Demolition in Urban Environment
The Asian Trade Centre Case – an accident occurred in a demolishing building in Yau Tong on 29 Nov 2001

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The Asian Trade Centre before the collapse
Existing structure of the Asian Trade Centre

1. **Building size:**
   about 45m by 50m on plan and 25m high

2. **Structural form:**
   - flat slab structure with limited amount of beams on the building edges and corners
   - non-load bearing reinforced concrete external wall
   - arranged in approx. 8m span in 5 x 6 bay grid
   - strength of concrete 30 N/mm² (judge according to speaker’s experience)
The site as seen after the collapse on 30.11.01 (viewing north)
The site as seen on 30.11.01 (viewing south)
The site as seen on 30.11.01 (viewing west)
The site as seen on 30.11.01
(viewing at J/O Sze Shan Street and Shung Shun Street)
The damage – the wreck of two out of the five breaking/excavating machines used for demolition
The damage – the 6-storey building collapsed inward forming a heap of debris about 6m high from ground
The damage – fortunately, the collapse does not damage the adjoining building which separated from the collapsed building by a separating joint only a few millimeter apart.
The remain – a section of the external wall on the west side of the building
The remain – a portion of building structure at the corner at J/O Sze Shan Street & Shung Shun Street
Observation – all the fallen columns centered inward indicates that the collapse orientated somewhat from the building center.
Observation – with the columns basically remain intact while no trace of floor slab can be observed in the remain indicates that the floor structure in general is a weak source that may cause the collapse
Observation – the exposed steel bars on the cut-edges indicates the collapsing structure fell rapidly and produced tremendous pulling force that fail to keep the floor in position. There is no trace of floor concrete adhered to the bar, again indicates that strength of concrete may be sub-standard.
Observation – further evidence of possible floor failure. More than 3 storeys of floor slab crushed to rubble and detached completely from the columns.
Observation – the steel props used as temporary support for the positioning of the heavy breaker machines seem insufficient for the purpose.
Props should rest on bearing plate rather than directly on floor to avoid concentration of loading.
Observation – the accommodation of large amount of debris above the floor impose great loads to the structure
Demolition work is one of the most dangerous operations in construction.

Reasons/causes:

- Injury to human workers due to the difficulty of accessing into or working inside a building which is under demolition.
- Falling of smaller objects or debris from the demolishing building.
- Falling of partially demolished structure.
- Collapse of unstable structure due to original structure being disturbed.
Difficult access for workers entering into a building under demolition
Further examples of difficult access in demolition jobs.
Partially demolished structure is hazardous and may easily collapse and create accident.
Reasons/causes (cont’):  
- Collapse of heavy demolition equipment due to inadequate support of the partially demolished structure.  
- Collapse of the partially demolished structure due to the accommodation of large amount of uncleared debris.  
- Congested site environment that easily cause damages to human workers or to other third parties and their properties that are nearby the demolishing site.
Heavy machinery used in demolition may have risk of collapse due to insufficient support.
Accommodation of too much debris during demolition can impose intolerable loading to the disturbed structure.
Typical congesting neighbourhood condition for demolishing small buildings within urban environment
HK Building Department has imposed very strict control to any form of demolition works by the use of approval & consent procedure.

1. Authorized person (AP) should be appointed to submit application for approval of the demolition, which includes an appraisal report with a method statement proposed for the demolition.

2. Building Department will approve the work subject to the satisfying of all precautionary measures pursuant to the Building (Demolition works) Regulations, hoarding and covered walkways or any other conditions as required.
3. After approval is obtained, another 2 stage consent procedure are still required before starting the actual demolition.

4. Stage 1 is to obtain the consent for carrying out all precautionary/temporary works which include the hoardings, covered walkways, scaffolding, catch fans, dust screens and shoring etc.

5. In case the provisions in Stage 1 is completed and to the satisfaction of the Building Department, Stage 2 of consent for the actual demolition can be applied.
Measures to be taken during demolition to reduce nuisance and improve safety
Typical dust screen and fans provision to protect building and minimize disturbance to public during demolition
Common ways to get rid of the demolished debris – to control the falling of the debris into a pre-determined vertical shaft
Temporary props erected to support heavy equipment
Erection of shoring to support affected structure

a) Basement demolition (left)
b) A nearby retaining wall (right)
Typical sectioning/sequencing arrangement of work during demolition – demolish from exterior inward
Typical sectioning/sequencing arrangement of work during demolition – demolish from one side to the other side of building
A service lane is provided for storage and machine circulation.

Provide a service lane separating from public to facilitate demolition.
Methods of demolition

Demolition can be done by

1. Human operatives
2. Deliberate collapse
3. Using of applied pulling/pushing forces
4. Using of mobile powered breaking machines
5. Using of hydraulic clamp or robotic breaker
6. Using of demolition ball
7. Using diamond saws and drills
8. Using explosive (blasting or expansion type)
Typical demolition arrangement done by human operatives
Demolition done by applying a pulling force to a portion of structure, in this case a controlled section of external wall – note that the large panel of debris remains have to be cleared afterward
Demolition by the help of mechanical plant – pneumatic breaker and bucketed excavator
Demolition using sawn-cut and drill method
Demolition using hydraulic clamp or robotic breaker
Other precautions to be noted

1. When handling the debris, continual spraying of water onto the debris can help suppressing the creating of dust.

2. Better work coordination should be maintained to ensure no worker is working inside the building when the debris is being pushed down from the debris shafts.

3. Secure all the partially demolished structures by prop, wire or bracing etc. to ensure the areas are save and will not fall down, at least temporary, and hurt the workers who is working around.
4. When a building is attached to other buildings nearby, the structure to be demolished should first be detached from the adjoining structure by hand demolition techniques.

5. Very special attention should be made to any demolition work that is carried out along the external perimeter of building for the falling of objects may cause great casualty to third party below.
Jetting water to the spot where demolition takes place

Protect by secure a free standing external wall section by steel ropes
Fence off the vertical shaft

Maintain a safe access for worker during demolition
Protect exposed retaining structure after demolition by steel shoring or by remaining building frame of the old structure.
Avoid letting a long section of wall free standing without support.
Some other very complicated demolition cases
The redevelopment of the Lee Gardens Hotel

The demolition of the basement structure working at the same time with the construction of the future building
The redevelopment of the Lee Gardens Hotel
The redevelopment of the Hilton Hotel

Demolition of the basement structure of the previous Hilton Hotel
The redevelopment of the Hilton Hotel

Demolition of the basement structure of the previous Garden Road Carpark
The Millennium City in Kwun Tong