

**Technical Guideline on the Design and Construction
of New Territories Exempted Houses**

1. Introduction

1.1 New Territories Exempted Houses (NTEH), although being small houses and relatively simple in their general arrangement and design, possess critical structural elements which are essential to building safety. The purpose of this guideline is to provide technical guidance to the fundamental requirements on the design and construction of such structural elements to ensure safety.

1.2 NTEHs are now conventionally constructed of reinforced concrete with shallow footings. Critical structural elements covered in this guideline include cantilevered balconies and canopies; long span beams (those equal to or exceeding 6m in span); long span slabs (those equal to or exceeding 4.5m in span) and foundation footings.

1.3 Professional advice should be sought if non-conventional building materials are used, e.g. structural steel; or when deep foundation are involved; or when the foundation are constructed in the vicinity of a slope or a retaining wall; or in case of doubt in complying with the requirements of this guideline.

2. Construction Materials

2.1 Concrete used should be not inferior to grade 25D as specified in Building (Construction) Regulation, i.e. with a minimum crushing strength of concrete of not less than 25 MPa. Where access and availability can be arranged, the use of ready-mix concrete from suppliers certified under the Hong Kong Quality Assurance Agency (HKQAA) is encouraged for the building structure.

2.2 Steel reinforcement bars used should be not inferior to grade 250 or grade 460 specified in Construction Standard CS2 for plain round bars and deformed high yield bars respectively, i.e. with a minimum yield stress of steel bars of 250MPa and 460MPa respectively.

3. Material Testing

3.1 Two numbers of standard concrete cubes should be prepared and tested in accordance with the requirements of Construction Standard CS1 when constructing each one of the following parts of the structure: foundation; vertical members for each floor and horizontal members for each floor. The tests should be carried out by a laboratory accredited with the Hong Kong Laboratory Accreditation Scheme (HOKLAS).

3.2 All steel reinforcing bars used should possess a manufacturer's certificate indicating that the requirements given in Construction Standard CS2 with respect to the physical, chemical and mechanical properties of the steel bars have been complied with.

4. Balconies and Canopies

4.1 Structural Design

- For balconies and canopies with cantilevered projections of span more than 1000mm, a beam-and-slab type construction should be used instead of cantilevered slab type of construction, where practicable. For beam and slab construction, slabs must be fully supported by beams at all sides and the overall depth of any cantilevered beam should be not less than 300mm at support. For cantilevered slab projections, the span to overall structural thickness ratio should be not greater than 7 and the structural slab thickness should be not less than 150mm. The concrete cover to the outermost reinforcement bar should be not less than 40mm, nor more than 50mm.
- Cantilevered concrete slabs should be reinforced in both faces and in both directions. Reinforcement bars should be at least 10mm in diameter and the spacing should be not greater than 150mm. The main reinforcement bars in the upper and lower sides of a slab respectively should be not less than 0.25% and 0.15% of the cross-sectional area of the structural concrete. Distribution steel should be not less than half of the main steel in cross-section.

- Main reinforcement bars of the projecting structure should be rigidly fixed to the reinforcement of the supporting member. The reinforcement bars should extend straightly into the far face of the supporting beam before bending, if bending is required to achieve adequate anchorage. Typical details of fixing of steel bars are given in appendices A and B for reference.
- Embedded service pipes and conduits are not permitted in beams. Such embedments are also to be avoided in slabs if possible. If it is impracticable to do so, they should be arranged to run perpendicular to the supporting member.
- Adequate allowance must be made for the superimposed loads due to the screeding, waterproofing materials, heavy parapets, maintenance work and possible ponding resulting from malfunctioning of the drainage system. A table on the minimum required thickness of cantilevered slab balconies and canopies is given in appendix C for reference.

4.2 Drainage Arrangement

- Effective waterproofing should be provided on the top surface.
- A fall should be laid from the supporting edge towards the outer edge to prevent accumulation of water, The minimum fall should be 1:75.
- Adequate drainage outlets/down pipes should be provided near the outer edge. The maximum distance between the drainage outlets/down pipes should be not more than 5 metres.

5. Long-span Beams

5.1 Structural Design

- Long-span beams should have supports on both ends. Span length is taken to be the distance between the centres of the supports or clear distance between the supports plus the depth of the beam whichever is less.

- Beam width should be not less than 300mm. The length of unrestrained compression zone of the beam should not exceed 30 times of the beam width.
- Beam depth should be not less than 450mm. The span to depth ratio should be not greater than 15.
- The concrete cover to the outermost reinforcement bars in the beams should be not less than 30mm, nor more than 50mm.

6. Long-span Slabs

6.1 Structural Design

- Long-span slabs should have supports at least on two opposite ends. Span length is taken to be the distance between the centres of the supports or clear distance between the supports plus the depth of the slab whichever is less.
- Slab thickness should be not less than 150mm. The span to depth ratio should be not greater than 30.
- The concrete cover to the outermost reinforcement bars in the slabs should be not less than 20mm, nor more than 30mm.

7. Raft or Strip or Pad Footings

7.1 Structural Design

- All columns should be supported by footings and be connected by a rectangular grid of strap beams at the support end.
- A minimum of two trial pits should be carried out to determine the condition of the subsoil and the allowable bearing pressure. Footings must not sit on top soil, loose fill, abandoned foundation or debris.
- Footings should be founded at least 1m below ground surface unless solid rock is encountered.

- Raft footings are generally preferred to single pad footings or strip footings. Raft footings should be adopted when the subsoil is medium dense to loose granular soils (which is readily removable by shovelling only) or where there is a high ground water table.
- Only when the subsoil is compact granular soils (which requires the use of a pick for removal) in dry condition, may single pad footings or strip footings be used.
- All strap beams, pad footings or strip footings should be not less than 450mm thick. Details of some typical foundation elements are shown in appendix D for reference.
- Raft footings should be not less than 375mm thick.
- Pad footings should be reinforced at the lower side in both directions. The steel bars provided in either direction should be not less than 1.0% of the cross sectional area of the structural concrete.
- Strip footings and strap beams should be reinforced longitudinally at both the upper and lower sides. The steel bars provided on either face should be not less than 1.5% of the cross sectional area of the structural concrete and should be binded by stirrups spaced at not more than 0.75 times the overall depth of the footing or beam.
- Raft footings should be reinforced in both faces and in both directions. The steel bars provided in either face and in either direction should be not less than 0.85% of the cross sectional area of the structural concrete.
- Concrete cover to the outermost reinforcement bars should be not less than 40mm, nor greater than 50mm.

8. Construction and Workmanship

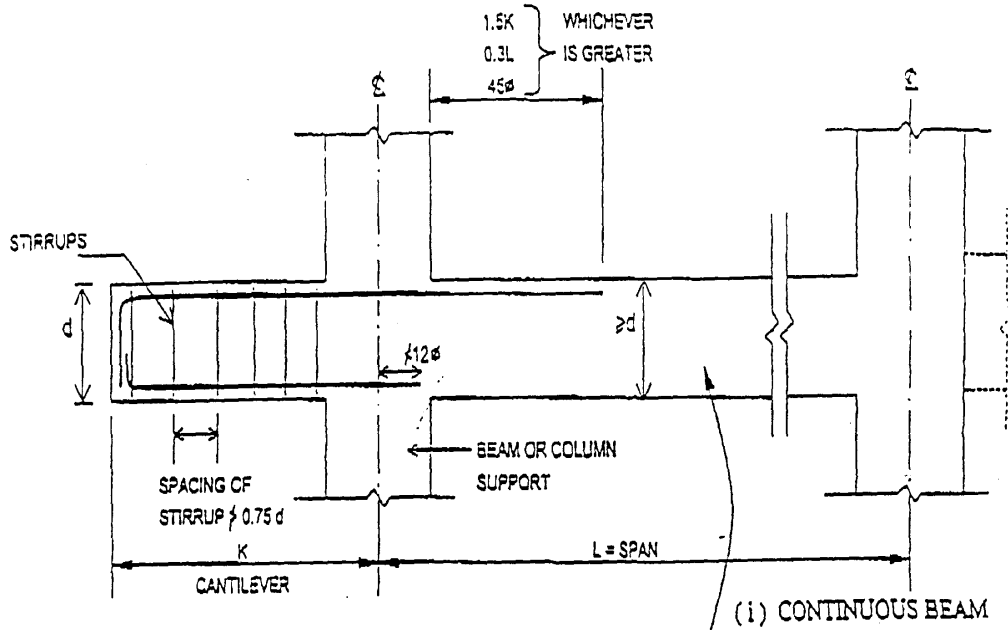
- All cantilevered balconies and canopies should be cast at the same time and monolithically with the members to which they derive support. If construction joints are unavoidable, they must be located at not less than

300mm from the supporting members and be free of loose material and dirt before casting. A typical detail of construction joint is shown in appendix C for reference.

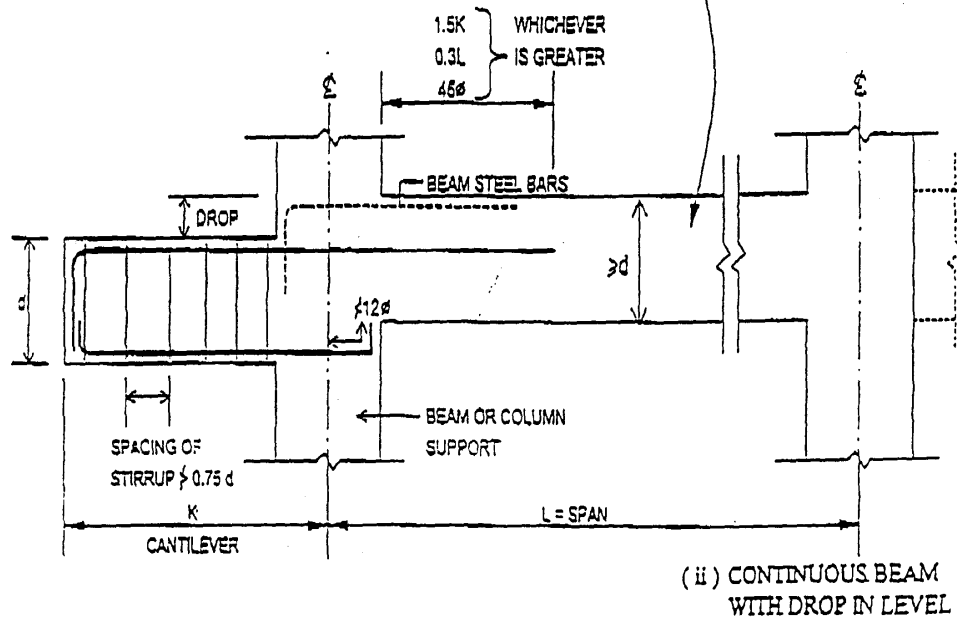
- Adequate bar spacers should be provided to maintain the position and alignment of the steel reinforcement. They should be placed at not more than 150mm from any edge of the structural element to be concreted and the spacing of all intermediate spacers should not exceed 1m.
- During concreting, adequate compaction should be given to ensure good quality concrete. Every endeavour should also be made to avoid steel reinforcement bars from being displaced or depressed.
- All proppings to the soffit of the formwork for the balconies and canopies should be maintained for at least 14 days.
- Excavation should always be maintained in a dry condition. A 75mm thick blinding layer of lean concrete should be laid on top of the subsoil before constructing the footings.

NOTATION:

ϕ DIAMETER OF STEEL BAR



BEAM TO RUN CONTINUOUSLY BEHIND SUPPORT FOR AT LEAST ONE BAY

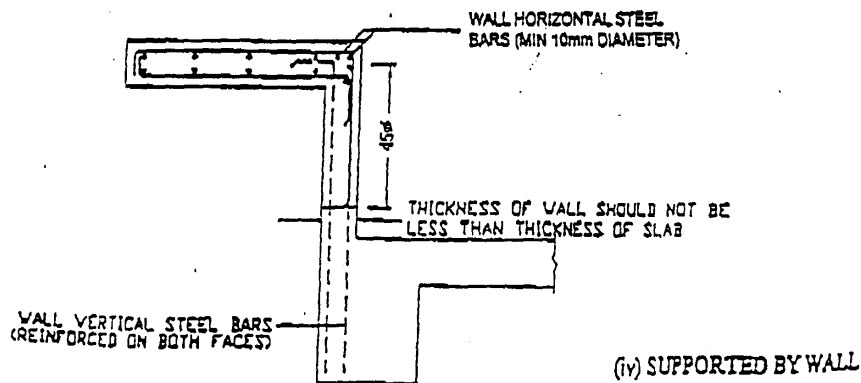
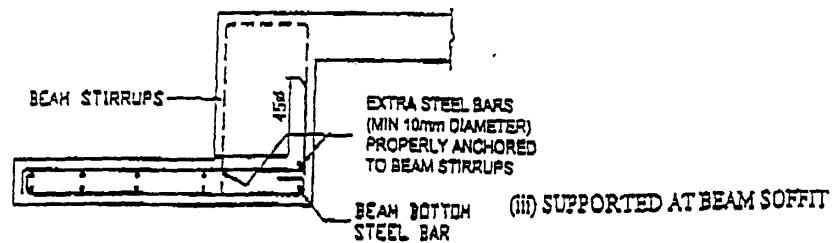
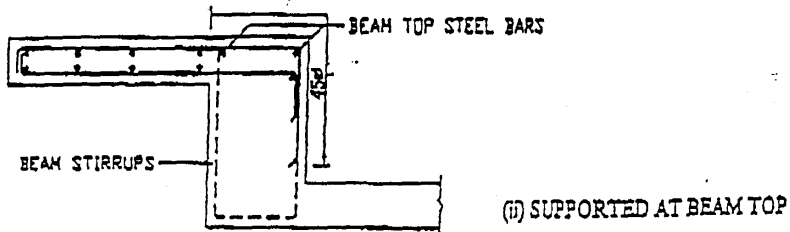
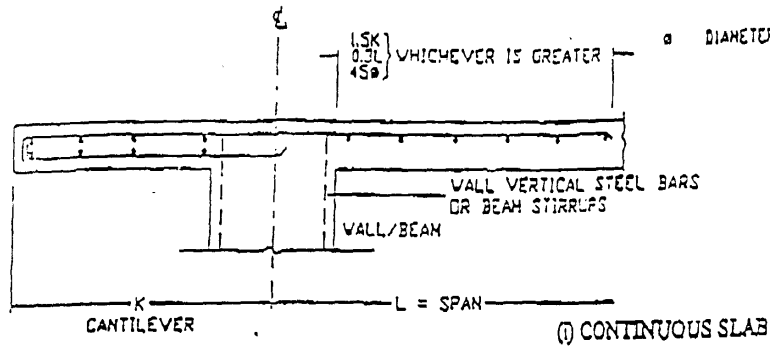


TYPICAL DETAILS SHOWING THE ARRANGEMENT OF REINFORCEMENT IN CANTILEVERED BEAMS (WITH AND WITHOUT DROP)

Appendix B

NOTATION

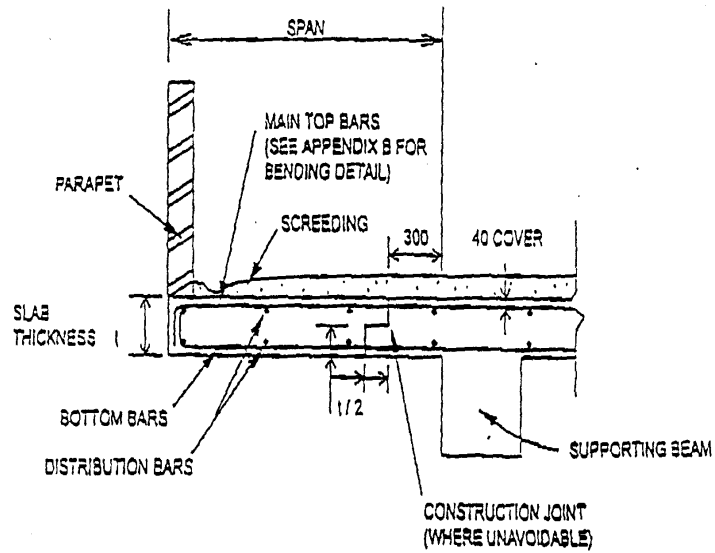
φ DIAMETER OF STEEL BAR



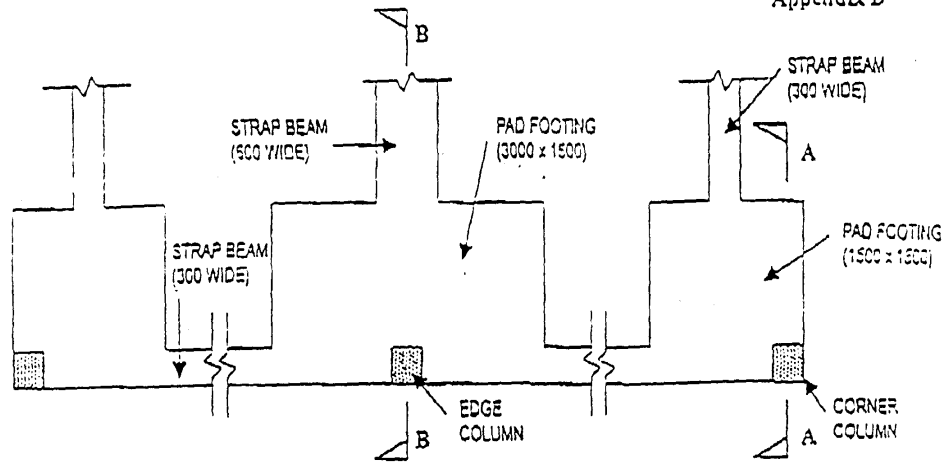
TYPICAL DETAILS SHOWING THE ARRANGEMENT OF REINFORCEMENT IN CANTILEVERED SLABS PROJECTED FROM DIFFERENT TYPES OF SUPPORT

Span (mm)	1220		1100		1000	
Avg. screeding thickness (mm)	50	100	50	100	50	100
Min. slab thickness (mm)	175	190	160	175	150	160
Min. / Max. cover to steel (mm)	40 / 50					

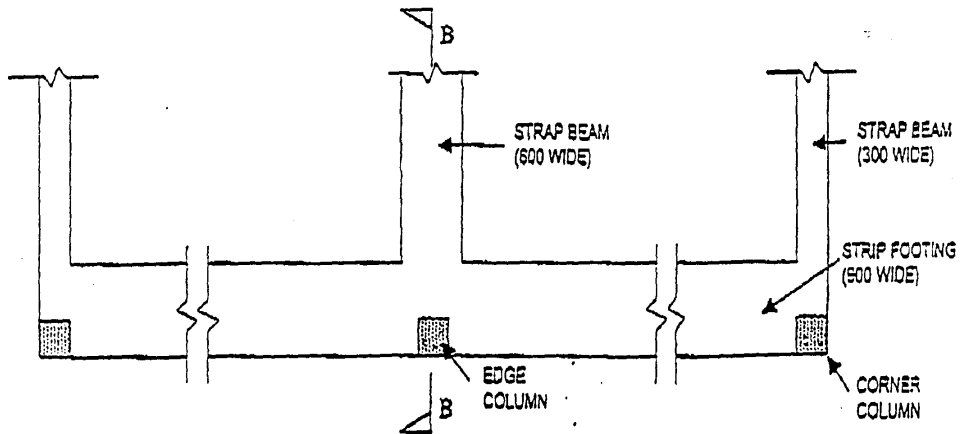
TABLE SHOWING MINIMUM REQUIRED SLAB THICKNESS OF CANTILEVERED SLAB BALCONIES OR CANOPIES



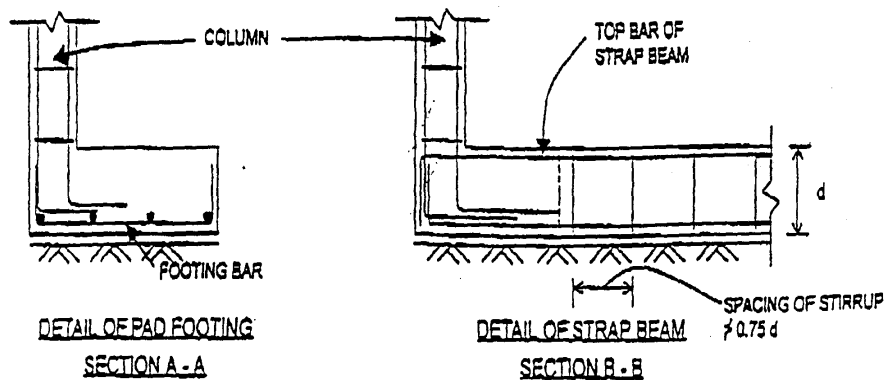
SECTIONAL DETAILS OF CANTILEVERED SLAB BALCONIES OR CANOPIES



PLAN SHOWING TYPICAL ARRANGEMENT OF PAD FOOTINGS & STRAP BEAMS



PLAN SHOWING TYPICAL ARRANGEMENT OF STRIP FOOTINGS & STRAP BEAMS



DETAILS OF SOME TYPICAL ARRANGEMENT OF FOUNDATION FOOTINGS & STRAP BEAMS

NOTE: ALL DIMENSIONS ARE GIVEN FOR REFERENCE ONLY