CHAPTER 19 - DEMOLITION

MG Latimer

19.1 SCOPE

This chapter focuses on the demolition of concrete in structures, where distinction can be made between the following categories of demolition:

- the full demolition of an entire structure
- the full demolition of a portion of a structure e.g. a deck span or column
- the partial demolition of a structural element e.g. cutting back into the face of a concrete surface to a depth behind the reinforcement.

Although much of the guidance presented in this chapter is applicable to all the above categories, emphasis is given to the partial demolition of a structural element as this requires that particular precautions be taken to protect and preserve the integrity of both concrete and reinforcement within the retained portion.

The guidance presented is not intended to provide detailed coverage of the subject, and specialist literature should be consulted where this is required.

Reference should be made to COLTO Series 12000: Rehabilitation of Structures and Bridges.

19.2 PLANNING

Numerous items need to be considered in the planning of demolition work, their applicability and extent being dependent upon the nature of the work and the particular circumstances of the site. Generally, consideration should at least be given to the following:

(a) Access and safety.
(b) As built details of the structure.
(c) Confirmation of presence/absence of prestressing.
(d) Necessity for initial exploratory work or reinforcement cover checks to locate reinforcement.
(e) Equipment and methods to be used.
(f) Method statements required.
(g) Sequence of operations.
(h) Possible temporary support requirements.
(i) Possible protection requirements.
(j) Environmental compliance.
(k) Disposal of materials.
(l) Consultation with the design office.
19.3 EQUIPMENT

Demolition equipment should be appropriate for the purpose. Powerful and highly destructive equipment such as that illustrated in Photo 19.1 can be used when an entire structure is demolished. However for partial demolition the use of heavy impact equipment should be carefully controlled as this can cause unacceptable damage to the preserved portions of the structure. It is therefore essential that monitoring staff ensure that the suitability of the equipment be discussed and approved during the planning stage. In general, it will be necessary to utilise lighter, less-destructive equipment when working close to the preserved face of the structure.

Photo 19.1: Powerful highly destructive equipment used for demolition of an entire bridge

Photo 19.2: Demolition of bridge parapet using hydraulic impact hammer.
Monitoring staff should be aware that fracturing/micro-fracturing of concrete will occur where percussion/impact equipment is used. The use of such equipment on or close to the preserved portions of the structure should therefore be carefully controlled to ensure that the degree of fracturing is contained within acceptable limits. Close inspection, experience and good judgement are necessary in the control of this aspect of the work. Tapping of the surface with a hard object should enable loose concrete to be audibly detected, and in situations of particular importance a bonding test can be performed to determine whether a weak zone has been created. Photo 19.3 shows the demolition of a portion of a wall, and illustrates the severity of damage which can be sustained when inadequate control is exercised.

Other equipment and techniques may include large diameter diamond-blade saws, diamond wire-cutting, stitch core-drilling and pre-splitting techniques. Where thermal cutting techniques are employed in partial demolition, care should be exercised to ensure that the process does not damage the reinforcement or concrete bond within the retained concrete.

![Photo 19.3: Poorly controlled demolition of portion of wall.](image)

**19.4 CARE AND SAFETY**

Demolition operations are often hazardous and it is therefore essential that the methods employed and the precautions taken recognise that the safety of construction personnel and members of the public is paramount. The relevant requirements of the OHS Act and Construction Regulations must be fully understood and complied with. Attention is drawn to the following:

- Section 12 “Demolition Work” of the Construction Regulations.
- Limitations and control of noise and dust when working in built up areas.
Monitoring staff should be aware that demolition workmen sometimes may not appreciate the need to prevent damage to portions of the structure. It is therefore important that steps be taken to educate and inform workmen of the specific requirements of the work, and of the importance of working with the necessary care.

19.5 PRESTRESSED CONCRETE

Special considerations apply to the demolition of prestressed concrete members, and it is essential that the presence/absence of prestressing be established early in the planning stages.

The type and location of all prestressed tendons and anchorages should be established, and the Contractor called upon to submit a full and detailed method statement for the demolition work. This should include details of the proposed sequence of operations and the methods and equipment to be employed. It is advisable that the Contractor’s method statement be examined and approved by an engineer experienced in the design of prestressed concrete members.

It is important that the difference in behaviour of bonded and unbounded tendons is clearly understood. In the case of unbounded tendons, the presence of high strains and forces within the tendons requires that the sudden release of energy be avoided, as this can result in considerable danger. For such tendons, it is common practice to carefully expose the strands/wires at a suitable location, and then release the energy by gradually heating them until they deform plastically.

The behaviour of tendons in pretensioned members and post tensioned members effectively bonded by cement grouting is very different. Here the energy is released incrementally as demolition of the member proceeds.

In certain circumstances it may be necessary that the member being demolished be propped to provide support when the prestress force is released. In such cases, the props should be tightly fitted to ensure that individual props are not overloaded.

19.6 PROTECTION WORKS

Monitoring staff should ensure that where necessary, suitable physical protection (boards, sandbags etc.) are provided to protect portions of the structure which are to be preserved. Protection measures may also be required to safeguard infrastructure below the demolition area (e.g. roadways, sidewalks etc.).

In general, demolition should not be permitted above areas open to pedestrian or vehicular traffic. When it is unavoidable that work be carried out above such areas, the work should be kept to the minimum and only light equipment should be used. Suitable screens/catch-nets etc. should be installed to prevent equipment or debris falling onto the areas below. Checks should be made to ensure that these do not reduce the required vertical clearance. Roads should be closed to traffic when heavy equipment is utilised and in all cases where substantial demolition is required. The need to obtain authorization for road closures and to provide adequate advance notice should not be overlooked.

When working over rivers, the importance of adhering to all environmental requirements must be emphasised and debris or waste material (both solid and liquid) must not be permitted to fall into the river. The provision of suitable screens or catch nets will usually be required in order to satisfy these requirements.
19.7 TEMPORARY SUPPORT REQUIREMENTS

In certain instances it may be necessary to prop or provide other temporary support measures to members being demolished. Such measures may be necessitated by temporary stability and safety considerations, or by the need to maintain control over falling concrete or debris.

When reinforced concrete members are required to be only partially demolished, precautions should be taken to ensure that the preserved portion is not damaged by bending of the protruding reinforcement. This form of damage is illustrated in Photo 19.4 and can easily occur if the protruding reinforcement remains attached to falling concrete. This action can cause severe spalling of the soffit concrete, particularly when reinforcement is located close to the bottom of the member. The resulting feathered edges can be difficult to repair.

![Photo 19.4: Damaged soffit caused by bending of bottom reinforcement.](image)

19.8 PRESERVATION OF STEEL REINFORCEMENT

It is often necessary that reinforcement be preserved in portions of the structure, such as at locations where new reinforced concrete is required to be connected to partially demolished members. Monitoring staff should ensure that the Contractor has a clear understanding of which bars are required to be preserved, and that measures are in place to ensure that these are not damaged by breakers, drilling, cutting etc.

It should however be recognised that even where considerable effort is made to comply with this requirement, some reinforcement damage is likely to occur. The design should therefore make provision for additional reinforcement to be dowelled into the existing concrete.

Excessive and unnecessary bending of steel reinforcement should not be permitted.

19.9 SAW-CUTS

When a portion of a concrete element is to be demolished, it is common practise to define the limit of demolition by first making shallow saw-cuts on the surfaces. Refer Photo 19.5. These saw-cuts reduce the occurrence of feathered edges and clearly define the demolition edge.

Monitoring staff should ensure that the depth of cut is controlled and does not damage reinforcement required to be preserved. All saw-cuts should be straight, neat and regular.
19.10 WATER JET CUTTING

Water jet cutting is a specialised method of cutting concrete, and utilises a fine jet of water discharged from a nozzle at extremely high pressure. Refer to Photo 19.6. The method involves no impact, and therefore has the advantage that it does not cause fracturing of the adjacent concrete. It is however very slow and expensive, and requires that stringent safety requirements be applied.

When correctly applied and controlled, the method does not damage steel reinforcement, but the presence of reinforcement does constrain access for the cutting jet and hinders the cutting action. If required, steel reinforcement can be cut by feeding a cutting-agent into the water stream.

Specialist literature should be consulted and advice obtained when planning for the use of this method.
INDEX TO APPENDICES

19A - DEMOLITION CHECK LIST
## CONSTRUCTION MONITORING CHECKLIST

**PROJECT NO. / NAME:** .................................................................

**INSPECTOR’S NAME(S):** .................................................................

**STRUCTURE:** ................................................................. **ELEMENT:** .................................................................

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**STATUS INCLUDES**

- A Contractor’s submission received
- B Engineer’s appraisal
- C Inspected / Tested
- D Compliance Verified
- E Approved / Rejected
- F Signed Off

CCP: Contractor’s Competent Person

**Note:** Indicate N/A under Status if not applicable