrical	0 days	Wed 23-08-17	Wed 23-08-17	100%	7%	Wed 23-08-17	Wed 23-08-17
148		Contract Plumbing	0 days	Tue 06-03-18	Tue 06-03-18	0%	7%	Sat 14-04-18	Sat 14-04-18
149		Contract Fire Fighting	0 days	Tue 25-09-18	Tue 25-09-18	0%	7%	Sat 10-11-18	Sat 10-11-18
150		Contract Lift	141 days	Sat 20-10-18	Mon 15-04-19	0%	7%	Thu 29-11-18	Mon 20-05-19
151		Lift PO issuance date	0 days	Sat 20-10-18	Sat 20-10-18	0%	7%	Thu 29-11-18	Thu 29-11-18
152		Lift delivery at Site	0 days	Mon 15-04-19	Mon 15-04-19	0%	7%	Mon 20-05-19	Mon 20-05-19
153		Contract Stack Parking Structural Fabrication	0 days	Thu 09-05-19	Thu 09-05-19	0%	7%	Wed 12-06-19	Wed 12-06-19

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ID	Resource Names	Task Name	Duration	Baseline Start	Baseline Finish	% Complete/Complete	Target % Complete/Complete	Start	Finish
154		Finishes	397 days	Mon 29-01-18	Mon 17-06-19	0%	7%	Mon 12-03-18	Sat 20-07-19
166		PROCUREMENT	804 days	Mon 14-11-16	Tue 16-07-19	0%	7%	Mon 14-11-16	Tue 16-07-19
264		CONSTRUCTION	1053 days	Fri 27-05-16	Tue 22-10-19	9%	7%	Sat 27-05-16	Fri 29-11-19
265		Milestone	1022 days	Fri 27-05-16	Wed 09-10-19	99%	7%	Fri 27-05-16	Sat 16-11-19
266		Start of Works	0 days	Fri 27-05-16	Fri 27-05-16	100%	7%	Fri 27-05-16	Fri 27-05-16
267		Start of Substructure Works	0 days	Sat 04-06-16	Sat 04-06-16	100%	7%	Sat 04-06-16	Sat 04-06-16
268		Start of Civil Works Package	0 days	Tue 06-09-16	Tue 06-09-16	100%	7%	Tue 06-09-16	Tue 06-09-16
269		Start of Finishings Works Pack	0 days	Fri 25-05-18	Fri 25-05-18	0%	7%	Wed 04-07-18	Wed 04-07-18
270		GFC from New Consultant & C	171 days	Fri 20-01-17	Thu 31-08-17	100%	7%	Fri 20-01-17	Thu 31-08-17
271		Roof Top out	0 days	Mon 14-01-19	Mon 14-01-19	0%	7%	Mon 18-02-19	Mon 18-02-19
272		Closeout & Handover	0 days	Wed 09-10-19	Wed 09-10-19	0%	7%	Sat 16-11-19	Sat 16-11-19
273		Civil Works	874 days	Mon 06-06-16	Thu 25-04-19	19%	7%	Mon 06-06-16	Thu 30-05-19
274		Civil Sub Structure	159 days	Mon 06-06-16	Wed 07-12-16	100%	7%	Mon 06-06-16	Wed 07-12-16
288		Civil Super Structure	521 days	Mon 14-08-17	Thu 25-04-19	10%	7%	Mon 14-08-17	Thu 30-05-19
289		RCC	468 days	Mon 14-08-17	Tue 19-02-19	30%	7%	Mon 14-08-17	Thu 28-03-19
290		SW 9 work as per new structural drawings	15 days	Mon 14-08-17	Fri 01-09-17	100%	7%	Mon 14-08-17	Fri 01-09-17
291	Arun Nair	RCC Slab 1st Conventional @ 4.1m	77 days	Mon 04-09-17	Mon 16-10-17	100%	7%	Mon 04-09-17	Sat 09-12-17
292	Arun Nair	RCC Slab 2nd Conventional @ 7m	23 days	Thu 05-10-17	Tue 14-11-17	100%	7%	Wed 06-12-17	Tue 02-01-18
293	Arun Nair	Service floor 3rd slab @ 8.3m	7 days	Wed 15-11-17	Wed 22-11-17	100%	7%	Wed 03-01-18	Wed 10-01-18
294	Arun Nair	RCC Slab 4th Conventional @ 9.9m	23 days	Fri 17-11-17	Thu 21-12-17	100%	7%	Fri 05-01-18	Thu 01-02-18
295	Arun Nair	RCC Slab 5th (Typical Starts) @ 12.8m	35 days	Fri 22-12-17	Fri 02-02-18	0%	7%	Fri 02-02-18	Fri 16-03-18
296	Arun Nair	RCC Slab 6th	15 days	Sat 03-02-18	Tue 20-02-18	0%	7%	Sat 17-03-18	Tue 03-04-18
297	Arun Nair	RCC Slab 7th	10 days	Wed 21-02-18	Tue 06-03-18	0%	7%	Wed 04-04-18	Sat 14-04-18
298	Arun Nair	RCC Slab 8th	8 days	Wed 07-03-18	Thu 15-03-18	0%	7%	Mon 16-04-18	Tue 24-04-18

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ID	Resource Names	Task Name	Duration	Baseline Start	Baseline Finish	% Complete/Complete	Target % Complete/Complete	Start	Finish
299	Arun Nair	RCC Slab 9th	8 days	Fri 16-03-18	Sat 24-03-18	0%	7%	Wed 25-04-18	Fri 04-05-18
300	Arun Nair	RCC Slab 10th	8 days	Mon 26-03-18	Tue 03-04-18	0%	7%	Sat 05-05-18	Mon 14-05-18
301	Arun Nair	RCC Slab 11th	8 days	Wed 04-04-18	Thu 12-04-18	0%	7%	Tue 15-05-18	Wed 23-05-18
302	Arun Nair	RCC Slab 12th	8 days	Fri 13-04-18	Sat 21-04-18	0%	7%	Thu 24-05-18	Fri 01-06-18
303	Arun Nair	RCC Slab 13th	8 days	Mon 23-04-18	Wed 02-05-18	0%	7%	Sat 02-06-18	Mon 11-06-18
304	Arun Nair	RCC Slab 14th	8 days	Thu 03-05-18	Fri 11-05-18	0%	7%	Tue 12-06-18	Wed 20-06-18
305	Arun Nair	RCC Slab 15th	8 days	Sat 12-05-18	Mon 21-05-18	0%	7%	Thu 21-06-18	Fri 29-06-18
306	Arun Nair	RCC Slab 16th	8 days	Tue 22-05-18	Wed 30-05-18	0%	7%	Sat 30-06-18	Mon 09-07-18
307	Arun Nair	RCC Slab 17th	8 days	Thu 31-05-18	Fri 08-06-18	0%	7%	Tue 10-07-18	Fri 03-08-18
308	Arun Nair	RCC Slab 18th	8 days	Sat 09-06-18	Mon 18-06-18	0%	7%	Sat 04-08-18	Mon 13-08-18
309	Arun Nair	RCC Slab 19th	8 days	Tue 19-06-18	Wed 27-06-18	0%	7%	Tue 14-08-18	Thu 23-08-18
310	Arun Nair	RCC Slab 20th	8 days	Thu 28-06-18	Fri 06-07-18	0%	7%	Fri 24-08-18	Sat 01-09-18
311	Arun Nair	RCC Slab 21st	8 days	Sat 07-07-18	Wed 01-08-18	0%	7%	Mon 03-09-18	Tue 11-09-18
312	Arun Nair	RCC Slab 22nd	8 days	Thu 02-08-18	Fri 10-08-18	0%	7%	Wed 12-09-18	Thu 20-09-18
313	Arun Nair	RCC Slab 23rd	8 days	Tue 11-08-18	Tue 21-08-18	0%	7%	Fri 21-09-18	Sat 29-09-18
314	Arun Nair	RCC Slab 24th	8 days	Wed 22-08-18	Thu 30-08-18	0%	7%	Mon 01-10-18	Wed 10-10-18
315	Arun Nair	Fire check floor 25th	30 days	Fri 31-08-18	Fri 05-10-18	0%	7%	Thu 11-10-18	Wed 14-11-18
316	Arun Nair	RCC Slab 26th	8 days	Sat 06-10-18	Mon 15-10-18	0%	7%	Thu 15-11-18	Fri 23-11-18
317	Arun Nair	RCC Slab 27th	8 days	Tue 16-10-18	Wed 24-10-18	0%	7%	Sat 24-11-18	Mon 03-12-18
318	Arun Nair	RCC Slab 28th	8 days	Thu 25-10-18	Fri 02-11-18	0%	7%	Tue 04-12-18	Wed 12-12-18
319	Arun Nair	RCC Slab 29th	8 days	Sat 03-11-18	Sat 17-11-18	0%	7%	Thu 13-12-18	Fri 21-12-18
320	Arun Nair	RCC Slab 30th	8 days	Mon 19-11-18	Tue 27-11-18	0%	7%	Sat 22-12-18	Tue 01-01-19
321	Arun Nair	RCC Slab 31st	8 days	Wed 28-11-18	Thu 06-12-18	0%	7%	Wed 02-01-19	Thu 10-01-19
322	Arun Nair	RCC Slab 32nd	8 days	Fri 07-12-18	Sat 15-12-18	0%	7%	Fri 11-01-19	Sat 19-01-19
323	Arun Nair	RCC Slab 33rd	8 days	Mon 17-12-18	Wed 26-12-18	0%	7%	Mon 21-01-19	Wed 30-01-19
324	Arun Nair	RCC Slab 34th	8 days	Thu 27-12-18	Fri 04-01-19	0%	7%	Thu 31-01-19	Fri 08-02-19
325	Arun Nair	RCC Slab terrace	8 days	Sat 05-01-19	Mon 14-01-19	0%	7%	Sat 09-02-19	Mon 18-02-19
326	Arun Nair	RCC Slab OHT LMR	30 days	Tue 15-01-19	Tue 19-02-19	0%	7%	Tue 19-02-19	Thu 28-02-19
327	Arun Nair	Blockwork (Kitchen & Toilet) & Door Frame	237 days	Mon 23-04-18	Tue 26-02-19	0%	7%	Sat 02-06-18	Thu 04-04-19

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ID	Resource Names	Task Name	Duration	Baseline Start	Baseline Finish	% Complete/Complete	Target % Complete/Complete	Start	Finish
362		Internal Plaster	230 days	Wed 09-05-18	Tue 05-03-19	0%	7%	Mon 18-06-18	Thu 11-04-19
397		Hole Filling, Grinding & External Plaster	45 days	Wed 06-02-19	Tue 02-04-19	0%	7%	Tue 12-03-19	Tue 07-05-19
399	Arun Nair	Shaft & Duct Plaster	10 days	Thu 31-01-19	Mon 11-02-19	0%	7%	Wed 06-03-19	Sat 16-03-19
400	Arun Nair	Shaft Duct & Lift White Wash	60 days	Tue 12-02-19	Thu 25-04-19	0%	7%	Mon 18-03-19	Thu 30-05-19
401		Waterproofing	252 days	Tue 29-05-18	Tue 23-04-19	0%	7%	Sat 07-07-18	Tue 28-05-19
473		Finishes Super Structure	460 days	Sat 24-03-18	Tue 22-10-19	0%	7%	Fri 04-05-18	Fri 29-11-19
975		MEP Super Structure	550 days	Thu 12-10-17	Thu 12-09-19	0%	7%	Wed 06-12-17	Thu 17-10-19
976		MEP Electrical	543 days	Thu 12-10-17	Thu 29-08-19	0%	7%	Wed 06-12-17	Wed 09-10-19
1050		MEP Plumbing	378 days	Wed 16-05-18	Sat 31-08-19	0%	7%	Mon 25-06-18	Fri 11-10-19
1186		MEP Firefighting	212 days	Tue 11-12-18	Wed 28-08-19	0%	7%	Mon 21-01-19	Tue 01-10-19
1187		Firefighting Sprinkler System	120 days	Tue 11-12-18	Mon 06-05-19	0%	7%	Mon 21-01-19	Fri 14-06-19
1190		Hydrant Piping in Shaft	30 days	Tue 21-05-19	Mon 24-06-19	0%	7%	Mon 24-06-19	Sat 27-07-19
1191		Hydrant Piping around Building	15 days	Sat 06-07-19	Tue 23-07-19	0%	7%	Fri 09-08-19	Tue 27-08-19
1192		Hydrant accessories and installation	10 days	Mon 05-08-19	Fri 16-08-19	0%	7%	Mon 09-09-19	Thu 19-09-19

Predect/Finish	Variance
1201	34 days
	34 days
1046FF	34 days
1204	34 days
	29 days
	29 days
974FS-	29 days
1210	29 days
	34 days
1048SS	34 days
1213	34 days
1185SS	29 days
1049FF	34 days
1185	29 days
	34 days
	29 days
1230	29 days
1226,1	29 days
396,40	29 days

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- Delay in go ahead for terrace slab
- Delay due to tower crane jumping
- Shortage of manpower
- Delay due to payment issues of the Finishing contractor
- Delay in go ahead for plinth works
- Delay due to payment issues of the RMC suppliers
- Delay in go ahead for above plinth works

All these delays can be broadly classified in factors that are accounted in the literature review too as the primary causes of delays on many construction sites. These factors are-

- 1) Factors related to manpower
- 2) Factors related to equipment
- 3) Factors related to management team at site
- 4) Factors related to weather
- 5) Factors related to government policies
- 6) Factors related to project characteristics
- 7) Miscellaneous factors

➤ **Pilot questionnaire survey analysis:**

The small sample of tenants was identified from housing societies under redevelopment. Simple questionnaire was designed to undertake this. The factors identified were incorporated in pilot questionnaire survey. The attributes identified were presented to respondents. The respondents (tenants, ten in number) were requested to respond to this. The rating of one most important attribute i.e. “Level of Risk” were sought on 1 to 10 scales, “1” represented “Strong disagreement” and “10” represented “Strong agreement”. (See Table I). The outcome of analysis of Pilot Questionnaire can be summarized as follows:

- 1) The learned and updated lot among tenants feels relatively less risk in the process.
- 2) Risk varies from project to project, person to person, phase to phase.

DISCUSSION OF RESULTS AND DELAY ANALYSIS:

➤ **Findings from the MSP at the case study site:**

The delay observed on the site is shown and highlighted below:

Effective delay as on 21.06.19				
Location	Baseline completion date	Projection as per MSP online	Total effective delay	Reasons
19.20	12-12-2019	28-05-2020	139	1. Delay in Tower Crane commissioning, breakdown & crane jumping . 2. Delay due to payment issues of civil contractor. 3. Delay due to delay in Tower Crane jumping. 4. Shortage of manpower
18	18-11-2019	28-02-2020	87	1. Delay in go ahead for terrace slab 2. Delay due to payment issues to finishing contractors.
38.39	07-10-2020	04-02-2021	98	1. Delay in go ahead for above plinth works. 2. Shortage of manpower / Crane breakdown. 3. Delay due to payment issues of civil contractor. 4. Shortage of manpower
27.28	22-04-2020	15-09-2020	123	1. Delay in go ahead for above plinth works. 2. Delay due to payment issues of civil contractor. 3. Delay due to payment issues to RMC suppliers 4. Shortage of manpower

Fig 5: findings of the Delay on the site selected for study

The reasons observed at the site that accounted for delays are –

- Delay in tower crane commissioning, breakdown and crane jumping
- Delay due to payment issues of the contractor

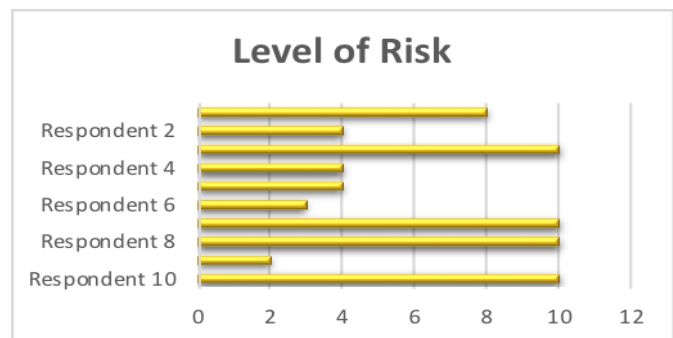


Fig 6: Analysis of Answers of Pilot Questionnaire Survey

Table 6.1: Project Phases and Risks

Phase of Project	Risk Level	Duration in Months
1 Initial Preparation and PMC Selection	Very High	2 to 3
2 Project Feasibility	Very High	2 to 4
3 Tendering, Developer	High	6 to 8

Selection		
4 Pre-execution	Medium	8 to 10
5 Construction, Handing over	Moderate	27 to 59

IV. CONCLUSIONS AND RECOMMENDATIONS

Conclusions:

The study focused on construction delays in Mumbai's redevelopment projects. The study sought the views of clients, consultants, tenants and contractors on the relative importance of factors contributing to delays in construction projects. Based on the above study, we can decide whether or not to frame the project within such a parameter to define the schedule. With proper planning and management, the material gained from the study can help overcome delays at any redevelopment site. Delays can be minimized if there is proper control over planning, scheduling and implementation during construction.

Delays can be minimized or minimized by a team of experienced or skilled staff, but delays cannot be avoided due to a variety of weather, labor availability, identity and many other factors. Therefore, effective planning and tracking / construction monitoring can lead to more or less additional costs of delay.

The responses that begin with the respondents make it clear that the parties are almost identical to the delays that occur with the project. From the above analysis I have come to the following conclusions: -

- Delay in installments, i.e. payments can lead to construction delay.
- Poor coordination on behalf of the contractor.
- Lack of qualified labor, supplies and equipment when qualification is required.
- The total time of the above project is 369 days after the planning of the above project.

From box to box plot analysis, it shows the most significant delays from manufacturers and low productivity workers for poor communication. Maximum delay was seen in brake device faults

6.2 Recommendations

If we practice and work properly to eliminate errors of the site. Delays can be reduced by the following factors.

1. Teamwork
2. Detailed investigation.
3. Careful and regular monitoring and meetings.
4. Careful and regular monitoring and meetings.
5. Effective management.
6. Collaboration and effective work and coordination.
7. Schedule carefully

Here are some ways or steps to avoid over time in redevelopment projects:

1. Regular Advance Meeting.
2. Use the upcoming engineering application.
3. Use the appropriate modern type of construction until date development.
4. Use appropriate development approaches.
5. The key to successful planning.
6. Getting the best material possible.
7. Early start-up cost estimates.
8. Clear most data and correspondence channels.
9. Continuous coordination is included between meetings.
10. Slang suitable for previous work experience.
11. Good project planning and planning.
12. Complete the long linear configuration.
13. Materials of 3M are always planned for backup conditions both man and machine.

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