

Demolition Methods For Building Structures

Mohd Saddam¹, Rahul Gangwar²

^{1,2}Dept of Structural Engineering

^{1,2}Bhagwant University, Rajasthan

Abstract- *On occasions we need to upgrade the old structures. Every construction has a life. Over the life of the building is complete it must get demolished or otherwise it can collapse any moment. The normal atmospheric changes and climate change deteriorate the life of a building. Usually building demolition is executed by a team of expert's usually civil engineers and explosive experts. If the structure is a small one then it can be manually demolished. In the case of an earthquake these structures are highly prone to stern damage and critical loss of life. We must demolish the unsuitable structures to ensure our safety in the case of any possible natural disasters.*

A multi-story structure there is one or more floors with windows. Usually these structures are mostly designed with pillars. If the building is multi-story then usually dynamite is preferred to demolish the complete structure. Specific points are identified in the building where the explosives are supposed to be planted. The major emphasis is on the key shear points which can collapse the building with the use of minimal explosives. The dynamite is placed at the foundation of the building and places where large pillars exist.

Keywords- Demolition, dismantling, building, collapse.

I. INTRODUCTION

Demolition is the tearing-down of buildings and other structures. Demolition contrasts with deconstruction, which involves taking a building apart while carefully preserving valuable elements for re-use. For small buildings, such as houses, that are only two or three stories high, demolition is a rather simple process. The building is pulled down either manually or mechanically using large hydraulic equipment: elevated work platforms, cranes, excavators or bulldozers. Larger buildings may require the use of a wrecking ball, a heavyweight on a cable that is swung by a crane into the side of the buildings. Wrecking balls are especially effective against masonry, but are less easily controlled and often less efficient than other methods. 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. The tallest building demolished

by no terrorist methods was the 47-story Singer Building in New York City, which was built in 1908 and torn down in 1967-1968 to be replaced by One Liberty Plaza.

II. PREPARATION

It takes several weeks or months to prepare a building for demolition.

The different steps before the execution of a demolition are:

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

All items useful, like copper wiring, are stripped from a building. Some materials must be removed, like glass which will form deadly projectiles, and insulation which will scatter over a good area. Non-load bearing partitions and drywall are removed. Selected columns on floors where explosives will be set are drilled and high explosives such as nitroglycerin, TNT or C4 are placed in the holes. Smaller columns and walls are wrapped in the detonating cord. The goal is to use as little explosive as possible; only a couple of floors are rigged with explosives, in order that it's safer (fewer explosives) and fewer costly. The areas with explosives are covered in thick geotextile fabric and fencing to soak up flying debris. Far more time consuming than the demolition itself is that the clean-up of the location, because the debris is loaded into trucks and hauled away.

Before any demolition activities, there are many steps that require to require place — including but not limited to performing abatement of a nuisance, removing hazardous or regulated materials, obtaining necessary permits from the authorities, submitting necessary notifications, disconnecting all the utilities, and development of site-specific safety and work plans. The typical razing of a building is accomplished as follows: Hydraulic excavators could also be wont to topple one- or two-story buildings by an undermining process. The strategy is to undermine the building while controlling the way and direction during which it falls. The demolition project manager/supervisor will determine where undermining is

important in order that a building is pulled within the desired manner and direction. The walls are undermined at the building's base, Safety and cleanup considerations also are taken under consideration in determining how the building is undermined and ultimately demolished. Hoe rams are properly used under supervision for removing the concrete road deck and piers during bridge demolition, while hydraulic shears remove the bridge's steel.

In some cases a crane with a wrecking ball is employed to demolish the structure right down to a particular manageable height. At that point undermining takes place as described above. However demolition balls mounted on the crane are rarely used within demolition thanks to the uncontrollable nature of the swinging ball and therefore the safety implications associated.

High reach demolition excavators are mostly used for taller buildings where explosive demolition is not appropriate or possible. Excavators with shear attachments are typically wont to dismantle steel structural elements.

Hydraulic hammers are often used for concrete structures and concrete processing attachments are wont to crush concrete to a manageable size, and to get rid of reinforcing steel.

To control dust, fire hoses are wont to maintain a wet demolition. Hoses could also be held by workers, secured in fixed location, or attached to lifts to realize elevation. Loaders or bulldozers can also be wont to demolish a building.

III. DEMOLITION METHODS

There are several methods of demolition, in which some are very old and traditional while some are very new and advanced.

Most of the old methods are now discontinued because of the introduction of the latest technology and techniques, as they are safer and eco-friendly.

The suitability of these methods is based on location, surroundings, type and size of building.

Some widely used demolition techniques are-

- HIGH REACH ARM
- CRANE AND BALL
- SELECTIVE
- BUILDIND IMPLOSION
- DECONSTRUCTION

High Reach Arm



Fig 1-A high reach excavator during demolition

The threshold for outlining a high reach demolition is when it reaches a height of quite 20 meters. This method is performed by a base machine (excavator, tank, engine, counterweights), a demolition arm consisting of three sections or by a telescopic boom and a primary tool attached to the base machine (crushers, shears, hammers).

High reach demolition machines are often equipped with different tools to form them suitable for executing demolitions of structures. This method is employed on concrete, masonry, steel, and mixed material structures.

The machines utilized in this sort of demolition aren't the sole machines utilized in the process; there must be additional components used for secondary operations like the crunching of materials. Several factors control the tactic just like the height of the structure being demolished, site conditions, and structure shape.

Crane & Ball Demolition



Fig 2-A wrecking ball in action at the demolition of the Rockwell Gardens

One of the oldest and most ordinarily used methods for building demolition, the ball and crane use a wrecking ball weighing up to 13,500 pounds to demolish concrete and masonry structures. During the method, the ball is either dropped onto or swung into the structure that's to be demolished. Thus the ball and crane is unsuitable for all demolition applications.

Only high skilled and experienced crane operators can carry out ball and crane demolition.

Smoothness in controlling the swing of the ball is critical since missing the target may tip or overload Grus.

The size of the building to be demolished with this method is restricted by crane size and dealing room, including proximity to power lines.

This form of demolition creates a huge amount of dust, vibrations, and noise.

Selective Demolition

Also referred to as strip-out, this process is extremely popular at present. As recycling and salvaging of building materials are very attractive to builders during lately, allowing them to re-use material or recycle it. Selective interior/exterior demolition or recycling of brick, metals, and concrete are all recycled for further use in new structures blending the old with the new. This demolition process is not limited to the removal of interior equipment, walls, floor, ceilings, and exterior components.

The main purpose of this method is to recover the utmost amount of primarily reusable and secondary recyclable

material during a safe and cost-effective procedure. Although it's a labor-intensive process and may be very difficult to realize during a timely and economical manner for light-framed buildings.

Building Implosion



Fig 3-Demolition of a chimney at the former brewery "Henninger" in Frankfurt am Main, Germany, on 2 December 2006

Implosion is a violent bursting inward that allows the sequential elimination of structural supports. Large buildings, tall chimneys, smokestacks, and increasingly some smaller structures could also be destroyed by building implosion using explosives.

Imploding a building is extremely fast — the collapse itself only takes seconds — and an expert can make sure that the building falls into its own footprint, so as not to damage neighboring structures.

Any errors are often disastrous, however, and a few demolitions have failed, severely damaging neighboring structures. The greatest danger is from flying debris which, when improperly prepared for, can kill onlookers. Even more dangerous is that the partial failure of an attempted implosion. When a building fails to collapse completely the structure could also be unstable, tilting at a dangerous angle, and crammed with un-detonated but still primed explosives, making it difficult for workers to approach safely.

A third danger comes from air overpressure that happens during the implosion. If the sky is obvious, the blast wave, a wave of energy and sound, travels upwards and disperses, but if cloud coverage is low, the wave generated during blast can travel outwards, breaking the window glasses or causing other damages to the surrounding buildings.

Stephanie Kegley of CST Environmental described shock waves by saying, "The blast wave is sort of a water hose. If you put your hand in front of the water as it comes out, it fans to all sides. When cloud coverage is below 1,200

feet, it reacts just like the hand ahead of the hose. The wave from the shock fans out instead of going up toward the sky."

While a controlled implosion is the method that the overall public often thinks of when, it is somehow dangerous and is only used as a last resort when other methods are impractical or too costly. At 439 feet (134 m) and a couple of, 200,000 square feet (200,000 m²), the J. L. Hudson emporium and Addition are that the tallest steel-framed building and largest single structure ever imploded.

Deconstruction



Fig 4-Deconstruction of a commercial building

A new approach to demolition is that the deconstruction of a building with the goal of minimizing the quantity of materials getting to landfills. This eco-friendly approach is used by removing the materials by material type and separating them for reuse or recycling. With proper planning this approach has resulted in landfill diversion rates that exceed 90% of a whole building and its contents in some cases. In addition, it also vastly reduces the CO₂ emissions of the removal of a building in comparison to demolition.

The development of plant and equipment has allowed for the better segregation of waste types on-site and therefore the reuse within the development of the replacement building. On-site crushers make the demolished concrete to be reused as type 1 crushed aggregate as a piling mat for ground stabilization or as aggregate used in the mixing of concrete. Wooden waste is mostly shredded using specialist timber shredders and composted, or used to form manufactured timber boards, like MDF or Chipboard.

Safety is paramount; a site safety officer is typically assigned to every project to enforce all safety rules and regulations.

IV. CONCLUSION

The type of demolition method depends upon various factors like site condition, sort of structures, age of the building, height of building, and economy.

Anyway controlled demolition of the building is necessary to ensure safety.

Explosive demolition is that the preferred method for safely and efficiently demolishing the larger structures. Almost all major building implosions within the world are handled by 20 well-established companies, blasting is passed on from generation to generation.

REFERENCES

- [1] Code of practice for demolition of buildings by Building Departments of Hong Kong.
- [2] Harris Tom, An article on How Building Implosions work.
- [3] "Technical Advisory for Demolition", Published in March 2009 by the Workplace Safety and Health Council in collaboration with the Ministry of Manpower, www.wshc.gov.sg
- [4] Buildings Department (2004), "Code of practice for demolition of buildings" published by Buildings Department
- [5] BUREAU OF INDIAN STANDARDS (2012), Draft NATIONAL BUILDING CODE OF INDIA 2005: PART 11 approach to sustainability
- [6] Rao A. , "Report on Demolition of Structures", SAG Refresher Course No. 12203
- [7] K. Arya, Sharma A.K., Kumar Arvind, Sharma N.K. , "Report on Demolition of Structures using Implosion Technology", SESSION NO 514 INTEGRATED COURSE IRICEN PUNE
- [8] Ch.F. Hendriks, Mrs G.M.T. Janssen (2001), "Construction and demolition waste: general process aspects", HERON, Vol. 46, No. 2 (2001) ISSN 0046-7316
- [9] Asif Husain, and Majid Matouq Assas (2013), "Utilization of Demolished Concrete Waste for New Construction", World Academy of Science, Engineering and Technology, 73