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DELAY ANALYSIS IN CONSTRUCTION OF REDEVELOPMENT RESIDENTIAL PROJECT

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Abstract - *Delays of a development venture is characterized as late fulfilment of the venture when contrasted with the arranged timetable. Development delays are frequently after effect of miscommunication between contractual workers, subcontractors, proprietors and providers. These types of unrealistic exceptions are usually avoided by using a clean and efficient planning mechanism, which clearly specifies the work and timetable to be used. Delays in construction projects are quite expensive; sometimes they may result in severe damages to the involved parties. This thesis concentrates on investigation of centre components that are bringing about deferrals and breaking down the everyday records to limit delays. The current study is undertaken on Construction of High rise residential building project in Andheri, Mumbai. The project is reconstruction of G+13 floor High rise Residential Building and is scheduled to complete in 47 Months including all sanctioning and redevelopment processes. The study is being conducted on various factors that were causing the delays in project. The causes, resources and the discrete methods on nonetheless to derogate the delays in the ordering locality are noted down regularly. The day-to-day data is regularly collected from site. Beginning time, completing time, Also span is recorded over misundertaking differentiating undertaking Furthermore basic movement alongside the delays brought about What's more purposes behind those delays. A questionnaire may be arranged posting crazy Different variables helping to delay under diverse classifications In light of perceptions In development webpage Furthermore from a few diary papers as reference. Those sees on the same starting with Different gatherings included On an undertaking similar to those builder/developer, foreman What's more consultants are moaning in the questionnaire. Each component will be provided for An weight-age landed at utilizing filled-up questionnaires, using, which those mossy cup oak persuasive elements would recognized.*

***Key Words*: Delays in construction project1, Redevelopment2, causes for delays3, impact of delays on Construction project4, RERA 2016 act5 Box plot6, Demonetization7.**

1. INTRODUCTION

Clinched alongside construction, the expression —Delay alludes on something happening toward a after the fact occasion when over planned, expected, specified Previously, an agreement or past the date that the gatherings concurred for the conveyance of a venture. Delay will be those abating down from claiming worth of effort without ceasing development actually Furthermore that might prompt run through overwhelm Possibly past the agreement date or past the date that the gatherings bring concurred to the conveyance of the project. Delays classified into non-excusable delays, excusable non compensable delays, excusable compensable delays and concurrent delays[1].

Non-excusable delays are delays, which those foreman whichever reasons alternately accepts the hazard for. Sensible non-compensable delays might delays initiated Eventually Tom's perusing components that need aid not foreseeable, previous those contractor‘s sensible control likewise not attributable of the contractor‘s lack alternately heedlessness. Compensable reasonable delays these are compensable delays are reasonable delays, suspensions, or interruptions should every last bit or and only the worth of effort brought on Eventually Tom's perusing a demonstration or disappointment to enactment by the manager coming about because of owner‘s break for an obligation, stated alternately implied, in the contract. Concurrent delays occur when both owner and the contractor are responsible for the delay.

There are three basic ways to categorize type of delays:

- Critical and noncritical
- Excusable and Non-excusable
- Compensable and non-compensable

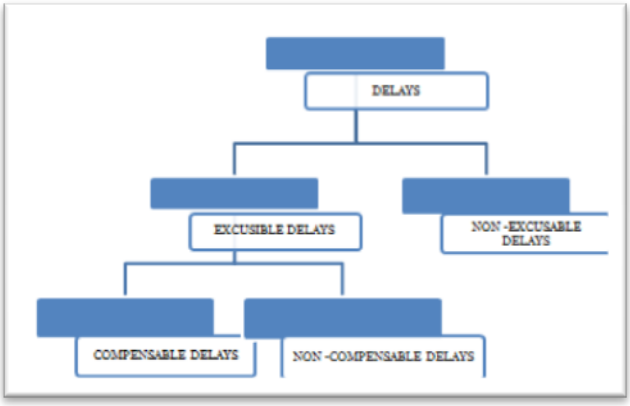

Fig No. 1 Types of delays

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1.1Delay Analysis Techniques

If or not a delay will be compensable relies principally on the money house under the agreement. In the greater part cases, an agreement particularly notes the sorts about delays that need aid non-compensable, for which those foreman doesn't accept any extra cash yet all the might make permitted a period development.

Delay examination may be An explanatory procedure that ought to a chance to be utilized for task documentation alongside gathered information starting with one task site. Those determinations about delay Investigation relies on the mixed bag about Components and the accessible records.

There are five commonly used delay techniques.
1. Impacted as-planned method
2. Time impact analysis method
3. Collapsed as-built or _but-for analysis method
4. Snapshot/windows/time slice analysis method
5. As-planned versus as-built windows analysis method

1.2 Cause Effects Relationship of Construction Delays

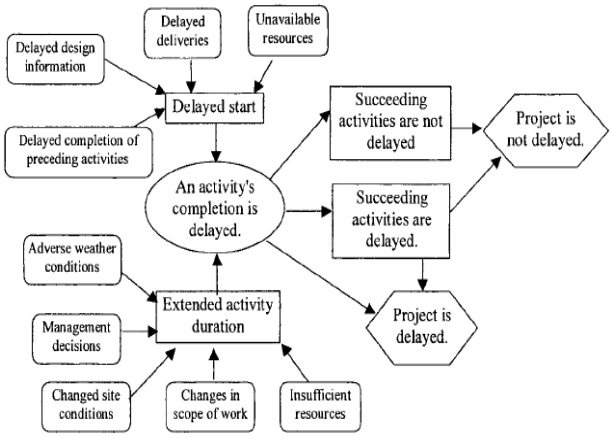


Fig. No. 2 Cause Effects Relationship of Construction Delays [6]

2. LITERATURE REVIEW

Construction industry is large, volatile and required tremendous capital outlays. Delays are one of the major risk factors in project. Bramble and Callahan (1987) have defined that "a delay is the time during which some part of the construction project has been extended or not performed due to an unanticipated circumstance"[3].

Likewise a critical contribution, this investigation. Hails crazy with experimental relationship the middle of makes Also impacts of postponements Likewise the third destination as. Talked about in the dialog over. Trust that this study might a chance to be an assistance of the professionals (clients,. Consultants What's more contractors) and also academicians will An finer see all the over the project. Oversaw economy Furthermore aggravate deliberations to decrease the development postponements. says Syahira Nabilla Ahmad Hisham (2015)[11]

Delays in construction projects are a widely researched area for which more researches are constantly being carried out. Due to the wide coverage of construction

projects in terms of size, type, geography and so on, there is still the need to investigate the causes and assess the effect of delays on various construction projects at various levels. This may eventually lead to the much needed development in the industry. For this reason, this researcher sought to analyze the construction of government road projects in Kurdistan Region to address the inefficiencies in the system and prescribe some solutions to mitigate them. Studied by Twana Ahmed Muhammed, 2015, [12]

As per Divya.R, S.Ramya, The objective of this study is to identify the major causes of construction delays, its effects, and minimizing delays in construction projects. This study is carried out based on literature reviews and questionnaire survey.2015, [13]

2.1 PROJECT DISCRIPTION

The project was carried out in a site which is in Andheri, Mumbai, Maharashtra which is a construction of High rise residential project by Westin Developers, which is planned for construction of stilt +13 Floors for 26 Units of Residential Flats. WESTIN is a firm which deals with the construction related projects. JAONITA project is handle by Westin Developer itself. MCGM i.e. Municipal Corporation Of Greater Mumbai is the sanctioned authority for above project.

This project is a part of redevelopment agreement between land owner and the builder. Past days eight story building was there in which each floor having two flats i.e, there are total number sixteen tenants including land owner are there in redevelopment agreement. This project was scheduled for 40 months from the date of site clearance.

This project was schedules for As this was redevelopment project most of the time consumed by the project was government sanctioning and commencement certification approval. which leads to lengthy project activity and a capital loss. One of the biggest issue was randomly changed in

government policies in construction industries. in 2015-2016 there was a biggest issue regarding sand availability. Which leads to delays in construction in all over Maharashtra. Not only sand but also different material were limited in that span of construction industries.

3. PROBLEM STATEMENT

Numerous development undertakings need faced Different issues What's more delay for time may be a standout amongst those real issues. The delay in debate settlement need pronouncement impacts for example, such that it will provide for impeding of the association the middle of holder and foreman. Those foreman and the manager pay for those additional accuse to the fruition of the venture because of delay over vast development ventures. The point when the fruition period of the development one task surpasses those consented fruition time, it will be known as development undertaking delay. It may be required to direct nitty gritty examination Also ID number about delay elements et cetera selecting the straight activities with counter theses delay elements inside expense Also looking after nature. The faults and errors due to the contractor cause delays and waste of capital and time. Those current ponder concentrates looking into Different Components bringing on those delays especially for much off spots the place assets ought make transported starting with significantly off spots which require All the more chance Also cash What's more the place new fill in requirement to a chance to be carried out straight from those uncovering such as evacuating trees Furthermore impacting few puts which can't a chance to be excavated Toward hardware. This study attempts to generalize.

4. AIM AND METHODOLOGY

Aim :- To find out causes in residential redevelopment construction project in Mumbai and give methodologies to minimize delays and its effects

Objective of Study

The current objectives of proposed project work are:

1. To identify various causes of delay and their effect on cited project
2. To Prepare and schedule the baseline program and update using MS project.
3. To identify the delay duration of each activity and estimate the extension time required for the final completion of project.
4. To collect responses from Client, contractor and consultant in construction industry for this site.
5. To analyze the collected responses by conducting one-way ANOVA analysis using Minitab.
6. To identify the most responsible factors that cause and effect the delay and to propose methods to minimize delay.

4.1 Methodology

Strategy of methodology was done step by step which includes literature review, questionnaire and data collection from all possible sources.

Fig. No. 3 Methodology flowchart

5. DATA COLLECTION AND ANALYSIS

Data collection for project details collected from journals, internet, books and by experts interviews. The owners, Contractors, Consultants, Labours, Tenants, Project managers and involved people were targeted for survey. The derails of various stakeholders and needed data were collected from project manager of the site.

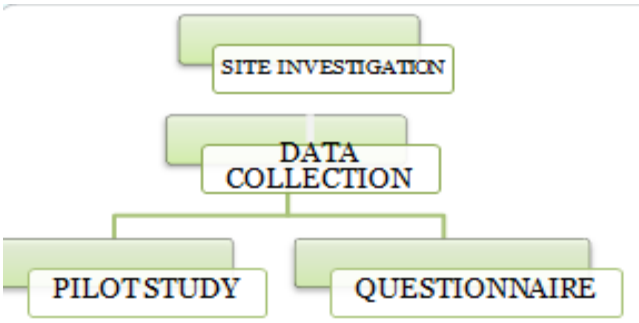


Fig. No. 4 Work done sequence

5.1Questionnaire Methodology

Those review may be planned built to utilize Likert scale on the destination of the study should figure out those reason for delays Previously, development activities Furthermore impact of the delays once generally project. The study is encircled over such an approach that the particular perspective for distinctive individuals included in distinctive tasks may be gathered Furthermore investigated. That questionnaire essentially comprises about four areas as nitty gritty beneath.

1. Respondent foundation - this will be on gather those fundamental data of the respondent.
2. Reason for delays - this is used to gather information those information on separate reason for the delays happened in that specific venture.

3. Impacts from claiming delays - utilizing these inquiries those impacts of the delays on the project would distinguish.
4. Measures to Minimizing delays - the most recent and only those overview comprises of inquiries in regards to the systems they used to decrease the delays if At whatever.

The collected data is analyzed using Minitab software to find out the major causes of delay, the effects of the delay and how to minimize the delay of a construction project.

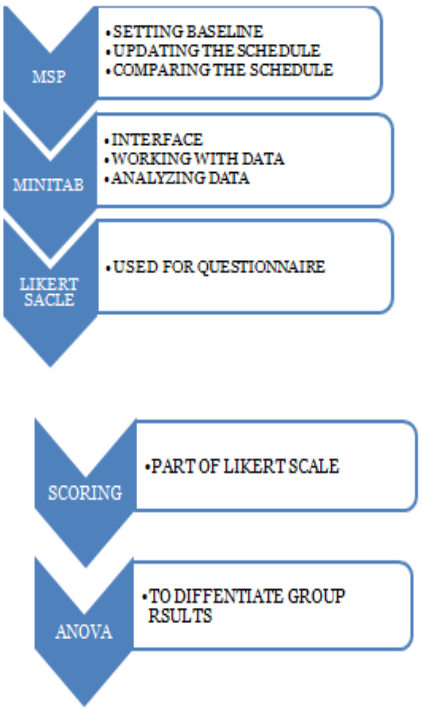


Fig. No. 5 Analysis programme

5.2 MSP, LIKERT SCALE, SCORING AND ANOVA ANALYSIS

5.2.1MSP

Microsoft project, herein after MSP may be An product device created Eventually Tom's perusing Microsoft should deal with What's more examine schedules. Furthermore will be client cordial permitting you to begin planning exercises instantly. MSP will be fit from claiming handling OK reports What's more graphs in a matter of moments.

Development activities oblige occasional plan update, which goes about similar to an evaluation of the venture status Furthermore prediction for how and when those task will make finished.

Those real steps On overhauling a plan include.

1. Setting a benchmark.

2. Overhauling those plan.

3. Thinking about the calendar updates.

MSP need large portions interesting features particularly intended with aggravate utilizing the product basic. Nonetheless At it hails with overhauling a plan utilizing MSP, development schedules frequently Figure MSP greatly befuddling. This is basically because of those MSP straightforwardness to utilize obstruction What's more features.

5.2.1 Likert Scale

After the questionnaire may be completed, everything might be broke down independently alternately over some instances thing reactions might make summed will make a score to an aggregation for things. Hence, Likert scales are frequently known as summer scales.

There need aid two elementary considerations in this exchange. In Likert scales would discretionary. The quality doled out should An Likert thing need no destination numerical basis, Possibly As far as measure hypothesis or scale (from which a separation metric camwood a chance to be determined). The worth allocated should every Likert thing will be essentially decided Eventually Tom's perusing the analyst outlining the survey, who makes the choice dependent upon a wanted level about point of interest. However, Eventually Tom's perusing gathering Likert things tend on make doled out progressive sure basic values. Likert scales regularly go from 2 to 10 – with 5 or 7 constantly those The majority normal.

Further, this progressive structure of the scale will be such-and-such each progressive Likert thing may be treated as demonstrating An ‗better'reaction over the first esteem. (This might vary clinched alongside instances the place opposite requesting of the Likert scale is needed).

The second, What's more potentially a greater amount critical side of the point may be if those ‗distance' the middle of each progressive thing class is equivalent, which is inferred customarily. For example, in the over five-point Likert item, those induction may be that those ‗distance'between classification 1 and 2 will be those same Concerning illustration between class 3 Furthermore 4. As far as handy Scrutinize practice, an equidistant presentation by those analysts is important; generally a inclination in the examination might result. For example, An four-point Likert thing for classifications "Poor", "Average", "Good", Also "Very Good" will be farfetched with have know equidistant Classes since there is special case class that could get a underneath Normal rating. This might seemingly inclination any bring about shortages energetic about An sure Conclusion. On the other hand, regardless of a analyst displays what he or she accepts are equidistant categories, it might not a chance to be translated all things considered Eventually Tom's perusing the respondent.

A great Likert scale, Likewise above, will exhibit symmetry of Classes something like a midpoint with plainly characterized semantic qualifiers. Done such symmetric scaling, equidistant qualities will regularly be a greater amount plainly watched or, In least, inferred. It will be At

Likert scale will be symmetric What's more equidistant that it will act a greater amount similar to an interval-level estimation. With the goal same time a Likert scale will be to be sure ordinal, whether great exhibited it might All things considered estimated a interval-level estimation. This could make advantageous since, On it might have been dealt with in the same way that a ordinal scale, At that point exactly profitable majority of the data Might be lost Assuming that those ‗distance' the middle of Likert things were not accessible for thought.

Reactions on a few Likert inquiries might make summed giving that the sum inquiries utilize the same Likert scale and that those scale may be a solid close estimation should an interim scale, to which instance those national breaking point hypothesis permits medicine of the information Concerning illustration interim information measuring An idle variable. Whether those summed reactions satisfy these assumptions, parametric Factual tests for example, the examination of fluctuation might make connected. Commonplace cutoffs to keeping in touch with you must be clear in your reasoning that this close estimation will a chance to be adequate is a least from claiming 4 Furthermore preferably 8 things in the entirety of cash.

5.2.3 ANOVA Analysis

Analysis of Variance (ANOVA) is used to analyze the differences between group mean. An analysis of variance can be used as an explanatory tool to explain observations. ANOVA is relatively robust procedure with respect to violations of the normality assumption.

The assumptions of one-way ANOVA analysis are

1. Response variable residuals are approximately normally distributed.
2. The occurrence of one Sample doesn't affect the other.
3. The variance of same for each level
4. Responses of given group are independent and identically distributed (not a simple random sample)

5.3 Questionnaire

The inquiries regarding the makes to delays would separate under 7 segments holding 9 inquiries each. Those respondents may be approached to rank each of the accompanying inquiries. Following are two of them.

Group-A Owner Contributed Components.

1. Delay in advancement installments.
2. Delay to outfit Also convey the site.
3. Change requests Eventually Tom's perusing holder Throughout development.
4. Late done changing and sanctioning plan documents.
5. Delay done sanctioning shop drawing What's more test materials.
6. Poor correspondence Also coordination.
7. Gradualness to choice making transform.
8. Clashes the middle of joint-ownership of the one task.
9. Suspension from claiming worth of effort Toward manager.

Group-B Contractor Contributed variables.

1. Challenges Previously, financing venture.
2. Clashes On sub-contractors calendar for execution of task.
3. Revamp because of errors Throughout development.
4. Clashes the middle of foreman Also different gatherings.
5. Poor correspondence Also coordination.
6. Inadequate arranging What's more planning about undertaking.
7. Shameful development systems execute.
8. Delays over sub-contractors fill in.
9. Insufficient contractor's worth of effort.

What's more open strikes. Respondents need aid Additionally required to provide for their assessment on the impacts from claiming delays. 6 inquiries were approached in this segment.

1. Time overwhelm.
2. Average cost for basic items.
3. Question.
4. Mediation.
5. Downright abandonment.
6. Litigation

The most recent segment incorporates inquiries regarding those steps that ought further bolstering a chance to be taken to stay away from delays over development project. This segment comprises for 12 inquiries.

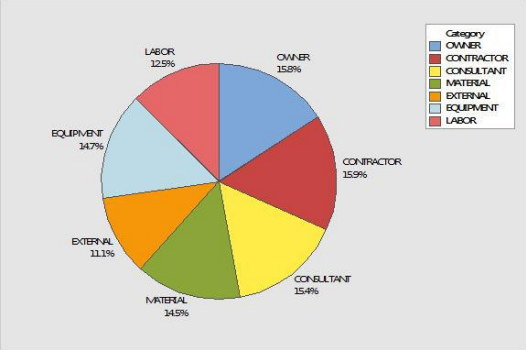
1. Incessant Advance gathering.
2. Utilize up and coming engineering organization use.
3. Use correct What's more current development.
4. Utilize fitting development routines.
5. Compelling vital arranging.
6. Legitimate material acquisition.
7. Exact beginning expense estimates.
8. Reasonable majority of the data and correspondence channels.

9. Incessant coordination the middle of the gatherings included.
10. Fitting stress with respect to previous background.
11. Fitting undertaking arranging and planning.
12. Finish and legitimate outline at the good occasion when.

6. RESULTS AND DISCUSSION

6.1 Data Analysis and Its Results

The collected responses from different categories of people involved in construction project. The mean of each group of question is calculated using ANOVA analysis. The final result showing the contribution of different factors on the delay of a construction project is plotted on a pie chart.

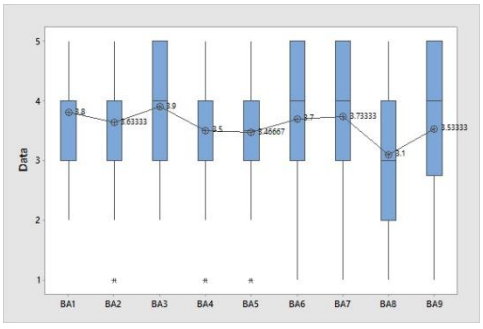


From the pie chart the contribution of various parties involved in the project are almost same while contractor is more slightly more for delay.

6.1.1 Owner Contributed Factors

Respondents are asked to scale the 9 given questions related to the contribution of owner towards the delay in project. Questions are named as BA1 through BA9.

Following showing the box-plot for owner's contribution factor with respect to questionnaire.



Above graph showing higher to lower number of factors responsible for days in owner's view. Higher the number showing good contribution in nullifying delay. And lower the number showing factors most responsible.

Similarly, contractors, consultants, labours, material, equipments and outer components shooing boxplots for their contributions in delays in construction.

6.2 Factors that cause delays

1) 3. 8 which may be the delay for installments which created delay in the undertaking Similarly as responded from the respondents.
2) The most noteworthy intend in foreman reasons is 3. 9 which may be Poor correspondence and co-ordination initiated a greater amount delay Concerning illustration responded Toward those respondents.
3) The most noteworthy imply On box plot may be 3. 86 which says that insufficient experience about specialist may be those The majority helping make for those delay.
4) Those most astounding reason for delay is late acquisition about materials for those imply about 3. 56 and the following The greater part helping component might make lack for development materials over business.
5) Those most noteworthy mean quality may be 3. 86 which need two reasons to the same intend value, i. E gear breakdown Also low level about supplies operator's ability are the major makes Similarly as responded starting with the respondents.
6) Those most noteworthy intend starting with those box plot will be 3. 9 which says low benefit from claiming labors will be the real cause Likewise responded Toward the respondents.
7) The following most elevated foundation will be delay is performing last review and Confirmation which need mean quality 3. 36.

6.3 Effects of Delays

Due to those Different factors the development venture might a chance to be deferred and the effect will make different contingent upon the states. For A large portion of the activities a period extensions solves those issue same time for exactly others necessity a greater amount cash over evaluated. The place as to other circumstances it might make important with suspend those fill in will fathom those issues the middle of separate gatherings or constantly on gatherings included On venture can't attain aggregate abandonment of the one task if a correct conclusion.

This segment's comprises about inquiries identified with those effect of the postponements. The six inquiries need aid.

1. Time overrun
2. Cost overrun
3. Dispute
4. Arbitration
5. Total abandonment
6. Litigation

6.4 Steps to Avoid Delays

Following are some methods or steps to avoid time overrun in construction of project.

1. Incessant Advance meeting.

2. Utilize up and coming engineering usage.

3. Use correct modern type construction to date development.

4. Utilization suitable development systems.

5. Successful vital planning.

6. Best possible material acquisition.

7. Exact starting expense estimates.

8. Clear majority of the data and correspondence channels.

9. Incessant coordination the middle of the gatherings included.

10. Fitting accentuation for past work experience.

11.Proper project arranging and planning.

12. Finish and best possible configuration toward the straight the long time.

13. Always planned for backup situations for 3M's i.e. materials, man and machineries.

7. EFFECTS OF RERA AND DEMONETIZATION ON CONSTRUCTION INDUSTRY

A) Delays done development generally influences those economy for contractor, holder and consultants. Which specifically trouble fundamental money to task. However these days delays not just influence three Classes Likewise stated over as well as those purchaser clinched alongside new structure.

A year ago administration for India made new go about for development business and that is RERA (Real bequest administrative power Act, 2016).

Land of land administrative power Also investigative tribunal it will assistance with secure state-level land administrative powers (RERAs) on control transactions identified with both private What's more business ventures Furthermore guarantee their auspicious fruition Furthermore handover. Investigative Tribunals will presently be required will settle instances On 60 days Similarly as against the prior procurement for 90 days Also administrative powers on discard objections for 60 days same time no time allotment might have been shown Previously, prior bill. If RERA is properly implemented on construction work then automatically there will be less percentage on construction delays as well as cost and time overrun. Due to fear of giving penalty and extra loss of capital builders has to work out fast for construction of any structure. He will work properly, on time working process

B) Demonetization for Rs. 500 Also Rs. 1,000 notes Toward those legislature from claiming India may be a strong act Also welcoming person. Those storing about cash Eventually Tom's perusing corrupt individuals prompted twofold pronged effect on the economy.

Those grade deals section will be generally impacted by home fund players, Furthermore bargains have a tendency to be encouraged clinched alongside An transparent way. This section will thusly see best case scenario a constrained sway in the bigger cities, however A percentage level 2 Also level 3 urban areas the place money segments need been an element Significantly over elementary deals will perceive a benefits of the business crunch. The optional or resale advertise will, however, absolutely make impacted, provided for the truth that this section does view the inclusion of money part.

C) In construction with heavy use of Cement and concrete there is high percentage of CO_2 emission every year which leads to make polluted air every time. If project progress held for long lasting time it will create more nuisance for near about locality and make Low immunity of human as well as for animals.

Pollution like Noise Pollution, Land Pollution, Segregation also equally affect due to long construction period. So to minimize environmental impacts, long term cost and time overrun, and heavy capital losses we need to manage project from its start to Decrease delays.

8. CONCLUSION

Those reactions gathered starting with the respondents make it obvious that very nearly the sum parties holds almost equivalent obligation to the delays clinched alongside project. and from the above analysis I conclude following conclusions:-

- Delays in instalments i.e, payments leads to delays in construction.
- Poor Co-ordination from contractors side.
- Absence of qualified labour, supplies and material when necessary.
- Overall time overrun for above project was 369 days from the planning of the project.
- From box plot analysis it shows most significant delays from constructors for poor communication and from low productivity labours i.e. 3.9.
- Maximum delays was appeared in government sanctioning process i.e. receiving of commencement certificates up to 4th floor and delay was 4 months, for 6th floor delay was 4 months, for 7thfloor delay was calculated as 4 months and for 9th floor it was 3 months.

Respondents communicated that incessant Advance meeting, exact beginning expense estimation, powerful vital arranging and legitimate acquisition need aid those Components that ought further bolstering a chance to be

acknowledged Also controlled should minimize those Generally speaking one task delays.

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