Demolition

Author: Marcela Spišáková
TU of Košice, Slovakia
Goal of the presentation

To inform about:

• methods and equipments of demolition works,
• processes of demolition works
• selective demolition
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1. Methods of demolition works - introduction
2. Methods and equipments of demolition works
3. Process of demolition works
4. Selective demolition
1 Methods of demolition works - introduction

Demolition works in the construction sector mean the bringing down of buildings and other structures that are load-bearing or otherwise related to the physical integrity of the structure.

Demolition of building is the process of dismantling or destroying of a structure after its life of serviceability by pre-planned and controlled methods.

Demolition works are often done in combination with site clearing i.e. disposing of the rubble and waste material.

The quality and composition of C&DW can largely influenced the realization of demolition of building structure, construction or their parts.
1 Methods of demolition works - introduction

Demolition of buildings and structures are required for various reasons.

The reasons for demolition of structures can be:

• change of construction layout
• change of construction purpose
• demolition of extensions
• creation of next entries into the construction
• demolition of whole construction
Methods of demolition works - introduction

The methods of the demolition in construction was depended on:

- the type of construction material of construction
  - stones and bricks connected by the mortar
  - concrete and reinforced concrete

- the type of construction material of construction
  - scale of construction
  - location of building
1  Methods of demolition works - introduction

The methods of the demolition in construction was depended on:

• **range of demolition**
  - condition of building
  - existence of local structures and restrictions

• **existing environmental requirements**
  - specific accident risk
  - permitted noise, vibration, dust
1 Methods of demolition works - introduction

The decision making process of the optimal demolition method always depends on the particular case.

Demolition contractors can choose from a range of methods to demolish buildings and civil engineering structures. These range from manual demolition to the use of explosives, each with their own applications.

The main decision criteria are:
- influence of demolition works to particular construction,
- influence of demolition works to surroundings,
- time of demolition works,
- costs of demolition works,
- influence of demolition works to occupational health & safety,
- influence of demolition works to environment.
2 Methods and equipments of demolition works

Methods of demolition works are:

A. Demolition using hand held tools
B. Demolition by machine
C. Demolition using implosion
D. Demolition using dismantling
E. Demolition using mechanical and chemical bursting
2 Methods and equipments of demolition works

A. Demolition using hand held tools

This method is usually used for small demolition volumes and often as preparatory work for another demolition methods.

It is highly labour intensive, slow and expensive.

The most common type of hand held equipments used are hand hammer and stone chisels.

Hydraulic hammer or pneumatic hammer is used for breaking away the concrete.

It is effective in localized and narrow space.
2 Methods and equipments of demolition works

A. Demolition using hand held tools - equipments

Sledgehammer - can be used to bust up concrete or taking out a wall

Crowbar (prybar or wrecking bar) - a crowbar can be used to remove nails or as a lever to force apart objects

Hammer drills – presents electric or hydraulic tools for disruption of masonry, concrete and reinforced concrete structures
2 Methods and equipments of demolition works

B. Demolition by machine

Common method used for demolition of structures.
When demolition by hand, tool is time consuming and unsafe, this method is adopted.
Used in large demolition volumes structures.

The use of powered mobile plant such as cranes, excavators, bulldozers, and elevating work platforms requires strict traffic management arrangements to prevent collision with pedestrians or other mobile plant.
2 Methods and equipments of demolition works

B. Demolition by machine - equipment

Demolition of buildings by machine can be done by using:
1. wrecking ball
2. hydraulic breakers
2 Methods and equipments of demolition works

B. Demolition by machine - equipment

Wrecking ball generally comprise a drag-line type crawler chassis fitted with a lattice crane jib. It is suspended from the lifting rope and swung by the drag rope. It was most commonly in use during the 1950s and 1960s.
2 Methods and equipments of demolition works

B. Demolition by machine – equipment - wrecking ball

• we know 2 ways of wrecking ball work

Vertical Drop - free falling of the wrecking ball onto the structure.

Swing in Line - winging of the ball in-line with the jib. A second dragline will normally connect to the ball horizontally to control the ball motion.
2 Methods and equipments of demolition works

B. Demolition by machine – equipment - hydraulic breakers

- it is a powerful percussion hammer fitted to an excavator for demolishing concrete structures or rocks. Powered by an auxiliary hydraulic system from the excavator, which is fitted with a foot-operated valve for this purpose.
- hydraulic breakers with long arm extension is used for high rise buildings.
- the crusher attachment breaks the concrete and the reinforcement by the hydraulic thrust through the long boom arm system.
2 Methods and equipments of demolition works

C. Demolition using implosion

• **Implosion** is the direct opposite of explosion.

• **Explosion** - a charge goes off and something solid is ripped into a lot of little pieces that fly all over the place, making everyone in the vicinity take cover.

• **An implosion** is the strategic placement of explosive charges that actually destroy the structural integrity of the building causing it to fall not out, but in upon itself (this is often referred to as falling into its own footprint).
2 Methods and equipment of demolition works

C. Demolition using implosion

• The basic idea of implosive demolition is:
If you remove the support structure of a building at a certain point, the section of the building above that 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.

• Demolition by implosion (controlled blasting technique) is based on rupture of critical elements of the structure that produce the same imbalance and as a result his downfall in a predetermined direction.
2 Methods and equipments of demolition works

C. Demolition using implosion

• This system of demolition is application mainly to slender structures built by structure pillars, beams and walls of buildings whose structure has been constructed through load of brick or reinforced concrete.

• To produce the rupture of the structural elements considered critical apply small explosive charges placed in boreholes drilled along the structural element to break; a proper sequence of the order of detonation of charges will contribute to building collapse in the selected direction. The explosives are just the trigger for the demolition. It's gravity that brings the building down.

• For concrete columns traditional dynamite is used.

• Demolishing steel columns is a bit more difficult, RDX is used as the specialized explosive material.
2   Methods and equipments of demolition works

C. Demolition using implosion

• Demolition can be done safely, but it must be carefully planned and carried out only by experienced workers under competent supervision.

• Contractors carrying out blasting should survey the structure, obtain drawings and as much information as possible on its method of construction and materials. Only with this information is it possible to determine whether blasting is appropriate in the first place, where charges should be placed, how much explosive should be used, what steps may be necessary to prevent ejection of debris and what sort of separation zones will be required around the site to protect workers and the public.
2 Methods and equipments of demolition works

D. Demolition using dismantling

By cutting concrete elements and then removing them by crane, the demolition of an entire concrete structure may be carried out with a minimum of noise, dust and impact on surrounding structures.

This may be done by the following methods:

1. water-jetting
   - minimizes and eliminates dust and fire hazards.
   - can be used to cut both, straight lines and contours.
   - requires the use of an abrasive and water-catching system during the cutting process.

2. thermic lance - is a tool that burns iron in the presence of pressurized oxygen to create very high temperatures for cutting.
2 Methods and equipments of demolition works

E. Demolition using mechanical and chemical bursting

Both mechanical and chemical pressure bursting split the concrete, either with a splitting machine operating on hydraulic pressure provided by a motor in the case of mechanical bursting, or through the insertion of an expansive slurry into a predetermined pattern of boreholes in the case of chemical bursting. The split concrete is then easily removed, either by hand or by crane.
2 Methods and equipments of demolition works

Environmental impact of demolition works

A. Demolition using hand held tools

- possibility to regulate the amount of CDW
- “gentle“ demolition works
- separation of CDW
2 Methods and equipments of demolition works

Environmental impact of demolition works

B. Demolition by machine

• emergence of noise and vibration (particular construction and surrounding)
• the small sensitivity of demolition,
• impossibility to regulate the quality and composition of CDW
2 Methods and equipments of demolition works

Environmental impact of demolition works

C. Demolition using implosion

- the least appropriate way
- impossibility of CDW separation and recycling
3 Process of demolition works

- **Process of demolition works** is to be performed safely and with a number of different steps involved before and during the execution of a demolition process.

- The **various steps involved** before the demolition process includes surveying the site of demolition, removal of hazardous materials, if any, and preparation of demolition plan with techniques to be implanted, stability report and the precautionary safety measures to be taken from the workers and the surrounding.
3 Process of demolition works

Different steps are involved in the process of demolition of building structures which are:

1) Surveying of buildings for demolition works
2) Removal of hazardous materials
3) Preparation of plan
4) Safety measures
3  Process of demolition works

1) Surveying of buildings for demolition works

Surveying means study of different parameters of the structure and its surroundings.

There are two types of surveying are mainly conducted. They are:

A. Building surveying
B. Structural surveying
3 Process of demolition works

A. Building surveying

In survey of buildings for demolition, following process are carried out:

• types of construction material used,
• usage of building prior and present during demolition,
• the presence of wastewater, hazardous materials, matters arising from toxic chemicals, flammable or explosive and radioactive materials, etc.
• drainage conditions and possible problems on water pollution, flooding and erosion,
• shared facilities with adjoining building, including common staircases, partition walls,
• adjoining pedestrian and vehicular traffic conditions,
• the sensitivity of neighborhood with respect to noise, dust, vibration and traffic impact.
3 Process of demolition works

B. Structural surveying

In structural survey, following process are involved in demolition:

• the method of construction

• the structural system and structural conditions of basements, underground tanks or underground vaults.

• the original structural system employed in the design.

• the condition of the building.
3 Process of demolition works

2) Removal of hazardous materials

If hazardous materials like asbestos minerals, petroleum contamination, and radioactive metals are found in the investigation of site for demolition. Specialized personals are called for the removal of the hazardous materials from the site prior to the demolition of structure.
3 Process of demolition works

3) Preparation of demolition plan for structures
A detailed demolition plan is made which illustrates the different process involved and they are:

• the location of the building to be demolished,
• the distances from the building to be demolished to its adjacent buildings, streets, structures and significant street furniture,
• the structural support systems of the building,
• a plan showing the procedure for the demolition of the building; detailed sequence of demolishing structural members; and the method of demolition to be adopted,
• a plan showing all precautionary measures for the protection of the public including hoardings, covered walkways, catch platforms, catch fans, scaffolding, protective screens and safety nets,
• method of handling demolished building debris,
• time required for the complete demolition process etc.
3 Process of demolition works – in 10 STEPS

1. **Building survey:** Examine construction materials, building use, pedestrian and traffic conditions, surrounding neighborhood, building codes

2. **Make a plan:** Include the area to be demolished, topography, distance to other structures, floor layouts, demolition procedures, sharing and temporary supports, paths of egress

3. **Mitigate hazards:** Remove lead, asbestos, contaminated soil, flammable objects; review safety hazards with crew; inspect demolition equipment daily

4. **Prepare the site:** Turn off utilities, cap pipes, install temporary lighting

5. **Strip nonstructural components from building:** Windows, plumbing, machinery, doors, fixtures, furniture, appliances
   - Separate the components into piles: Recycle, reuse, sell, donate

6. **Remove water tanks and lift rooms before demolishing the roof**

7. **Add shoring and temporary supports**

8. **Remove verandas, cantilever structures and features on external walls**
   - Remove floor beams in order of cantilever beams, secondary beams, then main beams
   - Remove load-bearing walls and columns after removing the beams on top

9. **Demolish floor slabs:** Begin mid-span and work toward support beams
   - Demolish floor beams in order of cantilevered beams, secondary beams, then main beams

10. **Sort building materials into piles:** Scrap metal, concrete, bricks, lumber, glass, drywall
    - Recycle, reuse, sell or donate the materials

(www.elderdemolition.com)
4 Selective demolition

• **Selective demolition (deconstruction) presents** demolition uses carefully planned sequenced activities that separate and sort the materials within a building.

• Selective demolition as an alternative to demolition means the systematic disassembly (‘construction in reverse’) of buildings in order to maximise the reuse and recycling of recovered materials.
4 Selective demolition

- Whereas the demolition of a building often leads to the mixing of various materials and contamination of non-hazardous components, deconstruction aims at separating materials at source.

- Complete selective dismantling is currently often not the preferred technique, mainly due to the higher cost, at least when a high purity of waste streams is not required.
Selective demolitions are best for buildings that are structurally sound. It might be appropriate include:

- interior remodels and renovations
- asbestos removal and the abatement of other hazardous materials
- building relocation
- site remediation
- a building needs alterations
- a proposed project meets a municipality’s zoning regulations and building codes
- preparing a building for construction work
- extending a building
- when buildings are large or heavily fortified
- preserving a historic building
4 Selective demolition

- Decision making steps for assessing the most sustainable approach to redevelopment
4 Selective demolition

When a deconstruction process is planned for existing buildings, several outstanding practices can be defined:

• **client specifications on selective deconstruction**, determining budgetary restrictions, timing, establishing goals and targets for waste sorting and recycling and identifying reuse opportunities.

• **elaboration of deconstruction or demolition plans** - detailed planning of the deconstruction process, including an evaluation of the appropriate scope for dismantling and an assessment of available recycling options, is recommended.

  In general, such plans can reduce the overall management cost and improve economic performance, working conditions, worker safety, and share and quality of recycled materials

• **site management plan** – an environmental management plan of deconstruction sites is quite similar to the management of construction sites.
4 Selective demolition

Building preparation for selective demolition

Many buildings during selective demolition retain their main operative functions. Before removing building components with demolition equipment:

- specialists ensure the safety of the project,
- prepare materials for removal and recycling.

This process involves cutting power to the respective area, capping pipes and turning off HVAC systems.

The supportive shoring or bracing to prevent movement, settlements or collapses may be also installed.
4 Selective demolition

• Because of the quantity of debris that demolition projects create, extensive sorting is required.

• **To reduce waste**, constructor uses special equipment to tear down a building.
• Attaching shears to the end of an excavator, for example, allows workers to reach high components without relying on a wrecking ball.
4 Selective demolition

- Concrete crushers turn concrete into gravel that a client can recycle or use for the building’s renovation.

- Powerful magnets separate scrap metal that a client can sell.
4 Selective demolition

- After the crew strips a structure’s mechanical, architectural and electrical elements, all that remains is a shell that is ready for remodeling, remediation or an extension.

- Selective demolition is an ideal solution when you want to alter or improve a building without tearing it down completely.