

# Selection of Suitable Techniques, Scope And Regulations For Demolition of Rcc Building

<sup>1</sup>Vikas Singh, <sup>2</sup>Vikram Singh Rawat, <sup>3</sup>Omkar Chavan, <sup>4</sup>Asso.Prof.R.H.Jadhav

<sup>1, 2, 3</sup>U.G. Student, Dept. of Civil Engineering, BharatiVidyapeeth (Deemed to be University), College of Engineering, Pune, India

<sup>4</sup>Associate Professor, Dept. of Civil Engineering, BharatiVidyapeeth (Deemed to be University), College of Engineering, Pune, India

## Abstract:

The life cycle of concrete structures is usually 50 to 80 years. During this life, structures often meet with some situations like disasters, changing functions, reconstruction, or improved residence demand due to population, all these lead to demolition or reconstruction of existing structures. In developing countries like India demolition is very essential for development of new structures for various residential and industrial purposes. Today various kinds of demolition methods are available, but the method of implementation for demolition work varies with the site condition, safety, time and cost. Demolition is the deliberate destruction of structures and materials by means of explosives, mechanical devices, chemical agent, etc. The demolition method also varies with the time available for demolition and need of site clearance for the new structure. Before execution of demolition work, the careful study of site condition, the type of structure, structural member, demolition range, rural or urban area and frequency. The application of method for demolition depends upon actual site condition and available space. The demolition technology that should be practice to demolish the concrete structures in a controlled way especially in Indian conditions. There is necessity to develop standard code of practice for demolition techniques and regulations.

**IndexTerms** -demolition, safety measures, regulations, and license.

## I. INTRODUCTION

**Demolition** is the tearing down of buildings and other man-made structures after its useful life period and for reconstruction. Demolition contrasts with deconstruction, which involves taking a building apart while carefully preserving valuable elements for re-use purposes. Demolition is carried out with the help of some equipment or other methods. Every concrete structure is designed for a life period usually 50 to 80 years. After the service life period is over structure becomes very dangerous to its occupants and surrounding structures. Therefore, the purpose of demolition is to prevent the accidental collapse of any part of the building and to ensure safety of workers, public, neighboring properties and environment.

### 1.1 Need of demolition

- Demands for modernization and improved comfort
- Existing land within built-up areas must be utilized
- Redevelopment of inner city areas
- Building expansion

## II. CURRENT SCENARIO OF DEMOLITION IN INDIA

- In India demolition industry is not a organized industry.
- Demolition has not been given due importance.
- Demolition is considered as skill or art rather than engineering.
- There is no institution or any courses available for understanding demolition
- Unskilled labors are used

## III. DIFFERENT METHODS OF DEMOLITION

- Demolition using hand-held tools
- Demolition using rig-mounted breaker
- Demolition using rig-mounted crusher
- Demolition by blasting

### 3.1 Demolition using hand-held tools

The hand-held breakers can either be compressed air, electrically or hydraulically powered. Different kinds of chisels are used depending on the material they are to be used on. The result of the work and the service life of chisels depends on such factors as the working pressure, the weight of the breaker, the cutting edge of the chisel and the bending stress the chisel is subjected to. The most common type of hand-held equipment used is usually compressed air powered. The reasons for this are their robust design, their reliability and their easy handling. Demolition using hand-held tools is expensive because of the high labour cost involved.

### 3.2 Demolition using rig-mounted breaker

The use of hand-held equipment for demolishing large volumes of concrete is simply uneconomic. Hydraulic breakers from 30-600 kg are available for mounting on different types of carriers. When compared to hand-held alternatives, these units have the great advantages of delivering much more powerful impact and feed forces and they are also much more effective. Hydraulic breakers demand the use of carriers with sufficient stability (weight ratio). The crucial factor here is that the surface the carrier is being used on is capable of bearing the load. If the method is used for sideways demolition of high vertical walls or columns, then great care should be taken to avoid collapse on the carrier or operator.

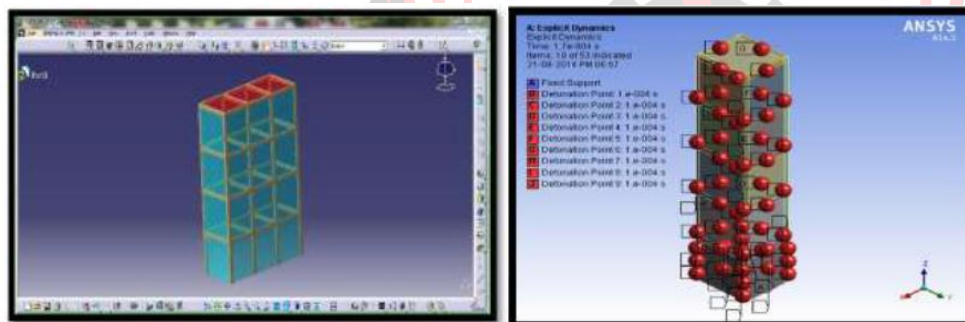
### 3.3 Demolition using rig-mounted crusher

The use of rig-mounted crusher for demolition has become an extremely alternative when requirements stipulate low noise levels while demolition work is carried out. It is more efficient than rig-mounted breaker. Rig-mounted breaker produces less vibrations than rig-mounted crusher. It is best suited for partial demolition.

### 3.4 Demolition by blasting or implosion

Implosion is the strategic placing of explosives materials and timing of its detonation so that a structure collapses on itself in a matter of seconds, minimizing the physical damage to its immediate surrounding. A thorough blasting programme must be drawn up first and approved by the respective authority. Blasters use different explosives like dynamite, RDX etc.

AUTODYN ANSYS software is used for pre-analysis of blasting. Principal stresses generated at each detonation point after explosion is shown in AUTODYN ANSYS software.



GEOMETRIC MODEL OF BUILDING PROPOSED PLACEMENT OF EXPLOSIVES

## IV. REUSE OF MATERIAL

In general, metal components such as window frames, pipes etc., timber components such as doors, wooden, floors etc., other wastes such as tiles, ceramic products should be removed first. Most of these materials may be recycled. The building demolition shall begin after all the above non-structural materials have been stripped and removed.

Concrete debris may be pulverized into aggregate size and used for road base, temporary haul roads, fill materials or aggregate for concrete. Old bricks may be salvaged for reuse as architectural features or others use.

## V. FACTORS INFLUENCING ON SELECTION OF DEMOLITION TECHNIQUES

### 5.1 Location of premises to be demolished

If the structure to be demolished is restrained by its surrounding then blasting and heavy machines can't be used for demolition. In this situation we can use hand-held tools and rig-mounted crusher.

### 5.2 Vibration

Demolition work will cause vibration to neighboring buildings or structures to various extents, depending on the method of demolition. The most serious vibration is caused by implosion. The effect of vibration caused by implosion are:

- Permanent ground distortion produced by blast-induced gas pressure
- Vibratory settlement of foundation materials

### 5.3 Type of structure

Different types of structure like load bearing masonry structure, RCC framed structure, steel structure etc.

### 5.4 Size of structure

If the size of structure is small, hand-held demolition can be used. For large structures and multistoried buildings deliberate collapse, implosion technique are necessary.

### 5.5 Available time period

Implosive method consumes very less time approximate 10-15 sec to demolish a high rise building whereas by hand-held demolition it takes several days or months.

### 5.6 Skill of workers and safety

Unskilled worker can't operate the equipment properly and they don't know about their own safety, which leads to injuries and loss of life and also affects the demolition work.

### 5.7 Cost

In India labour are highly available at low cost for any work and work can be done at very low expenses therefore contractors first priority is use of labour for demolition work. This is the only reason of using hand-held demolition at high level in India. Contractor's main focus is to make more and more profit instead of safety and environment, which he can get from laborious work but at low level of demolition only.

## VI. INFLUENCING FACTORS FOR SELECTION OF METHOD

AFTER STUDYING FACTORS AFFECTING AND RISK INVOLVED WE HAVE DECIDED SUITABLE METHODS

| METHODS             | INFLUENCING FACTORS                                                                                                                                                                  |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HAND-HELD TOOLS     | <ul style="list-style-type: none"> <li>• RESTRICTED AREA</li> <li>• SMALL DEMOLITION VOLUME</li> <li>• HIGH SCRAP VALUE</li> </ul>                                                   |
| RIG-MOUNTED BREAKER | <ul style="list-style-type: none"> <li>• RESTRICTED AREA</li> <li>• MORE POWERFULL IMPACT THAN HAND-HELD</li> <li>• LARGE DEMOLITION VOLUME THAN HAND-HELD</li> </ul>                |
| RIG-MOUNTED CRUSHER | <ul style="list-style-type: none"> <li>• LOW NOISE LEVEL</li> <li>• VIBRATION FREE</li> <li>• PARTIAL DEMOLITION</li> <li>• LONGER WORKING SHIFT THAN RIG-MOUNTED BREAKER</li> </ul> |
| IMPLOSION           | <ul style="list-style-type: none"> <li>• USED FOR HIGH RISE BUILDINGS</li> <li>• LESS TIME</li> <li>• EXTREMELY EFFECTIVEMETHOD</li> </ul>                                           |

## VII. APPLICATION OF METHODS AND THEIR EFFECT

| METHOD | COLUMN | BEAM | SLAB | WALL | FOUNDATION | WREAKING EFFICIENCY | NOISE | VIBRATION | DUST |
|--------|--------|------|------|------|------------|---------------------|-------|-----------|------|
|        |        |      |      |      |            |                     |       |           |      |

|                     |           |           |           |           |           |      |        |          |      |
|---------------------|-----------|-----------|-----------|-----------|-----------|------|--------|----------|------|
| Hand-held           | Effective | Effective | Effective | EFFECTIVE | Effective | Good | More   | Moderate | More |
| Rig mounted breaker | Effective | Effective | Effective | Effective | Effective | Nice | More   | More     | More |
| Implosion           | Effective | Effective | Less      | Less      | Effective | Nice | More   | More     | More |
| Rig mounted crusher | Effective | Effective | Effective | Effective | Less      | Nice | Medium | More     | More |

## VIII. RISK INVOLVED DURING DEMOLITION

Risk which may arise during building demolition are as follows:

- Accidents due to persons falling from high, unprotected workplaces and through openings
- Accidents due to persons being struck by falling objects
- The building collapsing suddenly and unexpectedly may cause death of the workers
- Falling of smaller objects or debris from the demolishing building
- Employing inappropriate methods to demolish
- Congested site environment that easily cause damages to human workers or to the third parties that are situated nearby the site
- Collapse of heavy demolition equipment due to inadequate support of the partially demolished structure

## VIII. SAFETY MEASURES

Safety has and always will be the most important part of constructions, and demolitions. Always having the best and most up-to-date equipment, as well as taking the necessary precautions, has saved countless lives throughout the years. These precautions take just a few minutes to oversee, but could make the difference when it comes to a safe demolition. Here are the top five safety precautions for demolition.

### 8.1 Equipment

Employees should always be knowledgeable of all aspects of work, regardless of their specialty or area of work. It's important that each and every employee understands what equipment should be worn and present throughout the demolition. Make sure that each employee also knows and understands how to use each piece of equipment properly.

### 8.2 Final sweep

Always do a final sweep before demolition begins. It's absolutely recommended to go into each and every room, including closets, bathrooms, hallways etc., to check that everyone should be out of the building. It's necessary to assure each worker is out of the building and at a safe distance before demolition. Unauthorized people don't get close to demolition site.

### 8.3 Experienced and trained employees

It's absolutely necessary that only trained and experienced employees handle the more dangerous and explosive materials. These employees should be qualified, professional, mature, experienced enough to handle the responsibility and carefulness required by those handling explosives.

### 8.4 Brace ceilings and walkways

If for any reason anyone needs to enter the building, it's necessary for every ceiling and walkway to be braced. This will easily provide extra support in case an accident occurs, helping prevent a huge amount of accidents, injuries and even deaths.

### 8.5 Cleaning up debris

Make sure that all employees are wearing and equipped with the proper equipment to clean up any and all debris once the demolition has taken place. This equipment includes gloves, a mask and work boots. Most importantly, however, make sure that only authorized employees are present during the cleanup and demolition.

## X. CODE OF PRACTICE AND REGULATIONS

In India suitable practice code is not available for demolition. There should be proper code of practice for managing health, safety, and demolition work. Many countries follow Work Health and Safety (WHS) act (ex: Australia).

The WHS Act and WHS regulations provide a framework to secure the health and safety of workers and workplaces by protecting workers and other persons against harm to their health, safety, and welfare through the elimination of risks arising from work. The WHS Act requires that a person who conducts a business or undertaking demolition work ensures the health and safety of workers engaged in work. Labours in India have very limited knowledge about safety, handling of equipment and demolition procedure which often results in fatal accidents hence, WHS act can be implemented in India to safeguard the laborers.

Indian Bureau of Standards should develop a suitable Code of practice for demolition of structures which should provide suitable guidance about:

- Planning of demolition
- Methods of demolition
- Factors affecting methods of demolition
- Proper procedure for implementing the methods
- Controlling the risk involved in demolition
- Safety measures

There should be a provision of separate license for demolition contractor and for issue the license to contractor there should be some criteria like:

- Insurance : workers compensation insurance and Public liability insurance
- Demolition removal plan: waste material management including hazardous chemicals and Environment management
- Requirement for a nominated competent person for supervision who should be 18 years old, atleast 3 year experience and have supervisory experience in the demolition of buildings or successfully completed at least 3 major project involving demolition work.

## XI. SCOPE

India is a developing country and there is much need of infrastructure development, for this we need to demolish the existing old structures and reconstruct the structures. Smart city concept is at peak in India and in smart city concept government is providing affordable housing and focusing on urban development. For all this proper demolition of old structure is required. There are many old structures present in cities like MUMBAI which have lost their life span and situated in congested areas where proper implementation of demolition technique is required. So, need of demolition is very high in future.

## XII. CONCLUSION

The selection of demolition method depends upon various factors such as site condition, type of structures, age of building, height of building, time period, economy and most important its location with presence of its surrounding with its structural ability. While comparing all the demolition techniques, implosive method of demolition is more efficient for large structures and also completion time period is very low. With the help of AUTODYN ANSYS software we can use this method nicely since we can know the implosive results before application of the method. Standard code of practice and regulations should be recommend for implementing the demolition techniques. There should be provision of separate license for demolition work.

## REFERENCES

- [1]. **Shweta O. Rathi, P.V. Khandve. 2014.** Demolition of Building and Overview International Journal of Advance Engineering and Research Development (IJAERD).
- [2]. **Dr. Jayeshkumar Pitroda. 2015.** Demolition methods and comparison International Conference on Engineering issues, Opportunities and Challenges for Development.
- [3]. **R.B Karthick, R.M Manojkumar, Dr. K. Muthukumar, V. Bhuvaneshwari. 2017.** Study of safety in demolition International Research Journal of Engineering and Technology.
- [4]. **Pauli Hietala, Kjell Larsson, Mikael Hedlund, A handbook: Demolition with Brokk.**
- [5]. **Hong Kong standards. 2004.** Code of practice for demolition of building.
- [6]. **Workplace Safety and Health Council in collaboration with the Ministry of Manpower. 2009.** Technical advisory for demolition.
- [7]. **Safe Work Australia. 2016.** Demolition Work Code of Practice