

Importance of Study of Demolition of Building

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Abstract— Demolition is the process of tearing down or falling down of a building after its life period with the help of some equipments or any other method. Demolition contrasts with deconstruction, which involves taking a building apart while carefully preserving valuable elements for re-use. Demolition of a building means tearing down or falling down of a building with the help of equipments or explosives. This seminar report deals with how a demolition work is to be performed safely and also elaborates different steps involved before and during the execution of a demolition process. The various steps involved before the demolition process includes surveying, removal of hazardous materials, preparation of demolition plan, stability report and the precautionary safety measures to be taken. The main equipments used for these demolition activities are sledge hammer, excavators, bulldozers, wrecking balls etc. and main explosives used are dynamites and RDX. When explosive are used for the demolition, it is known as Implosion. So removal of such structures with proper safety measures has got great importance. There are different steps involved before and during the time of a demolition activity.

Index Terms—1. Demolition 2. safety measures 3. Equipments 4. Explosive
Sub Area : Construction technology & Management
Broad Area : Civil Engineering

I. INTRODUCTION

Every Structure is designed for a life period called service Life. The existence of the structure after the designed or service life period is very dangerous to its occupants and surrounding buildings. The building act usually contains provisions that enable local authorities to control demolition works for the protection of public safety and to ensure adjoining premises and the site are made good on completion of the demolition. A notice of conditions is issued that require certain works to be undertaken to achieve these aims. Where demolition of a building takes place, the owner must inform the council. Greenhouses, conservatories, prefabricated garages and sheds do not require permission to be demolished. Usually if the building to be demolished has a volume of less than 1750 cubic feet (49.56 cubic meters), then permission is not required to knock it down.

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II. DEMOLITION

Demolition is the process of tearing down or falling down of a building after its life period with the help of some equipments or any other method. Demolition contrasts with deconstruction, which involves taking a building apart while carefully preserving valuable elements for re-use. When explosives are used for this then the demolition process are called as an implosion. Newer methods may use rotational hydraulic shears and silenced rock-breakers attached to excavators to cut or break through wood, steel, and concrete. The use of shears is especially common when flame cutting would be dangerous. Every civil engineering structure is designed for a life period. After that the existence of a structure is very dangerous. Before any demolition activities, there are many steps that need to take place, including but not limited to performing asbestos abatement, removing hazardous or regulated materials, obtaining necessary permits, submitting necessary notifications, disconnecting utilities, rodent baiting, and development of site-specific safety and work plans. So removal of such structures with proper safety measures has got great importance. There are different steps involved before and during the time of a demolition activity.

III. STEPS BEFORE DEMOLITION

The different steps before the execution of a demolition process are:

1. Surveying
2. Removal of hazardous materials
3. Preparation of plan
4. Stability report
5. Safety measures

IV. METHODS OF DEMOLITION

There are two types of demolition

1. Non explosive demolition
2. Explosive demolition.

Non explosive demolition

It means the demolition of a structure done with some equipment without the use of any explosive. The choice of choosing a demolition method depends on a number of factors such as the project conditions, site constraints, sensitivity of the neighbourhood and availability of equipment etc. In general, top-down methods are applicable for most sites, particularly for those situated in busy urban areas. Other mechanical methods applied from the outside of a building may be suitable for projects that have sufficient clear spaces. Hand demolition is not a quick method, because only hand tools are used. However, cranes and shear legs may be used to hold or lower beams during cutting. Chutes or crane-and-skip are usually used to get debris safely from the

upper stories to the ground. Different equipment used for the demolition activity are

a. Sledge hammer

A sledge hammer, equipment used for removing a stone wall or a single column. It consists of a long stem with a metallic head. It is used to give impacts on the surfaces and that cause the demolition of structure. It cannot be used for removal of large buildings.



Fig 1. Sledge hammer

b. Excavators and Bulldozers



Fig 2. Excavator

Hydraulic excavators may be used to topple one- or two-story buildings by an undermining process. The undermining process means erode the base or foundation, i.e., dig or excavate beneath the foundation so as to make it collapse. The strategy of excavation is to undermine the building while controlling the manner and direction in which it falls. The demolition project manager will determine where under mining is necessary so that the building is pulled into the desired manner and direction. Safety and cleanup considerations are also taken into account in determining how the building is undermined and ultimately demolished.



Fig 3. Bulldozer

Loaders or bulldozers may also be used to demolish a building. They are typically equipped with “rakes” (thick pieces of steel that could be an I-beam or tube) that are used to ram building wall. Skid loaders and Loaders will also be used to take material out and sort steel.

c. Wrecking balls



Fig 4. Crane with wrecking ball

In case of buildings have greater heights (5 to 6 story) normal excavators and bulldozers are not sufficient. In such cases crane with wrecking balls are used to perform the demolition activity. The wrecking balls are steel balls hanging from a steel rope which is attached to the crane. This method is more effective only for high rise masonry structures because of the uncontrolled backward movement of steel ball after the impact on the wall surface. Now this method not commonly used because of this uncontrolled behavior of wrecking balls.

High reach excavators



Fig 5. High reach excavator

High reach demolition excavators are more often used for tall buildings where explosive demolition is not appropriate or not possible. These excavators are used to demolish up to a height of 300 feet. These excavators with some attachments are also provided for some specific purposes. For example excavators with shear attachments are typically used to dismantle steel structural elements. Hydraulic hammers are often used for concrete structures and concrete processing attachments are used to crush concrete to a manageable size, and to removing reinforcing steel.

V. EXPLOSIVE DEMOLITION

The basic idea of explosive demolition is quite simple. If we remove the support structure of a building at a certain point, the section of the building above the point will fall down on the part of the building below that point. If this

upper section is heavy enough, it will collide with the lower part with sufficient force to cause significant damage. The explosives are just trigger for the demolition. It's gravity that brings the building down. Demolition is the most high risk activity in the construction sector, often involving the use of **explosives**. The production of sophisticated **explosives** and initiation methods has made the process both a fast and economic. **Explosives** can be controlled to precise timing and can follow a wide range of predetermined sequences allowing complex structures to collapse under their own weight.

Demolition blasters or blasting expert ("Blasting expert" means a person who is the holder of a valid mine blasting certificate.) load explosives on several different levels of the building so that the building structure falls down on itself at multiple points. When everything is planned and executed correctly, the total damage of the explosives and falling building material is sufficient to collapse the structure entirely, so cleanup crews are left with only a pile of rubble. The main challenge in bringing a building down is controlling which way it falls. There are mainly two ways to implode a building,

1. felling like a tree
2. falling into its own footprint felling like a tree

1. Felling like a tree

In this the blasting crew will be able to tumble the building over on one side, into a parking lot or other open area. This sort of blast is the easiest to execute, and it is generally the safest way to go. Tipping a building over is something like felling a tree. For example to topple the building to the north, the blasters detonate explosives on the north side of the building first, in the same way you would chop into a tree from the north side if you wanted it to fall in that direction. Blasters may also secure steel cables to support columns in the building, so that they are pulled a certain way as they crumble.

2. Falling into its own footprint

Sometimes, though, a building is surrounded by structures that must be preserved. In this case, the blasters proceed with a true implosion, demolishing the building so that it collapses straight down into its own footprints (that means the total area of building is removed into the base of the building). This feat requires such skill that only a handful of demolition companies in the world will attempt it.



Fig 6. Demolition of building by explosion (falling into footprint)

Blasters approach each project a little differently, but the basic idea is to think of the building as a collection of separate towers. The blasters set the explosives so that each "tower" falls toward the centre of the building, in roughly the same way that they would set the explosives to topple a single structure to the side. When the explosives are detonated in the right order, the toppling towers crash against each other, and all of the rubble collects at the centre of the building. Another option is to detonate the columns at the centre of the building before the other columns so that the building's sides fall inward.

According to Brent Blanchard, an implosion expert with the demolition consulting firm Protec Documentation Services, virtually every building in the world is unique. And for any given building, there are any number of ways a blasting crew might bring it down. Blanchard notes the demolition of the Hayes Homes, a 10-building housing project in Newark, New Jersey, which was demolished in three separate phases over the course of three years. "A different blasting firm performed each phase," Blanchard says, "and although all of the buildings were identical, each blaster chose a slightly different type of explosive and loaded varying numbers of support columns. They even brought the buildings down in different mathematical sequences, with varying amounts of time factored in between each building's collapse."

VI. EXPLOSIVES USED

Blasters use different explosives for different materials, and determine the amount of explosives needed based on the thickness of materials. For concrete column, blasters use traditional Dynamite or similar explosive materials. Dynamite is just absorbent stuffing soaked in a highly combustible chemical or mixture of chemicals. When the chemical is ignited, it burns quickly, producing a large volume of hot gas in a short amount of time. This gas expands rapidly, applying immense outward pressure (up to 600 tons per square inch) on whatever is around it. Blasters cram this explosive material into narrow boreholes drilled in the concrete columns. When the explosives are ignited, the sudden outward pressure sends a powerful shock wave busting through the column at supersonic speed, shattering the concrete into tiny chunks.

Demolition of steel column is a bit more difficult, as the dense material is much stronger. For buildings with a steel support structure, blasters typically used the specialized explosive material Cyclotrimethylenetrinitramine, called RDX for short. RDX – based explosive compounds expand at a very high rate of speed, up to 27,000 feet per second (8,230 meters per second). Instead of disintegrating entire column, the concentrated, high velocity pressure slices right through the steel, splitting it in half. Additionally blasters may ignite dynamite on one side of the column to push it over in a particular direction.

CONCLUSION

Demolition is the most high risk activity in the construction sector. The essence of safe **demolition** lies in efficient risk control, environmental management and careful planning. Type of demolition method depends upon various factors such as site condition, type of structures, age of

building, height of building and economy. Anyway controlled demolition of building is necessary to ensure safety. Explosive demolition is the preferred method for safely and efficiently demolishing the larger structures. Almost all major building implosions in the world are handled by 20 well-established companies, blasting is passed on from generation to generation.

REFERENCES

- [1] 29 CFR 1926 Subpart T, Demolition. OSHA.
- [2] Demolition and Cleanup [22 KB PDF*, 2 pages]. OSHA Fact Sheet, (2005).
- [3] Demolition. OSHA's Safety and Health Topics Page.
- [4] SEMINAR PRESENTATION ON DEMOLITION OF BUILDINGS GUIDED BY Dr.AJAY BINDLISH CHANDRA SHEKHAR PRAJAPAT Associate Professor CRN 11/321
- [5] "Demolition Planning" was published in The Architect's Handbook of Professional Practice, Update 2006, ©2006 by the American Institute of Architects, published by John Wiley & Sons, Inc.
- [6] BS 6187:2000 – Code of Practice for Demolition
- [7]. IS- 4130: 1991 – Demolition of Buildings – Code of Safety Code of Practice for Demolition of Buildings, 2004, Buildings Department, Hongkong

Technical & Higher education in national level competition magazine like – Competition Success Review, i-SUCCEED, Civil Services Chronicle, Pratiyogita Sahitya, Pratiyogita Vikas, and Pratiyogita Darpan also.



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