



## DEMOLITION OF STRUCTURE, TECHNIQUE AND COMPARATIVE ANALYSIS

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**Abstract:** Back in 1950 importance was not given to planning as a result we see unplanned residential buildings, commercial areas and industrial development except few well planned and developed areas. Earlier people used to get settle adjoining the river so that they get ample amount of water but in today's modern age development is been carried out in every region. Old settlements do have organic development in heart of cities resulting stress on basic amenities. Old structures have crossed the age of 50 years and are not in proper condition to with stand the live load, this structures are now not appropriate for habitant as per new codes and specification formulated recently by the NBC laws and TP laws. Hence it is need of hour to demolish such structures with appropriate technology and skills.

This research paper is focused on study of demolition method and their advance techniques, planning, safety of labors. The paper also examines comparative analysis between various techniques of demolition.

**Key words** – Demolishing, Habitant, Codes and Specification, NBC laws and TP laws, Organic development.

### INTRODUCTION

Demolishing activities is mainly caused either by

- 1) Renovation of Project
- 2) Redevelopment of Project.

This renovation and redevelopment is been carried out since the ancient times. Earlier building was demolished by only considering the material as waste product but now demolition is done in such a way that each and every part or material is used again. Demolishing is a process in which an existing building or any such structure is pulled down using some machines, tools and equipments. There can be various method

employed for demolishing so that minimum amount of waste is generated. During its evolution demolition has become more faster more safer and more cost effective. For small building, bungalow or any 2 storey building demolition is a simple process. Here building is either pulled down either by manually or mechanically using large hydraulic equipment such as elevated work platforms, cranes, excavators or bulldozers. Always structure has to demolished in parts and not as a whole. Larger building may require the use of innovative techniques. For explosive demolition the explosives are the start point of demolition.

In metropolitan areas such as Mumbai, Delhi, Bangalore etc. it is necessary to select proper demolishing technique with respect to economy, safety and speed. Building demolition due to natural causes such as earthquake, cyclone are also resulting to demolition of structure. This types of buildings are either completely or partly destroyed. Also building demolition has got more importance as one can get more FSI and thus more area for living. All old structures had a maximum height of 4-5 stories but now one can go for n number of floors. Hence due to development in construction technique people are demolishing there structure and making maximum use of rules and regulations.

**AIM** - To study and analysis suitable demolishing technique for demolishing of residential building and identify the better demolishing technique with respect to Time, Cost and Labor Safety.

### LITERATURE REVIEW

Approved code of practice for demolition has been prepared to inform for both employees and employer for precutions and safety practices that should be followed on site while carring out demolition work. It is hoped that the safe practices recommended will be a useful aid to those involved in

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demolition, to avoid the potential hazards associated with the work. It also deals with methods of demolition, explosive etc.

### **Paper -01 written by Samarjeet Kaur. (2005)**

He described that the number of demolition method and equipment with providing an overview of how each method works and what type of project it serves. The paper than discussed safety issues related to multi-storey RCC frame structure demolition and how a plan should be developed to provide safe work environment. The paper described a number of techniques and list of equipment and time required for demolition.

### **Paper-02 written by C.J. Anumbals (2008)**

He discussed the use of Analytic Hierarchy Process as one of the MCDM approaches to develop a tool for demolition technique selection. The tool was developed to assist demolition engineers to select the most appropriate demolition technique for any given project. It concludes that by using this tool demolishing engineer can make more informed decision on demolishing technique. Demolition is a activity in which the construction process is reversed that is the structure a structure a part of structure are disassembled and removed. Sometimes it is misleading to use the word demolition to describe the industry since some structures are no longer demolished instead dismantled so that more material can be reuse or recycled.

Code of practice for demolition of building 2004 is intended to give guideline for engineering practice and safe procedures for various demolition methods and to provide guidance on need of demolition. This code sets out the guideline on the compliance with relevant requirements of building ordinance and its subsidiary regulations. This code sets out the guidelines for demolition of building and individual structure, partial demolition of building, basement, underground tank and common civil engineering structures. The code covers methods commonly used in building demolition.

### **Paper -03 written by Mark loizeaux (2006)**

This paper aimed at developing a quantitative approach for estimating the cost of a demolition project. It uses residential building as a case study type in order to take advantage of number of single demolition occurrences and similar structural characteristic of this building type. This gives the collection of data from previous demolition projects and the tracking of new demolition projects. The actual demolition performed on site is numbered as demolition strategy one. The demolition strategy scenario two is deconstruction. Mechanical demolition is numbered as scenario three is demolished using cranes load shifting equipments etc. The paper first explains current practice of

demolition and than estimates cost by breaking down major cost component.

### **RESEARCH METHODOLOGY**

Research methodology consists of interviews with demolishers, sub-contractors as well as with owner. The demolition engineers chosen for interview were of different age and different experience. Three case studies of g+4 storey building was taken to evaluate cost,time safety for different demolition method. For cost comparative the DSR of pune region and current market rates are considered. In some cases actual cost may not exit and hence assumptions are made for the purpose of this cost comparison. Based on the interviews comparison was build to evaluate the best innovative technique of demolition. The manager have to select a balance between safest, quickest and most cost effective technique of demolition.

My research goes in following steps-

- i. Introduction of demolition of building.
- ii. Literature review of demolition.
- iii. Highlights the dismantling process and techniques of the building.
- iv. Case study wise comparative analysis of various methods of demolition.
- v. Preparing results and finding, conclusion and future scope of study.

### **MATERIAL**

#### **DISMANTLING PROCESS**

Prior to start of demolition an engineer or contractor does his survey in order to study the condition of doors, door frames, floors, electrical wires, water taps, plumbing fittings, plumbing fixtures, switch boards, floor tiles, granite et in order to avoid the wastage and use maximum material again. The demolition contractor is responsible for any hazard cause at site. He along with owner decides the type of demolition. Contractor will also have to decide the number of workers that are going to work on site, the equipments to be used on site, informing workers of hazards and safety requirements.

#### **SURVEYING**

Surveying means study of different parameters of structure and its surroundings. It includes mainly building survey and structural survey. Gases explosives or flammable material previously used or stored at work site should be removed before demolition starts. Cap and taps of all services should be located and shut down in order to prevent any hazard on site.

#### **BUILDING SURVEY**

It includes record drawings, survey and hazardous material. Building survey help to know existing record plan, layout plan, adjoining properties, pathways, walkway, roads etc.

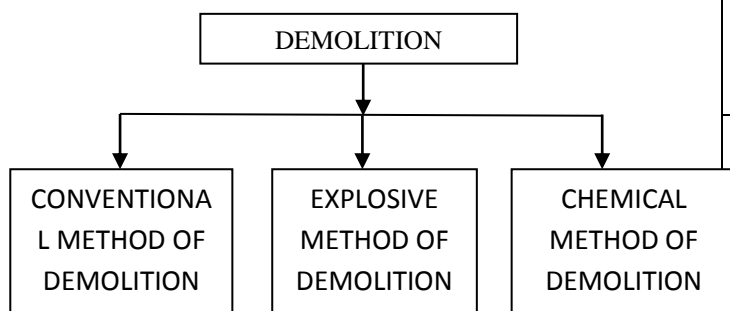
### STRUCTURAL SURVEY

Structural survey help you to know the strength of building which indirectly help contractor in knowing the time taken for demolition the equipments required for demolition and also the process of demolition. Structural engineer shall check the presence of unusual detailing that may cause abnormal structural behavior while demolition.

### METHODS OF DEMOLITION

There are various types of demolition technique which depends on the project condition, site constrains sensitivity of neighborhood and availability of equipment. Basically there are these method of demolition-

- 1) Conventional Method of Demolishing
- 2) Explosive Method of Demolishing
- 3) Chemical Method of Demolition



### RESULTS AND TABLES

When we construct a new building we have all sub-contractors who have there own specialty in the same manner while demolition the main contractor or engineer also has various sub-contractors such as electrician, plumber, tile person, carpenter etc so that maximum amount of material is reused again. This saves the pollution and helps in keeping the environment safe as well as they make some money from this. On site live case study along with contractor has been carried out which gives following outcome.

**CASE STUDY 01** – Case study is been done considering 3 factors Time, Cost and Labor Safety. For all the three type of dismantling cost will remain same

Location- Narhe, Pune.  
 Number of storey –G+5  
 Area - 480 SqM.

The initial cost for dismantling of building as per current market rates went upto – RS 3,66,942.  
 Time required for dismantling was – 35 days.

### Conventional Method of Demolishing RCC frame structure-

| Sr. Nos                    | Description                             | Time    | Quantity | Units | Rate | Total     |
|----------------------------|---|---------|----------|-------|------|-----------|
| 01                         | Demolishing of overhead RCC water tank. | 2 days  | 45       | Sqm   | 2000 | 90,000    |
| 02                         | Demolishing of RCC floor slab           | 20 days | 480      | Sqm   | 2000 | 9,66,000  |
| 03                         | Demolishing of RCC and columns          | 8 days  | 24       | Nos   | 4000 | 96,000    |
| 04                         | Demolishing of RCC foundation           | 5 days  | 120      | Sqm   | 2000 | 2,40,000  |
| Total cost of demolition - |   |         |          |       |      | 13,92,000 |
| Total time required -      |   |         |          |       |      | 35 day    |

Grand Total cost of Demolition = 3,66,942 + 13,92,000  
 = 17,58,940

Total Area = 480 SqM  
 Total cost per square feet = 3641/ SqM  
 Total time Required for demolition = 70 days

### Explosive Method of Demolishing RCC frame structure-

| Sr. Nos | Description                             | Time   | Quantity | Units | Rate | Total     |
|---------|---|--------|----------|-------|------|-----------|
| 01      | Demolishing of overhead RCC water tank. | 1 days | 45       | Sqm   | 2500 | 1,12,500  |
| 02      | Demolishing of RCC floor                | 10     | 480      | Sqm   | 2500 | 12,07,500 |

|                                   |                                |        |     |     |      |                  |
|-----------------------------------|--------------------------------|--------|-----|-----|------|------------------|
|                                   | slab                           | days   |     |     |      | 500              |
| 03                                | Demolishing of RCC and columns | 4 days | 24  | Nos | 4500 | 1,08,000         |
| 04                                | Demolishing of RCC foundation  | 3 days | 120 | Sqm | 2500 | 3,00,000         |
| <b>Total cost of demolition -</b> |                                |        |     |     |      | <b>17,28,000</b> |
| <b>Total time required -</b>      |                                |        |     |     |      | <b>19 day</b>    |

Grand Total cost of Demolition = 3,66,942 + 17,28,000  
= 20,94,942

Total Area = 480 SqM  
Total cost per square feet = 4337/ SqM  
Total time Required for demolition = 54 days.

### Chemical Method of Demolition RCC frame structure –

| Sr. Nos                           | Description                             | Time    | Quantity | Units | Rate | Total            |
|-----------------------------------|---|---------|----------|-------|------|------------------|
| 01                                | Demolishing of overhead RCC water tank. | 1 days  | 45       | Sqm   | 3500 | 1,57,500         |
| 02                                | Demolishing of RCC floor slab           | 10 days | 480      | Sqm   | 3500 | 16,90,500        |
| 03                                | Demolishing of RCC and columns          | 4 days  | 24       | Nos   | 5500 | 1,32,000         |
| 04                                | Demolishing of RCC foundation           | 3 days  | 120      | Sqm   | 3500 | 4,20,000         |
| <b>Total cost of demolition -</b> |   |         |          |       |      | <b>24,00,000</b> |
| <b>Total time required -</b>      |   |         |          |       |      | <b>18 day</b>    |

Grand Total cost of Demolition = 3,66,942 + 24,00,000  
= 23,66,942

Total Area = 480 SqM  
Total cost per square feet = 4900/ SqM

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Total time Required for demolition = 53 day

### CONCLUSION–

Area of Case study 01 is 310 Sqm, Area of Case study 02 is 480 SqM while area of Case Study 03 is 820 Sqm

| COST       |              |           |           |
|------------|--------------|-----------|-----------|
| CASE STUDY | CONVENTIONAL | EXPLOSIVE | CHEMICAL  |
| 01         | 08,54,556    | 10,05,058 | 12,24,896 |
| 02         | 17,58,940    | 20,94,942 | 23,66,942 |
| 03         | 25,48,236    | 28,56,714 | 31,54,719 |

| TIME       |              |           |          |
|------------|--------------|-----------|----------|
| CASE STUDY | CONVENTIONAL | EXPLOSIVE | CHEMICAL |
| 01         | 50 Days      | 35 Days   | 35 Days  |
| 02         | 70 Days      | 54 Days   | 53 Days  |
| 03         | 120 Days     | 95 Days   | 95 Days  |

| SAFETY     |              |           |          |
|------------|--------------|-----------|----------|
| CASE STUDY | CONVENTIONAL | EXPLOSIVE | CHEMICAL |
| 01         | ** ---       | *****     | **** _   |
| 02         | ** ---       | *****     | **** _   |
| 03         | ** ---       | *****     | *** _ _  |

### Conventional method -

It is used for smaller sites with congested space where larger machines cannot be employed. It is time consuming method because only one storey can be demolished at a time. In this method debris need to be removed regularly and not allowed to pile up on floor otherwise overloaded floor could collapse on the floor below it. This method is comparatively not safer for working.

### Explosive method –

It is both cost effective as well as time effective method of demolishing. Explosive method can reduce the demolition time by 25-50%. This one of the quickest method of demolition, it is also one of safest method of demolition. But sometimes shock vibrations may affect the adjacent properties and may disrupt the structural stability of adjoin plot.



Chemical method –

This method is one of the most costly method of demolition it demolishes building safely without environmental pollution, hence this method can be used in restrictive environment where flying debris, noise, dust toxic gases and vibration are less tolerated.

## RECOMMENDATION-

- 1) Demolition work contract should only be given to qualified civil engineer.
- 2) Demolition work should be completed in specific time.
- 3) All safety equipments should be used by labors.
- 4) There is need of having more transparence between the two dealing parties.
- 5) People should not always look to save money by adoption conventional method instead should also show responsibility by opting for green demolishing techniques.

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