Structural Construction Works

Level-II

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Acronyms

AAP	Asbestos Abatement Plan
AIR	Asbestos Investigation Report
APCO	Air Pollution Control Ordinance
CNP	Construction Noise Permit
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
OSHA	Occupational Safety and Health Administration
PME	Powered mechanical equipment
SWMS	Safe Work Method Statements
TTLM	Teaching, Training and Learning Materials
WPCO	Water Pollution Control Ordinance

Introduction to the Module

In Structural construction work; carry out general demolition work of minor building structures used to replace & facilitate alterations, extensions and additions structure of a building. And also it includes work being completed to a work schedule, plans and specifications

This module covers the units:

- Plan and prepare.
- Demolish of structures
- Clean up

Learning Objective of the Module

- Plan and Prepare
- Perform Demolish of structures
- Clean up

Module Instruction

For effective use this modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of units
4. Do the “LAP test” giver at the end of each unit and
5. Read the identified reference book for to get knowledge to do Examples and Exercise

Unit one: Plan and prepare

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Work instructions
- OH &S requirements
- Signage and barricade requirements.
- Plant, tools and equipment
- Material quantity requirements
- Preparing and safely handle materials
- Environmental requirements

This unit will also assist you to attain the learning outcomes stated below. Upon completion of this learning guide, you will be able to:

- Apply Work instructions
- Understand OH &S requirements
- Implement signage and barricade requirements.
- Select Plant, tools and equipment
- Calculate material quantity requirements
- Prepare and safely handle materials
- Identify environmental requirements

1.1. Work Instruction

Any work that is connected with the demolition of a structure is classified as 'construction work' under the WHS Regulations. When carrying out demolition work, the requirements relating to construction work must be complied with. Demolition work means to demolish or dismantle a structure or part of a structure that is load-bearing or otherwise related to the physical integrity of the structure, but does not include: Demolition work means to demolish or dismantle a structure or part of a structure that is load-bearing or otherwise related to the physical integrity of the structure, but does not include:

- ✓ The dismantling of formwork, false work, scaffolding or other structures designed or used to provide support, access or containment during construction work.
- ✓ The removal of power, light or telecommunication poles.

A structure is anything that is constructed, whether fixed or moveable, temporary or permanent, and includes buildings, sheds, towers, chimney stacks, silos, storage tanks. The demolition of an element of a structure that is load-bearing or otherwise related to the physical integrity of the structure is 'high risk construction work'. A safe work method statement (SWMS) must be prepared before the high risk construction work starts.

Demolition work that is notifiable under the WHS Regulations involves:

- ✓ Demolition of a structure, or a part of a structure that is load-bearing or otherwise related to the physical integrity of the structure, that is at least 6 meters in height
- ✓ Demolition work involving load shifting machinery on a suspended floor, and
- ✓ Demolition work involving explosives.

1.1.2. Health and safety duties in relation to demolition work

A person conducting a business or undertaking has the primary duty to ensure, so far as is reasonably practicable, that workers and other persons are not exposed to health and safety risks arising from the business or undertaking.

The WHS Regulations include specific obligations for a person conducting a business or undertaking to manage the risks associated with demolition work. These duties include:

- ✓ Preparing a Safe Work Method Statement (SWMS) for the proposed work, or ensuring a SWMS has already been prepared by another person, before any high risk construction work commences
- ✓ Obtaining a copy of the asbestos register for the workplace before demolition work is carried out
- ✓ If there is no asbestos register, you must:
- ✓ Not carry out the work until the structure or plant has been inspected to determine whether asbestos or asbestos containing materials (ACM) are fixed to or installed in the structure or plant
- ✓ Ensure that the determination is undertaken by a competent person

Undertaking that has management or control of the demolition work is sometimes referred to as the ‘demolition contractor.

A principal contractor for a construction project

- ✓ **Designers** of structures must ensure, so far as is reasonably practicable, that the structure is without risks to health and safety, when used for a purpose for which it was designed. Designers must give the person who commissioned the design a written safety report that specifies the hazards relating to the design of the structure
- ✓ **Officers,** such as company directors, have a duty to exercise due diligence to ensure that the business or undertaking complies with the WHS Act and Regulations. This includes taking reasonable steps to ensure that the business or undertaking has and uses appropriate resources and processes to eliminate or minimize risks that arise from the demolition work.
- ✓ **Workers** have a duty to take reasonable care for their own health and safety and that they do not adversely affect the health and safety of other persons. Workers must comply with any reasonable instruction and cooperate with any reasonable policy or procedure relating to health and safety at the workplace.
- ❖ Selective demolitions are best for buildings that are structurally sound. It might be appropriate include.
  - o Interior remodels and renovations
  - o Asbestos removal and the abatement of other hazardous materials
  - o Building relocation
  - o 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

1.2. OH & S Requirements

1.2.1. Introduction OH & S

Construction industry, often termed as 'high-risk', has a significant impact on the health and safety of the workers. Though it is common to see a construction worker work at heights with equipment and building materials, these scenarios are plagued by potentially dangerous situations and poor working conditions. They are exposed to hazards that are difficult to quantify. Different job sites have different procedures and conditions – identifying the source(s) that poses challenges to Occupational Health and safety (OHS) of the workforce remains critical.

Health and safety is a multi-step process which includes the workers at the site, nearby people, supervisors, managers etc. Effective management of activities and competent site supervision are essence in maintaining healthy and safe conditions.

In construction activities especially, greater the risk, greater the degree of hazard control and supervision is required.

- **Competent OH & S personnel Should:**

✓ Identify and devise risks and their management strategy

✓ Ensure training – site specific and job-specific

✓ See that the workforce has access to PPEs and know how to use them

✓ Observe, inspect and report that agreed safe work methods are implemented, site-wide

Upon arrival at the site, employees, contractors and visitors should receive information about the site hazards and steps taken to control those risks. Also, briefing them about the hazards, PPEs, welfare facilities and site rules can ensure that the work in progress is smooth and efficient. Much of the construction works include scaffolds, and collective fall prevention becomes a necessity.

They must be equipped with guardrails, toe boards and brick guards. Personal prevention such as podium steps, can be used to prevent falls while working at height. If the weather seems inappropriate, emergency and rescue procedures should be well-defined in advance to avoid adverse effect on workers. All working platforms must be checked for safe conditions and should be inspected for slip and trip hazards.

Other preventive measures that make safe conditions certain are:

- Regular inspections of the site and the machineries to detect hazards in the first place
- Selection of the right PPE (respirators, helmets) to avoid inhalation of asbestos, dust and fiber with provision for appropriate trainings.
- Avoid repetitive motions and use long-handled tools to reduce the need of bending down.
- Make sure that workers are protected from wet concrete (provide PPE and proper washing facilities)
- Ensure safe dismantling procedures are in place
- Site traffic (for vehicles or moving equipment) should be planned and managed to avoid fatalities onsite
- Forklifts should be used carefully in material handling
- Confirm site wide PPE implementation

- Pneumatic silencers should be used to reduce noise; electrical hazards (faulty wiring) must be checked and firefighting equipment should be in place

Incorporating health and safety checks can keep a tab on the worker progress and well-being. Risk assessments, health and safety trainings, corrective and preventive measures all should be the part of the checklist of a construction company.

Safety (**OHS**) is to be in accordance with state or territory legislation, regulations, codes of practice, organizational safety policies and procedures, and project safety plan and may include:

- ✓ Emergency procedures, including emergency shutdown and stopping, extinguishing fires, organizational first aid requirements and evacuation
- ✓ Handling of materials
- ✓ Hazard control
- ✓ Hazardous materials and substances
- ✓ Safe operating procedures, including the conduct of operational risk assessment and treatments associated with:
- ✓ Traffic control
- ✓ Work site visitors and the public
- ✓ Working at heights
- ✓ Working in proximity to others
- ✓ Organizational first aid
- ✓ Personal protective clothing and equipment prescribed under legislation, regulations and workplace policies and practices
- ✓ Use of firefighting equipment
- ✓ Use of tools and equipment
- ✓ Workplace environment and safety.

➢ Demolition Safety:

Building has been inspected for areas containing asbestos, lead coatings and other toxic substances. Public services such as gas, water, electricity, sewers, etc. have been located, and the authorities located. A demolition plan has been prepared. Loads can be safely placed on floors to be used as working platforms. Necessary arrangements have been made for scaffolds, props, fencing, screens, notices, etc. Permit from the local authority has been obtained; the work has been notified, if modifiable; and a competent safety supervisor has been appointed.

Any demolition work should be proceeded by:

i. Site survey which should be comprehensive

ii. Decide on the location and position of screens, scaffolds etc.,
iii. Protection of the public
iv. Methods to protect surrounding buildings from the danger of collapse.
v. Electric power to all services within the structures should be shut off. Similarly
vi. Gas, water and steam service lines should be shut off.
vii. The structure to be demolish should be adequately fenced and cordoned off
viii. Display boards to be displayed prominently warning the public of the danger.
ix. Glass in doors and windows, loose objects and projecting parts to be removed.

- **Personal protective equipment (PPE)**

The working conditions in construction are in most cases such that, despite all preventive measures in project planning and work design, some personal protective equipment (PPE), such as a helmet, hearing and eye protection, boots and gloves, is needed to protect workers. However, there are disadvantages in using PPE:

- Wearing some forms of PPE may involve discomfort to the user and slow down the work.
- Extra supervision is called for to see that PPE is worn.
- PPE costs money.

Wherever possible, it is better to try to eliminate the hazard rather than providing PPE to guard against it.

Some PPE such as safety helmets and footwear should be used on all construction sites. The need for other PPE will depend on the sort of work you do. Remember, too, that proper work clothes will provide protection for the skin.

a. Head protection

Falling objects, overhead loads and sharp projections are to be found everywhere on construction sites. A small tool or bolt falling from 10 or 20 m high can cause serious injuries or even death if it strikes an unprotected head. Head injuries often occur when moving and working in a bent position, or when arising from such a position. Safety helmets protect the head effectively against most of these hazards, and you should wear a helmet whenever you are on site and particularly when you are in an area where overhead work is going on. These areas, known as “hard-hat areas”, should be clearly marked with safety signs at entrances and other suitable places see the following figure.

Figure 1.1 Head Protaction

The same rule applies to managers, supervisors and visitors. Only safety helmets which have been tested to national or international standards should be used. A chin-strap on the helmet prevents it from failing off and should be used when appropriate.

b. Foot protection

Foot injuries fall into two broad types: those due to penetration of the sole by nails which have not been knocked down or removed, and those due to crushing by falling materials, which can be minimized by wearing protective footwear. The type of safety shoes or boots to be used will depend on the nature of the work (e.g. the presence of ground water on construction sites), but all safety footwear should have an impenetrable sole and uppers with a steel toe-cap

Figure 1.2 Foot Protaction

- **There are many types of safety footwear now available such as:**

- light, low-cut leather safety shoes for climbing jobs;
- Normal safety shoes or boots for heavy-duty work;
- Rubber or plastic safety wellingtons or gumboots which provide protection against corrosive substances, chemicals and water.

c. Hand and skin protection

Hands are extremely vulnerable to accidental injury, and in construction more injuries are caused to hands and wrists than to any other part of the body. Open wounds, abrasions, fractures, dislocations, strains, amputations and burns occur. They are largely preventable by better manual handling techniques and equipment, and by wearing suitable hand protection such as protective gloves and gauntlets.

Among the common hazardous tasks where hand protection should be provided are:

- operations involving contact with rough, sharp or jagged surfaces;
- contact with or splashes from hot, corrosive or toxic substances such as bitumen and resins;
- Working with vibratory machines such as pneumatic drills where some cushioning of the vibrations is desirable;
- Electrical work in humid and cold weather. Skin trouble is common in the construction industry.

Contact dermatitis is the commonest type of skin disease. It feels itchy and looks red, scaly and cracked, and can become so bad that it affects your ability to continue working. Wet cement is one of the main skin hazards, but other substances include tar and pitch, which can cause skin cancer after prolonged exposure, paint thinners, acids for masonry cleaning and epoxy resins. In addition to gloves, use barrier creams and wear long-sleeved shirts, full-length trousers and rubber boots.

Figure 1.3Hand and Skin Protaction

d. Eye protection

In industry many eye injuries occur as a result of flying material, dust or radiation when the following jobs are being carried out:

- Breaking, cutting, drilling, dressing or laying of stone, concrete and brickwork with hand or power tools;
- Chipping and dressing painted or corroded surfaces;
- Cutting off or cutting out cold rivets and bolts;
- Dry grinding of surfaces with power grinders;
- Welding and cutting of metals.

In some industrial processes there may also be a risk from the spillage, leakage or splashing of hot or corrosive liquids.

Some of these hazards can be removed permanently by proper machine guarding, exhaust ventilation or work design. For many hazards, for example, stone cutting or dressing, personal eye protection (goggles, safety glasses or shields) is the only practical solution. Sometimes workers are aware of the danger they run and the consequences if their eyes are damaged, but do not wear eye protection. This is because the type chosen interferes with vision or is uncomfortable to wear, or is not immediately at hand when needed.

Figure 1.4 Eye Protection

e. Respirator protection

On construction sites there are often tasks where harmful dust, mist or gas may be present, such as:

- Rock crushing and handling;
- Sandblasting;
- Dismantling buildings containing asbestos insulation;
- Welding or cutting materials with coatings containing zinc, lead, nickel or cadmium;
- paint spraying;
- Blasting.

➢ Correct choice of respirator

Whenever there is doubt about the presence of toxic substances in the atmosphere, a respirator must be worn. The correct type of respirator will depend upon the hazard and the work conditions, and you need to be trained in its use, cleaning and maintenance. Advice on suitable types of respirator and filter should be sought from appropriate safety and health authorities.

The simplest masks are disposable paper types. Remember that these are only effective against nuisance dusts.

There are three types of half-face mask with filters:

1) For protection against airborne particles, e.g. stone dust, with a coarse filter fitted in the cartridge (note, these filters have a specific lifetime and should be changed as necessary);
2) For protection against gases and fumes, e.g. when using paints containing solvents, with a filter containing activated carbon;

3) A combination filters containing both a dust and a gas filter. Cartridges must be replaced regularly.

A full-face mask can be fitted with the same types of filter, and it also protects the eyes and face. Self-contained breathing apparatus with a full-face mask fed with air at positive pressure always gives the best protection, and must be used in confined spaces and whenever a sufficient supply of air or oxygen at the working place is in doubt. The air may be supplied from a compressor with a filter, or air/oxygen bottles. In a hot climate, the full-face type is the most comfortable mask because it is looser fitting around the face and the air itself has a cooling effect. Users must be trained in the use of self-contained breathing apparatus and must keep to the manufacturers' specifications.

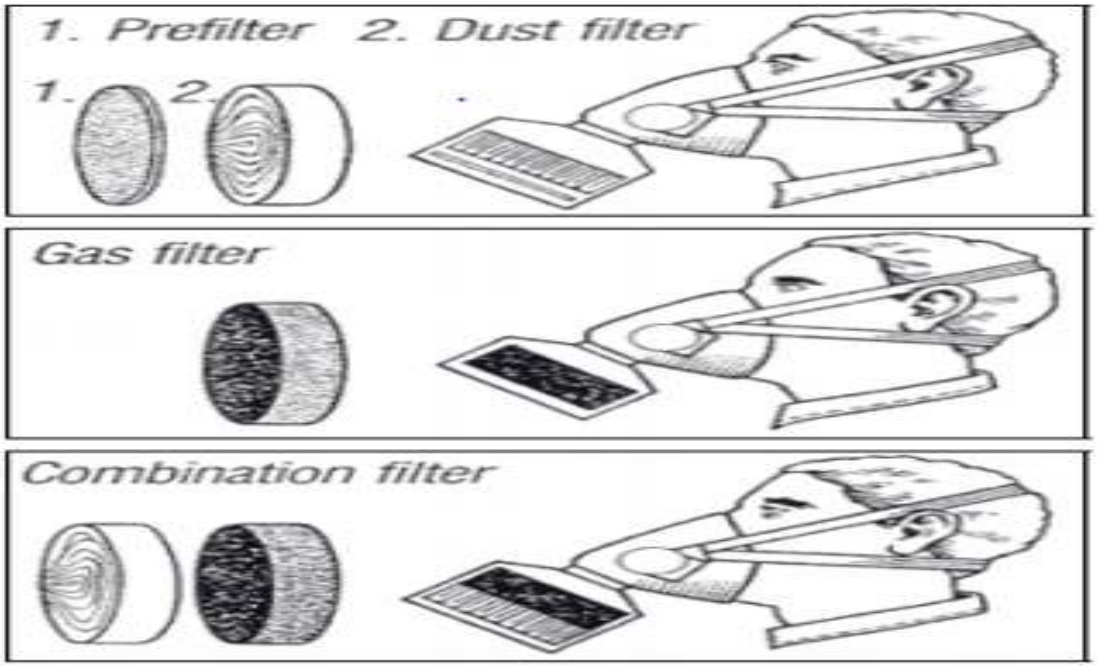


Figure 1.5 Type of face half mask

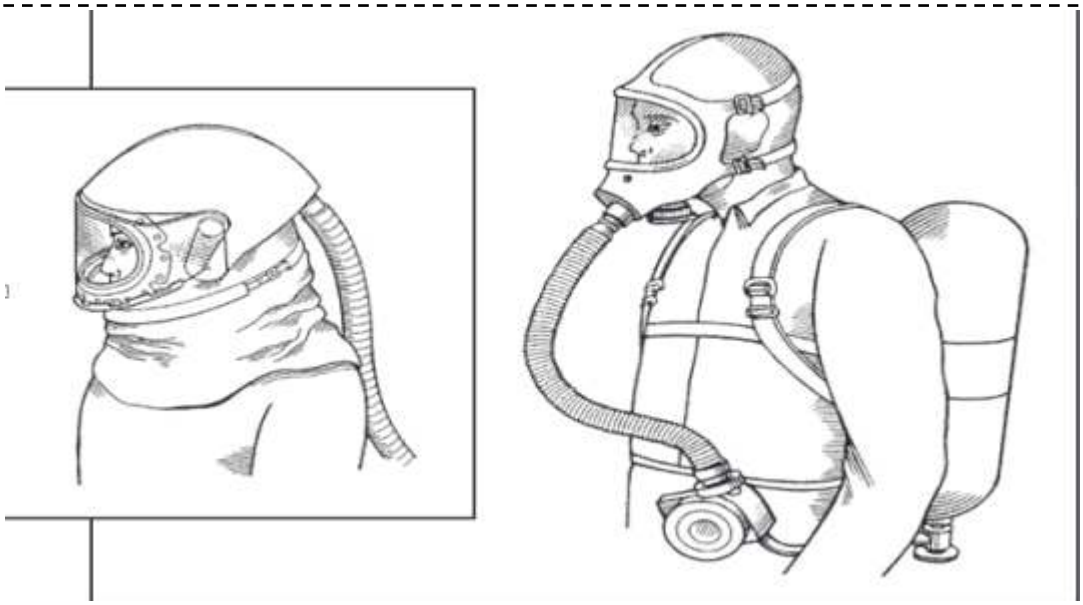


Figure 1.6 Self-contained Birthing apparatuses

a. Safety harness

The majority of fatal accidents in construction are due to falls from heights. Where work cannot be done from a scaffold or ladder, or from a mobile access platform, the wearing of a safety harness may be the only way to prevent serious injury or death.

Circumstances in which a safety harness may be worn. Another common situation in which a safety harness may be used – sometimes supplemented by the use of a safety net is maintenance work on steel structures such as bridges and pylons. There are many types of safety belt and safety harness available. The manufacturer or supplier should be asked for advice on suitable types for the intended purpose and for instructions on use and maintenance. A full safety harness should always be used in preference to a safety belt.

Figure 1.7 Safety Harness

➢ **A safety harness and lanyard must:**

- ✓ Limit your fall to a drop of not more than 2 m by means of an inertia device;
- ✓ Be strong enough to support your weight;
- ✓ Be attached to a strong structure through a firm anchorage point above the place at which you are working.

b. Fire precautions

Fires on construction sites arise from the misuse of compressed gases and highly flammable liquids, from the ignition of waste material, wood shavings and cellular plastic materials, and from the failure to recognize that adhesives and some floor and wall coatings are highly flammable.

Every individual on site should be aware of the fire risk, and should know the precautions to prevent a fire and the action to be taken if fire does break out. If fire breaks out, get someone to call the fire brigade. Do not continue trying to fight the blaze yourself if large quantities of fumes are being emitted in a closed space. Get out as fast as possible. Fires are sometimes caused by carelessness in drying wet clothes. Heaters for this purpose, gas, oil or electric, should be mounted on and backed with non-flammable material, and enclosed in a stout wire mesh with effective air space to prevent clothing being placed directly upon them.

- **During the course of work:**

Site is properly enclosed and protective screens erected. Danger notices have been erected, and access to the site by the public barred. Propping is sufficient to prevent premature structural collapse or damage to adjacent property. Floors are not being overloaded. All ladders, cranes, cables and other equipment being used are in good order. Workers are using safety helmets, boots and other protective clothing and equipment as necessary. Dust is being kept under control by watering. There are sufficient fire extinguishers or other firefighting equipment on site.

- **The principal causes of accidents during demolition are:**

- The choice of an incorrect method of demolition;
- An unsafe place of work;
- The unintentional collapse of the building being demolished, or of an adjoining structure, because of lack of temporary support.

- **Safety precautions**

The following precautions are essential before you enter a confined space regardless of any work you intend to carry out:

- Never enter without instructions from a supervisor and without a written permit to enter or permit to work.
- Equipment for monitoring the atmosphere at frequent intervals must be provided and must be used by a competent person. You must not enter the confined space until the competent person is satisfied that entry is safe.
- There should be forced ventilation to remove and dilute dangerous gases and provide fresh air.
- Monitoring must continue while work proceeds, and you must leave immediately if told to do so.

- You should have received proper training and instruction in the precautions to be taken, including the use of emergency breathing apparatus.
- Rescue harnesses should be worn by everyone inside the confined space, with lifelines attached to a point outside the space.
- Not less than two persons should be present when there is work in a confined space. One should be outside the confined space to keep watch and to offer rescue action or assistance. Additional emergency and accident assistance must also be readily available.
- When working at a manhole in a road or public area, ensure that guard stands are provided and the appropriate traffic signs displayed.
- Make sure that you have been trained by a competent person in the use of the safety and rescue equipment. Some of these points are illustrated:

1.3. Implement Signage and Barricade requirements

1.3.1. Introduction and key terms

Barricade" means an obstruction to deter the passage of persons or vehicles.

Signs are the warning of hazard, temporarily or permanently affixed or placed, at locations where hazards exist. Signs, signals, and barricades are important, if not critical to the safety of all workers. Several important definitions are applicable:

- **Barricades**: Means an obstruction to deter the passage of person or vehicles.
- **Signs/ placards**: Are the warnings of hazard, temporarily or permanently affixed or placed, at locations where hazards exist.
- **Signals**: Are moving signs, provided by workers, such as flagmen, or by devices, such as flashing lights to warn of possible or existing hazards.
- **Tags**: Are temporary signs, usually attached to a piece of equipment or part of a structure, to warn of existing or immediate hazards.

➢ Requirements for all signs and barricade

Signs and symbols required shall be visible at all times when work is being performed, and shall be removed or covered promptly when the hazards no longer exist.

I. **Danger signs** Used as a warning when a potential hazard is life threatening. The word "Danger" should be featured inside red oval, located inside a black rectangle. Sign wording in black.

II. **Caution signs** Hazard symbol should be black on yellow background and triangle should enclose symbol. Sign wording in black lettering. Used as a warning when a potential hazard is non-life threatening.

III. **Mandatory signs** White symbol/image on circular blue or black ground. Sign wording in black lettering. Used to specify that a requirement or instruction is to be followed.

IV. **Emergency signs** notify the location of emergency related facilities such as exits and first aid kits. White symbol on a green background.

V. **Exit signs** these signs notify exits in a variety of options including luminous materials and backlit options.

VI. **Fire signs** Notify the location of firefighting equipment and fire alarms. Feature white symbol and/or text on a red background.

VII. **Facility signs** these signs can provide direction, inform visitors and employees about policies and regulations

Figure 1.8 Signage and Barricade

The following situations will identify the need for a barricade.

1) **Task Oriented –**Requirement identified as the result of completing a JSEA / Risk Assessment
2) **Plant Hazard** –Requirement identified as the result of plant failure or defect found necessitating access to be controlled (e.g. – Steam leak or hazard which presents risk to health and safety, removal flooring or handrails etc.)

Once the need of a barricade is identified the method of barricading must be determined.

Consideration should be given to hazards in the area when erecting barricading (i.e. access points, stairs wells, falling objects), and that the barricading itself does not introduce a hazard.

Methods implementing of Barricading

- **Soft Barricading**

Soft barricading is the use of tape and signage to advise of the hazards and indicate access requirements. CS Energy uses two (2) types of endorsed tape and signs, which are supplied by Black woods. Refer to sections below for more information regarding their use.

Where there is a fall risk >0.5m – 2m (e.g. pit or uneven ground) soft barricading may be used to demarcate the hazard. This barricading shall 2m away from the hazard.

Figure 1.9 Barricading

When a worker erects a barricade the following must be completed every time:

- Barricade is always erected with approved signage on every open side;
- Information on the hazard/situation present in the area;
- Task to be undertaken and any possible interactions;
- Details of the Officer-in-Charge (OIC), Person-in-charge of Works (PICW) or Erector & date; (including contact number)
- Associated specific instructions
- Access Points should be installed (don't force people to go under or step over barricade)
- Keep barricade at waist height
- Always attempt to install bollards to support barricade and not the plant – always encapsulate the area.

Wheelie bins and other devices that can be moved and affect the integrity of the barricaded zone must be not used. Soft barricading can be applied to hard barricading to increase visibility.

❖ **Warning Tape and Warning Signs**

Warning Tape and Warning Signs shall be used as a barricade for control of access to a "general hazard". A PTW is not required to use warning tape. Black on yellow 'Warning' tape and associated signs are to be used whenever it is deemed appropriate to provide warning to others that some extra care is required within the identified area. Where warning tape is used, warning signs (filled out) must also be used to provide information on the hazard/situation present and the responsible person for the area. To access the area inside the warning tape and signs, persons must ensure they are aware of the hazards present inside the area and any other restrictions as detailed on the warning sign.

- **Points to be considered must include**:
    1. Identify the hazards;
    2. The task to be undertaken and any possible interaction; and
    3. Associated specific instructions.
    4. Tape and signs are available from workgroup stores.

Note: this form of barricading may not stop a person entering the taped zone. Any high-risk hazards (e.g. falling objects, suspended loads, exposed electrical parts) need to be managed by risk. Danger tape must be applied to manage the risk of inadvertent access.

❖ **Danger Tape and Dangers Signs**

Danger Tape and Danger Signs shall be used as a barricade for control of access to a "High risk hazard areas" which may present a life threatening risk. Danger tape is Red and white striped with the wording 'Danger Do Not Enter'

Where danger tape is used, danger signs (filled out) shall also be used to provide information on the hazard/ situation present and details of the Erector and PTW as required. Danger tape shall be linked to a PTW to allow control of the area. Before any person accesses the area inside the danger taped area they must have approval by the OIC/PICW and sign on to the PTW and JSEA. The following are exemption where PTW are is not required:

- ✓ To control high risk areas when deemed necessary by the Operator Lead/Supervisor or Site Management. e.g. areas with steam leaks, high risk hazards,
- ✓ To control an area where required by the Emergency Response team.

After hours (or when permit has been suspended by the OIC), the Operator Lead/Supervisor can give authority to entry after a risk assessment is performed to identify the hazards control are in place.

Figure 1.10 Warning Tape and Warning

❖ **Live Electrical Work Barricading**

Danger tape and Danger Signs shall be used as a barricade for control of access to live electrical equipment, which may present a life threatening risk.

- Electric shock and burns from contact with live parts.
- Injury from exposure to arcing, fire from faulty electrical equipment or installations.
- Explosion caused by unsuitable electrical apparatus or static electricity igniting flammable vapors or dusts, for example in a spray paint booth.

This requirement shall be determined by the OIC/PICW and documented on the JSEA, guidance is provided below:

- Barricades shall be used for:
  - High voltage testing;
  - Working on a switchboard that has energized sections (all live cubicles shall be barricaded).
- Barricades are not mandatory for:
  - Routine testing to prove dead, voltage measurement etc.
  - where a safety observer can control access of others to exposed live parts

❖ **Solid Barricades**

The use of a solid barricade shall be determined by:

- A Job Safety Environment Analysis(S1878)/ Risk Assessment
- CS-PTW-HAZ-02 Working at heights and Unprotected Edges
- Where access into an uncontrolled area will expose a fall risk, which has the potential to cause injury.

The purposes of a solid barricade it to provide a physical barrier capable of performing the same function as a permanent handrail.

- **Solid Barricade shall be used**

- Have a solid top rail (e.g. Scaffold tube and coupling or equivalent) with the applicable sign attached (Top rail to be at least 1 meter high);
- If the fall height is greater than 2.0 meters, amid rail and a kick plate must also be fitted;
- Have a construction with suitable strength to support a person leaning or falling into the barricade;
- Triton barricades/bollards (e.g. yellow water filled plastic barricades) are classed as a suitable

  barricading method and should be linked together and water filled where there is risk of vehicle impact;

Figure 1.11. Soid Barriced

❖ **Plastic Chain**

The main purpose for plastic chain is for safety and crowd control. The colors of the chain have real meaning, and by far the most common color is yellow. Yellow chain indicates caution or warning of some risk. In some cases, OSH a requires a visual barrier must be in place

Instances where soft barricading is required to be installed for an extended period of time plastic chain should be used as a substitute to plastic tape.

1.4. Plant, Tools and Equipment

Construction plant is construction, plant typically refers to heavy machinery and large equipment used on construction sites – think cranes, excavators and bulldozers. Construction plant is used in many types of construction projects, from rail and road works to house building

Construction equipment means any equipment or device designed and intended for use in construction or material handling including but not limited to air compressors, air tracks, pile drivers, pneumatic or hydraulic tools, bulldozers, tractors, excavators, trenchers, cranes, derricks, loaders, backhoes, scrapers, pavers, generators, off-highway haulers or trucks, ditchers, compactors and rollers, pumps, concrete mixers, graders and other material handling equipment

Tools are particularly important in construction work. They are primarily used to put things together (e.g., hammers and nail guns) or to take them apart (e.g., jackhammers and saws). Tools are often classified as hand tools and power tools. Hand tools include all non-powered tools, such as hammers and pliers. Power tools are divided into classes, depending on the power source: electrical tools (powered by electricity), pneumatic tools (powered by compressed air), liquid-fuel tools (usually powered by gasoline), powder-actuated tools (usually powered by an explosive and operated like a gun) and hydraulic tools (powered by pressure from a liquid).

❖ **Small plant and equipment to carry demolition work include:**

a. **Small plant**, such as:

- ✓ Air compressors
- ✓ Elevated work platforms (EWPS)
- ✓ Forklifts
- ✓ Generators
- ✓ Jack hammers
- ✓ Material and personnel hoists
- ✓ Mini-loaders
- ✓ Pumps
- ✓ Rubber-tired loaders
- ✓ Bolsters
- ✓ Grabs
- ✓ Brooms
- ✓ builders' lines
- ✓ Dumpy levels
- ✓ Hammers (bricks, club and cutch)
- ✓ Jig saws

b. Other Equipment, such as:

- ✓ Safety equipment, including:
- ✓ Barricades
- ✓ Fall prevention
- ✓ PPE
- ✓ Scaffolds
- ✓ Signs
- ✓ Pallet trolleys
- ✓ Wheelbarrows.

c. Plant and equipment

A range of plant and equipment typically used for demolition work includes:

- Powered mobile plant
- Personnel and/or materials hoists
- Hydraulic jacks
- Oxy-acetylene (gas cutting/welding)
- Concrete saws and corers
- Ladders (limited use), and

d. Many types of hand held plant including:

- Angle grinders,
- Power saws,
- Hammers,
- demolition saws,
- Hydraulic jacks and pinch/lever bars

You should ensure: plant is used and operated by a competent person that appropriate guards and operator protective devices are fitted that the safe working load is displayed and any load

measurement devices are operating correctly plant is maintained in accordance with the manufacturer/supplier's instructions and manufacturers recommendations for the safe use and storage of oxy-acetylene cutting equipment are referred to.

Safety and Rescue equipment

Whenever work is to be carried out in a confined space, the following equipment should be provided:

- ✓ An atmospheric testing device (proprietary meters and lamps are available);
- ✓ Two rescue harnesses with adequate lengths of rope taking into account the location of the work site;
- ✓ Hand torches or lamps safe for use in a flammable atmosphere;
- ✓ At least one set of suitable breathing apparatus (cartridge, canister or filter) and an emergency breathing pack;
- ✓ First-aid equipment;
- ✓ Firefighting apparatus;
- ✓ An audible alarm for summoning help;
- ✓ Resuscitation equipment;
- ✓ Means of communicating with surface workers.

Figure 1.12 Safety and Rescue equipment

❖ Powered mobile plant

The use of powered mobile plant such as cranes, excavators and bulldozers, requires the preparation of a SWMS before work commences. A high risk work license is required to operate some types of powered mobile plant, such as some cranes, elevating work platforms or forklifts. Whenever powered mobile plant is to be used for demolition work, traffic management arrangements should be implemented to prevent collision with pedestrians or other mobile plant. Cranes may be used in demolition work for a number of purposes including:

- ✓ Lifting and lowering plant and/or materials
- ✓ lifting and lowering personnel work boxes, and
- ✓ Holding suspended loads.
- ✓ Cranes require a licensed operator.

Figure 1.13 Powered mobile plant

1.5. Estimating Technique Calculating Material Quantity

Construction and demolition waste is generated whenever any construction/demolition activity takes place, such as, building roads, bridges, fly over, subway, remodeling etc. It consists mostly of inert and non-biodegradable material such as concrete, plaster, metal, wood, plastics etc. A part of this waste comes to the municipal stream. These wastes are heavy, having high density, often bulky and occupy considerable storage space either on the road or communal waste bin/container. It is not uncommon to see huge piles of such waste, which is heavy as well, stacked on roads especially in large projects, resulting in traffic congestion and disruption.

Waste from small generators like individual house construction or demolition, find its way into the nearby municipal bin/vat/waste storage depots, making the municipal waste heavy and degrading its quality for further treatment like composting or energy recovery. Often it finds its way into surface drains, choking them. It constitutes about 10-20 % of the municipal solid waste (excluding large construction projects).

Figure 1.14 Demolition or Debris Material

1.5.1. Method of Calculating Demolition Material Quantity

Dimensions used to calculate volume of waste material are estimated based on field measurements and approximations, GPS data, and survey topographic data provided by the USFS. Surveyed measurements of the waste sources and structures were not taken. Structure footprint dimensions were gathered using a tape measure or measuring wheel or a combination thereof. Estimated depths and representative geometric shapes were of soil/rock materials were made.

❖ Emperical equations

Building Demolation Estimation Formula **CY= (length*width*height*0.33)/27**

Mobile Home Debris Estimation Formula

CY= (length*width*height)/27

Example:1

Plan View
(not to scale)

Dimensions:

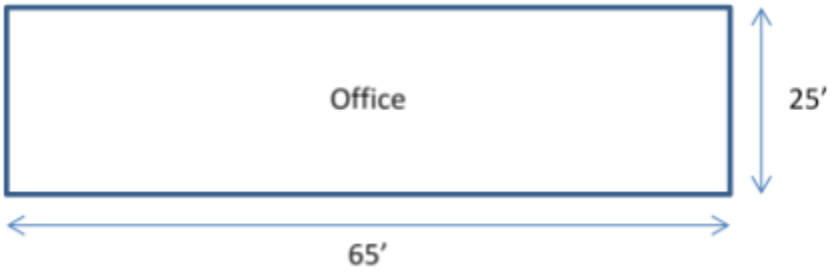
Length = 125 ft
Width = 35 ft
Height = 30 ft

$$General\ Building\ C\&D\ Debris\ Volume = \frac{(125\ ft)x\ (30\ ft)x\ (30\ ft)\ x\ 0.33}{27} = CY$$

$$General\ Building\ C\&D\ Debris\ Volume = 1604\ CY \cong \mathbf{1650\ CY}$$

Example: 2

Office Objective: Calculate the estimated volume of demolition material that will result from the demolition of the Office building. The structure has a total length of 65 ft and width of 25 ft. The Office has estimated height of 10 ft. Solution: Using the FEMA debris estimating empirical equation for General Buildings, calculate the estimated C&D debris for the structure. For volume estimating purposes, assume a uniform height across the length and width of the structure.



Dimensions:
Length = 65 ft
Width = 25 ft
Height = 10 ft

$$General\ Building\ C\&D\ Debris\ Volume = \frac{Length\ x\ Width\ x\ Height\ x\ 0.33}{27} = CY$$

$$General\ Building\ C\&D\ Debris\ Volume = \frac{(65\ ft)x\ (25\ ft)x\ (10\ ft)\ x\ 0.33}{27} = CY$$

$$General\ Building\ C\&D\ Debris\ Volume = 198.6\ CY \cong \mathbf{225\ CY}$$

Asphalt pavement Sidewalks and road structures made with asphalt binder

the U.S. Environmental Protection Agency (EPA) has targeted C&D materials for reduction, reuse, and recovery as part of its Resource Conservation Challenge (RCC). The RCC is a national effort to conserve natural resources and energy by managing materials more efficiently. The goals of the RCC are to prevent pollution and promote reuse and recycling, reduce priority

and toxic chemicals in products and waste, and conserve energy and materials. The RCC has identified four national focus areas:

Municipal solid waste recyclingIndustrial materials recycling, specifically:

- ❖ C&D materials reduction, reuse, and recycling
- ❖ Coal combustion products
- ❖ Foundry sands

Green Initiatives: Green Building and Electronics

Priority and toxic chemical reductions

With respect to C&D materials, EPA has undertaken the following activities in an effort to increase the amount of C&D materials reduced, reused, or recycled:

https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5357505.pdf

1.6. Prepare Handling of Materials

❖ Introduction Handling of Materials

Material handling is the job done by every worker in an industry from unloading raw materials, dispatching the finished product and Materials handled between operations in every department or plant of the company. Mechanized material handling equipment has come into the industry to eliminate the human handling or to assist the person to handle move, varied and heavy objects. Mechanical handling of materials reduces manufacturing cost and increases the productivity. At the same time mechanical handling has, a new set of hazards and injuries.

The accidents in material handling are almost due to human failure or unsafe acts rather than mechanical failures or unsafe conditions.

The following statistics, highlights the magnitude of material handling problems to be solved in eliminating the unsafe acts and conditions.

- ➢ For every ton of finished product 50 to 120 ton of equivalent material has to be handled.

- 2/3 of manufacturing cycle is material handling.
- 40% accidents are due to unsafe material handling.
- 80% accidents in material handling are due to human failure or unsafe acts.

❖ **Materials are handled in three methods:**

✓ Manual handling

✓ With the help of hand tool

✓ Mechanized material handling

a) During demolition, the following basic utilities shall be required to provide a safe and healthy working environment:

1) Temporary water supply shall be required to provide water spraying during demolition as dust pollution abatement measures;
2) Temporary telecommunication link between the demolition site and outside organization shall be maintained for both security and communication reasons
3) Temporary electricity supply for lighting and other construction use.

b) In the case when temporary utilities are available, all such temporary utilities, including electrical fittings shall be weather-proofed.

➢ Hazardous Material

If hazardous materials, such as asbestos containing materials, petroleum contamination and radioactive contamination, exist in the building, further investigation and removal of such hazardous material or contamination by specialist shall be referenced. Hazardous material means a hazardous substance, or material containing a hazardous substance, that may be handled, disturbed or removed in the course of the demolition or salvage of machinery, equipment, a building or a structure, or the renovation of a building, including:

(a) Asbestos-containing material

(b) Lead or any other heavy metal

(c) Toxic, flammable or explosive material.

➢ Asbestos Containing Material

Specialists shall be employed to take samples and cause such samples to be tested for asbestos containing material. In the case when asbestos containing material are discovered, specialist contractor shall be employed to remove such asbestos containing material. The asbestos waste

should be handled, stored and disposed of as chemical waste in accordance with the Waste Disposal Ordinance and Waste Disposal (Chemical Waste) (General) Regulation.

- **Soil Contamination Material**

In the case when possible soil contamination material is present, specialist shall be employed to prepare soil contamination test proposal and submit such proposal to the Environmental Protection Department for comment. Upon agreement by the Environmental Protection Department, and completion of the tests, a Soil Contamination Assessment shall be submitted to the Environmental Protection Department for acceptance. In the case when remedial works are required, the remedial proposal shall be submitted to the Environmental Protection Department for approval prior to implementation of such remedial works.

On-site sorting of surplus construction and demolition (C&D) material is strongly recommended so that inert material can be disposed of at public filling areas as far as practicable, and the remaining C&D waste disposed of at landfills. Dumping Licenses issued to lorry owners by the Civil Engineering and Development Department for delivering public fill to public filling areas require that material to be disposed of at public filling areas must comprise only earth, building debris, broken rock and concrete. Such materials shall be free from marine mud, household refuse, plastic, metal, industrial and chemical waste, animal and vegetable matter and other matter considered unsuitable by the Filling Supervisor. Small quantities of timber mixed with otherwise suitable material may be permitted.

- **Handling of debris/demolished material**

Once the cladding wall is separated from the building frame, it may be lifted away and lowered onto the ground or adequately supported floor for further processing. Depending on the type of cladding, it may be reused as building materials or further broken down and transported away as construction debris.

- **Handling of Contaminated Soil**

Precautions must be taken during excavation and removal of the storage tank. The excavation and disposal of contaminated soil shall be handled with care and be in compliance with the EPD requirements. Special care shall be taken to confine the contamination. Protection of the surrounding properties to provide a safe support for any below ground works shall be considered. Temporary shoring for the excavation shall be designed.

1.7. Environmental Requirements

The general requirements to minimize environmental impacts from construction sites can also be applied to demolition processes. The following sections contain some of the procedures to be adopted:

a. Air Pollution

Concrete breaking, handling of debris and hauling process are main sources of dust from building demolition. Dust mitigation measures complying with the Air Pollution Control (Construction Dust) Regulations shall be adopted to minimize dust emissions. Burning of waste shall not be allowed. Diesel fumes generated by mechanical plant or equipment shall be subject to the control of the Air Pollution Control (Smoke) Regulations.

b. Noise

Noise pollution arising from the demolition works including, but not limited to, the use of specified powered mechanical equipment (SPME), powered mechanical equipment (PME), such as pneumatic breakers, excavators and generators, etc., scaffolding, erection of temporary works, loading and transportation of debris, etc. affects the workers, and the sensitive receivers in the vicinity of the demolition site. Silent type PME shall be used to reduce noise impact as much as practicable. Demolition activity shall not be performed within the restricted hours. Currently under the Noise Control Ordinance, noise from the use of SPME and PME within restricted hours is governed by a Construction Noise Permit (CNP) system which is further discuses

c.Water

The discharge of wastewater from demolition sites requires a valid discharge license from the EPD and the application of such a license shall be made under the Water Pollution Control Ordinance (WPCO). Effluent shall be treated to the standards as stipulated in the license before discharge. The Registered Specialist Contractor (Demolition) shall maintain proper control of temporary water supply and an effective temporary drainage system.

d. Hazardous Materials

If removal of asbestos containing material is needed, an Asbestos Investigation Report (AIR) shall be submitted to EPD. An Asbestos Abatement Plan (AAP) shall be submitted at least 28 days before the asbestos abatement work commences. The asbestos abatement works shall be carried out in accordance with the Air Pollution Control Ordinance (APCO) and the Factories and Industrial Undertakings (Asbestos) Regulations before demolition. Other materials such as LPG cylinders in domestic flats, toxic and corrosive chemicals for industrial undertakings, and

any other hazardous materials have to be identified and properly handled and removed prior to the commencement of the demolition of the building.

The management of waste must fully comply with the Waste Disposal Ordinance. Additionally, management of waste which is classifiable as a chemical waste must also comply with the Waste Disposal (Chemical Waste) (General) Regulation. The Environmental Protection Department should be consulted if in case of doubt about the waste classification.

❖ **Environmental requirements** include:

- ✓ clean-up protection
- ✓ noise and dust
- ✓ vibration
- ✓ waste management

The environmental protection movement has contributed to the uncertainty for construction because of the inability to know what will be required and how long it will take to obtain approval from the regulatory agencies.

The requirements of continued re-evaluation of problems and the lack of definitive criteria which are practical have also resulted in added costs. Public safety regulations have similar effects, which have been most noticeable in the energy field involving nuclear power plant sand coal mining. The situation has created constantly shifting guidelines for engineers, constructor sand owners as projects move through the stages of planning to construction. These moving targets add a significant new dimension of uncertainty which can make it virtually impossible to schedule and complete work at budgeted cost. Economic conditions of the past decade have further reinforced the climate of uncertainty with high inflation and interest rates. The deregulation of financial institutions has also generated unanticipated problems related to the financing of construction.

Uncertainty stemming from regulatory agencies, environmental issues and financial aspects of construction should be at least mitigated or ideally eliminated. Owners are keenly interested in achieving some form of breakthrough that will lower the costs of projects and mitigate or eliminate lengthy delays. Such breakthroughs are seldom planned. Generally, they happen when the right conditions exist, such as when innovation is permitted or when a basis for incentive or reward exists.

However, there is a long way to go before a true partnership of all parties involved can be

forged. During periods of economic expansion, major capital expenditures are made by industries and bid up the cost of construction. In order to control costs, some owners attempt to use fixed price contracts so that the risks of unforeseen contingencies related to an overheated economy are passed on to contractors. However, contractors will raise their prices to compensate for the additional risks.

When the building is complete, these forces and reactions are in balance, and equilibrium and stability is achieved. The severance or removal of a load-carrying member may unbalance the forces, upset the equilibrium and cause collapse of the whole or that part of the building. There are particular problems in some newer buildings which are post-tensioned or unbounded stressed structures, or are structures which have been progressively stressed as construction proceeds.

Self-check -1	**Question related to plan and prepare**

Part -I Matching

Instruction: select the correct answer for the give choice. You have given 1 Minute for each question. Each question carries 2 Point.

A	B
---------1. Head protection	A. Mechanical demolition
---------2. Powered mobile plant	B. To modernize the existing structure
---------3. Structural demolition	C. Noise, air and pollution
---------4. Causes of demolition	D. Crane, excavator and bull dozer
---------5. Pressure jetting	E. Destructive energy
---------6.Tools used in manual demolition	F. Falling objects, overhead loads and sharp
---------7.Wrecking Ball method	G. Sledge hammer
	H. Beam, column, floor

Part II Multiple choice

Instruction: Answer all the questions listed below. Use the Answer sheet provided in the next page: (2points each)

1. In organizational safety policies and procedures, and project safety plan and may include.
   A. Handling of materials
   B. Hazard control
   C. Hazardous materials and substances
   D. All

2. Which types of PPE is used to protect eye
   A. Helmet
   B. Safety shoes or boots
   C. Goggle

3. _____Is the use of tape and signage to advise of the hazards and indicate access requirements.
   A. Soft Barricading
   B. Warning Tape and Warning Signs
   C. Danger Tape and Dangers Signs
   D. Solid Barricades

4. A new range of concrete sawing equipment has been developed to aid demolition.
   A. Overturning-Wire Rope Pulling
   B. Concrete sawing method
   C. Wrecking Balls
   D. Pusher arm technique
   E. All

5. Which of the Following (OHS) requirements
   A. Hazard control
   B. Handling of materials
   C. Working at heights
   D. Use of firefighting equipment
   E. All

Part III: Short Answer writing

Instruction: write short answer for the given question. You are provided 4 minute for each question and each point has Points.

1. Demolition work that is notifiable under the WHS Regulations involves?
2. Purpose Personal protective equipment (PPE)?
3. The principal causes of accidents during demolition?
4. Methods implementing of Barricading?

Unit Two: Demolish of structures

This unit to provide you the necessary information regarding the following content coverage and topics:

- Demolition area of building structure
- Risks of existing services.
- Preparatory work
- Demolition procedures
- Handle of Materials and building component
- Handle, store and stack materials and components.

This guide will also assist you to attain the learning outcomes stated. in the cover page

Specifically, Upon completion of this learning guide, you will be able to:

- Determine designed demolition area of building structure
- Identifying and managing risks of existing services.
- Complete preparatory work
- Carry out demolition procedures

- Determine handling materials and building component
- Understand Handle, store and stack materials and components

2.1. Demolition area of structure

2.1.1. Introduction of Demolition:

Demolition means tearing down, destruction, breakup, razing or removal of the whole or part of a building or structure, or of free standing machinery or equipment that is directly related to the function of the structure. Building demolition is the process of dismantling, destroying, or knocking down building structures along with the materials used in the construction of the property. A building is demolished for various reasons such as: it's past its span of serviceability, the structural integrity is compromised, parts of the establishment will need to be refurbished to improve its quality and value, or the property owner intends to sell a vacant lot.

If a building is not demolished when it needs to be, it can pose a significant threat and endanger not just the people occupying the property, but others in the vicinity as well. According to the Occupational Safety and Health Administration (OSHA), proper planning is crucial to ensuring that building demolitions are conducted without injuries and accidents. 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 reusing.

❖ **Causes of Demolition**

Demolition is carried out in following circumstance:

- **a.** When the structure has lost its stability.
- **b.** To build new structure in the existing place.
- **c.** To modernize the existing structure.
- **d.** When the structure has exceeded its life time and lost its structural properties.

2.1.2. Different Types of Demolition

I. **Total demolition**

As the name suggests this involves the demolition of an entire structure. This is mostly applied to the re-structure of a building. There are different methods to carry this type of demolition each of them is given below.

II. Implosion demolition

It is a form of demolition in which objects are destroyed by collapsing on themselves. This method employs the use of explosives to bring down high structures by undermining structural supports so that it collapses within their footprint or along a predetermined path. Depending on how the structure falls, there are two types of implosion:

a) Falling like a tree and Falling into its footprint. In this method instead of an explosion outwards, the force of the explosion is directed at critical support points, which are suddenly weakened making the weight of the building unstable. It collapses in a controlled manner.

III. **Chemical demolition –**

This method involves the use of concrete demolition powder, concrete breaking chemical, and concrete cracking chemical you can quickly and safely bring down large structures. This advanced concrete cracking agent has expansive power that demolishes even massive buildings with minimum effort and time. The concrete breaking powder is non-explosive and soundless. Chemical demolition without the use of explosives works safely and can be more cost-effective. There is no lengthy permitting process required, as opposed to blasting. The remainder of the structure is safe from vibration, and certain areas of valuable stone can be preserved.

IV. **Controlled demolition**

It is a demolition method that involves taking down buildings and structures in a safe, guided manner in order to achieve the best timely results. Most structures can't be taken down in a day, so when things are in the process of being demolished, a building must be taken down in sections to ensure that the remains are as stable as possible. Controlled demolition can be used for tall buildings, bridges, chimney stacks and cooling towers this type of demolition is done by diamond drilling and hydraulic concrete crunching.

V. Mechanical demolition

This method involves the use of specialized mechanical equipment and tools. These equipment include hydraulic excavators equipped with specialized attachments that can break concrete and steel to demolish the structure apart. The building with a greater height up to (6-7 story) cannot be demolished with the help of excavators or bulldozers. In such cases, cranes with wrecking balls are used to perform the demolition activity. The wrecking ball crack is attached with a huge steel ball hanging from a steel rope. The steel ball is pulled and released towards the building. High-reach arm machines can be used for projects of 20 meters.

The arm is telescopic and has demolition tools attached at the end; shear, hammer or crushers. This type of demolition is more precise than the crane and ball because specific demolition tools can be used on different building materials like steel or concrete.

VI. Selective demolition

This type of demolition includes removing specific parts of a building. Some old buildings stand the test of time and others don't. This method involves the removal of specific interior portions while protecting the remaining structure and exterior portions of a building protecting nearby structures and areas. For interior demolition, sledge hammers are used and for exterior demolition excavators, bulldozers or skid steers loaders are used.

VII. Interior demolition

This type of demolition involves the removal of specific interior buildings the method will vary based on whether you want to remove one or multiple sections from the buildings. This usually includes removal of walls, ceilings, pipes, etc.

VIII. Strip-out demolition

This method involves the careful dismantlement or deconstruction of a building or structure to preserve parts for reuse, refurbishment or recycling. In this type, careful dismantlement or deconstruction of a structure is done to preserve components for reuse.

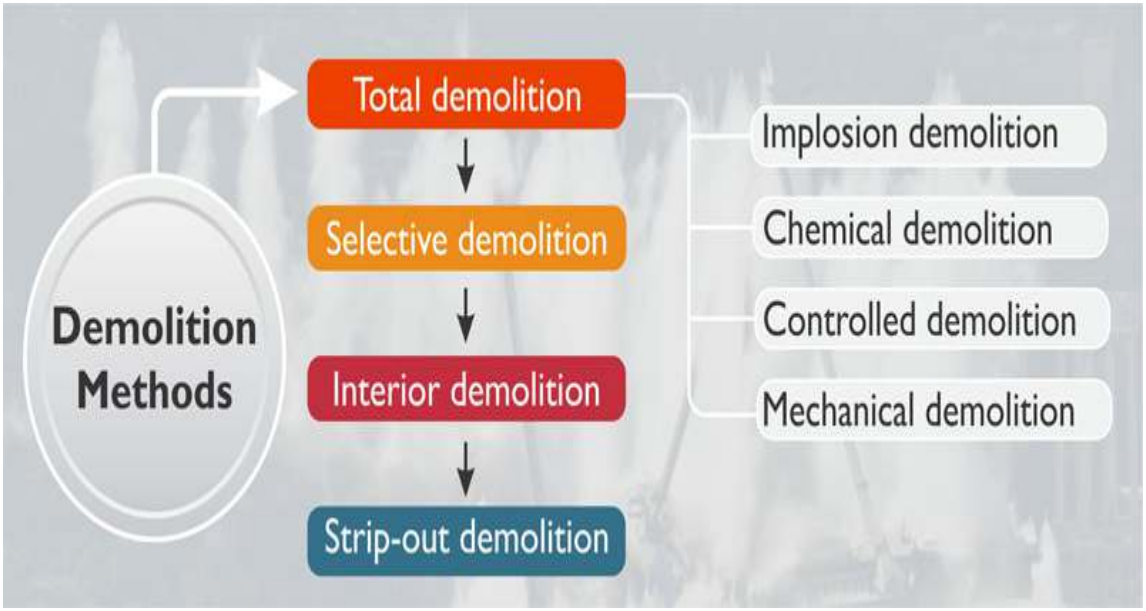


Figure 2.1 Demolation Methods

2.1.3. Demolition Methods for Buildings and other Structures

There are two types of demolition methods used for buildings and structures

1.Non-explosive demolition

2.Explosive demolition.

1. Non-explosive demolition

a.Sledge hammer:-

It is a small handheld hammer used for the demolition of small wall or single column.

Figure 2.2 Sledge hammer

b. High Reach Excavators

Figure 2.3 Excavators

Figure 2.4 Bulldozers

c. Wrecking Balls

The building with the greater height up to (6-7 story) cannot be demolished with the help of excavators or bulldozers. In such cases crane with wrecking balls are used to perform the demolition activity. The wrecking ball crack is crack attached with a huge steel ball hanging from a steel rope.The steel ball is pulled and released towards the building. The steel ball with force strikes the building and the part of the building is demolished. This method is not recommended as the trajectory of the steel ball cannot be controlled after it strikes the structure.

Figure 2.5 Wrecking Balls

d. High Reach Excavators

High Reach Excavator machines are used in the demolition of tall building where demolition by explosion is not possible. The building of height up to 300ft can be demolished by this type of machine. High reach excavators can be used for different use by doing some attachments such as: Excavators with shear attachments – excavators with shear attachments. Hydraulic hammers – Hydraulic hammers and remove steel reinforcement.

Figure 2.6 High Reach Excavators

e. Pusher arm Technique

Pusher arm technique Articulated, hydraulically-powered pusher-arm machines are normally mounted on a tracked or wheeled chassis, and have a toothed plate or hook for applying for applying horizontal force to a wall. The pusher arm method is not recommended for large buildings on confined sites but it is good for masonry in-filled structures. The building is pushed over in stages by a horizontal force from a machine, usually a back-acting excavator.

An arm is fitted instead of a bucket, and the crowd ram or the excavator's tracks gives the push. The machine should stand on a firm level base and apply force by a controlled movement of the pusher arm. This allows speedy and safe demolition


Figure 2.7 Pusher arm Technique

f. Overturning-Wire Rope Pulling:-

This method is the application of a horizontal force at a high level by pulling with wire ropes attached to winches or vehicles, and allowing the impact on overturning to demolish the building or structure an adequate steel cab or cage should protect the winch or the pulling vehicle and the operator. Building over 21m high should not normally be demolished by rope pulling.

Figure 2.8 Overturning-Wire Rope Pulling:

g. Concrete sawing method

Concrete sawing method a new range of concrete sawing equipment has been developed to aid demolition. These basically incorporate a suitable driving mechanism and appropriately designed diamond blade. The emphasis is on increasing the speed and efficiency of the equipment coupled with reduction in noise levels

Implosion is the process of demolition of a building using explosives. If the supports of the building are removed, the structure collapses.Using implosion technique, the main supports of the buildings such as column's, beams and slab are fixed with explosives. When these explosives are detonated, the column collapse and so is the structure.

Figure 2.9 Concrete sawing method

2.**Explosive demolition**

a. Falling like a tree

In this type of implosion, the building is made to fall like a tree to the sideward. This is the commonly used type of implosion. When free space is available besides the building, this type of demolition is prescribed.

If the free space is available on the left side of the building, the explosives are set on the lower level of the building on the left side columns. As the explosives are detonated, the columns bursts, the building tends to falls towards the left side. Steel cables are tied to the building to control the falling direction of the building.

Figure 2.10 Falling like a tree:

b. Falling into its own footprint

When the free spaces are not available around the building and the structure around the building are to be protected. This type of demolition is used. In this type of demolition, explosives are set in the floor below the middle part of the building.

Figure 2.11 falling into its own footprint

c. Thermic lance Technique;-

A thermal lance holder and oxygen supply are the major components of this technique. On ignition, a flame is produced in excess of 2500 o C, enough to melt reinforcement and concrete which aids demolition.

Figure 2.12 Thermic lance Technique

A number of holes are drilled along the desired line of separation and are filled to the brim with the slurry obtained by mixing the powder with water.

The slow and silent bursting force developed will induce stress levels of 300 kg/sq. cm. in a few hours. This causes development of cracks along the line joining the holes. The cracks continue to expand till disruption takes place.

a. Microwave Technique:

When microwave energy is passed into the mass, its transfer causes heat. This results in vaporization of the absorbed liquid. Concrete disintegrates in this process**.**

b. Concrete sawing method:

Concrete sawing method a new range of concrete sawing equipment has been developed to aid demolition. These basically incorporate a suitable driving mechanism and appropriately designed diamond blade. The emphasis is on increasing the speed and efficiency of the equipment coupled with reduction in noise levels.

c. Deliberate collapse method:

A surrounding clear area and exclusion zone are required to protect both personnel and property from the fall of the structure itself. The collapse is usually achieved either by removing key structural elements (e.g. with explosive charges) or by wire rope pulling at a high level to overturn. If the operation is not successful, the remaining structure may be extremely dangerous

for the completion of the demolition. This method is not usually appropriate for pre-stressed concrete except for simple pre-tensioned floor planks or slabs.

d. Overturning-Wire Rope Pulling:

This method is the application of a horizontal force at a high level by pulling with wire ropes attached to winches or vehicles, and allowing the impact on overturning to demolish the building or structure. An adequate steel cab or cage should protect the winch or the pulling vehicle and the operator. Building over 21m high should not normally be demolished by rope pulling. Overturning-Wire Rope Pulling

e. Pressure jetting;-

A new series of equipment and tools has been developed wherein the destructive energy of water can be utilized for constructive purposes. The jet heads are generally small and so can easily be manipulated without affecting steel.

The action of the jet is mainly to loosen the aggregate by washing out softer mortar.

Figure 2.13 Pressure jetting

Techniques of Demolition activity

- ✓ Manual Demolition Methods
- ✓ Mechanical Methods.
- ✓ Implosion Methods.
- ✓ Deconstruction Method

❖ **Classification of Demolition**

- Non-Structural Types: Dismantling of Doors, windows, flooring, cabinetry and appliances.
- Structural Types: Dismantling of Beams, columns, floors, Walls, roofs.

❖ **Mechanical demolition:**

Methods of Mechanical Demolition:

- ✓ Wrecking Ball method.
- ✓ Pusher arm technique.
- ✓ Thermic lance technique.
- ✓ Non-explosive demolition.
- ✓ Microwaves technique.
- ✓ Concrete sawing method
- ✓ Deliberate collapse method
- ✓ Pressure

2.2. Risks of existing services

The evolution of demolition industry in civil engineering has followed closely the developments in structural as a whole. An understanding of structural and material science is desirable to solve any problems regarding demolition risks. Today, demolition projects undertaken are complex in nature, demanding greater skill, experience and precision than ever before. New innovative advancements have been made to ensure safe operation and work that is more efficient

- **Risks associated with demolition**
  - Electricity
  - Gas
  - Telephone
  - Water
  - Falls from height.
  - Injury from falling materials.
  - Uncontrolled collapse.
  - Risks from connected services.
  - Traffic management.
  - Hazardous materials.
  - Noise and vibration.
  - Fire.
- **Existing Essential services**

Essential services mean services that supply:

a) Gas, water, sewerage, telecommunications, electricity and similar services, and
b) Chemicals, fuel and refrigerant in pipes or lines.

One of the most important elements of pre-demolition planning is the location and disconnection of all essential services. Essential services include the supply of gas, water,

sewerage, telecommunications, electricity, chemicals, fuel and refrigerant in pipes or lines. The principal contractor must ensure, so far as is reasonably practicable, that essential services at the workplace are without risks to health and safety. Construction work is defined by the WHS Regulations as 'high risk construction work' when carried out:

- On or near pressurized gas distribution mains or piping
- On or near chemical, fuel or refrigerant lines, and
- On or near energized electrical installations.

➢ **Plumbing line (sewer and supply)**

Sewer lines protect your home from sanitation issues and serious health risks, but over time vital piping will be threatened by clogs, tree roots, cracks, and other issues. When this happens, you could face serious sewage backups into your fixtures and drains, contaminating your home and exposing it to harmful odors. The best way to address these issues is with a thorough sewer line inspection, regular maintenance, and immediate repair service.

The following Sewer lines are often threatened by the following issues:

- Overgrown tree roots
- Corrosion from clay soil
- Clogs made of fats, oils, and grease
- Leaks caused by freezing temperatures
- Mold growth and sediment buildup

➢ **Electrical & telephone**

Underground electric facilities shall be routed so as to avoid open drainage ditches, creeks and marsh areas, or other areas that are environmentally sensitive, historically significant, or may hinder construction or operation of the electric system.

A. Location of cables and equipment the underground electrical system generally will run along front lot lines approximately 4 feet behind the property line.

B. Telephone& cable systems Telephone or cable TV lines shall not share feck's primary or secondary distribution ditch unless the telephone or cable company has a valid joint-trench agreement with feck.

Underground Essential Services**:** Where there are underground essential services that may be disturbed by the work, the demolition contractor must take all reasonable steps to obtain current information on the services prior to commencing work and:

- Have regard for the information
- Keep the information readily available for inspection under the WHS Act
- Make the information available to any principal contractor and subcontractors, and
- Retain the information until the excavation is completed or, if there is a modifiable incident relating to the excavation, 2 years after the incident occurs.

The available information about existing underground essential services may not be accurate. Therefore it is important that demolition methods include an initial examination of the area to be demolished.

❖ **Required to manage the risks associated with demolition work**

A person conducting a business or undertaking must manage risks associated with the carrying out of construction work.

- ✓ Identify reasonably foreseeable hazards that could give rise to the risk
- ✓ Eliminate the risk so far as is reasonably practicable
- ✓ If it is not reasonably practicable to eliminate the risk, minimize the risk
- ✓ Reasonably practicable by implementing control measures in accordance with the Hierarchy of risk control
- ✓ Maintain the implemented control measure so that it remains effective, and
- ✓ Review, and if necessary revise control measures so as to maintain, so far as is Reasonably practicable, a work environment

❖ **Assessing demolition the risks**

Under the WHS Regulations, a risk assessment is not mandatory for demolition work however it is required for specific situations, for example when working with asbestos or explosives. In many circumstances a risk assessment will assist in determining the control measures that should be implemented. It will help to:

- ❖ identify which workers are at risk of exposure
- ❖ determine what sources and processes are causing that risk
- ❖ identify if and what kind of control measures should be implemented

❖ Check the effectiveness of existing control measures.

❖ Safe Work Method Statements

If the demolition work is or involves high risk construction work, a person conducting a business or undertaking must prepare a SWMS before the work starts. The SWMS must:

- Identify the type of high risk construction work being done
- Specify the health and safety hazards and risks arising from that work
- Describe how the risks will be controlled
- Describe how the control measures will be implemented, monitored and reviewed

One SWMS can be prepared to cover all high risk construction work being carried out at the workplace by contractors and/or subcontractors. For example, demolition work might involve a number of types of high risk construction work, including work that:

- Involves a risk of a person falling more than 2 meters
- Involves, or is likely to involve, the disturbance of asbestos
- Involves structural alterations or repairs that require temporary support to prevent collapse
- Is carried out on or near a confined space
- Involves the use of explosives
- Is carried out on or near pressurized gas distribution mains or piping
- Is carried out on or near chemical, fuel or refrigerant lines
- Is carried out on or near energized electrical installations or services, and
- Is carried out at a workplace in which there is any movement of powered mobile plant.

In this case, the contractors or subcontractors can consult and cooperate to prepare one SWMS.

2.3. Preparatory work

Before starting the demolition of structures, when necessary, reinforcement must be provided for the parts that could collapse due to the strain produced by the work. These reinforcements can consist of normal supports or metallic carpentry or, if necessary, structural consolidation, restoring the original static conditions.

The building to be demolished is isolated from any adjacent buildings, which must not undergo any damage due to vibrations or shaking. Adjacent buildings and transit areas inside or outside the work site must be adequately protected with shielding or other devices.The removal

wooden roof structures involve the use of significant temporary works against the risk of the falling from above, both on the outer perimeter (scaffolding) and underneath (sub-scaffolding or protection nets). The elements removed are harnessed and removed with lifting equipment.

The removal of wooden floors first involves the removal of the covering, with the workers being harnessed and secured to sufficiently tight cables. The subsequent removal of the underlying frame is conducted with use of small plat forms or tower scaffolding. The operation involves the removal of nails of the secondary framework, of present, detachment or cutting of main beams and their subsequent removal.

The supporting walls (walls and pilasters) after being isolated are demolished with the same methods described for the demolition of filling walls and partitions, considering that external scaffolding must be separated only from the part of the masonry to be demolished.

The demolition of reinforced brick and cement brick floor slabs requires the application of the safety measures described for wooden floors: after clearing the area of the floors, demolishing blocks, vaults or large hollow flat tiles, the boards are removed or cut with a blow torch and reinforced concrete beams separated from the beams with demolition hammer and blow torch.

New technologies allow for the clearing of floor areas using mini excavators with hydraulic demolition hammers. The demolition of reinforced concrete beams involves the construction of stronger supports, with respect to the smaller beams, the sectioning and the subsequent removal with the crane. If the activities regard several floors, it is necessary avoid demolition at the same time.

The demolition of vaulting involves a different procedure according to the type, dealing with the side supports in the case of consecutive evaluating. In barrel vaulting demolition by front sections with the use of a platform underneath is used, while for cloister vaulting demolition follows a spiral course starting from the middle. The removal of protruding parts always requires effective supports which ensure that the operation can be conducted without the risk of sudden collapse. In particular, the problem occurs during the demolition of old buildings when the cornice is balanced by the weight of the roof or with stairs built with the steps inserted in the masonry: the operation is conducted with help of supporting equipment, scaffolding and tools for the demolition and detaching of elements.

The stairs, in general, are the last parts to be demolished in relation to the level reached for the maintenance of traffic. The workers involved in the demolition of the stairs work with safety belts and walkways on the stairs being demolished. The demolition of landings takes place subsequently with a similar procedure.

The metallic structures are demolished with inverse procedures with respect to their construction. The elements of the structure are removed with the use of the blowtorch, flexible tube and hand tools. The elements, after suitable harnessing, are lowered to the ground by use of lifting equipment.

2.4. Demolition Procedures

2.4.1. Preliminary Procedures:

The overall stability and the possible occurrence of unbalanced thrusts should be checked. All bracing members should be identified and protected to ensure that demolition is carried out in a sequence that maintains the stability and safety of the structure and adjacent works. The nature of the support or tail-loading of any cantilevered construction such as balconies, heavy cornices or stair case should be ascertained. Before demolition is commenced, the nature and condition of the concrete, the condition and position of reinforcement, and the possibility of lack of continuity of reinforcement should be ascertained. Trees or other plants should not be removed or cut without instructions. Trees to be retained should be protected from damage to branches and trunk by a suitable fence at least 1m from the bowl.

Demolition work involves many of the hazards associated with construction. However, demolition incurs additional hazards due to unknown factors such as: deviations from the structure's design introduced during construction, approved or unapproved modifications that changed the original design, materials hidden within structural members, and unknown strengths or weaknesses of construction materials.

If cranes are used to suspend loads that are to be cut and then lowered to the ground, it is important for the loads to be accurately calculated. It may be necessary to cut samples in order to determine the weight per unit length or area. Where this occurs, the safe working load of the crane should be reduced a similar approach should be followed where weights cannot be determined with reasonable consistency and accuracy.

2.4.2. Process of demolition works

I. Survey

A. Survey building

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
- ✓ The method of construction
- ✓ Drawing records
- ✓ Material survey
- ✓ Hazardous material
- ✓ Photograph of the building, surrounding buildings
- ✓ The height of the building, distance from nearby buildings
- ✓ Type of building

B. Structural surveying

- ✓ 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
- ✓ Drawing records
- ✓ Special structure
- ✓ Behavior of structure
- ✓ Structural support system
- ✓ Degree of deterioration

II.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

Figure 2.14 Removal of hazardous materials

III.Preparation of demolition plan for structures

- ✓ 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.

IV.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 maximize the reuse and recycling of recovered materials

Figure 2.15 Selective demolition

- ➢ **Demolition Plan include the following things:**
  - Plan showing the location of the building
  - Height of the building, structural system, the extent of damage
  - Details of structures around the building, height, etc.
  - Layout plan
  - The proposed method of demolition
  - Shopping and safety measures of surrounding buildings.
  - Safety Measures
  - Sequence of various steps of demolition work
  - Plan for handling and disposal of debris
  - Arrangements for site supervision, etc.
  - Details of machinery to be used in demolition

Figure 2.16 Procedures of demolition work

2.4.3. Demolition Building structure

- **Demolition of walls steps are:-**

While walls or sections of masonry are being demolished, it shall be ensured that they are not allowed to fall as single mass upon the floors of the building that are being demolished so as to exceed the safe carrying capacity of the floors. Overloading of floors shall be prevented by removing the accumulating debris through chutes or by other means immediately. The floor shall be inspected by the engineer-in charge before undertaking demolition work and if the same is found to be incapable to carry the load of the debris, necessary additional precautions shall be taken so as to prevent any possible unexpected collapse of the floor.

Walls shall be removed part by part. Stages shall be provided for the men to work on, if the walls are very thin and dangerous to work by standing over them.

- No section of wall whose height is more than 15 times of thickness, shall be permitted to stand without lateral bracing unless such wall is in good condition and was originally designed to stand without such lateral bracing or support.

- Structural or load supporting members on any floor shall not be cut or removed until all the stores above that floor have been demolished and removed.
- Before demolishing any interior or exterior wall within 3 m of the opening in the floor immediately below, such opening shall be substantially planked over, unless access is denied to workmen to that portion of the area of the floor immediately below the opening, in the floor of the story being demolished, where any debris pieces passing through this opening may fall.
- In framed structures, the steel frame may be left in place during demolition of masonry work. Where this is done, all steel beams, girders, etc., shall be cleared of all loose materials as the demolition of masonry work progress downward provided it is still strong enough to stand as an independent structure.
- Walkways shall be provided to enable workmen to reach or leave their work on any scaffold or wall. Such walkways shall be not less than 3 planks, nor less than 0.8 m in width. At the completion of each day's work, all walls shall be left stable to avoid any danger of getting overturned.
- Foundation walls which serve as retaining walls to support earth or adjoining structure, shall not be demolished until such an adjoining structure has been underpinned or braced and the earth removed by sheet piling or sheathing.

➢ **Demolition of floors**

➢ Demolition of floor steps are:-

a) In cutting holes in a floor which spans in one direction, a slit of width not exceeding 300 mm shall be cut at the first stage for the entire length of the slab along which it spans. The opening shall thereafter be increased to the desired width by suitable installments.
b) Planks of sufficient strength not less than 50 mm thick and 250 mm wide shall be provided at spacing not greater than 0.4 mm for the workmen to work. The length of planks shall not be less than 2 mm. These planks shall be so placed as to give workmen firm support to guard against any unexpected floor collapse.
c) Stringers of ample strength shall be installed to support the planks where necessary and the ends of such stringer shall be supported by floor beams, girders and not by floor slab alone.

d) When floors are being removed, no workmen shall be allowed to work in the area, directly underneath and such area shall be barricaded to prevent access to it.

e) The demolition of floor shall be started only after the floor in question and the surrounding floor area for a distance of 6.0 m have been entirely cleared of persons, and the debris and other unnecessary material removed.

f) Planks used for temporary protection shall be sound and at least 50 mm thick. They shall be laid close together with the ends having at least 100 mm bearing over solid support to prevent tipping under load. If corrugated GI Sheets are used for temporary protection, it shall be secured to the solid support with suitable framework.

- **Demolition of steel structures**

  - Demolition of steel structures steps are**:-**

a) When a derrick is used, care shall be taken to see that the floor on which it is supported is amply strong for the loading so imposed. If necessary, heavy planking shall be used to distribute the load to floor beam and girders.

b) Overloading of equipment shall not be allowed.

c) Tag lines shall be used on all materials being lowered or hoisted up and a standard signal system shall be used and the workmen instructed on the signals.

d) No person shall be permitted to ride the load line.

e) No beams shall be cut until precautions have been taken to prevent it from swinging freely and possibly striking any worker or equipment to any part of the structure being demolished.

f) All structural steel members shall be lowered from the building and shall not be allowed to drop.

- **Demolition of exterior walls of multistory structures**

  - Demolition of exterior walls of multistory structures steps are:

a) In demolition of exterior walls of multistoried structure, it is advisable to provide catch plat form of heavy planking to prevent injuries to the worker working below and to the public, when the external walls are more than 20 m in height.

b) Such catch platform shall be constructed and maintained not more than 3 stores below the story from which exterior wall is being demolished. When demolition has progressed to within 3 stores of ground level, catch platform will not be considered necessary.

c) Catch platforms shall not be less than 1.5 m in width measured in a horizontal direction from the face of the structure and shall consist of outriggers and planks. Planks shall be laid tight together, without openings between them and the walls. Catch platform shall be provided with a continuous solid parapet along its outer edge of at least 1 m height. The parapet shall be constructed of the same specification as the platform.

d) Catch platform can be constructed of material other than wood also, provided such material is of equal strength.

e) Catch platform shall be capable of sustaining a live load of not less than 6 100 N/m2.

f) The outriggers shall be of ample strength and shall not be spaced more than 3 m apart.

g) Materials shall not be dumped on catch platform nor shall such catch platform be used for the storage of materials.

➢ **Demolishing of Roof trusses**

➢ Demolition of Roof trusses steps are**:-**

a) If a building has a pitched roof, the roof structure should be removed to wall plate level by hand methods. Sufficient purlins and bracing should be retained to ensure stability of the remaining roof trusses while each individual truss is removed progressively

b) Temporary bracing should be added, where necessary, to maintain stability. The end frame opposite to the end where dismantling is commenced, or a convenient intermediate frame should be independently and securely guyed in both directions before work starts.

c) On no account should the bottom tie of roof trusses be cut until the principal rafters are prevented from making outward movement.

Demolishing of Heavy floor beams

Heavy baulks of timber and steel beams should be supported before cutting at the extremities and should then be lowered to a safe working place.

➢ **Demolishing of Jack arches**

Where tie rods are present between main supporting beams, these should not be cut until after the arch or series of arches in the floor have been removed. Particular care should be exercised and full examination of this type of structure undertaken before demolition is commenced. The floor should be demolished in strips parallel to the span of the arch rings (at right angles to the main floor beams)

❖ **Demolishing of Brick arches**

a) Expert advice should be obtained and, at all stages of the demolition, the closest supervision should be given by persons fully experienced and conversant with the type of work to ensure that the structure is stable at all times.
b) As much dead load as possible may be removed provided it does not interfere with the stability of the main arch rings but it should be noted that the load-carrying capacity of many old arches relies on the filing between the spandrels. On no account should the restraining influence of the abutments be removed before the dead load of the spandrel fill and the arch rings are removed.
c) Special temporary support shall be provided in the case of skew bridges.
d) A single span arch can be demolished by hand by cutting narrow segments progressively from each springing parallel to the span of the arch, until the width of the arch has been reduced to a minimum which can then be collapsed.
e) Where it is impossible to allow debris to fall to the ground below, centering designed to carry the load should be erected and the arch demolished progressively. The design of the centering should make appropriate allowance for impact.
f) Where deliberate collapse is feasible the crown may be broken by the demolition ball while working progressively from edges to the center.
g) Where feasible and appropriate, collapse of the structure can be affected in one action by the use of explosives. Charges should be inserted into boreholes drilled in both arch and abutments. This method is the most effective for demolition of tall viaducts.
h) In multi-span arches before individual spans are removed, lateral restraint should be provided at the springing level. Demolition may then proceed as for a single span; care being taken to demolish the spandrels down to the springing line as the work proceeds.

Where explosives are used it is preferable to ensure the collapse of the whole structure in one operation to obviate the chance of leaving unstable portions standing.

➢ **Demolishing of Cantilevers (not part of a framed structure)**

A cantilever type of construction depends for its stability on the superimposed structure. Canopies, cornices, staircases and balconies should be demolished or supported before the tailing down load is removed.

1) Demolition will coordinate and acquire all necessary permits (such as building permit and public space permit) to perform this work. Once permits are obtained they will be posted on-site.
2) Miss Utility will be notified at least 48 hours prior to commencement of any work.
3) Temporary fencing shall be erected by others.
4) Prior to demolition DSI will perform an engineering survey of the structure to determine structural hazards. The survey will be conducted by a registered Professional Engineer. Prior to demolition DSI will perform an environmental survey of the structure. This will include asbestos and lead based paint.
5) Prior to beginning work DSI will obtain a copy of the Site-Specific Work Plan for 4825 Glenbrook Road Remedial Action. The demolition activities will be performed in accordance with the Parsons' Accident Prevention Plans included in the 4825 Glenbrook Road Site-Specific Work Plan for Remedial Action.
6) Prior to demolition DSI will disconnect all utility lines (including electrical, gas, water, and sewer) at property line and remove universal waste stream (i.e. light bulbs and ballast). Utility lines will be capped at the property line. Any overhead power lines will be de energized or protected according to Miss Utility's procedures.
7) Prior to demolition, the AC units will be removed and Freon from these units will be collected by a licensed company. The collection of Freon will be documented and a close out report will be provided to the owner. *See attached AHA provided by Freon Recovery Company.
8) Pre-demolition meeting will be held onsite.
9) Access to the site will be restricted to authorized personnel only and patrolled by a contracted security guard after hours. Privacy fencing will be installed along Glenbrook

Road and around the perimeter of the Parsons Command Post compound. After hours and on weekends, access points to the site will be locked with a key and key log will be maintained by the Parsons Site Manager. Portable restrooms will be available to site workers as needed.

10) All demolition activities shall be conducted with minimal disruption to the community. Dust will be controlled by wet demo methods. Water will be supplied by an on-site water supply/source. Noise will be controlled by working within the allowed hours of operations for the community. Normal working hours are 7am to 4pm M-F.
11) Demolition activities cannot disturb soil surfaces surrounding the structure. Any part of the building which comes into contact with subsurface material is to remain in place. This will include but is not limited to the basement walls on the west, south, and east side of the building. No demolition of the residence is to be performed below the slab of the house. The entire wall on the north side of the building (where the garage doors are located), including the basement wall, will be knocked down to the slab. The basement supporting walls will remain intact (i.e., do not remove structural or load bearing walls that support the exterior basement walls.
12) Structural demolition will be performed systematically from top of building to bottom, using a 200 series Track Excavator (73,000 LBS). All demolition shall be conducted using the mentioned equipment. All hand work will be conducted from the ground such as separation of wood debris from metal or concrete. Heavy equipment will enter the property from the driveway entrance and locate in the driveway in front of the garage for the demolition activities.
13) All construction debris will be hauled offsite using roll offs and/or demo trailers 15. Construction debris will be taken to an appropriate landfill. All metals, concrete, and brick will be taken to a recycler.
14) The site will be cleaned and cleared before departing each day to the approval of the Parsons Site Manager. If at any time materials cannot be hauled off site before departing for the day materials will be neatly stored and secured.
15) D company will provide traffic controls to conduct demolition activities. Traffic controls will be conducted during loading and unloading of equipment and haul trucks or at times

when traffic will be impacted due to demolition activities. Traffic controls will be set up as two man operation using stop and slow signs to direct traffic. The traffic controllers will be required to wear Class III high visible vest. Approximately 50 trips are estimated for the demolition effort.

2.5. Handling of Materials and Building Component

Demolition Debris will be separated into four (4) waste streams.

They are:

a) Construction Debris (i.e. wood, trash)

b) Masonry materials (i.e. brick, concrete block)

c) Metals

d) Universal waste (I.e. fluorescent bulbs, ballast, and mercury containing switches) Construction debris will be separated and disposed of at East End Landfill and Cox's Darby town Road Landfill in accordance with all Local, State, and Federal guidelines. The disposal permits are included in the attachments.

Concrete, masonry, and metal materials will be hauled to a recycler.

If any universal wastes (fluorescent bulbs, ballasts, mercury switches) are identified, they will be disposed of along with any identified environmental waste as determined by the environmental survey performed prior to demolition. The waste will first be transported to the Interim Holding Facility on the federal property for temporary storage, and then transport to an approved disposal facility selected based on the environmental survey results. All waste streams will be disposed of in accordance with all Local, State, and Federal guide lines. The receipt will indicate the date of receipt, and the quantity of material received. The receipt will also indicate the condition of the materials as delivered to the landfill and the location where the debris will finally rest.

❖ **Cranes in demolition**

A cast-steel ball or weight suspended from a crane jib is an extensively used method of demolition. Cranes as such are not designed for extremes of shock loading likely to arise when a demolition ball is in use and therefore should be used only to drop the ball vertically on a free fall for such operations as breaking up concrete slabs. They should not be used for swinging the

ball. Excavators which are convertible to cranes are designed for drag-line operations which impose a shock load and are more suited to use with a ball.

The excavator manufacturer's recommendations as to weight and attachment of the ball should be followed. Generally the weight of the demolition ball should not be more than 33 per cent of the machine's safe working load and not exceed 10 per cent of the hoist rope's minimum breaking load. All parts should be inspected twice daily, and a high standard of maintenance is necessary. As an operator you need to be familiar with demolition balling and should be protected from debris by a protective structure with safety glass or metal mesh.

2.6. Handle, Store and Stack materials and components

- **Slate**: It is locally available and found in abundance in that region. It is a suitable material for construction in that climate, slate provides with sufficient insulation and strength to the structure. It is used for raising the superstructure and as roof cladding.
- **Clay**: The soil is clayey in that region which makes it a suitable material for making handmade sundried bricks. Mostly slate is used for constructing the walls but when it becomes hard to transport the material from the quarry to the construction; handmade bricks are preferred over slate for construction. Construction of such kind requires more maintenance and becomes a more costly alternative in the longer run, so they prefer building with slate rather than sundried bricks whenever possible.
- **Insulation**: For insulating the walls of the houses, waste rubber tires and other rubber based products are used. The tires and similar waste products which have been discarded; which are ready to go the landfill are cut and turned into small bits and pieces. These are then compressed and used as insulation for the buildings.
- **Foundations**: Foundations of prior construction which have been demolished or deconstructed are used again for new projects. Foundations are the part of the whole project where concrete is used in maximum quantity, by reusing them we save on lot of new materials and energy. By saving on such things, the project becomes very cost efficient and successful.
- **Doors and Windows:** Doors and windows from dismantled houses are reused whenever they are available. In this region, the population is scarce and people generally have fewer funds. Thus, they prefer to renovate their homes rather than building new ones.

This becomes a problem as there are very less times when the doors and windows are available in the right quantity of what they are required.

- **Gutters**: Mild steel is required for casting gutters in the houses. They try to reuse as much as possible but when they do not have the supply, buying scrap metal and molding it into the gutter is preferred over buying new prefabricated sections. Reusing such materials and features saves lots of resources in turn making the project cost efficient. They prefer to reuse as much as possible and build with naturally occurring locally available materials.
- **Removal**: Tapes and barricades must be removed once they are no longer required. The person who erected the barricade shall ensure it is removed and the area left is a safe condition. Where the person who erected the barricade is not contactable, approval shall be obtained by Site Management or Operator leads / supervisors.

Self-check-2	Demolish of structures

Part I Multiple choice

Instruction: Answer all the questions listed below. (2points each)

1. The Causes of Demolition**?**
   A. When the structure has lost its stability.
   B. To build new structure in the existing place.
   C. To modernize the existing structure.
   D. When the structure has exceeded its life time and lost its structural properties
   E. All
2. _____It is a form of demolition in which objects are destroyed by collapsing on themselves?
   A. Controlled demolition
   B. Mechanical demolition
   C. Chemical demolition
   D. Implosion demolition
   E. Selective demolition
3. Which of the following Demolition Risks of existing services?
   A. Gas
   B. Telephone and other communications
   C. Electricity
   D. Water
   E. All
4. Safe Work Method Statements (SWMS) can be prepared to cover all high risk construction work being carried out?
   A. Person falling more than two meters.
   B. Involves the use of explosives.
   C. Involve, the disturbance of asbestos.
   D. Involve, the disturbance of asbestos.
   E. All

5. One of Construction work is defined by the WHS Regulations as 'high risk construction work' when carried out?
   A. On or near pressurized gas distribution mains or piping.
   B. On or near chemical, fuel or refrigerant lines.
   C. On or near energized electrical installations.
   D. All
6. _____Deconstruction presents demolition uses carefully planned sequenced activities that separate and sort the materials within a building?
   A. Preparation of demolition plan for structures.
   B. Preparation of demolition plan for structures.
   C. Selective demolition.
   D. None.
   E. All
7. One of the following is not Tools used manual demolition?
   A. Sledge hammer
   B. Jack hammers
   C. Drills Manual Demolition
   D. Thermic lance
   E. All
8. Assessing demolition the risks it will help to_____?
   A. Identify which workers are at risk of exposure.
   B. Determine what sources and processes are causing that risk.
   C. Check the effectiveness of existing control measures.
   D. A and B
   E. All

Test II True or False

1. If a Building has a pitched roof, the roof structure should be removed to wall plate level by hand methods.
2. Building construction is the process of dismantling, destroying, or knocking down building structures along with the materials used in the construction of the property
3. Implosion demolition it is a form of demolition in which objects are destroyed by collapsing on themselves
4. Thermic lance Technique thermal lance holder and oxygen supply on ignition, a flame is produced in excess of 2500 o C, enough to melt reinforcement and concrete which aids demolition.
5. Completing preparatory work before starting the demolition of structures, when necessary, reinforcement must be provided for the parts that could collapse due to the strain produced by the work
6. Before starting the demolition of structures, when necessary, reinforcement must be provided for the parts that could collapse due to the strain produced by the work.
7. In Structural demolition temporary fencing shall be erected.

Test III: Short Answer writing

Instruction: write short answer for the given question. You are provided 3 minute for each question and each point has 5Points.

1.What is the purpose of Demolition?
2.Write down at least five process demolition?
3.What is the determination handling material?
4. What are Hazardous Materials?
5. Write salvaged materials for demolish construction?

Operation sheet-2	Demolishing of structures

Operation Title : Caring out demolition structure

Purpose: - To know Demolish building structure.

1. **Instruction**: - Demolition simple building structure like floor, wall, Columns, mass concrete structures etc. Using the right tools to perform your task within the given time. You have given 1.15hr for the task.

Equipment and Tools

- Jack hammer.
- Tape.
- Demolition hammer.
- Diamond wire saw.
- Hydraulic hammer

Precaution:-

- Asbestos Surveys
- (PPE) must be worn
- Monitor noise, vibration and dust
- Manage traffic movement
- Be Aware of proximity to plant
- Manage waste disposal
- Clean site is a safe site

Procedures for

Step1. Drilling the structure by jack hammer

Step2. By using Demolition hammer hammering structure

Step3. Spraying water to the structure

Step 4. Repeat stepe1

Step 5. Collect demolition material

Step 6. Clean working area

Lap Test-2	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within **1.15hr**. The project is expected from each student to do it.

Task 1: Carry out demolition structure

Unit Three: Clean up

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Clear Work area
- Dispose, reuse or recycle materials
- Cleaning, checking, maintaining and storing plant, tools and equipment

This guide will also assist you to attain the learning outcomes stated. in the cover page

Specifically, Upon completion of this learning guide, you will be able to:

- Apply Clear Work area
- Execute Dispose, reusing or recycling materials
- Follow and confirm , maintaining and storing plant, tools and equipment

3.1. Clearing Work Area

Before starting a demolition, the person or persons in charge must adequately prepare for the task with regard to the health and safety of the workers. These preparatory operations involve the overall planning of the demolition job, including the methods to be used to bring the structure down, the equipment necessary to do the job, and the measures to be taken to perform the work safely.

Before doing demolition work, inspect available personal protective equipment (PPE), and select, wear and use the PPE appropriate for the task. Demolition work involves many of the same hazards associated with construction work. However, demolition also poses additional hazards due to unknown factors such as:

- ✓ Deviations from the structure's original design,
- ✓ Approved or unapproved modifications that altered the original design,
- ✓ Materials hidden within structural members, and
- ✓ Unknown strengths or weaknesses of damaged materials.

To counter these unknowns, all personnel involved in a demolition project need to be fully aware of these types of hazards and the safety precautions available to control these hazards.
Before starting a demolition, the person or persons in charge must adequately prepare for the task with regard to the health and safety of the workers. These preparatory operations involve the overall planning of the demolition job, including the methods to be used to bring the structure down, the equipment necessary to do the job, and the measures to be taken to perform the work safely. Before doing demolition work, inspect available personal protective equipment (PPE), and select, wear and use the PPE appropriate for the task.

Demolition work involves many of the same hazards associated with construction work. However, demolition also poses additional hazards due to unknown factors such as: deviations from the structure's original design, approved or unapproved modifications that altered the original design, materials hidden within structural members, and unknown strengths or weaknesses of damaged materials. To counter these unknowns, all personnel involved in a demolition project need to be fully aware of these types of hazards and the safety precautions available to control these hazards.

❖ Preliminary Tasks

A written engineering survey must be performed on each structure being considered for demolition to determine the condition of the framing, floors and walls, and to assess the possibility of an unplanned collapse of any portion of the structure. Brace or shore the walls and floors of structures which have been damaged and which employees must enter. Inspect and maintain all stairs, passageways and ladders. Properly illuminate all stairways.

Shut off or cap all electric, gas, water, steam, sewer and other service lines outside the building line. Notify appropriate utility companies. Temporarily relocate and protect any essential power, water, or other utilities.

Determine the types of hazardous chemicals, gases, explosives, and flammable materials which have been used in any pipes, tanks, or other equipment on the property. Test and purge the hazardous chemicals, gases, explosives, or flammable materials. Survey for asbestos or other hazardous materials.

Guard wall openings to a height of 42 inches. Cover and secure floor openings with material able to withstand the loads likely to be imposed. Debris dropped through holes in the floor without the use of chutes must be completely enclosed with barricades not less than 42 inches high and not less than 6 feet back from the projected edge of the opening above.

Post signs at each level of structures, warning of the hazard of falling materials. Protect entrances to multi-story structures with sidewalk sheds or canopies for a minimum of 8 feet. Canopies must be at least 2 feet wider than the structure entrance and be able to hold a load of 150 lbs. /sq. ft. Storage of material and debris must not exceed the allowable floor load.

Chutes

Debris waste and other materials shall not be thrown, tipped or shot down from a height where they are liable to cause injury to any person on or near the site. Existing lift shaft, light well and openings on floor may be used to convey debris down the building floors. Areas adjacent to the openings of these features used as a chute shall be barricaded when they are not in use. Warning signs shall be posted to prevent workers from entering the area. As an option, plastic chutes may be used inside the floor openings and lift wells to minimize noise and confine the falling debris.

a) Lift Shaft

Lift shaft may be used to convey debris inside the building. The openings to the elevator shall be adequately enclosed to prevent spilling out of debris.

b) Light Well

All the glass windows in the light well shall be taken out or protected before using the light well for conveyance of debris in order to minimize any dangerous situation.

c) Opening on Floor

Openings on the floor may be used to convey debris. If openings are created on the floor, the total openings shall be less than 25% of the total aggregate floor area. Each opening shall not be larger than 900 mm × 900 mm unless otherwise substantiated with structural justifications with regard to the safety of the remaining structure and minimizing the possible risks arising from the impact force induced. Openings shall not cut through structural support elements that may affect the stability of any structural components.

d) Exterior Chutes

No demolition materials shall be allowed to fall freely outside the building unless it is confined within a chute. If exterior chutes are used, adequate clear spaces shall be provided for their operation. Temporary refuse chutes, assembled from old metal barrels shall not be used. The chutes shall not cause any obstruction to the public. A dust barrier shall be provided if the chute outlet is near public access. The chute shall be designed and constructed with adequate strength and support to allow safe conveyance of debris.

3.2. Dispose, Reuse or Recycle Materials

Nowadays, due to globally increasing building densities in cities, demolition works are an inherent part of construction. And they are focal activities related to life-cycle-oriented management of construction materials, which aims at drastically reduce the deployment and consumption of primary non-renewable construction materials. To give an overview on related worldwide existing activities, the state of the art of demolition and of reuse and recycling of construction materials is summarized in a report of selected countries based on reports of these countries. Within this report, first typical structures of the demolition and recycling industry in

different countries, typical phases of demolition and recycling processes and involved stakeholders with their characteristic competencies are described.

Secondly, leading companies, associations and research institutions in selected countries are outlined. Leading processes are identified by distinguishing between design processes for deconstruction, deconstruction processes on-site and innovative on-site and off-site recycling processes.

Thirdly, challenges related to demolition and reuse and recycling of construction materials are identified and analyzed in terms of technical, economic, ecologic, organizational and educational and political/legal challenges. Finally, single, country specific, already existing approaches to meet these challenges are identified

3.2.1. Debris Recycling

Better site management and practice would not only prevent the mixing of the inert portion together with the non-inert portion of construction and demolition waste, but could also facilitate and allow on site sorting, and separation at source of construction and demolition waste. The method of 'selective demolition' should be adopted as far as practicable. It involves demolition and removal of wastes of the same category one at a time. The goal is to facilitate recycling of wastes for beneficial reuse, thus minimizing the burden on municipal landfills and public filling areas.

In general, domestic wastes such as furniture, household appliances, etc., metal components such as window frames, pipes, etc., timber components such as doors, wooden floors, etc., other wastes such as tiles, asphaltic materials, 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.

The sequence of demolition shall be planned to allow the separation and sorting of building materials.

Concrete and/or brick debris shall be broken down into smaller sizes and separated from reinforced steel for disposal. Concrete debris may be pulverized into aggregate size and used for road base, temporary haul roads, fill materials or aggregates for concrete. Old bricks may be salvaged for reuse as architectural features or other uses. Broken concrete may be disposed of at construction and demolition materials recycling facilities for processing into recycled products

and aggregates for beneficial reuse. In the event that broken concrete is mixed with some other wastes, broken concrete should be sorted out on site from the mixture of wastes, before disposal at C&D materials recycling facilities. As regards the way for facilitating the recycling of broken concrete, Authorized Persons / Registered Structural Engineers may seek advice from Civil Engineering and Development Department during the planning stage for demolition.

❖ **C&D Materials**

C&D materials are generated when new building and civil-engineering structures are built and when existing buildings and civil-engineering structures are renovated or demolished (including deconstruction activities). Civil-engineering structures include public works projects, such as streets and highways, bridges, utility plants, piers, and dams.

C&D materials often contain bulky, heavy materials such as:

- Concrete
- Wood (from buildings)
- Asphalt (from roads and roofing shingles)
- Gypsum (the main component of drywall)
- Metals
- Bricks
- Glass
- Plastics
- Salvaged building components (doors, windows, and plumbing fixtures)
- Trees, stumps, earth, and rock from clearing sites

3.2.2. Debris Disposal and Management System

To avoid accumulation of debris and to make sure that they are disposed of promptly, the Authorized Person / Registered Structural Engineer should ensure that a debris disposal and management system is prepared and implemented by the Registered Specialist Contractor Demolition.

The debris disposal and management system should clearly lay down the following details:

a) Method of handling demolished building debris;
b) The routing and movement of debris from each floor to on grade holding area prior to leaving the site;
c) Means of transportation of debris off site;
d) Time and frequency of debris disposal off site;

e) Record scheme on the tonnage of each truck load, truck license plate, driver's name, trip tickets and location of dump site; and the site supervisory personnel responsible for the debris management system

❖ **Recycling and Reuse**

The use of these materials basically depends on their separation and condition of the separated material. A majority of these materials are durable and therefore, have a high potential of reuse. It would, however, be desirable to have quality standards for the recycled materials. Construction and demolition waste can be used in the following manner: ·

- Reuse (at site) of bricks, stone slabs, timber, conduits, piping railings etc. to the extent possible and depending upon their condition. ·
- Sale / auction of material which cannot be used at the site due to design constraint or change in design. ·
- Plastics, broken glass, scrap metal etc. can be used by recycling industries. ·
- Rubble, brick bats, broken plaster/concrete pieces etc. can be used for building activity, such as, leveling, under coat of lanes where the traffic does not constitute of heavy moving loads. ·
- Larger unusable pieces can be sent for filling up low-lying areas. ·
- Fine material, such as, sand, dust etc. can be used as cover material over sanitary landfill.

❖ **Deconstruction for Reuse**

Deconstruction is the process of carefully dismantling buildings to salvage components for reuse and recycling. Deconstruction can be applied on a number of levels to salvage usable Materials and significantly cut waste.

➢ **Deconstruction has many benefits, including the following**:

- Maximizes the recovery of materials.
- Conserves finite, old-growth forest resources.
- Provides many employment and job training opportunities.
- When coupled with traditional demolition methods, allows communities to create local economic activities around manufacturing or reprocessing salvaged materials.
- Diverts demolition debris bound for disposal
- Preserves resources through reuse.

- **Main C&D Recovery Streams**

Reuse—many materials can be salvaged from demolition and renovation sites and sold, donated, stored for later use, or reused on the current project. Typical materials suitable for reuse include plumbing fixtures, doors, cabinets, windows, carpet, brick, light fixtures, ceiling and floor tiles, wood, HVAC equipment, and decorative items (including fireplaces and stonework).

Recycling—Materials can either be recycled onsite into new construction or offsite at a C&D processor. Typical materials recycled from building sites include metal, lumber, asphalt, pavement (from parking lots), and concrete, roofing materials, corrugated cardboard and wallboard

3.3. Cleaning, checking, maintaining and storing plant, tools and equipment

A person with management or control of plant at a workplace, who may be a principal contractor or demolition contractor, must:

- Take all reasonable steps to ensure the plant is only used for the purpose for which it is designed unless the person has assessed that the proposed use does no increase the risk to health and safety.
- In determining whether or not the proposed use of plant increases the risk to health and safety, ensure that the risk associated with the proposed use is assessed by a competent person, and
- Take all reasonable steps to ensure that all safety features, warning devices, guarding, operational controls, emergency stops are used in accordance with instructions and information provided by the person.

❖ A person with management or control of plant at a workplace, who may be a principal contractor or demolition contractor, should ensure:

- Plant is used and operated by a competent person
- Appropriate guards and operator protective devices are fitted
- The safe working load is displayed and load measurement devices are operating correctly
- The ground is prepared to place plant, especially if the terrain is uneven

- Plant is maintained in accordance with the manufacturer's or supplier's instructions of both, and relevant Australian Standards where necessary, and
- Manufacturer's recommendations for the safe use and storage of oxyacetylene cutting equipment are referred to.

❖ **Powered mobile plant**

The person with management or control of powered mobile plant such as cranes, excavators and bulldozers, must ensure a SWMS is prepared before work commences.

A SWMS must be prepared for excavation work involving the use of powered mobile plant.

A high risk work license is required to operate some types of powered mobile plant, such as some cranes, elevating work platforms and forklifts. Whenever powered mobile plant is to be used for demolition work, traffic management arrangements must be implemented to prevent collisions, for example with pedestrians or other mobile plant. All equipment shall be tested and examined before use. They shall be properly stored and maintained. The equipment shall be inspected daily and results of the inspection shall be recorded accordingly. A detailed safety instruction shall be provided to cater for specific situations of the project, if necessary

Self-check-3	Clean up

Test I Multiple choice

Instruction: Answer all the questions listed below. (2points each)

1. Factors of demolition hazards associated are?
   A. Deviations from the structure's original design,
   B. Approved or unapproved modifications that altered the original design
   C. Materials hidden within structural members
   D. All
2. Debris disposal and management system is including
   A. Means of transportation of debris off site;
   B. time and frequency of debris disposal off site
   C. Method of handling demolished building debris.
   D. All

1. The total Openings on the floor may be used to convey debris openings shall be less than _____ of the total aggregate floor area.
   A. 10%
   B. 20%
   C. 25%
   D. 5%
2. Written engineering survey must be performed on each structure being considered for demolition to determine the condition of the framing, floors and walls, and to assess the possibility of an unplanned collapse of any portion of the structure.
   A. Preliminary Tasks
   B. Derbies
   C. Hazardous materials.
   D. All

3._____ be used to convey debris inside the building

A. Light Well

B. Lift shaft
C. Exterior Chutes
D. Debris Recycling
E. All

4. Which of the following are not are not C and D Material?
   A. Metals
   B. Bricks
   C. Glass
   D. Plastics
   E. All
5. The person with management or control of powered mobile plant such as cranes, excavators and bulldozers, must ensure_____?
   A. PPE
   B. SWMS
   C. CNP
   D. Safety

Test II: short Answer writing

Instruction: write short answer for the given question. You are provided 3 minute for each question and each point has Points.

3.Write management or control of plant at principal workplace demolishing

4. What is successful maintenance program?

5.Before doing demolition work, inspect available personal protective equipment (PPE), and select, wear and use the PPE appropriate for the task.

6.The principal causes of accidents during demolition?

7.Write about debris disposal and management system?

Test II: say True or False

1. Before starting a demolition, the person or persons in charge must adequately prepare for the task with regard to the health and safety of the workers

2. The person with management or control of powered mobile plant such as cranes, excavators and bulldozers, must ensure a SWMS is prepared after work commences.

3. Concrete debris may be pulverized into aggregate size and used for road base, temporary haul roads, fill materials or aggregates for concrete.

4. A high risk work license is required to operate some types of powered mobile plant, such as some cranes, elevating work platforms and forklifts

5. Demolition work involves many of the same hazards associated with construction work.

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MINISTRY OF LABOR
AND SKILLS


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