DRAFT CODE OF PRACTICE FOR DEMOLITION OF BUILDINGS

建築物拆卸作业守则暨稿

Buildings Department
This book was received in accordance with the Books Registration Ordinance Section 4
Foreword

There has been an increase in building demolition activities in Hong Kong as more buildings erected in the 60’s and 70’s are put down to give way for new developments in busy urban areas. Nowadays, buildings to be demolished include high-rise buildings of various structural forms and construction materials. Better planning, control, and selection of the appropriate demolition method and precautionary measures are required to cope with the increasing size and complexity of buildings to be demolished.

Demolition is a skilled and potentially dangerous operation. This draft Code is issued to provide guidance on safe and good practices for demolition works and for compliance with the requirements of the relevant provisions of the Building (Administration) Regulations and Building (Demolition Works) Regulations relating to demolition works. Therefore, this draft Code should be read and used in conjunction with the Buildings Ordinance and the aforesaid Regulations when preparing demolition plans for approval by the Building Authority.

This draft Code includes basic information for consideration of selecting the appropriate method of demolition of different types of structures and provides a basis for a logical approach to safe procedures and advice on safety precautions. The methods of demolition covered in this code are for the consideration of practitioners in planning their demolition works. Practitioners must exercise their own professional judgement when selecting the most suitable method, taking into account the particular construction condition, previous use and age of the structure to be demolished, and the special conditions of the site and its surroundings to ensure safety. Practitioners’ attention is drawn to the relevant provisions of the Buildings Ordinance and Regulations requiring the submission of demolition plan and obtaining the approval of the Building Authority for the demolition method adopted in each case.

This draft Code is now issued as a draft document for trial use for a period of one year. It will be replaced by a finalised edition when it has been reviewed through experience gained in its application.

Comments to improve the draft Code are welcome and should be sent to the Legal and Management Division of the Buildings Department.

Buildings Department

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1. **GENERAL**

1.1 **Scope**

1.1.1 This Code of Practice outlines good practices for planning and implementation of demolition of various building works in Hong Kong aiming at minimising the following risks:

(A) Damage to persons and properties of the public;

(B) Endanger the health and safety of site personnel; and

(C) Damage to the neighbourhood environment.

The prime intention of this Code is to give guidelines for engineering practice and safe procedures for various demolition methods and to provide guidance on compliance with relevant requirements of Building (Administration) Regulations and Building (Demolition Works) Regulations. Aspects related to environmental, labour health and safety are referenced to relevant regulations.

1.1.2 This Code sets out the guidelines for demolition of buildings. This Code is applicable to individual structures, partial demolition of buildings, basements, underground tanks, and common civil engineering structures, e.g., silos, industrial plants, piers, etc. However, this Code is not intended to cover major civil engineering works, such as underpinning, excavation, highway or railway bridges, dams and nuclear reactors.

1.1.3 This Code covers methods commonly used in building demolition. Though it does not include all demolition methods, it is not the intention to discourage the use of other methods which are not included in this Code. Any newly invented demolition method not covered in this Code may be used subject to careful consideration and recommendation by experienced Authorized Person, Registered Structural Engineer and Registered Specialist Demolition Contractor, or their equivalent professionals or counterparts and subject to the approval of the Building Authority or other equivalent approving Authority. Such new demolition method proposed shall be supported by scientific research and engineering experience.

1.2 **Definitions**

For the purpose of this Code, the following definitions shall apply:
"Authorized Person" means a person whose name is on the Authorized persons' register kept under Buildings Ordinance section 3(1):

(a) as an architect; or

(b) as an engineer; or

(c) as a surveyor;

"Blasting Expert" means a person who is the holder of a valid mine blasting certificate or a special authorization issued by the Commissioner of Mines pursuant to Dangerous Goods (General) Regulations 47.

"Building Height" means the vertical distance measured from the top most part of the building to be demolished to the lowest ground level;

"Building Survey" means an inspection on the Building and its surroundings aiming at spotting any potential problems that may arise during demolition and developing a Method Statement for Demolition;

"Catch Platform" is a temporary structure erected on top of the covered walkway or underneath structures that are being demolished including, but not limited to, balconies and cantilever structures for the purpose of catching and retaining debris and to protect the area beneath such structures being demolished;

"Catchfan" is a temporary structure, generally, installed at an inclined angle, and is erected around, attached or abutting the exterior wall of the building being demolished for the purpose of catching and retaining debris that fall outside the building;

"Covered Walkway" means a temporary structure with protective roof erected along the site boundary and on or adjacent to the existing footpath to protect the pedestrian from the falling debris during demolition;

"Demolition" means dismantling, razing, destroying or wrecking any building or structure or any part thereof by pre-planned and controlled methods;

"Demolition Plan" is one of the prescribed plans stated in the Building (Administration) Regulation, and its contents are stated in Building (Administration) Regulation 8(3).

"Hanging Structure" means unconventional structure that is supported from the top by tension members such as suspended cables, tie rods or other means;

"Hoarding" means a temporary fence enclosure erected along the site boundary to separate the demolition site from the adjacent properties;
“Implosion” means demolition by use of explosives, in which, the building debris falls inwards or in a controlled manner;

“Implosion Expert” means a person who has acquired adequate knowledge and experience in building implosion through training and practical experience and is competent in taking up the full responsibility to design, organise and control building implosion, subject to approval by the Building Authority and the Commissioner of Mines.

“Mid Levels Area” means Schedule Area No. 1 as defined in the fifth schedule of the Buildings Ordinance;

“Non-Ventilated Light Well” means a light well which does not provide either natural ventilation through openings at both top and bottom, or mechanical ventilation that allow circulation of air;

“Party Wall” means a common wall that separates two adjoining buildings;

“Public Dump” means dumping site operated by the Government of the Hong Kong Special Administrative Region for receiving suitable construction and/or demolition waste for reclamation and land formation projects;

“Registered Specialist Demolition Contractor” means a person whose name is for the time being on the register of specialist demolition contractors maintained under Buildings Ordinance section 8A;

“Registered Structural Engineer” means a person whose name is for the time being on the structural engineer’s register kept under Buildings Ordinance section 3(3);

“Standards of Scaffold” means vertical members of scaffolding;

“Stability Report accompanying Demolition Plan” is a stability report which include stability calculations of the building to be demolished, its supports, if any, the adjoining properties and the loading due to powered mechanical plants, or equipments, and its contents are stated in Building (Administration) Regulation 8(4).

“Structural Survey” means a survey on the existing structural element prior to demolition in order to check the layout arrangement of structural elements, the state of maintenance and deterioration, and any structural implication that may affect the demolition;

“Thermal Lance” means an intense heat process used to cut or severe structural elements, including reinforced concrete elements, by means of a high temperature torch with heat source generated from fusion of oxygen and metal.
2. PLANNING

2.1 Building Appraisal and Demolition Plan

Prior to carrying out any building demolition, detailed building appraisal by means of surveys and appropriate assessments shall be required. In general, the surveys shall include a Building Survey and a Structural Survey with photographs or videos taken for future reference. Based on the findings of these surveys, a demolition plan shall then be prepared and submitted to the Buildings Department for approval. The demolition plan must also be accompanied by a report together with structural calculations assessing the stability of the building to be demolished and all affected buildings, structures, streets, land and services.

2.1.1 Building Survey

(A) Record Drawings

Prior to the Building Survey, the existing record plan, including layout plan showing adjoining properties, pedestrian walkway, roads and street, etc. shall be retrieved.

(B) Survey Items

The Building Survey shall cover the following:

(1) The construction materials;

(2) The existing use and, if possible, the past uses of the building prior to demolition;

(3) The presence of wastewater, hazardous materials, matters arising from toxic chemicals, flammable or explosive and radioactive materials, etc. and possible presence of materials which can contribute to air pollution and soil contamination;

(4) Potential dangerous areas, e.g., abnormal layouts, presence of enclosed voids, and non-ventilated light wells which may trap obnoxious gas at the bottom;

(5) Adjoining properties and site conditions, such as the existence of slope and retaining wall, wall supporting ground, illegal structures, bridges, underground railway and its above ground structures, including entrances, vent
shafts, distribution substations, traction substations, plantrooms, overhead railway structures, surface track sections, overhead cables or guy wires, and other utility service connections;

(6) Drainage conditions and possible problems on water pollution, flooding and erosion, especially on sloping sites and water receiving bodies;

(7) Shared facilities with adjoining building, including common staircases, party walls, and possible effect on it, such as self-enclosed walls to the adjoining buildings, during demolition;

(8) Hoarding and covered walkway requirements;

(9) Adjoining pedestrian and vehicular traffic conditions;

(10) Available headroom, clear spaces and distance of building from lot boundary which may affect the loading operation and transportation of building debris during demolition;

(11) The sensitivity of neighbourhood with respect to noise, dust, vibration and traffic impact;

(12) Available site area to allow on-site sorting of building debris;

(13) Street furniture such as fire hydrant, parking space/metres, street light, street sign, hawker and stalls which could be affected by the demolition project.

(C) Hazardous Materials

(1) Unless the Building Survey reviews that no obvious hazardous material is present in the building, the Authorized Person shall cause proper sampling and testing for the hazardous materials;

(2) In the case when hazardous materials are present, such hazardous materials e.g., asbestos containing materials, or petroleum, shall be removed and cleaned according to the statutory requirements administered by the Environmental Protection Department, Fire Services Department, Labour Department and any other Government Departments, referred to in Appendix D;
(3) In the case when the site has previously been used to store chemicals, and other dangerous goods, soil contamination assessment shall be required at pre-demolition stage and/or post-demolition stage;

(4) In the case when the site has previously been used to store explosives, special procedures to ensure no explosives remain on site will be required.

2.1.2 Structural Survey

(A) Record Drawings

Prior to the Structural Survey, the existing record layout, structural framing plans and structural details shall be studied. The Registered Structural Engineer shall check the presence of unusual detailing that may cause abnormal structural behaviour during demolition, e.g., upward anchor of tensile reinforcement in cantilever structures. If existing record plans are available, these plans shall be used as reference and preferably be brought along with the Structural Survey.

(B) Survey Items

The Structural Survey shall cover the followings:

(1) The structural materials used;

(2) The original structural system employed in the design;

(3) The method of construction;

(4) Any dilapidation and degree of deterioration on any structural elements;

(5) The structural conditions of adjoining structures and its shoring which may be affected by the proposed demolition work;

(6) The presence of continuous structures that may be truncated by the demolition;

(7) The structural system and structural conditions of basements, underground tanks or underground vaults;

(8) The presence of exposed bracing or possible presence of covered bracing;
(9) The nature of walls, whether it is blockwall, reinforced concrete walls, load bearing walls or partition walls;

(10) Cantilever structures such as canopies, balconies, or other forms of architectural features;

(11) Any fixtures to the building such as signboard, sun-shading devices.

(C) Special Structures

The Structural Survey shall review the following:

(1) the correctness of structural information available;

(2) any presence of unconventional structural elements referred to in 2.1.3(A)(3) which may require special attention and well-defined modification procedures;

(3) the possibilities of structural modification to enable efficient demolition traffic during demolition;

(4) any limitation on shoring and other temporary supports.

(D) Investigation and Testing

In the case when no structural details are available, the Structural Survey shall include on site measurement and retrieve any structural framing as much as practical, performing tests and exposing some key structural elements to facilitate checking on existing structure. This will allow the development of procedures that ensure the stability of the building at all stages during demolition.

2.1.3 Demolition Plan and Stability Report including Calculations

(A) Demolition Plan

A Demolition Plan shall include the following:

(1) A plan showing:

(a) the location of the building to be demolished;

(b) a detailed topography of the site and its surrounds together with ground level contours and sections of the slopes and ground supported by the building where appropriate;

(c) details of ground removal and/or backfilling; and
(d) the distances from the building to be demolished to its adjacent buildings, streets, structures and significant street furniture.

(2) A layout plan of all floors of the building to be demolished, with adequate sections, showing:

(a) the occupancy usage of the floors;
(b) the structural support systems;
(c) principal materials of construction;
(d) the condition of the building e.g. the degree of deterioration;
(e) the relationship of the building to be demolished with neighbouring properties affected by the demolition, which include all adjoining buildings and unauthorized structures, shared staircases, party walls, truncating continuous frames, slopes, retaining wall, overhead cables, guy wires and underground utility services.

(3) A plan showing the structural arrangement and construction of all unconventional structural elements, such as prestressed concrete structures, precast concrete members, stressed skin structures, hanging ties, trusses or Vierendeel girders, deep beams, arches, transfer plates, transfer girders, earth retaining or basement structures, flat slabs, hollow block ribbed slabs and large cantilevered structures;

(4) A plan showing the procedure for the demolition of the building; detailed sequence of demolishing particular structural members; and the method of demolition to be adopted including the restrictions on the use of any particular type of equipment;

(5) In the case when powered mechanical plants and equipment are used, a plan showing the route of movement of powered mechanical plants and equipment including the method of lifting mechanical plant, where necessary, onto the top floors of the structure; any structural alterations required to suit the demolition, e.g. temporary strengthening to suit early removal of any ground floor/or cockloft structure to facilitate vehicular movement at ground floor, or strengthening of deteriorated key structural members; and any shoring, temporary supports and/or floor propping required;

(6) A plan showing all precautionary measures for the protection of the public including hoardings, covered walkways, catch platforms, catchfans, scaffolding, protective screens and safety nets;
(7) A plan showing the proposed shoring and precautionary measures for all affected adjacent buildings, slopes, retaining structures and services at each stage of the demolition works;

(8) A plan showing the proposed shoring and temporary support to be provided to the building to be demolished;

(9) A plan or descriptive notes on the proposed methods for handling and disposal of debris including:

(a) the permissible temporary accumulation of building debris at upper floors and at ground floor;

(b) the transportation route of building debris both horizontally and vertically;

(c) a temporary parking layout for mobile machines and trucks, if necessary;

(B) Stability Report including Calculations

According to Building (Administration) regulation 4, the Demolition Plan must be accompanied by a Stability Report with supporting calculations. The Stability Report shall include the following parts:

(1) a report on the stability of the building to be demolished during all stages of demolition;

(2) in the case when powered mechanical plants or equipments are used, a report on the stability of the building with supporting calculations, that the use of the plants and equipments will not render inadequate the margin of safety of, or cause damage to any building, structure, street, land and services;

(3) in the case when powered mechanical plants or equipments are used, structural calculations for all temporary supports and bracings;

(4) a report on the stability of neighbouring buildings, adjoining properties as stated in 2.1.1.(B)(5), party walls, streets, land and services which may be affected by the demolition work;

(5) in the case when temporary or permanent supports are required to these neighbouring buildings, adjoining properties, and party walls, structural calculations for these temporary and permanent supports; and
(6) a report with calculations demonstrating that the demolition work will not render inadequate the margin of safety of, or cause damage to any building, structure, street, land and services.

A checklist for preparing a Demolition Plan and Stability Report with Calculations is depicted in Appendix B.

2.2 Utilities

2.2.1 Termination of Utilities

Prior to actual demolition, the Authorized Person shall liaise with all available utility companies so as:

(A) to keep records of available utilities leading into the premises; and
(B) to cause all utilities to be terminated.

2.2.2 Effects of demolition on Utilities

The demolition plan shall ensure that during the course of demolition, no existing utilities in the vicinity of the demolition sites are affected by the demolition operation.

2.2.3 Common Utilities

The common utilities encountered in building demolition generally include the following:

(A) Electricity;
(B) Water;
(C) Gas;
(D) Telecommunication;
(E) Drainage
(F) Overhead and Underground Cables;
(G) Railway Tunnel and its accessories, such as vent shafts;
(H) Sewage Tunnel and its accessories;
(I) Disused Tunnel.

All utility companies and relevant agencies shall be consulted prior to demolition of the structure.
2.2.4 Maintenance of Certain Utilities

(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 organisation 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.

2.3 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.

2.3.1 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.

2.3.2 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 both the Buildings Department and the Environmental Protection Department for approval prior to implementation of such remedial works.
3. PRECAUTIONARY MEASURES

3.1 General

Site safety features shall emphasise protection of the public, particularly, the pedestrian and vehicular traffic and the adjacent properties. Proper safety features shall be designed to make sure that the demolition can be carried out safely and the site personnel is protected.

3.2 Hoarding and Covered Walkway

The primary purpose of hoarding and covered walkway is to provide protection of the public during the construction or demolition of buildings. Generally, hoarding isolates the demolition site from the public, thus preventing unauthorized access and trespassing. The covered walkway, in conjunction with catch platform, provides additional protection to the pedestrian traffic against falling debris. Suggested designs for hoarding, covered walkway and catch platform are listed in the following:

3.2.1 Requirements for Hoarding, Covered Walkway and Catch Platform

The criteria for use of covered walkway for a site depend on the height of the building being demolished and its proximity to the vehicular and/or pedestrian traffic. The requirements for hoarding, covered walkway and catch platform are described in the following:

(A) For buildings that have a clear space between the building line and the lot boundary equal to or more than the building height (hereinafter referred to as clear space), only hoarding shall be required;

(B) Covered walkway shall be provided for building with clear space less than the building height;

(C) Covered walkway with catch platform shall be provided for buildings with clear space less than half the building height. No catch platform is required for building less than 4 m high;

(D) The hoarding and/or covered walkway shall be provided along the full length of the site boundary adjacent to public access. The width of the catch platform shall not be less than 2 m when it abuts a street;

(E) The requirements for hoarding, covered walkway and catch platform are illustrated in Figure 3.1.
CASE 1. Only hoarding is required, if clear distance > H

CASE 2. Hoarding and covered walkway are required if H > clear distance > H/2

CASE 3. Hoarding, covered walkway and catch platform are required if clear distance < H/2. Catch platform is not required for building less than 4m high.

FIGURE 3.1 CRITERIA FOR HOARDING & COVERED WALKWAY
3.2.2 Dimensions

A minimum vertical clearance of 2.3 m shall be provided for the covered walkway. A minimum clearance of 5.5 m shall be maintained for the catch platform over a carriageway. 5.5 m clear headroom over gantry shall be maintained as far as practicable. The minimum clear widths are set out in Table 3.1. The required clear width must not be obstructed in any manner by traffic sign, temporary supports, scaffoldings or the like.

Table 3.1 Width of Covered Walkway

<table>
<thead>
<tr>
<th>Existing Pavement Width</th>
<th>Clear Width in Walkway</th>
</tr>
</thead>
<tbody>
<tr>
<td>No pavement</td>
<td>1.1 m</td>
</tr>
<tr>
<td>2.5 m or less</td>
<td>1.5 m, if pavement is of insufficient width a minimum clear width of 1.1 m shall be maintained</td>
</tr>
<tr>
<td>over 2.5 m</td>
<td>2 m</td>
</tr>
</tbody>
</table>

3.2.3 Design Criteria

The roof of the covered walkway shall be designed to support a uniformly distributed load of 7.5 kPa. The combined covered walkway and catch platform structure shall be designed to sustain a uniformly distributed load of 7.5 kPa or a point load of 45 kN acting on an effective area of 300 mm x 300 mm. Design criteria for covered walkway and catch platform are summarised in Table 3.2. The hoarding, covered walkway and catch platform shall be designed to sustain the wind load according to the current Code of Practice on Wind Effects in Hong Kong or its latest equivalent publication. The location of the proposed covered walkway shall be compatible to the existing traffic environment.

Typical details for the catch platform and covered walkway are illustrated in Figure 3.2

Table 3.2 Design Criteria for Covered Walkway and Catch Platform

<table>
<thead>
<tr>
<th></th>
<th>Uniform Distributed Load</th>
<th>Point Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covered Walkway</td>
<td>7.5 kPa</td>
<td>-</td>
</tr>
<tr>
<td>Catch Platform and Covered Walkway</td>
<td>7.5 kPa</td>
<td>OR 45 kN distributed over an effective area of 300 mm x 300 mm.</td>
</tr>
</tbody>
</table>
**TYPICAL SECTION**

- **Hollow box section**
  - 250x150x12.5
  - 300x200x10

- **Steel plate**
  - 12mm thick

- **Covered walkway**

**FOOTING DETAIL**

- **Hollow box section**
  - 127x127x15.8

**REUSABLE FOOTING**

- **Levelled base**

**NOTES**
1. Safe bearing pressure of soil underneath pavement slab is 100 kPa (125 kPa with wind).

**PLAN OF CATCH PLATFORM**

- 250x150x12.5 HBS
- 300x200x10 HBS

**ELEVATION OF CATCH PLATFORM**

- 50x50

**EXISTING BUILDING**

- Anchor and tie to existing building for stability.

**CATCH PLATFORM DETAILS**

- 1 No. M20 through bolt

**FOOTING SIZE**

<table>
<thead>
<tr>
<th>L1(m)</th>
<th>L2(m)</th>
<th>L3(m)</th>
<th>Size of Footing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>1.3</td>
<td>0.8</td>
<td>1.6mx0.75mx0.3m depth</td>
</tr>
<tr>
<td>2.0</td>
<td>1.3</td>
<td>0.6</td>
<td>1.2mx0.6mx0.3m depth</td>
</tr>
<tr>
<td>0.6</td>
<td>1.5</td>
<td>0.6</td>
<td>1.2mx0.6mx0.3m depth</td>
</tr>
<tr>
<td>0.5</td>
<td>2.2</td>
<td>0.5</td>
<td>1.2mx0.6mx0.3m depth</td>
</tr>
</tbody>
</table>

**TABLE OF FOOTING SIZES**

- 250x150x12.5 HBS
- 300x200x10 HBS
anchor and tie to existing building for stability. In case no anchor point is available, alternative tie on ground shall be designed by RSE.

catch platform shall be dismantled when demolition reached this level.

2 No. HSL M12 (M16 for gantry) Hilti anchor.

min. clearance of 5500mm shall be maintained within 300mm distance from edge of carriageway, unless otherwise agreed by the highways department.

minimum clearance of 1200mm shall not be less than 1200mm.

Safe bearing pressure of soil underneath pavement slab is 100 kPa.(125 kPa with wind)

This footing details assume the presence of 125 thk. paving slab, in the case when no paving slab is available, 1100x1100x125 thk. R.C. base slab will be required.

NOTES:
1. The clear distance between footing shall not be less than 1200mm.

2. Safe bearing pressure of soil underneath pavement slab is 100 kPa.(125 kPa with wind)

3. This footing details assume the presence of 125 thk. paving slab, in the case when no paving slab is available, 1100x1100x125 thk. R.C. base slab will be required.

FIGURE 3.2 REUSABLE STEEL CATCH PLATFORM AND COVERED WALKWAY ON ALT. FOOTING (SHEET 2 OF 5)
PLAN AT CATCH PLATFORM LEVEL

SECTION B

note: 1, unless otherwise stated, all column to be 127x127x15.8 HBS.

ELEVATION

FIGURE 3.2 REUSABLE STEEL CATCH PLATFORM AND COVERED WALKWAY (SHEET 3 OF 5)
FIGURE 3.2 REUSABLE STEEL CATCH PLATFORM AND COVERED WALKWAY (SHEET 4 OF 5)
1. This set of drawings shows the general case of a standard hoarding design subject to
- basic wind pressure of 1.2 kPa.
- vertical imposed load of 7.5 kPa.
- accidental load of 45 kN.
2. Unless otherwise stated, all dimensions are in mm and all levels are in m PD.
3. Unless otherwise stated, all structural steelwork shall be grade 43A to B.S. 4360 with yield stress 250 MPa.
4. Unless otherwise stated, all side claddings to be corrugated metal claddings that can resist design pressure of 2.4 kPa.
5. Unless otherwise stated, all weldings to be 6 mm continuous fillet weld to B.S. 5135.
6. Unless otherwise stated, all bolts are high strength friction grip bolt to B.S. 4604.
7. Unless otherwise stated, all M12 anchor shall be able to resist tension load of 10 kN/bolt.
All anchor bolts shall be installed according to manufacturer's specification.
8. Finishes to structural steelwork depends on life of the steelwork. In general the following finishes may be acceptable:
   (i) Painting with:
      - 2 pack epoxy based zinc rich primer to B.S. 4652, dry film thickness = 75 μm.
      - 2 pack epoxy based paint undercoat, dry film thickness = 125 μm.
      - Chlorinated rubber finishing paint applied in 2 coats, dry film thickness = 150 μm.
      - Chlorinated rubber finishing paint applied in 2 coats, minimum overall dry film thickness = 330 μm.
(ii) Hot dipped galvanised steelwork.
3.2.4 Proper Use of Covered Walkway

Debris shall not be accumulated on the roof of the covered walkway. It shall not be used for any other purposes such as displaying advertisement or for storage of building materials and equipment inside or above the covered walkway.

If it is intended to build a temporary contractor's shed over the covered walkway, it must be structurally independent of the covered walkway. The roof of the contractor's shed shall sustain the design load criteria for the catch platform or covered walkway whichever is applicable.

The roof of the covered walkway shall be pitched inwards to better contain the debris and for roof drainage. Upstand edge board of 1.1 m or higher measured from the toe of roof line of the catch platform's outer edge shall be provided to retain the fallen debris.

3.2.5 Construction

As far as practicable, the structural components of the covered walkway and catch platform shall be prefabricated and fastened together on site by bolts so that they can be reused. Site welding shall be minimised in order to reduce the erecting time and potential hazard to pedestrians or vehicular traffic. Prefabricated shoring systems, glass fibre reinforced panels and other ready to use systems shall be used for the hoarding, cover walkway or catch platform installation as much as possible.

3.2.6 Lighting

A system of temporary lighting shall be provided for the covered walkway and shall be maintained in good order. The average illuminance on the floor level of the covered walkway shall be within the range of 35 lux to 50 lux. The lighting shall be weather-proofed. A recommended lighting layout for typical covered walkway is the installation of luminaries complete with 18 W or 20 W 600 mm long tubular florescent lamps at 3 m spacing.

3.3 Scaffolding and Screen Covers

3.3.1 Scaffolding

Bamboo scaffolds or metal scaffolds shall be used for top down demolition projects. Both bamboo scaffolds and metal scaffolds are considered acceptable provided that they are erected according to the Construction Sites (Safety) Regulations and the Code of Practice for Scaffolding Safety.
(A) Scaffolding Construction and Work Platform Requirements

The erection, dismantling and safety requirements of the work platforms and scaffold shall be in accordance with the Construction Sites (Safety) Regulations and the Code of Practice for Scaffolding Safety (CoPSS). The erection and dismantling of the scaffold shall be carried out by competent workers possessing adequate experience of such work, under the immediate supervision of a competent person. Double row scaffoldings shall be provided for all demolition projects by top down methods. Work platforms shall be provided on the three consecutive lifts directly below the floor being demolished. Toe boards shall be provided at the outer edge. These platforms may be used as work platforms and also for precautionary measures to retain small debris falling out of the building. Periodic maintenance shall be performed to remove any debris accumulated on the platforms.

(B) Bamboo Scaffold

Structural ties to the building structure shall be provided. Bamboo scaffold shall be tied to sound anchors at intervals of not more than 4m in both horizontal and vertical directions.

If the scaffold is higher than 15m, steel brackets anchored to the existing building structure or other support system shall be provided at interval of not more than 15m to support the scaffold. The steel brackets and anchors or other equivalent support system shall be designed by a Registered Structural Engineer to properly support the weight of the scaffold and the loading including the catchfins, work platforms, etc.

(C) Metal Scaffold

As a minimum, the scaffold shall be able to support the live load imposed on three consecutive layers of work platform plus its own weight. Additional loading conditions, if any, shall be included in determining the allowable height for the scaffoldings. Tie to existing structure shall be in accordance with manufacturer’s recommendations.
(D) Dismantling

Dismantling of the scaffolds shall coincide with the demolition progress. When the wall ties are disconnected due to the demolition of the building structure, the unsecured section of the scaffolds shall be removed accordingly. The unbraced sections shall not be higher than 2m from the nearest anchor.

3.3.2 Screen Covers

(A) Requirements

Two layers of protective screen shall be placed over the scaffolds to completely enclose the building structure for retaining dust and small debris. Tarpaulin and heavy duty nets shall be used to cover the exterior face of the scaffold. Tarpaulin shall be placed over the net. The screen system shall satisfy the requirements under the Air Pollution Control (Construction Dust) Regulation administered by the Environmental Protection Department, where applicable.

(B) Ties

The protective screens shall be secured to the scaffoldings at not less than 2 m intervals at both horizontal and vertical directions or the width of the net, whichever is less. The screens shall have a minimum overlapping width of 300 mm.

(C) Nets

(1) Materials and Installation

Heavy duty nets shall be relatively light weight and have good retaining capability for small debris. The material shall resist ultra-violet light deterioration. The nets shall be secured to the scaffold and at the catchfan so that debris can be retained and not deflected onto the ground.

The net shall meet the minimum requirements as listed in Table 3.3 or approved equivalent.
Table 3.3 Minimum Specification for Polyethylene Net

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Minimum Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>material</td>
<td>polyethylene</td>
</tr>
<tr>
<td>string diameter</td>
<td>1 mm</td>
</tr>
<tr>
<td>pplys</td>
<td>16</td>
</tr>
<tr>
<td>mesh grid opening</td>
<td>20 mm</td>
</tr>
<tr>
<td>weight</td>
<td>130 g/m²</td>
</tr>
</tbody>
</table>

(D) Tarpaulin

Tarpaulin shall be light weight and constructed of fire retardant materials.

The fire retardant characteristic of the tarpaulin shall meet either one of the following requirements:

1. Class B material as specified in British Standard 5867;
2. Flame retardant test for certain items, light weight cloths methods, provided by the Fire Retardant Regulations for Protective Canvas for Construction, Japan Ministerial Ordinance of the Ministry of Home Affair;
3. Any equivalent standard criteria or testing.

3.4 Catchfan

3.4.1 Requirements

The design intention of the catchfans is to catch small pieces of building debris that passes through the protective screen and net, and the catchfans are not designed to collect large pieces of building debris which should have been collected by the protective screen or net. A small piece of debris could be disastrous after gaining enough kinetic energy through falling great heights. Thus, a catchfan shall be installed at a vertical distance of not more than 10 m below the working floor. A catchfan shall have a horizontal extension of 1.5 m from the exterior face of the scaffolding. The typical angle of inclination shall be 20° to 45° from the horizontal plane. Catchfans shall be used only as precautionary measures and shall not be used as temporary support for any anticipated loads.
Both bamboo catchfans and metal catchfans are acceptable provided that they are properly installed. Under the present craftsman’s techniques, bamboo catchfans can be applied to either bamboo scaffolds or metal scaffolds, but metal catchfans are allowed to be mounted on metal scaffolds only.

3.4.2 Bamboo Catchfan

Typical Detail of Bamboo Catchfan is illustrated in Figure 3.3.

(A) Framing

A bamboo catchfan shall be constructed with bamboo framing tied to the building and the scaffold. The supporting bamboo member shall be tied to the standards of both the outer and inner scaffolding layers at the desirable inclined angle extended into the building. The catchfan supports shall be anchored to the building wall or other structural elements. The spacing between the supporting bamboo members shall be not less than the distance between the standards of the scaffold or not more than 1.3 m whichever is less. The supporting bamboo framing shall be anchored to the building wall or other structural elements with anchor bolts and steel wire ties of adequate strength. The spacing between the anchor shall be not more than 3 m. The supporting bamboo shall have an effective diameter of not less than 40 mm.

(B) Decking

The Bamboo members which are tied to the supporting members to form the deck of the fan shall have diameter of not less than 40 mm. Bamboo shall be placed across the supporting members at not less than 200 mm centres. Tarpaulin, net and metal sheet or corrugated metal sheet shall be placed on the top of the fan to retain debris. The thickness of the metal sheet shall be 0.5 mm. The tarpaulin, net, and metal sheets shall be securely fastened to the bamboo.
screen tie at every 2m horizontally and vertically over lapping width not less than 300mm

wall tie

steel wires with anchor bolt maximum spacing 3m

0.5mm metal sheet

net

tarpaulin

bamboo with effective diameter not less than 40mm

bamboo maximum spacing 200mm centres

1.5m (minimum)

NOTES:
1. Bamboo for the construction of scaffold and catchfan shall have an effective diameter not less than 40mm.
2. Metal sheet, net and tarpaulin shall be fastened to the bamboo deck at 4 corners of the sheet or at spacing no less than 1.5m apart whichever is less.

FIGURE 3.3 TYPICAL DETAIL FOR BAMBOO CATCHFAN AND SCREEN COVER
3.4.3 Steel Catchfan

The steel catchfans are considered as temporary cantilevered structures with steel framing extended from the building. The use of expansive anchor bolts in erecting the catchfan shall be avoided as far as practicable since the anchor bolt may be loosened by vibration generated during the demolition process. In the case when anchors are used, they shall be applied cautiously with extreme care; and not as a primary support. Extreme care shall be exercised in erecting and dismantling the catchfan to avoid the structural components from accidentally falling off. All the components of the steel catchfan shall be supported, and securely fastened to the lifting appliances or supporting structural element until the installation is completed. Catchfan may be constructed with components of prefabricated steel/metal scaffold. Such use is particularly compatible with metal scaffolds. The design and installation of catchfan using prefabricated metal scaffold components shall be in accordance with the manufacturer’s recommended criteria. As far as practicable, the components of the catchfan shall be prefabricated and fastened by bolt to minimise welding.

3.5 Temporary Supports

3.5.1 General

(A) Requirements

Temporary supports to the structure or the elements of the structure being demolished shall be provided for any or combination of the following conditions:

(1) when the whole or any part of the structure is subjected to excess loading derived from the demolition activities, movement of powered mechanical plants or debris accumulation;

(2) when any part of the structure or any element being demolished is not self-supporting; or

(3) when the temporary stability of the structure or its elements could be impaired as a result of the demolition activities.

Temporary supports shall not be removed until its supporting loads are completely removed.
On the other hand, temporary supports shall be removed as much as possible and practicable after demolition. In the case when temporary supports have to remain, the Owner, his Authorized Person, Registered Structural Engineer and Registered Specialist Demolition Contractor shall be responsible for routine inspection and maintenance of such temporary works until they are completely removed.

(B) Cantilever Structures

Temporary supports shall be required during the demolition of cantilever construction that may affect the safety of the public. If the anchorage or holding down load of the cantilever construction has been removed prior to the demolition of such elements, the cantilever must be temporarily supported before the removal of the anchorage and holding down load. The area underneath any cantilever structure shall be protected by a temporary platform which is designed to resist the anticipated demolition loading prior to in-situ demolition of any cantilever structures, unless the cantilever structure is demolished by cut and lift, or other similar techniques.

(C) Catch Platform

Catch platform shall be provided on top of the covered walkway in accordance with the requirements and design criteria as described in 3.2.

Catch platform shall also be provided underneath structural elements when the area adjacent to or directly underneath the said structural element requires protection from falling debris or other potential hazard caused by the demolition. These structural elements generally include, but are not limited to, projected canopies and balconies. Depending on the demolition process, catch platforms may be required underneath special structures such as external architectural features and prestressed concrete elements. Catch platform shall be installed prior to commencement of demolition. Catch platform shall be designed to support the anticipated loading condition during the demolition process.

(D) Adjacent Building
Temporary supports shall be provided to adjacent properties including, but not limited to, buildings, public or private utilities, slopes, retaining walls or land when the removal of the building or any part of the building being demolished could affect the stability of such properties. Common features, such as truncated continuous beams, exposed party walls and common staircases, shall be protected and stabilised.

Safe ingress and egress for adjoining properties shall be maintained. Adequate supports shall be provided to maintain the stability of common staircases for maintaining continuous access for the adjoining properties. Demolition project, such as the tenement house, may involve the removal of structural members that are part of the integral structure for supporting the remaining building. Appropriate supports to brace the structure shall be installed.

(E) Incomplete Demolition Projects

When a demolition project is shut down for a prolonged period before its completion, the remaining structure, if any, shall be stabilised by temporary support and/or bracing systems.

3.5.2 Materials and Types

(A) Materials

The temporary supports used for demolition shall be built with structural steel, heavy timber, fill embankment/buttress, or other material which is considered to be appropriate for the purpose.

(B) Pre-manufactured System

Pre-manufactured components such as tubular shores, telescope steel props, framed towers, etc., may be used as temporary supports provided their design capacity and their erection and maintenance requirements are followed in strict accordance with manufacturer’s recommendations. Where the design capacity of a pre-manufactured component cannot be established by standard structural design and analysis, tests shall be performed to establish the design capacity.

(C) Existing Structure

Existing non-structural concrete or partition walls shall not be considered as part of the temporary support system unless it is shown by structural analysis that they are adequate for the purpose.
(D) Used Timber

Timber which has been damaged or has deteriorated due to repeated use, insect, decay or chemical attack shall not be used.

(E) Used Structural Steel

Used structural steel shall not be employed unless pre-approved by the Registered Structural Engineer. Where used structural steel is employed, the actual dimensions of the steel section shall be measured and its section properties shall be calculated on the basis of the least cross-sectional area including appropriate allowances for any existing bolt holes, etc. Where the material sources are not known, material properties shall be checked.

All used structural steel with excessive pre-existing bolt holes shall be repaired. Steelworks that has been repaired by welding may be used provided that the remedial work has been carried out according to the Code of Practice on Structural Use of Steel (1987).

3.5.3 Loads

(A) Gravity Loads

The temporary support systems shall be designed to simultaneously withstand, all of the following loads:

(1) construction loads such as the construction operatives, hand tools and small equipment;

(2) debris accumulation and impact from fallen debris;

(3) heavy machinery used.

Subject to a detailed evaluation for special circumstances, in no case shall the construction loads due to item (1) be assumed to be less than 1.5 kPa.

Loading due to items (2) and (3) shall be established by the actual weight of the debris likely to be accumulated and the weight of machinery to be used. In the case where no working load is available, minimum impact factor of 1.25 shall be applied to the static weight of the machinery for the purpose of design for the temporary works to account for the vibration from moving equipment on a suspended floor.

(B) Lateral Loads
To ensure the lateral stability of the temporary supports, they shall be designed to withstand the following lateral loads:

(1) The wind force shall be determined in accordance with Section 3.4 of the Code of Practice on Wind Effects in Hong Kong (1983). If the temporary support is not exposed to wind loading and its supported structure is provided with its own lateral stability system against wind loading, this requirement may be waived;

(2) A minimum of 3% of total vertical loads at the centre of gravity of these applied loads, or a minimum of 1.5 kN per metre length of the supported structure, whichever is greater;

(3) Any calculated or reasonably anticipated lateral forces which shall be applied to the temporary support due to adjacent slope/retaining wall or building, moving machinery or impact from dumping of demolition debris.

(C) Design Consideration for Temporary Support

(1) All temporary support systems shall be supported on adequate foundations or floors. In the case when the immediate floor below the floor under demolition is not adequate to carry the imposed loading from the demolition activities, shoring shall be carried down to the lower floors until adequate support is achieved;

(2) The lower floors may be allowed to carry the balance of the excess loading provided that their support capacities are not exceeded. The shores on the lower floors shall be aligned in the same position on each floor to provide continuous support without causing punching shear or reverse bending in the lower floors;

(3) Attention shall be paid to avoid placing the temporary supports on foundations which may exhibit intolerable differential settlements;

(4) The load capacity of the floor slabs shall be checked to ensure that they can adequately resist the concentrated loads from the temporary supports. Distributing the loads through the use of sleepers and base plates may increase the capacity of the floor slab.
3.5.4 Structural Analysis and Design

The capacity of the support system and its components shall be determined by using the codes as listed in Appendix D. Other well established codes may be used as supplement whenever applicable.

3.5.5 Temporary Propping System

Prefabricated propping system may be used to support the operation of the mechanical plant, or other loading during the demolition process on a suspended floor. A guideline for propping requirements under typical loading conditions is depicted in Table 3.4.

<table>
<thead>
<tr>
<th>Design imposed load of floor to be demolished</th>
<th>3 kPa</th>
<th>5 kPa</th>
<th>7.5 kPa</th>
<th>12.5 kPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum weight of mechanical plant allowed</td>
<td>11,600 kg</td>
<td>11,600 kg</td>
<td>11,600 kg</td>
<td>11,600 kg</td>
</tr>
<tr>
<td>Minimum no. of consecutive floors required to distribute mechanical plant loading, through propping</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Minimum no. of consecutive floors required to distribute localised loading from temporary ramp, through propping</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Maximum spacing of steel props in each direction</td>
<td>1.2m</td>
<td>1.2m</td>
<td>1.2m</td>
<td>1.2m</td>
</tr>
</tbody>
</table>

The application of the propping requirements in Table 3.4 shall follow the limitations and design requirements as listed below:

(A) The propping requirements are not applicable to special structures and unconventional layout as described in 2.1.3(A)(3);
(B) In general, debris accumulation shall not be permitted unless the debris accumulation is justified by engineering calculation;

(C) The propping design is based on the use of structural steel access ramp. The gradient of the ramp shall not be steeper than 30°;

(D) Minimum bearing capacity for the steel prop shall not be less than 25 kN for supporting the mechanical plant and 45 kN for area under the access ramp;

(E) The props shall be braced to provide lateral restraints in at least 2 directions;

(F) The top and bottom supports of props shall be adequately secured and wedged tight;

(G) Adequate spreader shall be provided for props bearing on ground, if necessary, to avoid undue settlement.

3.5.6 Erection and Dismantling

(A) All temporary supports shall be erected strictly in accordance with the approved plans and/or in accordance with the manufacturer’s recommendations. All pre-manufactured systems and their accessories shall be examined for structural defects. Any damaged components and their accessories shall be discarded;

(B) All vertical supports shall be erected and maintained plumb as much as possible. Other arrangements may be acceptable as long as the supporting structural members are not stressed beyond the acceptable limits;

(C) All bracing shall be installed in accordance with the approved plans and the manufacturer recommendations. Its connections to the main members shall be checked to ensure tight fit and adequacy;

(D) All temporary supports shall not be dismantled or modified until their use is no longer required. The design of the temporary supports shall ensure that they can be dismantled safely without imposing danger to the workers or the public.
3.6 Protection of Properties

3.6.1 General

Stability treatment shall be provided to protect building elements that may be affected by the demolition project. The design of the bracing system shall be based on a structural assessment and engineering evaluation to provide necessary and sufficient protection for the affected properties.

3.6.2 Party Walls and External Walls

Party walls that separate the adjoining building and the demolition project shall remain and be protected during and after the demolition project. Redundant party wall shall be removed as far as possible. Demolition of structural elements adjacent to the party wall or the external wall of adjoining building (hereinafter in section 3.6.2 referred to as external wall) shall be performed by manual method with extreme care to prevent any damage to the party wall or the external wall.

The party wall or external wall stabilisation and treatment shall be applied on each floor immediately after the said floor is demolished.

(A) Waterproofing

The party wall or external wall shall be protected against infiltration and water seepage when it is exposed to the weather. Roof lines and wall joints are more susceptible to water leakage problems and shall be checked for waterproofing treatment. All loose bricks or fill materials shall be removed. All openings and voids shall be filled with concrete.

(1) Waterproofing may be achieved by cement mortar treatments. The application of the cement-mortar finish shall follow the procedures below:

(a) The surface of the party wall or external wall shall be thoroughly cleaned;

(b) Application of bonding agent in accordance with manufacturer's recommendation;

(c) Cement exterior finishing shall be applied in two coats:
(i) The first coat shall have a minimum thickness of 10 mm with a cement-lime-sand mix ratio of 1:2:6;

(ii) The second coat shall have a minimum thickness of 10 mm with a cement-lime-sand mix ratio of 1:3:6.

(2) Waterproofing paper may be used as temporary treatment to protect the party wall or external wall. The waterproofing paper on the upper row shall always overlap the row of paper immediately below. The waterproofing paper shall be securely fastened to the building wall.

(3) Waterproofing to party wall or external wall shall be carried out as soon as practicable. In general, such waterproofing work shall be performed as building demolition progresses.

(B) Structural Supports

The exposed party walls or unprotected external wall may be temporarily supported by timber raking shores or installation of stiffeners consisting of structural steel members with concrete cover or other corrosion protective system as designed by the Registered Structural Engineer. If structural conditions allow, the stability of the party wall or the external wall may be improved by leaving a portion of the common beams and slabs which are connected to the party wall.

The layout of the temporary supports to the party wall or the external wall shall be considered in the new construction. Permanent support is required to ensure continuity of the party wall support and minimise any possible interference. The temporary wall treatment shall be maintained until the application of the permanent treatment which may be incorporated in the construction of the new building.

3.6.3 Foundation Support

A thorough evaluation shall be conducted for demolition involving basement, below ground structures or any structure that may affect the foundation of the adjoining properties. Appropriate shoring, underpinning or other protective measures shall be installed if necessary. Details of the demolition of the underground structure shall be referred to in 5.9.
3.7 Protection of Traffic

3.7.1 Adjacent Traffic

Any closure of roads and walkways may seriously impact the traffic/pedestrian circulation and cause disruption to the public. Therefore, as far as practicable, the installation of the precautionary measures and the demolition operation which causes any closure of traffic lanes shall be avoided. If unavoidable, prior permission/arrangement of Police and Transport Departments shall be obtained. Temporary closure of a traffic lane may be considered for night work. Temporary closure of a traffic lane may also be considered for exceptional cases where there is no other practical alternatives to safely demolish the building elements such as projected canopies, balconies or verandah.

3.7.2 Traffic Impact Assessment

If traffic closure is necessary, a proper Traffic Impact Assessment shall be submitted to the Transport Department and the Police for their review and approval. The Traffic Impact Assessment shall conform to the requirements of the Transport Department.

3.7.3 Site Access

Safety measures for construction access to and from the site shall be considered in a demolition project. Proper sightline, segregation, loading/unloading location, illumination etc. shall be provided for the protection of vehicular and pedestrian traffic from the ingress and egress of construction vehicles.

3.8 Special Safety Considerations

3.8.1 Training and Communication

Demolition workers, including plant operators, shall go through proper job safety training and be informed of the potential hazards by attending training sessions as well as on-the-job training. At present, the Construction Industry Training Authority has organised the following training courses:

(A) Demolition of Building Courses for Supervisors/Foremen,
(B) Demolition of Building Courses for Plant Operators.
Site safety and project understanding shall be promoted through an induction meeting at the beginning of the project, where information related to the project such as the proposed method and procedures, potential danger during the operation, safety measures and project specifics can be disseminated to all on site personnel.

The safety concept can be maintained by regular safety meetings throughout the project period. Site safety attitude may be cultivated by strict enforcement of the safety regulations by the site supervisor.

Apart from instilling the importance of safe attitudes to workers and plant operators, they shall be trained by competent instructors on the following to observe safety precautions in accordance with regulations as listed in Appendix D where appropriate:

(A) Working at Heights;
(B) Working in Confined Spaces;
(C) Working with Lifting Appliances and Lifting Gears;
(D) Use of Personal Protective Equipment;
(E) Hot Works;
(F) Handling of Chemicals;
(G) Health Hazards in Demolition Works;
(H) Safe plant operating zones and safe plant manipulation zones.

3.8.2 Equipment Maintenance

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.

3.8.3 Electrical Safety

A properly connected power source from a local electric utility supplier or a mobile electricity generator shall be utilised in demolition sites. The safety requirements given in the Factories and Industrial Undertakings (Electricity) Regulations shall be adhered to.
3.8.4 Fire

All flammable goods shall be removed from site unless they are necessary for the works involved. Any remaining flammable goods shall be stored in proper storage facilities. All furniture, timber, doors, etc. shall be removed before any welding work is performed. Fire fighting appliances shall be provided and maintained in working conditions.

The Construction Site (Safety) Regulations require the contractor to maintain in good condition and free from defects all fire fighting appliances provided in such construction site.

Details of emergency access are further discussed in 3.8.6.

3.8.5 Occupational Health

The health of workers on site shall be properly protected in accordance with the relevant subsidiary regulations of the Factories and Industrial Undertakings Ordinance and the Occupational Safety and Health Ordinance with particular attention to the following areas:

(A) Exposure to Dust;
(B) Chemical Exposure;
(C) Heat Stress and Ventilation;
(D) Noise Exposure;
(E) Medical and First Aid Facilities;
(F) Sanitation;
(G) Occupational Diseases.

3.8.6 Emergency Exit Requirements in Demolition Sites

Emergency exits shall be provided during building demolition. In case of any emergency evacuations, the emergency exit will serve as a lifeline for transportation of injured workers. A minimum of one exit route shall be maintained and designated as the emergency exit at all times during the demolition. Adequate lighting and fire extinguishing equipment shall be provided. Emergency exit shall be properly protected, free of obstruction, and properly marked with exit signs or other indications to clearly show the route. All workers shall be informed about the exit route.
3.8.7 Vibration

Demolition work will cause vibration to neighbouring buildings or structures to various extent, depending on the method of demolition. The most serious vibration is caused by implosion. The effect of vibration caused by implosion are categorised as follows:-

1. permanent ground distortion produced by blast-induced gas pressures,

2. vibratory settlement of foundation materials,

3. projectile impact (i.e. blast fly rock),

4. vibratory cracking from ground vibration or air blast.

These effects will have to be dealt with specifically in the method statement for implosion. For other mechanical demolition methods, the vibration effect is usually less than some other construction processes, such as percussive piling and blasting. In some cases, the traffic vibration caused by heavy duty tractors are more significant than that caused by mechanical demolition. In order to identify the actual cause and effect of vibration, Registered Specialist Demolition Contractors are advised to carry out vibration monitoring during demolition. As a general guideline, the peak particle velocities at any adjoining structure shall not exceed 15mm/sec for prolonged vibration caused by mechanical demolition.

3.9 Environmental Precautions

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

3.9.1 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) Regulation shall be adopted to minimise dust emissions. Burning of waste shall not be allowed. Diesel fumes generated by mechanical plant or equipment shall also be controlled.
3.9.2 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. Silenttype PME shall be used to reduce noise impact as much as practicable. Demolition activity shall not be performed within the restricted hours as established by EPD. 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 discussed in Appendix E.

3.9.3 Water

The discharge of wastewater from demolition sites requires a valid discharge licence from the EPD and the application of such a licence shall be made under the Water Pollution Control Ordinance (WPCO). Effluent shall be treated to the standards as stipulated in the licence before discharge.

As stated in 3.10.3, the Registered Specialist Demolition Contractor shall maintain proper control of temporary water supply and an effective temporary drainage system.

3.9.4 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 Undertaking (Asbestos) Special Regulations before demolition. The procedure for notification is discussed in Appendix E.

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.
3.10 Debris and Waste Handling

3.10.1 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 minimise 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 minimise 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 x 900 mm. 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.
3.10.2 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.

In general, metal components such as windows, pipework and timber such as doors and wood floor shall be removed first. Most of these materials shall 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 pulverised 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.

3.10.3 Dust Minimisation

To prevent dust generation during the debris hauling, water spraying shall be applied during the hauling process. However, the Registered Specialist Demolition Contractor shall ensure proper control of water supply and floor drainage system in order to avoid flooding which is a nuisance and may cause overloading of floors.

3.10.4 Debris Accumulation

In general, the debris accumulation on the floors is not allowed unless the debris accumulation is justified by engineering calculations. Debris shall not accumulate against the hoarding or external wall. Excessive accumulation of debris may cause overloading condition and may induce lateral loading on the walls and shall be avoided. The propping design shall include the debris loading.

3.10.5 Debris Loading

In the case when loaders and trucks have to work at ground floor level, the following conditions shall be considered:
(A) The route of loaders and trucks shall be checked to avoid conflict with temporary propping supports;

(B) The working headroom at ground floor shall be checked, any local strengthening to suit removal of mezzanine floor or first floor beams shall be properly designed;

(C) Loading of the debris shall conform to the Code of Practice for the Loading of Vehicles by the Transport Department.

### 3.10.6 Debris Disposal

Inert materials such as concrete, rock, brick, aggregates and inert building debris should be disposed of at public dumps complying with conditions as set out in the public dumping licence and/or the requirements of the Civil Engineering Department and its related regulations. Construction and demolition waste with only a small amount of inert materials will be allowed for disposal at various landfills designated by the government. List of disposal facilities are included in the Appendix E.

### 3.11 Inspection and Maintenance

(A) Frequency

Site inspection shall be performed by the Authorized Person or his experienced and competent representative, the Registered Structural Engineer or his experienced and competent representative and the Registered Specialist Demolition Contractor at the corresponding frequencies not less than those specified in the Technical Memorandum for Supervision Plans and the Code of Practice for Site Safety Supervision of Building Works and Street Works to ensure that the temporary structures, catchfan, catch platform and other precautionary safety measures are in good condition. Any movement, damage or distortion to the temporary structures shall be identified and repaired, if necessary.

The Registered Specialist Demolition Contractor shall perform a daily inspection to remove any debris accumulated on catchfans and catch platforms. The contractor's representative shall provide full time continuous site supervision and check the condition of the demolition work including the unstable and/or partially demolished structures and ensure that they are stable and safe each day before leaving the site.

Regular inspection shall also include preventive and protective measures adopted to protect the workers' health such as dust suppression measures and personal protective measures.
In the case when discrepancies from the Method Statement are discovered during inspection, the inspector shall report to his senior, if applicable, and keep the Authorised Person and the Registered Structural Engineer informed of the discrepancies. No further demolition shall be carried out until rectification work has been completed and written instruction to commence site work is issued by the Authorized Person or the Registered Structural Engineer.

(B) Unsafe Condition

If any unsafe conditions are present, all demolition activities supported by temporary structures shall be immediately halted until the unsafe conditions are rectified. All unsafe condition shall be reported to Authorised Person/Registered Structural Engineer for further instruction.

(C) Scaffolding

Inspection and maintenance of scaffolding shall be performed in accordance with the Factories and Industrial Undertakings Ordinance and its subsidiary regulations including the Construction Sites (Safety) Regulations and Code of Practice for Scaffolding Safety. The scaffold shall not be used unless:

(i) it has been inspected by a competent person within the immediate preceding month;

(ii) it has been inspected by a competent person since exposure to adverse weather conditions is likely to have affected its strength or stability or to have displaced any part;

(iii) a report has been made by the person carrying out the inspection in the prescribed form containing the prescribed particulars which includes a statement to the effect that the scaffold is in safe working order.

3.12 Post-Demolition Precautions

Once the demolition is completed, the site shall be reinstated to eliminate any potential hazard to the public. The following precautionary measures shall be considered:

(A) The site shall be levelled and cleared of any debris. Adequate drainage shall be provided;

(B) If the new development is not immediately commenced, the site shall be completely enclosed to prevent public trespassing;
(C) Supports to adjacent building structures, weather-proofing and stabilisation of exposed party walls shall be completed. A final inspection by the Registered Structural Engineer on the supports of adjacent structures shall be conducted to ensure satisfactory and safe conditions before leaving the site. If temporary shoring remains on site, inspection and maintenance as described in 3.11 shall be continued until the temporary shoring is removed or replaced by permanent supports;

(D) Any excavation shall be braced and stabilised;

(E) For sloping sites, and/or sites with retaining wall supporting ground, the following additional precautionary measures shall be included:

(1) The ground surface shall be sealed up to prevent water infiltration;

(2) Any unstable structures and ground shall be stabilised;

(3) The demolition plans shall be provided to the subsequent foundation or site formation contractor so that any temporary support works constructed during demolition are maintained during the new development phase.
4. METHODS OF DEMOLITION

4.1 General

The choice of demolition method depends on the project conditions, site constraints, sensitivity of the neighbourhood and availability of equipment. Top down methods are applicable for most sites, particularly for those situated in busy urban areas. Other mechanical methods applied from the outside of the building may be suitable for projects that have sufficient clear spaces. For structural projections, such as balconies, canopies and verandahs extending beyond the building lines, demolition by hand held tools or the cut and lift process may be a safe solution. Methods using wrecking ball and explosive should be adopted with extreme care when well planned adequate precautionary measures are provided. The applications of demolition methods are summarised in Table 4.1. The suggested procedures described in this Code of Practice are recommended good practices for demolition of common structural elements only. Each site has its specific features and conditions. The method, including detail procedures, shall be designed to accommodate the specific project requirements. In general, demolition should be carried out in the reverse order of construction, as far as appropriate.

4.2 Top-Down Methods

Top down methods discussed below are those methods that proceed from the roof to ground in a general trend, there are particular sequences of demolition which may vary, depending on site conditions and structural elements to be demolished.

4.2.1 Manual Method

(A) General

For reinforced concrete buildings, jack hammers are commonly used to break down the concrete. Oxy-acetylene torch could be used to cut the reinforcements. The structural elements shall be broken down gradually or by alternate methods as described in the following sub-section. The reinforcements shall remain until all the concrete connecting to or supported by the reinforcement is broken away or when its support is no longer required. Cantilever canopies, balconies and exterior walls are critical elements in building demolition. In congested areas, these features could critically impact on the safety of the public. Demolition of these features shall be performed with extreme caution. If rope or tie wires are used to pull down the structural elements, the pulling wire must be at least 4 time stronger than the anticipated pulling force. In addition, workers shall be shielded from the rope or tie wires. The rope or tie wire shall be checked at least twice per day.
<table>
<thead>
<tr>
<th>Method</th>
<th>Principle</th>
<th>Applicability</th>
<th>Operation Characteristics</th>
<th>Pollution Characteristics</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top down manual w/ jack hammer or pneumatic hammer</td>
<td>Breaking away the concrete by hand held jack hammer or pneumatic hammer</td>
<td>Column</td>
<td>Beam</td>
<td>Slab</td>
<td>Wall</td>
</tr>
<tr>
<td>Top down/ machine Percussive breaker</td>
<td>Breaking away the structure by machine mounted percussive breaker</td>
<td>Column</td>
<td>Beam</td>
<td>Slab</td>
<td>Wall</td>
</tr>
<tr>
<td>Top down/ machine Hydraulic crusher</td>
<td>Breaking away the structure by machine mounted hydraulic crusher</td>
<td>Column</td>
<td>Beam</td>
<td>Slab</td>
<td>Wall</td>
</tr>
<tr>
<td>Hydraulic crusher w/ long boom</td>
<td>Breaking away the structure by machine mounted hydraulic crusher with long arm extension</td>
<td>Column</td>
<td>Beam</td>
<td>Slab</td>
<td>Wall</td>
</tr>
<tr>
<td>Wrecking ball</td>
<td>Distraction by impact of steel ball suspended from a crane</td>
<td>Column</td>
<td>Beam</td>
<td>Slab</td>
<td>Wall</td>
</tr>
<tr>
<td>Implosion</td>
<td>Use of explosives</td>
<td>Column</td>
<td>Beam</td>
<td>Slab</td>
<td>Wall</td>
</tr>
<tr>
<td>Mechanical method w/ machinery</td>
<td>Toppling or breaking away structure by large machinery from outside the building</td>
<td>Column</td>
<td>Beam</td>
<td>Slab</td>
<td>Wall</td>
</tr>
</tbody>
</table>
Table 4.1  Summary of General Characteristics of Demolition Methods (Continue)

<table>
<thead>
<tr>
<th>Saw cutting w/ circular saw or chain saw</th>
<th>Wire saw cutting</th>
<th>Drilling</th>
<th>Non explosive demolition agent</th>
<th>Thermal lance</th>
<th>Water Jet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting with circular saw or chain saw</td>
<td>Cutting with wire saw</td>
<td>Coring, drilling and cutting by stitch drilling</td>
<td>Expansion pressure from absorption of CaO or other chemical reactions</td>
<td>Use of intense heat by fusion of metal</td>
<td>Jetting of water at high pressure</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>- Solid working platform</td>
<td>- Solid working platform</td>
<td>- Solid working platform</td>
<td>- Protection of person and properties from intensive heat</td>
<td>- Protection of person and properties from high pressure water</td>
<td></td>
</tr>
<tr>
<td>- Arrangement for hoisting out cut section</td>
<td>- Counter measure to prevent danger of wire breaks</td>
<td>- Allows precise separation</td>
<td>- Fire damage protection required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Arrangement for hoisting out cut section</td>
<td>- Allows precise separation</td>
<td>- Allows precise separation</td>
<td>- Good for foundation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Counter measure to prevent danger of wire breaks</td>
<td>- Allows precise separation</td>
<td>- Good for cutting massive structures</td>
<td>- Good for foundation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Explanation of Symbols for Table 4.1

Applicability:
- O Very effective
- © Moderately to slightly effective
- • Not efficient

Wrecking Efficiency:
- O Excellent
- © Good
- • Poor

Dust Particles:
- O Very little dust
- © Moderate amount of dust
- • Significant amount of dust

Explanation:
- O Not felt by the human body
- © Very little effect on human
- • Significant effect

Noise:
- O 70 dB(A) or below (30m locality)
- © 70 - 74 dB(A) (30 m locality)
- • 75 - 79 dB(A) (30 m locality)
- © 80 dB(A) or above (30 m locality)

Noise level indicated above are for reference only. Actual noise level will depend on the machine used and site conditions.
(B) Demolition Sequence

Demolition sequence shall be determined according to actual site conditions, restraints, the building layout, the structural layout and its construction. In general, the following sequence shall apply:

(1) All cantilevered slabs, canopies, verandahs and features attached to the external walls shall first be demolished prior to demolition of main building and its internal structures on each floor;

(2) When demolishing the roof structure, all lift machine rooms and water tanks at high level shall be demolished in “top down” sequence to the main roof level. In demolishing the external wall or parapet wall, the procedure as stated in 4.2.1.(D) shall apply.

(3) Demolition of the floor slabs shall begin at mid span and work towards the supporting beams;

(4) Floor beams shall be demolished in the order as follows:
   (a) cantilever beams;
   (b) secondary beams; then
   (c) main beams.

In the case when structural stability of beams are affected, e.g., due to lost of restraints, the affected beams shall be propped prior to loss of support or restraint.

(5) Non-load bearing walls shall be removed prior to demolition of load bearing walls;

(6) Columns and load bearing walls shall be demolished after removal of beams on top;

(7) If site conditions permit, the first floor slab directly above the ground floor may be demolished by machine sitting on ground level and mounted with demolition accessories.

(C) Cantilever Structures and Balconies

Cantilever structures, balconies and canopies may project out of the building over the pedestrian footpath or in some cases over a portion of the traffic lane. Temporary supporting structures and/or
catch platform shall be placed directly underneath the cantilever balcony as precautionary measures. Details of the criteria for temporary design are referred to in 3.5. Common problems related to cantilever structures are also discussed in 5.3. The general sequence of dismantling cantilever slabs and beams is described in the following:

1. The exterior wall shall be demolished first, and detail is referred to in 4.2.1(D), Exterior Walls;

2. Any structure or dead load supported by the cantilever system shall be removed prior to demolishing the cantilever slabs and beams;

3. The concrete shall be broken down gradually starting from the exterior edge of the cantilever floor, working inwards and toward its supporting beams. Figure 4.1 illustrates the demolition of cantilever slab;

4. The cantilever beam shall be demolished after the demolition of the connecting floor slab. Demolition of the cantilever beam shall not advance further than the floor slab so that the support for the slab is always maintained. Figure 4.2 illustrates the demolition of cantilever beam with the slab;

5. Saw cut and lift may be used to dismantle the cantilever features. The slab shall be cut into a manageable size and lifted away. The cantilever beams shall be cut and removed after the removal of the slab load and any load supported by them. The cut and lift applications are discussed in 4.6.3.

(D) Exterior Wall

1. Brick in-fill Wall

   (a) To avoid any potential hazard of bricks falling out of the building, all the brick in-fill shall be removed by pushing inward, before dismantling the reinforced concrete framing. Working platforms outside the building shall be used for removal of the brick in-fill walls. Brick removal shall begin from the top layer downwards;

   (b) The reinforced concrete framing can be dismantled by taking down the individual beams and columns separately and/or by taking down the frame of a bay
reinforcing bars to be cut after breaking away the concrete

cantilever beam to remain

direction of concrete demolition

cantilever beam to remain

regular beam to remain

PLAN

FIGURE 4.1 DEMOLITION OF CANTILEVER REINFORCED CONCRETE SLAB
FIGURE 4.2  DEMOLITION OF CANTILEVER REINFORCED CONCRETE SLAB AND BEAM
between two columns as described in 4.2.1(D)(2), 4.2.1(D)(3) and 4.2.1(D)(4).

(2) Exterior Beam

(a) The exterior beam may be demolished by gradually breaking away the concrete or by dismantling the entire beam section. Demolition of the exterior beams is illustrated in Figure 4.3 and described in the following:

(i) Wire and winch or other systems shall be used to secure the cross beam to other structural members;

(ii) The concrete is first broken away at both ends near its column supports to expose the reinforcement;

(iii) Reinforcement shall be cut at one end to allow the beam to partially drop. The wire shall safely winch the beam down to the building floor in a controlled manner;

(iv) The dismantling would be completed by cutting the reinforcement at the remaining end, and the beam will then be lowered completely in a controlled manner.

(3) Exterior Column

(a) Exterior column may be demolished by the following procedures and as illustrated in Figure 4.5.

(i) The top of the column shall first be secured to a structural member by wire and winch;

(ii) Pre-weakening shall be performed at the bottom of the column to reduce the pulling force and to ensure that the break occurs at the desired location. The concrete cover of the reinforcement shall first be removed. Reinforcement at the interior face shall remain. Reinforcement at the exterior face shall be cut immediately before the pulling of the column;
1. Prop all span of external beam.
2. Tie the span of beam to be demolished.
   (details of the connection may refer to figure 4.4)
3. Remove props at span to be demolished.
4. Expose all reinforcement.
5. Cut reinforcement at cut 1, cut 2, and cut 3.
6. Lower the end at cut 1 & cut 2.
7. Cut reinforcement at cut 4.
8. Lower the beam.

Note: The tie wire are indicative. If there are permanent anchors or lifting machines available tie wire arrangements may be simplified to suit.

FIGURE 4.3 DEMOLITION OF EXTERNAL BEAM
wire connects to winch and anchors to stable structure

ALTERNATE CONNECTION TO BEAM

PLAN

wire connects to winch and anchors to stable structure

ALTERNATE CONNECTION TO BEAM

ELEVATION

Note: The tie wire arrangement is for illustration purpose. It may be simplified to suit depending on the availability of structural anchor.

FIGURE 4.4 DETAILS FOR SECURING EXTERNAL BEAMS BEFORE DISMANTLING
NOTES:

1. Secure the column by wire & winch to existing structure or excavator arm.

2. Pre-weakening at the bottom of column
   i) Break away the concrete to expose the reinforcing bars.
   ii) Cut the reinforcing bars at the exterior half of the column. Cutting shall be performed immediately prior to pulling.

3. Pulling down the column in a controlled motion.
(iii) After pre-weakening, the column shall be pulled down by the wire and winch towards the interior in a controlled manner.

(4) Exterior R. C. Frame

(a) The exterior R. C. frame may be demolished in sections. The demolition procedures are generally described in the following:

(i) For manual demolition, the optimum section of the frame to be demolished shall be a bay between the two adjacent columns but shall not be wider than 3 m;

(ii) The frame section shall be secured to other structural members with wire and winch before disconnecting the framing from the remaining structure;

(iii) Pre-weakening shall be performed at the bottom of the two columns. The pre-weakening of the columns shall follow 4.2.1(D)(3);

(iv) The reinforcing bars connecting the beams shall be cut off after pre-weakening. The framing shall be pulled down by exerting force through winch and pulley system.

(5) Reinforced Concrete Wall

(a) Load Bearing Wall

Reinforced concrete walls may be demolished by cutting down the wall into manageable sections. The width of the wall shall not be wider than 2 m. Demolition of the reinforced concrete wall sections is illustrated in Figure 4.6 and described in the following:

(i) Before demolition begins, wire and winch systems shall be used to secure the wall section;

(ii) Pre-weakening at the bottom of the wall shall be performed, particularly if the wall section contains columns. The concrete along the cut line of the interior face of the wall section
additional tie wire for external walls only
size and no. of tie wire shall be determined by the ESE and shall be specified on the demolition plans

wall tie anchored to interior column or beam

begin with section at mid span, break away a vertical groove with some reinforcing bars remain to support the structure

EXTERNAL R.C. WALL (VIEW FROM INSIDE)

SECTION A
prior to pulling

Cutting away the reinforcing bars connecting the wall section. Reinforcing bar at the bottom to remain. Pulling down the wall section by wire and winch in a controlled motion.

rubber tires (optional)

NOTES:
This method may apply to both hand-felling of interior and external walls.

FIGURE 4.6 FELLING OF A REINFORCED CONCRETE WALL
shall be broken away by hand held tools. Pre-weakening of columns shall follow 4.2.1(D)(3). The operation must be careful to minimise debris from falling out from the building.

(iii) After the concrete along the cut line is removed, the reinforcing bars along the vertical cut line shall be separated. Force shall be exerted through the wire and winch systems to pull the wall down into the building.

(b) Non-Load Bearing Wall

For non-load bearing walls or walls with heavy cross beams, the dismantling procedures are similar to that of the load bearing wall except that the cross beams are dismantled separately from the building walls. Figure 4.7 illustrates the felling of non-load bearing wall sections separately from the cross beam.

(E) Floor Slabs

Reinforced concrete floor slab shall be demolished by gradually breaking away the concrete. The reinforcement shall remain and be cut off after the concrete is broken away. The sequence for demolition of typical floor slabs are discussed in the following:

(1) Two way slab

The two way slab is supported by beams or structural members on all four sides. Demolition of the slab shall begin in the middle of the slab and advance towards the sides in all 4 directions. Figure 4.8 illustrates the demolition of two way slab.

(2) One way slab

The breaking of concrete shall begin at the unsupported end and proceed in strips perpendicular to the supporting beam or structural member. The strips shall be demolished from their centre towards the supports in both directions.

(3) Flat slab

Demolition of flat slab shall begin at the centre of the bay between the supporting columns and proceed outwards to
addition tie wire for external walls only
wall tie anchored to interior column or beam

EXTERNAL R.C. WALL (VIEW FROM INSIDE)

reinforcing bars to remain for additional support
tie wire for addition safety (external walls only)
size and no. of tie wire shall be determined by the RSE and shall be specified on the demolition plans

SECTION A
prior to pulling

Cutting away the reinforcing bars connecting the wall section. Reinforcing bar at the bottom to remain. Pulling down the wall section by wire and winch in a controlled motion.

rubber tires (optional)

NOTES:
This method may apply to both hand-felling of interior and external walls.

FIGURE 4.7 FELLING OF REINFORCED CONCRETE WALL SEPARATELY FROM THE CROSS BEAM
beams to remain

reinforcing bars to be cut after removal of concrete

directions of concrete demolition

beams to remain

PLAN

FIGURE 4.8 DEMOLITION OF TWO WAY SLAB
the columns and/or members that provide lateral support of the slab. Care must be exercised not to prematurely weaken the shear capacity of the columns or other supports.

(F) Interior Beam

(1) Interior beam normally supports floor slabs on both sides. The supporting beam shall not be removed until all other dead loads imposed on the beam are removed, including the slabs supported by the beam;

(2) The dismantling of interior or secondary beams is illustrated in Figure 4.9.

(G) Interior Column

Interior column may be dismantled by pre-weakening at their base and pulling down by wire and winch system. The process is similar to the demolition of the exterior column as previously described in 4.2.1(D)(3).

4.2.2 Top Down by Machines

(A) General

The sequence of demolition by machine is typically the same as the top down manual method, except that most of the demolition is done by mechanical plant. The demolition begins with the lifting of the mechanical plant on to the building top floor. When rope or tie wire is used for pulling, the workers shall be protected or stay away from the area within reach of the rope or tie wire. The wire strength shall be at least 4 times the anticipated load. The rope or tie wire shall be checked at least twice per day to ensure that they are in good working conditions.

(1) Supports for Machines

The loading to be imposed on the floors by the mechanical plant shall be checked. If needed, propping shall be installed at floor levels below the working floor to safely support the operation of the mechanical plant. The movement of the mechanical plant shall only be within the propped area. The movement of the mechanical plant shall be prohibited in the following areas:

(a) Within 2 m of the building edge;
1. Ensure no load on the beam.
2. Tie the beam to be demolished.
   (details of the connection may refer to figure 4.10)
3. Expose reinforcement at both ends of the beam.
4. Cut reinforcement at positions cut 1, cut 2, and cut 3.
5. Lower the beam at external end.
6. Cut reinforcement at cut 4 and lower the beam completely.

Note: The tie wires are indicative. If there are permanent anchors or lifting machines available, tie wire arrangements may by simplified to suit.
ALTERNATE CONNECTION TO BEAM

PLAN

ALTERNATE CONNECTION TO BEAM

ELEVATION

Note: The wire arrangement is for illustration purpose. It may be simplified to suit depending on the availability of structural anchor.

FIGURE 4.10 DETAILS FOR SECURING SECONDARY BEAMS BEFORE DISMANTLING
(b) 1 m of any floor openings; or

c) any cantilever structures.

Markings such as ribbons, paints or other appropriate means shall be used to identify the propped area and limits of the mechanical plant movement. The extent of the propping shall be determined based on the anticipated operation, the allowable loading on the floor slabs and the site conditions. Design criteria for the propping requirements are referred to in 3.5.5.

(2) Lifting of machinery

The mechanical plant shall be lifted onto the roof of the building by the use of mobile crane or other appropriate means as approved by the Registered Structural Engineer. Prior to the lifting operation, propping shall be installed on the floors beneath the roof in accordance with the approved design. The crane shall be properly tested, examined and operated in accordance with the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations. The operating area shall be blocked off during the lifting operation. Approval from the Police and Transport Departments shall be obtained prior to the operation if temporary road closure is required.

(3) Temporary Ramp Construction

The machine shall descend down to the next floor by means of a ramp. The ramp may be a temporary structure or other appropriate design. The slope of the ramp shall be no steeper that 1.75 to 1 or as recommended by the machine manufacturer. Temporary structure shall be designed and constructed in accordance with 3.5. Propping requirements for the temporary access ramp are referred to in 3.5.5.

(B) Demolition Sequence

Demolition sequence shall be determined according to the actual site conditions, restraints, original building layout and its construction. In general, the following sequence shall apply:

(1) prior to demolition of internal floors, all cantilever slabs and beams, canopies, and verandahs shall first be demolished;
(2) the structural elements, in general, shall be demolished in the following sequence:

- slab;
- secondary beams;
- main beams.

(3) mechanical plant shall descend from the floors with temporary access ramp;

(4) when a mechanical plant has just descended from the floor above, the slabs and beams, in two consecutive floors may be demolished by the mechanical plant simultaneously. The mechanical plant may work on structural elements on the same floor and breaking up the slabs on the floor above;

(5) the wall panel, including beams and columns shall be demolished by gradually breaking down the concrete or by pulling them down in a controlled manner;

Figure 4.11 illustrates the typical sequence of top down method with mechanical equipment.

(C) Cantilever Canopies and Balconies

Demolition of cantilever canopies and balconies may critically affect public safety and must be performed with extreme caution. Temporary supporting structures and/or catch platform shall be placed directly underneath the cantilevers or balconies. Common problems related to cantilever structure are discussed in 5.3. The process of demolition of the cantilever structures is described in the following:

(1) The exterior wall that forms a part of the cantilever structure or balcony shall be removed first. This is further discussed in 4.2.2(D) exterior wall;

(2) The floor slab and cantilever beam may be demolished in sections. Demolition of cantilever slab is illustrated in Figure 4.12;

(3) The machine arm with wire passing through the slab section shall be used to stabilise the structure while the cutting is performed;
1. Demolition of Slabs and Beams

2. Continue Demolition of Slabs and Beams

FIGURE 4.11  TYPICAL SEQUENCE OF TOP DOWN METHOD WITH MECHANICAL EQUIPMENT (sheet 1 of 3)
3. An access ramp of steel structural frame to allow machine to climb down to the next floor below.

4. Demolition of interior column may be needed to create access and working room for exterior wall demolition. Demolish column by first pre-weakening the bottom, then dismantled by machine in fully controlled motion.

FIGURE 4.11 TYPICAL SEQUENCE OF TOP DOWN METHOD WITH MECHANICAL EQUIPMENT (sheet 2 of 3)
5. Cutting the exterior wall in sections and pre-weakening of columns. (see figure 4.14) Cutting should be careful to minimise debris falling outside.

6. Machine should be used to brace the wall section while cutting the reinforcing bars connecting the wall section. The wall section shall be pulled down in a controlled motion.

FIGURE 4.11 TYPICAL SEQUENCE OF TOP DOWN METHOD WITH MECHANICAL EQUIPMENT (sheet 3 of 3)
CASE 1. MACHINE MOUNTED ON SUSPENDED FLOOR

CASE 2. MACHINE MOUNTED ON GROUND
all slab reinforcement bar to be cut

A. CUTTING OF CANTILEVER SLAB

B. LIFTING OF CANTILEVER SLAB

FIGURE 4.12 DEMOLITION OF CANTILEVER SLAB BY MOBILE MACHINE (CUT AND LIFT METHOD) (SHEET 2 OF 2)
(4) Cuttings may be performed by jack hammer or pneumatic hammer for the concrete and oxy-acetylene flame cutter for the reinforcements. The concrete shall be broken away first before the cutting of reinforcement. Alternatively the reinforced concrete slab may be cut by saw cutting;

(5) The slab shall be lifted into the building by a derrick arm.

(D) Exterior Wall

Demolition of exterior wall shall be proceeded with extreme caution. The exterior wall may be demolished in sections by mechanical plant. The width of wall section shall be determined by the RSE. The mechanical plant shall have adequate working capacity to safely handle the weight of the wall sections. A short span of the slab, about 300 mm, attached to the external beam at the top of the wall, may be left in order to keep the loading resultant of the exterior wall further into the building.

(1) Brick in-fill wall

Demolition of the brick-in-fill wall is generally described in the following:

(a) The in-fill bricks shall first be manually removed. The brick shall be removed from the top layer down by pushing in from outside. Work platforms erected outside the building may be used for this operation;

(b) After the in-fill bricks are removed. The reinforced concrete frame may be demolished by dismantling the framing sections as described in 4.2.2(D)(3).

(2) Exterior Column

(a) The excavator arm with wire or hydraulic crusher attachment shall be used to brace the column;

(b) Pre-weakening shall be performed at the bottom of the columns, similar to the process described in 4.2.1(D)(3);

(c) After pre-weakening, the column shall be pulled down in a controlled motion into the building by the excavator arm.

(d) Demolition inside the building by the excavator arm.
(3) Exterior R.C. Frame

Dismantling of the exterior R.C. frame, is illustrated in Figure 4.13 and is described in the following:

(a) The concrete along the proposed cut-line shall be broken first. The reinforcing bars shall be kept to stabilise the structure. The excavator arm shall secure the reinforced concrete framing;

(b) Pre-weakening may be performed at the bottom of the columns as described in Figure 4.5. The excavator arm shall continue to stabilise the frame while cutting the reinforcing steel at the disconnecting points;

(c) The excavator arm shall pull and guide the frame safely onto the floor.

(4) Reinforced Concrete Wall

The process of demolishing a reinforced concrete wall section is similar to that of a reinforced concrete frame. Demolition of a reinforced concrete wall section is illustrated in Figure 4.14 and is described in the following:

(a) The reinforced concrete wall shall be vertically separated from the remaining wall by breaking away the concrete. The width of the wall section shall be determined by the Registered Structural Engineer. The reinforcing bars shall remain to provide support to the wall section;

(b) If the wall section contains columns, pre-weakening shall be performed at the level where the wall is to be separated. Pre-weakening of column is referred to in 4.2.1(D)(3);

(c) The machine arm shall be used to secure the wall section during the cutting of the reinforcements along both sides of the wall section;
1. Excavator arm with wire or hydraulic crusher attachment secures the R.C. Frame.

2. The length of the frame section shall be determined by the RSE.

3. Pre-weakening of the concrete column at the bottom by breaking out the concrete cover to expose the reinforcing bars. Only the reinforcing bars at the exterior face, where the columns fall away from, shall be cut. (see Figure 4.5)

4. Excavator arm pulls down the frame in a slow and controlled motion.
1. Breaking away the concrete along vertical slots to separate the wall section. Width of wall section shall be determined by the RSE. Reinforcing bars shall be left to stabilise the section. Breaking of concrete shall be done cautiously to minimise debris from falling outside the building.
2. Excavator arm with wire to brace the wall section while pre-weakening at the bottom of columns. (see Figure 4.5)
3. Machine continue to brace the wall section, while cutting the reinforcing bars. Reinforcing bar at the bottom to remain. After cutting off reinforcements, excavator arm pulls the wall down in a controlled motion.
(d) After the reinforcing bars are severed, the machine arm shall steadily guide and pull down the wall section into the building for further break down.

(E) Floor Slab

Floor slabs may be dismantled by breaking down the concrete gradually with machine mounted attachments. Reinforcing bars shall be cut afterwards. The sequence for demolishing one way slab, two way slab and flat slab shall be the same as described in 4.2.1(E). The slab may be demolished by machine with breaker, hydraulic crusher or other appropriate attachments.

(F) Interior Beam

Interior Beam may be demolished by breaking the concrete away gradually and disconnecting the reinforcement afterwards.

(G) Interior Column

Reinforced concrete column may be demolished by using the same procedures as described for the exterior column in 4.2.2(D)(2).

4.3 Mechanical by Hydraulic Crusher with Long Boom Arm

4.3.1 General

The crusher attachment breaks the concrete and the reinforcement by the hydraulic thrust through the long boom arm system. The hydraulic crusher can be operated from the ground outside the building. This method is also suitable for dangerous buildings, silos and other industrial facilities. Figure 4.15 illustrates the typical operation of hydraulic crusher with long boom arm. For environmental reason, it should be used wherever practicable because of its quietness.

4.3.2 Application Criteria

(A) The operation shall have a minimum clear space of 1/2 the building height as a safety zone for the falling debris;

(B) The equipment shall be inspected and maintained periodically to make sure the equipment is in good and safe condition. The excavator shall operate on firm ground that can support the machine during the crusher operation;
FIGURE 4.15 DEMOLITION BY HYDRAULIC CRUSHER WITH LONG ARM BOOM
(C) Except for special applications, each section of the structure shall be demolished in a top down sequence to ensure stability of the structure;

(D) Debris may be used to build up a platform for the excavator to extend the range of reach. It is important that the debris is densely compacted to support the operation of the excavator. The platform must be flat and the slope must be stable. The height of the build up platform shall be limited to 3 m. The side slope of the temporary platform shall not be steeper than 1:1 (horizontal to vertical) unless the condition allows a steeper slope. The slope of access ramp for the machine shall be in accordance with the manufacturer recommendation. The width in both directions of the platform shall be at least one and one-half the length of the machine to allow safe manoeuvre during the demolition operation;

(E) To minimise the dust impact, the structure shall be pre-soaked with water before demolition. Water shall be continuously sprayed during the crushing operation;

(F) Debris may fall out of the building during the demolition. The site shall be completely fenced off. There shall be 24-hours guarded security to allow only authorized personnel for site access. During the operation of the crusher there shall be no worker within the machine operating area or inside the building;

(G) The crusher operator shall possess the essential skills and significant experience in the crusher operation. There shall be a spot person to assist in the operation and alert the operator of any potential problem during the operation.

4.4 Wrecking Ball

4.4.1 General

The wrecking ball application consists of a crane equipped with a steel ball. The destruction of the building is by the impact energy of the steel ball suspended from the crawler crane. The wrecking ball operates outside the building. This method is suitable for dilapidated buildings, silos and other industrial facilities. However, the operation requires substantial clear space. The application also demands high level skill operators and well-maintained equipment. Figure 4.16 illustrates the operation of Wrecking Ball.
JIB HEAD 3m ABOVE BUILDING BEING DEMOLISHED

VERTICAL DROP METHOD

SWING IN-LINE METHOD

FIGURE 4.16 OPERATION OF WRECKING BALL
4.4.2 Application Criteria

The recommended criteria for the use of wrecking ball are presented in the following:

(A) Except for special application, the balling of each section of the structure shall proceed from top to bottom. Care shall be taken to maintain the stability of the structure;

(B) Recommended techniques for the wrecking ball operations include:

   (1) Vertical Drop - free falling of the wrecking ball onto the structure;

   (2) Swing in line - swinging of the ball in-line with the jib. A second dragline will normally connect to the ball horizontally to control the ball motion. The ball shall be swung into the building. The ball shall strike at the top of the member so as to avoid the member from falling outside the building.

Slewing the jib is not recommended. The motion of the ball by slewing the jib is difficult to control. It demands expert knowledge of the machine and structure as well as operating skills to safely perform the task. Slewing can potentially induce a tremendous amount of stress on the jib, as such, its use shall be avoided.

(C) The jib or boom shall be operated with no less than 3 m above the portion of the structure being demolished;

(D) Clear space for operation between the crane and the structure being demolished shall be 50% of the height of structure, the clear distance between the site boundary and the building to be demolished shall not be less than 50% of the building height plus an additional 6 m for the crane to manoeuvre, this criteria shall apply to all sides of the building to be demolished by wrecking ball;

(E) The demolition ball shall be connected with swivel type anti-spin device to prevent twisting and tangling of the wire during operation;

(F) The wire and boom of the machine used for balling shall have a rated capacity, at the working radius, of at least 5 times the weight of the ball;
(G) The strength of the wire shall be at least twice the tensile strength of the nominal steel reinforcement of the floor slab and beams. The high strength wire allows the pullout of the wrecking ball from potential traps;

(H) To ensure that the crane is in good condition, the wire connecting to the ball, the boom components and connecting pins shall be inspected twice daily;

(I) A sufficient length of the wire shall be provided to allow the ball to drop to the lowest working level plus an addition of 10% of the wire length and no less than 3 drums. For swing in-line method, there shall be sufficient length of the dragline wire to allow the ball to fall in the event that the ball is entangled with the falling debris;

(J) The operation shall not be performed adjacent to overhead power lines;

(K) The site shall be entirely fenced off to forbid public access. A 24-hour security guard shall be assigned to the site to enforce the access restriction; depending on the relative location between the fence and the building, and fence shall be designed to withstand accidental impact by the wrecking ball;

(L) During the use of the demolition ball, except for the crane operator and the spot person, all other workers shall be kept away from the demolition ball’s working radius. No body shall stay inside the building;

(M) To minimise the dust impact on the surrounding area, the structure to be demolished shall be pre-soaked with water before demolition. Water spraying shall continue on the structure during demolition;

(N) Since the safety and success of the project depend highly on the operator and site personnel, the operator must have proven experience and skill for operating the wrecking ball to the satisfaction of the approval authority;

(O) A spot person shall be on site during the operation to assist the operator and to ensure site safety. The spot person shall have extensive knowledge and experience in the use of wrecking ball. The qualification and experience of the spot person shall be equivalent to those of the wrecking ball operator.
4.5 Implosion

4.5.1 Pre-blast Considerations

If the Contractor intends to blast a building structure, the Contractor shall carry out a comprehensive Risk Assessment Report and an Environmental Assessment Report on the effect of implosion on the affected neighbourhood. With positive results on both the risk assessment and environmental impact assessment and agreed by the relevant approval Authority, through the central processing of the Buildings Department, the Contractor may begin studying the structure of the building and develop a blasting design. The design may include pre-weakening of the structure, the strategy in placement of the explosives and time delay so that the building will collapse in a safe manner. Pre-weakening of the structure may include cutting out a portion of the shear walls and other structural elements. A test blast may be conducted to verify the strength of the structural member and to fine tune the explosive design. Protection of the adjacent properties and habitats is also an important consideration.

4.5.2 General Concerns

General concerns and good practices in controlled demolition by blasting are discussed in the following:

(A) Pre-weakening of the structure shall be designed to ensure the structural stability before the implosion;

(B) To minimise the dispersion of building debris into adjoining land after blasting, a trench or bund wall shall be installed outside the building to contain the debris, unless a basement exists;

(C) A good design will cause the structure to fall towards the centre of the building and/or within the protected area;

(D) A good design will provide adequate and sufficient time delay to allow only one or two floors of the building debris to fall on ground level at a time in order to limit the magnitude of the impact on the ground;

(E) The design must also identify an exclusion zone to evacuate all residents or inhabitants during the blasting. The impacts of noise and dust generated during the blasting shall be considered. Radius of the typical exclusion zone shall not be less than 2.5 times the building height;
(F) If there are slopes and earth retaining walls or features, a geotechnical assessment shall be conducted to ensure that the blasting will not affect the stability of these features;

(G) The entire site shall be under 24-hour security from the installation of explosive until final blasting. Handling and storage of explosives shall be in conformance with the Dangerous Goods Ordinance, any requirements of the Commissioner of Mines and other relevant regulations. The implosion expert shall have proven experience and track records in design and supervision of blasting similar building structures to the satisfaction of the Commissioner of Mines. The blasting expert shall have acquired the relevant training and practical experience in using the proposed explosives. The blasting expert shall obtain from the Commissioner of Mines an authorization to carry out blasting. All personnel must be evacuated from the site before and during blasting;

(H) The contractor must co-ordinate with the government and local community to determine the best procedures in notification, schedules for the events, traffic routing, design for the sequence of events, evacuating residents, clear out personnel from the building and assigning responsibilities during blasting. For the purpose of crowd control, blasting should be carried out in the early morning of a Sunday or public holiday;

(I) An emergency plan shall be prepared to handle emergency situations such as premature explosion, misfire or interruption due to bad weather including thunder and lightning;

(J) After the explosion, the blasting expert must check to make sure that there is no unfired explosive left on site. The entire area must remain clear and under security control until the unfired explosives have been detonated or safely dealt with by the blasting expert;

(K) As far as practicable, non-electrical initiation systems should be used to avoid the risk of pre-mature detonation by stray currents, external electro-magnetic waves or radio frequencies. The installation shall include a redundant system to ensure successful detonation. Nitroglycerine based explosives are not permitted to be used.

(L) The contractor must provide evidence of his capability to safely perform the demolition and shall illustrate to the approving authorities that the procedures are safe;

(M) The mode of collapse shall be demonstrated to ascertain that:
(1) no part of the building will fall beyond the protected area;

(2) the impact of the structural collapse will not cause significant vibration affecting

(a) any underground tunnels;

(b) any underground utilities; and

(c) any adjoining properties.

(N) The structural safety of the building to be imploded shall be checked and certified to be sound and safe at all stages prior to implosion.

4.6 Other Methods

4.6.1 Non Explosive Demolition Agent

Non Explosive Demolition Agent (NEDA) is a static demolition agent. When the reaction takes place in a confined drill hole, the NEDA generates an expansive pressure to crack and break concrete and stone.

The NEDA is a suitable application in a restrictive environment where noise, flying debris and vibration are less tolerated. A drilling pattern shall first be designed. For large projects, test breaking shall be performed. The NEDA shall be mixed with water to form a slurry and immediately placed into the pre-drilled holes. The loading intensity and water content shall be controlled to optimise the expansive pressure and prevent blow-out of the NEDA. The breaking effect of NEDA is relatively small comparing to explosives. Secondary efforts are required to further break down and remove the debris by mechanical means.

NEDA may be used on foundation works, pile caps or structures that are fully supported.

When used in rock, NEDA should be contained within strong, flexible, impermeable bags to prevent uncontrolled entry into rock joints.

4.6.2 Saw Cutting

Saw cutting is suitable for alteration and additional works where accuracy in the cutting is important and the tolerance to noise and vibration is very limited. It can be used to cut concrete slabs and wall
elements into segments. An entire building may be dismantled by saw cutting. Saw cutting generally includes conventional disc saw and chain saw, diamond core stitch drilling and wire saw.

(A) Wire Saw Cutting

Wire saw cutting comprises a special steel wire often impregnated with diamond beads to increase its cutting ability. The wire saw method is a suitable application for projects that require precision and total control of demolition work. A hole shall first be pre-drilled for the passage of the diamond wire, the wire cutting operation follows. Because of its flexibility, it may be used for “hard to reach” areas. A diamond wire saw may also be applied in cutting off piling of marine structures and bridges. Its flexibility and range of application are depicted in Figure 4.17.

(B) Diamond Core Stitch Drilling

Diamond core stitch drilling may be adopted to cut concrete elements by continuously coring a set of holes to carve up the concrete structure. The thickness of the concrete to be cut depends on the depth of the drilling or coring equipment. Diamond core stitch drilling is particularly suitable in the removal of existing pile cap for construction of large diameter bored pile foundation.

(C) Management of Process Water

The sawing and drilling operations require large amounts of water to cool down the blade which cuts through the concrete at high speed. Provision shall be made to provide a water source for the operation and for the disposal of the cooling water.

4.6.3 Cutting and Lifting

Cutting and lifting involve the initial cutting of the structure into individual pieces or segments, and then lifting the pieces or assembly by crane onto the ground for further demolition or hauling away. Slabs can be cut into segments and then lifted off for further cutting into smaller pieces before disposal. Precast concrete structures can be cut into pieces and then lifted off as a reversal of the construction sequence when the precast elements are fabricated from pieces into an assembly of structure. Cutting and lifting may be applied to safely remove projections such as projections such as canopies, architectural features, balconies and bay windows. The typical procedures for cutting and lifting are summarised in the following:
FIGURE 4.17 APPLICATION OF WIRE SAW TECHNIQUES
(A) Prior to cutting, the structural stability of the remaining structure shall be checked;

(B) The structural element to be removed shall be secured, either by temporary supports or by tie wires connected to lifting appliances. The lifting appliances must have adequate capacity to support the weight of the structural section. The wire strength shall not be less than 4 times the anticipated loads;

(C) The lifting appliance, cutting by disc saw, chain saw and diamond wire saw shall comply with the relevant Factories and Industrial Undertakings Regulations;

(D) After cutting, the structural element shall be lowered to the designated area in a controlled manner. Free falling shall be avoided.

4.6.4 Mechanical Demolition

(A) General

Mechanical demolition generally involves the use of large machinery with attachment to dismantle the building from outside. The common mechanical methods include the use of a pusher arm, wire rope and clam shell. The operations of these applications are illustrated in Figure 4.18. These methods shall only be applied to isolated buildings on relatively flat ground. The concerns and good practices of the mechanical demolition generally included the following:

(1) The machine shall be operated on smooth and firm ground. It shall also have adequate counter-weight to prevent overturning during the operation;

(2) The equipment and accessories such as attachments and rope shall be inspected frequently and shall be repaired or replaced whenever necessary;

(3) The impact of the collapsed structural sections on the floor or ground shall be checked to prevent the potential overloading of the suspended floor, vibration and disturbance to adjacent properties and damage to underground utilities;
(i) MECHANICAL BY PUSHER ARM - PUSHING IN

(ii) MECHANICAL BY PUSHER ARM - PULLING OUT

(iii) MECHANICAL BY CLAM SHELL

(iv) MECHANICAL BY WIRE ROPE
The site shall have full time security to prevent unauthorized personnel entering the site. No person shall stay within the working area of the machine and the building while the machine is operating;

Sufficient water spray or other anti-dust precautions shall be provided to minimise air pollution by dust;

The cab of the machine shall be equipped with impact proofed glass and its construction shall be robust enough to protect the operator from flying debris;

A spot person shall be on site full time to provide guidance and assistance to the operator in the demolition process.

In addition to the above, specific criteria for each mechanical method are discussed in the following sections:

(B) Mechanical by pusher arm

Mechanical pusher arm involves the use of machines equipped with a pusher arm attachment for applying horizontal thrust to demolish the structural element. Special conditions for pusher arm demolition are listed below:

(1) The pusher arm shall be constructed of steel or equivalent material and shall have adequate strength to operate on the building; a crane boom shall not be used;

(2) Minimum safety distance of 0.5 times the height of the building element being demolished shall be maintained between the machine and the building for pushing into the building;

(3) Minimum safety distance of 1.5 times the height of the building element being demolished shall be maintained if structural elements are pulling out of the building;

(4) The point of pushing Application shall not be less than 2/3 of the height and not more than 600 mm below the top of the wall;

(5) The pusher arm method shall be limited to buildings less than 15 m high.
(C) Mechanical by deliberate collapse

Mechanical demolition by deliberate collapse generally consists of systematic removal, or weakening of the key structural elements to induce the collapse of the structure. Special conditions for deliberate collapse are as follows:

(1) Minimum safety distance of 1.5 times the height of building element being demolished shall be maintained throughout the operation;

(2) The procedures shall be carefully designed and executed in the removal of key structural elements so that there will be no pre-mature collapse and the structure will collapse onto the anticipated area;

(3) Application of the deliberate collapse method shall be limited to buildings less than 15 m high.

(D) Mechanical by wire rope pulling

Mechanical demolition by wire rope pulling generally involves the use of an earth mover machine or mechanical winch device equipped with heavy steel wire for pulling down structural members. Special conditions for wire rope pulling are listed in the following:

(1) A safety distance of 1.5 times the height of element to be demolished shall be maintained between the machine and the building during the pulling;

(2) The machine shall always travel parallel to the line of pull during the pulling operation;

(3) In the case when pulling is done by a pulley, such a pulley device shall be securely anchored;

(4) The wire rope or chain shall be composed of steel with tensile strength not less than 4 times the theoretical force required to perform the pulling;

(5) The wire rope used for the operation shall be inspected for wear and damage at least twice daily and replaced as necessary;
(6) Any sharp edge that is to be wound by the rope shall be protected to minimise the possibility of cutting or wearing of the rope during pulling;

(7) The bottom of the wall may be pre-weakened with care and protection to ensure controlled collapse;

(8) The wire rope pulling shall be limited to buildings less than 15 m high;

(9) All workers shall stay away from the area within reach of the rope or wire in case it breaks.

(E) Mechanical by clam shell

Demolition by clam shell typically involves the use of a crane equipped with a clam shell attachment which progressively bites away the structure. Special conditions for clam shell are listed in the following:

(1) A minimum safety distance of 0.5 times the height of the building element being demolished shall be maintained between the machine and the building during the operation;

(2) The process of biting off the structural elements shall begin from the top and progress downwards;

(3) The clam shell shall be operated not less than 1 m above the structure being demolished.

4.6.5 Thermal Lance

Cutting of reinforced concrete by thermal lance involves very high temperature up to 2,000 - 4,000°C. The extremely high heat requires special precautionary measures and care. The use of a thermal lance in cutting reinforced concrete shall not be used unless:

(A) the project demonstrated that there is no other viable alternative;

(B) adequate protective measures are provided to isolate the operation and to prevent any potential fire spreading out;

(C) adequate protective measures are provided to prevent the injury of the workers, and any third party by flame and the molten concrete.
4.6.6 Water jet

Water jetting involves the use of a water jet stream pumped at high pressure to erode the cement matrix and wash out the aggregates. Abrasive compounds may be added for cutting reinforcing steel. The application of the water jetting shall be subject to the following criteria:

(A) City water supply shall be used in water jet cutting. Provision shall be included to dispose the water used in the operation, and to recycle the water for continuous operation through local filtration and sedimentation;

(B) The area behind the structural member to be cut shall be shielded to avoid damage to persons and properties during the cutting;

(C) In the case when abrasive water jets are used, further precautionary measures shall be provided in accordance with manufacturer recommendations to confine the rebound of the abrasive compounds. All site personnel shall wear adequate safety cover and clothing.
5. SPECIAL STRUCTURES

5.1 Precast Concrete Structures

5.1.1 General

Precast concrete structures are constructed of precast concrete elements joined together. The continuity of the structure depends on the treatment of joints. The joint details shall be studied. In case of doubt, open up inspection at critical positions may be required.

5.1.2 Simple Precast Construction

The joints in this type of structure do not normally provide continuity. The stability of this type of structure relies on other elements such as stairs, lift shafts, shear walls or other framed structures.

(A) Dismantling

Each precast element shall be removed in the reverse order of construction and broken on the ground or an adequately supported floor. Elements providing lateral stability shall not be demolished prior to the removal of the precast elements or prior to the installation of the temporary bracing. Temporary supports shall be adequately braced or tied to laterally stable elements.

(B) Existing Lifting Points

The re-use of the existing lifting points or accessories to lift the precast elements shall not be allowed unless the record erection plans showing the function of the existing lifting points are checked and verified to be adequate for current use.

(C) Lateral Support During Lifting

Special consideration shall be given to long span precast elements with narrow compression flanges during lifting. Spreader beams shall be used to reduce the spacing of the lifting points. The use of spreader beam is illustrated in Figure 5.1.
(a.) Potential lateral / rotational instability of a long slender precast element during lifting.

(b.) Use of spreader beam for equalizing lifting loads & to reduce unsupported length.
(Use with caution for prestressed elements)
5.1.3 Continuous Precast Construction

In this type of structure, the precast elements have continuity at their joints and the lateral stability is provided by the precast elements themselves. The continuous precast elements may be in the form of shear walls or moment resisting frames. It is possible that a combination of the simple construction and continuous construction exist in a single structure.

(A) Dismantling

The demolition of this type of structure may be performed in a way similar to that of a cast-in-place concrete construction provided that the continuous joints are cut in such a way that the lateral stability is maintained. If the precast elements are intended to be removed in a piece by piece manner in their reverse order of construction, the continuous joint shall be cut by appropriate pre-approved method such as saw cutting. The precast elements shall then be lifted off their support and lowered to the ground or to an adequately supported floor for demolition. Temporary bracing during lifting as described in 5.1.2(C) may be required.

5.2 Prestressed Concrete Structures

5.2.1 General

The prestressed concrete structures are constructed of either precast or cast-in-place concrete in which prestressing is introduced to the concrete by tensioning the steel reinforcement, or tendon, to counteract a desired degree of stress resulting from a given external loading. The types of prestressing and guidelines for identification are discussed in Appendix C.

5.2.2 Classification of Prestressed Concrete Structures

Based on the construction technique, the prestressed concrete construction can be classified into three major classes. Depending on the method of stress transfer, i.e., pre-tensioning or post-tensioning, and whether it is grouted, each class of construction can be further subdivided into separate categories as follows:

(A) Class I: Precast Prestressed Construction:

Category P1  Precast pre-tensioned

Category P2  Precast pre-tensioned/post-tensioned
Category P3  Precast post-tensioned

(B) Class II:  Cast-in-Place Prestressed Construction

Category C1  Post-tensioned before application of dead and live load and having all tendon ducts fully grouted.

Category C2  As Category C1 but having the tendon ducts ungrouted.

Category C3  Post-tensioned is in stages as the load carried by the member is increased in stages as the construction progress. The tendon ducts are fully grouted in the final condition. Transfer beam supporting multi-level frames is an example of this category.

Category C4  As Category C3 but having the tendon ducts ungrouted.

(C) Class III:  Others

(1) Segmental Post-Tensioned Construction

The segmental post-tensioned structures involve the construction of the main structural elements in segments. Their final integrity is achieved through post-tensioning of tendons which pass through and tie the segments together.

(2) Circumferential Prestressed Tanks

The tanks are prestressed by tendons bonded in grouted ducts or by unbonded tendons.

5.2.3 Precautionary Site Measures

(A) Detensioning

Due to the high energy stored in the prestressed members, the demolition of such members must be proceeded within a planned sequence and well controlled manner. During detensioning of the
tendons, a protective screen made of sand bags or similar material such as a backed plywood screen shall be placed at the anchor ends. The protection screen is illustrated in Figure 5.2.

(B) Shoring and Site Safety

The prestressed concrete floor system shall be properly shored prior to detensioning to prevent the collapse of the system. The release of energy during the demolition of prestressed concrete could be extremely hazardous. All workers on site must be informed of the presence of prestressing in the structure and the hazardous result on deviating from the prescribed procedures. A pre-determined safety plan shall be in place.

(C) Grout

For a structure with bonded construction, the conditions of the grout shall be checked. If the tendons are not fully grouted, additional grout shall be applied to fully fill the ungrouted voids. After grouting, the prestressed structure may be demolished similar to that of a bonded construction.

5.2.4 Demolition Procedures

The following procedures for each class and category of prestressed concrete shall only be used as a guideline. Detailed procedures shall be independently developed for each structure by an engineer experienced in prestressed construction based on the design, layout of the tendons, sequence of the stressing and construction.

(A) Class I: Precast Prestressed Structures

(1) Category P1: Precast Pre-Tensioned Structures

Precast pre-tensioned structures are typically single span elements and must generally be demolished in the reverse order of construction.
FIGURE 5.2 PROTECTION FOR DETENSIONING OF PRESTRESSED CONCRETE TENDONS
The precast pre-tensioned elements can be lifted off and turned on their sides, after the connections at the supports are removed. The lifting points shall be located near the ends of the units and shall be adequately designed to ensure safe lifting of the precast elements with these elements turned on to their side. The above process will generally fracture the structure and causing a sudden release of energy. After the energy is released, the elements can then be cut or pulverised into pieces before they are hauled away.

If turning the elements on their sides does not release the energy, a sand bag or other suitable screen shall be provided around the ends. The prestressed energy can be released by appropriate means such as the one described in 5.2.6(B)(2)(c).

(2) Category P2: Precast Pre-Tensioned/Post-Tensioned Structures

Sometimes two or more pieces of precast prestressed elements are continuously connected together at the supports by post-tensioning. This post-tensioning shall be detensioned according to the recommendations for demolition of post-tensioned structures in Class II construction as described in the 5.2.6(B). After the post-tension energy is released the remaining precast prestressed elements may be demolished in accordance with the procedures for Category P1 elements.

(3) Category P3: Precast Post-Tensioned Structures

These precast elements shall be lifted off from their support and placed on their side if the prestressed tendons are of grouted construction. If the conduits are not fully grouted, the elements shall be placed level on the ground and the post-tensioning forces shall be released in accordance with the procedures for Category C2 elements as described in 5.2.6(B)(2).

Adequate protection must be provided at the ends of the elements in case the tendons shoot out at the ends. In general, cutting of unbonded tendons at mid-span will dampen the shoot off effect.
(B) Class II: Cast-in-Place Prestressed Structures

(1) Category C1: Post-Tensioned Grouted

These elements shall be demolished as precast elements. For a single span slab, the slab may be saw cut into segments and lifted off similarly to precast elements. For continuous spans, the prestress over the support shall be released prior to cutting the slab into segments. It must be noted that prestressing may be provided in two directions and the detailed procedures shall take this into account. For beam and slab, caution shall be exercised to avoid upward failure of the beam when the slab is removed. When detensioning of tendons is involved, all slab and beam spans shall be temporarily supported to prevent unintentional collapse of the structure.

(2) Category C2: Post-Tensioned Ungrouted

The demolition of these elements shall generally proceed as follows:

(a) Shore up all slab and beam spans for which detensioning of tendons is required.

(b) Remove all superimposed dead load.

(c) The prestressing forces can be released by cutting away the concrete in front of the anchorage until the anchorage has been loosened. Alternatively, the forces may be released by saw cutting at appropriate locations along the tendons. During the detensioning, the ends of the tendons shall be protected from shooting off.

(d) The structure can be demolished as normal reinforced concrete.

(3) Category C3: Post-Tensioned in Stages and Fully Grouted

Care shall be exercised to avoid premature failure of the elements when the dead load superimposed on the elements is reduced as demolition progresses. The load which is carried by the element must be supported by temporary structures extended above the element. After the temporary supports are constructed, the elements may then be demolished by the following steps:
(a) Locate and mark the centrelines of the columns supported by the member;

(b) Locate the profile of the tendons and mark it on both faces of the member;

(c) Expose the exterior tendons on each face of the member midway between the centrelines of all intermediate columns supported by the member;

(d) Cut the exposed tendons at each location starting from the centre of the member on alternating faces and proceed to the ends of the member;

(e) Repeat steps (c) and (d) until all the tendons have been completely severed.

Demolition using the above procedures shall be exercised with caution to prevent the tendons from pulling together the columns at the ends of the elements due to the elastic shortening at the exposed tendons.

(4) Category C4: Post-Tensioned in Stages but Ungrouted

Care shall be exercised to avoid premature failure of the elements when the dead load superimposed on the elements is reduced as demolition progresses. Temporary structures shall be provided to shore up the elements as needed. The prestressed force shall be detensioned sequentially in reverse order of stressing in accordance with the amount of dead load removed. The sequence of the detensioning shall preferably be in the reverse order of the tensioning when the element was constructed. When all supporting dead load and tendons are removed, the element can be demolished in the same manner as for normal reinforced concrete.

Alternatively, demolition may proceed in the same manner as for Category C3.

(C) Class III: Others

(1) The demolition of segmental construction shall proceed in the reverse order of the segmental erection. Temporary supports shall be provided as required before the post-tensioning forces are released. Where the segmental units are pre-tensioned, demolition shall proceed as for precast pre-tensioned/post-tensioned construction. Where the units are not pre-tensioned, demolition shall proceed in the same manner as for post-tensioned construction.
(2) During detensioning of the prestressed cables or tendons in a circumferential prestressed tank, appropriate protective measures, such as adequately designed protective chain nets, screens or friction brakes shall be provided to avoid uncontrolled unwinding of tendons.

(3) The demolition of segmental construction, or circumferential prestressed tanks is relatively complex and it must be demolished under the guidance of a professional engineer experienced in this type of construction.

5.3 Statically Determinate Structures

5.3.1 General

(A) Statically determinate structures normally lack continuity, which has the following characteristics:

(1) large deflection; and

(2) high stress concentration at critical position.

The disadvantage is that if any part of the structural system fails, it can cause a disastrous collapse of the structure.

(B) Special attention is required where dealing with demolition or partial demolition of the following structures:

(1) statically determinate structures;

(2) redundancy structures that may become statically determinate structures during demolition or after substantial alteration.

(C) Common statically determinate structures include the following:

(1) cantilever structures,

(2) hinged or pin-jointed trusses.
5.3.2 Cantilever Structures

(A) In general, cantilever structures shall be demolished prior to demolition of the main structure of the building;

(B) In the case when 5.3.2(A) cannot be satisfied, the cantilever structures shall be properly shored until it is completely demolished;

(C) Common problems of cantilever structures are described in Figure 5.3.

5.3.3 Hinged or pin-jointed trusses

(A) Under normal circumstances, hinged or pin-jointed structures are braced structures. Temporary supports shall be provided if bracings are removed;

(B) Hinged or pin-jointed trusses shall preferably be removed by lifting and lowering to ground level prior to demolition;

(C) In the case when the truss has to be dismantled on the spot, the sequence of every partially dismantled configuration shall be checked.

5.4 Composite Structures and Steel Structures

5.4.1 General

Steel structures and reinforced concrete composite structures are, in most cases, designed as “simple design” or “semi-rigid design” according to earlier structural steel design codes. Under such design assumptions, the detailing of the beam column joints is, in most cases, not rigid joints and the structure may become statically determinate during demolition or substantial alteration. Details of demolition of statically determinate structures are referred to in 5.3.

5.4.2 Demolition Method

Similar to conventional buildings, composite structures may be demolished by top down method, cut and lift or other methods that are adequate for the site condition.
CASE 1. Main reinforcements in cantilever beam bent up at columns. The cantilever beam may topple when the column/walls are demolished.

CASE 2. The load on the cantilever beam is counter-balanced by the loading above the beams, the cantilever beam may topple when the counter balance load is removed.

CASE 3. When one side of a balanced cantilever beam/slab is removed, the remaining cantilever beam/slab may topple.

FIGURE 5.3 COMMON PROBLEMS OCCUR IN CANTILEVER STRUCTURES
5.4.3 Shoring of Slender Member

Structural steel members in steel structures and reinforced concrete composite structures are generally designed as slender members subject to bending and/or compression. Except for concrete encased steel members, the Registered Structural Engineer shall check the load resisting capacity of the slender structural members when lateral restraints are removed during demolition. Proper shoring shall be installed if required.

5.5 Cladding Walls

5.5.1 Demolition Method

Demolition of cladding walls shall be proceeded with extreme caution since cladding walls are mostly external features. Each cladding wall shall be demolished individually in the reverse order of its construction. Saw cut and lift is suitable for dismantling cladding walls.

5.5.2 Guidelines

(A) Support

The cladding wall shall be fully supported before disconnection from its supporting structural member. Crane or other lifting appliances may be used to support the total weight of the cladding. The lifting appliances and wire must have sufficient strength to support the weight of the cladding wall.

(B) Disconnecting from Building

The connections or joints to the building structure shall be disconnected only after the cladding wall is fully supported.

(C) Handling

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.
5.6 Hanging Structures

5.6.1 General

The hanging structure is primarily composed of a structural system in which the floor loading is suspended by tension members hung from other elements at the upper portion of the structure. Unlike conventional structures, hanging structures shall be demolished from their bottom level and progressively upward to the support.

5.6.2 Demolition Method

Selection of methods shall depend on the actual site conditions and the construction materials. Cutting and lifting, in general, are suitable for dismantling the structural components of the hanging structure. Temporary supports may be needed to maintain the stability of the hanging structural elements during the demolition process.

5.6.3 Guidelines

The following items shall be considered in demolishing hanging structures:

(A) The sequence of demolition shall be planned such that the hanging loads are gradually reduced, without overstressing at any particular structural element or ties;

(B) Hanging ties shall be destressed before cutting;

(C) Main gravity structures supporting the hanging ties and other elements that provide lateral stability of the hanging structure shall not be demolished prior to complete release of all hanging ties;

(D) The main gravity structure shall be checked so that it is stable at all stages of demolition, bracing may be required if deemed necessary.

5.7 Oil Storage Facilities

5.7.1 General

Oil storage facilities generally consist of structures that contain petroleum products which may be classified as hazardous materials or dangerous goods. The key issues for demolishing the oil storage facilities are the clean-up and disposal of the hazardous materials and dangerous goods. Once the contamination assessment and initial
clean-up are completed, the method of demolition may be selected based on the structural and site conditions. Additional clean-up may be required if the contamination has extended to the adjacent area and/or the subsurface soil. Precautionary measures and work systems to be adopted for working in such an environment shall comply with the Factories & Industrial Undertakings (Confined Spaces) Regulations.

5.7.2 Demolition Methods

The selection of methods and actual demolition of oil storage structures shall be carried out in accordance with the structural aspects. Storage buildings may be demolished by top down method or other methods for building demolition. Circular steel tanks may be dismantled by the use of hydraulic shear or other appropriate methods. Reinforced concrete tanks may be dismantled by any method that is suitable for reinforced concrete construction. If flammable fuel is likely to be present, use of flame cutting shall be avoided. Methods of demolition are referred to in Section 4.

5.7.3 Guidelines

The following items shall be considered in demolishing oil storage facilities:

(A) Chemical Waste Clean Up

Prior to demolition, all oil storage facilities shall be thoroughly cleaned. Any accumulated gas shall be removed. The management of waste and wastewater generated from the process must conform with the Waste Disposal Ordinance and the Water Pollution Control Ordinance. Additionally, the management of any waste which is classifiable as a chemical waste, such as oil sludge from tank cleaning must also comply with the Waste Disposal Ordinance (Chemical Waste) (General) Regulation. In the case when a dangerous goods storage licence has been issued, the relevant licensing authority, i.e. Fire Services Department, or Gas Standard Office, shall be informed prior to any demolition operation. Any risk of fire explosion and exposure to toxicity shall be minimised.

(B) Soil Contamination Assessment

After completion of demolition, Soil Contamination Assessment (SCA) shall be carried out according to the SCA and Clean-up proposal agreed by the EPD. In the case when soil contamination is discovered, the contaminated soil shall be removed in its entirety and replaced with clean fills. The placement of the fill shall be
under the supervision of the Authorized Person or Registered Structural Engineer or an equivalent professional. The disposal of contaminated soil shall be carried out in strict accordance with the EPD requirements. In-situ treatment of the contaminant may be applied subject to the approval of the EPD.

(C) 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 in accordance with 3.5.

5.8 Marine Structures

5.8.1 General

Marine structures include ocean structures and all kinds of water front structures. Besides the basic considerations for normal land operation, marine demolition shall also attend to the debris handling and the dismantling of the marine piles.

5.8.2 Method of Demolition

The methods used for demolishing marine structures are similar to those for buildings founded on land. Top down methods may be applied to demolish the superstructure. Non-explosive demolition agent may be used to demolished the piers. For sensitive water, saw cut and lift can be used to demolish the platform and the piers to minimise debris falling into water.

5.8.3 Guidelines

(A) Soundings

Soundings shall be performed before the demolition so that the seabed condition is defined and any unanticipated underwater structure can be reviewed. The pre-demolition sounding record shall be used as a basis for the scope of restoration.
(B) Pier Structure

If mechanical plants and/or trucks will travel on the platform supported by piers, the structure of the platform slab shall be checked to ensure that it can support the machine operation and the anticipated debris loading.

(C) Protection of Marine Environment

The effect of the demolition on the marine environment shall be considered. If the demolition site is scheduled to be reclaimed, concrete debris may be left on the seabed. Otherwise, all the debris dropped on the seabed during demolition must be removed. The seabed shall be restored to the comparable depth of the pre-demolition stage. A silt screen or underwater fence shall encompass the site to contain debris and turbulence generated by the demolition. It may also prevent marine life from entering the site area during demolition. The silt screen shall be taken out after the area is completely restored.

(D) Piling

As far as practical, piling shall be pulled out entirely, or, as a minimum, it shall be cut off at 3m below the seabed or a desirable depth below the original seabed level, depending on the future use of the area.

5.9 Underground Structures

5.9.1 General

From the operational and economic standpoints, demolition of underground structure shall be incorporated into the new foundation construction. Such arrangement may eliminate the redundancy of the temporary works for soil retention and dewatering systems.

5.9.2 Demolition Method

With appropriate shoring and protection, underground structures above the basement floor may be demolished by top down methods or other methods that are suitable for the specific site conditions. The use of non-explosive demolition agents may minimise vibration impact on the adjacent foundation. Diamond core stitch drilling is suitable for cutting localised underground obstructions such as an old pile cap without completely demolishing the whole pile cap.
5.9.3 Guidelines

(A) Shoring

A geotechnical evaluation shall be conducted to determine the soil stabilisation and retaining schemes for protection of the adjacent properties as well as the operation of the below ground demolition. The shoring plan shall be taken into account of the construction method to the original underground structure. If the floors or part of the building structure acts as propping to the basement wall, this propping system shall be maintained or a shoring system shall be provided to safely support the basement wall when demolishing the building structure.

(B) Uplift Pressure

In high water table areas, assessment shall be made to ensure that the remaining structure will have adequate factor of safety against uplift upon demolition at all stages. If necessary, the uplift pressure acting on the basement structure shall be relieved before demolishing the structure.

(C) Dewatering

If a dewatering system is required, the effect of the dewatering on adjacent foundations must be considered in the design. It is also important that the disposal of the ground water shall not affect the quality of the surrounding water resource and/or cause localised flooding.

(D) Existing Foundation

The existing piles shall be evaluated and, if possible, incorporated into the new foundation system. The bearing capacity of the old foundation can be determined by reviewing the previous design and by performing actual load tests and/or test borings.

(E) Site Security and Safety

The site shall be secured to prevent any unauthorized person from entry, particularly into the basement area. If work is to be performed in deep excavated area, an escape route must be provided.
5.10 Structures Supporting Ground or Sitting on Slopes

5.10.1 General

Demolition of buildings supporting sloping ground or buildings sitting on slopes or retaining walls may affect the stability of adjacent structures and land and may even create regional slope instability due to removal of toe weight. Maintaining adequate ground support by backfilling or structural support during demolition work is important. The demolition plan should be properly engineered by a competent and experienced geotechnical engineer.

5.10.2 Demolition Method

Top down method is suitable for demolition of hillside slope structures. Other methods may be applicable depending on the actual site conditions.

5.10.3 Guidelines

(A) Buttress/Shoring for Building Supporting Ground

If part of the building structure serves as a retaining wall system, the height of the building that is required to be left in order to safely support the retaining structure shall be determined. Adequate shoring and/or buttress shall be provided prior to the demolition of the remaining structure. A demolition plan shall be provided to the foundation contractor so that the shoring work installed during demolition are considered and protected during the foundation work.

(B) Retaining Wall System

Prior to demolition of the retaining wall, the slope or earth supported by the retaining wall system must first be stabilised. Stabilisation may be achieved by excavation of the soil behind the retaining wall to a free standing stable slope or by installing temporary or permanent support such as sheet piling, soldier pile or other appropriate methods. The scheme for stabilisation of the slope behind the retaining wall shall be properly engineered.
(C) On-grade Floor Slab

Unless site conditions allow and with the support of an engineering report, the on-grade floor slabs shall remain to protect against erosion. The floor slabs can also serve as impermeable cover against infiltration.

(D) Surcharge on Slope and Retaining Wall

No storage of debris or surcharge shall be imposed on the area on the top of the retaining wall and/or slope. Surcharge on the top of the retaining wall and/or slope may affect its stability.

(E) Drainage

The water table may affect the stability of the slope. Drainage from surface runoff, off site drainage and infiltration shall be considered and managed throughout the project.
6. SITE SUPERVISION AND INSPECTION

6.1 General

Demolition consists of operational processes in dismantling structures in a sequential order that is documented in a method statement. Demolition work can be carried out safely when the sequence of demolition work is followed and each demolition process is properly executed. To achieve this end, proper supervision of the demolition work and adequate training of on site personnel are essential.

A site supervision plan shall be prepared in accordance with the Technical Memorandum for Supervision Plans and the Code of Practice for Site Safety Supervision of Building Works and Street Works.
APPENDIX A

DEMOLITION CHECKLIST

1. Before Demolition

1.1 Site Location

☐ Identify site location, neighbouring conditions, adjoining buildings, slopes, and retaining walls.

☐ Identify special site restrictions such as the designated scheduled areas, specific restrictions on the time of operation, limitation on the noise and vibration etc.

☐ Identify impact on special buildings adjacent to the site which may be affected by the demolition project such as hospitals and other occupancies that are sensitive to noise, vibration and dust or other nuisance produced by the demolition.

1.2 Project Site and Building Structures to be Demolished

☐ Identify the building/structures to be demolished.

☐ Verify dimensions of site, building set backs, available working spaces etc.

☐ Identify hoarding/covered walkway requirements.

☐ Verify the dimensions of buildings, such as overall building height, headroom of floors, and building footprint.

☐ Verify the building construction, types of material used in construction of the building, construction method, illegal construction, special structural features that need special treatment during demolition such as cantilever structures, precast structures and prestressed structures etc.

☐ Verify the existing fixtures: any features which may affect the demolition progress and need to be removed prior to demolition of the structure, such as water tanks, air conditioning units and other mechanical services.
Appendix A
Demolition Checklist

☐ Verify the building use: the type of occupancy, the history of building use and any illegal use.

1.3 Utilities Location

☐ Verification of all below ground and overhead utilities.

☐ Termination and disconnection of any services to the building to be demolished in accordance with the requirements of the utility companies.

☐ Arrangement of temporary utilities for the project use, such as water supplies for dust suppression, etc.

1.4 Demolition Schedule

☐ Identify factors that may affect the demolition schedules such as any operational restrictions imposed by regulations and anticipated seasonal weather conditions.

☐ Develop a realistic schedule which will reflect the time required for installation of precautionary measures, testing and removal of hazardous materials, if any, processing of approval and consent, demolition process, clean up and site restoration.

1.5 Testing and removal of hazardous materials

☐ Arrange investigation for asbestos containing materials by a registered asbestos consultant.

☐ If asbestos abatement work is required, submit an Asbestos Investigation Report and Asbestos Abatement Plan and notification of commencement of asbestos work to EPD and Labour Department.

1.6 Safety Measures

☐ The requirements of covered walkway and catch platform for pedestrian protection.

☐ The requirement of catchfan, if necessary.
1. Demolition Checklist

- The requirement of double layer scaffolding, screens and working platforms for retaining dust and flying debris if the method used and site conditions warrant.
- The safety procedures for machine operation. Adequate ground or floor support for the machine; and the installation of temporary proppings.
- Temporary supports and bracing for any weakened structures.
- Protection of vehicular and pedestrian traffic adjacent to site.
- Supports for adjacent retaining wall and/or slopes.

1.7 Debris Handling

- Sorting and removal of non-structural materials such as timber, doors and windows etc. and disposal to recycling facilities or landfill.
- Adequate number and size of chutes depending on the rate of debris generation, and the disposal route.
- Planning of traffic route for debris handling, including provision of lorry car parks.

1.8 Preparation of Demolition Plan (details refer to Appendix B)

1.9 Stability Report with Calculations

- Stability of building to be demolished.
- In the case of powered mechanical plants or requirements are used, stability of the building.
- Shoring to support powered mechanical plants.
- Effect on neighbourhood building, adjoining properties, and party walls caused by the demolition.
- Structural or geotechnical calculation to support adjoining properties.
Appendix A
Demolition Checklist

1.10 Consent Application

☐ Submit Supervision Plan

☐ Submit names and details of Technically Competent Persons.

☐ Submit details of particular of plant operators.

2. During Demolition

☐ All on site precautionary measures and temporary supports for adjacent properties are installed according to the design in the method statement.

☐ Removal of hazardous materials, if any, are completed before the demolition. Chemical wastes such as oily sludge from oil tank cleaning, asbestos waste, unwanted toxic chemicals are managed in compliance with the Waste Disposal (Chemical Waste) (General) Regulation.

☐ All site personnel are fully informed about the specifics of the projects and the necessary precautionary measures to be taken to ensure safety.

☐ Establish emergency access.

☐ Establish clear and operational line of communication to the supervisor.

☐ The demolition to be progressed in conformance with the method statement and/or with the approval of the AP and RSE.

☐ Removal of debris to avoid accumulation, considering the traffic condition and availability of trucks.

☐ Control the dust emission in compliance with Air Pollution Control (Construction Dust) Regulation.

☐ Adequate supervision by full time competent supervisor on site, periodic visit by representatives of the AP and RSE, and full time supervision by engineer for special structures as required.
Appendix A
Demolition Checklist

☐ Protection of adjoining party wall during the demolition.

☐ Ensure all workers follow safety procedures and the machines and equipment are well maintained.

☐ Provide security for the site as appropriate.

☐ Schedule regular inspection and maintenance of scaffolding, and special inspection after typhoon or fire accident.

3. After Demolition

☐ The site shall be clear of debris and levelled.

☐ The boundaries shall be secured against unlawful entry.

☐ Excavations, if any, shall be protected.

☐ For sloping site and/or site with retaining wall the following items shall be included.

- Ground surface shall be sealed to prevent water infiltration.

- Surface drainage shall be provided.

- Demolition plan shall be provided to the foundation contractor so that temporary supports constructed during demolition can be maintained.
APPENDIX B

DEMOLITION PLAN CHECKLIST

All the information and data collected during the pre-demolition survey shall be used as input for choosing the method for the demolition project. Although the demolition method shall be efficient and cost effective, however, in developing the Demolition Plan, the author shall always have public safety and site safety in mind. Each project has its unique features and conditions. Demolition Plan shall be customised to meet the conditions of the individual project. One of the purposes of the Demolition Plan is to provide instructions and guidelines for the on site personnel to follow so that the works can be performed safely and effectively. Therefore, when developing the Demolition Plan, it has to bear in mind that the Demolition Plan shall be straight forward, easy to follow and understood by personnel at various levels of education. Typically, the Demolition Plan shall include, but not limited to, the following information:

1. Location Plan

A scaled plan showing the following information:

- The scale of the plan shall be in accordance to B(A)R13.
- Location of the project building with respect to lot boundary, adjacent footpath and traffic way.
- Location and relative heights of existing utilities, adjoining buildings and properties and their use.
- The plan shall be fully dimensioned with elevations shown.

2. Existing Building Information

The Plan showing the project building and site conditions shall include the following:

- An assessment on the conditions of the building, site and adjacent properties including their historical and existing use and traffic conditions of the abutting roads.
Appendix B
Demolition Plan Checklist

- Any features that need protection and may induce hazard during the demolition program such as environmental or historical features, adjacent slope protective features, special features such as flyover and footbridges and existing utilities such as overhead cables etc.

- Proposed arrangement for the removal of hazardous materials and/or chemical wastes if they are present.

3. The layout of the building, including sections, and Existing Structural Information

A structural plan shall include the following:

- The overall height of the building, the ceiling height of the floors, dimensions and depth of the basements, if any.

- Structural plans and sections, details and layouts of the structural supports and the construction materials, if available.

- Structural evaluation of the adjacent buildings and shared features such as party wall, staircases and common supporting structures.

- Information on any special structures that require special attention, such as cantilever structures, prestressed concrete, precast concrete, steel composite structures, cladding walls, stressed skin structures, hanging structures etc.

4. Demolition Procedure and Sequence of Operation

The Plan showing the proposed method used to demolish the structure shall include the following:

- Descriptions of the equipment to be used.

- Specific guidelines on the limitations of the machine's operation such as travel area, specific distance from the building line and any area with inadequate support or limited headroom.

- The sequence and proposed procedures for the demolition.

- Detail instructions for demolishing special features and critical areas that may impact on the general safety of the public and on site personnel.

- Specific precautionary steps for identifying these features.
5. **Precautionary Measures**

Specification, and construction details for precautionary measures which are essential to the project safety. The type of precautionary features shall be selected to best meet the requirements of the demolition method and the site conditions. The following features shall be included wherever it is necessary:

- Covered walkways, catch platforms and hoardings:
- Scaffolding and catchfans.
- Temporary supporting systems to support machines working on the building floors.
- Temporary supports for cantilever structures and for bracing weakened structural elements.
- Detailed design for temporary support and protection of any structure that may be affected by the demolition, such as party walls, or any attached structures, whether they are legal or not.
- Inspection and maintenance frequency for the precautionary measures.
- Support for adjacent retaining walls or slopes that may be affected by the demolition.

6. **Debris Handling**

- A proposed plan for conveyance of debris, on site sorting and management, estimated amount of debris required for off site transportation.

7. **Special Safety Considerations**

- Means of emergency escape, and access route.
- Means to reduce the dust, noise and vibration impacts.
- Storage and handling of any flammable material that may be used in the demolition process.
- Proper packaging, labelling and storage of asbestos waste generated in the demolition process.
8. Traffic

☐ If the project involves any temporary closure of traffic, a Traffic Impact Assessment with detail locations of the temporary traffic signs shall be provided.

9. Post-Demolition Arrangement

☐ Permanent treatment to party walls and stabilisation of adjacent structures.

☐ Site security

☐ Stabilisation of excavation, if any.

☐ For sloping sites or sites with retaining walls, additional arrangements for sealing off ground surface, provide adequate drainage and stabilisation of the slopes and/or retaining structures.

10. Chinese Version

☐ A properly translated Chinese Version of the Demolition Plan shall be provided.
APPENDIX C

PRESTRESSED CONCRETE AND GUIDELINES FOR IDENTIFICATION

1. Types of Prestressing

(A) Pre-tensioning

Pre-tensioning is a prestressing process in which the tendons or cables are tensioned prior to the casting of concrete. The prestressing is then transferred to the hardened concrete by bonding. This type of process is commonly used in construction of precast elements including structural and non-structural, such as precast concrete cladding. Normally, the tendons are placed in one direction of the element along its longitudinal axis.

(B) Post-tensioning

Post-tensioning is a prestressing process in which the tendons or cables, encased in sheathing or ducts, are placed without tensioning prior to casting of concrete. When the concrete attains an acceptable specified strength, the tendons will be tensioned by jacking at the ends of the member through the anchors. After the tensioning is done, the sheathing will be either grouted with cementitious grout or left ungrouted. In the former case, the construction is known as bonded construction. In the latter case, it is the unbonded construction. In the case of the unbonded construction, the sheathing is normally filled with grease. The prestressing tendons may be placed in two directions in particular for slab construction.

2. Guidelines for Identification of Prestressing Structures

2.1 Record Drawing

Prior to the demolition of a building, a full investigation must take place to determine if any prestressed construction exists in the structure. This can be obtained through review of the record drawings of the buildings or through site observation if the record drawings are not available. If record drawings are available, information should be obtained on the structural design, on the method and sequence of the tensioning, and on whether the tendons are bonded or unbonded.

2.2 Characteristics of Prestressed Concrete

If record drawings are not available, the following provides some minimum guidelines for identifying the potential existence of prestressed construction.
(A) Review the existing floor system and the type of construction. It could be an indication of possible use of post-tensioning construction for a one-way or two-way slab with a span exceeding 8 metres, for a joist system exceeding 11 metres and for a beam system exceeding 15 metres.

(B) In addition to the above guidelines, the span depth ratio shown in Table C-1 could be used as a supplement for judgement.

(C) Large span beams supporting multi-storey columns above them may be an indication of being post-tensioned.

(D) If long span precast concrete construction is found, it is normally quite easily identified, as jointing between precast units quite often are visible with even soffit level. The units may be prestressed.

(E) Check the edges of the slab, along the perimeter of the building, along the inside face of stairwells, elevator shafts, duct shafts, etc. for signs of post-tensioned anchorage or any signs of burned off tendon ends.

(F) Check the ends of beams for any patches of regular shapes which could indicate the existence of prestressed tendons.

(G) During the course of demolition, if any concrete elements exhibit an unusually high degree of resilience upon impacting with demolition tools, this could be an indication that the member is prestressed.

When prestressing is suspected without any record drawings, further investigation shall be performed to identify the layout and construction of the system. A discovery of one post-tensioned floor in a structure does not necessarily prove that all floors are post-tensioned and vice versa.
<table>
<thead>
<tr>
<th>Floor System</th>
<th>Normal Span Depth Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single Span</td>
</tr>
<tr>
<td>One way slab</td>
<td>25 to 30</td>
</tr>
<tr>
<td>Two way slab</td>
<td>30 to 35</td>
</tr>
<tr>
<td>Floor joists</td>
<td>20 to 25</td>
</tr>
<tr>
<td>Beams</td>
<td>18 to 20</td>
</tr>
</tbody>
</table>

Table C-1 Normal Span Depth Ratio of Reinforced Concrete Floor System Exceeding which Could be an Indication of the Existence of a Prestressed System
APPENDIX D

REGULATIONS RELATING TO DEMOLITION PROJECTS

1. Building demolition is subject to the following legislation and subsidiary documents administered by the Building Authority:

   (i) The Buildings Ordinance, Laws of Hong Kong Special Administrative Region, CAP 123,
   (ii) The Building (Administration) Regulations,
   (iii) The Building (Construction) Regulations,
   (iv) The Building (Demolition Works) Regulations,
   (v) The Building (Planning) Regulations,
   (vi) Practice Note for Authorised Persons and Registered Structural Engineers 71, Demolition Works - Measures for Public Safety,
   (vii) Practice Note for Authorised Persons and Registered Structural Engineers 75, Hoarding, Covered Walkways and gantries (Including Temporary Access for Construction Traffic) - Building (Planning) Regulations Part IX,
   (viii) Practice Note for Authorised Person and Registered Structural Engineer 175, Antiquities and Monuments - Antiquities and Monuments.
   (ix) Practice Note for Registered Contractors 4, Hoarding, Walkways and Contractors Sheds - Building (Planning) Regulations Part IX,
   (x) Practice Note for Registered Contractors 6, Demolition Works,
   (xi) Technical Memorandum for Supervision Plans.

2. Building demolition is subject to the following legislation and subsidiary documents administered by the Environmental Protection Department:

   (i) Air Pollution Control Ordinance,
   (ii) Air Pollution Control (Construction Dust) Regulation,
   (iii) Noise Control Ordinance, and relevant technical Memoranda,
   (iv) Waste Disposal (Charges for Disposal of Waste) Regulation,
   (v) Waste Disposal (Chemical Waste)(General) Regulation,
(vi) Water Pollution Control Ordinance,

(vii) Waste Disposal Ordinance,

(viii) Code of Practice on the Packaging, Labelling and Storage of Chemical Waste,

(ix) Code of Practice on the Handling, Transportation and Disposal of Asbestos Waste.

3. Building demolition is subject to the following legislation and subsidiary documents administered by the Labour Department:

(i) Factories and Industrial Undertakings Ordinance,

(ii) Factories and Industrial Undertakings Regulations,

(iii) Factories and Industrial Undertakings (Confined Spaces) Regulations,

(iv) Factories and Industrial Undertakings (Lifting Appliances and Lifting gear) Regulations,

(v) Factories and Industrial Undertakings (Fire Precaution in Notifiable Workspaces) Regulations,

(vi) Factories and Industrial Undertakings (Protection of Eyes) Regulations,

(vii) Factories and Industrial Undertakings (Electricity) Regulations,

(viii) Factories and Industrial Undertakings (First Aid in Notifiable Workplaces) Regulations,

(ix) Factories and Industrial Undertakings (Dangerous Substances) Regulations,

(x) Factories and Industrial Undertakings (Safety officers and Safety Supervisors) Regulations,

(xi) Factories and Industrial Undertakings (Noise at Work) Regulations,

(xii) Construction Sites (Safety) Regulations,

(xiii) Factories and Industrial Undertaking (Asbestos) Regulations,
(xiv) Code of Practice for Scaffolding Safety,

(xv) Safety Guidelines for Demolition of Building Structures.

4. In the design of hoarding, covered walkways, temporary works, and possible modifications of the existing building structure, the following documents are relevant:

(i) Building (Planning) Regulations provide general requirements on hoarding, covered walkways and contractor sheds,

(ii) Building (Construction) Regulations provide general requirements on construction including hoarding requirements,

(iii) Building (Demolition Works) Regulations provide precaution requirements,

(iv) Code of Practice on Structural Use of Concrete (1987) (Concrete Code 1987),

(v) Code of Practice on Structural Use of steel (1987) (Steel Code 1987),


(vii) Code of Practice for Site Safety Supervision on Building Works and Street Works.

5. Design of temporary supports to stabilise the slopes and grounds during the demolition of retaining structures, basements and other geotechnical features shall refer to:

(i) Geotechnical Manual for Slopes,


6. Other Ordinances and Regulations:

(i) Dangerous Goods Ordinance,

(ii) Gas Safety (Registration of Gas Installers and Gas Contractors) Regulations,

(iii) Code of Practice on Avoiding Danger from Gas Pipes.
APPENDIX E

NOTIFICATIONS AND PROCEDURES

1. Asbestos Abatement Works

If asbestos abatement work is to be carried out in a building to be demolished, the owner of the premises must submit both an Asbestos Investigation Report and Asbestos Abatement Plan and a written notice of the date of commencement of asbestos abatement work to the EPD 28 days before the asbestos abatement work commences.

Factories and Industrial Undertakings (Asbestos) Special Regulations require the contractor to give a written notice to the Commissioner for Labour not less than 28 days before he begins an asbestos process. Before carrying out any work which may expose any worker to asbestos an adequate assessment of the likely exposure shall be made by a competent person, in accordance with the Factories and Industrial Undertaking (Asbestos) Special Regulations. The Contractor shall also observe the aforesaid regulations and take appropriate preventive measures to prevent asbestos exposure and to protect the health of the workers engaged in the removal work.

2. Hoarding Permit

Prior to the demolition of the building structure, a hoarding permit shall be obtained from the Buildings Department for the installation of hoarding, covered walkways and any other temporary supporting structures outside the lot boundary. The hoarding permit would be issued after the review and approval of the Hoarding Plan submitted by the AP and RSE.

3. Excavation Permit

If the hoarding, covered walkway or any of the demolition related installation is to be installed on the public land, an Excavation Permit shall be required from the Highways Department. If required, the Excavation Permit shall be obtained before the installation of any precautionary measures.
4. Consent for the Demolition Works

A Demolition Plan together with a Stability Report including calculations shall be submitted to the Buildings Department for approval. Upon approval of the Demolition Plan, the Authorised Person shall submit a specified form applying for consent for demolition, together with

(i) a site safety supervision plan,
(ii) the names of Technically Competent Persons and their particulars, and
(iii) the details of powered mechanical plant operators;

and the Buildings Department will consider issuance of the Consent for the Demolition Work. Demolition may begin once the consent for demolition work is obtained. Prior to commencement of demolition work, the Authorised Person shall inform the Building Authority the appointment of a Registered Specialist Demolition Contractor using the specified Form BA10; and the Registered Specialist Demolition Contractor shall inform the public the appointment of a Technically Competent Person by posting the specified Form BA20 on the external facade of the site.

5. Notification for Commencement

Under the Air Pollution Controls (Construction Dust) Regulation, the principal contractor shall give notice to the EPD in a specified form with the specified particulars before the demolition work commences. If there is any proposed change to any of the particulars given in a previous notice, the principal contractor shall also notify the EPD before the proposed change take effect.

6. Posting of Information

Prior to the commencement of demolition work, the Registered Specialist Demolition Contractor shall post the following information on the hoarding:

(A) the Hoarding Permit,

(B) the Excavation Permit,

(C) the Consent for Demolition,

(D) Form BA20 informing the Competent and Experienced Site Supervisor in charge of the demolition work,

(E) the contact telephone number of
Appendix E
Notifications and Statutory Procedures

- the Authorised Person,
- the Registered Structural Engineer,
- the person-in-charge of the Registered Specialist Demolition Contractor.
- Experienced and competent person in charge of the demolition site.

7. Demolition Activities within the “Restricted Hours”

No works involving the use of Powered Mechanical Equipment and/or Specified Powered Mechanical Equipment within restricted hours should be allowed without a valid Construction Noise Permit (CNP) issued by the EPD. The requirement shall be referred to the Technical Memorandum on Noise from Construction Work in Designated Areas. The restricted hours are defined as all day during 1900 to 0700 hours and general holidays, including Sunday, during 0700 to 1900 hours. The application of such a CNP has to be submitted to the Authority at least 28 days before the proposed commencement of any works to allow for the processing of the application. A CNP will be cancelled immediately if a breach against any of the conditions is found.

8. Discharge to the Waters of Hong Kong

If the work involves making a new discharge into the water of Hong Kong, application for a licence will be required under the Water Pollution Control Ordinance. The applicant should notify the public by publishing the application in an English and a Chinese Newspaper at his own expenses. The Director of Environment Protection Department may grant a licence to the applicant not earlier than 40 days after the publishing of the notice and if no objection is received.

9. Notification for Completion

Upon completion of the demolition and the necessary required post-demolition works, the Buildings Department shall be notified in specified form for inspection and acceptance of the work. Buildings Department will acknowledge the acceptance of the specified form upon satisfactory completion of the project.

10. Debris Disposal

The disposal requirements of construction demolition waste at various landfills are listed in the following:

E3
Waste Disposal Facilities provided by Government:

A - Construction and Demolition (C&D) Waste with a small amount of inert material not exceeding 20% by volume.

<table>
<thead>
<tr>
<th>Disposal Site</th>
<th>Opening Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>SENT Landfill</td>
<td>0800 - 2300</td>
</tr>
<tr>
<td>Wan Po Road, Tseng kwan O</td>
<td>including Sunday &amp; Public Holiday</td>
</tr>
<tr>
<td>Enquiry - 2706 8888</td>
<td></td>
</tr>
<tr>
<td>NENT Landfill</td>
<td>0800 - 1800</td>
</tr>
<tr>
<td>Wo Keng Shan Road, Ta Kwu Ling</td>
<td>including Sunday &amp; Public Holiday</td>
</tr>
<tr>
<td>Enquiry - 2674 6505</td>
<td></td>
</tr>
<tr>
<td>WENT Landfill</td>
<td>0800 - 1800</td>
</tr>
<tr>
<td>Lung Kwu Tan Road, Tuen Mun</td>
<td>including Sunday &amp; Public Holiday</td>
</tr>
<tr>
<td>Enquiry - 2472 4382</td>
<td></td>
</tr>
</tbody>
</table>

B - Mixed C&D Waste with inert material exceeding 20% by volume

<table>
<thead>
<tr>
<th>Disposal Site</th>
<th>Opening Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>SENT Landfill</td>
<td>0800 - 2300</td>
</tr>
<tr>
<td>Wan Po Road, Tseng kwan O</td>
<td>including Sunday &amp; Public Holiday</td>
</tr>
<tr>
<td>Enquiry - 2706 8888</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX F

EXAMPLE OF DEMOLITION PLAN AND STABILITY REPORT
FOR TOP DOWN MANUAL METHOD

1. DEMOLITION PLAN

1.1 The demolition plan shall consist of the following plans

1.1.1 Fig F1 Site Plan and Adjoining Site Conditions.
1.1.2 Fig F2 Typical Floor Plan and Existing Building Information.
1.1.3 Fig F3 Elevation A.
1.1.4 Fig F4 Demolition procedure and sequence.
1.1.5 Fig F5 Precautionary Measures.
1.1.6 Fig F6 Typical Support at Cantilever.
1.1.7 Fig F7 Typical detail for Party Wall Strengthening.

1.2 In the case of sloping ground, the following additional plans are required:

1.2.1 Plan showing adjoining slopes, buildings, structures, utilities that may be affected by the demolition.
1.2.2 Sections Showing the slopes etc.
1.2.3 Supports to slopes, buildings etc. at each stage of demolition.

2 STABILITY REPORT

2.1 The Stability Report of this project shall consist of the following:

2.1.1 A Stability report to justify the safety of the existing building during all phases of demolition.
2.1.2 A structural check with calculation on the support of the cantilever slab between guidelines A and B.
2.1.3 A structural check with calculation on the hoarding, covered walkway and catch platform.
2.1.4 A structural check with calculation on the strengthening of the Party Wall.

2.2 In the case of a sloping site, the Stability Report shall include the following:

2.2.1 Stability check of the adjoining slopes, buildings, structures and utility which may be affected by the demolition, with supporting calculations.

2.2.2 Optional Structural and Geotechnical checks on any remedial measures to strengthen the slope.
Figure F.1. Site plan and adjoining site conditions
- 1, A Street (Sheet 1 of 2)
GENERAL NOTES:

1. The building to be demolished is No. 1, A street. Detailed information of this building is shown on Fig. F2 and F3.

2. General information of No. 1, A street are as follows:
   2.1 The site is outside all scheduled area.
   2.2 Site area : 11m x 12m
   2.3 Boundary conditions:
       North : A 2 m wide service land separated the project building from the adjacent building.
       East : The project building is directly adjoining an adjacent building at No. 3, A street.
       South : The building abuts A street.
       West : The building abuts B street.
   2.4 Topography : Flat, no slope or retaining wall within the vicinity of the site.
   2.5 Traffic conditions : Moderate traffic on both A street and B street.
   2.6 No antiques, historical monument or special feature required protections.

3. Adjacent utilities which may be affected by demolition:
   3.1 There are no above ground cable or wire.
   3.2 There are water services, underground telephone and electric services along A street and B street. The closest utility services is about 4 m from the building line. Therefore, the demolition of the building will not affect these underground utilities.

4. Adjacent buildings:
   4.1 Structural and general information:
       The structure at No. 3, A street adjoins the project building is also built in the 1960's. It is a 4-storey high reinforced concrete building with conventional frames, slabs and pile foundation.
   4.2 Conditions:
       The building appears to be in good structural condition with no major cracks or structure deterioration. Except for the party wall, the demolition process should not have any significant impact on the structure of the adjacent building.

4.3 Party wall and common features:
   (A) Party wall:
       (i) There is a 4-storey high party wall between the premises and the building at No. 3, A street.
       (ii) The party wall is of brick construction. The thickness of the wall is 450 mm (18") at the ground floor and 350 mm (14") at 1 st floor and above.
       (iii) Party wall between the premises and No. 3, A street will require strengthening during the demolition process.
   (B) Common features:
       There are no other elements such as shared staircases, unauthorised building, overhead cables or wires shared services that would be affected by the proposed demolition.

FIGURE F.1. SITE PLAN AND ADJOINING SITE CONDITIONS
- 1, A STREET (SHEET 2 OF 2)
LEGEND:

- cantilever balconies, propping with 20 kN at 1.2 m centre shall be provided on all floors

FIGURE F.2. TYPICAL FLOOR PLAN AND EXISTING BUILDING INFORMATION - 1, A STREET (SHEET 1 OF 2)
NOTES ON EXISTING BUILDING:

1. General information and dimensions
   1.1 Age: 30 years (built in 1960)
   1.2 Use: Residential
   1.3 Building cover area: 12.5m x 12m
   1.4 Building height: 23.5m, 8 storeys
   1.5 Floor height: Ground floor is 3.6m with a 2.2m mezzanine; 1st floor and above are 3.5m.

2. Structural conditions
   2.1 Structure: The structure consists of reinforced concrete frames with conventional column, beams and slabs. Both exterior and interior walls have in-fill bricks. The building is founded on a pile foundation.
   2.2 Conditions: The building is currently vacant and has been maintained in a satisfactory condition. Based on our site inspection, the building shows no sign of any significant structural damage or deterioration. Only minor cracks to the non-structural brick walls were observed.

3. Special structural features
   3.1 The building consists of cantilever slabs and beams along the frontage of A street. No other special structure as listed in section 2.1.3(a)6 in the Code of Practice for Demolition of Buildings were found.

4. Hazardous materials:
   4.1 An Asbestos Investigation Report (AIR) will be conducted by a registered asbestos consultant. If asbestos containing material is found to be inside the building, an Asbestos Abatement Plan (AAP) will be submitted to the Environmental Protection Department 28 days before the asbestos abatement work commences. The asbestos abatement works shall be performed in accordance with the Air Pollution Control Ordinance and the Factories and Industrial Undertaking (asbestos) Regulations. The AIR and AAP will be submitted to the EPD directly.

FIGURE F.2. TYPICAL FLOOR PLAN AND EXISTING BUILDING INFORMATION - 1, A STREET (SHEET 2 OF 2)
FIGURE F.3. ELEVATION A - 1, A STREET

mPD = m Principal Datum
DEMOlITION PROCEDURES:

1. General
   1.1 Demolition shall be carried out by hand operated pneumatic jack hammer. Weight of the jack hammer shall be not more than 50 kg. Oxy-acetylene torch may be used to cut the reinforcement. Mobile air compressor shall be placed on ground floor.
   1.2 Demolition shall begin on the roof and proceed down floor by floor to the ground floor. The concrete of each structural element shall be broken down gradually. The reinforcement shall be left in place until the concrete is broken away and when its support is no longer need.
   1.3 The demolition of each structural element shall be performed according to the following:
      (i) Cantilever slab shall be demolished by hand held jack or pneumatic hammer; prior to such demolition, the cantilever slab shall be supported by a timber working platform as designed.
      (ii) The cantilever beams shall be demolished by hand held jack or pneumatic hammer; the cantilever beam shall not be demolished prior to demolition of slabs and walls which are supported by the cantilever beams.
      (iii) Interior beams shall be demolished as shown on the drawing (The drawing shall include details similar to Fig. 4.9 in the Code of Practice).
      (iv) Interior columns shall be demolished as shown on the drawing (The drawing shall include details similar to Fig. 4.5 in the Code of Practice).

2. Demolition sequence
   2.1 Demolition of roof floor:
      (i) Cantilever slabs and beams shall first be demolished.
      (ii) The parapets, the stairhood and other structures above roof floor level shall then be demolished.
      (iii) The roof slabs shall follow.
   2.2 Demolition of 6th and 5th floor:
      (i) External brick in-fill walls shall be removed manually before demolition of the concrete cross beams and frames. The brick shall be pushed in from outside, beginning from the top layer down.
      (ii) The external walls shall be demolished with tie wires as illustrated on the drawing (The drawing shall include details similar to Fig. 4.3, 4.6 and 4.8 in the Code of Practice).
      (iii) R.C. columns and beams on the floor shall be demolished.
      (iv) The cantilever slabs and beams shall then be demolished.
      (v) Demolition of the remaining slabs shall be followed.
   2.3 Demolition of 4th floor and subsequent floors below 4th floor:
      (i) The procedures as stated in 2.2(ii) shall be repeated for demolition down to ground floor. The party wall between the premises and No. 3. A street shall be strengthened by steel channels as shown Fig. F4. Strengthening of the party wall shall be carried out as demolition work progress. The maximum height of the unstrengthened party wall shall not exceed one storey height or 3500, whichever is the less. Demolition of the floor below shall not be proceeded until the party wall on the prevailing floor has been strengthened.
      (iii) The ground floor slab shall be demolished.

FIGURE F.4. DEMOLITION PROCEDURE AND SEQUENCE (SHEET 1 OF 4)
FIGURE F.4. DEMOLITION PROCEDURE AND SEQUENCE (SHEET 2 OF 4)
Appendix F

3.5m  4m

steel bracket and anchors for supporting the scaffolds at intervals no more than 15m

removal of external wall sequence 2.2(ii)

removal of internal wall sequence 2.2(i)

removal of R.C. COL. sequence 2.2(iii)

scaffolds -
catchfan
tarpaulin & net
proppings -
catchfan

removal of E.G. COL. sequence 2.2(iii) - adjoining;
party wall
demolition of remaining slab sequence 2.2(v)

catch platform
covered walkway

CARRIAGeway
STREET B

4500 min.

300 min.

FIGURE F.4. DEMOLITION PROCEDURE AND SEQUENCE (SHEET 3 OF 4)
strongening of party wall
sequence 2.3(ii)
removal of R.C. col. &
beam sequence 2.2(iii)
removal of internal brickwall
sequence 2.3(i)
removal of external wall-
sequence 2.3(i)
catch, platform
sequence 2.3(i)

CARRIAGEWAY
STREET B

FIGURE F.4. DEMOLITION PROCEDURE AND SEQUENCE
(SHEET 4 OF 4)
HOARDING PLAN

(Details of hoarding, covered walkway, catch platform similar to Fig. 3.2, 3.3 shall be shown on this drawing)

FIGURE F.5. PRECAUTIONARY MEASURES

(SHEET 1 OF 4)
Appendix F

FIGURE F.5. ELEVATION A — PRECAUTIONARY MEASURES
(SHEET 2 OF 4)
PRECAUTION MEASURES:

Prior demolition, the following precautionary measures shall be taken:

1. Covered walkway and catch platform
   The covered walkway and catch platform shall be constructed in accordance with the plans and conditions accompanied by the hoarding permit. The covered walkway shall cover the entire length of the property boundaries along A street, B street and the service land. The foundation for the covered walkway shall be carefully excavated by hand tools to ensure no damage to the existing underground utilities. The conditions accompanied by the excavation permit imposed by the Highways Department will be complied with.

2. Temporary support
   The catch platform on top of the covered walkway shall be placed underneath the balconies to support the cantilever structures. Steel propping with timber platform shall be installed on all floors underneath the cantilever slabs and beams. Steel propping shall have a bearing capacity of 20 kN, spaced at 1.2 m on centre. The props shall be braced with lateral restraints.

3. Scaffolds, screens and catchfan
   3.1 Double row scaffold with net and tarpaulin shall be installed and shall cover the external face of the building.
   3.2 Bamboo catchfan shall be provided at vertical intervals of no less than 10 m.
   3.3 The scaffold, catchfans, net and tarpaulin installation shall be in accordance with the Code of Practice for Demolition of Buildings and the Code of Practice for Scaffolding Safety.

4. Existing utilities
   All existing utilities shall be terminated. Sewer service and drainage connections shall be properly disconnected and sealed off at the last manhole.

5. Debris handling
   5.1 Any existing furniture, wood floors, door frames, windows, piping and other building services shall be removed. Any salvageable material will be sorted and removed separately.
   5.2 Building debris shall be conveyed through a 800mm x 800mm opening on the floor slabs at location as shown on the typical floor plan. Openings shall not cut through structural support elements. Plastic chute shall be erected through the openings to convey the debris to the ground floor.
   5.3 Demolition debris shall be picked up on ground floor with bull dozer and carried away by dump trucks. Approximate 90 m³ of building debris will be produced from demolition of each floor. Debris clearing and transportation shall be scheduled to maintain the following conditions:
   (A) Debris accumulation on the first floor or above shall not be higher than 100mm.
   (B) Debris accumulation on the ground floor shall not exceed 1 m.
   (C) No. debris shall be allowed to accumulate on the cantilever structures.
   Structural justification of the debris accumulation is included in Attachment B.

5.4 The floor slabs S-08 and S-09 of the mezzanine shall be removed to provide the required height for the debris loading operation and truck passage. The removal of two mezzanine floor slabs would not affect the stability of the remaining structure. The structural checking for the slabs removal is included in Attachment B.

6. Special site safety
   6.1 Emergency exit
      The existing staircase shall be used as emergency route. The emergency route shall be maintained throughout the demolition process. The route shall be cleared of obstruction at all time. Signs or markings shall be installed to clearly identify the route.

   6.2 Fire Prevention
      (A) Fire extinguisher or fire fighting equipment shall be placed in a visible location, adjacent to the staircase, on each floor.
      (B) All flammable materials shall be stored in a safe location in accordance with the Factories and Industrial Undertakings Regulations.

FIGURE F.5. PRECAUTIONARY MEASURES
(SHEET 3 OF 4)
PRECAUTION MEASURES:

6.3 Dust and noise
   (A) Water spraying shall be applied to suppress the dust generated during the demolition operation and debris hauling.
   (B) Super silenced type air compressor shall be used. Demolition works shall not be performed within the restricted hours from 1900 hrs. to 0700 hrs. all day and from 0700 hrs. to 1900 hrs. on general holidays including SUNDAY.

6.4 Training
   All site personnel shall go through a training programme to understand the project and site safety requirements. The training programme shall be conducted by a competent trainer. The training programme shall include the following:
   (A) An induction course at the beginning of the job to circulate information on the proposed method and required safety measures to perform the work,
   (B) Daily safety meetings to maintain and reinforce the safety concept.

6.5 Typhoon
   In the case when Typhoon Signal No. 3 is hoisted, the Contractor shall inspect all scaffolding, protective screen, and externally exposed temporary work and strengthen any loose connections. After the typhoon, all scaffolding, protective screens and externally exposed temporary works shall be inspected and confirmed to be safe by the competent and experienced person.

7. Maintenance and inspection
   7.1 All the precautionary measures, covered walkway, catch platforms, catch fans and temporary supports shall be inspected by the AP and RSE on a weekly basis and the contractor on a daily basis. Any accumulation of building debris on the catch fans and catch platforms shall be removed. Any deficiency shall be repaired when found necessary. The inspection and repair records shall be provided to the AP and RSE.
   7.2 Before leaving the job site each day, the contractor shall identify and rectify any unsafe conditions such as partially demolished structural elements and damaged temporary supports.
   7.3 The scaffolding shall be inspected and maintained in accordance with the Code of Practice for Scaffolding Safety and the Construction Site (Safety) Regulations by the contractor.

8. Emergency plan
   8.1 Emergency telephone numbers shall be clearly displayed in a conspicuous location. In the event of any emergency or accident, the contractor shall notify the Police and Fire service Departments for assistance. The contractor shall also notify the AP and RSE immediately.
   8.2 At the initial warning of a typhoon or a major storm event, the following shall be performed:
      8.2.1 Contractor shall secure all scaffold, screen, temporary supports and loose elements on site. The scaffold shall be taken down to the prevailing top level of the building.
      8.2.2 All flammable materials, oxygen and acetylene bottles shall be removed or secured in a safe location.
      8.2.3 No unstable and/or partially demolished structural elements shall be left on site. If this is unavoidable, the unstable structure shall be braced and secured.

9. Post demolition
   9.1 Upon completion of the demolition, the site shall be levelled and cleared of debris.
   9.2 In the case of no immediate redevelopment, the site boundary shall be completely enclosed to prevent public access.
   9.3 Arrangement shall be made for permanent treatment of the party wall.
   9.4 Damage to pavement, footpath and other elements within the right of way shall be repaired to its original condition prior to the completion of the demolition project.

FIGURE F.5. PRECAUTIONARY MEASURES
(SHEET 4 OF 4)
TYPICAL PLAN AT CANTILEVER
(MIN. SUPPORT CAPACITY = 12 kN/LEG)

TYPICAL SECTION AT CANTILEVER

SECTION 1:50

FIGURE F.6. TYPICAL SUPPORT AT CANTILEVER
Appendix F

1500
anchor to r.c. beam or brick wall (see note 3)

site boundary
anchor into brick wall

(1 A street)
(adjoining bldg.)

162x89x23.84 kg/m³ (optional beam to be anchored into concrete floor slab if r.c. beam is not present (see Detail c))

brick party wall to remain

162x89x23.84 kg/m³
Φ1500

cement exterior finishing to protect existing party wall and structural steel

TYPICAL DETAIL FOR PARTY WALL STRENGTHENING

SECTION B

anchor into slab (see note 3)

DETAIL C

NOTES:
1. The max. height of unstrengthened party wall shall not exceed one storey height of 3500.
2. Cement exterior finishing shall be applied in two coats:
   (i) The first coat shall have a minimum thickness of 10mm with a cement-lime-sand mix ratio of 1:2:6.
   (ii) The second coat shall have a minimum thickness of 10mm with a cement-lime-sand mix ratio of 1:3:6.
3. Anchor with adequate strength shall be designed by RSE.

FIGURE F.7. TYPICAL DETAIL FOR PARTY WALL STRENGTHENING
APPENDIX G

EXAMPLE OF DEMOLITION PLAN AND STABILITY REPORT FOR TOP DOWN METHOD WITH MACHINE

1. Demolition Plan

1.1 The demolition plan shall consist of the following plans:

1.1.1 Fig G1 Site Plan and Adjoining Site Conditions.
1.1.2 Fig G2 Typical Floor Plan and Existing Building Information.
1.1.3 Fig G3 Elevation A
1.1.4 Fig G4 Demolition procedure and sequence
1.1.5 Fig G5 Precautionary Measures
1.1.6 Fig G6 Typical Support (This drawing is not shown, it is similar to Fig F6 in Appendix E)

2.0 Stability Report

2.1 The stability report of this project shall consist of the following:

2.1.1 A stability report to justify the safety of the existing building during all phases of demolition.
2.1.2 A structural check with calculation on the support of cantilever slab and beams between guideline 5 and 6.
2.1.3 A structural check with calculation on the support to typical floors catering for the loading due to powered mechanical plants.
2.1.4 A structural check with calculation on the temporary ramp design to allow the descending of the machines.
2.1.5 A stability report with calculation to justify the safety of lifting of the machine to the roof.
2.1.6 A structural check with calculation on its hoarding, covered walkway, and catch platform.
FIGURE G.1. SITE PLAN AND ADJOINING SITE CONDITIONS
- 7, XX STREET (SHEET 1 OF 2)
GENERAL NOTES:

1. The building to be demolished is No. 3, XX street. Detailed information of this building is shown on Fig. G2 and G3.

2. General information of No. 3, XX street are as follows:

   2.1 The site is outside all scheduled area,
   2.2 Site area: 21m x 16m
   2.3 Boundary conditions:
       North: A 2 m wide service lane separated the project building from the adjacent building,
       East: Adjoining adjacent building with independent external wall,
       South: The building abuts XX street,
       West: Adjoining adjacent building with independent external wall,
   2.4 Topography: Flat, no slope or retaining wall in the vicinity of the site,
   2.5 Traffic conditions: Moderate to heavy traffic on XX street,
   2.6 No antiques, historical monument or special feature required protection.

3. Adjacent utilities:

   3.1 There are no above ground utilities or street furniture adjacent to the site,
   3.2 Underground utilities including telephone cable, water and sewer services that run along XX street,
   3.3 The closest utility is the telephone cable that is located along XX street, approximately 4.5 m from the building.

4. Adjacent buildings:

   4.1 General and structural information:
       The adjacent building are about 30 years old and consist of conventional reinforced concrete framing on pile foundation.
   4.2 Structural conditions:
       No significant deterioration or damage to the structural element or significant foundation settlement were observed. These adjacent buildings appear to be properly maintained and would not be adversely affected by the demolition of the project building.
   4.3 Party wall and common features:
       The adjacent buildings have an independent external wall. There are physical separations between the premises and the adjacent buildings. There is no common party wall or share structure between the buildings.

FIGURE G.1. SITE PLAN AND ADJOINING SITE CONDITIONS

- 7, XX STREET (SHEET 2 OF 2)
FIGURE G.2. TYPICAL FLOOR PLAN AND EXISTING BUILDING INFORMATION - 7, XX STREET (SHEET 1 OF 2)
EXISTING BUILDING:

1. General information and dimensions
   - Age: 30 years (built in 1960's)
   - Use: Industrial
   - Building cover area: 21m x 16m
   - Building height: 44m, 11 storeys high
   - Floor height: Ground floor is 5.5 m; 1st floor and up are 3.5 m.
   - Typical floor plan is shown on the drawing. Elevation of the Building is shown on Fig. G3.

2. Structural conditions
   2.1 Structure:
       - The building is reinforced concrete construction with conventional slab, beam, column and rigid frame design. It is supported on pile foundation.
   2.2 Conditions:
       - The inspection reviewed that the building is well maintained and kept in good conditions. Other than minor cracks appearing on the finishing, no serious deterioration or damage to the structural element was observed.

3. Special structural features
   - The building has cantilever balconies projecting over the existing foot path on XX street.
   - There is no other special structural element in the building.

4. Hazardous materials:
   4.1 The building may contain asbestos containing materials such as asbestos coated pipes.
       - An Asbestos Investigation Report (AIR) will be conducted by a registered asbestos consultant. If asbestos containing materials are found to be inside the building, an Asbestos Abatement Plan (AAP) will be submitted to the Environmental Protection Department 28 days before the asbestos abatement work commences. The asbestos abatement work shall be conducted in accordance with the Air Pollution Control Ordinance and the Factories and Industrial Undertakings (Asbestos) Regulation. The AIR and AAP will be submitted separately to EPD.
   4.2 Handling of hazardous materials:
       - If asbestos containing materials and/or chemicals are present on the premises, all asbestos containing materials and/or chemicals shall be removed by registered asbestos contractor in accordance with Environmental Protection Department and Labour Department regulations prior to the commencement of the demolition work.

FIGURE G.2. TYPICAL FLOOR PLAN AND EXISTING BUILDING INFORMATION - 7, XX STREET (SHEET 2 OF 2)
FIGURE G.3. ELEVATION A - 7, XX STREET
FIGURE G.4. DEMOLITION PROCEDURE AND SEQUENCE
(SHEET 1 OF 5)
sequence 5.1(ii)
demolition of cantilever
roof slab
sequence 5.1(iii)
demolition in part
of roof
double row
scaffolding
tarpaulin
& net
catchfan
catch
platform
covered
walkway

sequence 5.1(i)
demolition of roof
water tank & others
water tank
steel
sheds
stairhood
double row
scaffolding
propping
steel bracket
and anchors
for supporting
the scaffolding
at intervals
no more than
15m
catchfan
at intervals
no more than
10m
tarpaulin
& net

catch
platform
covered
walkway

FIGURE G.4. DEMOLITION PROCEDURE AND SEQUENCE
(SHEET 2 OF 5)
sequence 5.1(iv)
The excavator proceed down onto 10/F, add additional propping before moving the machine downwards.

sequence 5.1(i)
The excavator continue to demolish the remaining roof slab, main beams and col.
sequence 5.2(ii)
Remove all beams, col., wall and other structures on 10/F.

sequence 5.1(ii)
Remove cantilever structure between grid 5 & 6 on 9/F.

sequence 5.1(iii)
Demolition of remaining 9/F.
The procedure/sequence repeats as it reaches the ground level, and propping to be installed accordingly.

FIGURE G.4. DEMOLITION PROCEDURE AND SEQUENCE
(SHEET 4 OF 5)
Demolition procedures:

1. General

The building shall be demolished by Top Down Method with Machine. The procedures for demolition of structural elements by machine is as follows:

1.1 Cantilever slab shall supported by timber platform and steel proppings prior to demolition, the cantilever slab shall be demolished as shown on the drawing (The drawing shall include details similar to Fig. 4.12 in the Code of Practice).

1.2 The demolition of cantilever beams shall not commence unless all slabs and wall which are supported by the cantilever beam are removed.

1.3 The demolition of slabs and beams shall be as shown on the drawing (The drawing shall include details similar to Fig. 4.8, 4.9, 4.10 and 4.11 in the Code of Practice).

1.4 The demolition of columns and R.C. frames shall be as shown on the drawing (The drawing shall include details similar to Fig. 4.5, 4.6, 4.12 & 4.14 in the Code of Practice).

2. Excavator and its movement restrictions

2.1 Excavator of XYZ brand, Model 123, or approved equivalent, equipped with breaker or hydraulic crusher shall be used. The total weight of machine shall not exceed 11,000kg.

2.2 The movement of the excavator shall be restricted to within the area with adequate propping. The excavator shall not move into the following areas:

(i) 2 m from the building edge,
(ii) 1 m from any openings,
(iii) any cantilever structures.

2.3 Marking shall be placed to clearly identify the restriction for the movement of the excavator.

3. Exterior wall

Exterior walls of the cantilever balconies within grid lines 5 & 6 shall be demolished by hand held tools. The concrete shall be broken down in small manageable pieces with hand tools or pneumatic jack hammer no heavier that 50 kg. The reinforcing steel may be cut off after all the concrete are removed or when its support is not longer needed.

4. Lifting of excavator

The excavator shall be lifted on the roof within the designated area where propping were installed. The lifting shall be performed by truck crane which is capable of lifting 130 ton load up to a height of 80 m. Approval from the Police and Transport Departments shall be obtained prior to the lane closure and lifting operation.

5. Demolition sequence

5.1 Roof

(i) The reinforced concrete water tank and other incidental structures on the roof shall be demolished,
(ii) Demolition of the cantilever roof slab between grid lines 5 & 6,
(iii) Demolition shall proceed with the roof slabs and secondary beams in the following order:
\[ S_{-M} , S_{-M} , S_{-M} , S_{-M} , S_{-M} , S_{-M} , S_{-M} , S_{-M} , S_{-M} \]
(iv) The reinforcing bar of the beams connecting the exterior walls to the interior columns shall be left until the demolition of the exterior wall,
(v) The excavator shall proceed down onto the 14th floor by means of the temporary steel ramp placed at slabs S-M and S-M.

5.2 10th Floor

(i) The excavator shall continue to demolish the remaining roof slab, walls, the main beams and columns,
(ii) Upon removal of all the beams, columns, walls and other structural elements above the floor, the cantilever structure between grid lines 5 & 6 shall be demolished,
(iii) Demolition of the remaining floor shall follow the procedures as described in 5.1 (iii), (iv) and (v).

5.3 9th Floor

(i) The process of demolition of the 10th floor floor shall be repeated for 9th floor through ground floor,
(ii) After demolition of the structural elements above ground floor, the ground floor slab shall be broken up.
(iii) The existing pile cap and pilings below the existing ground level shall remain.

FIGURE G.4. DEMOLITION PROCEDURE AND SEQUENCE
(SHEET 5 OF 5)
HOARDING COVERED WALKWAY AND CATCH PLATFORM

(details of hoarding, covered walkway, catch platform and catch fan similar to those as shown on drawing 3.2 & 3.3 of the code of practice shall be shown)

FIGURE G.5. PRECAUTIONARY MEASURES

(SHEET 1 OF 5)
PROPPING SCHEDULE

<table>
<thead>
<tr>
<th>AREA</th>
<th>PROPPING BEARING CAPACITY</th>
<th>SPACING</th>
<th>No. OF FLOORS BELOW REQUIRE PROPPING</th>
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</thead>
<tbody>
<tr>
<td>cantilever balconies</td>
<td>25kN</td>
<td>1.2m</td>
<td>all floors</td>
</tr>
<tr>
<td>general floor</td>
<td>25kN</td>
<td>1.2m</td>
<td>3</td>
</tr>
<tr>
<td>access ramp</td>
<td>45kN</td>
<td>1.2m</td>
<td>4</td>
</tr>
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</table>

FIGURE G.5. PRECAUTIONARY MEASURES
(SHEET 2 OF 5)
FIGURE G.5. ELEVATION A - PRECAUTIONARY MEASURES
(SHEET 3 OF 5)
Appendix G

PRECAUTIONARY MEASURES:

Prior to the demolition of the main building structure, the following precautionary measures shall be carried out:

1. Utilities disconnection
   All utilities and services to the building shall be terminated. The sewer and drainage connections shall be plugged at the terminal manhole.

2. Covered walkway and catch platform
   (A) Covered walkway and catch platform shall be erected according to the approved plan by Building Authority along the entire length of the property boundaries on XX Street and the service lane. The covered walkway and catch platform foundation installation shall also comply with the conditions of the Excavation Permit by the Highways Department if necessary.
   (B) The carriageway shall be located on XX Street between grid lines E & H.
   (C) The catch platform along XX street shall be extended underneath the entire area of the 1st floor cantilever balconies.

3. Scaffolds, screen and catchfàn
   (A) Double row scaffold with net and tarpaulin shall be erected to cover the entire building.
   (B) The installation of the scaffold, net, tarpaulin and catchfàn shall be in accordance with the Code of Practice for Scaffolding Safety and the Code of Practice for Demolition of Buildings.
   (C) Bamboo catchfàn shall be installed around the building at vertical intervals of no more than 10m.

4. Temporary support
   (A) Propping shall be installed to support the operation of the mechanical plant and the demolition activities. The propping requirements for different floor areas were selected based on the recommendation of the Code of Practice for Demolition of Buildings. The propping Schedule is summarised in Figure G2.
   (B) The top and bottom supports of the props shall be adequately secured. Bracing and/or lateral restraints in at least two directions shall be installed to prevent lateral movement of the props. Propping shall not be removed unless the support for the mechanical plant, debris or other loading conditions for the demolition process is no longer required.
   (C) A structural steel access ramp shall be provided for the excavator to manoeuvre down the floor. The grade of the temporary ramp shall not be steeper than 30° or as recommended by the manufacturer.
   (D) Timber platform with steel props shall be installed underneath cantilever beams and slabs.

5. Debris handling
   (A) The steel sheds shall be dismantled. All trash, furniture, timber, door framed, windows shall be removed from the building. Any salvageable items shall be sorted and removed separately.
   (B) Debris shall be conveyed to the ground floor through the lift shafts between grid lines G & H. The areas near the lift entrance shall be barricaded. Approximately 175 cu. m of building debris would be generated from the demolition of each floor. Clearing and transportation of debris shall be arranged to ensure the following conditions are maintained at all time:
     (A) Accumulation of debris in the lift shafts shall not exceed 1 m high,
     (B) Temporary storage on the floors shall not exceed 100 mm above the floors,
     (C) Debris accumulation on the ground floor shall not exceed 1 m above the ground floor slab,
     (D) No debris shall be accumulated on the cantilever structures.

6. Special site safety
   (A.1) Emergency exit
     The staircase between grid lines B and C shall be used as emergency exit route. The route shall be cleared of debris at all time. Identification signs and/or marks shall be used to clearly indicate the route.
   (B) Fire prevention
     Fire extinguishers shall be placed at a convenient location on each floor. All gasoline, flammable materials, oxygen and acetylene bottles shall be stored in a protected area in accordance with the Factories and Industrial Undertakings Regulations.

FIGURE G.5. PRECAUTIONARY MEASURES
(SHEET 4 OF 5)
PRECAUTIONARY MEASURES:

6.3 Training
A competent trainer shall train all on site personnel. The training programme shall include the following:
(A) An induction course at the beginning of the project to provide the opportunity for on site personnel to understand the demolition procedures, site safety rules and critical safety concerns of the project,
(B) Daily safety meetings to reinforce the safety concept.

6.4 Dust and noise
(A) Dust generated during the demolition shall be suppressed by spraying water continuously during the breaking operation.
(B) All jack hammers and excavator mounted breakers shall be equipped with silencer attachments. The air compressor shall be super silence type. Demolition work shall be performed within the restricted hours from 1900 hrs. to 0700 hrs. all day and from 0700 hrs. to 1900 hrs. on general holidays including SUNDAY. Mobile air compressor shall be placed on ground floor.

7. Maintenance & inspection
7.1 Inspection shall be performed by AP and RSE on a weekly basis and contractor on a daily basis to ensure that all the temporary structures, catchfans and catch platforms are in good conditions. Any accumulation of debris shall be removed. Any movement, damage or distortion to temporary structures shall be identified and repaired, if necessary. The inspection and repair activities shall be recorded and copied to the AP.

7.2 Contractor shall also inspect the site, daily, to identify any unsafe condition, such as damage to the temporary supports or unstables and/or partially demolished structural elements. Any unsafe conditions shall be rectified before leaving the job site.

7.3 Inspection and maintenance of scaffold shall be performed in accordance with the Code of Practice for Scaffolding Safety and the Construction Site (Safety) Regulations by the contractor.

8. Emergency plan
8.1 Emergency telephone numbers shall be posted in conspicuous locations. In case of accident or emergency, the contractor shall report to the Police and Fire Service Departments for immediate assistance. The contractor shall also contact the AP and RSE immediately about the incident.

8.2 Prior to a typhoon warning the following items shall be performed:
8.2.1 All the temporary supports, scaffold, screens and any loose materials shall be secured. The scaffold shall be taken down to the prevailing top level of the building.
8.2.2 Flammable materials shall be removed or stored in a protected area.
8.2.3 The excavator should be moved to a location with proper support, preferably close to the centre of the building.
8.2.4 Any unstable and/or partially demolished structure shall be completed. If it is not practical to complete the demolition timely the unstable structural element shall be braced and supported.

9. Post demolition
9.1 The site shall be levelled and clear of debris.
9.2 If the new development is not immediate, the property boundaries shall be properly enclosed to prevent public entrance.
9.3 Any damage to pavement, footpath and elements within the right of way shall be repaired to its original conditions prior to the completion of the demolition project.

FIGURE G.5. PRECAUTIONARY MEASURES
(SHEET 5 OF 5)
Note:
1. This flowchart applies to common methods of demolition, excluding special methods such as wrecking ball and implosion.
2. The Building Department will be the coordinating department for central processing of Boarding Permit and Demolition Work, except for Excavation Permit, Hazardous Material Removal and Soil contaminations.
3. Submission of specified forms are excluded in this flowchart.
4. Legends:
   - AP = Authorised Person
   - RSE = Registered Structural Engineer
   - RSDC = Registered Specialist Demolition Contractor
   - BD = Building Department
   - EPD = Environmental Protection Department
   - TCP = Technically competent person

**FIGURE H1**
FLOWCHART FOR CURRENT DEMOLITION PROCEDURE IN HONG KONG
建築物拆卸
作業守則擬稿

一九九八年二月
前言

在香港，楼宇拆卸已成为一种不断增长的工程项目。在繁盛的市区内，越来越多在六、七十年代兴建的楼宇，都须要被拆去，以便腾出空间，从事新发展。目前，需要拆卸的楼宇包括各种结构形式和各种以不同材料建成的高层建筑物。为了配合这些日新月异和复杂的楼宇拆卸工程，较严谨的策划与管制，及采用适当的拆卸方法和预防措施是必要的。

拆卸工程是一种技术性及有潜在危险的工作。这作业守则根据安全和良好的拆卸工程作业及为遵守建筑物（管理）规例和建筑物（拆卸工程）规例有关的条文提供指引。因此，这作业守则应与建筑物条例及上述的规例一起参阅和使用，以便制订拆卸图则以获得建筑事务监督的批准。

这作业守则概述了基本的资料，作为考虑选择各种不同建筑物的拆卸方法的参考，为奠定安全的拆卸程序提供依据，也作为安全的预防措施提出建议。在该守则内的各种拆卸方法，是给予执业者在策划拆卸工程时作为参考。执业者必须运用其专业知识，考虑该被拆卸的建筑物的特别建造状况、过去的用途及其用途，和该地盘及其周围的特别情况，以选用最合适拆卸方法，确保安全。同时，执业者应注意建筑物条例及其规则对呈交拆卸图则的要求和拆卸方法必须获取建筑事务监督批准的范围。

这作业守则现在以稿形式发出，试用期一年。当经过应用而获得经验和作出检讨后，本稿将被最后定稿取代。

所有提出改良本作业守则的建议均无任欢迎，如将建议送达房屋署法律及管理部。

屋宇署

初版：一九九八年二月
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1. 概述

1.1 範圍

1.1.1 本作業守則勾劃出在香港策劃和實施各種建築物的拆卸工程時的良好做法，目的在於把下列風險減到最低限度：

(A) 對公眾人士和財產的損害；

(B) 對地盤人員的健康和安全構成的危險；以及

(C) 對鄰近環境的損害。

本守則的主要目的是為各種拆卸方法的工程慣例和安全程序提供指引。並引導符合建築物（管理）規例和建築物（拆卸工程）規例的有關要求，至於環境、勞工健康及安全有關的方面，則請參閱有關規例。

1.1.2 本守則提供拆卸建築物的指引。本守則適用於拆卸全幢構築物或部分建築物、地庫、地下油罐及常見土木工程構築物如筒倉、工廠、碼頭等。然而本守則並不適用於托換基礎、土方開挖、公路或鐵路橋樑、水壩及核反應壇等大型土木工程。

1.1.3 本守則包括建築物拆卸中常用的方法。本守則並未包含所有拆卸方法，亦並不阻止人們使用沒有包括在本守則範圍的其他方法。任何沒有記載在本守則內的其他新發明的拆卸方法都可以使用，但須經有經驗的認可人士、註冊結構工程師和註冊專門拆卸承建商，或其同等專業人士或類似人士仔細研究並提出建議，並且獲得建築事務監督或同等的審批單位批准。然而該新拆卸方法必須由科學研究結果和工程設計經驗提供充分根據。

1.2 定義

就本守則而言，下列定義應適用：
「認可人士」指名列根據第 3(1)條備存的認可人士名冊的以下人士——
(a) 以建築師身分名列於名冊者；或
(b) 以工程師身分名列於名冊者；或
(c) 以測量師身分名列於名冊者；

「樓宇測量」指對將拆卸建築物及鄰近地物的檢查，目的在發掘拆卸工程時能出現的問題，及開發拆卸工程方法陳述書。

「爆破專家」指持有有效礦坑爆破證書的人士或持有由礦務處處長根據危險品（一般）條例第 47 條發出特別授權書的人士。

「項台」是一種臨時構築物，架設在有蓋行人通道的頂部，或架設在正拆卸中的構築物下方，包括（但不限於）露台及懸臂結構等，以便捕集和截留泥石，並保護正拆卸中的構築物以外場所的安全。

「斜柵」是一種臨時構築物，一般傾斜安裝，並安裝、附設或緊靠附設於正拆卸中的建築物外圍周圍，用於捕集和截留從建築物中掉落的泥石。

「建築物高度」指由建築物最高結點的水平至最低地面水平測得的垂直距離。

「有蓋行人通道」是指設有保護性頂蓋的臨時構築物，設於地段邊界和現有人行道上或鄰近，以便在拆卸過程中保護行人免受掉落的泥石傷害。

「拆卸」指使用預先規劃而又受到控制的方法拆卸、拆毀、摧毀或破壞任何建築物或構築物或其任何部分。

「拆卸圖則」指建築物 (管理) 規例第八條所指的訂明圖則的其中一種，它的內容在建築物 (管理) 規例第八 (三) 條中列明。

「懸吊結構」指從上而用懸索、繩索或其他裝置等受拉桿件支撐的非常規結構。

「圍板」指沿著地段邊界架設將拆卸地盤與鄰近物業分開的臨時圍欄。

「內向爆破」指使用炸藥拆卸，爆破以受控方式進行，使建築物的泥石向內掉落。
「內向爆破專家」指透過訓練及實際經驗而獲得足夠知識和經驗，同時亦合資格負全責設計、組織、及控制建築物內向爆破並需得到建築事務監督及礦務處處長批准的人士。

「半山區」指建築物條例第五附表中界定的一號附表區域。

「非通風採光井」指並未在頂部或底部的洞口提供自然通風，亦未設置讓空氣流通的機械通風裝置的採光井。

「共有牆」指把兩座相鄰建築物分隔開來的共用牆。

「公共物料傾倒區」指香港特別行政區政府經營的物料傾倒場所，接受適當的施工及/或拆卸廢物，用於填海和土地開拓工程。

「註冊專門拆卸承建商」指當其時名列根據建築物條例第 8A 條備存的專門拆卸承建商名冊的人；

「註冊結構工程師」指當其時名列根據建築物條例第 3(3)條備存的結構工程師名冊的人；

「棚架支柱」指棚架的垂直構件。

「穩定性報告（附同於拆卸工程訂明的圖則）」指附同於拆卸工程訂明的圖則的穩定性報告，包括對要拆卸樓宇，其支撐，鄰近物業及機械裝置所產生的荷載的穩定性驗算，它的詳細內容見建築物（管理）規例第八(四) 條。

「結構測量」指在拆卸前對現有結構構件進行的測量，以便檢查結構構件的佈置安排、保養和磨損情況以及任何可能影響拆卸工程的結構情況。

「熱噴槍」指一種高溫噴槍，用來切割鋼筋混凝土或類似材料。由氧氣連同金屬作爲燃料維持燃燒。
2. 策劃

2.1 建築物評估及拆卸圖則

在進行任何建築物拆卸工程之前，必須進行詳細的建築物評估工作。這些工作包括測量和適當的評核。一般來說，測量工作包括建築測量和結構測量，並應拍下相片或錄影帶作爲日後參考的資料。根據測量工作獲得的資料及評定結果，然後制訂拆卸圖則，並將圖則呈交房屋署審批。拆卸圖則亦須連同附有結構計算資料的報告，該報告須予即時拆卸的建築物及所有受影響的建築物、構築物、街道、土地及公共設施的穩定性作出評估。

2.1.1 建築測量

(A) 記錄圖則

在進行建築測量之前，必須先找得現有記錄圖則，包括顯示毗連物業、人行道、街道等的佈置平面圖。

(B) 測量項目

建築測量應包括以下項目：

(1) 建築材料；

(2) 建築物的現有用途；在可能情況下，亦應包括從前的各種用途；

(3) 是否存有廢水、危險物質、有毒化學品產生的危險品、易燃或爆炸性及放射性物質等，以及有無可能在導致空氣和土壤污染的物質；

(4) 潛在危險區域，例如不正常佈置場所、有無存在被封閉空間及可能在底部聚集有害氣體的非通風採光井等；

(5) 毗連物業及地盤情況，例如有無存在斜坡和護土牆、靠牆壁支撐的地面、非法構築物、橋樑、地下鐵路及其他構築物，包括入口、通風豎井、配電分站、牽
2.1.2 結構測量

(A) 記錄圖則

在進行結構測量之前，必須研究現有記錄佈置圖、結構框架圖及結構詳細資料。註冊結構工程師必須檢查有無存在可能在拆卸過程中導致異常結構性能的不尋常細部設計，例如懸臂結構中的抗拉鋼筋的向上錨固。如有現成記錄圖則，這些圖則應用作參考，並最好連同結構測量報告一起提交。

(B) 測量項目

結構測量應包括以下項目：

(1) 所用結構材料；

(2) 設計中使用的原有結構系統；

(3) 施工方法；

(4) 任何結構構件上破碎和變質程度；

(5) 可能受到擬進行的拆卸工程影響的相鄰構築物及其支撐物的狀況；

(6) 有無存在可能被拆卸工程截斷的連續結構；

(7) 地庫、地下箱館或地下室的結構系統和結構情況；

(8) 有無存在外露支撐物或有無可能存在埋藏式支撐物；

(9) 牆壁的性質，不論是砌塊牆、鋼筋混凝土牆、承重牆或隔牆；

(10) 簍篷、露台等懸臂結構或其他形式的構築物。

(11) 附設於建築物上的招牌、遮陽光裝置等特殊構築物。
(c) 主要建築材料；

(d) 建築物的狀況，例如退化程度；及

(e) 將要拆卸的建築物和受拆卸影響的鄰近物業的關係，鄰近物業包括毗連建築物及非法僭建物、共用樓梯、共有牆及截斷連續框架、斜坡、護土牆、架空電纜、牽索及地下公用事業供應管道等。

(3) 一幅圖則，顯示所有特殊的結構構件，例如預應力混凝土構築物、預製混凝土構件、應力表層構築物、懸吊繩桿、桁架或空腹大樑、深樑、拱門、轉移板、轉移大樑、護土及地庫構築物、無樑樓板、空心砌塊密肋樓板以及大型懸臂式構築物等的結構布置和建造；

(4) 一幅圖則，顯示拆卸樓宇的程序和拆除特別構件的詳細次序及擬用拆卸方法，包括限制使用某些機械設備；

(5) 如有需要利用動力機械裝置或裝備，圖則顯示動力機械裝置或裝備的運輸路程，包括在必要情況下將機械設備吊到構築物的頂層的方法；適應拆卸工程所需的結構修改工作，例如臨時加固，以適應提早拆卸底層及／或閣樓結構，以便車輛在地下來往行駛，或加固已磨損變壞的主要結構構件；和任何必須的樁頂、臨時支撐及樓板支撐；

(6) 一幅圖則，顯示所有保障公眾的預防措施，包括圍板和有蓋行人通道、墊台、斜柵、柵架、保護網和安全網。

(7) 一幅圖則，顯示在每個拆卸程序中，對鄰近建築物、斜坡、護土構築物和公共設施所需要的樁頂和防護設施；

(8) 一幅圖則，顯示在將要拆卸樓宇內的樁頂和臨時支撐；

(9) 一幅圖則或敘述摘要，說明裝卸和處理碎石的擬用方法，包括：

(a) 可允許在較高樓層和底層臨時堆積建築物的碎石；

(b) 水平和垂直搬運拆卸廢物的路線；

(c) 流動機械及貨車的臨時停泊布置圖。
(B) 穩定性報告 (包括計算書)

按建築物 (管理) 規例第四條，拆卸圖則必須附有穩定性報告和輔助的計算書。穩定性報告應包括以下部份：

(1) 將被拆卸的樓宇在每一拆卸過程中穩定性報告；

(2) 如果使用動力機械裝置或裝備時，樓宇穩定性的報告必須有計算資料以証明該樓宇在拆卸過程中，不會有不足夠的安全系數，或引致任何樓宇、構築物、道路及公共設施遭損損害；

(3) 如果使用動力機械裝置或裝備，所有臨時支撐及樁頂均須附有結構設計的計算資料；

(4) 可能受拆卸影響的鄰近建築物，在 2.1.1(B)(5) 所指的毗連物業、共有牆、道路、土地和公共設施的穩定性的報告；

(5) 如果需要臨時或永久的支撐裝置在鄰近建築物、毗連物業和共有牆，這些臨時或永久支撐的結構計算書；及

(6) 證明拆卸工程不會導致任何建築物、構築物、街道、土地及公共設施的安全度不足夠，或導致任何建築物、構築物、街道、土地及公共設施受損的穩定性報告，其內須載有計算資料。

附錄 B 中列出了編制拆卸圖則和穩定性報告及計算書所用的核對表。

2.2 公用事業設施

2.2.1 終止公用事業服務

在實際拆卸之前，認可人士應與所有現有公用事業公司聯絡以便：

(A) 保存通往拆卸地盤的現有公用事業設施的有關記錄；以及

(B) 使所有公用事業設施終止服務。

2.2.2 拆卸對公用事業設施的影響

拆卸圖則應保證所有在拆卸工程影響範圍內的公用事業設施，在整個拆卸過程中，不受拆卸操作所影響。
2.2.3 常見公用事業設施

拆卸工程中遇到的常見公用事業設施一般包括以下項目：

(A) 電力；
(B) 供水；
(C) 煤氣；
(D) 電訊；
(E) 排水；
(F) 架空和地下電纜；
(G) 鐵路隧道及其附屬設施，包括空調豎井；
(H) 污水隧道及其附屬設施；
(I) 廢棄隧道。

在拆卸有關結構之前，必須先諮詢所有公用事業公司和有關機構。

2.2.4 保留某些公用事業設施

(A) 在拆卸過程中，必須設有下述基本公用事業設施，以提供安全健康的工作環境：

(1) 必須設置臨時供水設施，在拆卸過程中供水，作爲消除灰塵污染的措施；

(2) 必須爲保安和通訊之用而保持拆卸地盤與外間機構的臨時電訊聯繫；以及

(3) 用作照明和其他建築用途的臨時電力供應。
(B) 如果已設有臨時公用事業設施，則所有此等臨時公用事業設施，包括電氣配件，都必須附設耐風雨裝置。

2.3 危險物質

如果建築物中存在危險物質，例如含石棉物料、石油污染及放射性污染等危險物質，就必須由有關專家進行此等危險物質或污染物進一步的調查和清除工作。

2.3.1 含石棉物料

應聘請有關專家抽取樣本，並化驗是否有含石棉物料，如果發現有含石棉物料，應聘專門清拆石棉承造商清拆石棉物料。

2.3.2 土壤污染物

如果有可能存在土壤污染物，應聘請有關專家編制土壤污染測試方案，並提交環境保護署審核，經環境保護署同意及測試完成之後，應把土壤污染評估報告送交環境保護署核實，如果需要作補救工作，應先將補救方案送呈署及環境保護署審批後，方可進行補救工作。
3. 防護設施

3.1 概述

地盤安全專用構築物應著重於保護公眾，特別是保護行人和車輛交通及鄰近物業的安全，必須設計適當的安全專用構築物以確保拆卸工程安全進行而地盤工作人員受到保護。

3.2 圍板和有蓋行人通道

圍板和有蓋行人通道的主要用途是在建築物施工或拆卸過程中保護公眾的安全。一般來說，圍板把拆卸地盤與公眾分隔開來，從而防止有人未經授權而進入和侵犯地盤。有蓋行人通道與壘台一起，進一步保障來往行人不受掉落的泥石傷害。圍板、有蓋行人通道和壘台的建議設計在以下各段中列明：

3.2.1 圍板、有蓋行人通道及壘台的要求

地盤所採用的有蓋行人通道的標準，取決於正在進行拆卸的建築物的高度，以及其與來往車輛及／或行人的接近程度。以下各段中說明對圍板、有蓋行人通道及壘台的要求：

(A) 建築物的邊界與地盤邊界之間的淨距（以下簡稱淨距），
    如果等於或超過建築物高度，只須使用圍板。

(B) 如果淨距比建築物高度少，就必須設置有蓋行人通道。

(C) 如果淨距少於建築物高度的一半，就必須設置附有壘台的有蓋行人通道。如建築物高度少於 4 米，則毋須加設壘台。

(D) 必須在與公共通道相鄰的地盤邊界的整個長度設置圍板及／或有蓋行人通道。如果壘台與一條街道毗連，其寬度不得少於 2 米。

(E) 圍板、有蓋行人通道及壘台的要求在圖 3.1 中圖解說明。
图3.1 圆柱或圆锥体人通过度

- 如采用标准轴心距的4米，由圆柱
- 要采用本设计，与设计人洽谈

案三：如设计例 H/2（一半高）

- 保证 H > H/2
- 保证 H > H/2
- 保证 H > H/2
- 保证 H > H/2

案二：如宽度H < H/2（一半高），

- 保证 H > H/2
- 保证 H > H/2
- 保证 H > H/2
- 保证 H > H/2

案一：如采用最大宽度，取最大宽

- 保证 H > H/2
- 保证 H > H/2
- 保证 H > H/2
- 保证 H > H/2
3.2.2 尺寸

必須為有蓋行人通道提供至少 2.3 米的豎向淨高。車行道上方的墊台則必須保持 5.5 米的豎向淨高。在實際可行情況下，應盡量在起重機架上保持最小 5.5 米的淨高。最小淨寬如表 3.1 所示。所需淨寬無論如何不得被交通標誌、臨時支撐物、棚架或同類物體所阻礙。

表 3.1 有蓋行人通道寬度

<table>
<thead>
<tr>
<th>現有人行道寬度</th>
<th>有蓋行人通道寬度</th>
</tr>
</thead>
<tbody>
<tr>
<td>無人行道</td>
<td>1.1 米</td>
</tr>
<tr>
<td>2.5 米或以下</td>
<td>須為 1.5 米；如人行道寬度不足，就必須保持至少 1.1 米的淨寬。</td>
</tr>
<tr>
<td>2.5 米以上</td>
<td>2 米</td>
</tr>
</tbody>
</table>

3.2.3 設計標準

在設計有蓋行人通道的頂蓋時，該頂蓋須能承受 7.5 千帕的均佈負荷。在設計有蓋行人通道和墊台的組合結構時，該結構必須能夠承受 7.5 千帕均佈負荷，或者施加在 300 毫米 x 300 毫米有效面積上的 45 千牛頓的集中負荷。有蓋行人通道和墊台的設計標準在表 3.2 中歸納說明。在設計圍板、有蓋行人通道和墊台的組合結構時，該結構須能承受香港現行風力效應守則或其最新同類出版物所述的適用風力負荷。擬搭建有蓋行人通道的位置應配合現有交通環境。

墊台和有蓋行人通道的典型詳圖，在圖 3.2 中圖解說明。

表 3.2 有蓋行人通道和墊台的設計標準

<table>
<thead>
<tr>
<th></th>
<th>均佈負荷</th>
<th>集中負荷</th>
</tr>
</thead>
<tbody>
<tr>
<td>有蓋行人通道</td>
<td>7.5 千帕</td>
<td>-</td>
</tr>
</tbody>
</table>
| 墊台和有蓋行人通道 | 7.5 千帕 | 或 45 千牛頓分佈在 300 毫米 x 300 毫米的
有效面積上。 |
图3.2 可重复使用的墩台及
有盖行人通道(五页之一)
說明：
1. 基礎之間淨距最少為
   1200毫米
2. 若基礎梁下之承重能力
   嚴100牛頓（按照力學原理
   125牛頓）
3. 在選基礎設計，基製上下板
   125毫米的混凝土板，若
   125毫米的建築板不存在，
   應安放1000x1000x125厚
   的鋼板混凝土板代替。

圖3.2 可重複使用的墜台及
有蓋行人通道(五頁之二)
圖3.2 重複使用的墜台及
有蓋行人通道（五頁之三）
圖3.2 可重複使用的墊台及
有蓋行人通道（五頁之四）
圖3.2 可重複使用的墜台及
有蓋行人通道（五頁之五）
3.2.4 有蓋行人通道的適當使用

切勿讓泥石堆積在有蓋行人通道的頂蓋上，切勿將頂蓋用於展示廣告等任何其他用途上，亦切勿在有蓋行人通道內或上貯放建築材料和設備。

如果打算在有蓋行人通道上建造承建商屋棚，屋棚的結構必須獨立於有蓋行人通道的結構，承建商屋棚的屋頂必須能夠承受壓台或有蓋行人通道的設計標準負荷。

有蓋行人通道的頂蓋必須向內傾斜以便更好地承接泥石以及方便頂蓋排水，必須在墻台的外緣設置直立緣板以便截留掉落的泥石，其高度為從其頂蓋緣的坡角處算起 1.1 米或以上。

3.2.5 施工

盡量在切實可行的情況下，有蓋行人通道和墻台的結構構件都應預製好，然後在現場用螺栓緊固好，以便重複使用，應盡量減少地盤焊接工作，以便減少進行安裝時及對過路行人或來往車輛的構成潛在危險，圍板、有蓋行人通道和墻台裝置應盡可能使用預製支撐系統、玻璃纖維增強板以及其他現成系統。

3.2.6 照明

必須為有蓋行人通道設置臨時照明系統，而該系統須保持良好狀態，有蓋行人通道地板水平的平均照度應在 35 勒克司（米燭光）至 50 勒克司之間。該照明系統必須加設防風雨裝置。

典型有蓋行人通道的建議照明佈置是，在每間隔 3 米處，應安裝設有 18 瓦或 20 瓦，600 毫米長的光管。

3.3 槲架和護網

3.3.1 槲架

在由上至下拆卸工程中，必須使用竹槲架或金屬槲架。如按建築地盤（安全）規例及槲架工作安全守則蓋搭的槲架，不論是竹或金屬槲架都可接受。
(A) 梯架構造和工作平台要求

工作平台和梯架的搭建、拆卸及安全要求必須符合建築地盤(安全)規例及梯架工作安全守則。梯架的搭建和拆卸工作，必須在合資格人士現場監督下，由具有該類工程充足經驗的合資格工作人員進行。在所有使用由上至下方法的拆卸工程中，必須設置雙排梯架。必須在正拆卸的樓層下方的三個連續樓層上設置工作平台。必須在梯架外緣設置圍護側板。這種平台既可用作工作平台，亦可用作截留從建築物中掉落的小塊泥石的防護設施。必須定期進行保養工作，清除在平台上堆積的泥石。

(B) 竹梯架

必須設置固定在建築物結構上的結構繩桿。竹梯架必須在每隔不超過4米的水平和垂直方向繫在堅固的絞釘上。

如果梯架高度超過15米，就必須在最多每隔15米處設置絞釘，用來緊固在現有建築物結構上的鋼托架或其他支撐系統，以便支撐梯架，鋼托架鉸具或其他同等支撐系統，應由註冊結構工程師設計，以便適當支撐梯架重量及包括斜柵、工作平台等的負荷。

(C) 金屬棚架

棚架至少須能承受施加在三個連續工作平台上的活動負荷及其本身重量，在確定棚架的允許高度時，必須（在設計中）考慮到可能出現的額外負載情況。必須按照製造商的建議將棚架繫到現有結構上。

(D) 拆卸

棚架的拆卸工作應與拆卸工程的進展配合一致。當由於建築物結構拆卸而除下牆壁繫桿時，棚架的無固定部分應相應拆卸，無支撐部分離開最近絞釘的高度不得超過2米。
3.3.2 護網

(A) 要求

必須在棚架上舖設兩層護網，完全圍住建築物結構，以便截留灰塵和小塊泥石。必須使用柏油帆布和厚網覆蓋棚架外面。柏油帆布應覆蓋在網上。在適用情況下，護網系統應符合環境保護署所實施的空氣污染管制（建造工程塵埃）規例的要求。

(B) 繁柱

護網必須在水平和垂直方向不少於 2 米的間隔或網寬（以何者較少為準）處固定在棚架上。護網至少要有 300 毫米的重疊寬度。

(C) 網

(1) 材料和安裝

強力網的重量必須相對較輕，而且具有截留小塊泥石的良好能力。材料應能抵禦紫外光引起的變質。網應固定在棚架及斜柵上，以便留住泥石，使泥石不致於轉向而掉到地面上。

護網須符合表 3.3 所列最低要求或其他獲准同等要求。

<table>
<thead>
<tr>
<th>表 3.3</th>
<th>聚乙烯網的最低規格</th>
</tr>
</thead>
<tbody>
<tr>
<td>標準條件</td>
<td>最低要求</td>
</tr>
<tr>
<td>材料</td>
<td>聚乙烯</td>
</tr>
<tr>
<td>細繩直徑</td>
<td>1 毫米</td>
</tr>
<tr>
<td>股數（繩絲數）</td>
<td>16</td>
</tr>
<tr>
<td>網格孔</td>
<td>20 毫米</td>
</tr>
<tr>
<td>重量</td>
<td>每平方米 130 克</td>
</tr>
</tbody>
</table>

(D) 柏油帆布

柏油帆布重量要輕，並由防火材料製成。
柏油帆布的防火特性應符合以下其中之一要求：

(1) 英國 BS 5867 號標準規定的 B 類材料；

(2) 日本內務部部頒條例（建築防火帆布的防火規例）中規定的使用輕型布法進行的（防護帆布）某些項目防火試驗；及

(3) 任何同等標準或測試。

3.4 斜柵

3.4.1 要求

設計斜柵的目的是收集一些能穿過護網的小塊泥石。斜柵設計並非用來收集一些能被斜護網收集的較大的塵粒，經下墜而聚積的動力，所能令一小塊泥石變成果具殺傷力。所以斜柵必須在工作樓層以下逆向距離不超過 10 米的地方安裝。斜柵應由棚架向外水平延伸 1.5 米，典型的傾斜角在於距水平面 20 度至 45 度之間。斜柵只能用作防護之用，而不應作任何預期會出現的負荷的臨時支撐物。

正規安裝的竹斜柵及金屬斜柵均可，以目前的棚架技術，竹斜柵可用作竹柵或金屬柵枱上，但金屬斜柵只可安裝在金屬柵枱上。

3.4.2 竹斜柵

竹斜柵的典型詳圖表示在圖 3.3 上

(A) 櫆架

竹斜柵應由栓至建築物和棚架上的竹柵枱製成。支撐竹柵枱，應以向建築物延伸的理想傾斜角，栓在柵枱內，外層的支柱（垂直柱）上。斜柵支撐物應設在建築物的牆壁或其他結構構件上。支撐竹柵枱之間的間距，不得少於柵枱支柱之間的距離或不得超過 1.3 米（以較少者為準）。支撐用的竹柵枱應使用具有適當強度的鐵線螺栓和鋼繩繩縫，以使拴在建築物的牆壁或其他結構構件上。絞釘
(b) 翻譯

因此，40毫米。這段距離，不得超過3米。支持物體的有效高度不得少
圖3.3. 竹斜柵及護網的典型詳圖

注：
1. 用來搭建柵架及斜柵的竹柵，有效直徑應不少於40毫米。
2. 金屬片、網及柏油帆布應在其四角處，固定在竹斜柵上，或間距不少於1.5米，兩者取較少者，固定在竹柵板上。
3.4.3 鋼斜柵

鋼斜柵被視為臨時懸臂結構。其鋼框架由建築物中延伸出來。安裝斜柵時應盡量避免使用膨脹式錨固螺栓，因爲錨栓可能被拆卸過程中產生的震動所鬆脫。如果必需使用錨固螺栓時，使用時須極度謹慎及小心，並且不應用作主要支承。在安裝和調整時，必須極端小心以免結構構件意外掉落。鋼斜柵的所有構件必須支撐妥當，並牢牢地固定在起重機械或支撐物結構構件上。直至安裝工作完成為止。斜柵可用預製鋼或金屬棚架的構件搭建成斜柵。斜柵的這種使用方法與金屬棚架尤其能夠互相配合作用於預製鋼或金屬棚架的構件搭建成的斜柵，其設計及安裝相符合棚架製造商的建議標準。只要實際可行，斜柵應採用的預製構件，並且用螺栓固定，藉以盡量減少焊接工作。

3.5 臨時支撐物

3.5.1 概述

(A) 要求

在下列情況下，必須為拆卸中的構築物或構築物構件提供臨時支撐物：

(1) 當結構的全部或任何部分受到拆卸活動、機動設備移動或泥石堆積所產生的過量負荷時；

(2) 當正拆卸的結構的任何部分或任何構件並非自行支撐時；或

(3) 當結構或其構件的臨時穩定性可能由於拆卸活動而受到損害時。

切勿拆除臨時支撐物直至其所支撐的負荷完全消除為止。

另一方面，在拆卸工程完成之後，若實際情況容許的話，應盡量清除所有臨時支撐物。如有臨時支撐物需要保留，擁有者、其認可人士、註冊結構工程師和註冊專門拆卸承建商應負責定期檢查和保養該等臨時支撐物，直至全部支撐物被清除為止。
(B) 懸臂結構

在拆卸過程中，可能影響公眾安全的懸臂結構，必須設置臨時支撐物。如果在拆卸該等構件之前要先清除平衡懸臂的錨固力或下壓負荷時，必需在開始拆卸懸臂構件時，在懸臂構件底下安裝臨時承台，該承台應足以承托拆卸懸臂構件所產生的荷載。除非該懸臂結構是利用割切和起吊方法或其他同等技術來拆卸的。

(C) 墜台

必須按照第3.2款所述要求和設計標準在有蓋行人通道上設置墜台。

若擬拆卸的結構構件的鄰近或在其下方的範圍需要加以保護，以免受到掉落泥石或拆卸工程所引起的其他潛在危険的損害時，亦必須在該等結構構件的下方設置墜台。這些結構構件一般包括，但不限於突出篷篷及露台。視乎所進行的拆卸操作程序，可能需要在特殊構築物（例如外部構築物構件和預應力混凝土構件等）的下方設置墜台。墜台必須在開始拆卸工程之前安裝妥當。墜台的設計，必須使護台能夠支撐在拆卸過程中的預期負荷。

(D) 鄰近建築物

拆卸建築物或其任何部分而可能影響鄰近物業的穩定性時，必須為該等物業提供臨時支撐物，該等物業一般包括，但不限於建築物、公共或私人基建設施、斜坡、護土牆或土地。截斷連續樑樑、外露公有牆及共用樓梯等共用構築物，必須加以保護並加固。

必須維持鄰近物業的安全進出通道。必須設置適當支撐物以便維持共用樓梯的穩定性，從而讓人們可不受阻礙地進出鄰近物業。拆除窯所式樓宇時可能會涉及拆除某種結構構件，而這些構件是支撐其餘建築物的必要構築的一部分。應安裝支撐該結構的適當支撐物。
3.5.2 材料和製作

材料

(e) 未完成結構

結構鋼材未焊接

鋼架與其他鋼材不應適用於該用途的材料製成。

(b) 組裝系統

結構所用鋼材之接縫及其他用作

（V）

於支撐之其他鋼材不應適用於該用途的材料製成。

(c) 標準結構

除非結構分析計算結果有特別規定外，構造接縫應適用於有

鋼束或鋼箍件

於接縫處等構件接縫處應使用鋼管接頭。

(d) 燒水材

不得使用於未完成接頭使用，烤箱，風化及化學侵蝕而損壞或

（V）

腐蝕的木材。

(e) 鋼結構

除非經結構工程師確認並批准，否則不得使用鋼結構材

小橫木橋構造橋梁作橋面特性，包括任何具有螺栓孔等的調

整公差。在不知道材質來源的情況下，必須檢驗材料特

性。
如果已用過去的結構鋼上釘有過多螺栓孔，就必須先行修理這些已用過去的結構鋼。經過焊接修理的鋼製品或仍可使用，惟補救工作必須按照（一九八七年）鋼材結構作業守則進行。

3.5.3 負荷

(A) 重力負荷

必須設計臨時支撐系統以同時承受所有下述負荷：

(1) 施工人員、手提工具及小型設備等施工負荷；

(2) 泥石堆積和掉落泥石的衝擊；

(3) 所用重型機械。

在任何情況下，第(1)項所造成的施工負荷均不得假定為少於 1.5 千帕。經過詳細評估後的特殊情況則屬例外。

第(2)和(3)項造成的負荷量必須根據可能堆積泥石的實際重量和所用機械的重量資料。如果並無工作負荷資料可供應用，必須在機械的靜重上應用 1.25 最小衝擊係數以便在設計臨時工程時顧及在懸吊地板上移動的設備震動的影響。

(B) 側向負荷

為了確保臨時支撐物的側向穩定性，其設計須能承受下述側向負荷：

(1) 風力應按照香港（一九八三年）風力效應作業守則第 3.4 條確定。如果臨時支撐物並不受風力負荷影響，而其所支撐的結構設有本身抵擋風力負荷的側向穩定系統，這項要求可以豁免。

(2) 總堅向負荷的至少百分之三受力於負荷重心，或至少 1.5 千牛頓/米的負荷受力於被支撐的結構上二者取較大者。
(3) 由於鄰近斜坡／護土牆或建築物、移動機械或傾倒泥土對臨時支撐物產生的側向力，這側向力可由工程計算或合理估算決定。

(C) 臨時支撐物的設計考慮因素

(1) 所有臨時支撐系統必須在適當基或樓板上支撐好。若正拆卸的樓層以下的各層樓宇不足以承受拆卸活動的負荷，應在較低的樓層上設置樑項直至實現足夠的支撐力為止。

(2) 可讓較低樓層承受過量負荷的其餘部分，但不得超過其支撐能力。較低樓層上的構項應在各層的同一位置上對準，以便提供連續支撐能力，而不在較低樓層中形成斷裂或反向彎曲作用。

(3) 注意避免把臨時支撐物欄在可能呈現不能容忍的不均勻沉降的地基上。

(4) 必須檢查樓板的負荷能力，以便確保能充分承受臨時支撐物產生的集中負荷，而通過使用墊塊或墊板將該等集中負荷分佈開來，可增加樓板的負荷能力。

3.5.4 結構分析和設計

支撐系統及其構件的承載能力應使用附錄 D 所列守則確定。在適用情況下，其他被廣泛接受的守則可作補充使用。

3.5.5 臨時撐桿支撐系統

在懸空樓板上進行拆卸工程過程中，可使用預製撐桿系統支撐（活動）機械設備的作業或其他負荷。典型負荷情況下撐桿支撐要求的指引，在表 3.4 中加以描述。
### 表 3.4 機械設備在懸空樓板上作業時的攔桿支撐要求

<table>
<thead>
<tr>
<th></th>
<th>3 千帕</th>
<th>5 千帕</th>
<th>7.5 千帕</th>
<th>12.5 千帕</th>
</tr>
</thead>
<tbody>
<tr>
<td>離拆除樓板的設計活荷載</td>
<td>11,600 公斤</td>
<td>11,600 公斤</td>
<td>11,600 公斤</td>
<td>11,600 公斤</td>
</tr>
<tr>
<td>允許機械設備的最大重量</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>通過擋桿支撐分佈機械設備負荷所需連續樓層的最低數目</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>各方向鋼桿間的最大間隔</td>
<td>1.2米</td>
<td>1.2米</td>
<td>1.2米</td>
<td>1.2米</td>
</tr>
</tbody>
</table>

在應用表 3.4 中的擋桿支撐要求時，必須遵循以下限制及設計要求。

(A) 擋桿支撐要求並不適用於第 2.1.3(A)(3)項所述的特殊構築物及非常規佈置。

(B) 一般情況下，泥石堆積是不容許的，除非有工程結構計算的支持。

(C) 擋桿支撐設計，以使用結構鋼進出坡道為根據。坡道的坡度不得超過 30 度。

(D) 鋼桿柵在支撐機械設備時，其最小承載力不得少於 25 千牛頓，而設置於進出坡道以下場所時，不得少於 45 千牛頓。

(E) 至少必須在兩個方向將擋桿支撐好以便提供側向限制。

(F) 擋桿的頂部和底部支撐物必須充分固定並楔緊。

(G) 如有必要，必須為地面上的擋桿設置適當的鏡板以避免不適當的沉降。
3.5.6 安裝和拆卸

(A) 所有臨時支撐物必須嚴格按照批准平面圖及／或按照製造商的建議安裝。必須檢查所有預製系統和其配件，看看有無結構缺陷。所有損壞構件和其配件必須廢棄。

(B) 所有垂直支撐物在安裝時必需保持垂直。如果承載的結構構件未有被加載至不可接受範圍，其他支撐佈置或安排亦可被接受。

(C) 所有支撐物必須按照獲批准圖則及按照製造商的建議安裝。必須檢查其支撐物與主要構件的連接處，必須檢查以確保其緊密配合及充分連接。

(D) 在不再需要使用臨時支撐物之前，切勿拆卸或修改所有該等支撐物。臨時支撐物的設計必須確保其可安全拆卸，而不會給工人或公眾造成危險。

3.6 保護物業

3.6.1 概述

必須進行穩定性處理以保護可能受拆卸工程影響的建築物構件。支撐系統的設計必須根據結構評估和工程評值而進行，以便為受影響的產業提供必要而足夠的保護。

3.6.2 共有牆及外牆

把相鄰建築物和拆卸工程隔開的共有牆必須保留，在拆卸期間和拆卸後必須保護。多餘的共有牆應儘快拆卸。共有牆鄰近結構構件的拆卸工作，應用人手進行，並須極端小心從事，以防對共有牆或外牆造成任何損壞。

在各樓層拆卸後，應立即加固及處理共有牆或外牆。

(A) 防水

當共有牆或外牆外露時，必須保護共有牆或外牆以防止水滲入和滲出。屋頂和牆縫較容易出現漏水問題，必須加以檢查以便進行防水處理。必須清除所有鬆脫的磚頭或填充材料，所有空隙應用混凝土填滿。
(1) 用水泥砂漿處理就可達到防水效果。塗敷水泥砂漿塗層時，必須遵循以下程序：

(a) 共有牆或外牆表面必須徹底清洗；

(b) 按照製造商的建議塗敷黏結劑；

(c) 必須塗上兩層水泥外塗層：

(i) 第一層的最小厚度是 10 毫米，水泥 - 石灰 - 沙的混合比例是 1 : 2 : 6。

(ii) 第二層的最小厚度是 10 毫米，水泥 - 石灰 - 沙的混合比例是 1 : 3 : 6。

(2) 可用防水紙臨時處理以保護共有牆或外牆。上一排防水紙一定要覆蓋在下一排防水紙上。防水紙必須牢牢地貼合在建築物牆壁上。

(3) 共有牆或外牆的防水工程應在可行情況下儘快進行。按一般情況，防水工程應與拆卸建築物同時進行。

(B) 結構支撐物

外露共有牆或沒有支承的外牆可臨時用斜木橋頂支撐，或由以混凝土或其他由註冊結構工程師設計的其他防腐蝕系統覆蓋的結構鋼構件組成的加勁樁臨時支撐。如果結構情況許可，讓一部分共用樑和樓板仍連接到共有牆或外牆上，可提高該共有牆或外牆的穩定性。

在新結構中，應考慮到共有牆或外牆臨時支撐物的佈置。必須設有永久支撐，這可確保共有牆或外牆支撐的連續性，並且把可能出現的干擾減到最低。必須保持臨時牆壁處理，直至進行可能結合入新建築物施工中的永久處埋為止。

3.6.3 地基支撐

對涉及地庫、地面以下構築物或可能影響鄰近物業地基的其他
3.8 树木冬季修剪

3.7.3 地面巡查

3.7.2 枝条摘除

3.7.1 树冠正圆

3.6.9 树干支撑与固定

3.6.8 树枝安全与固定

3.5.1 植物空间

3.4.8 树木病虫害防治
在工程開始時，必須召開介紹會，藉以促進工人對地盤安全和工程本身的了解，在會議上可向所有地盤人員傳達擬用方法和程序，作業過程中的潛在危險、安全設施及工程特點等工程有關資料。

安全概念可通過整個工程期間舉行的定期安全會議加以保持。地盤主管嚴格實施安全規章制度，可培養工人注重地盤安全的觀念。

除了向工人們灌輸注重地盤安全的態度的重要性以外，還必須由合資格教官在下列方面對工人進行培訓以便促使他們按照附錄 D 所列適用規例的規定遵守安全預防措施：

(A) 高空工作；
(B) 在密閉場地裡工作；
(C) 使用起重機械及裝置安全；
(D) 個人防護裝備的使用；
(E) 熱作工程；
(F) 化學品處理；
(G) 樓宇拆卸工程面對的健康危害；以及
(H) 機械的安全行動範圍及機械的安全活動範圍。

3.8.2 設備保養

所有設備必須在使用前加以測試及檢查，所有設備和工具必須適當貯存及保養。每日均須檢查設備，並把檢查結果相應記錄下來，必要時，應編製詳細安全說明書以符合工程的特種情況。

3.8.3 電氣安全

在拆卸地盤中，必須利用當地供電公司或流動發電機提供適當連接的電源，必須遵守工廠及工業經營（電力）規例制定的安全規定。
3.8.4 防火

除非所涉工程需要，否則所有易燃物品必須搬離地盤。剩餘易燃物品，必須貯放在適當的貯存設施內。在進行焊接工作之前，必須搬走所有傢俱、木材、木門等。應提供防火設備，並必須保持良好效能。

建築地盤（安全）規例要求承建商使該地盤提供的所有防火設備應保持良好狀態，毫無缺陷。

緊急通道的詳情，在第 3.8.6 分款中進一步討論。

3.8.5 職業健康

應按照工廠及工業經營條例及職業安全健康條例的有關附屬規例保護地盤工作人員的健康，特別注意以下方面：

(A) 接觸塵埃；

(B) 接觸化學品；

(C) 熱應力和通風；

(D) 接觸噪音；

(E) 醫療和急救設施；

(F) 衛生；

(G) 職業病。

3.8.6 拆卸地盤的緊急出口要求

在建築物拆卸過程中，必須在地盤內設置緊急出口。如果進行緊急疏散，緊急出口將可作運送受傷工人的生命線。在拆卸過程中必須保持至少一條出口路線，限定為緊急出口。必須提供適當照明及滅火設備。緊急出口必須受到適當保護，不受阻礙，並適當標明出口標誌或其他指示以便清楚顯示該出口路線。應把該出口路線通知所有工人。

3.8.7 震動

拆卸工程對鄰近建築物或構築物造成各種程度的影響，取決於
拆除方法。最严重影響是內向爆破所引起的。內向爆破所引起的影響分類如下：

1. 爆破誘發氣體壓力產生的永久地面變形。
2. 基礎材料的震動性沉降。
3. 彈射體衝擊（即爆破岩石碎塊衝擊）及
4. 地面震動或空氣波動造成的震動性破裂。

這些影響的處理方法必須在內向爆破方法陳述書內詳細說明。對其他機械拆除方法來說，震動影響通常比一些其他施工過程少，（例如衝擊打樁及爆破）。在某些情況下，重型拖拉機造成的交通震動比機械拆除造成的震動還要嚴重。為了查明震動的實際原因，建議註冊專門拆除承建商在拆除過程中進行震動監控。作爲一般指引，對機械拆除所造成的長時間震動來說，任何鄰近結構的峰值震動速度不得超過每秒鐘 15 毫米。

3.9 環境防護設施

把建築地盤對環境所造成的影響減到最低的一般規定亦適用於拆除過程。以下各節載有所要採用的某些程序：

3.9.1 空氣污染

混凝土破碎、泥石處理及搬運過程，是建築物拆除工程中形成灰塵的主要來源。必須採用符合空氣污染管制（建造工程塵埃）規例的防護及措施，盡量減少灰塵的排放。不得燃燒廢物，機械裝置或設備產生的柴油煙霧亦必須受到控制。

3.9.2 噪音

在拆除工程上，使用指定的機動設備或其他機動設備，例如氣動破碎機、挖土機及發電機等，棚架、臨時工程的架設、泥石的裝載及運輸等，均會產生噪音污染，從而影響工作人員以及拆卸地盤附近對易受噪音影響的地方。在切實可行情況下，應使用低噪音機動設備以減少噪音的影響。拆除活動不得在環境保護署所規定的限制時間內進行。目前按照噪音管制條例，在限制時間內使用指定機動設備或其他機動設備，均受到建築噪音許可證制度管制，該制度在附錄 E 中進一步討論。
3.9.3 水

拆除地盤若要排放廢水，必須由環境保護署領得有效的排放牌照，而且必須按照水污染管制條例規定申領有關牌照。排出的廢水應按照牌照中規定的標準來處理，然後才排放。

為防止在地盤內或其鄰近地方水浸，註冊專門拆除承建商應按3.10.3分款中，保持臨時自來水的控制及有效的排水系統。

3.9.4 危險物質

如果需要清除含石棉物料，必須向環境保護署呈交石棉調查報告。必須在石棉消減工作開始之前至少二十八天呈交石棉消減計劃。石棉消減工程必須在拆卸工程前完成。工程需按照空氣污染管制條例及工廠及工業經營（石棉）規例進行。通知程序在附錄E中討論。

在開始拆卸建築物之前，必須查明並適當處理及清除其他危險物質，例如家庭單位的石油氣罐、工業經營所用有毒和腐蝕性化學品以及其他任何危險物質。

廢物的管理，必須完全符合廢物處置條例。此外，化學廢物的管理，亦必須符合廢物處置（化學廢物）（一般）規例的要求。

3.10 泥石和廢物處理

3.10.1 廢物槽

切勿把泥石、廢物及其他物料從高處扔下、倒下或射下。這樣可能使地盤上或附近的人士受傷。

現有電梯井、採光井及樓板上的開口，可用作向下輸送泥石。與這些廢物槽或輸送設施環繞相鄰的場地不使用時，必須用圍欄或隔板隔開。必須張貼警告標誌，以防工人進入該等場地。作爲一種選擇，可在樓板開口及電梯井中使用塑膠廢物槽以便盡量減少噪音及限制掉落泥石的墜下方向。
(A) 電梯井

電梯井可用來輸送建築物內的泥石。電梯的開口必須妥善封閉，以防泥石散落出來。

(B) 採光井

必須在用作輸送泥石槽之前，取出或保護採光井中的所有玻璃窗，以便盡量減少危險的情況。

(C) 樓板上的開口

樓板上的開口可用來輸送泥石。如果樓板上開了口，各層樓板上的開口總面積不得超過樓面總面積的百分之二十五。每個開口不得大於 900 毫米 x 900 毫米，開口不得穿過可能影響結構構件穩定性的結構支持構件。

(D) 外用廢物槽

除非拆卸物料已清封在廢物槽內，否則不得任由拆卸物料掉落建築物外面。如果使用外用廢物槽，必須提供充分淨高以便操作。切勿使用由舊金屬桶裝配而成的臨時廢物槽。廢物槽切勿對住戶造成阻礙。如果廢物槽出口接近公共通道，必須設置防塵屏罩。在設計和建造廢物槽時，廢物槽必須具有足夠強度，並適當支撐以便安全輸送泥石。

3.10.2 泥石循環再用

較好的地盤管理及慣例，不僅會避免把建築及拆卸廢物的非活性部分與活性部分混濁在一起，而且方便工作人員在建築及拆卸廢物來源處進行現場分類並分開處理。

一般說來，必須首先拆除窗框、喉、管子等金屬構件以及門及木地板等木材。這些物料大多數可以循環再用。在剝離並搬走所有上述非結構物料後，才開始拆卸工程。必須把拆卸程序預先規劃好以便把建築物料分開並分類處理。

混凝土及／或磚的泥石必須破碎成較小塊，與鋼筋分開，以便處理。
3.11 檢查和保養

(A) 頻率

認可人士或其有經驗及稱職的代表，註冊結構工程師或其有經
驗及稱職的代表，和註冊專門拆卸承建商必須進行地盤檢查，
其頻率不應少於刊登在監工計劃書的技術備忘錄和建築工程和
街道工程地盤安全的作業守則內的頻率，務求使臨時構築物、
斜枱、墜台和其他安全防護設施的情況良好，如有任何移動、
損壞、臨時構築物變形等情形必須立刻找尋原因，如有需要，
立刻維修。

註冊專門拆卸承建商應每日檢查地盤，並清除斜柵及墜台及堆
積的泥石。承建商代表應無間地長駐地盤監察和檢查拆卸工
程，包括任何不穩定結構，和已部份拆卸的建築物，該代表應
在每日離開地盤前確保所有臨時構築物和正在拆卸中的建築物
的安全。

正常檢查亦應包括為保護工作人員健康而採用的防護措施，例
如灰塵抑制措施及個人防護措施。

如檢查人員發現實際施工與方法陳述書不符合，應向上司匯
報，並通知認可人士，和註冊結構工程師有關不符合情況，並
停止拆卸工程，直到糾正工作完成和得到認可人士和註冊結構
工程師的書面復工指令才可復工。

(B) 不安全的情況

如果出現任何不安全的情況，用臨時支撐物支撐的一切拆卸活
動，必須立即停止，直至糾正所有不安全的情況為止。所有不
安全情況應向認可人士或註冊結構工程師匯報，並等候指令。

(C) 棚架

必須按照工廠及工業經營條例以及其包括建築地盤（安全）規
例及棚架工作安全守則等附屬規例，進行棚架的檢查和保養工
作。

除非具備下列條件，否則切勿使用棚架：

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3.12 拆卸後的防護設施

拆卸工程完成後，應即回復地盤的原來面貌，以便清除任何對公眾構成的潛在危險。必須考慮以下防護設施：

(A) 必須平整地盤，並清除任何泥石。應有充足的排水系統。

(B) 如果新發展項目並不立即動工，必須完全圍住地盤以防公眾擅自進入。

(C) 必須安裝好相鄰建築物結構的支撐物，並完成外露共有牆或外牆的防風雨和加固工作。註冊結構工程師必須進行相鄰構築物支撐物的最後檢查工作，以確保在承建商離開地盤之前，該等支撐物處於令人滿意而又安全的狀況。如果臨時支撐物仍留在現場，必須繼續進行第 3.11 款所述檢查及保養工作，直至拆除臨時支撐物或以永久支撐物取代為止。

(D) 任何挖掘處必須支撐並加固。

(E) 就斜坡地盤及/或設有護士牆支撐地面的地盤而言，必須包括下述附加防護措施：

(1) 地面應密封以防水滲入。

(2) 任何不穩定構築物及地面必須加固。

(3) 必須向以後的地基或地盤開拓承建商提供拆卸計劃及圖則，以便使拆卸期間建造的臨時支撐工程得在新發展階段中保持作用。
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注：
- 项目1：水能评估
  - 项目内容：水能开发
  - 项目描述：
- 项目2：水力资源
  - 项目内容：水资源开发
  - 项目描述：
- 项目3：水利工程
  - 项目内容：水利工程开发
  - 项目描述：
(B) 拆卸次序

必須按照地盤實際情況、約束、建築佈置、結構佈置及其構造確定拆卸次序。一般來說，下述程序將適用：

(1) 在拆卸主建築物及其各層內部結構前，必須先拆卸所有懸臂樓板、蓋篷、走廊及附設於其外圍上的構築物；

(2) 當拆卸天台結構，所有電梯機房、水箱等高處建築，應按由上而下次序拆至天台樓板。當拆卸天台外牆或女兒牆時可按 4.2.1(D)施工。

(3) 樓板的拆除工作，應先從跨度中央切起，然後朝著支撐橫樑繼續拆除；

(4) 必須按照下述次序拆卸地板橫樑：

(a) 懸臂樑；

(b) 次樑；然後

(c) 主樑；

如果橫樑的結構穩定性受到影響，例如失去約束，就應在失去支撐或約束之前，把受到影響的橫樑支撐妥當；

(5) 必須在拆卸承重牆之前先拆卸非承重牆；

(6) 必須在拆卸頂部的樑以後拆卸支柱和承重牆；

(7) 如果地盤情況许可，底層上方的一樓地板樓板的拆卸可用機械上安裝的拆卸配件。

(C) 懸臂結構和露台

懸臂結構、露台和蓋篷可能突出建築物以外而懸空於人行道之上方，或在某些情況下，懸空於一部分交通路線之上方。臨時支撐結構及／或懸台，應設在懸臂露台之下方，

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作為防護設施，臨時設計標準的詳情，可參閱第 3.5 節。
與懸臂結構有關的常見問題，亦在第 5.3 節中討論。拆卸
懸臂樓板和樑的一般順序在以下各段中加以說明：

(1) 外牆必須先拆卸，詳情請參閱第 4.2.1(D)段；外牆：

(2) 必須在拆卸懸臂樓板和樑之前，先拆卸由懸臂系統支
撐的結構或靜負荷；

(3) 逐步鑽去混凝土，先從懸臂地板的外緣開始，向內並
朝著支撐樑拆卸；圖 4.1 說明懸臂樓板的拆卸過程；

(4) 懸臂樑應在拆卸與該樑連接的樓板之後，才可拆卸。
在拆卸樓板之前，不應先拆卸懸臂樑，從而一直保持
對樓板的支撐力。圖 4.2 說明懸臂樑及樓板的拆卸過
程；

(5) 可用鋸割和起吊法拆卸懸臂構築物。先把樓板鋸成容
易處理的尺寸吊走，才切割並清除該等懸臂樑。在拆
卸懸臂樑之前，應先清除懸臂所支撐的樓板負荷及其
支撐的任何負荷。鋸割和起吊法的應用在第 4.6.3 分款
中討論。

(D) 外牆

(1) 填磚牆

(a) 爲了避免磚頭從建築物中往外掉落的潛在危險，
必須在拆卸鋼筋混凝土框架之前，把所有填入的
磚頭往內推除下。建築物外的工作平台應用來拆
卸填磚牆。應由頂層開始向下拆去磚頭。

(b) 可用以下兩種方法拆卸鋼筋混凝土框架：分別拆
卸各根懸樑和支柱及／或如第 4.2.1(D)(2)、
4.2.1(D)(3)和 4.2.1(D)(4)各項所述拆卸兩根支柱之
間的框架。
圖4.1. 把原始數據進行數字化轉換

[Diagram description: A diagram with labeled parts and annotations in Chinese. ]
圖4.2. 拆卸懸臂鋼筋混凝土樓板和樓樑
(2) 外樑

(a) 可用逐歩鑽去混凝土或拆卸整個樑段的方式拆卸外樑。圖 4.3 說明外樑的拆卸過程，並在以下各段中敘述：

(i) 必須使用鋼索和絞車或其他系統把樑固定在其他結構構件上。

(ii) 先鑽去樑兩端支柱的支點上的混凝土，使鋼筋外露。

(iii) 切割鋼筋的一端，使樑部分掉落。鋼索必須以外一種受控方式安全地把橫樑絞放在建築物的地板上。

(iv) 切割鋼筋的另一端，完成樑的拆卸工作，然後以受控方式完全放下樑。

(3) 外柱

(a) 可用下述程序拆卸外柱，並在圖 4.5 中加以說明。

(i) 必須先用鋼索和絞車把柱頂端固定在其他結構構件上。

(ii) 先將支柱底部預削弱以減少拉力並確保在所要位置折斷，必須先鑽去包住鋼筋的混凝土。必須保留內面的鋼筋，而外面的鋼筋則須在拉倒支柱之前切割。

(iii) 預削弱後，必須用鋼索和絞車以一種受控方式將支柱朝著內側拉倒。
1. 支撐整根外樑。
2. 要好要拆卸的整根外樑。
(關於連接詳情，可參閱圖4.4)
3. 清除在拆除損件的支撐物。
4. 使所有鋼筋外露。
5. 在切口一、切口二及切口三處切割鋼筋。
6. 放下切口一和切口二處的一端。
7. 在切口四處切割鋼筋。
8. 放下橋樑。

註：說明只是指示性的，如果設有永久設置或起重機器，緊急安排可簡化設備。

圖4.3. 拆卸外樑
图4.4：在析构函数定分数的对策

立体图

平面图
(4) 外部鋼筋混凝土框架

(a) 可分段拆卸結構框架。拆卸程序在下文中一般性地說明：

(i) 對人工拆卸來說，要拆除的框架最佳部位是兩根相鄰支柱之間的部分，但兩柱的柱距不得超過 3 米。

(ii) 必須在使框架脫離其餘結構之前，用鋼索和絞車把框架段固定在其他結構構件上。

(iii) 必須把兩柱的底部預先削弱。關於支柱的預先削弱工作，應按照第 4.2.1(D)(3)段規定進行。

(iv) 必須在預先削弱後，切割連接棧樑的鋼筋。通過絞車絞動施加力量，把框架拉倒。

(5) 鋼筋混凝土牆

(a) 承重牆

亦可把鋼筋混凝土牆切成容易處理的分段，然後拆卸。每個牆段的寬度不得超過 2 米。圖 4.6 說明鋼筋混凝土牆分段拆卸的過程，並在下文中敘述：

(i) 在開始拆卸之前，必須使用鋼索和絞車系統固定牆段。

(ii) 必須把牆壁的底部預先削弱，特別是牆段中設有支柱時，更應如此。用手持工具靛去牆段內面切割線兩邊的混凝土。關於支柱的預先削弱工作，應按照第 4.2.1(D)(3)段規定進行。作業時，必須十分小心以便盡量減少從建築物中掉落的泥石。
(iii) 在把切割線兩邊的混凝土鑽去後，必須分割垂直切割線兩邊的鋼筴。通過鋼索和絞車系統施加拉力，把牆向著建築物內拉倒。

(b) 非承重牆

對非承重牆設有重橫樑的牆壁來說，拆卸程序與承重牆的拆卸程序相似，但不同的是，橫樑與建築物的牆壁分開拆卸。圖 4.7 說明非承重橫樑與橫樑分開拉倒的原理。

(E) 樓板

逐步鑽去混凝土後，就可拆卸鋼筋混凝土樓板。必須保留鋼筋，在鑽去混凝土後，才切割鋼筋。拆卸典型樓板的順序在下文中討論：

(1) 雙向樓板

雙向樓板在所有四側都由橫樑或結構構件支撐。樓板的拆卸工作必須從樓板的中間開始，而逐步沿著所有四個方向朝著四側繼續拆卸。圖 4.8 說明雙向樓板的拆卸過程。

(2) 單向樓板

必須從沒有支撐的一端開始拆卸，然後繼續沿著與支撐橫樑或結構構件垂直的方向一條接著一條拆卸。必須從中央向著兩個方向的支撐物把板條拆卸。

(3) 無樑樓板

必須從支柱之間部位的中央開始拆卸無樑樓板，然後繼續朝著支柱及／或提供樓板側向支撐的構件拆卸。必須十分小心，以免提早削弱支柱或其他支撐物的剪切能力。
圖4.7 把鋼筋混凝土牆與橫樑分開拉倒
(F) 樓板

(1) 樓板通常在兩側支撐樓板。在消除樓板上的其他所有靜荷載（包括樓板支撐的樓板在內）之前，切勿拆除支撐樓板。

(2) 圖 4.9 說明內柱或次樓的拆卸過程。

(G) 柱

把內柱底部預先削銼，再用鋼索和絞車系統拉倒，就可拆卸內柱。這個過程與前面第 4.2.1(D)(3)段所述的外柱拆卸過程相似。

4.2.2 使用機器由上至下拆卸

(A) 概述

在典型情況下，使用機器由上至下拆卸的次序，與人工由上至下拆卸的方法相同，而不同的是，大多數拆卸工程都由機械設備進行。開始拆卸時，先把機械設備吊到建築物的頂層上。如果使用鋼索或繩索，工人必須獲得保護或站在鋼索或繩索折斷時所能擊到的範圍以外的地方。繩索的負載力必須至少為預計負載的四倍。每天至少必須檢查鋼索或繩索兩次，以便確保鋼索或繩索處於良好工作狀態。

(1) 機器的支撐物

必須檢查機械設備對樓層形成的負荷。如果需要，應在工作樓層以下的樓板安裝撐桿以便支持機械設備的作業。機械設備只能在受到支撐的範圍內移動。在上述範圍內，應禁止機械設備移動。

(a) 在離建築物邊緣 2 米的範圍內；
图4.10 生产过程固定次序的详情
- 主樑。

(3) 機械設備應通過臨時進出坡道駛入下面的樓層；

(4) 當機械設備剛從上層通過臨時坡道進入下面樓層時，
該項機械設備就可用來同時拆卸兩個連續樓層的樓板
和樑樑。機械設備可在同一樓層的結構構件上工作，
並拆卸上一樓層的樓板。

(5) 樓板包括樑樑和支柱，可用逐步破碎混凝土方法拆
卸，或用受控方式拉倒。

圖 4.11 說明使用機械設備由上至下拆卸方法的典型順序。

(C) 懸臂篩篷和露台

懸臂篩篷和露台的拆卸工作可能嚴重影響公眾安全，因此
必須以極為慎重的態度進行。臨時支撐結構和塢台，應直
接設於懸臂結構或露台以下。與懸臂結構有關的常見問
題，在第 5.3 節中討論。懸臂結構的拆卸過程在下文中敘
述：

(1) 必須先拆除作爲懸臂結構或露台一部分的外牆，有關
過程並在第 4.2.2(D)段《外牆》中進一步討論。

(2) 樓板和懸臂樑可分段拆卸。圖 4.12 說明懸臂樓板的拆
卸過程。

(3) 在切割過程中，必須使用附有穿過樓板段的鋼索的機
械吊臂，使結構保持穩定。
一．拆卸樓板和樑模

二．繼續拆卸樓板和樑模

圖4.11. 利用機械由上至下拆卸的典型程序（三頁之一）
三．由鋼結構框架築成的運輸斜道讓機器向下移到下一樓層。

四．可能需要拆卸內柱以形成拆卸外牆所需通道和工作空間。拆卸支柱時，先削除其底部，然後用機器以完全受控的動作拉離。

圖4.11．利用機械由上至下拆卸的典型程序（三頁之二）
4.11. 制用起重机在主至支持的支架程序（三之三）

在使用起重机之前要先将支持的支架程序。

图中所示为起重机的安装位置，须确保安全。
圖4.12. 利用機械拆卸懸臂板（慣用法）（二頁之一）
(4) 可用風鎬或壓氣鎬切割混凝土，而用氧氣乙炔火焰切割器切割鋼筋。必須先拆卸混凝土後，才切割鋼筋。此外，也可選擇用銼割切斷樓板。

(5) 用吊臂把樓板吊入建築物內。

(D) 外牆

外牆的拆卸工作，應極為小心地進行。外牆可用機械設備分段拆卸。牆段寬度應由註冊結構工程師決定，機械設備應具有足夠工作能力以安全處理牆段重量，可保留外牆頂部外樑所附的短跨度（約300毫米）樓板，以便把外牆形成的負荷進一步保持在建築物內。

(1) 填砌牆

填砌牆的拆卸過程在下文中一般性地說明：

(a) 填入的磚塊必須先用人工方法拆除。在拆除磚頭時，必須從外部向內推，及從頂層開始向下拆除。在這種作業中，可使用建築物外安裝的工作平台。

(b) 在填入的磚頭拆除後，鋼筋混凝土框架可用第4.2.2(D)(3)項所述拆卸框架段的方法拆卸。

(2) 外柱

(a) 必須使用附有鋼索或油壓式破碎配件的挖土機臂撐住支柱。

(b) 必須把支柱底部預先削弱，然後與第4.2.1(D)(3)項《使用人工由上至下方法拆卸外柱》所述過程相似。

(c) 在預先削弱後，必須用挖土機臂以受控動作把支柱拉倒在建築物內。

(d) 以挖土機臂伸入建築物內進行拆卸。
(3) 外部鋼筋混凝土框架

外部鋼筋混凝土框架的拆卸過程在圖 4.13 中圖解說明，並在下文中敘述：

(a) 沿著擬斷開處的混凝土必須先行打碎，必須保留鋼筋使結構保持穩定，挖土機臂必須固定鋼筋混凝土地框架。

(b) 可用圖 4.5 所述方法，在支柱底部進行預先削弱工作。在切割斷開點處的鋼筋的過程中，挖土機臂必須使框架保持穩定。

(c) 挖土機臂必須把框架安全地拉動並引導到樓板上。

(4) 鋼筋混凝土牆

拆卸鋼筋混凝土牆段的過程與鋼筋混凝土框架的拆卸過程相似。鋼筋混凝土牆段的拆卸過程在圖 4.14 中圖解說明，並在下文中敘述：

(a) 必須打碎擬斷開處的混凝土，把鋼筋混凝土牆與其餘牆壁垂直分開。牆段的寬度應由註冊結構工程師決定。應保留鋼筋，以便為牆段提供支撐力。

(b) 如果牆段中設有支柱，必須在分開牆段的高度進行預先削弱工作。關於支柱的預先削弱工作，參閱第 4.2.1(D)(3)項。

(c) 在切割牆段兩側鋼筋的過程中，必須使用機器臂固定牆段。

(d) 鋼筋切開後，機器臂必須穩定地把牆段引導並拉到建築物內，以便進一步拆除。
1. 設有鋼索或油壓式破碎機配件的挖土機臂
固定鋼筋混凝土框架
2. 框架段的長度必須由註冊結構工程師決定
3. 去混凝土覆蓋層使鋼筋外露，在底部
預削鋼混凝土柱0只切斷支柱外面層的
鋼筋。4.5)
4. 挖土機臂以緩慢而受到控制的動作拉開
框架。

圖4.13. 利用挖土機拆卸鋼筋混凝土框架
沿著垂直槽壁去混凝土以便分開縫段。縫段宽度由註冊結構工程師決定。必須留下鋼筋使縫段保持穩定。必須小心壓去混凝土以便儘量減少從建築物中掉落的碎料。

圖4.14. 利用挖土機拆卸鋼筋混凝土牆 (三頁之一)
2. 在拆除弱支点位置时，应设有
预留的挖土机械支撑结构。
（见图4.5）

圖4.14 利用挖土機拆卸鋼筋混凝土牆（三頁之二）
3. 在切斷鋼筋時，機器繼續支持鋼筋。保留底部的鋼筋。切割鋼筋後，挖土機以一種受控動作拆除鋼筋。

圖4.14 利用挖土機拆卸鋼筋混凝土牆（三頁之三）
(E) 樓板

使用機械安裝配件逐步拆除混凝土，就可拆卸樓板。以後必須切割鋼筋。拆卸單向樓板、雙向樓板及無樁樓板的次序，與第 4.2.1(E)段所述次序相同。樓板可用附有破碎機、油壓式破碎機或其他適當配件的機械拆卸。

(F) 內樑

逐步拆除混凝土，並在以後切斷鋼筋，就可拆卸內樑。

(G) 內柱

使用第 4.2.2(D)(2)項所述外柱的同樣程序，就可拆卸鋼筋混凝土柱。

4.3 使用帶長臂的油壓式破碎機的機械方法

4.3.1 概述

破碎機配件，使用通過長臂傳遞的液壓推力，打碎混凝土和鋼筋。油壓式破碎機，可從建築物外的地面上進行作業。這種方法亦適用於危險建築物、筒倉及其他工業設施。圖 4.15 說明附有長臂的油壓式破碎機的典型作業。由於油壓式破碎機運作時比較平靜，為環保緣故，此方法應盡量使用。

4.3.2 應用標準

(A) 在作業中，至少要有相當於建築物高度一半的淨距，作爲泥石掉落的安全區域。

(B) 必須定期檢查及保養設備，以確保設備處於良好安全的狀態。在破碎機作業過程中，挖土機必須在可支撐機械的結實地面上作業。
圖4.15 利用設有長臂的油壓式破碎機拆卸
4.4 透障

4.4 透障

由于存在障碍物，系统可能存在碰撞。

在该障碍物附近，系统可能会出现碰撞。

为了防止碰撞，需要采取相应的措施。

(1) 调节参数，调整策略，以避免碰撞。

(2) 设置安全距离，避免碰撞。

(3) 定期进行维护，确保系统正常运行。

(4) 提高系统的智能化程度，减少碰撞的可能性。

(5) 加强人员培训，提高操作人员的技术水平。

(6) 定期进行安全检查，及时发现并解决问题。

(7) 采用先进的技术手段，提高系统的稳定性。

(8) 定期进行系统更新，提高系统的性能。
圖4.16 撞擊球作業
4.4.2 應用標準

使用撞擊球的建議指引，在下文中說明：

(A) 除了特殊用途以外，各段結構必須用鋼球由上至下撞擊，
    必須小心保持結構的穩定性。

(B) 撞擊球作業的建議技術包括：

(1) 垂直墜落 - 讓撞擊球自由墜落在結構上；

(2) 內摞索 - 鋼球隨著起重機臂擺動。通常有另一條拉索
    水平連接到鋼球上以控制鋼球的活動。撞擊球應向著
    建築物擺動，擊中有關構件的頂部以避免該構件掉出
    建築物以外。

轉動起重機臂的做法並不適宜。轉動起重機臂使鋼球活動
很難控制。這種作業要求操作員對機械和結構都具有專業
知識，以及具有安全執行任務的操作技能。轉動很可能在
起重機臂上誘發大量應力，因此必須避免使用這種動作。

(C) 必須在正拆卸中的結構部分上方超過 3 米的距離操作起重
    機臂。

(D) 起重機與正拆卸中的構築物之間的作業淨距必須是建築物
    高度的百分之五十。地盤邊界與擬拆卸建築物之間的淨距
    不得少於建築物高度的百分之五十，另須加上 6 米供起重
    機移動之用。若建築物將會以撞擊球拆卸，則建築物的每
    一面都必須依從這項標準。

(E) 撞擊球必須與本身是旋轉式的吊裝裝置連接，以防止鋼索
    在作業過程中纏結在一起。

(F) 機器用來撞擊的鋼索和起重臂，在工作範圍內，至少必須
    具有達鋼索重量五倍的額定能力。

(G) 鋼索的強度至少必須是樓板和構架的構造鋼筋的標準抗拉
    強度的兩倍。高強度鋼索使撞擊球能脫離潛在操作陷阱。

(H) 為了確保起重機狀態良好，每天必須兩次檢查鋼索與撞擊
球的連接情況、起重臂部配件及連接螺釘。

(I) 必須提供足夠長度的鋼索，使鋼索能落到最低工作高度上，到時仍有百分之十和不多於三（個）圈的剩餘鋼索長度。對內擴索方法來說，要有足夠的拉索長度，使鋼球與掉落的泥石糾纏在一起時能自行掉落。

(J) 在架空電力電纜附近，不得進行這種作業。

(K) 地盤必須完全圍住，使公眾無法進入地盤。必須在地盤上安排二十四小時保安護衛員，以便進一步執行進入限制。按地盤中建築物與圍板的相對距離及撞擊球的操作情況，圍板設計應考慮撞擊球或泥石的意外相撞。

(L) 在拆卸球使用過程中，除了起重機操作員及視察員以外，其他所有工作人員必須位於撞擊球的工作半徑以外。任何人均不得留在建築物內。

(M) 爲了盡量減少灰塵對周圍地區的影響，要拆卸的結構必須在拆卸之前預先用水浸溼。在拆卸過程中，必須在結構上連續噴水。

(N) 因為工程的安全和成功在很大程度上取決於操作員和地盤工作人員，所以操作員必須具備審批部門滿意的操作撞擊球的經驗和技能。

(O) 視察員必須在作業過程中在現場協助操作員，並確保地盤的安全。視察員必須具有撞擊球方面的廣泛知識和使用經驗。視察員的資歷和經驗必須相當於撞擊球操作員的資歷和經驗。

4.5 內向爆破

4.5.1 爆破前考慮事項

如果承建商有意使用爆破方法拆卸樓宇，他先要進行對鄰近地方的整體性風險評估作報告及環境評估作報告。如該兩項報告書作出正面結果，並且經屋宇署中央統籌的有關部門同意，承建商才可研究建築物的結構，並制定爆破設計。設計可包括結構的預先削弱、安放炸藥的策略及時間延遲，以便使建築物
4.5.2 一般事項

受控爆破拆卸工程中的一般事項和良好做法在下文中討論：

(A) 在設計結構的預先削弱工作時，必須確保結構在內向爆破前的穩定性。

(B) 為了盡量減少爆破後散落到鄰近土地上的建築物泥石，除非設有地庫，否則必須在建築物周圍挖掘一道溝槽或設置一道岸壁以容納泥石。

(C) 良好的爆破設計將使構築物朝著建築物中心及／或在受到保護的範圍內崩坍。

(D) 良好的爆破設計將提供適當而又足夠的時間延遲，使每次只有一兩個樓層的泥石掉落至地面上，以便限制其對地面的衝擊程度。

(E) 有關設計亦必須界定一個專有區域以便在爆破過程中疏散居民或住戶。必須考慮在爆破過程中產生的噪音和灰塵的影響。典型專有區域的半徑不得少於建築物高度的兩倍半。

(F) 如果存在著斜坡並設有護土牆或其他構築物，就必須進行土力評估，以確保爆破不會影響這些構築物的穩定性。

(G) 從炸藥安放時起直至最後爆破為止，整個地盤必須置於二十四小時保安之下。炸藥的處理和貯存工作，必須符合危險品條例、礦務處處長頒佈的要求及其他有關規例。內向爆破專家必須在設計和監管類似建築物結構的爆破方面具有經查證的經驗及紀錄。而礦務處處長亦對其感到滿意。爆破專家亦必須在使用將要採用的炸藥方面受過有關訓練和具有實際經驗。爆破專家必須獲得礦務處處長發出的爆破授權書。在爆破前及爆破期間，必須疏散地盤上的所有人員。
(H) 承建商必須與政府和當地社區配合以便確定通知、編定工作時間表和交通路線、設計工作順序、從建築物中疏散居民及人員以及分配爆破過程中的責任的最佳程序。為了方便控制人群，爆破工作應在星期日或公眾假期早上進行。

(I) 必須制定一項緊急計劃，以便應付由於惡劣天氣（包括雷暴及電擊）所造成的過早爆破、誤爆、或中止爆破等緊急情況。

(J) 爆破後，爆破專家必須進行檢查，以確保現場上不會留下任何未爆破的炸藥。整個區域必須清場，並受保安戒備，直至未爆破的炸藥已經完全引爆或被爆破專家作安全處理為止。

(K) 只要切實可行，必須使用非電訊雷系統，以避免大氣電波、電磁波、或無線電頻率所造成過早爆破的危險。裝置中應包括暫餘系統以便確保成功引爆；不得使用以硝化甘油製成的炸藥。

(L) 承建商必須提供其安全執行拆卸工程的能力的證據，而且應向審批機構說明有關程序是安全的。

(M) 必須說明建築物崩坍的方式以便確定：

(1) 建築物並無任何部分將掉到受保護範圍以外；

(2) 結構崩坍不會引起影響以下結構的重大震動：

   (a) 任何地下隧道；

   (b) 任何地下公用事業設施；以及

   (c) 任何鄰近物業。

(N) 擬內向爆破的建築物的結構安全性，必須在爆破之前檢查，而且證明該建築物在爆破前所有階段均屬結實而又安全。
圖4.17 鋼絲鋸技術的應用
機械拆卸

(A) 概述

機械拆卸一般涉及使用設有配件的大型機械從外面拆卸建築物。常用機械方法包括使用推桿、鋼索及蛤殼式抓斗。圖 4.18 說明這些裝置的操作。這些方法只適用於相對平坦地面上的孤立建築物。機械拆卸工程中的事項和良好做法一般包括以下各項：

(1) 機器必須在平坦堅固的地面上操作。機器亦必須具有足夠的對重裝置以防在作業過程中傾覆。

(2) 必須經常檢查設備及配件和鋼索等配件，而必要時加以修理或更換。

(3) 必須檢查崩坍結構段對地板或地面的影響以防止懸空樓板的潛在超載，對鄰近物業造成的震動和干擾以及對地下公用事業設施的損壞。

(4) 地盤應安排二十四小時保安，以防未獲授權的人員進入地盤。在機器作業過程中，其他人士不得停留在機器的工作範圍和建築物內。

(5) 必須提供足夠的噴水或其他防塵防護設施以便盡量減少灰塵造成的空氣污染。

(6) 機器的駕駛室必須設有防衝擊玻璃，而其構造必須十分堅固以便保護操作員不受飛散泥石傷害。

(7) 必須二十四小時在現場安排一位觀察員在拆卸過程中提供指導並協助操作員。
(i) 機械方法的使用推桿推入法

(ii) 機械方法的使用推桿拉出法

(iii) 機械方法的使用蛤蠣式抓斗

(iv) 機械方法的鋼索使用
除了上述以外，各種機械方法的具體標準在以下章節中討論：

(B) 使用推桿的機械方法

使用推桿的機械方法涉及使用設有推桿配件的機器，施加水平推力以拆卸結構構件。用推桿進行拆卸的具體條件列明如下：

(1) 推桿必須由鋼或同等材料製成，並具有足夠強度以便對建築物發揮作用；切勿使用起重機臂；

(2) 在機械與建築物之間必須保持最短安全距離以便推桿推入建築物內，這個距離應是正拆除中的建築物高度的一半；

(3) 在把結構構件拉出建築物外時，必須保持的最短安全距離為拆卸中的建築物構件高度的一倍半；

(4) 推進作業點不得低於建築物高度的三分之二，亦不得超過基礎以下 600 毫米。

(5) 推桿法只限於在高度不到 15 米的建築物上使用。

(C) 故意崩坍的機械方法

故意崩坍的機械方法，一般是有系統地拆除或削弱關鍵結構構件以便誘發該結構的崩坍。故意崩坍的具體條件如下：

(1) 在整個作業中，必須保持的最短安全距離是正拆除中的建築物構件高度的一倍半；

(2) 在拆除關鍵結構構件時，必須仔細設計並執行有關程序以免構件提早崩坍，而且能使結構崩坍到預期範圍內；

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抓斗的具體條件列明如下：

(1) 在作業過程中，機械與建築物之間必須保持最短安全距離，這個距離應是正拆釘中的建築物構件高度的一半；

(2) 「拆掉」結構構件的過程必須從頂部開始，然後向下繼續進行；

(3) 蛤殼式抓斗應在正拆釘中的結構上方不少於 1 米的距離操作。

4.6.5 熱噴槍

用熱噴槍切割鋼筋混凝土，涉及很高的溫度，高達 2,000 至 4,000 °C。這種極高熱量需要特別的防護設施和謹慎態度，除非出現下述情況，否則切勿使用熱噴槍來切割鋼筋混凝土：

(A) 工程顯示並無其他任何可行替代辦法；

(B) 提供足夠的防護措施把作業隔離開來，而且防止可能發生的火災向外蔓延；

(C) 提供足夠的防護措施，防止火焰和熔化的混凝土傷及工作人員及任何第三者。

4.6.6 水力噴射

水力噴射法涉及使用高壓噴出的噴射水流，沖蝕水泥基體並沖刷骨料。可加入磨損合物，用於切割鋼筋。水力噴射法的應用必須符合以下標準：

(A) 水力噴射切割作業中，應使用城市自來水。必須設置處置作業用水及通過局部過濾和沉澱使水反覆循環用於連續作業的設施。

(B) 要切割的結構構件後面的範圍必須加以防護，以免在切割過程中傷害他人和損害財產。

(C) 如果使用磨損合物的噴射水流，就必須按照製造商的建議，提供進一步防護設施，以便局限磨損合物的反射。所有地盤人員必須佩戴足夠的安全護具和衣服。
5. 特殊結構

5.1 預製混凝土結構

5.1.1 概述

預製混凝土結構由預製混凝土構件結合在一起製成。結構的連
續性取決於接縫的處理。必須研究接縫詳情。若有疑問，可能
有必要在關鍵位置進行開口檢查。

5.1.2 簡支預製構造

這種類型結構的接縫，通常並不提供連續性，而這類結構的穩
定性取決於其他構件，例如樓梯、電梯井、剪力牆及其他框架
結構。

(A) 拆卸

各個預製構件必須按照製造時的相反次序拆卸，並在地面
或適當支撐的樓板上破碎。在拆卸預製構件之前，或在安
裝臨時支撐之前，切勿拆卸提供側向穩定性的構件。臨時
支撐物必須適當支撐或連接到側向穩定的構件上。

(B) 現有起吊點

除非檢查和證明現有起吊點功能的安裝圖記載，並證實有
有關圖則適合使用，否則不准重新使用現有起吊點或屬物起
吊預製構件。

(C) 提升過程中的側向支撐

在提升過程中，必須特別考慮到設有狹窄受壓翼緣的長跨
度預製構件。必須使用擴展式橫樑減少起吊點的間距。擴
展式橫樑的使用，在圖 5.1 中例解說明。
(a.) 在起重過程中細長預制構件的潛在側向/旋轉不穩定性。

(b.) 使用擴展式桿使起重負荷平衡並減少桿的支撐跨度。
     （在預應力構件上小心使用）
(A) 第一類： 預製預應力結構：

P1 品種 預製預拉伸

P2 品種 預製預拉伸／後拉伸

P3 品種 預製後拉伸

(B) 第二類： 現澆預應力結構：

C1 品種 在應施加靜和活負荷之前後拉伸，並使所有鋼筋束管道灌滿水泥漿。

C2 品種 如同 C1 品種，但鋼筋束管道未灌漿。

C3 品種 因為構件隨著施工進展而分階段加載，所以有關構造亦分階段後拉伸，在最後階段，鋼筋束管道灌滿灰漿，轉換樑支撐多層框架是這種類別的實例。

C4 品種 如同 C3 品種，但鋼筋束管道未灌漿。

(C) 第三類： 其他

(1) 分段後拉伸構造

分段後拉伸結構涉及分段建造主要結構構件。其最後完整性通過後拉伸的鋼筋束，穿過各分段的構件並繫在一起而造成的。

(2) 圓周預應力池

對這種類型結構來說，池由在灌漿通道中黏合的鋼筋束或由未黏合鋼筋束預加應力。
(a.) 螺合板保護屏障

(b.) 沙包屏障

圖5.2 預應力混凝土鋼筋束除去張力時的保護
在支座的接頭拆卸後，這些構件就可吊離其支座，轉動構件側立擺放，起吊點必須設在構件的端部附近，並應適當設計，以確保預製構件安全起吊而放下時是側立的。上述過程一般會使這些構件斷裂，從而突然釋放能量。在能量釋放後，構件就可切或打碎成小塊，然後運走。

如果轉動構件側立擺放並不能釋放能量，就必須在末端周圍放置沙包或其他適當屏障。預應力能量可用第 5.2.6(B)(2)(C)分項所述方法之類適當方法釋放。

(2) P2 品種：預製預拉伸／後拉伸結構

有時候，兩個或幾個預製預應力構件，用後拉伸法在支撐物處連綿連接在一起。這種後拉伸構件，必須按照如 5.2.6(B)段所述第二類構造中關於拆卸後拉伸結構的建議去拉力。在去拉力後，可按照 P1 品種構件的程序拆卸其餘預製預應力構件。

(3) P3 品種：預製後拉伸結構

如果預應力鋼筋束是灌漿構造，這些預製構件就必須吊離其支座，並側立擺放。如果管道並未灌滿灰漿，構件就應平放在地面上，並按照第 5.2.6(B)(2)項所述 C2 品種構件程序釋放後拉伸力。

必須在構件端部提供足夠防護以防鋼筋束射出構件端部以外。一般說來，在跨距中間切割未灌漿的鋼筋束，將會減少鋼筋束的射出效應。

(B) 第二類：現澆預應力結構

(1) C1 品種：後拉伸灌漿結構

這種構件必須如同預製構件一樣拆卸。對單跨樓板來說，樓板可以與預製構件相似的方法鋸割成若干段，然後吊離其支座。對連續跨度樓板來說，在把樓板分段之前，必須先釋放支座上方的預應力。必須注意的
C2 品種：後拉伸未覆蓋結構

(2) 選擇機架一般拆卸工具如下：
(3) C3 品種：分階段後拉伸未覆蓋結構

(4) 支撐需要去拉力的所有框架和構件的整個跨度。
(5) 清除所有障礙的結構負載。
(6) 在鋼材切割部分上，直至鋼材被切割為止，就可
(7) 在清除鋼梁負荷之前應將鋼架結構與鋼材連接。
(8) 斷開分割鋼架結構，並在鋼材兩面標明。
(e) 重複(c)和(d)步驟直至所有鋼筋束完全截斷為止。

在使用上述程序拆卸這種構件的過程中，必須小心防止由於外露鋼筋束處的彈性縮短而使鋼筋束把構件兩端的支柱拉在一起。

(4) C4 品種：分階段後拉伸但未灌漿結構

當構件上加疊的靜負荷隨著拆卸工程進展而減少時，必須小心避免構件提早斷裂。必要時，必須建造臨時支撐物以支撐構件。必須根據拆除的靜負荷量，按照加應力的相反次序順序消除預應力。理想的作法是，去拉力的順序必須與建造構件時加拉力的次序相反。消除和拆卸所有支撐性靜負荷和鋼筋束後，該構件可按照正常鋼筋混凝土的同樣方式拆卸。

另外一種方法是，可按與 C3 品種相同的方式拆卸構件。

(C) 第三類：其他

(1) 分段構造的預應力結構必須按照分段安裝的相反次序拆卸。在釋放後拉伸力之前，必須根據需要提供臨時支座。如果分段裝置經過預拉伸，就必須按照預製預拉伸／後拉伸構造的同樣方法拆卸。如果裝置未預拉伸，就必須按照後拉伸構造的同樣方法拆卸。

(2) 在環形預應力池中的預應力鋼纜或鋼筋束去拉力的過程中，必須提供適當設計的保護性鍊網、屏風或摩擦制動器以免鋼筋束不受控制地解開。

(3) 分段構造或環形預應力池的拆卸工作比較複雜，因而必須在對這種類型構造很有經驗的專業工程師指導下拆卸。
5.3 靜定結構

5.3.1 概述

(A) 靜定結構通常缺乏連續性，因而有以下特徵：

(1) 大幅度彎曲；以及

(2) 在關鍵位置的應力十分集中。

缺點是：如果結構系統的任何部分斷裂，可能導致結構災難性地崩坍。

(B) 在處理下列結構的拆卸或部分拆卸工作時，工程師必須特別注意：

(1) 靜定結構；

(2) 在拆卸過程中或大幅度改動後可能變成靜定結構的超靜定結構。

(C) 常見靜定結構包括以下結構：

(1) 懸臂結構；

(2) 縫縫或螺栓連接桁架。

5.3.2 懸臂結構

(A) 一般說來，在拆卸建築物的主要結構之前，必須先拆卸懸臂結構。

(B) 如果無法達到第 5.3.2(A) 段的要求，必須適當支撐懸臂結構，直至完全拆卸為止。

(C) 圖 5.3 說明懸臂結構的常見問題。
案例一 懸臂構樑中的主鋼筋在支柱處向上彎曲。當支柱/橋拆除時，懸臂構樑就會倒下。

案例二 懸臂構樑上的負荷由構樑上所加的負荷平衡。當平衡負荷消除時，懸臂構樑就會倒下。

案例三 當平衡懸臂構樑/橋板的一側拆除時，其餘懸臂構樑/橋板就可能倒下。

圖5.3 懸臂結構中經常出現的問題
562 桑折射

之

5.6.1 稠度

5.6 稠度

(1) 稠度方

(2) 稠度 caractère

(3) 稠度

(4) 稠度

5.5.2 质

5.5.1 质地
般說來，鋸割和起吊法適用於拆卸懸吊結構的結構構件。在拆卸過程中，可能需要臨時支撐物以保持懸吊結構構件的穩定性。

5.6.3 指引

在拆卸懸吊結構時，必須考慮以下各項：

(A) 拆卸次序必須策劃妥當，使懸吊負荷逐步減少，而不會對任何具體結構構件或纜桿形成過度應力；

(B) 在切割懸吊纜桿之前必須去應力；

(C) 在完全釋放所有懸吊纜桿之前，切勿拆卸支撐懸吊纜桿和其他構件的主要重力結構。因這些重力結構提供懸吊結構的側向穩定性。

(D) 必須檢查主要重力結構，務使結構在拆除的所有階段都保持穩定。必要時，可能需要加聯結支撐。

5.7 貯油設施

5.7.1 概述

貯油設施一般由裝著石油產品的結構組成，這些產品可分類為危險物質或危險品。拆卸貯油設施的關鍵問題是清洗和處置危險物質和危險品。污染評估和初步清洗一完成後，可根據結構和地盤情況選擇拆卸方法。如果污染已擴展到鄰近區域及／或地下污染，可能需要進一步清洗。在這樣的環境下工作所採取的預防措施及工作系統應符合工廠及工業經營（密閉場地）規例的要求。

5.7.2 拆卸方法

必須按照結構形式選擇貯油結構的拆卸方法及進行實際拆卸工程，例如，貯油建築物可用由上至下法或其他拆卸方法拆卸。圓形鋼罐可用油壓式剪或其他適當方法拆卸。鋼筋混凝土罐可用任何適用於鋼筋混凝土構造的方法拆卸。如果有易燃燃料，必須避免使用火焰切割法。關於拆卸方法，應參閱第 4 條。
3.8.1 组配

3.8 组合装置

(3) 组合装置

(2) 组合装置

(1) 组合装置
處理和海槽的拆卸。

5.8.2 拆卸方法

用來拆卸海上構築物的方法與陸上所建的建築物的拆卸方法相似。可用由上至下方法拆卸上層建築。可用非爆炸性拆卸劑拆卸墩。對敏感水域來說，可用銼割和起吊法拆卸平台和墩以便盡量減少掉入水中的泥石。

5.8.3 指引

(A) 測深

在拆卸前必須進行測深工作以便界定海底的情況，並可檢查有無意料之外的水下結構。拆卸前的測深記錄必須用作修復範圍的基礎。

(B) 碼頭結構

如果機械設備及／或貨車將在碼頭支撐的平台上行駛，必須檢查平台板的結構以確保平台可支持機器作業並支撐預期泥石負荷。

(C) 海洋環境的保護

必須考慮拆卸工程對海洋環境的影響。如果預定將在拆卸地盤上填海，混凝土泥石可留在海床上。否則，必須清除在拆卸過程中掉在海床上的所有泥石，而海床必須恢復到拆卸以前的相似深度。攔沙屏障或水下柵欄必須圍住地盤以容納拆卸工程產生的泥石和紊流。這種屏障亦可防止海洋生物在拆卸過程中進入地盤範圍。該區域完全復原之後，必須取出攔沙屏障。

(D) 槽

只要切實可行，槽必須全部拉出，否則至少必須在海床以下 3 米處或根據該區域的未來用途，原海床水平以下的理想深度切割。
(D) 現有地基

必須評估現有地樁，而可能的話，把樁結合入新地基系統中。審查以前的設計和進行實際負荷試驗及／或試鑽孔，就可確定舊地基的承重能力。

(E) 地盤保安和安全

地盤必須保安以防任何未獲授權的人士進入地盤，特別是進入地庫範圍。如果必須在深挖場所進行工作，必須提供逃生路線。

5.10 坐落於斜坡上或有擋土作用的構築物

5.10.1 概述

若建築物對傾斜的地面有支持作用，或建築物坐落於斜坡或護土牆，則在拆卸這類建築物時可能會由於除去坡腳的重量而影響鄰近構築物的穩固性，甚至會令整個區域斜坡不穩固。因此，在進行拆卸工作期間，以回填方式或構築物支持來維持足夠的地面支持力，是非常重要的。拆卸計劃應由有經驗及適任的土力工程師，適當地作出各項工程計算。

5.10.2 拆卸方法

由上至下方法適用於拆卸山坡結構。根據地盤實際情況，其他方法亦可能適用。

5.10.3 指引

(A) 建築物支撐地面的支墩／斜撐柱

如果建築物結構的一部分作爲擋土牆系統，必須確定所要保留以便安全支撐擋土結構所需的建築物高度。在拆卸其餘結構之前，必須設置適當的斜撐柱及／或支墩。必須向地基承建商提供拆卸計劃，以便承建商在地基工程過程中考慮和保護在拆卸過程中安裝的斜撐柱工程。
(B) 擋土牆系統

在拆除擋土牆前，必須先加固擋土牆系統所支撐的斜坡或泥土。在擋土牆後面挖掘土壌，形成一道獨立斜坡，或安裝板樁牆、豎樁或用其他適當方法等臨時或永久支撐物，就可實現加固效果。必須適當設計加固擋土牆後面的斜坡的方案。

(C) 坐地樓板

除非地盤情況許可，並在工程報告支持下，必須保留坐地樓板以防防止侵蝕。樓板亦可作農防止水滲入的不滲透蓋。

(D) 斜坡和擋土牆上的填土

切勿在擋土牆及／或斜坡頂部範圍貯放泥石或進行填土。擋土牆及／或斜坡頂部的填土可能影響其穩定性。

(E) 排水

地下水位可能影響斜坡的穩定性。在整個工程中，必須考慮和管制地面徑流、向地盤外排水及水滲入的情況。
6. 地盤監督和檢查

6.1 概述

拆卸工程由按照次序拆卸結構時的作業過程組成，這些過程載入方法
陳述書中。當遵循拆卸工程的次序並適當執行各個拆卸過程時，拆卸
工程就可安全進行。為了實現這個目的，適當監督拆卸工程並充分培
訓現場人員，均極為重要。

建築工程及街道工程的地盤安全監工計劃書必須按照監工計劃書的
技術備忘錄及地盤安全監督作業守則編寫。
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1.3 公用事業設施位置

☐ 核實所有地下和架空公用事業設施。

☐ 按照公用事業公司的要求終止及切斷對要拆除的建築物的任何公用事業服務。

☐ 安排工程使用的臨時公用事業設施，例如抑制灰塵的供水，等等。

1.4 拆卸時間表

☐ 查明可能影響拆卸時間表的因素，例如規例和預期季節天氣情況對作業的限制。

☐ 制定切實的時間表以反映採取防護設施，測試及清除若存在的危險物質、處理批准及同意、拆卸過程，清洗及地盤復原所需的時間。

1.5 測試和清除危險物質

☐ 安排由一位註冊石棉顧問進行含石棉材料的調查。

☐ 如果有必要進行石棉消除工程，向環境保護署及勞工處提交一份石棉調查報告，石棉消除計劃並通知石棉消除工程動工時間。

1.6 安全措施

☐ 保護行人的有蓋行人通道和墊台的要求。

☐ 斜柵的要求。

☐ 如果所用方法和地盤情況需要，雙層棚架及截留灰塵和飛散泥石的屏障和工作平台的要求。

☐ 機器作業的安全程序，機器的適當地面或樓板支撐；以及臨時撐桿的安裝。

☐ 任何削弱結構的臨時支撐物和加固物。

☐ 地盤附近車輛和行人來往的保護措施。

☐ 鄰近擋土牆及／或斜坡的支撐物。

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1.7 泥石處理

- 把木材、門窗等非結構材料分類和清除，運往再循環設施或堆填區。
- 根據泥石產生的速率，提供適當數目和尺寸的斜槽，及處置路線。
- 策劃拆卸時的運輸路線，包括臨時貨車車位。

1.8 編制拆卸圖則（詳情參閱付錄 B）

1.9 穩定性報告及計算

- 需要拆卸樓宇的穩定性。
- 如有動力機械設備或裝備，其對樓宇的穩定性。
- 如有動力機械設備或裝備，需要有關支撐的計算。
- 拆卸工程對鄰近樓宇、毗鄰物業及共有牆的影響。
- 對鄰近物業作支撐的結構或土力計算。

1.10 申請展開工程同意書

- 呈交地盤安全監工計劃書。
- 呈交適任技術人員姓名及詳細資料。
- 呈交機械操作人員詳細資料。

2. 在拆卸過程中

- 根据方法陳述書中的設計，採取並安裝所有現場防護設施及鄰近物業的臨時支撐物。
- 在拆卸工程開始前完成，若有危險物質的清除工作。按照廢物處置（化學廢物）（一般）規例管理從油罐清洗所產生的油泥之類化學廢物、石棉廢物及不需有的毒化學品。
- 所有地盤工作人員充分獲悉工程的詳情及確保安全所應採取的必要防護設施。
設立緊急通道。

設立與主管聯繫的清晰而有效的通訊設備。

必須按照方法進行清潔及/或在可取人員和註冊結構工程師的批准下進行拆卸工程。

清除沉積物以滿足績效要求，考慮交通情況和有無危險情況可用。

按照《建築承建條例》及《建築承建條例》規例管制程序的發放。

全體合資格主管在現場進行監督，認可人士和註冊結構工程師須

會同代表定期檢查地盤以及監控結構工程師的監理及特殊場

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的代表定期檢查地盤以及監控結構工程師的監理及特殊場

的代表定期检查地盘及/或指定有結構地盤的監理人員

在拆卸期間要確保相關數據和資料。

提供地盤適當保安，

確保所有工人遵守安全程序。機器和設備受到良好保安。

定期檢查及保養精密儀器，如火災後，要特別檢查。

地盤應清除泥石及異物，並加以平整。

建築物加設防護措施，防止非法進入。

若有一方開挖，應加以防護。

地鐵應密封以防水浸入。

應提供地鐵排水設施。
3. 原有結構資料

結構圖則必須包括以下內容：

- 建築物的整個高度、樓層的天花板高度以及可能存在的地庫尺寸和深度。
- 顯示結構支撐及建築材的結構平面圖，截面圖，詳圖和佈置。
- 鄰近建築物、共有牆和樓梯等共用結構及共用支撐結構的結構評估。
- 需要特別注意的特殊結構的資料，例如懸臂結構，預應力混凝土結構，鋼組合結構，骨架填充牆，應用表層結構，懸吊結構，等等。

4. 拆卸程序和操作次序

爲了拆卸結構而建議使用的方法應在圖則上包括以下內容：

- 擬用設備的說明。
- 關於機械作業限制的具體指引，例如移動範圍，離開建築物邊界的具體距離以及支撐或淨高高度不足的場所。
- 拆卸的次序和建議程序。
- 拆卸可能影響公眾和現場工作人員一般安全的特殊構築物和重要場所的詳細指示。
- 查明這種結構的具體預防步驟。

5. 防護設施

防護設施的規格和施工詳圖，對工程安全極爲重要。必須選擇適當類型的防護設施，以便盡量適應拆卸方法和地盤情況的要求。凡有需要的，應包括下述設施：

- 有蓋行人通道、墊台及圍板。
- 橋架和斜欄。
- 支撐在建築物樓層上工作的機械的臨時支撐系統。
10. 中文本

10. 中文本

10. 中文本

10. 中文本

9. 9. 新报价的支持
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表 C-1  鋼筋混凝土樓板系統的正常
跨深比，超過這個比例就表
示可能有預應力系統存在

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<td>連續跨度</td>
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<td>18 至 20</td>
<td>20 至 25</td>
<td></td>
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附錄 D
拆卸工程有關法規

1. 建築物拆卸工程受到建築事務監督實施的下列法規及附屬文件的管轄：
   
   (i) 香港特別行政區法律第 123 章：建築物條例；

   (ii) 建築物（管理）規例；

   (iii) 建築物（建造）規例；

   (iv) 建築物（拆卸工程）規例；

   (v) 建築物（規劃）規例；

   (vi) 認可人士及註冊結構工程師作業備考 71 : 拆卸工程 - 公眾安全措施；

   (vii) 認可人士及註冊結構工程師作業備考 75 : 圍板、有蓋行人通道及龍門架（包括施工交通的臨時通道）- 建築物（規劃）規例第九部分；

   (viii) 認可人士及註冊結構工程師作業備考 175 : 古蹟及紀念碑；

   (ix) 註冊承建商作業備考 4. 建築物（規劃）規例第 IX 部，圍板、行人通道及承建商地盤小屋；

   (x) 註冊承建商作業備考 6. 拆卸工程；以及

   (xi) 監工計劃書的技術備忘錄。

2. 建築物拆卸工程受到環境保護署實施的下列法規及附屬文件的管轄：

   (i) 空氣污染管制條例；

   (ii) 空氣污染管制（建造工程塵埃）規例；

   (iii) 噪音管制條例及有關技術備忘錄；

   (iv) 廢物處置（廢物處置的收費）規例；

   (v) 廢物處置（化學廢物）（一般）規例；

   (vi) 水污染管制條例；
(vii) 廢物處置條例；
(viii)化學廢物包裝、標籤及貯存守則；以及
(ix) 石棉廢物裝卸、運輸及處置守則。

3. 建築物拆卸工程受到勞工處實施的下列法規及附屬文件的管轄。

(i) 工廠及工業經營條例；
(ii) 工廠及工業經營規例；
(iii) 工廠及工業經營（密閉空間）規例；
(iv) 工廠及工業經營（起重機械及起重裝置）規例；
(v) 工廠及工業經營（應呈報工場的防火設備）規例；
(vi) 工廠及工業經營（保護眼睛）規例；
(vii) 工廠及工業經營（電力）規例；
(viii) 工廠及工業經營（應呈報工場的急救設備）規例；
(ix) 工廠及工業經營（危險物質）規例；
(x) 工廠及工業經營（安全主任及安全督導員）規例；
(xi) 工廠及工業經營（工作噪音）規例；
(xii) 建築地盤（安全）規例；
(xiii) 工廠及工業經營（石棉）規例；
(xiv) 梯架工作安全守則；以及
(xv) 拆卸樓宇安全工作指引。

4. 在圍板、有蓋行人通道及臨時工程的設計，以及現有建築物結構的可能修改中，下列文件很有關係：

(i) 建築物（規格）規例規定圍板、有蓋行人通道及承建商屋柵的一般要求；
(ii) 建築物（建造）規例規定施工的一般要求，包括圍板要求；

(iii) 建築物（拆卸工程）規例規定防護設施要求；

(iv) （一九八七年）混凝土結構使用作業守則（一九八七年混凝土守則）；

(v) （一九八七年）鋼材結構使用作業守則（一九八七年鋼材守則）；

(vi) （一九八三年）香港風力效應作業守則（一九八七年風力守則）；

(vii) 為建築工程及街道工程而編寫的地盤安全監督作業守則。

5. 在設計拆卸護土結構、地庫及其他土力構築物過程中加固斜坡及地面的臨時支撐物時，應參閱：

(i) 斜坡土力手冊；及

(ii) 護土牆設計指南，地質指南 1。

6. 其他條例及規例：

(i) 危險品條例；

(ii) 氣體安全（氣體裝置技工及氣體工程承建商註冊）規例；及

(iii) 避免氣管危險守則。
5. 開工通知

按照空氣污染管制（建造工程塵埃）規例規定，主承建商應在拆卸工程動工前，在指定表格上向環境保護署發出通知，載明指定詳細資料。如果在以前三通知的任何詳細資料上有任何變動，主承建商亦應在該變動生效前通知環境保護署。

6. 張貼資料

在開始拆卸工程之前，註冊專門拆卸承建商就必須把下列資料張貼在圍板上：

(A) 圍板許可證；

(B) 挖掘許可證；

(C) 拆卸工程開工紙；

(D) 告知負責拆卸工程的合格經驗地盤主管的 BA20 號表格；

(E) 以下人士的聯繫電話號碼：

- 認可人士；

- 註冊結構工程師；

- 註冊專門拆卸承建商的負責人；及

- 負責拆卸工程的聲任及有經驗人員。

7. 「限制時間」內的拆卸活動

未有環境保護署簽發的有效建築噪音許可證，不得進行涉及使用電動機械設備及／或指定電動機械設備的工程。所有日子的限制時間界定為 1900 至 0700 時，而一般假期（包括星期日），則為 0700 至 1900 時。這種建築噪音許可證的申請書，至少必須在工程擬開始日期之前二十八天，呈交當局以便處理有關申請。如果發現違反任何條件，建築噪音許可證即會取消。
8. 排入香港水域

如果工程涉及向香港水域排放廢水，必須按照水污染管制條例申請許可證。申請人應自費在一份英文及一份中文報章公佈申請書。環境保護署署長可在發出通告後至少四十天，如果未收到任何異議，向申請人簽發許可證。

9. 竣工通知

拆卸工程和必要拆除後の工程－完成後，必須以指定表格通知屋宇署以便驗收工程。屋宇署將在工程令人滿意地完成時簽收指定表格。

10. 泥石處置

施工及拆卸廢物在各個堆填區的處置要求如下：

政府提供的廢物處置設施：

A - 含有少量非活性物質而其體積不超過百分之二十的施工及拆卸廢物

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<tr>
<td>新界東南堆填區</td>
<td>0800 - 2300</td>
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<tr>
<td>將軍澳環保大道</td>
<td>（包括星期日及公眾假期）</td>
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<td>新界東北堆填區</td>
<td>0800 - 1800</td>
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<td>打鼓嶺徑山路</td>
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<td>新界西堆填區</td>
<td>0800 - 1800</td>
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<tr>
<td>屯門龍鼓灘路</td>
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</table>

B - 含有體積超過百分之二十非活性物質的混合施工及拆卸廢物

<table>
<thead>
<tr>
<th>處置場地</th>
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</table>
附錄 F

由上至下人工拆卸方法的拆卸圖則及穩定性報告範例：

1. 拆卸圖則

1.1 拆卸圖則應包括下列圖則：

1.1.1 圖 F1 地盤位置圖及地盤鄰近情況；

1.1.2 圖 F2 典型樓層平面圖及現在樓宇資料；

1.1.3 圖 F3 立視圖 A；

1.1.4 圖 F4 拆卸程序及次序；

1.1.5 圖 F5 防護措施；

1.1.6 圖 F6 典型懸臂支撐；

1.1.7 圖 F7 共有牆加固的典型詳細圖；

1.2 如果樓宇在斜坡地區，需要以下各種圖則：

1.2.1 平面圖包括可能受拆卸影響的鄰近斜坡、樓宇、結構公共事業設備；

1.2.2 能顯示斜坡的剖面圖；

1.2.3 能顯示在拆卸過程中所有對鄰近斜坡及樓宇的支撐。

2. 穩定性報告

2.1 這項目的穩定性報告要有下列文件：

2.1.1 證明在每一拆卸過程中，目前樓宇的穩定性；

2.1.2 對在軸線 A 和 B 之間的懸臂板支撐的結構計算；

2.1.3 對圍板有蓋行人通道及墊台的結構計算；
2.2.2 如有需要，如图所连接的附录的精华二次为增长

2.2.1 如图所示桥梁示意图中的详细结构、建筑结构、道路及公用事业组成部分

2.2 如显示模型在模型上，模型位置和地块位置不同

2.2.4 如图所示有接触的精确计算。
說明
1. 需要拆卸樓宇位於A街一號, 連同樓宇詳圖見圖F2及F3。
2. A街一號一般資料如下:
   2.1 該地盤位於建築物條例附表所列地區以外。
   2.2 地盤面積: 11米x12米
   2.3 邊界情況:
      北: 一條2米寬的服務小路將工程建築物與相鄰建築物分隔開來。
      東: 工程建築物與A街3號相鄰建築物直接毗鄰。
      南: 建築物與A街毗連。
      西: 建築物與B街毗連。
   2.4 地形: 平坦, 附近無斜坡或護土牆。
   2.5 交通情況: A街與B街交通適量。
   2.6 没有需要保護的古蹟、歷史紀念碑或特殊構築物。
3. 可能受拆卸影響的鄰近公用事業設施
   3.1 地面以下並無電纜或電線。
   3.2 沿著A街和B街鋪有供水管路及地下電話和供電管道。最近的公用事業供應管路離原房屋邊緣約4米。因此建築物的拆卸工程不會影響這些地下公用事業設施。
4. 鄰近建築物
   4.1 結構及一般資料
      A街3號與工程建築物毗鄰的建築物,亦在六十年代落成。該建築物是四層樓高鋼筋混凝土建築物,設有常規框架、樓板及樓基礎。
   4.2 狀況
      建築物的結構狀況看來良好,並無重大裂縫或結構變質。除了壁膜之外,拆卸過程不應對該相鄰建築物的結構造成重大影響。
   4.3 共有樓及共用構築物
      (A) 共有樓
         (i) 在該址與A街3號建築物之間設有四層高的共有樓。
         (ii) 共有樓是鋼筋構造。地面層部份樓的厚度是450毫米(18吋),而一樓及以上是350毫米(14吋)。
         (iii) 在拆卸過程中,該址與A街3號建築物之間的共有樓必須加固。
      (B) 共用建築物
         並無將受到擬進行拆卸工程影響的任何其他構建,例如共用樓梯、廁建物、架空電纜或電線、或共用服務。

圖F.1.A 街1號地盤位置圖及地盤鄰近情況（二頁之二）
現有建築物說明

1. 一般資料及尺寸
   1.1 樓齡：30年（六十年代落成）。
   1.2 用途：住宅。
   1.3 建築物佔地面積：12.5米x12米
   1.4 建築物高度：23.5米，六層。
   1.5 樓層高度：地面層3.8米，附有2.2米高的閣樓；一樓及以上為3.5米。

圖F2顯示典型樓層平面圖。圖F3顯示建築物的立視圖。現有建築物的照片刊於附件A中。

2. 結構情況
   2.1 結構
     該結構由鋼筋混凝土框架與常規支柱、樑及樓板組成。其內外牆均含有鎚磚牆。建築物建在
     柱基礎上。
   2.2 狀況
     建築物目前已空置，而且保持令人滿意的狀況。根據我們的現場視察，建築物並無顯示重大結構
     損害或變質的跡象。只觀察到非修補性鋼筋上出現小裂縫。

3. 特殊結構特點
   3.1 建築物面A面正面由斜臂樓板與斜臂樑組成。並無發現建築物拆卸時則第2.1.3(α)6條所列其
     他特殊結構。

4. 危險物質
   4.1 擔任一位註冊石棉顧問撰寫石棉調查報告。如果在建築物內發現含石棉物質，將在石棉消除工
     程開始前二十八天向環境保護署呈交石棉消除計劃。石棉消除工程應按照空氣污染管治條例及
     工廠及工業經營（石棉）特別規定進行。石棉調查報告和石棉消除計劃將直接呈交環境保護署。

圖F.2A街1號典型樓層平面圖及現有樓宇資料（二頁之二）
圖F.3.A 街1號立視圖
1. 偵述

1.1 必須用手動氣動風銑進行拆除工程。風銑的重量不得超過50公斤。可用氧氣乙炔焊接切割鋼筋。流動空氣壓縮機應置於地面層。

1.2 必須從屋頂開始拆除，然後逐層拆除直至地面層。每個結構構件的混凝土應逐漸拆除。鋼筋應留在原位，直至混凝土拆除而不再需要支撐為止。

1.3 各個結構構件應按下列方式拆除：

   (i) 鋼筋鋼板須用手拆卸；在拆除之前，懸臂鋼板須用所設計的水平支撐；

   (ii) 懸臂鋼板須用手拆卸；在拆除懸臂鋼板所支撐的鋼板及樑之前，切勿拆卸懸臂鋼桿；

   (iii) 内柱應如圖中所示拆卸（圖則應包括與本守則中圖4.9類似的詳細資料）。

   (iv) 內柱應如圖中所示拆卸（圖則應包括與本守則中圖4.5類似的詳細資料）。

2. 拆卸次序

2.1 拆卸屋頂樓板

   (i) 必須先拆除懸臂鋼板和樑；

   (ii) 然後拆除女兒牆、樓梯樓層及屋頂樓板高度以上的其他結構；

   (iii) 最後拆除屋頂樓板。

2.2 拆卸六樓及五樓

   (i) 在拆卸鋼和樑架之前，先用手拆除外牆磚塊。磚塊應由外往內推，從頂層開始往下拆卸；

   (ii) 外牆必須如建築物拆除守則圖4.3、圖4.6及圖4.7所示用繩索拆卸。

   (iii) 必須拆除樓板上的鋼筋混凝土支柱及樑桿；

   (iv) 然後拆卸懸臂鋼板及樑；以及

   (v) 最後拆除其餘樓板。

2.3 拆卸四樓及四樓以下各層

   (i) 必須遵循第2.2(B)條的程序，拆除直至地面層；

   (ii) 該址與A街3號之間的共有樓必須如圖F.4所示，用木樁加固。當隨著拆除工程的進展加固界樁，未加固共有樓的最大高度，不得超過一個樓層的高度或3500毫米當中的較小者。

   在上一樓層的界樁未加固前，切勿拆除下一個樓層；以及

   (iii) 拆卸地面樓板。
图 F.4 拆卸程序及次序（四页之四）
圍板圖

(圍板、有蓋行人道、護欄、護網斜樑等
詳盡圖與作業守則的圖3.2及3.3等放
在圖面上。)

圖F.5防護措施 (四頁之一)
圖F.5 防護措施（四頁之二）

3.8米  2.2米  3.5米  3.5米  3.5米  3.5米  3.5米  2.5米
防護措施

在拆卸前，必須採取下列防護措施：

1. 有蓋行人通道和樓梯

有蓋行人通道和樓梯應按照附有圖則和條件搭建，有蓋行人通道應覆蓋沿著A街、B街及設有小車的物業邊界的整個長度。有蓋行人通道的地基必須用手工具小心挖掘，以確保不對現有地
下公用事業設施造成損害。必須遵守路政署在挖掘許可證上提出的附加條件。

2. 臨時支撐物

有蓋行人通道上的樓梯，應設置在樓台下以支撐該等樓梯結構。應在所有樓層的樓梯樓梯
樓梯中間以1.2米間隔，具有20牛頓的承載力。支撐應有側向約束的結構。

3. 櫃架、護網及斜梯

3.1 櫃安裝有護網及掛油布的雙排櫃架應完全覆蓋建築物的外面。

3.2 應以不少於10米的垂直間隔設置斜梯。

3.3 在安裝樓梯、斜梯、護網及掛油布時，必須遵守建築物拆卸守則及樓梯工作安全守則。

4. 現有公共設施

所有現有公共設施需要截斷、污水及雨水水道需要在「尾井」內截斷。

5. 混凝土處理

5.1 任何現有家具、木地板、門框、窗、管道及其他建築設施，必須撤走。任何可作廢物利用的材料應
分類，並分開撤走。

5.2 建築物水泥，應通過吊裝用噴霧機所示位置上穿過樓層樓板的300毫米x800毫米開口輸送。

5.3 在按樓層時，應在樓層間設置開口，以便將泥石輸送到樓下。

5.4 運用推土機在樓層抬起拆卸泥石，裝在自卸貨車上運走。拆卸每個樓層時，將產生大約90立方米的泥石。

5.5 必須預先確定泥石的清除及運輸工作以保持地表的清澈。

(A) 拆卸時不得超過100毫米；

(B) 拆卸時不得超過1米高度；

(C) 拆卸時不使用機械工具。

泥石的堆積對結構是否適當的問題，在穩定性報告中加以闡述。

6. 防火

6.1 擴展出口

現有樓梯應設置緊急出口路線，應在整個拆卸過程中維持該緊急出口路線。該路線必須設置
於每座樓梯，以及其他消火栓設備。

6.2 消防

(A) 燃炸物必須按照工業及工業經營規例放在安全的地方。

圖F.5 防護措施(第四頁之三)
6.3 灰塵和噪音

(A) 在拆卸作業及泥石搬運過程中，必須應用灑水來抑制所產生的灰塵。

(B) 必須使用適量靜型空氣壓縮機，在每日下午七時至上午七時，以及在一般假期（包括星期日）
上午七時至下午七時的限制時段內，不得進行拆卸工程。

6.4 培訓

所有地盤人員必須接受一種培訓課程，以便了解工程項目及地盤安全要求。培訓課程應由合資格
培訓人員進行。培訓課程應包括以下各項：

(A) 在開始工作時提供導引課程，以便傳達進行工程的建議方法及所需安全措施；以及

(B) 日常安全會議以便維持及加強安全觀念。

6.5 防風

當風力超過或達，許可拆卸承建商必須檢查所有棚架、護欄及向外的臨時支撐物，並收納脆弱的
地方。

7. 保養和檢查

7.1 當承建商在拆卸工作前，需確保所有重點檢查所有防風支撐，以確保其支撐力。<br>
7.2 當承建商在拆卸工作後，需確保所有防風支撐已拆除及固定好。

8. 緊急計劃

8.1 當承建商在拆卸工作時，需確保所有防風支撐已被拆除及固定好。

8.2 當承建商在拆卸工作時，需確保所有防風支撐已被拆除及固定好。

8.2.1 承建商在拆卸工作後，需確保所有防風支撐已被拆除及固定好。

8.2.2 承建商在拆卸工作後，需確保所有防風支撐已被拆除及固定好。

8.2.3 承建商在拆卸工作後，需確保所有防風支撐已被拆除及固定好。

9. 拆卸後

9.1 拆卸後，需確保所有防風支撐已被拆除及固定好。

9.2 拆卸後，需確保所有防風支撐已被拆除及固定好。

9.3 拆卸後，需確保所有防風支撐已被拆除及固定好。

9.4 拆卸後，需確保所有防風支撐已被拆除及固定好。

F.5 防護措施(四頁之四)
說明:
1. 未加固共有牆的必要高度，不得超過3500毫米的一個樓層高度。
2. 加固上兩層外用水泥抹面：
   (ⅰ) 第一層的最小厚度應為10毫米，水泥一石炭一砂的比例為1:2:6。
   (ⅱ) 第一層的最小厚度應為10毫米，水泥一石炭一砂的比例為1:3:6。
3. 具有適當厚度的鋼筋，應由註冊結構工程師設計。
2.1. 制图前需有充分的资料准备和选择适当的坐标系。

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2.1.5 制图前需有充分的资料准备和选择适当的坐标系。

2.1.6 制图前需有充分的资料准备和选择适当的坐标系。
圖G.1. XX街7號地盤位置圖及地盤鄰近情況（二頁之一）
說明
1. 雙方拆除的樓宇為XX街一號，樓宇詳細資料見圖G2及G3。
2. XX街一號一般資料如下：
   2.1 樓宇在建築物條例附表所列地區外。
   2.2 地盤面積：21米x15米
   2.3 邊界情況：
       北：一塊2米寬的公共小巷將工程建築物與相鄰建築物分隔開來。
       東：以獨立共有的土地相鄰建築物毗鄰。
       南：建築物與XX街毗連。
       西：以獨立共有的土地相鄰建築物毗鄰。
   2.4 地形：平坦，地盤附近並無斜坡或護土築。
   2.5 交通情況：XX街交通流量至大。
   2.6 沒有需要保護的古蹟、歷史紀念碑或特殊構築物。
3. 鄰近公用事業設施
   3.1 地面以上並無公用事業設施或街道設施。
   3.2 沿著XX街設有電話電纜、供水及污水管道。
   3.3 最近的公用事業設施是電話線路，沿XX街鋪設，離建築物約45米。
4. 鄰近建築物
   4.1 結構及一般資料
       相鄰建築物樓齡約為三十年，並由樓基礎上的常規鋼筋混凝土構架構成。
   4.2 結構狀況
       並未觀察到結構構件有任何重大變質或損壞或地基有任何重大沉降。相鄰建築物看來保養適當，不會受到工程建築物的拆除工程的不利影響。
   4.3 共有樓及共用結構物
       相鄰建築物設有一道獨立外牆。在該址與相鄰建築物之間設有實際分隔物。建築物之間並無共有層或共用結構。

圈G.1．XX街7號地盤位置圖及地盤鄰近情況（二頁之二）
圖G.2. XX街7號典型樓層平面圖及現在樓宇資料（二頁之一）
現有建築物

1. 一般資料及尺寸
   1.1 樓齡：30年（六十年代落成）。
   1.2 用途：工業。
   1.3 建築物佔地面積：21米x16米
   1.4 建築物高度：44米，十一層樓高。
   1.5 樓層高度：地面層5.5米；一樓及以上層3.5米。

圖G2顯示典型樓層平面圖；圖G3顯示建築物的立面圖。

2. 結構情況
   2.1 結構
     該結構是鋼筋混凝土構造，設有常規樓板、樑、支柱及鋼性構架設計。建築物支撐在樑基礎上。
   2.2 狀況
     觀察顯示建築物保養良好而且保持良好狀況。除了小裂縫出現在抹面上外並無其他發現，而且
     並未觀察到結構構件有任何嚴重變質或損壞。

3. 特殊結構特點
   3.1 建築物設有突出於XX街面有人行道上方的懸臂露台，建築物內並無其他特殊結構構件。

4. 危險物質
   4.1 建築物可能夾雜含石棉物質，例如石棉塗層管子。將由一位註冊石棉顧問編寫石棉調查報告。

   如果在建築物內發現含石棉物質，將在石棉消除工程開始前二十天向環境保護署呈交石棉
   消除計劃。石棉消除工程應按照空氣污染管制條例及工廠及工業經營（石棉）特別規例進行。

   石棉調查報告和石棉消除計劃將直接呈交環境保護署。

5. 危險物質的處理
   如果該址存在著含石棉物質/或化學品，所有含石棉物質及/或化學品均須在拆除工程開始之前，
   由註冊石棉承建商按照環境保護署及勞工署的規例清除。

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圖G.2. XX街7號典型樓層平面圖及現在樓宇資料（二頁之二）
圖G.4.  XX街7號拆卸程序及次序（五頁之二）
次序5.1(iv)挖土機數到10樓上，注意，在挖土機數到10樓之前，應在7/F 及 6/F 紅頂
次序5.1(i)挖土機繼續拆卸其餘天面、樑、板及柱

圖G.4. XX街7號拆卸程序及次序(五頁之三)
拆卸程序及次序說明

1. 概述

建築物應使用機器由上至下拆卸。使用機器拆卸結構構件的程序如下：

1.1 在拆卸之前，耐臂樓板須用木台及鋼探棒支撐，然後如下圖所示拆卸。(圖則應包括與本守則中圖4.12類似的詳細資料)

1.2 除非耐臂樓板所支撐的所有樓板及牆已經拆除，否則切勿開始拆卸耐臂樓板。

1.3 框板或鋼構應如圖中所示拆卸(圖則應包括與本守則中圖4.8、4.9、4.10及4.11類似的詳細資料)。

1.4 柱及混凝土框架應如圖中所示拆卸(圖則應包括與本守則中圖4.5、4.6、4.13及4.14類似的詳細資料)。

2. 挖土機及活動限制

2.1 必須使用設有破碎機或油壓式破碎的XYZ牌123型挖土機。機械的總重量不得超過11,000公

2.2 挖土機的活動區域限制在由拋桿充分支撐的範圍內。挖土機不得進入下列場所：

(i) 建築物邊緣的2米範圍內;
(ii) 離任何開口1米，以及
(iii) 任何懸臂結構。

2.3 必須設置標誌以便清楚指示挖土機活動的限制。

3. 外牆

必須使用手持工具拆卸軸線5與6內的懸臂露台的外牆。混凝土應使用手工具或氣動風鎚破碎或容
易處理的混凝土塊，重量不超過50公斤。所有混凝土已拆卸後，或不再需要支撐時，方可切掉鋼筋。

4. 起吊及拆卸

挖土機必須起吊到屋頂上，置於安裝吊桿的指定範圍內。起吊工作应使用能將130噸重的負荷吊到
80米高的吊車。在封閉小路及進行拆卸之前，必須取得警方及運輸署批准。

5. 拆卸程序

5.1 屋頂

(i) 必須先拆除屋頂上的鋼筋混凝土水箱及其他附屬構件；
(ii) 拆卸軸線5與6之間的懸臂屋頂樓板；
(iii) 繼續按照下列之次序拆卸屋頂樓板及次樑：
    S-63、S-64、S-64、S-64、S-63、S-64、S-64、S-63及S-64；
(iv) 將外牆與內柱連接起來的鋼筋的鋼筋割下，直至外牆拆卸為止；
(v) 挖土機將通過設於樓板S-03與S-03之間的臨時鋼樑道上駛到十樓上。

5.2 十樓

(i) 挖土機繼續拆卸，樓頂樓板、牆壁、主樑及柱；
(ii) 在屋頂上所有鋼筋、支柱、牆壁及其它構件拆除後，必須拆卸軸線5與6之間的鋼
    筋結構；
(iii) 其餘構件的拆除工作，應遵從第2.4.5(A)(iii)、(iv)及(v)項所述程序。

5.3 九樓及以下各樓

(i) 從九樓至地面層，必須重複十樓的拆卸過程；
(ii) 在拆卸地面層以上的結構構件後，應拆卸地面樓板。
(iii) 現有地面水平以下的現有樓板及樑，必須加以保留。

圖G.4 XX街7號拆卸程序及次序(五頁之五)

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圖板有蓋行人通道及墊台

（圖圖案放置作業守則中圈3.2及3.3的
圖板、有蓋行人通道、墊台及斜樁等大樣）

圖G.5. 防護措施（五頁之一）
圖G.5 防護措施(五頁之三)

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防護措施

在拆除建築物前，必須採取下列防護措施:

1. 切斷公用事業設施

所有通往建築物的公用事業設施及供應管道必須終止。終端檢查孔處的下水道及排水渠必須堵塞。

2. 有蓋行人通道和接台

(A) 有蓋行人通道上和接台應按照建築物拆除監督批准的圖則，沿著XX街及服務小巷的物業邊界的整個長度搭建。在安裝有蓋行人通道和接台的基礎時，如有需要必須遵守路政署簽發的挖掘許可證上提出的條件；

(B) 車行道應設於XX街上軸線E與H之間；以及

(C) 沿著XX街的接台，應延伸到整個一樓懸臂露台的下方。

3. 框架、護欄及裝飾

(A) 應按照設計有護欄及構造的實際構架以覆蓋整個建築物。

(B) 框架、護欄、構造及裝飾的安裝工作，必須符合構造工作安全守則及建築物拆卸守則。

(C) 柱斜樑必須以不超過10米的豎向間隔安裝在建築物周圍。

4. 臨時支撐物

(A) 必須安裝前樑以支撐機械設備的作業及拆卸活動。應根據建築物拆卸守則的建築選擇不同樓層面積的撐樑支撐要求。撐樑支撐要求在圖G.2中詳述說明。

(B) 支撐的頂部及底間支撐物應充分固定好。至少必須在兩個方向安裝支撐物及結頭或吊桿構件以確保頂部及底間動。除非拆卸過程中不需要機械設備、泥石或其他負荷情況，否則切勿移除撐樑。

(C) 必須設置結構鋼架以便移動機械下面的樓層移動。臨時撐樑的傾斜度不得超過三十度，或按照製造商的建議構築。

(D) 在懸臂樑或樓板底下要安裝木板台及鋼支撐物。

5. 泥石處理

5.1 臨時小鋼度必須拆除。所有廢料、家具、木材、門框及窗，必須從建築物中搬走。任何可作廢料利用的材料應分類，並分開堆放。

5.2 泥石必須通過軸線G與H之間的結構機械送到樓下。電梯入口附近的場所應用鋼板圍住。拆卸每個樓層時，將產生大約175立方米的建築物泥石。必須安排泥石的清除及運輸工作以確保無論何時都能保持下述情況:

(A) 泥石在電梯井中堆積的高度不得超過一米的高度；

(B) 泥石在各個樓層存放的高度，不得超過地板以上100毫米；

(C) 樓下堆積的泥石，不得超過地面地板以上一米高度；以及

(D) 切勿在懸臂結構上堆積泥石。

6. 特殊防護安全

6.1 緊急出口

軸線B與C之間的懸臂應用作緊急出口路線。無論何時均應清除緊急出口路線上的泥石。必須設置告示牌及／或標誌以清楚指明該出口路線。

圖G.5 防護措施（五頁之四）
6.2 防火

必須在每個樓層的方便位設置滅火器。所有油料、易燃物質、氧炔及乙炔瓶必須按照工廠及工業經營規例存放在受保護的地方。

6.3 培訓

應由合資格培訓人員培訓所有現場人員進行。培訓課程應包括以下各項：

(A) 在工程開始時提供導引課程，使現場人員有機會了解拆除程序、地盤安全規則及工程的重大安全考慮事項；以及

(B) 日常安全會議以保持及加強安全觀念。

6.4 灰塵和噪聲

(A) 在破碎作業及泥石搬運過程中，必須連續應用噴水來抑制拆除過程所產生的灰塵。

7. 保護和檢查

7.1 承建商應按時檢查工程或拆除作業場所，以確保所有臨時支撐物、斜桅及圍欄保持良好狀態。如果泥石堆積，必須清除。如果認為有需要，對臨時支撐物造成的移動、損壞及變形。檢查及修理活動均須記錄下來並向認可人士提供副本。

7.2 承建商亦必須每日檢查地盤以查明任何不安全的情況，例如臨時支撐物損壞或不稳固及/or部分拆除結構損件。在離開工作地點之前，承建商應修理任何不安全的情況。

7.3 承建商應每週檢查工作安全守則及建築地盤（安全）規格的檢查及保養構件。

8. 緊急計劃

8.1 緊急用電話號碼應在顯目位置清楚張貼。遇有緊急情況或事故，承建商應向警方及消防處報告尋求即時協助。承建商亦應立即將事件通知認可人士和註冊結構工程師。

8.2 在發出緊急警告前，應進行下列事項：

8.2.1 承建商應加固地盤上所有臨時支撐物、鋼架、護網及圍欄的材料。鋼架應拆卸到建築物的兩層。

8.2.2 易燃物質應移走及存放於受保護地點。

8.2.3 挖土機應移入設有適當支撐物的位置，最好接近建築物中心。

8.2.4 必須完成任何不穩定及/or部分拆除結構損件的拆卸工作。如果及時完成拆卸工作並
不實際，不穩定結構應支撐確定好。

9. 拆卸後

9.1 在拆卸工程竣工後，地盤應加以平整，泥石應清除乾淨。

9.2 如果不立即進行防護發展項目，地盤邊界必須完全封閉以防止公眾進入。

9.3 應作出永久處理共有層的安排。

9.4 如對進行範圍內人行道、小路及其他構件造成損壞，應在拆卸工程竣工前，加以修理，使之恢復原有情況。

圖G.5 防護措施（五頁之五）
目前香港的拆卸程序流程表

圖H1 目前香港的拆卸程序流程表
HK 690.260289 H77
Hong Kong (China). Buildings Dept.
Draft code of practice for demolition of buildings

Date Due

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