CODE OF PRACTICE
FOR IN-BUILDING
OPTICAL FIBRE CABLING FOR
GENERAL HOUSING DEVELOPMENT

(IFC GHD CODE)

01 DECEMBER 2015

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CODE OF PRACTICE FOR IN-BUILDING OPTICAL FIBRE CABLINGS FOR GENERAL HOUSING DEVELOPMENT (2015)

In pursuance of the functions and duties entrusted to the Authority under The AITI Order, 2001 (as amended), the Authority hereby exercises the power conferred under Section 8 and Section 26 of Telecommunications Order, 2001 (as amended) to issue the following Code of Practice for In-building Optical Fibre Cablings for the telecommunications sector in Brunei Darussalam.

CHAPTER 1. PRELIMINARY

1.1 CITATION AND COMMENCEMENT

1.1.1 This Code may be cited as the Code of Practice for In-building Optical Fibre Cablings for General Housing Development 2015 for the purpose of setting up a common and integrated fixed network distribution system to be made available in the buildings. The Code or part thereof shall come into effect from the date of its notification in the Official Gazette and shall continue to remain in force until further notification. Any amendments as appropriately brought in shall come into effect on a prospective basis.

1.2 PURPOSE OF THE CODE

1.2.1 This Code specifies –

1.2.1.1 the space and facilities that the developer or owner of a land or building shall provide at his expense to enable the deployment and operation of installation, plant or systems to be used for telecommunications;

1.2.1.2 the duties that shall be observed by the developer or owner of a land or building in relation to the space and facilities provided within, or on, the land or building pursuant to this Code or previous codes; and

1.2.1.3 the duties that shall be observed by a licensee who deploys and operates its installation, plant or systems within the relevant space and facilities.

1.3 DEFINITIONS

1.3.1 In this Code, unless the context otherwise requires –

1.3.1.1 **"Authority"** means the Authority for Info-communications Technology Industry of Brunei Darussalam established under the Authority for Info-communications Technology Industry of Brunei Darussalam Order, 2001 (as amended);

1.3.1.2 **"basement"** means any floor or floors of a building which is or is at a level lower than the ground floor;

1.3.1.3 **"building"** means any permanent building or structure;

1.3.1.4 **"BS"** means the latest published edition of the British Standard specification;

1.3.1.5 **"cable"** means a cable, wire or line used or intended to be used for telecommunications;

1.3.1.6 **"cable distribution system"** means a network of cable trays, cable ladders, trunking, conduits, and under floor ducts, which enables cables to be laid from one point to another point within a building or a development;

1.3.1.7 **"construction"** in relation to a building, means the erection, extension of, alteration and/or addition to the building, and "construct" and "constructed" shall be construed accordingly;

1.3.1.8 **"detached building"** means any building not attached to any other buildings;

1.3.1.9 **"developer"** in relations to any land or building means a person or a company who is or are renovating and re-leasing existing building/s or to the purchase of raw land and the sale of improved land or parcels to others, including the coordinating of the activities, converting ideas on paper into real property;

1.3.1.10 **"development"** means a single project (whether completed or not) consisting of 1 or more buildings, and includes all parcels of land comprised within the same project;

1.3.1.11 **"duct"** or **"trunking"** means an enclosed space which is used to house and conceal cables and includes spaces provided in a wall and in the skirting of walls and partitions;

1.3.1.12 **"dwelling unit or house"** means a building or part of a building designed for use as a dwelling by a single person or family (including servants) together with such outbuildings used therewith;

1.3.1.13 **"Effective Date"** means the date this Code comes into operation;

1.3.1.14 **"flat"** means any separate dwelling used or constructed or adapted to be used wholly or principally for human habitation for a single family, where the kitchen, lavatory and bathroom or water-closet are contained within the separate dwelling and that dwelling is contained in a building comprising two or more such dwellings joined vertically;

1.3.1.15 **"ground floor"** means the lowest level of a building to which there is an entrance from the outside on or above the level of the ground at the front of the building;

1.3.1.16 **"installation, plant or system"** includes all structures, machinery, equipment, cables, poles and lines used or intended for use in connection with telecommunications;

1.3.1.17 **"landed dwelling-house"** means any of the following types of houses used wholly or mainly for the purpose of human habitation –

(a) detached house;

(b) semi-detached house; or

(c) terrace house;

1.3.1.18 **"lead-in pipes"** in relation to –

(a) a landed dwelling-house, means the pipes which extend outwards from the boundary of the house to enable the laying of cables from outside the property into the property; and

(b) a development consisting of a building or buildings other than landed dwelling-houses, means the pipes which extend outwards from the boundary of the development to enable the laying of cables from outside the development into the development;

1.3.1.19 **"main distribution frame"** means the frame on which incoming main cables and the local distribution cables within a building or development are terminated and cross-connected;

1.3.1.20 **"main distribution frame room"** means a room within a building or development that is used to house a main distribution frame and licensees' installation, plant or systems;

1.3.1.21 **"mixed-use building"** means a building used for both residential and non-residential purposes;

1.3.1.22 **"mobile coverage area"** refers to any area within a development which is to be served by any public cellular mobile telecommunication system;

1.3.1.23 **"mobile deployment space"** means the space to be set aside by the developer or owner for the deployment of installation, plant or systems by mobile telecommunication licensees;

1.3.1.24 **"multi-level residential building"** means a residential building, other than a landed dwelling-house or strata landed dwelling-houses, consisting of two or more levels used wholly or mainly for the purpose of human habitation;

1.3.1.25 **"non-residential building"** means a building used for any non-residential purpose and includes –

(a) office towers;

(b) shop houses and shopping complexes;

(c) convention and exhibition complexes;

(d) markets and food centers;

(e) hotels, boarding houses, guest houses, service apartments, student hostels and workers' dormitories;

(f) resort developments;

(g) factories and warehouses;

(h) utilities and telecommunication installations,

(i) business or technology park developments;

(j) airport or sea port terminals;

(k) bus terminals or bus interchanges;

(l) fire stations, police stations, military camps, prison buildings, hospitals, government offices or embassies;

(m) places of worship;

(n) libraries, museums, community clubs or centers, association buildings, sports and recreational complexes, homes for the aged and hospices; and

(o) primary schools, secondary schools, junior colleges, universities, polytechnics, foreign and specialist schools;

1.3.1.26 **"owner"** in relation to any land means the registered owner of the title under which such land is held and in relation to any building and includes any person entitled to the rents or profits of the building under a lease or sub-lease;

1.3.1.27 **"previous codes"** means any previously issued codes of practice or guidelines which specified the space and facilities to be provided by developers or owners of buildings for

the purpose of enabling the deployment and operation of installation or plant to provide telecommunication services to the buildings;

1.3.1.28 **"public road"** means any road over which the public has a right of way;

1.3.1.29 **"relevant competent authority"** means any authority appointed from time to time pursuant to any guidelines or any existing committee who has the responsibility for approving any matters pertaining to this code;

1.3.1.30 **"relevant space and facilities"** means the space and facilities provided by the developer or owner of a building pursuant to this Code or any previous codes;

1.3.1.31 **"residential building"** means a building of part thereof designed, adapted or used for human habitation;

1.3.1.32 **"room"** means any portion of a building enclosed by walls or partitions;

1.3.1.33 **"RJ-45 patch panel"** means a panel for mounting RJ-45 outlets for patching purposes;

1.3.1.34 **"SC/APC connector"** means standard connector / angle polished connector;

1.3.1.35 **"semi-detached building"** means any building designed to be built as one pair having a party wall as one of its walls;

1.3.1.36 **"shop house"** means any building, part of which is designed, adapted or used for business purposes;

1.3.1.37 **"telecommunications"** means a transmission, emission or reception of signs, signals, writing, images, sounds or intelligence of any nature by wire, radio, optical or other electro-magnetic systems whether or not such signs, signals, writing, images, sounds or intelligence have been subjected to rearrangement, computation or other processes by any means in the course of their transmission, emission or reception;

1.3.1.38 **"telecommunication licensee"** means a telecommunication system licensee as defined in the Telecommunications Order, 2001;

1.3.1.39 **"telecommunication room"** means a room within a building or a development that is used to house a licensee's installation, plant or system;

1.3.1.40 **"telecommunication riser"** means a compartment that is used to house and distribute telecommunication cables to the individual levels of a building;

1.3.1.41 **"temporary certificate of fitness for occupation"** has the same meaning as in the "BUILDING Guidelines and Requirements PBD 12 : 2017 Fourth Edition : 2017 from the Ministry of Development";

1.3.1.42 **"terrace house"** means any residential building designed as a single dwelling unit and forming part of a row or terrace of not less than three such residential buildings;

1.3.1.43 **"underground pipes"** –

(a) in relation to a landed dwelling-house, means the pipes which extend from the boundary of the house into the house; and

(b) in relation to a development consisting of a building or buildings other than landed dwelling-houses, means the pipes which extend from the boundary of the development to the main distribution frame room or to the retaining wall of the development (as the case may be) and which extend from the retaining wall to the

telecommunication room to the telecommunication riser within the development; and

1.3.1.44 **"usable floor area"** refers to any floor space within a development which is to be served by any telecommunication system (excluding any floor spaces that are served only by public cellular mobile telecommunication systems).

1.4 APPLICATION OF THIS CODE

1.4.1 Where a development has been granted provisional or written permission for its construction by the competent authority under the "BUILDING Guidelines and Requirements PBD 12 : 2017 Fourth Edition : 2017 from the Ministry of Development" on or after the Effective Date, the developer or owner of the development shall, unless he obtains a waiver from the Authority in accordance with paragraph 1.5 of this Code, provide at his expense the space and facilities described in Chapters 4 to 6, as may be applicable.

1.4.2 Chapters 4 to 6 specify the space and facilities to be provided for the following types of development:–

(a) development consisting of one (1) or more residential single dwelling unit (SDU) buildings [Chapter 4];

(b) development consisting of one (1) or more residential multi dwelling unit (MDU) buildings [Chapter 5]; and

(c) development consisting of one (1) or more non-residential buildings (NRB) [Chapter 6].

1.4.3 Where a development consists of –

(a) one (1) or more mixed-use buildings; or

(b) a mix of single dwelling unit-houses, multi-dwelling unit residential buildings, non-residential buildings, mixed-use buildings or any combination thereof,

the developer or owner shall refer to and provide at his expense the relevant space and facilities specified in Chapters 4 to 6 corresponding to the use or type of building in the development. For the avoidance of doubt, a set of space and facilities provided for the residential portion of a development shall not be counted towards the requirement for the relevant space and facilities for the non-residential portion or vice-versa. For example, in the case of a development consisting of a multi-level mixed-use building, the developer or owner shall provide the space and facilities specified in Chapter 5 in respect of the residential portion of the building and provide the space and facilities specified in Chapter 6 in respect of the non-residential portion of the building. In the event of any uncertainty as to the space and facilities to be provided, the developer or owner shall consult the Authority for clarification.

1.4.4 Where the space and facilities to be provided for a particular development are not specified in this Code, the developer or owner shall consult the Authority on the space and facilities to be provided at his expense for such development and comply with such requirements as may be imposed by the Authority.

1.4.5 Where a development has been issued with a temporary certificate of fitness for occupation permit, regardless of when the development was constructed, the developer or owner shall comply with Chapter 2 of this Code unless he obtains a waiver from the Authority in accordance with paragraph 1.5 of this Code.

1.4.6 Every developer or owner who is required to provide:-

(a) lead-in pipes, underground pipes or manholes;

(b) telecommunication rooms;

(c) mobile deployment spaces;

(d) telecommunication risers; and/or

(e) optical fibre cables with associated fibre interface points and fibre termination points

pursuant to Chapters 4 to 6 of this Code shall comply with the additional requirements set out in Chapters 7 to 10 of this Code (as the case may be).

1.4.7 Every licensee who uses the space and facilities provided by the developer or owner of a development pursuant to this Code or any previous codes shall comply with Chapter 11 of this Code.

1.4.8 Nothing in this Code shall limit the Authority's power to issue a direction under the Telecommunications Order.

1.4.9 For the avoidance of doubt, the developer or owner of a development shall not be excused from any failure to observe the requirements of this Code arising from acts or omissions of any consultant or contractor whom he engages to design and construct the development.

1.5 WAIVER

1.5.1 The Authority may, on receipt of an application in relation to the space and facilities to be provided in accordance with this Code, waive any of the requirements specified in this Code upon and subject to such terms and conditions as it thinks fit.

1.5.2 Any such application shall be made in writing to the Authority by or on behalf of the developer or owner of the development to which such application relates and shall:

(a) state the nature and extent of and reasons for the proposed waiver of such requirements; and

(b) be accompanied by such plans and particulars as may be required to support the application.

1.5.3 A waiver may be permanent, temporary (either for a fixed period or effective until the occurrence of a specific event) or on a one-time basis.

1.6 GUIDELINES

1.6.1 The following guidelines shall be read in conjunction with this Code. Developers and owners should refer to the guidelines for the technical specifications of the space and

facilities to be provided under this Code and the recommended practices in relation to the construction thereof:

1.6.1.1 **Annex 1 – Implementation Guidelines for In-buildings Optical Fibre Cablings for General Housing Development 2015**

1.7 REGULATORY PRINCIPLES

1.7.1 The following regulatory principles provide the foundation for the Code, and guide its implementation:

1.7.1.1 Equitable proportionate regulation for the evolving sector.

1.7.1.2 Increased transparency for stakeholders especially to help customers to make informed choices and to understand the limitations, if any.

1.7.1.3 Reliance on self-regulation to enhance resource optimisation.

1.7.1.4 Harmonious alignment with other regulatory instruments and legislations.

1.7.1.5 Adherence to technological neutrality in consonance with technical interoperability and feasibility.

1.7.1.6 Simultaneous regard to public safety, emergency communications and rights of other stakeholders'.

CHAPTER 2. OBLIGATION TO PROVIDE SPACE AND FACILITIES

2.1 OBJECTIVE

2.1.1 The objective of this chapter is to specify:

(a) the obligations of the developer or owner of a development that has already been issued with a temporary certificate of fitness for occupation; and

(b) the continuing obligations of the developer or owner relating to the use of, access to and maintenance of the relevant space and facilities, and liability for costs in relation thereto.

2.1.2 The Authority reserves the right to require any developer or owner to provide additional space and facilities, to meet the demand for telecommunication services where necessary.

2.2 OBLIGATION TO PROVIDE MOBILE DEPLOYMENT SPACE

2.2.1 If the relevant development consists of one (1) or more multi-level residential buildings, with sixty (60) or more residential units, the developer or owner shall, where required and notified by any mobile telecommunication licensee, provide within a reasonable time, mobile deployment space in accordance with the dimensions specified in **Table 1** based on the total number of residential units in the development.

Table 1: Mobile deployment space to be provided in each relevant development for residential buildings

Total number of residential units in the development	Mobile deployment space (m^2)		Minimum height of mobile deployment space (m)
	Where the mobile deployment space is provided as a single space	Where the mobile deployment space is provided as two or more separate spaces	
60 to 200	18	24*	3.5
201 to 400	36*		
< 401	54*		

* Size of each disaggregated Mobile Deployment Space (MDS) shall be at least 8 m^2

2.2.2 If the relevant development consists of one (1) or more non-residential buildings with a total mobile coverage area of more than 2,000 m^2, the developer or owner shall, where required and notified by any mobile telecommunication licensee, provide within a reasonable time, mobile deployment space in accordance with the dimensions as specified in **Table 2** based on the mobile coverage area in the development. If the relevant development consists of a total mobile coverage area of more than 200,000 m^2, the developer or owner shall consult the Authority on the mobile deployment space to be provided and comply with such requirements as may be imposed by the Authority.

Table 2: Mobile Deployment Space (MDS) to be provided in each relevant development for non-residential buildings

Total mobile coverage area ('000 m^2)	Mobile deployment space (m^2)		Minimum height of mobile deployment space (m)
	Where the mobile deployment space is provided as a single space	Where the mobile deployment space is provided as two or more separate spaces	
> 2 to ≤ 6	18	24*	3.5
> 6 to ≤ 20	36*		
> 20 to ≤ 100	54*		
> 100	72*		

* Size of each disaggregated Mobile Deployment Space (MDS) shall be at least 8 m^2

2.2.3 The developer or owner may locate the mobile deployment space to be provided under paragraphs 2.2.1 and 2.2.2 at any unused space in the development (e.g. carpark and roof top), subject to the additional requirements provided in paragraphs 2.2.5 to 2.2.6 and Chapter 8 of this Code.

2.2.4 For the avoidance of doubt, the mobile deployment space shall not be located in the telecommunication room, unless there is sufficient space available after having fulfilled the space requirements of the telecommunication room and there is a clear demarcation of the space designated as mobile deployment space.

2.2.5 Where:

(a) there is no basement level or a single basement level, the mobile deployment space shall be located on the ground floor or first level of the relevant development; and

(b) there are multiple basement levels; the mobile deployment space shall be located:

i. on the ground floor or first level; or

ii. on the uppermost basement level provided that:

(A) in the event of flooding in the mobile deployment space leading to an outage in the provision of public cellular mobile telecommunication services supplied to the development, the developer or owner shall bear all costs incurred by the relevant licensee in restoring the public cellular mobile telecommunication services in the development except that where the relevant licensee is restoring such services to the development and external properties, the developer or owner shall only be obliged to bear a reasonable proportion of such costs attributable to the provision of public cellular mobile telecommunication services to the development;

(B) in the event of flooding in the mobile deployment space leading to damage caused to any installation, plant or system of any licensee by the flooding, the developer or owner shall bear all costs incurred by the relevant licensee in replacing such damaged installation, plant or system of the licensee except that where such damaged installation, plant or system is also deployed by the licensee to serve external properties, the developer or owner shall only be obliged to bear a reasonable

proportion of such costs attributable to the provision of public cellular mobile telecommunication services to the development;

(C) in the event of flooding in the mobile deployment space leading to an outage in the provision of public cellular mobile telecommunication services supplied to the development and/or damage caused to any licensee's installation, plant or system, the developer or owner shall:

I. promptly notify the residents or tenants of the development that public cellular mobile telecommunication services may be affected as a result of such event; and

II. relocate the mobile deployment space to another location in the first or higher level of the development and bear all costs in connection therewith except that where the installation, plant or system is also deployed by the licensee at the mobile deployment space to serve external properties, the developer or owner shall only be obliged to bear a reasonable proportion of such costs attributable to the provision of public cellular mobile telecommunication services to the development.

2.2.6 Where the relevant development comprises one (1) or more buildings, any of which has twenty (20) or more levels, the developer or owner shall provide the mobile deployment space in two (2) or more separate spaces, provided that the total space provided meets the relevant mobile deployment space and each separate space is at least 8 m^2 with a minimum width of at least 2 m. In determining the location of such spaces, the developer or owner shall locate them so as to facilitate the provision of public cellular mobile telecommunication services to the whole development.

2.2.7 Subject to paragraph 2.2.6, the developer or owner may provide the mobile deployment space in one or more separate spaces, provided that the total space meets the relevant mobile deployment space and each separate space is at least 8 m^2 with a minimum width of at least 2 m.

2.2.8 The developer or owner shall, at its own cost, comply with any legislation or regulatory requirements in connection with the provision of the mobile deployment space (e.g. obtaining the relevant approvals for conversion of car park lots to mobile deployment space, installation of fencing or trellis).

2.2.9 Where the licensee wishes to install any facilities (e.g. cable trays and power points) required to serve its installation, plant or system at the mobile deployment space, the developer or owner shall provide reasonable assistance to facilitate such installation by the licensee.

2.2.10 Without prejudice to paragraph 2.2.9, the developer or owner shall ensure that the electrical consumer switch room has sufficient power capacity (up to 32 A, 3-phase 50 Hz power supply per mobile telecommunication licensee) to supply electricity for the operation of the licensee's installation, plant or system in the development.

2.2.11 Subject to paragraph 12.4.7, where a licensee's installation, plant or system has been laid, placed, carried or erected in, on, over, under, upon, along or across the mobile

deployment space, and the developer or owner desires to use the mobile deployment space in a manner which renders it necessary or convenient for such installation, plant or system to be altered, removed, relocated or diverted, the developer or owner may request the licensee to alter, remove, relocate or divert such installation, plant or system accordingly.

2.2.12 The licensee shall, at the request of the developer or owner under paragraph 2.2.11, alter, remove, relocate or divert the installation, plant or system if it is satisfied that such alteration, removal, relocation or diversion is reasonable and the owner or developer complies with such reasonable terms and conditions (which may include terms and conditions relating to the payment by the developer or owner of all costs and expenses necessary for such alteration, removal, relocation or diversion) as the licensee may impose.

2.3 CHARGES FOR USE OF AND ACCESS TO RELEVANT SPACE AND FACILITIES

2.3.1 The provision and maintenance of the space and facilities required to be provided under this Code or any previous codes shall, unless otherwise specified in this Code, be at the expense of the developer or owner of the development.

2.3.2 Without prejudice to the generality of paragraph 2.3.1 and subject to paragraph 2.3.4, no charges or rent (except as expressly provided for under this Code) shall be imposed on or collected from a licensee for its use of or access to the relevant space and facilities, including but not limited to –

(a) telecommunication rooms;

(b) telecommunication risers;

(c) lead-in pipes, underground pipes and manholes; and

(d) cable distribution systems.

2.3.3 The developer or owner of a development shall come upon an agreement with the licensee for the charges or rent for the usage of the mobile deployment space other than the telecommunication room. If the mobile deployment space is located inside the telecommunication room subject to paragraph 2.2.4, no charges or rent shall incur.

2.3.4 The developer or owner of a development shall provide lighting and ventilation to the relevant space and facilities (save for mobile deployment space) at his own expense where this is necessary to enable a licensee to deploy and operate its installation, plant or system in such space and facilities.

2.3.5 Where the mobile deployment space is located in an enclosed space, the developer or owner of the development shall provide lighting and ventilation to the mobile deployment space at his own expense where this is necessary to enable a licensee to deploy and operate its installation, plant or system in such space and facilities.

2.3.6 The developer or owner of a development is not required to bear the utility charges for the operation of any installation, plant or system deployed by any licensee in the relevant space and facilities.

2.3.7 Where the developer or owner requires a licensee to bear the utility charges for the operation of any installation, plant or system deployed by the licensee in the relevant space and facilities, the developer or owner shall serve a notice to this effect on the licensee. The licensee shall bear the utility charges on a prospective basis commencing no earlier than a period of one (1) month from the date of service of such notice.

2.3.8 Where such notice as specified in paragraph 2.3.7 is served on the licensee, the developer or owner and the licensee shall reach an agreement on the basis upon which to compute the utility charges to be borne by the licensee. Where the developer or owner and the licensee are unable to agree on such basis, the utility charges to be borne by the licensee shall be based on the estimated power consumption of the licensee's installation, plant or system.

2.3.9 Notwithstanding paragraph 2.3.8, where it is physically feasible, the licensee may at its own cost, install the necessary electrical installations (including cables, a separate utility meter and any other accessory) to enable the utility charges to be computed on an "as incurred" basis and paid directly to the utilities provider.

2.3.10 For the avoidance of doubt, the developer or owner shall not require the licensee to bear any utility charges incurred prior to the commencement date referred to in paragraph 2.3.7.

2.4 SPACE AND FACILITIES FOR EXCLUSIVE USE OF LICENSEES

2.4.1 All space and facilities required to be provided under this Code or any previous codes shall be for the exclusive use of licensees.

2.4.2 The developer or owner of a development shall not use the relevant space and facilities for any other telecommunication purposes or otherwise, unless prior consent and approval from the Authority.

2.4.3 The developer or owner of a development shall not use the relevant space and facilities for the storage of any items whatsoever.

2.5 CONTINUING OBLIGATION TO PROVIDE ACCESS TO AND USE OF THE RELEVANT SPACE AND FACILITIES

2.5.1 The developer or owner of a development shall, upon reasonable notice being given by a licensee, grant the licensee access to and use of the space and facilities provided pursuant to this Code or any previous codes, for the licensee to inspect, install, maintain, repair and upgrade its installation, plant or system. Where the developer or owner objects to the licensee's intended access to and use of the space and facilities, the developer or owner shall raise its objection to the licensee within the stipulated timeframe in the notification and state the reasons for its objection. For the avoidance of doubt, the developer or owner shall ensure that its own internal processes do not cause any undue delay to the grant of such access under this paragraph 2.5.1.

2.5.2 Without prejudice to the generality of paragraph 2.5.1, the developer or owner shall, where it installs a false ceiling obstructing or covering any access to the relevant space and

facilities (e.g. cable trays and metal trunking), provide appropriate access panels or openings.

2.5.3 The obligation of the developer or owner to provide access shall include removing and/or opening any temporary or permanent structures which are obstructing the licensee's access to the relevant space and facilities, at no cost to the licensee.

2.5.4 Where the developer or owner requires the licensee to submit any proposal for cabling works based on the relevant building plans, floor plans or blueprints, the developer or owner shall provide the licensee with at least one (1) set of the relevant building plans, floor plans or blueprints, at no cost to the licensee.

2.5.5 Where the relevant space and facilities are located at a height of more than four (4) meters above floor level, the developer or owner shall provide the necessary means for the licensee to access such space and facilities in accordance with prevailing legislation or regulatory requirements on workplace safety and health, at no cost to the licensee. For the avoidance of doubt, this provision does not exempt any party from its relevant obligations under the prevailing legislation or regulatory requirements on workplace safety and health.

2.5.6 The developer or owner shall not impose any charge or rent on the licensee (e.g. administrative charges, security escort charges, costs to reinstate access panels or openings) or impose any additional requirements on the licensee (e.g. requiring any insurance policy or additional insurance coverage to be taken) in connection with the grant of access to and use of the space and facilities under paragraph 2.5.1. Without prejudice to the foregoing, the developer or owner may require that a licensee place a deposit in connection with any upgrading, installation or removal works to be carried out by the licensee at the relevant space and facilities, provided that such deposit meets the following requirements:

(a) the deposit must be refundable (subject to any deductions based on reasonable criteria that have been made known to the licensee in advance);

(b) the deposit must be refunded to the licensee promptly after completion of the upgrading, installation or removal works; and

(c) the deposit must be of a reasonable amount, taking into consideration the scope of the installation works.

2.6 CONTINUING OBLIGATION TO MAINTAIN THE RELEVANT SPACE AND FACILITIES

2.6.1 The developer or owner of a development shall, in relation to the space and facilities provided pursuant to this Code or any previous codes, at his own expense –

(a) maintain the relevant space and facilities in a condition that is fit for the purpose of its use;

(b) repair any part of the relevant space and facilities that falls into disrepair or is damaged unless such damage is caused by a licensee in which case the developer or owner may require the licensee, and the licensee shall be obliged, to carry out the necessary repairs (at the licensee's cost); and

(c) implement reasonable measures to safeguard the security of the relevant space and facilities.

2.7 OBLIGATION TO SEAL UNDERGROUND PIPES

2.7.1 Every developer or owner of a development who has provided or will be providing ventilation for the telecommunication room by way of air-conditioning (or in any case where such room is enclosed with no louvers, exhaust fans or their equivalent) shall ensure that all unused underground pipes are sealed by the timeframe specified in **Table 3** (based on the stage of completion of construction of the development) at the point of entry into such room, with a material that is durable, can be easily removed, and will not cause damage to the underground pipes or any telecommunication cables that may be used in the underground pipes, such that no foreign gaseous matter (which may be toxic or flammable) will pass through the underground pipes into such room.

Table 3: Timeframe for sealing of unused underground pipes by developer or owner

Stage of completion of construction	Timeframe for sealing
Buildings and developments under construction as at the Effective Date and the temporary certificate of fitness for occupation has not been issued	Prior to issuance of the temporary certificate of fitness for occupation
Buildings and developments that have been issued with the temporary certificate of fitness for occupation as at the Effective Date	Within 2 years of the Effective Date
New buildings and new developments	Prior to issuance of the temporary certificate of fitness for occupation

CHAPTER 3. SUBMISSION OF INFORMATION BY THE DEVELOPER OR OWNER

3.1 OBJECTIVE

3.1.1 The objective of this segment is to specify the requirements to be observed by the developer or owner of a development who is required to provide space and facilities under this Code.

3.2 SCOPE

3.2.1 The document covers the requirements where a development has been granted provisional or written permission for its construction by the competent authority under the "BUILDING Guidelines and Requirements PBD 12 : 2017 Fourth Edition : 2017 from the Ministry of Development" on or after the Effective Date, the developer or owner shall ensure that the building plans for the development fully and accurately incorporate the requirements of this Code before construction commences.

3.3 SUBMISSION OF BUILDING PLANS TO THE AUTHORITY FOR BUILDING CONTROL AND CONSTRUCTION INDUSTRY ("ABCi")

3.3.1 The developer or owner shall submit the building plans to the Authority for Building Control and Construction Industry ("ABCi") during the planning stage of the development together with the following information:

(a) the name and contact details (including contact number and address) of the developer or owner;

(b) the names and contact details (including contact numbers and addresses) of the consultants and contractors engaged for the building works, including the architect, the M&E consultant and building contractors;

(c) the location of the development;

(d) the proposed number of units and the usable floor area;

(e) the intended use of the development;

(f) the estimated commencement and completion dates of the building works; and

(g) the house or unit numbering plan.

3.3.2 In addition to the information required in paragraph 3.3.1, the developer or owner shall submit –

(a) the site plan indicating the location of the proposed development; and

(b) building plans indicating the space and facilities (excluding mobile deployment space) provided for the development as specified in Chapters 7 to 10 of this Code (as the case may be).

3.3.3 The building plans, including the softcopy of drawings and cover letter detailing the information required under paragraphs 3.3.1 and 3.3.2, shall be submitted in hardcopies and softcopy via a compact disc (CD) to the ABCi.

CHAPTER 4. DEVELOPMENT CONSISTING OF ONE (1) OR MORE RESIDENTIAL SINGLE DWELLING UNIT (SDU) BUIDLINGS

4.1 OBJECTIVE

4.1.1 The objective of this segment is to specify the space and facilities to be provided for a development consisting of one (1) or more residential single dwelling unit (SDU) buildings. The Authority reserves the right to require any developer or owner to provide additional space and facilities, to meet the demand for telecommunication services where necessary.

4.2 SCOPE

4.2.1 The document covers on the system infrastructure requirement, space and facilities to be provided for a development consisting of one (1) or more residential single dwelling unit (SDU) buildings to be constructed by the developer or owner, as well as the minimum installation guidelines and standards.

4.3 BUILDING TYPE

4.3.1 **Detached Houses or Bungalows**

In general, the character of detached houses and bungalows is a free-standing residential building of moderate density where the structure does not share an inside wall with any other house or dwelling. It has only outside walls and does not touch any other dwelling. Each two (2) houses have definite distance.

4.3.2 **Semi-detached Houses**

In general, the character of semi-detached houses is a residential house with two (2) units sharing a common wall, connected uprightly and up to three (3) levels of floor. Complete and befit for family residence.

4.3.3 **Terrace Houses**

In general, the character of terrace houses is medium density, each unit connected to each other in one line of not less than three (3) residential units and up to three (3) levels of floor. The quantity of one line normally six (6) or above, every two (2) line regarded as one (1) row.

4.3.4 **General housing and ancillary businesses (mixed-use building)**

In general, the character of general housing and ancillary businesses is the utilization of a single building as a residential unit as the main usage and small business as a secondary means on a piece of land.

4.4 PROVISION OF LEAD-IN PIPES AND UNDERGROUND PIPES

4.4.1 Subject to paragraph 4.4.2, every single dwelling unit shall be provided, at the minimum, with –

(a) one (1) lead-in pipe for a telecommunication (copper and optical fibre cables) system which shall extend from the boundary of the house to the adjoining road, to

a point within 1 m on the access reserve beyond the roadside drain located immediately outside the house;

(b) one (1) underground pipe for a telecommunication (copper and optical fibre cables) system which shall connect from the lead-in pipes at the boundary of the house and run to the front or back wall of the house, terminating at the Termination Box (TB) at outside of the wall; and

(c) one (1) draw rope shall be provided in the every lead-in pipe and underground pipe designated for a telecommunication system.

4.4.2 Where there is one (1) or more existing pipe running from outside the development into the development, and the developer or owner intends to redevelop the development, the developer or owner shall provide the underground pipes required in paragraph 4.4.1, such that they are connected to the existing pipe running into the development as specified in **Table 4**, and the developer or owner shall also provide a reduced number of lead-in pipes as specified in **Table 4**.

Table 4: Manner in which new underground pipes are to be connected and number of new lead-in pipes to be provided

Number of existing pipes	Manner in which new underground pipes are to be connected	Number of new lead-in pipes to be provided
1	1 of the new underground pipes shall be connected to the existing pipe, and 1 of the new underground pipes shall be unconnected	1
2	All 2 of the new underground pipes shall be connected to the 2 existing pipes	0

4.4.3 For the purposes of paragraphs 4.4.1 and 4.4.2, all lead-in pipes and underground pipes shall be made of unplasticised polyvinyl chloride (uPVC) material with a nominal diameter of 50 mm and be compliant with the British Standards BS 3506.

4.4.4 In addition to the requirements set out in paragraph 4.4.1 to 4.4.3, all lead-in pipes and underground pipes shall be provided in accordance with the requirements set out in Chapter 7 of this Code.

4.5 PROVISION OF CONDUITS TO EACH RESIDENTIAL UNIT

4.5.1 Every single dwelling unit shall be provided, at the minimum, with –

(a) one (1) conduit of a minimum size of 20 mm in diameter for a telecommunication (copper and optical fibre cable) system which shall run from the Termination Box (TB) into each single dwelling unit, and terminating at the Access Termination Box (ATB) located at the adjacent wall or on the utility room or closet; and

(b) one (1) conduit of a minimum size of 20 mm in diameter for a telecommunication (spare) system which shall run from which shall run from the termination box (TB) into each single dwelling unit, and terminating at the Access Termination Box (ATB) located at the adjacent wall or on the utility room or closet. (optional)

4.5.2 The conduit is required for laying the cable inside the building and acts as the protection and cable guide. The bending radius of the conduit must be greater than ten (10) times of the conduit size to ensure that the optical fibre cable meet the minimum bending radius. The conduit must be made from PVC or harder type of conduit with minimum 20 mm diameter. All conduits or cable enclosure need to be completely concealed and should not protrude so as to reduce the aesthetics within or outside the premise.

4.6 PROVISION OF CABLES IN THE CONDUIT

4.6.1 With regards to the conduit referred in paragraphs 4.5.1 and 4.5.2 -

(a) a minimum of one (1) 2-core of internal optical fibre cable complying with ITU-T G.657.A2 specifications shall be provided in the conduit designated for an optical fibre cable system, which shall terminate into a Termination Box (TB), located at either at the front or back of the outside wall of the house, with a minimum of one (1) set of SC/APC connector at one end and into an Access Termination Box (ATB), with a minimum of one (1) set of SC/APC connector located in the adjacent wall or in the utility room/closet at the other end.

The two (2)-core optical fibre cable, SC/APC connector, Termination Box (TB) and Access Termination Box (ATB) shall be provided in accordance with the requirements set out in Chapter 10 of this Code; and

(b) one (1) draw rope shall be provided in the conduit designated for a telecommunication system. (optional)

4.7 PROVISION OF INTERNAL TELECOMMUNICATION WIRING

4.7.1 Every single dwelling unit shall be provided, at the minimum, with -

(a) unshielded twisted pair cable(s) (Category 6 or better) complying with TIA 568-C specifications to the master bedroom, which shall terminate into an RJ-45 patch panel (which may be located in the utility room or closet; or adjacent to the Access Termination Box (ATB) at one end, and into an RJ-45 outlet in the master bedroom at the other end. The length of each unshielded twisted pair cable shall not exceed 90 m; and

(b) unshielded twisted pair cable(s) (Category 6 or better) complying with TIA 568-C specifications to the main living room, which shall terminate into an RJ-45 patch panel (which may be located in the utility room or closet; or adjacent to the Access Termination Box (ATB) at one end, and into an RJ-45 outlets in the main living room at the other end. The length of each unshielded twisted pair cable shall not exceed 90 m.

4.8 PROVISION OF ELECTRICAL SWITCH SOCKET OUTLET

4.8.1 Every single dwelling unit shall be provided with a minimum of one (1) 13 A electrical switch socket outlet, which shall be placed adjacent to the Access Termination Box (ATB) referred to on paragraph 4.6.1(a).

4.9 RELEVANT SPACE AND FACILITIES TO BE READY THREE (3) MONTHS PRIOR TO THE DATE OF ISSUANCE OF THE CERTIFICATE OF FITNESS FOR OCCUPATION BY THE RELEVANT AUTHORITY

4.9.1 Where the developer or owner wishes to have telecommunications services provided to the development commencing from the date of issuance of the certificate of fitness for occupation permit by the relevant authority, the developer or owner shall ensure that the relevant space and facilities (e.g. underground and lead-in pipes) are ready for use by the licensees at least three (3) months before.

4.10 GUIDELINES FOR SDU

4.10.1 For detailed descriptions and specifications of the space and facilities in regards to the development for the single dwelling unit (SDU), the guidelines titled **"Annex 1 – Implementation Guidelines for In-buildings Optical Fibre Cablings for General Housing Development 2015"** shall be read in conjunction with this Code.

4.10.2 Developers and owners should refer to the guidelines for the technical specifications of the space and facilities to be provided under this Code and the recommended practices in relation to the construction thereof.

CHAPTER 5. DEVELOPMENT CONSISTING OF ONE (1) OR MORE RESIDENTIAL MULTI DWELLING UNIT (MDU) BUILDINGS

5.1 OBJECTIVE

5.1.1 The objective of this segment is to specify the space and facilities to be provided for a development consisting of one (1) or more residential multi dwelling units (MDU) buildings. The Authority reserves the right to require any developer or owner to provide additional space and facilities, to meet the demand for telecommunication services where necessary.

5.2 SCOPE

5.2.1 The document covers on the system infrastructure requirement, space and facilities to be provided for a development consisting of one (1) or more residential multi dwelling units (MDU) buildings to be constructed by the developer or owner, as well as the minimum installation guidelines and standards.

5.3 BUILDING TYPE

5.3.1 **Apartments and condominiums**

In general, the character of an apartment or a condominium is a new purpose-built self-contained residential unit that occupies only part of a building. Telecommunication Room is made available and located at the basement or ground floor of the building.

5.3.2 **Walk-Up Flats**

In general, the character of walk-up flats is an apartment in a building without an elevator. They consist of a number of residential units which is self-contained and occupies only part of a building. Walk-up flats are up to four (4) levels, in which the ground floor could be used as a parking area or, occupied as residential units. Telecommunication Room is made available and located at the basement or ground floor of the building.

5.3.3 **Shop Houses**

In general, the character of shop houses is a vernacular architectural building type, mostly two or three stories high, with a shop on the ground floor for mercantile activity and a residence above the shop. Most shop houses are low rise buildings. Telecommunication Room is made available and located at the ground floor of the building.

5.4 MULTI DWELLING UNIT (MDU) CLASSIFICATION

5.4.1 **Low Rise:**

In general, an average of more than four (4) to twenty-four (24) residential units located on less than four (4) floors in a building.

5.4.2 **Medium Rise:**

In general, an average of twelve (12) to forty-eight (48) residential units located on four (4) to eight (8) floors in a building.

5.4.3 **High Rise:**

In general, more than forty-eight (48) residential units located on more than eight (8) floors in a building.

5.5 PROVISION OF TELECOMMUNICATION ROOMS

5.5.1 A telecommunication room shall be provided in every residential multi dwelling units (MDU) building within a relevant development that has a total of more than ten (10) residential units, except where such building already houses a main distribution frame room. Where:

(a) there is no basement level or a single basement level in the residential multi dwelling units building, the telecommunication room shall be located on the ground floor or first level of the residential multi dwelling units building; or

(b) there are multiple basement levels, the telecommunication room shall be located:

i. on the ground floor or first level; or

ii. on the uppermost basement level provided that:

(A) in the event of flooding in the telecommunication room leading to an outage in the provision of telecommunication services supplied to the relevant residential multi dwelling building(s), the developer or owner shall bear all costs incurred by the relevant licensee in restoring the telecommunication services except that where the relevant licensee is restoring such services to the development and external properties, the developer or owner shall only be obliged to bear a reasonable proportion of such costs to the extent that such restoration affects services provided to the development;

(B) in the event of flooding in the telecommunication room leading to damage caused to any installation, plant or system of any licensee by the flooding, the developer or owner shall bear all costs incurred by the relevant licensee in replacing such damaged installation, plant or system of the licensee except that where such damaged installation, plant or system is also deployed by the licensee to serve external properties, the developer or owner shall only be obliged to bear a reasonable proportion of such costs attributable to the provision of telecommunication services to serve the development; and

(C) in the event of flooding in the telecommunication room leading to an outage in the provision of telecommunication services supplied to the relevant residential multi dwelling units building(s) and/or damage caused to any licensee's installation, plant or system, the developer or owner shall:

I. promptly notify the residents of the development that telecommunication services may be affected as a result of such event; and

II. relocate the telecommunication room to another location in the ground floor or first level of the relevant residential multi dwelling units building(s) and bear all costs in connection therewith except that where the installation, plant or system is deployed by the licensee at the telecommunication room to serve external properties, the developer or owner shall only be obliged to bear a reasonable proportion of such costs attributable to the provision of telecommunication services to the development.

5.5.2 The size of the telecommunication room to be provided under paragraph 5.5.1 shall be based on the total number of residential units in the residential multi dwelling units building, as specified in **Table 5**.

Table 5: Sizes of the telecommunication room to be provided in each residential multi dwelling units building

Total number of residential units in the residential MDU building	Minimum floor area of the telecommunication room (m^2)	Minimum height of the telecommunication room (m)
11 to 24	4	3.5
25 to 60	5	
61 to 120	6	
121 to 200	8	
201 to 400	10	

5.5.3 Where the floor area to be provided for the telecommunication room is up to and including 6 m^2, the minimum width of the telecommunication room shall be 2 m. The ratio of the length and width to be provided for a telecommunication room with a floor area of 8 m^2 or greater shall be between 1:1 and 2:1.

5.5.4 Where:

(a) there is no basement level in the residential multi dwelling units building, the developer or owner shall provide underground pipes for each telecommunication room in accordance with paragraphs 5.5.5, 5.5.6 and 5.5.7; and

(b) there is one (1) or more basement level(s) in the residential multi dwelling units building, the developer or owner shall provide:

i. underground pipes for each telecommunication room in accordance with paragraphs 5.5.5, 5.5.6 and 5.5.7; or

ii. a minimum of two (2) cable trays for each telecommunication room in accordance with paragraphs 5.5.8.

5.5.5 The underground pipes referred to in paragraph 5.5.4 shall be in accordance with the quantities specified in **Table 6** below.

Table 6: Number of underground pipes to be provided for the telecommunication room

Total number of residential units in the multi dwelling units building	Minimum number of underground pipes to be provided
11 to 24	4
25 to 60	6
61 to 200	8
201 to 400	10

5.5.6 When entering the telecommunication room, the underground pipes referred to in paragraph 5.5.5 shall be configured in accordance with the formation specified in **Table 7**.

Table 7: Pipe formation in the telecommunication room

Total number of residential units in the residential multi dwelling units building	Pipe formation in the telecommunication room
≤ 24	2 x 2
25 to 60	2 x 3
61 to 200	2 x 4
201 to 400	2 x 5

5.5.7 For the purposes of paragraphs 5.5.1 to 5.5.6, all underground pipes shall be made of unplasticised polyvinyl chloride (uPVC) material with a nominal diameter of 100 mm and be compliant with the British Standards BS 3506.

5.5.8 The cable trays referred to in paragraph 5.5.4 shall include a minimum of one (1) cable tray which shall be used for copper and optical fibre cables.

5.5.9 The developer or owner shall provide for ventilation of the telecommunication room by way of louvers and/or exhaust fans in accordance with the requirements set out in Chapter 8 of this Code.

5.5.10 Three (3) sets of electrical distribution panels operating on 230 V, single phase, 50 Hz power supply connecting to the switch socket outlets shall be provided in the telecommunication room in accordance with paragraphs 5.5.11 and 5.5.12.

5.5.11 Every electrical distribution panel shall contain –

(a) a 30 mA residual current circuit breaker of appropriate electrical current rating and miniature circuit breakers for final circuit connections and to facilitate the installation of electrical meters;

(b) two (2) spare 20 A miniature circuit breakers; and

(c) a single-line diagram in each panel.

5.5.12 Three (3) 2-gang 13A switch socket outlets and three (3) 20 A isolators shall be provided in the telecommunication room, which are to be distributed evenly between the three (3) sets of electrical distribution panels.

5.5.13 Where a standby power generator is provided in the relevant development, the power supply to the telecommunication room shall be connected to such standby power generator.

5.5.14 Natural and/or electrical lighting shall be provided in the telecommunication room.

5.5.15 A clean earth of 1 Ω or less (without the use of salt) shall be provided for the exclusive use of licensees' installation, plant or system in the telecommunication room. The clean earth shall be connected directly to:

(a) an independent earth electrode system; and

(b) the development's electrical safety earth system.

5.5.16 The clean earth that is provided pursuant to paragraph 5.5.15 shall be in the form of a pure copper earth bar of at least 300 mm in length, 8 mm in width and 5 mm in thickness, with screw holes that are 6 mm in diameter.

5.5.17 In addition to the requirements set out in paragraphs 5.5.1 to 5.5.16, the telecommunication room shall be provided in accordance with the requirements set out in Chapter 8 of this Code.

5.6 PROVISION OF LEAD-IN PIPES, UNDERGROUND PIPES AND MANHOLES WHERE THERE IS NO BASEMENT IN THE RELEVANT DEVELOPMENT

5.6.1 Continuous lead-in pipes and underground pipes shall be provided for the relevant development as follows –

(a) the lead-in pipes shall extend from the boundary of the development to the adjoining road, to a point within 1 m on the access reserve beyond the roadside drain located immediately outside the development; and

(b) the underground pipes shall connect from the lead-in pipes at the boundary of the development and run to the telecommunication room.

5.6.2 The number of lead-in pipes and underground pipes to be provided under paragraph 5.6.1 shall be in accordance with the quantities specified in **Table 8**.

Table 8: Number of lead-in pipes and underground pipes to be provided for the relevant development with no basement

Total number of residential units in the development	Minimum number of lead-in and underground pipes to be provided
≤ 24	4
25 to 60	6
61 to 200	8
201 to 400	10

5.6.3 The underground pipes shall enter the telecommunication room in accordance with the formation specified in the **Table 9**.

Table 9: Pipe formation in the telecommunication room

Total number of residential units in the development	Pipe formation in the telecommunication room
≤ 24	2 x 2
25 to 60	2 x 3
61 to 200	2 x 4
201 to 400	2 x 5

5.6.4 For the purposes of paragraph 5.6.1, all lead-in pipes and underground pipes shall be made of unplasticised polyvinyl chloride (uPVC) material with a nominal diameter of 100 mm and be compliant with the British Standards BS 3506.

5.6.5 In addition to the requirements set out in paragraphs 5.6.1 to 5.6.4, all lead-in pipes and underground pipes shall be provided in accordance with the requirements set out in Chapter 7 of this Code.

5.6.6 Manholes shall be provided in each relevant development as follows –

(a) a manhole shall be constructed at every location where there is effectively an approximately 90° or sharper bend in the direction of the underground pipes; and

(b) a minimum of one (1) manhole must be provided for every 200 m segment of underground pipes laid.

5.6.7 The type of manhole to be provided under paragraph 5.6.6 shall be in accordance with **Table 10** below based on the highest number of underground pipes entering any one side of the manhole.

Table 10: Type of manhole to be provided

Highest number of underground pipes entering any one side of the manhole	Type of manhole to be provided
1 way 100 mm pipe	FJB 0B
1 way 100 mm pipe	FJB 01, FJB 03
≤ 2 way 100 mm pipe	FJB 02, FJB 04
4 to 6 way 100 mm pipe	CJB
4 to 8 way 100 mm pipe	STD 1
8 to 12 way 100 mm pipe	STD 2
12 to 24 way 100 mm pipe	STD 4

5.6.8 In addition to the requirements set out in paragraphs 5.6.6 to 5.6.7, all manholes shall be provided in accordance with the requirements set out in Chapter 7 of this Code.

5.7 PROVISION OF LEAD-IN PIPES, UNDERGROUND PIPES, MANHOLES AND CABLE TRAYS WHERE THERE IS ONE (1) OR MORE BASEMENT LEVEL(S) IN THE DEVELOPMENT

5.7.1 Continuous lead-in pipes and underground pipes shall be provided for the relevant development as follows –

(a) the lead-in pipes shall extend from the boundary of the development to the adjoining road, to a point within 1 m on the access reserve beyond the roadside drain located immediately outside the development; and

(b) the underground pipes shall connect from the lead-in pipes at the boundary of the development and run to the retaining wall of the development.

5.7.2 The number of lead-in pipes and underground pipes to be provided under paragraph 5.7.1 shall be in accordance with the quantities specified in **Table 11** below.

Table 11: Number of lead-in pipes and underground pipes to be provided for the relevant development with 1 or more basement level(s)

Total number of residential units in the development	Minimum number of lead-in and underground pipes to be provided
≤ 24	4
25 to 60	6
61 to 200	8
201 to 400	10

5.7.3 For the purposes of paragraph 5.7.1, all lead-in pipes and underground pipes shall be made of unplasticised polyvinyl chloride (uPVC) material with a nominal diameter of 100 mm and be compliant with the British Standards BS 3506.

5.7.4 A cable duct sealing module system shall be installed at the retaining wall of the relevant development to prevent any ingress of water flowing from the underground pipes into the basement.

5.7.5 In addition to the requirements set out in paragraphs 5.7.1 to 5.7.4, all lead-in pipes and underground pipes shall be provided in accordance with the requirements set out in Chapter 7 of this Code.

5.7.6 Manholes shall be provided in each relevant development as follows –

(a) a manhole shall be constructed at every location where there is effectively an approximately 90° or sharper bend in the direction of the underground pipes; and

(b) at the minimum, one (1) manhole must be provided for every 200 m segment of underground pipes laid.

5.7.7 The type of manhole to be provided under paragraph 5.7.6 shall be in accordance with **Table 12** below based on the highest number of underground pipes entering any one side of the manhole.

Table 12: Types of manhole to be provided

Highest number of underground pipes entering any one side of the manhole	Type of manhole to be provided
1 way 100 mm pipe	FJB 0B
1 way 100 mm pipe	FJB 01, FJB 03
≤ 2 way 100 mm pipe	FJB 02, FJB 04
4 to 6 way 100 mm pipe	CJB
4 to 8 way 100 mm pipe	STD 1
8 to 12 way 100 mm pipe	STD 2
12 to 24 way 100 mm pipe	STD 4

5.7.8 In addition to the requirements set out in paragraphs 5.7.6 to 5.7.7, all manholes shall be provided in accordance with the requirements set out in Chapter 7 of this Code.

5.7.9 A minimum of two (2) cable trays shall be provided from the retaining wall of the relevant development to the telecommunication room, of which a minimum of one (1) cable tray shall be used for copper and optical fibre cables;

5.7.10 The total width of these cable trays shall cover the total cross-sectional width of the underground pipes terminating at the retaining wall.

5.8 PROVISION OF THE TELECOMMUNICATION RISERS

5.8.1 Telecommunication risers shall be provided in every residential multi dwelling units building in the relevant development.

5.8.2 The serving radius of each telecommunication riser shall not exceed 30 m. Each telecommunication riser shall be labeled as “Telecom Riser” and numbered for easy reference and identification.

5.8.3 All telecommunication riser shafts must be constructed in a direct vertical line throughout the building.

5.8.4 The dimensions of each telecommunication riser to be provided under paragraph 5.8.1 shall be based on the total number of residential units to be served by the telecommunication riser, as specified in **Table 13**.

Table 13: Dimensions of the telecommunication riser

Total number of residential units served by a telecommunication riser	Minimum dimensions of each telecommunication riser
≤ 24	900 mm (width) x 600 mm (depth)
> 24	1200 mm (width) x 600 mm (depth)

5.8.5 Every telecommunication riser shall have a door which can be fully opened outwards throughout its entire width for easy access at each floor level. The height of the door shall be at least 2.1 m. The width of the door shall be in accordance with the dimensions specified in **Table 14** below.

Table 14: Minimum width of door of the telecommunication riser

Minimum dimensions of each telecommunication riser	Minimum width of each door of the telecommunication riser
900 mm (width) x 600 mm (depth)	500 mm
1200 mm (width) x 600 mm (depth)	600 mm

5.8.6 All doors of the telecommunication risers shall be locked.

5.8.7 A minimum of two (2) cable trays shall be provided in each telecommunication riser from the ground floor or basement to the topmost level of every residential multi dwelling units building, of which a minimum of one (1) cable tray shall be used for copper and optical fibre cables; and

5.8.8 For the purposes of paragraph 5.8.7, cable trays shall be provided in accordance with the requirements specified in **Table 15**.

Table 15: Width of cable trays in each telecommunication riser

Number of levels (floors) for the residential multi dwelling units buildings	Minimum width of each cable tray where the telecommunication riser has a side wall depth of 600 mm
Cable tray for buildings up to and including 25 floors	300 mm
Cable tray for buildings more than 25 floors and up to and including 50 floors	400 mm

5.8.9 The telecommunication riser openings on every level in each residential multi dwelling units building shall be sealed in accordance with the "BUILDING Guidelines and Requirements PBD 12 : 2017 Fourth Edition : 2017 from the Ministry of Development".

5.8.10 In addition to the requirements set out in paragraphs 5.8.1 to 5.8.9, all telecommunication risers shall be provided in accordance with the requirements set out in Chapter 9 of this Code.

5.9 PROVISION OF CABLE TRAYS FROM THE TELECOMMUNICATION ROOM TO EACH TELECOMMUNICATION RISER

5.9.1 A minimum of two (2) cable trays shall be provided from the telecommunication room of each building to each telecommunication riser, of which a minimum of one (1) cable tray shall be used for copper and optical fibre cables; and in accordance with the requirements specified in **Table 16**.

Table 16: Width of cable trays to be provided from the telecommunication room to each telecommunication riser

	Minimum width of each cable tray where the telecommunication riser serves ≤ 24 residential units	Minimum width of each cable tray where the telecommunication riser serves > 24 residential units
Cable tray (for copper and optical fibre cables)	300 mm	400 mm

5.10 PROVISION OF CONDUITS FROM THE TELECOMMUNICATION RISERS TO EACH RESIDENTIAL UNIT

5.10.1 Every residential unit in the relevant development shall be provided, at the minimum, with –

(a) one (1) conduit of a minimum size of 20 mm in diameter for a telecommunication (copper and optical fibre cable) system which shall run from the telecommunication riser into the residential unit, and terminating at the Access Terminal box (ATB) located in the utility room or closet, or in the main living room; and

(b) one (1) conduit of a minimum size of 20 mm in diameter for a telecommunication (spare) system which shall run from the telecommunication riser into the residential unit, and terminating at the Access Termination Box (ATB) located in the utility room or closet, or in the main living room. (optional)

5.11 PROVISION OF CABLES IN THE CONDUITS

5.11.1 With regard to the conduits referred to in paragraph 5.10.1. –

(a) a minimum of one (1) 2-core of internal optical fibre cable complying with ITU-T G.657.A2 specifications shall be provided in the conduit designated for an optical fibre cable system, which shall terminate into a Fibre Distribution Terminal (FDT), located in the telecommunication riser at one end, and into an Access Termination Box (ATB) with one (1) set of SC/APC connector located in the utility room or closet, or in the main living room at the other end.

The two (2)-core optical fibre cable, SC/APC connector, Fibre Distribution Terminal (FDT) and Access Termination Box (ATB) shall be provided in accordance with the requirements set out in Chapter 10 of this Code; and

(b) one (1) draw rope shall be provided in the conduit designated for a telecommunication system. (optional)

5.12 PROVISION OF INTERNAL TELECOMMUNICATION WIRING

5.12.1 Every residential unit shall be provided, at the minimum, with –

(a) Unshielded twisted pair cable(s) (Category 6 or better) complying with TIA 568-C specifications to the master bedroom, which shall terminate into an RJ-45 patch panel (which may be located in the utility room or closet; or adjacent to the Access Termination Box (ATB)) at one end, and into an RJ-45 outlet in the master bedroom at the other end. The length of each unshielded twisted pair cable shall not exceed 90 m; and

(b) unshielded twisted pair cable(s) (Category 6 or better) complying with TIA 568-C specifications to the main living room, which shall terminate into an RJ-45 patch panel (which may be located in the utility room or closet; or adjacent to the Access Termination Box (ATB)) at one end, and into an RJ-45 outlets in the main living room at the other end. The length of each unshielded twisted pair cable shall not exceed 90 m.

5.13 PROVISION OF ELECTRICAL SWITCH SOCKET OUTLET

5.13.1 Every residential unit shall be provided with a minimum of one (1) 13 A electrical switch socket outlet which shall be placed adjacent to the Access Termination Box (ATB) referred to in paragraph 5.11.1(a).

5.14 PROVISION OF MOBILE DEPLOYMENT SPACE

5.14.1 If the relevant development consists of sixty (60) or more residential units, the developer or owner shall, where required and notified by any mobile telecommunication licensee, provide within a reasonable time, mobile deployment space in accordance with the dimensions specified in **Table 17** based on the total number of residential units in the development.

Table 17: Mobile deployment space to be provided in each relevant development

Total number of residential units in the development	Mobile deployment space (m^2)		Minimum height of mobile deployment space (m)
	Where the mobile deployment space is provided as a single space	Where the mobile deployment space is provided as two or more separate spaces	
60 to 200	18	24*	3.5
201 to 400	36*		
< 401	54*		

* Size of each disaggregated MDS shall be at least 8 m^2

5.14.2 The developer or owner may locate the mobile deployment space to be provided under paragraph 5.14.1 at any unused space in the development (e.g. carpark and roof top), subject to the additional requirements provided in paragraph 5.14.3 and in Chapter 8 of this Code. For the avoidance of doubt, the mobile deployment space shall not be located in the telecommunication room, unless there is sufficient space available after having fulfilled the space requirements of the telecommunication room and there is a clear demarcation of the space designated as mobile deployment space.

5.14.3 Where:

(a) there is no basement level or a single basement level, the mobile deployment space shall be located on the ground floor or first level of the relevant development; and

(b) there are multiple basement levels, the mobile deployment space shall be located:

i. on the ground floor or first level; or

ii. on the uppermost basement level provided that:

(A) in the event of flooding in the mobile deployment space leading to an outage in the provision of public cellular mobile telecommunication services supplied to the development, the developer or owner shall bear all costs incurred by the relevant licensee in restoring the public cellular mobile telecommunication services in the development except that where the relevant licensee is restoring such services to the development and external properties, the developer or owner shall only be obliged to bear a reasonable proportion of such costs attributable to

the provision of public cellular mobile telecommunication services to the development;

(B) in the event of flooding in the mobile deployment space leading to damage caused to any installation, plant or system of any licensee by the flooding, the developer or owner shall bear all costs incurred by the relevant licensee in replacing such damaged installation, plant or system of the licensee except that where such damaged installation, plant or system is also deployed by the licensee to serve external properties, the developer or owner shall only be obliged to bear a reasonable proportion of such costs attributable to the provision of public cellular mobile telecommunication services to the development;

(C) in the event of flooding in the mobile deployment space leading to an outage in the provision of public cellular mobile telecommunication services supplied to the development and/or damage caused to any licensee's installation, plant or system, the developer or owner shall:

I. promptly notify the residents of the development that public cellular mobile telecommunication services may be affected as a result of such event; and

II. relocate the mobile deployment space to another location in the ground floor or first level of the development and bear all costs in connection therewith except that where the installation, plant or system is also deployed by the licensee at the mobile deployment space to serve external properties, the developer or owner shall only be obliged to bear a reasonable proportion of such costs attributable to the provision of public cellular mobile telecommunication services to the development.

5.14.4 The developer or owner shall, at its own cost, comply with any legislation or regulatory requirements in connection with the provision of the mobile deployment space (e.g. obtaining the relevant approvals for conversion of car park lots to mobile deployment space, or installation of fencing or trellis).

5.14.5 Where the licensee wishes to install any facilities (e.g. cable trays and power points) required to serve its installation, plant or system at the mobile deployment space, the developer or owner shall provide reasonable assistance to facilitate such installation by the licensee.

5.14.6 If the developer or owner wishes to arrange for telecommunication mobile coverage for the relevant development prior to the date of issue of the temporary certificate of fitness for occupation permit, the developer or owner may refer to **Annex 1 – Implementation Guidelines for In-buildings Optical Fibre Cablings for General Housing Development 2015.**

5.15 PROVISION OF ACCESS TO AND USE OF THE RELEVANT SPACE AND FACILITIES

5.15.1 The developer or owner of a development shall, upon reasonable notice being given by a licensee, grant the licensee access to and use of the space and facilities provided pursuant to this Code or any previous codes, for the licensee to inspect, install, maintain, repair and upgrade its installation, plant or system. For the avoidance of doubt, the developer or owner shall ensure that its own internal processes do not cause any undue delay to the grant of such access under this paragraph 5.15.1.

5.15.2 Without prejudice to the generality of paragraph 5.15.1, the developer or owner shall, where it installs a false ceiling obstructing or covering any access to the relevant space and facilities (e.g. cable trays), provide appropriate access panels or openings.

5.15.3 The obligation of the developer or owner to provide access shall include removing and/or opening any temporary or permanent structures which are obstructing the licensee's access to the relevant space and facilities, at no cost to the licensee.

5.15.4 Where the developer or owner requires the licensee to submit any proposal for cabling works based on the relevant building plans, floor plans or blueprints, the developer or owner shall provide the licensee with at least one (1) set of the relevant building plans, floor plans or blueprints, at no cost to the licensee.

5.15.5 Where the relevant space and facilities are located at a height of more than 4 m above floor level, the developer or owner shall provide the necessary means for the licensee to access such space and facilities in accordance with prevailing legislation or regulatory requirements on workplace safety and health, at no cost to the licensee. For the avoidance of doubt, this provision does not exempt any party from its relevant obligations under the prevailing legislation or regulatory requirements on workplace safety and health.

5.15.6 The developer or owner shall not impose any charge or rent on the licensee (e.g. administrative charges, security escort charges, reinstatement costs) or impose any additional requirements on the licensee (e.g. requiring any insurance policy or additional insurance coverage to be taken) in connection with the grant of access to and use of the space and facilities under paragraph 5.15.1. Without prejudice to the foregoing, the developer or owner may require that a licensee place a deposit in connection with any upgrading, installation or removal works to be carried out by the licensee at the relevant space and facilities, provided that such deposit meets the following requirements:

(a) the deposit must be refundable (subject to any deductions based on reasonable criteria that have been made known to the licensee in advance);

(b) the deposit must be refunded to the licensee promptly after completion of the upgrading, installation or removal works; and

(c) the deposit must be of a reasonable amount, taking into consideration the scope of the installation works.

5.16 RELEVANT SPACE AND FACILITIES TO BE READY SIX (6) MONTHS PRIOR TO THE DATE OF ISSUANCE OF THE CERTIFICATE OF FITNESS FOR OCCUPATION PERMIT BY THE RELEVANT AUTHORITY

5.16.1 Where the developer or owner wishes to have telecommunications services (including public cellular mobile telecommunication services) provided to the development commencing from the date of issuance of the certificate of fitness for occupation permit by the relevant authority, the developer or owner shall ensure that the relevant space and facilities (e.g. mobile deployment space, telecommunication room, telecommunications risers and lead-in pipes) are ready for use by the licensees at least six (6) months before.

5.17 GUIDELINES FOR MDU

5.17.1 For detailed descriptions and specifications of the space and facilities in regards to the development for the multi dwelling unit (MDU), the guidelines titled **"Annex 1 – Implementation Guidelines for In-buildings Optical Fibre Cablings for General Housing Development 2015"** shall be read in conjunction with this Code.

5.17.2 Developers and owners should refer to the guidelines for the technical specifications of the space and facilities to be provided under this Code and the recommended practices in relation to the construction thereof.

CHAPTER 6. DEVELOPMENT CONSISTING OF ONE (1) OR MORE NON-RESIDENTIAL BUILDINGS (NRB)

6.1 OBJECTIVE

6.1.1 The objective of this segment is to specify the space and facilities to be provided for a development consisting of one (1) or more non-residential buildings. The Authority reserves the right to require any developer or owner to provide additional space and facilities, to meet the demand for telecommunication services where necessary.

6.2 SCOPE

6.2.1 The document covers on the system infrastructure requirement, space and facilities to be provided for a development consisting of one (1) or more non-residential buildings, to be constructed by the developer or owner, as well as the minimum installation guidelines and standards.

6.3 BUILDING TYPE

6.3.1 In general, any non-residential buildings, which deem qualifies in these segment of this Code. Telecommunication Room is made available and located at the basement or ground floor of the building.

6.4 PROVISION OF THE TELECOMMUNICATION ROOMS

6.4.1 A minimum of one (1) main telecommunication room shall be provided in every relevant development. Where:

(a) there is no basement level or a single basement level, the telecommunication room shall be located on the ground floor or first level of the relevant development; or

(b) there are multiple basement levels, the telecommunication room shall be located:

i. on the ground floor or first level; or

ii. on the uppermost basement level provided that:

(A) in the event of flooding in the telecommunication room leading to an outage in the provision of telecommunication services supplied to the development, the developer or owner shall bear all costs incurred by the relevant licensee in restoring the telecommunication services in the development except that where the relevant licensee is restoring such services to the development and external properties, the developer or owner shall only be obliged to bear a reasonable proportion of such costs attributable to the provision of telecommunication services to the development;

(B) in the event of flooding in the telecommunication room leading to damage caused to any installation, plant or system of any licensee by the flooding, the developer or owner shall bear all costs incurred by the relevant licensee in replacing such damaged installation, plant or system

of the licensee except that where such damaged installation, plant or system is also deployed by the licensee to serve external properties, the developer or owner shall only be obliged to bear a reasonable proportion of such costs attributable to the provision of telecommunication services to the development; and

(C) in the event of flooding in the telecommunication room leading to an outage in the provision of telecommunication services supplied to the development and/or damage caused to any licensee's installation, plant or system, the developer or owner shall:

I. promptly notify the tenants of the development that telecommunication services may be affected as a result of such event; and

II. relocate the telecommunication room to another location in the ground floor or first level of the development and bear all costs in connection therewith except that where the installation, plant or system is also deployed by the licensee at the telecommunication room to serve external properties, the developer or owner shall only be obliged to bear a reasonable proportion of such costs attributable to the provision of telecommunication services to the development.

6.4.2 The size of the telecommunication room to be provided under paragraph 6.4.1 shall be based on the total usable floor area of the non-residential building in the relevant development, as specified in **Table 18**.

Table 18: Total size of telecommunication room to be provided in each relevant development

Total usable floor area in the development ('000 m^2)	Minimum total floor area of the telecommunication room (m^2)	Minimum height of the telecommunication room (m)
up to 2	6	3.5
> 2 to 5	12	
> 5 to 12	20	
> 12 to 25	30	
> 25 to 50	40	
> 50 to 75	60	
> 75 to 100	80	
> 100 to 125	100	
> 125 to 150	120	
> 150 to 175	140	
> 175 to 200	160	

6.4.3 Where the usable floor area of the relevant development exceeds 50,000 m^2, two (2) or more telecommunication room shall be provided to facilitate cable distribution by licensees. The total combined size of the telecommunication rooms shall be no less than the minimum size specified in **Table 18** based on the relevant usable floor area, and each telecommunication room shall be no smaller than 12 m^2.

6.4.4 The developer or owner shall, in accordance with the requirements set out in Chapter 8 of this Code, provide for ventilation of the telecommunication room by way of:

(a) air-conditioning from the central system (where central air-conditioning system is provided in the relevant development); or

(b) louvers and/or exhaust fans.

6.4.5 Three (3) sets of electrical distribution panels operating on 230 V, single phase, 50 Hz power supply connecting to switch socket outlets and isolators shall be provided in the telecommunication room in accordance with paragraphs 6.4.6 and 6.4.7.

6.4.6 Every electrical distribution panel shall contain –

(a) a 30 mA residual current circuit breaker of appropriate electrical current rating and miniature circuit breakers for final circuit connections and to facilitate the installation of electrical meters;

(b) two (2) spare 20 A miniature circuit breakers; and

(c) a single-line diagram in each panel.

6.4.7 Switch socket outlets and isolators shall be provided in every telecommunication room in accordance with the quantities specified in **Table 19** which are to be distributed evenly between the three (3) sets of electrical distribution panels.

Table 19: Requirements of switch socket outlets and isolators for every telecommunication room in each relevant development

Size of telecommunication room (m^2)	Minimum number of switch socket outlets to be provided in telecommunication room	Minimum number of isolators to be provided in telecommunication room
≤ 30	3 x 2-gang 13 A	6 x 30 A
> 30	3 x 2-gang 13 A	9 x 30 A

6.4.8 Where a standby power generator is provided in the relevant development, the power supply to the telecommunication room shall be connected to such standby power generator.

6.4.9 Where a standby power generator is not provided in the relevant development, the 30 A isolators in the telecommunication room shall be connected to power sockets for connection to portable power generators and equipped with a manually activated switch to effect the changeover.

6.4.10 Natural and/or electrical lighting shall be provided in the telecommunication room.

6.4.11 A clean earth of 1 Ω or less (without the use of salt) shall be provided for the exclusive use of licensees' installation or plant in the telecommunication room. The clean earth shall be connected directly to:

(a) an independent earth electrode system; and

(b) the development's electrical safety earth system.

6.4.12 Where the usable floor area of the development served by a telecommunication room is less than or equal to 25,000 m^2, the clean earth that is provided pursuant to paragraph

6.4.11 shall be in the form of a pure copper earth bar of at least 300 mm in length, 8 mm in width and 5 mm in thickness, with screw holes that are 6 mm in diameter.

6.4.13 Where the usable floor area of the development served by a telecommunication room is more than 25,000 m^2, the clean earth that is provided pursuant to paragraph 6.4.11 shall be in the form of a pure copper earth bar of at least 600 mm in length, 8 mm in width and 5 mm in thickness, with screw holes that are 6 mm in diameter.

6.4.14 In addition to the requirements set out in paragraphs 6.4.1 to 6.4.13, the telecommunication room shall be provided in accordance with the requirements set out in Chapter 8 of this Code.

6.5 PROVISION OF LEAD-IN PIPES, UNDERGROUND PIPES AND MANHOLES WHERE THERE IS NO BASEMENT IN THE DEVELOPMENT

6.5.1 Continuous lead-in pipes and underground pipes shall be provided for the relevant development as follows –

(a) the lead-in pipes shall extend from the boundary of the development to the adjoining road, to a point within 1 meter on the access reserve beyond the roadside drain located immediately outside the development; and

(b) the underground pipes shall connect to the lead-in pipes at the boundary of the development and run to the telecommunication room.

6.5.2 The number of lead-in pipes and underground pipes to be provided under paragraph 6.5.1 shall be in accordance with the quantities specified in **Table 20**.

Table 20: Number of lead-in pipes and underground pipes to be provided for relevant development with no basement

Size of the telecommunication room (m^2)	Minimum number of lead-in and underground pipes to be provided
6	6
> 6 to < 30	8
30 to < 60	10
60 to < 100	12
100 to < 140	16
140 to <160	20
≥ 160	24

6.5.3 The underground pipes shall enter the telecommunication room in accordance with the formation specified in **Table 21**.

Table 21: Pipe formation in the telecommunication room

Size of the telecommunication room (m^2)	Pipe formation in the telecommunication room
6	2 x 3
> 6 to < 30	2 x 4
30 to < 60	2 x 5
60 to < 100	2 x 6
100 to < 140	2 sets of 2 x 4
140 to <160	2 sets of 2 x 5
≥ 160	2 sets of 2 x 6

6.5.4 Where the size of the telecommunication room is 100 m^2 or more, the two (2) sets of underground pipes to be provided in accordance with paragraph 6.5.3 shall enter the telecommunication room in different directions.

6.5.5 For the purposes of paragraph 6.5.1, all lead-in pipes and underground pipes shall be made of unplasticised polyvinyl chloride (uPVC) material with a nominal diameter of 100 mm and be compliant with the British Standard BS 3506.

6.5.6 In addition to the requirements set out in paragraphs 6.5.1 to 6.5.5, all lead-in pipes and underground pipes shall be provided in accordance with the requirements set out in Chapter 7 of this Code.

6.5.7 Manholes shall be provided in each relevant development as follows –

(a) a manhole shall be constructed at every location where there is effectively an approximately 90° or sharper bend in the direction of the underground pipes; and

(b) a minimum of one (1) manhole must be provided for every 200 m segment of underground pipes laid.

6.5.8 The types of manhole to be provided under paragraph 6.5.7 shall be in accordance with **Table 22** based on the highest number of underground pipes entering any one side of the manhole.

Table 22: Types of manhole to be provided

Highest number of underground pipes entering any one side of the manhole	Types of manhole to be provided
1 way 100 mm pipe	FJB 0B
1 way 100 mm pipe	FJB 01, FJB 03
≤ 2 way 100 mm pipe	FJB 02, FJB 04
4 to 6 way 100 mm pipe	CJB
4 to 8 way 100 mm pipe	STD 1
8 to 12 way 100 mm pipe	STD 2
12 to 24 way 100 mm pipe	STD 4

6.5.9 In addition to the requirements set out in paragraphs 6.5.7 to 6.5.8, all manholes shall be provided in accordance with the requirements set out in Chapter 7 of this Code.

6.6 PROVISION OF LEAD-IN PIPES, UNDERGROUND PIPES, MANHOLES AND CABLE TRAYS WHERE THERE IS A BASEMENT IN THE DEVELOPMENT

6.6.1 Continuous lead-in pipes and underground pipes shall be provided for the relevant development as follows –

(a) the lead-in pipes shall extend from the boundary of the development to the adjoining road, to a point within 1 m on the access reserve beyond the roadside drain located immediately outside the development; and

(b) the underground pipes shall connect from the lead-in pipes at the boundary of the development and run to the retaining wall of the development.

6.6.2 The number of lead-in pipes and underground pipes to be provided under paragraph 6.6.1 shall be in accordance with the quantities specified in **Table 23**.

Table 23: Number of lead-in pipes and underground pipes to be provided for relevant development with basement

Size of the telecommunication room (m^2)	Minimum number of lead-in and underground pipes to be provided
6	6
> 6 to < 30	8
30 to < 60	10
60 to < 100	12
100 to < 140	16
140 to <160	20
≥ 160	24

6.6.3 Where the size of the telecommunication room is 100 m^2 or more, half of the underground pipes that run to the retaining wall of the development shall enter the basement from a different direction.

6.6.4 For the purposes of paragraph 6.6.1, all lead-in pipes and underground pipes shall be made of unplasticised polyvinyl chloride (uPVC) material with a nominal diameter of 100 mm and be compliant with the British Standard BS 3506.

6.6.5 A cable duct sealing module system shall be installed at the retaining wall of the development to prevent any ingress of water flowing from the underground pipes into the basement.

6.6.6 In addition to the requirements set out in paragraphs 6.6.1 to 6.6.5, all lead-in pipes and underground pipes shall be provided in accordance with the requirements set out in Chapter 7 of this Code.

6.6.7 Manholes shall be provided in each relevant development as follows –

(a) a manhole shall be constructed at every location where there is effectively an approximately 90° or sharper bend in the direction of the underground pipes; and

(b) a minimum of one (1) manhole must be provided for every 200 m segment of underground pipes laid.

6.6.8 The type of manholes to be provided under paragraph 6.6.7 shall be in accordance with **Table 24** based on the highest number of underground pipes entering any one side of the manhole.

Table 24: Types of manhole to be provided

Highest number of underground pipes entering any one side of the manhole	Types of manhole to be provided
1 way 100 mm pipe	FJB 0B
1 way 100 mm pipe	FJB 01, FJB 03
≤ 2 way 100 mm pipe	FJB 02, FJB 04
4 to 6 way 100 mm pipe	CJB
4 to 8 way 100 mm pipe	STD 1
8 to 12 way 100 mm pipe	STD 2
12 to 24 way 100 mm pipe	STD 4

6.6.9 In addition to the requirements set out in paragraphs 6.6.7 to 6.6.8, all manholes shall be provided in accordance with the requirements set out in Chapter 7 of this Code.

6.6.10 A minimum of two (2) cable trays shall be provided from the retaining wall of the development to each telecommunication room, of which a minimum of one (1) cable tray shall be used for copper and optical fibre cables.

6.6.11 The total width of these cable trays shall cover the total cross-sectional width of the underground pipes terminating at the retaining wall.

6.6.12 Where additional telecommunication rooms are provided, the developer or owner shall consult the Authority on the quantity and size of cable trays to be provided between each telecommunication room, and comply with such requirements as may be imposed by the Authority.

6.7 PROVISION OF TELECOMMUNICATION RISERS

6.7.1 Telecommunication risers shall be provided in every non-residential building in the relevant development.

6.7.2 The serving radius of each telecommunication riser shall not exceed 40 m. Each telecommunication riser shall be labeled as “Telecom Riser” and numbered for easy reference and identification.

6.7.3 All telecommunication riser shafts must be constructed in a direct vertical line throughout the building.

6.7.4 The dimensions of each telecommunication riser to be provided under paragraph 6.7.1 shall be based on the usable floor area of the non-residential building, as specified in **Table 25**.

Table 25: Dimensions of the telecommunication riser

Total usable floor area of the building (per '000 m^2)	Minimum dimensions of the telecommunication riser
≤ 2	600 mm (width) x 450 mm (depth)
> 2 to ≤ 75	1100 mm (width) x 800 mm (depth)
> 75	1600 mm (width) x 800 mm (depth)

6.7.5 Every telecommunication riser shall have a door which can be fully opened outwards throughout its entire width for easy access at each floor level. The height of the door shall be at least 2.1 m. The width of the door shall be in accordance with the dimensions specified in **Table 26** below.

Table 26: Minimum width of door of the telecommunication riser

Minimum dimensions of the telecommunication riser	Minimum width of door of the telecommunication riser
600 mm (width) x 450 mm (depth)	500 mm
1100 mm (width) x 800 mm (depth)	900 mm
1600 mm (width) x 800 mm (depth)	Double leaf door of total minimum width of 1400 mm

6.7.6 All doors of the telecommunication risers shall be locked.

6.7.7 A minimum of two (2) cable trays shall be provided in each telecommunication riser from the bottommost level to the topmost level of every non-residential building, of which a minimum of one (1) cable tray shall be used for copper and optical fibre cables.

6.7.8 For the purposes of paragraph 6.7.7, cable trays shall be provided in accordance with the requirements specified in **Table 27**.

Table 27: Width of cable trays in each telecommunication riser

Total usable floor area of the building (per '000 m^2)	Minimum width of each cable tray where the building has up to and including 25 floors	Minimum width of cable trays where the building has more than 25 floors
≤ 2	300 mm	450 mm
> 2	450 mm	600 mm

6.7.9 The telecommunication riser openings on every level in each non-residential building shall be sealed in accordance with the "BUILDING Guidelines and Requirements PBD 12 : 2017 Fourth Edition : 2017 from the Ministry of Development".

6.7.10 In addition to the requirements set out in paragraphs 6.7.1 to 6.7.9, all telecommunication risers shall be provided in accordance with the requirements set out in Chapter 9 of this Code.

6.8 PROVISION OF CABLE TRAYS FROM THE TELECOMMUNICATION ROOM TO EACH TELECOMMUNICATION RISER

6.8.1 A minimum of two (2) cable trays with a minimum width of 300 mm each for a non-residential building with a total usable floor area of up to and including 2,000 m^2 and 600 mm each for a non-residential building with a total usable floor area of more than 2,000 m^2 shall be provided from the telecommunication room to each telecommunication riser, of which a minimum of one (1) cable tray shall be used for copper and optical fibre cables.

6.8.2 Slots of a minimum height of 300 mm shall be provided in the wall of each telecommunication riser for cable trays to pass through.

6.9 PROVISION OF A CABLE DISTRIBUTION SYSTEM FROM THE TELECOMMUNICATION RISER TO EACH NON-RESIDENTIAL UNIT

6.9.1 A cable distribution system shall be provided to facilitate the laying of copper and optical fibre cables from the telecommunication riser to each non-residential unit. The developer or owner may select an appropriate cable distribution system as described in **Annex 1 – Implementation Guidelines for In-buildings Optical Fibre Cablings for General Housing Development 2015.**

6.10 PROVISION OF MOBILE DEPLOYMENT SPACE

6.10.1 If the relevant development consists of one (1) or more non-residential buildings, the developer or owner shall, where required and notified by any mobile telecommunication licensee, provide within a reasonable time, mobile deployment space in accordance with the dimensions as specified in **Table 28** based on the mobile coverage area in the development. If the relevant development consists of a total mobile coverage area of more than 200,000 m^2, the developer or owner shall consult the Authority on the mobile deployment space to be provided and comply with such requirements as may be imposed by the Authority.

Table 28: Mobile deployment space to be provided in each relevant development

Total mobile coverage area ('000 m^2)	Mobile deployment space (m^2)		Minimum height of mobile deployment space (m)
	Where the mobile deployment space is provided as a single space	Where the mobile deployment space is provided as two or more separate spaces	
> 2 to ≤ 6	18	24*	3.5
> 6 to ≤ 20	36*		
> 20 to ≤ 100	54*		
> 100 to ≤ 200	72*		
> 200	To consult with the Authority		

* Size of each disaggregated Mobile Deployment Space (MDS) shall be at least 8 m^2

6.10.2 The developer or owner may locate the mobile deployment space to be provided under paragraph 6.10.1 at any unused space in the development (e.g. carpark and roof top), subject to the additional requirements provided in paragraphs 6.10.3 to 6.10.4 and in

Chapter 8 of this Code. For the avoidance of doubt, the mobile deployment space shall not be located in the telecommunication room, unless there is sufficient space available after having fulfilled the space requirements of the telecommunication room and there is a clear demarcation of the space designated as mobile deployment space.

6.10.3 Where:

(a) there is no basement level or a single basement level, the mobile deployment space shall be located on the ground floor or first level of the relevant development; and

(b) there are multiple basement levels, the mobile deployment space shall be located:

i. on the ground floor or first level; or

ii. on the uppermost basement level provided that:

(A) in the event of flooding in the mobile deployment space leading to an outage in the provision of public cellular mobile telecommunication services supplied to the development, the developer or owner shall bear all costs incurred by the relevant licensee in restoring the public cellular mobile telecommunication services in the development except that where the relevant licensee is restoring such services to the development and external properties, the developer or owner shall only be obliged to bear a reasonable proportion of such costs attributable to the provision of public cellular mobile telecommunication services to the development;

(B) in the event of flooding in the mobile deployment space leading to damage caused to any installation, plant or system of any licensee by the flooding, the developer or owner shall bear all costs incurred by the relevant licensee in replacing such damaged installation, plant or system of the licensee except that where such damaged installation, plant or system is also deployed by the licensee to serve external properties, the developer or owner shall only be obliged to bear a reasonable proportion of such costs attributable to the provision of public cellular mobile telecommunication services to the development;

(C) in the event of flooding in the mobile deployment space leading to an outage in the provision of public cellular mobile telecommunication services supplied to the development and/or damage caused to any licensee's installation, plant or system, the developer or owner shall:

I. promptly inform the tenants of the development that public cellular mobile telecommunication services may be affected as a result of such event; and

II. relocate the mobile deployment space to another location in the first or higher floor of the development and bear all costs in connection therewith except that where the installation, plant or system is also deployed by the licensee at the mobile deployment space to serve external properties, the developer or owner shall only be obliged to bear a reasonable proportion of such costs

attributable to the provision of public cellular mobile telecommunication services to the development.

6.10.4 Where the relevant development comprises of one (1) or more buildings, any of which has thirty (30) or more floors, the developer or owner shall provide the mobile deployment space in two (2) or more separate spaces, provided that the total space provided meets the relevant mobile deployment space and each separate space is at least 8 m^2 with a minimum width of at least 2 m. In determining the location of such spaces, the developer or owner shall locate them so as to facilitate the provision of public cellular mobile telecommunication services to the whole development.

6.10.5 Subject to paragraph 6.10.4, the developer or owner may provide the mobile deployment space in one (1) or more separate spaces, provided that the total space meets the relevant mobile deployment space and each separate space is at least 8 m^2 with a minimum width of at least 2 m.

6.10.6 The developer or owner shall, at its own cost, comply with any legislation or regulatory requirements in connection with the provision of the mobile deployment space (e.g. obtaining the relevant approvals for conversion of car park lots to mobile deployment space, or installation of fencing or trellis).

6.10.7 Where the licensee wishes to install any facilities (e.g. cable trays and power points) required to serve its installation, plant or system at the mobile deployment space, the developer or owner shall provide reasonable assistance to facilitate such installation by the licensee.

6.11 PROVISION OF ACCESS TO AND USE OF THE RELEVANT SPACE AND FACILITIES

6.11.1 The developer or owner of a development shall, upon reasonable notice being given by a licensee, grant the licensee access to and use of the space and facilities provided pursuant to this Code or any previous codes, for the licensee to inspect, install, maintain, repair and upgrade its installation, plant or system. For the avoidance of doubt, the developer or owner shall ensure that its own internal processes do not cause any undue delay to the grant of such access under this paragraph 6.11.1.

6.11.2 Without prejudice to the generality of paragraph 6.11.1, the developer or owner shall, where it installs a false ceiling obstructing or covering any access to the relevant space and facilities (e.g. cable trays), provide appropriate access panels or openings.

6.11.3 The obligation of the developer or owner to provide access shall include removing and/or opening any temporary or permanent structures which are obstructing the licensee's access to the relevant space and facilities, at no cost to the licensee.

6.11.4 Where the developer or owner requires the licensee to submit any proposal for cabling works based on the relevant building plans, floor plans or blueprints, the developer or owner shall provide the licensee with at least one (1) set of the relevant building plans, floor plans or blueprints, at no cost to the licensee.

6.11.5 Where the relevant space and facilities are located at a height of more than 4 m above floor level, the developer or owner shall provide the necessary means for the licensee to

access such space and facilities in accordance with prevailing legislation or regulatory requirements on workplace safety and health, at no cost to the licensee. For the avoidance of doubt, this provision does not exempt any party from its relevant obligations under the prevailing legislation or regulatory requirements on workplace safety and health.

6.11.6 The developer or owner shall not impose any charge or rent on the licensee (e.g. administrative charges, security escort charges, reinstatement costs) or impose any additional requirements on the licensee (e.g. requiring any insurance policy or additional insurance coverage to be taken) in connection with the grant of access to and use of the space and facilities under paragraph 6.11.1. Without prejudice to the foregoing, the developer or owner may require that a licensee place a deposit in connection with any upgrading, installation or removal works to be carried out by the licensee at the relevant space and facilities, provided that such deposit meets the following requirements:

(a) the deposit must be refundable (subject to any deductions based on reasonable criteria that have been made known to the licensee in advance);

(b) the deposit must be refunded to the licensee promptly after completion of the upgrading, installation or removal works; and

(c) the deposit must be of a reasonable amount, taking into consideration the scope of the installation works.

6.12 RELEVANT SPACE AND FACILITIES TO BE READY SIX (6) MONTHS PRIOR TO THE DATE OF ISSUANCE OF THE CERTIFICATE OF FITNESS FOR OCCUPATION PERMIT BY THE RELEVANT AUTHORITY

6.12.1 Where the developer or owner wishes to have telecommunication services (including public cellular mobile telecommunication services) provided to the development commencing from the date of issuance of the certificate of fitness for occupation permit by the relevant authority, the developer or owner shall ensure that the relevant space and facilities (e.g. mobile deployment space, telecommunication room, telecommunication risers and lead-in pipes) are ready for use by the licensees at least six (6) months before.

6.13 GUIDELINES FOR NRB

6.13.1 For detailed descriptions and specifications of the space and facilities in regards to the development for the non-residential building (NRB), the guidelines titled **"Annex 1 – Implementation Guidelines for In-buildings Optical Fibre Cablings for General Housing Development 2015"** shall be read in conjunction with this Code.

6.13.2 Developers and owners should refer to the guidelines for the technical specifications of the space and facilities to be provided under this Code and the recommended practices in relation to the construction thereof.

CHAPTER 7. LEAD-IN PIPES, UNDERGROUND PIPES AND MANHOLES

7.1 OBJECTIVE

7.1.1 The objective of this segment is to set out the additional requirements for the provision of –

(a) lead-in pipes;

(b) underground pipes; and

(c) manholes.

7.1.2 The quantities of lead-in pipes, underground pipes and manholes specified in this Code are the required to be provided. The Authority reserves the right to require any developer or owner to provide additional lead-in pipes, underground pipes and manholes to meet the demand for telecommunication services where necessary.

7.2 QUALIFIED BUILDERS

7.2.1 Every developer or owner who is required to provide lead-in pipes or an underground pipeline system or both shall ensure that they are constructed by builders who are registered with Development Control Section of the Authority for Building Control and Construction Industry (ABCi), Ministry of Development.

7.3 GENERAL REQUIREMENTS FOR ALL PIPES

7.3.1 Every developer or owner who is required to provide lead-in pipes or underground pipes or both, shall for such purpose –

(a) use only pipes and associated fittings that are made from unplasticised polyvinyl chloride (uPVC) material which are compliant with the British Standard BS 3506 or its equivalent;

(b) use only pipes and associated fittings that are of the grey colour and shall be resistant to ultra violet radiation;

(c) provide all pipes in lengths of not less than 6.0 m as specified in the British Standard BS 3506 or its equivalent;

(d) provide all pipes complete with one (1) fitting per pipe;

(e) ensure that all pipes are clearly, indelibly and continuously marked at intervals of not more than 1.0 m along the length of the pipe using a distinctive colour with the following description –

i. Manufacturer’s identification/100 mm uPVC pipe/Day/Month/Year/BS 3506; or

ii. Manufacturer’s identification/50 mm uPVC pipe/Day/Month/Year/BS 3506; or

(f) ensure that all associated fittings are manufactured by injection moulding method. Details for coupling are shown in **Figure 1**. The fitting shall comply with all tests as specified in the British Standard BS 3506 or its equivalent;

(g) ensure that all associated fittings are of the dimensions and tolerances specified in **Table 29** below;

Table 29: Dimension and tolerance of fittings

Fitting Length	220.0 mm ± 5.0 mm
Internal Diameter	At the edges: 110.5 mm + 0.2 mm − 0.0 mm At the center: 110.0 mm + 0.0 mm − 0.2mm
Wall Thickness	Average Value: 3.5 mm Individual Value: 3.3 mm (min)
Wall thickness for a length of 15 mm from both ends of the fitting shall increase to:	Average Value: 4.5 mm + 0.2 mm Individual Value: 4.0 mm (min)

(h) lay all pipes throughout in a straight run as far as practicable;

(i) join all pipes together using a coating of solvent cement to both fittings and pipes;

(j) where a bend is required to any pipe, use a factory-made bend of nominal diameter of 100 mm and 50 mm as illustrated in **Figure 2 and Figure 3** for 90° upturns and, ensure that the pipe is clipped and flushed against the wall and rises up to a height of 1 m above ground as illustrated in **Figure 4 and Figure 5**;

(k) where a straight pipe reducer is required to reduce the nominal diameter of the pipe from 100 mm to 50 mm, use a pipe reducer in accordance with the specifications shown in **Figure 6**;

(l) construct all pipes located below carriageways at a minimum depth of 1 m;

(m) construct all pipes located below footpaths at a minimum depth of 0.6 m;

(n) ensure that all pipes that are buried in the ground under vehicular access are encased in 50 mm concrete surround of Grade 20 or equivalent;

(o) provide a nylon/polyethylene pulling rope in every pipe to facilitate cable pulling;

(p) cap the unconnected ends of all pipes with rubber caps to prevent entry of earth, debris or cement except those ends terminating in manholes and those ends required to be sealed in another manner in accordance with this Code;

(q) separate all pipes from power cables by no less than –

  i. 50 mm of concrete surround of Grade 20 or equivalent; or

  ii. 300 mm in well tamped earth;

(r) where the underground pipes enter a building in a horizontal position, install a cable duct sealing module system to prevent the ingress of water and construct a drain below the module system to allow for the drainage of water;

(s) where the telecommunication room is located in the basement of the building, ensure that the underground pipes do not lead directly into the room but connect to cable trays installed outside the telecommunication room for entry via such cable trays into the room;

(t) ensure that all pipes terminating inside the telecommunication risers are flush against the wall and rise up to a minimum height of 1.0 m;

(u) ensure that all lead-in pipes and the underground pipeline system are constructed in accordance with the practice as illustrated in **Figure 7 to Figure 10**; and

(v) ensure that all pipes are free of obstructing materials and substances to facilitate the deployment of cables by licensees.

7.4 SPECIFIC REQUIREMENTS FOR LEAD-IN PIPES

7.4.1 Every developer or owner who is required to provide lead-in pipes shall –

(a) construct all lead-in pipes at a depth of no less than 1 m from the base of the existing or proposed roadside drain in accordance with the requirements of the relevant authorities except that where it is not possible for the lead-in pipes to under-cross the roadside drain, the owner shall consult the Authority on the construction of such lead-in pipes and comply with such requirements as may be imposed by the Authority;

(b) orientate all lead-in pipes to face public roads and ensure that they are not constructed into State Land or oriented to face the direction of trees, lamp posts, traffic lights, road signs or other permanent obstacles;

(c) ensure that the number of lead-pipes provided is equivalent to and no less than the number of pipes in the underground pipeline system entering the telecommunication room;

(d) where a common services tunnel (CST) or an equivalent type of tunnel system is constructed for the laying of telecommunication cables to building developments –

i. construct and connect the lead-in pipes to the pipe-sleeves of the designated CST junction box adjacent to the building or building development and obtain all necessary approvals from the relevant authorities for such connection works; and

ii. ensure that the number of lead-in pipes provided is equivalent to and corresponds with the number of pipe-sleeves of the designated CST junction box, notwithstanding the quantities of lead-in pipes specified in the relevant Chapters of this Code; and

(e) indicate the position of the lead-in pipes by a marker on the final ground level and indicate by such marker that these pipes are for telecommunication use.

7.4.2 The developer or owner is advised to consult the Authority for Building Control and Construction Industry (“ABCi”) for guidance on the most suitable location and orientation for its lead-in pipes.

7.5 SPECIFIC REQUIREMENTS FOR THE PROVISION OF UNDERGROUND PIPES

7.5.1 Every developer or owner who is required to provide underground pipes shall –

(a) where multi-way pipes are used, ensure that spacers are installed;

(b) where the laying of the underground pipes is obstructed by other services or deep culverts which require the under-crossing or over-crossing of such obstacles, lay the

pipes in a gradual gradient of not less than 1:6 for pipes of nominal diameter of 100 mm and not less than 1:3 for pipes of nominal diameter of 50 mm;

(c) deflection of underground pipes in a straight line must be greater than 40 mm per 1 m for a single duct; and

(d) ensure that the number of underground pipes connecting from the lead-in pipes to the telecommunication room is equivalent to and corresponds with the number of lead-in pipes.

7.5.2 Developers or owners are advised to refer to the testing procedures specified in **Annex 1 – Implementation Guidelines for In-buildings Optical Fibre Cablings for General Housing Development 2015** for the testing of the underground pipes.

7.6 MANHOLES

7.6.1 Where manholes of type FJBx, CJB or STDx are constructed, the developer or owner shall comply with the specifications set out in **Figure 11** to **Figure 50** in relation to such manholes.

7.6.2 Where it is necessary for larger manholes or non-standard manholes or irregular manholes to be constructed, the developer or owner shall obtain the specifications for such manholes from the Authority for Building Control and Construction Industry ("ABCi").

7.6.3 Before any concrete is laid for the construction of any manhole, the developer or owner shall ensure that –

(a) the bottom of the excavation is properly leveled and consolidated;

(b) the bottom of the excavation is kept dry by providing a sump-hole to accommodate water pump, and where necessary provide a layer of 150 mm thick hard-core materials;

(c) pipes are cast on site and that manhole fittings are placed as the construction proceeds;

(d) uPVC pipes with a flared mouth at one end and which comply with the British Standard BS 4660 are used for entry into the wall of the manhole;

(e) the underground pipes enter each manhole in the manner shown in **Figure 11** to **Figure 50** and at such depths as to ensure a minimum clearance for the following types of manholes, unless otherwise specified –

i. For FJBx manhole type, a minimum clearance of 150 mm above the floor level and 550 mm below the roof.

ii. For CJB manhole type, a minimum clearance of 200 mm above the floor level and 800 mm below the roof.

iii. For STDx manhole type, a minimum clearance of 480 mm above the floor level and, 530 mm (minimum) and 1020 mm (maximum) below the roof.

(f) the manhole is constructed at a depth which allows for a concrete (1:2:4) shaft wall of varying height to be constructed for the various manhole sizes shown in **Figure 11** to **Figure 50**;

(g) manhole walls are fair faced and not rendered, and that all projections or cavities in the manhole walls are removed or filled with cement mortar respectively;

(h) the manhole walls are not coated with cement or cement sand wash;

(i) the floor of the manhole is given a 20 mm rendering of cement mortar with fall towards the sump-hole from all directions;

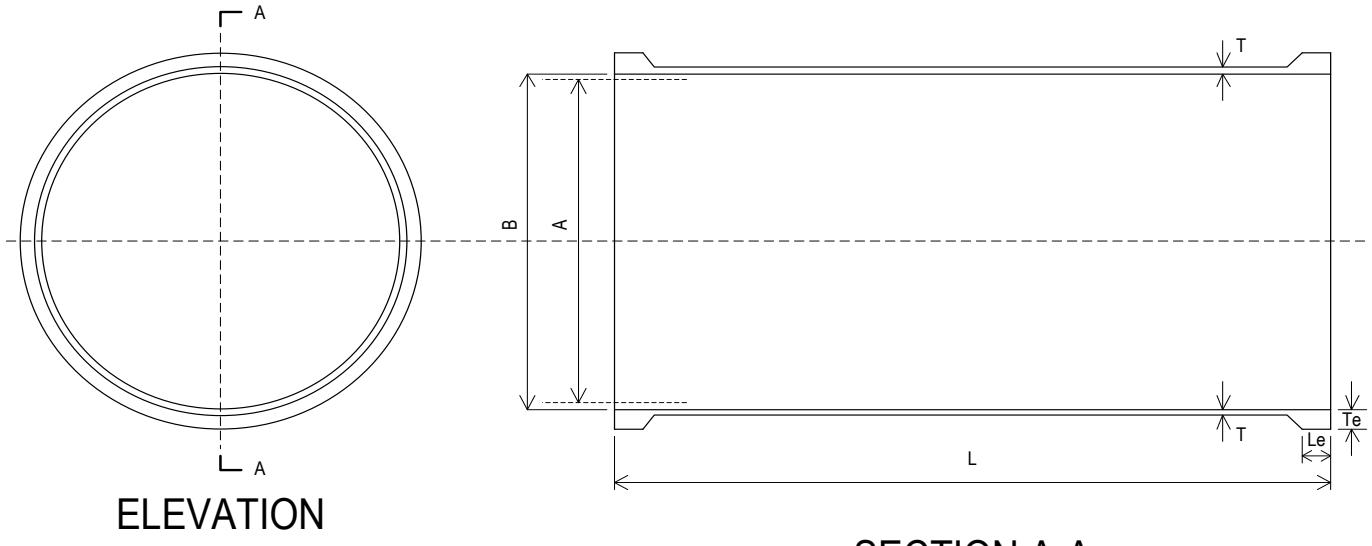
(j) only approved formwork is used in the construction of manholes;

(k) where the manhole is constructed under carriageways or vehicular access areas, a heavy duty manhole cover which complies with the British Standard 497/ 1976 or equivalent, is used for such manhole; and

(l) where the manhole is constructed under turfed areas or pedestrian footways, a medium duty manhole cover which complies with the British Standard 43A / 4360 mild steel or equivalent, is used for such manhole. The covers shall be hot dip galvanized with British Standard 729 / 1971 after fabrication.

7.6.4 The developer or owner may choose to install pre-cast manholes as an alternative to constructing the manholes.

7.6.5 The developer or owner may purchase manhole frames, covers and channel brackets directly from suppliers or from licensees. Every developer or owner shall ensure that the manhole covers which he provides do not bear the name of any licensee.



ELEVATION

SECTION A-A

DRAWINGS NOT TO SCALE

L = 220.0mm ± 5.0mm

A = Ø 110.0mm + 0.0mm
- 0.2mm

B = Ø 110.5mm + 0.2mm
- 0.0mm

T = 3.5mm ± 0.2mm

Te = 4.5mm ± 0.2mm

Le = 15mm ± 0.2mm

NOTE:

(1) All dimension are in millimeters (mm).

(2) The material, physical and mechanical characteristics shall comply to BS 3506 or its equivalent.

(3) The uPVC coupling for 100mm uPVC pipe shall be gradually tapered from the cemtre towards the edges with dimensions shown in the drawing.

FIGURE 1. **uPVC COUPLING FOR 100mm NOMINAL SIZE UPVC PIPE**

Figure 1: uPVC coupling for 100 mm nominal size uPVC pipe

A = Ø 110.5mm + 0.2mm – 0.0mm

T = 4.1mm ± 0.1mm

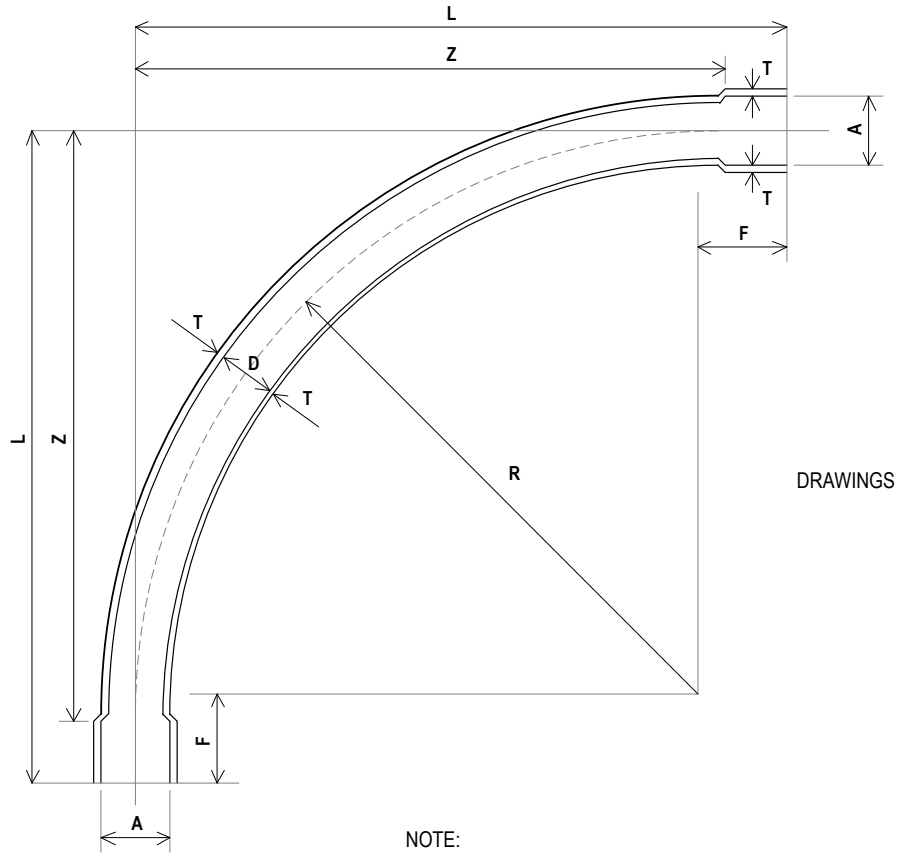
D = Ø 110.0mm + 5.0mm – 5.0mm

R = 500mm

L = 630mm

F = 130mm

Z = 540mm



DRAWINGS NOT TO SCALE

NOTE:

(1) All dimension are in millimeters (mm)

(2) The material, physical and mechanical characteristics shall comply to BS 3506 or its equivalent.

FIGURE 2. 100mm DIAMETER uPVC BEND PIPE

Figure 2: 100 mm diameter uPVC bend pipe

A = Ø 60.5mm + 0.3mm – 0.0mm

T = 2.5mm + 0.3mm – 0.0mm

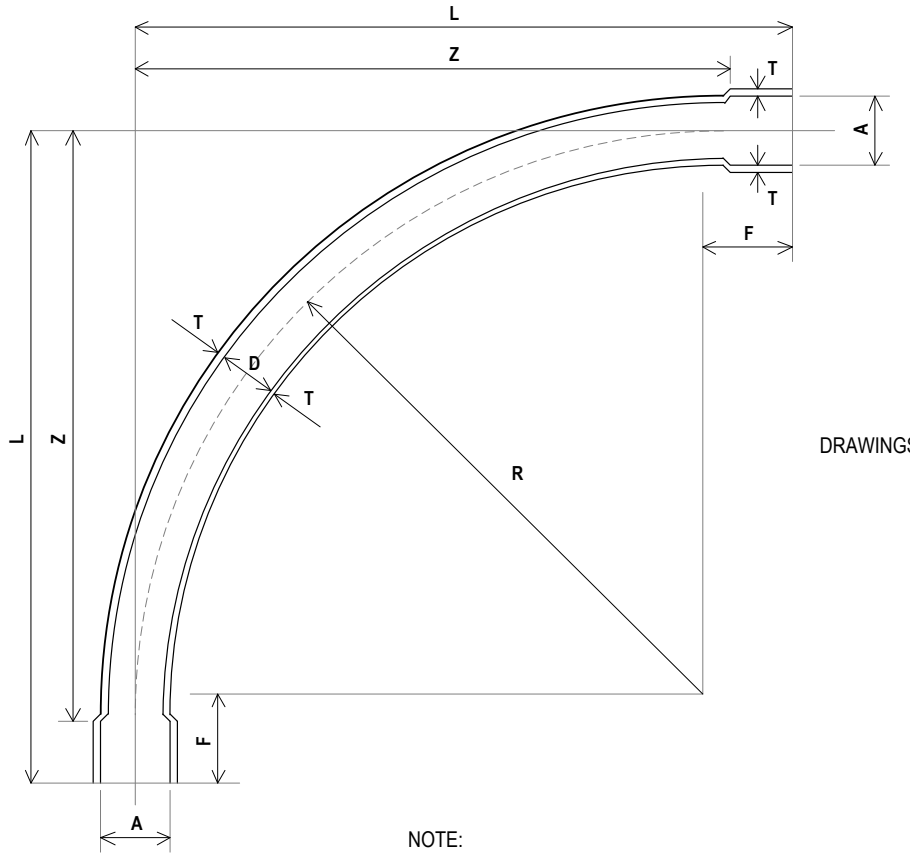
D = Ø 54.0mm + 0.3mm – 0.0mm

R = 300mm

L = 395mm

F = 95mm

Z = 330mm



DRAWINGS NOT TO SCALE

NOTE:

(1) All dimension are in millimeters (mm).

(2) The material, physical and mechanical characteristics shall comply to BS 3506 or its equivalent.

FIGURE 3. 50mm DIAMETER uPVC BEND PIPE

Figure 3: 50 mm diameter uPVC bend pipe

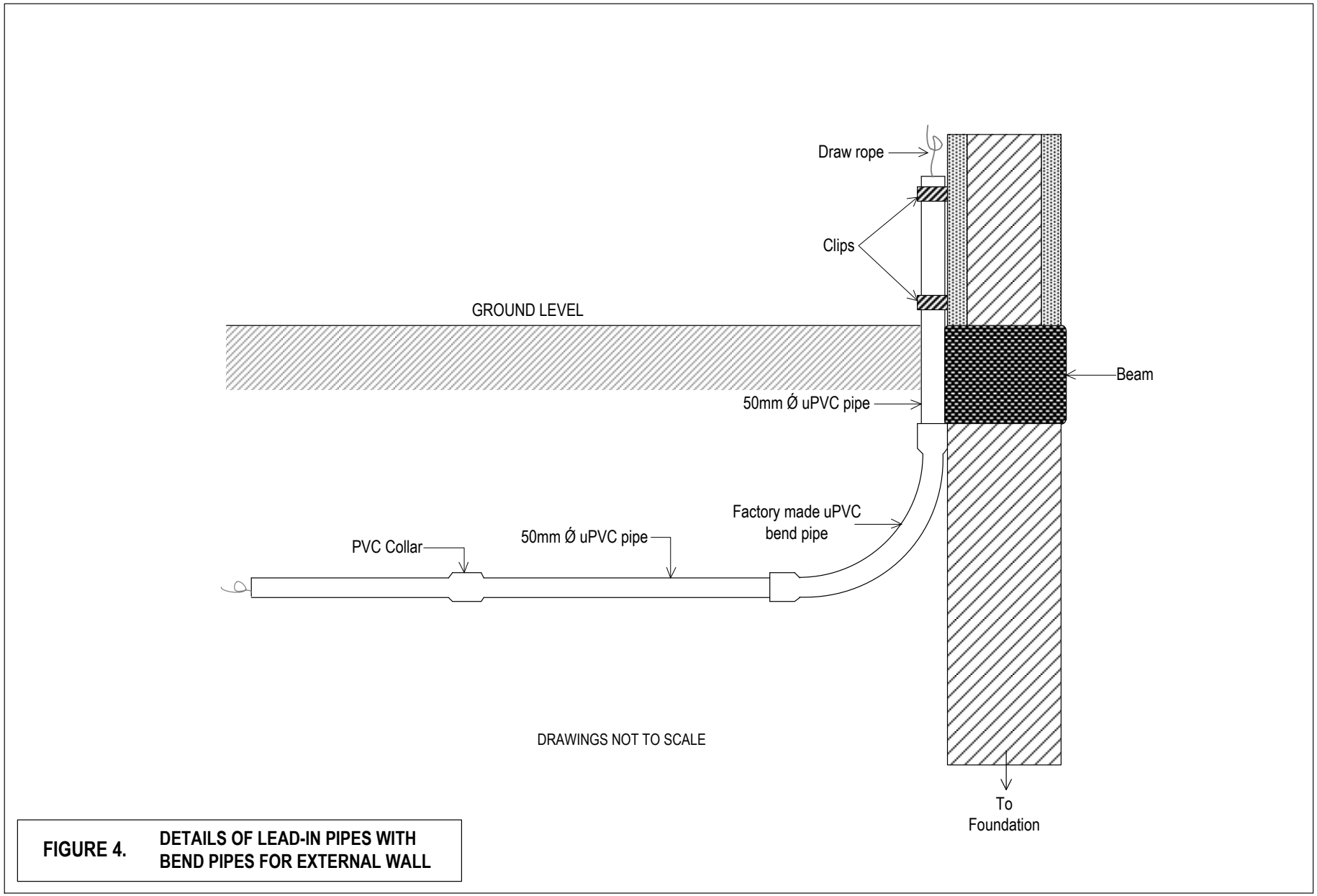


Figure 4: Details of lead-in pipes with bend pipes for external wall

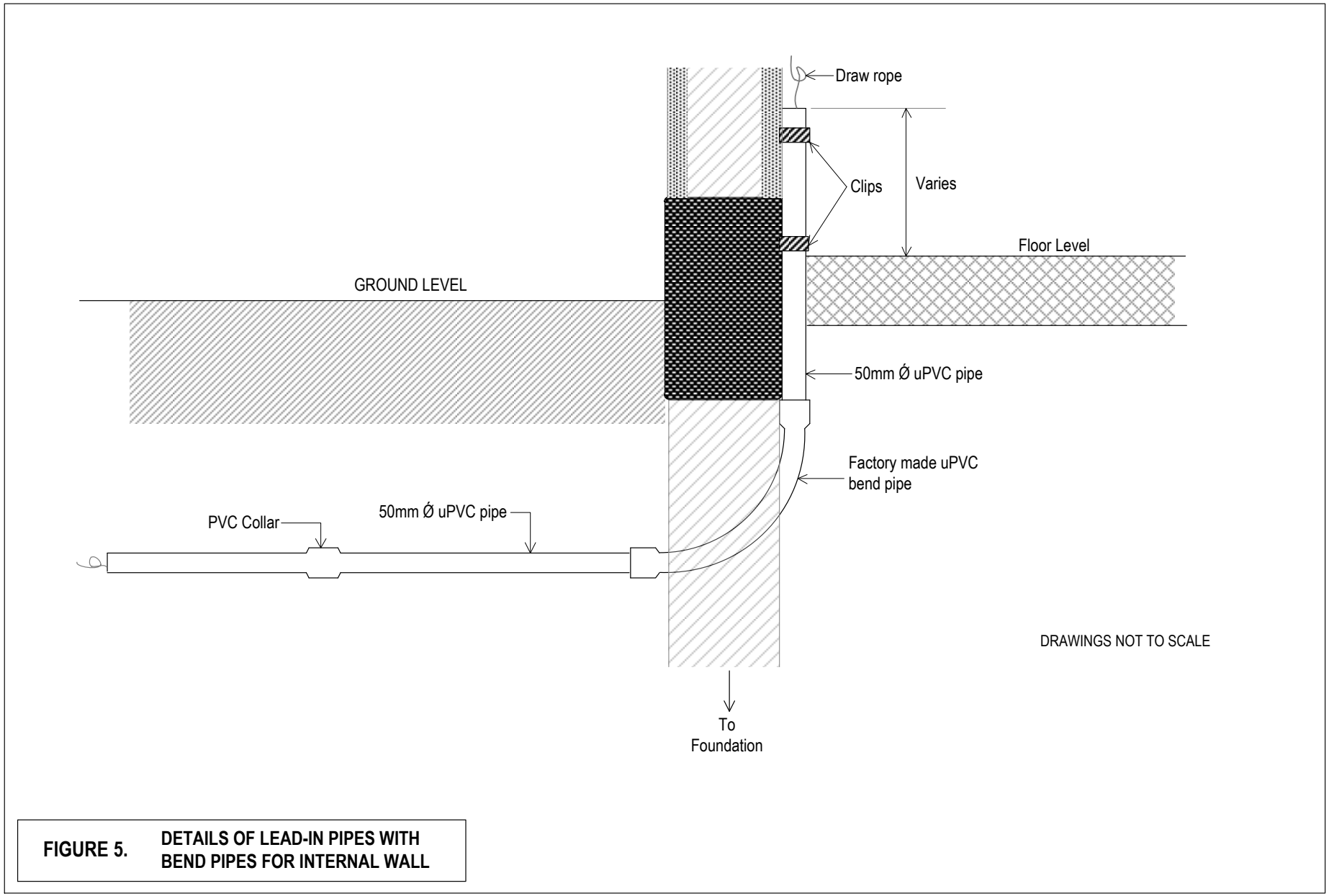


FIGURE 5. DETAILS OF LEAD-IN PIPES WITH BEND PIPES FOR INTERNAL WALL

Figure 5: Details of lead-in pipes with bend pipes for internal wall

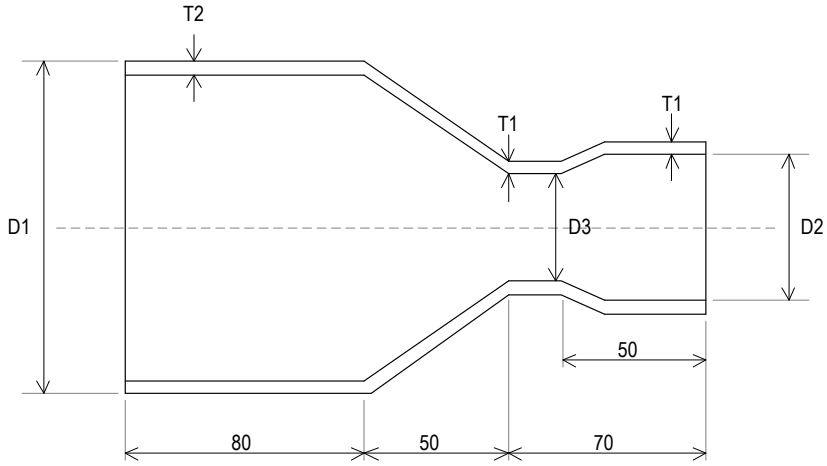
D1 : max = 110.8mm
min = 110.5mm

D2 : max = 60.9mm
min = 60.6mm

D3 : max = 49.5mm
min = 48.0mm

T1: max = 6.1mm
min = 5.4mm

T2 : max = 3.4mm
min = 3.0mm



DRAWINGS NOT TO SCALE

NOTE:

(1) All dimension are in millimeters (mm)

(2) The material, physical and mechanical characteristics shall comply to BS 3506 or its equivalent.

FIGURE 6. REDUCER FOR 100mm TO 50mm DIAMETER NOMINAL SIZE uPVC PIPE

Figure 6: Reducer for 100 mm to 50 mm diameter nominal size uPVC pipe

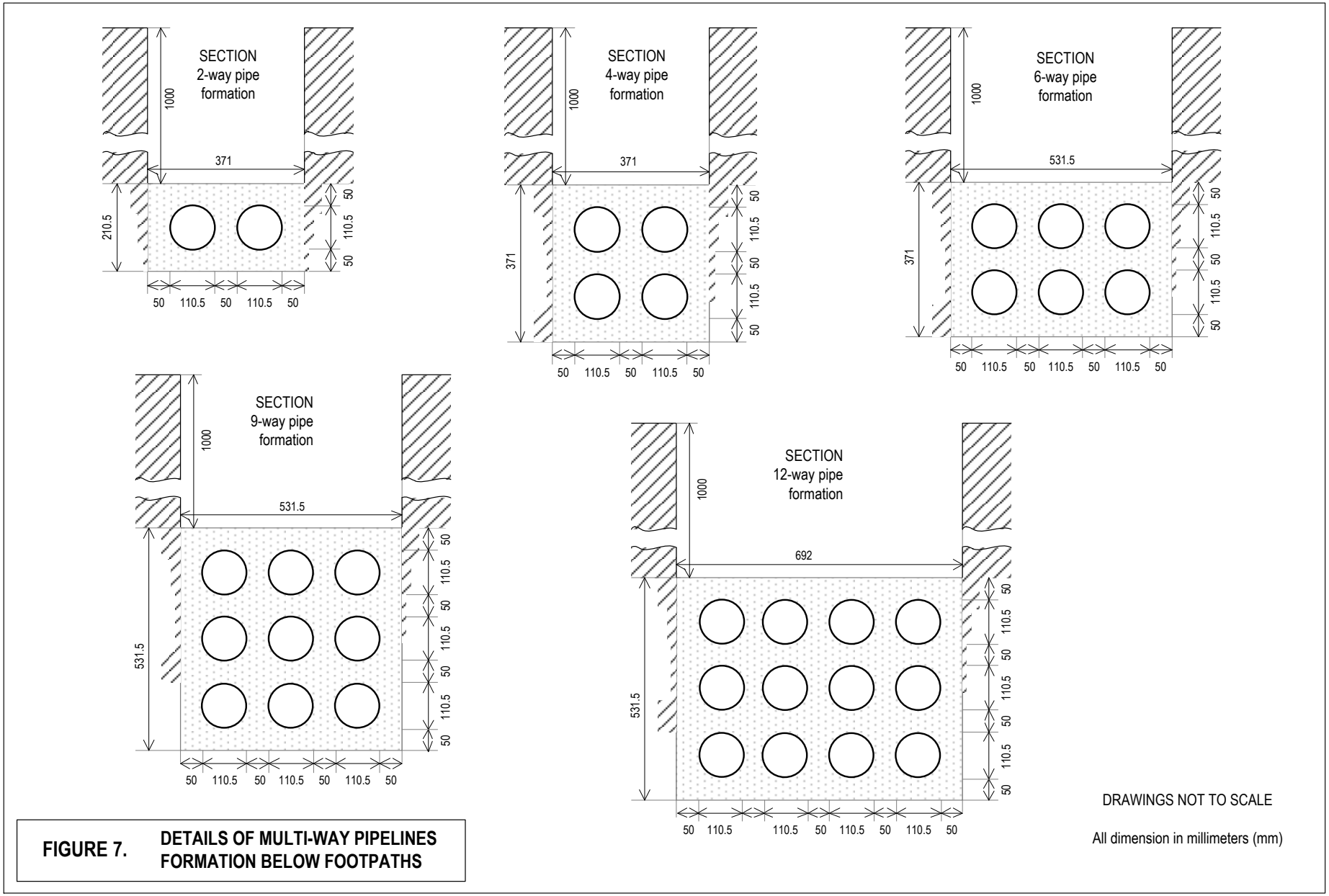


Figure 7: Details of multi-way pipelines formation below footpaths

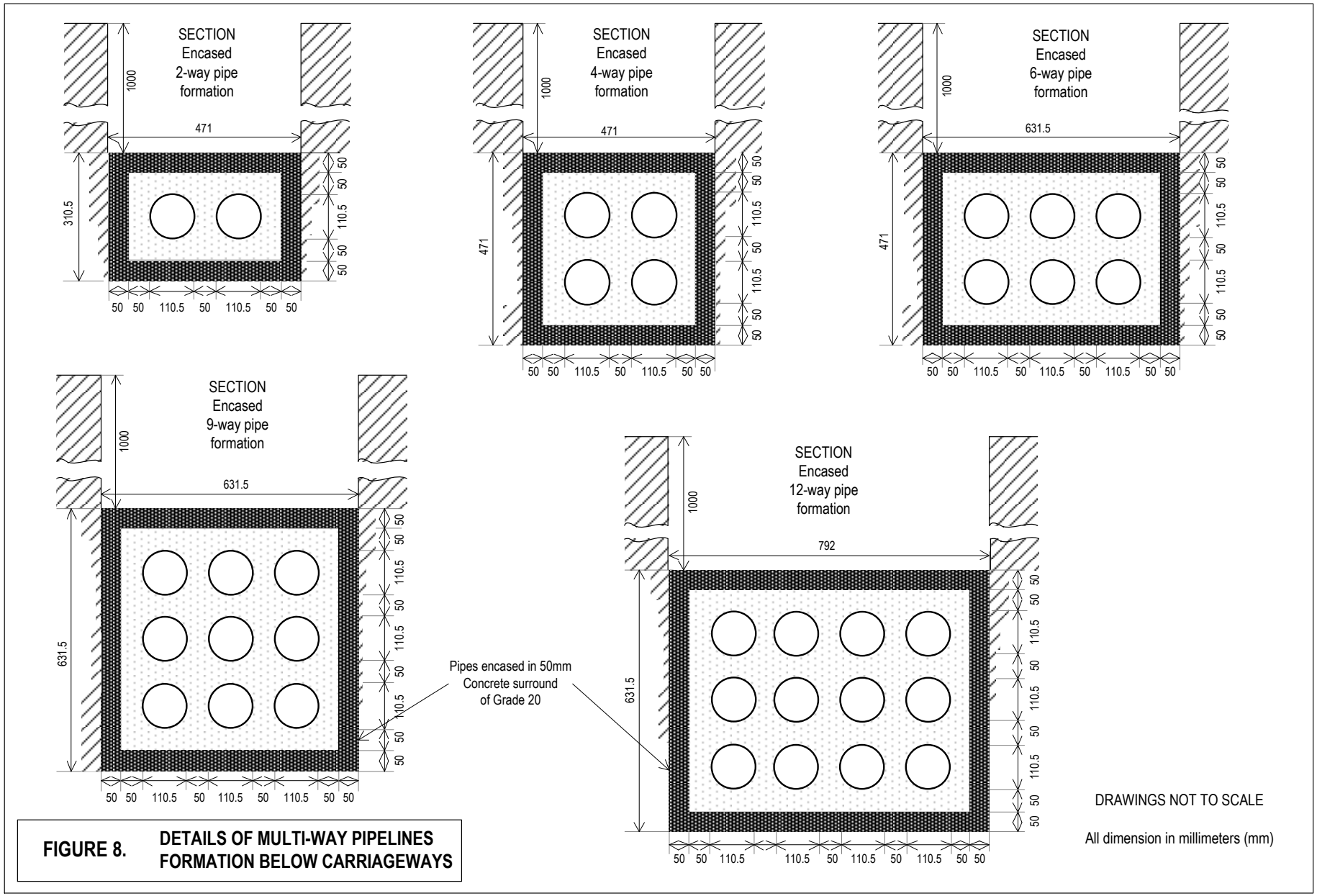
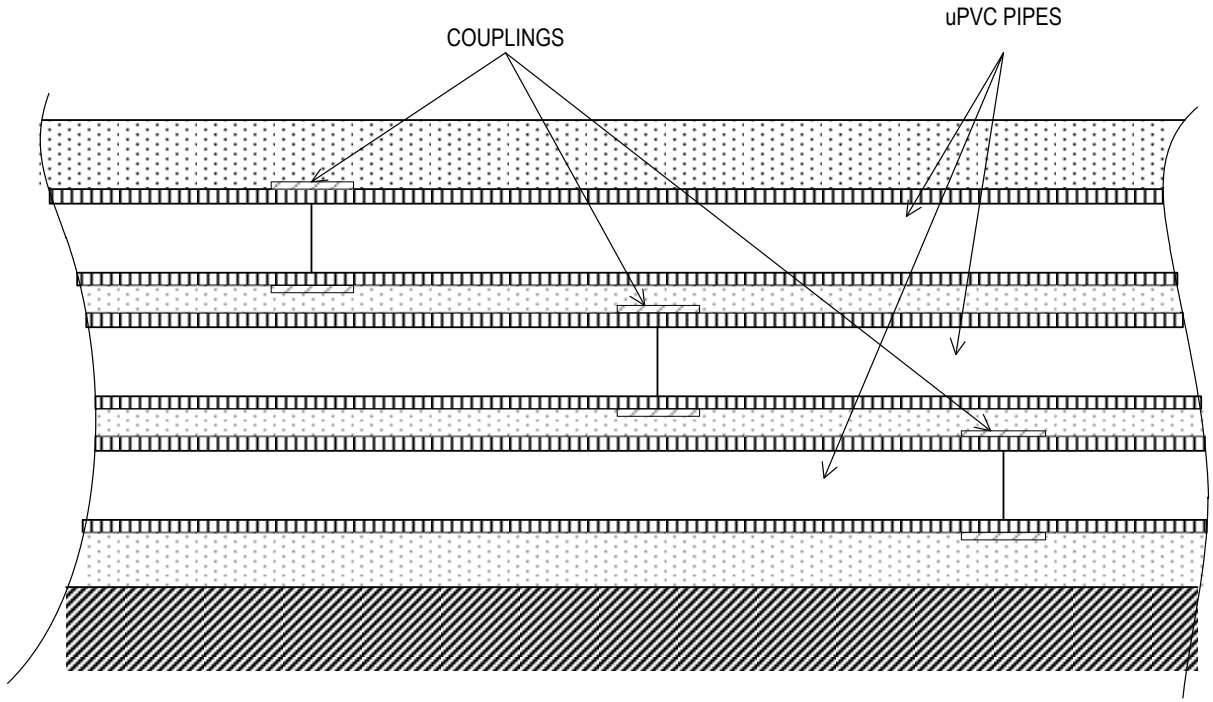


FIGURE 8. DETAILS OF MULTI-WAY PIPELINES FORMATION BELOW CARRIAGEWAYS

Figure 8: Details of multi-way pipelines formation below carriageways



Detail showing staggered joints of uPVC pipes applicable to multi-ways.

FIGURE 9. DETAILS OF MULTI-WAY PIPELINES STAGGERED JOINTS

Figure 9: Details of multi-way pipelines staggered joints

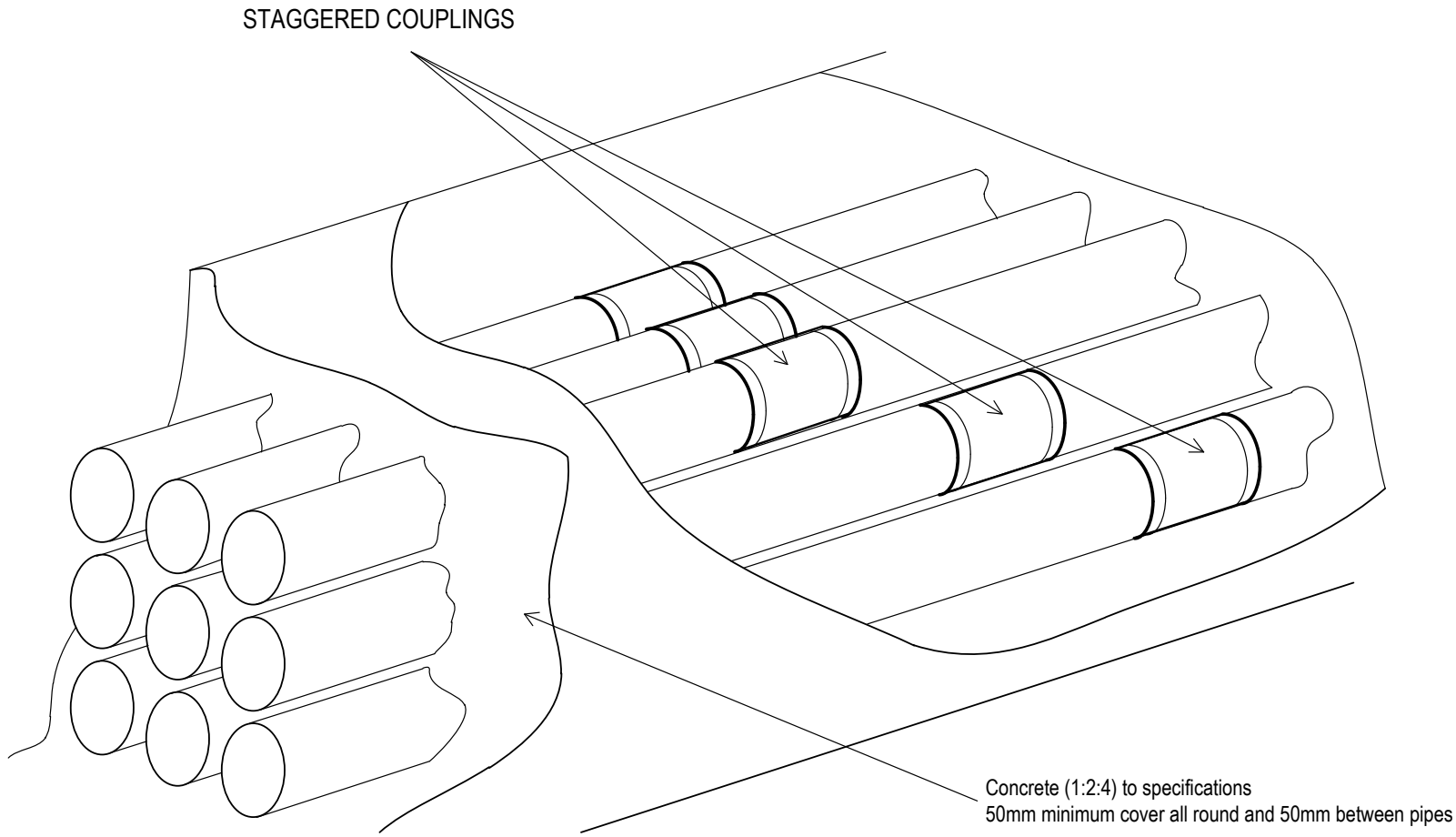


FIGURE 10. DETAILS OF MULTI-WAY PIPELINES COUPLING FORMATION

Figure 10: Details of multi-way pipelines coupling formation

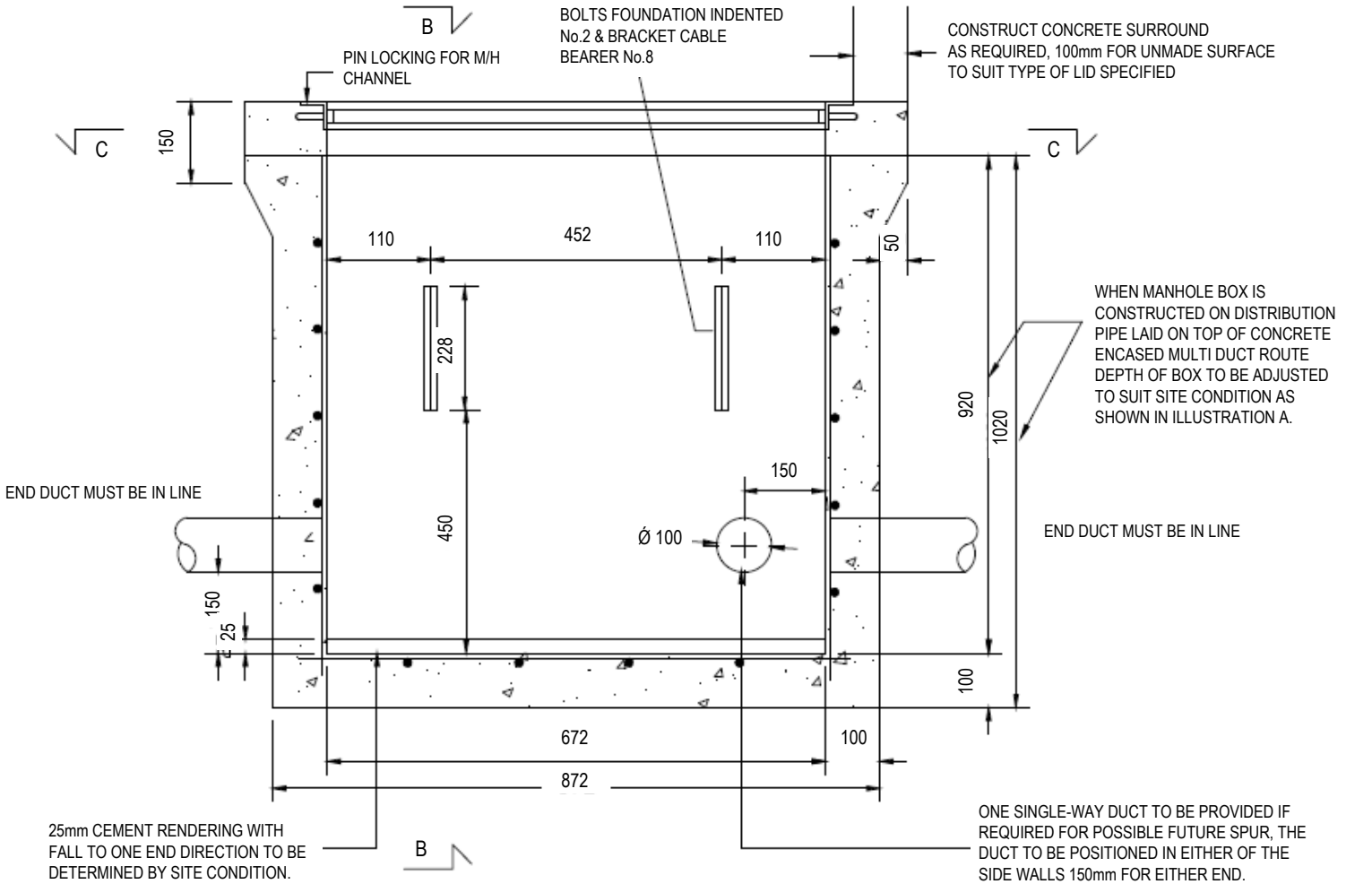
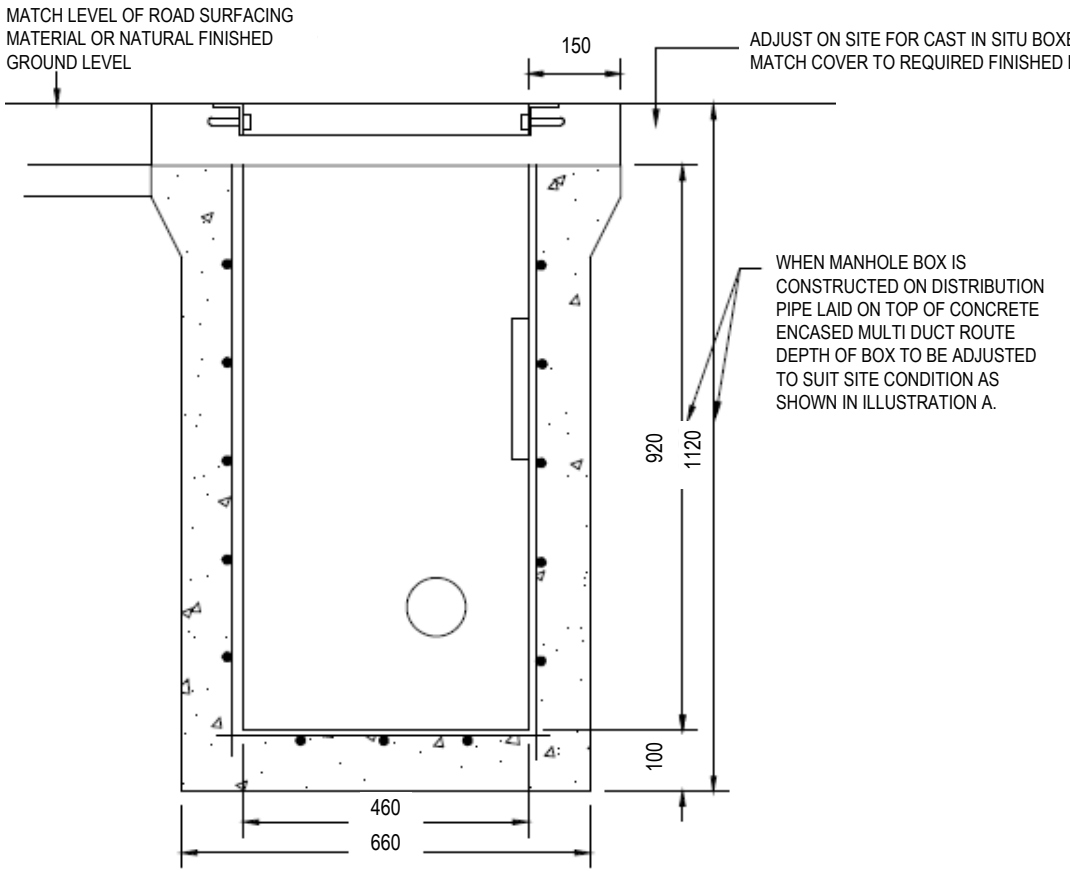


FIGURE 11. MANHOLE DRAWINGS DETAILS – TYPE FJB0 / SECTION A-A

Figure 11: Manhole drawings details – Type FJB0 / section A-A



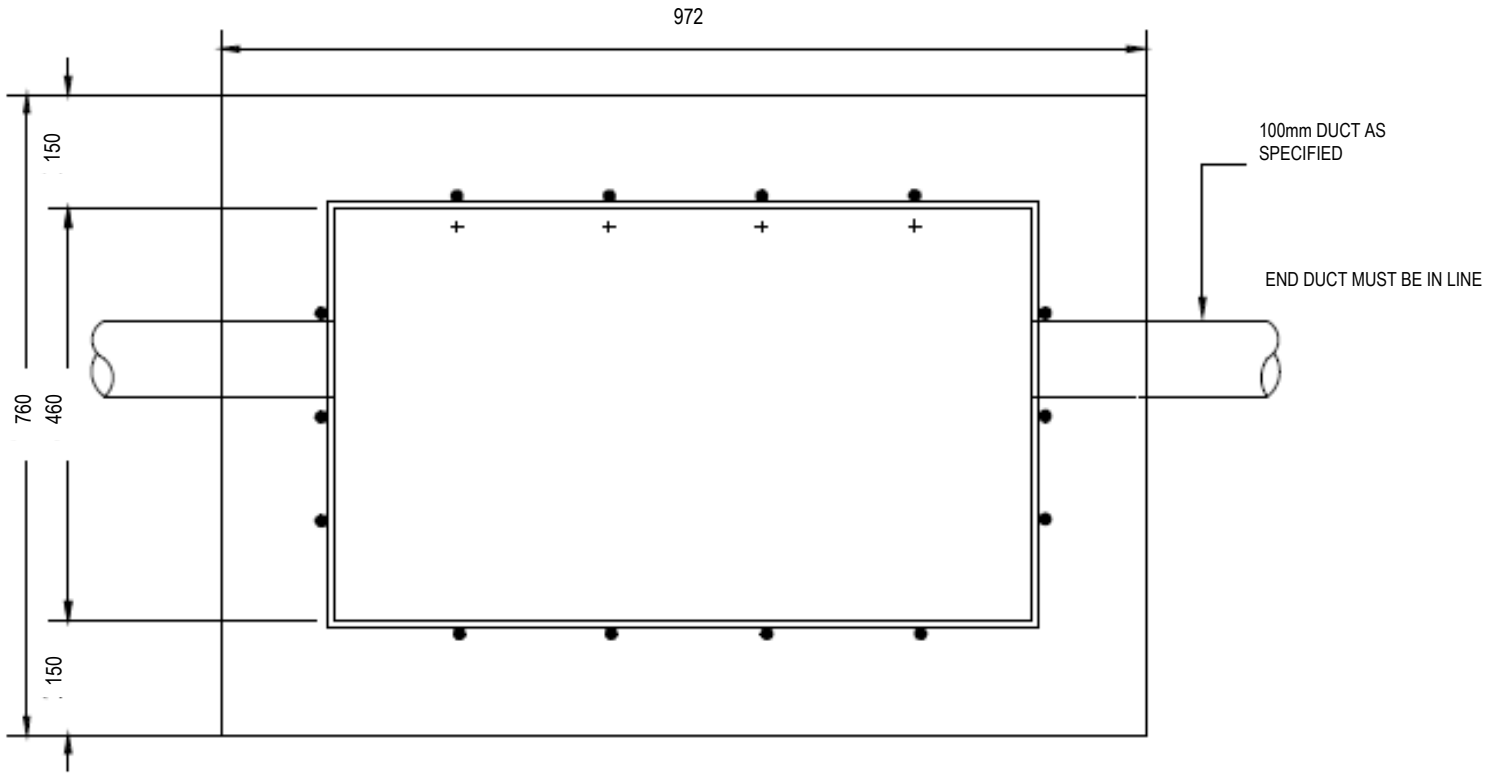
SECTION B-B

DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 12. MANHOLE DRAWINGS DETAILS – TYPE FJB0 / SECTION B-B

Figure 12: Manhole drawings details – Type FJB0 / section B-B



SECTION C-C

DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 13. MANHOLE DRAWINGS DETAILS– TYPE FJB0 / SECTION C-C

Figure 13: Manhole drawings details – Type FJB0 / section C-C

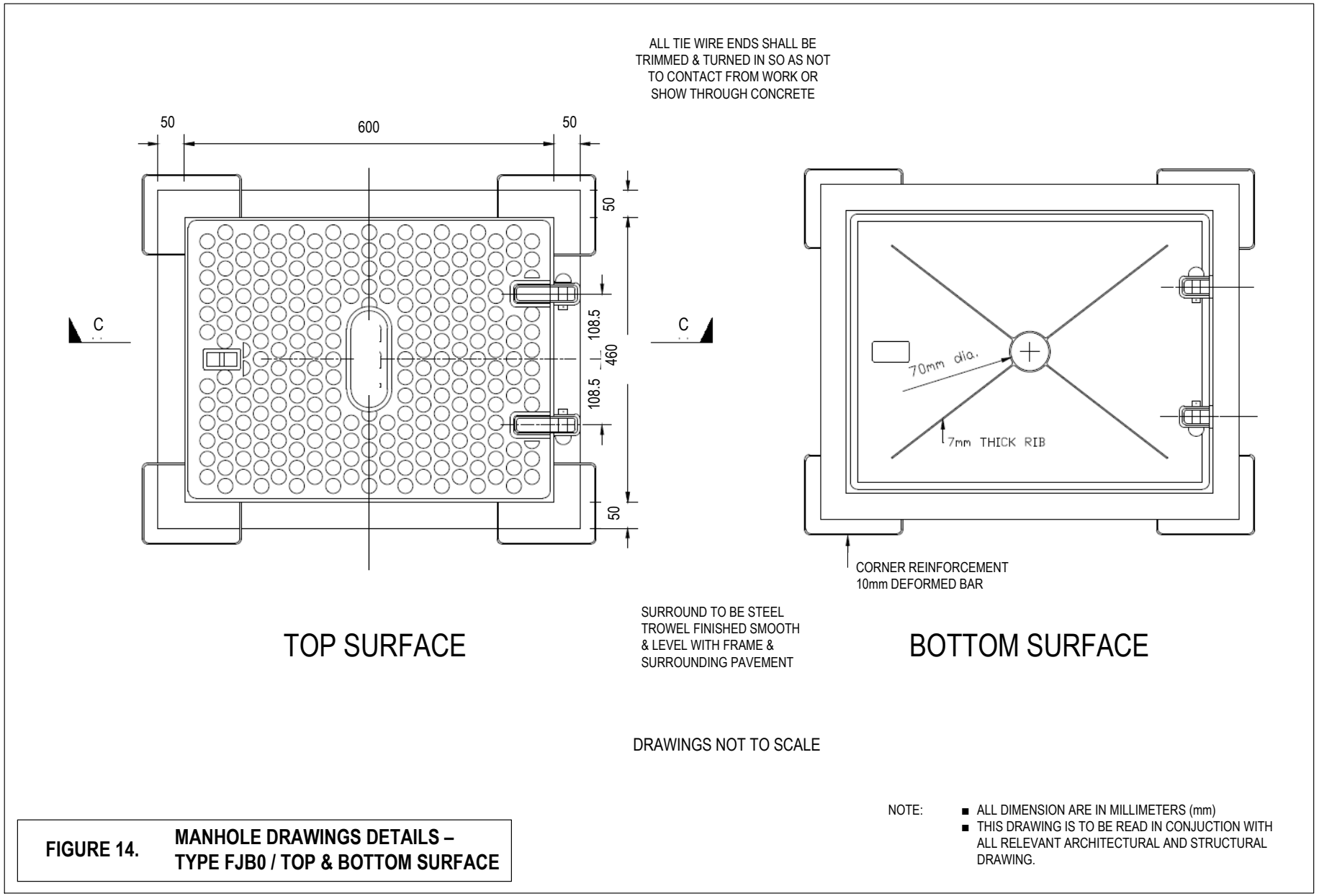


Figure 14: Manhole drawings details – Type FJB0 / Top and bottom surface

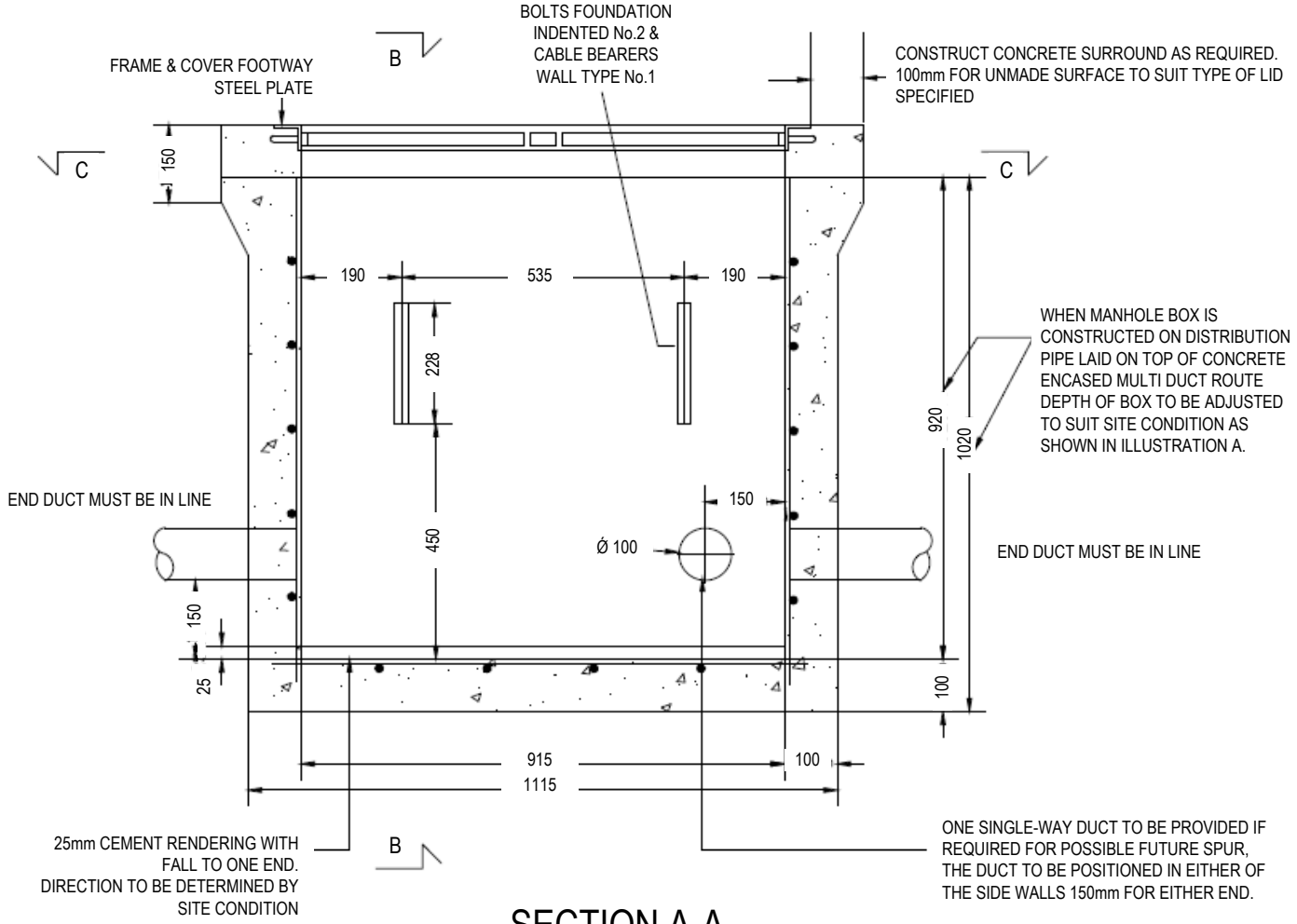
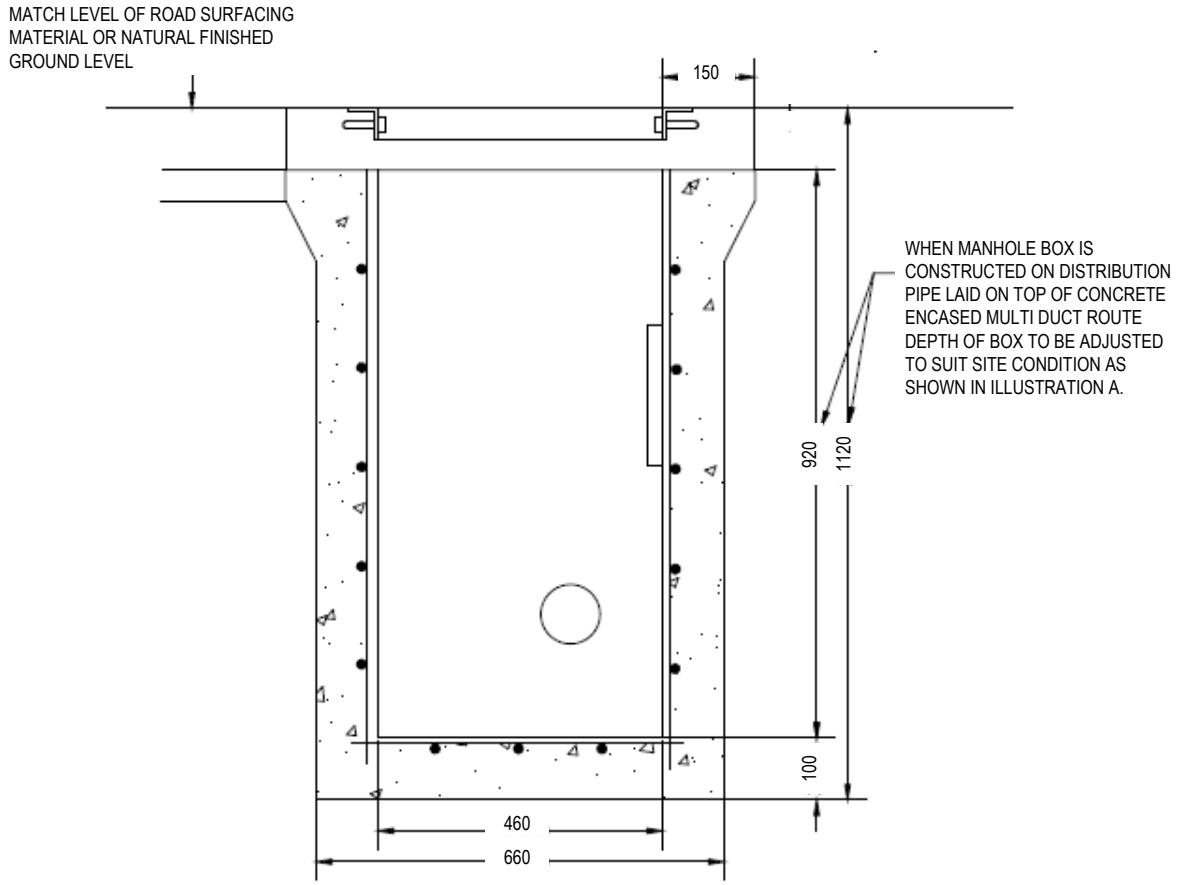


FIGURE 15. MANHOLE DRAWINGS DETAILS – TYPE FJB1 / SECTION A-A

Figure 15: Manhole drawings details – Type FJB1 / section A-A



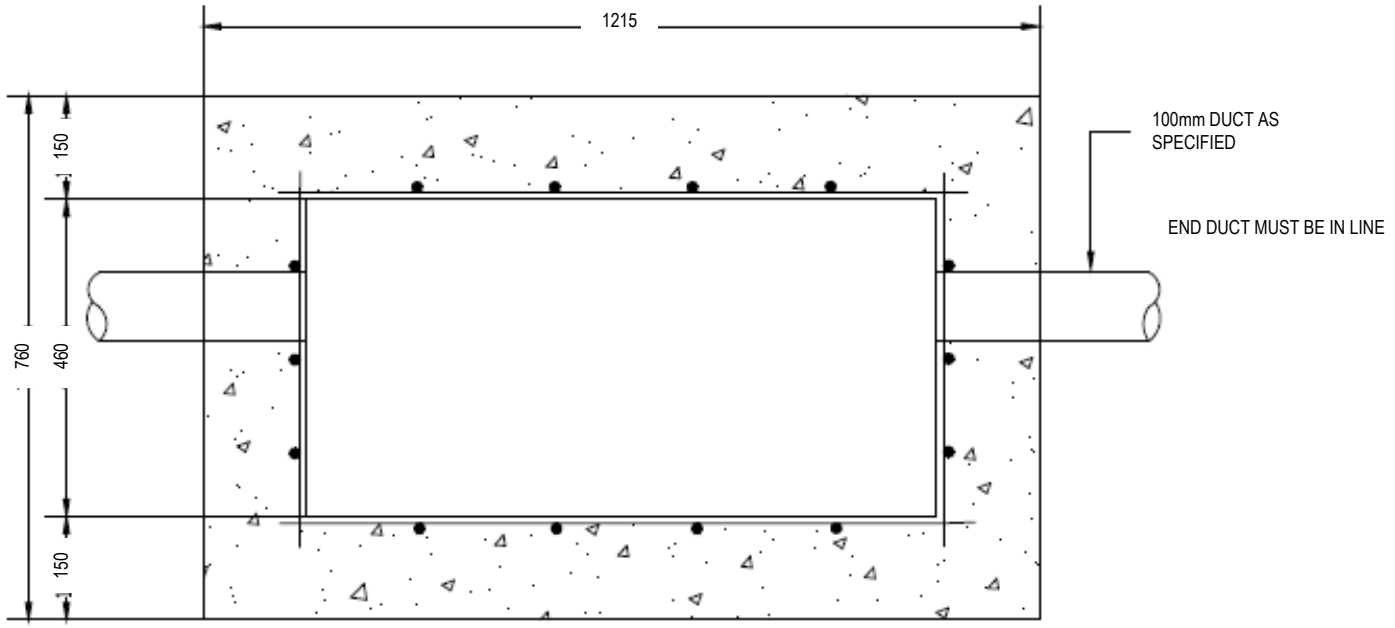
SECTION B-B

DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 16. MANHOLE DRAWINGS DETAILS – TYPE FJB1 / SECTION B-B

Figure 16: Manhole drawings details – Type FJB1 / section B-B



SECTION C-C

DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 17. MANHOLE DRAWINGS DETAILS – TYPE FJB1 / SECTION C-C

Figure 17: Manhole drawings details – Type FJB1 / section C-C

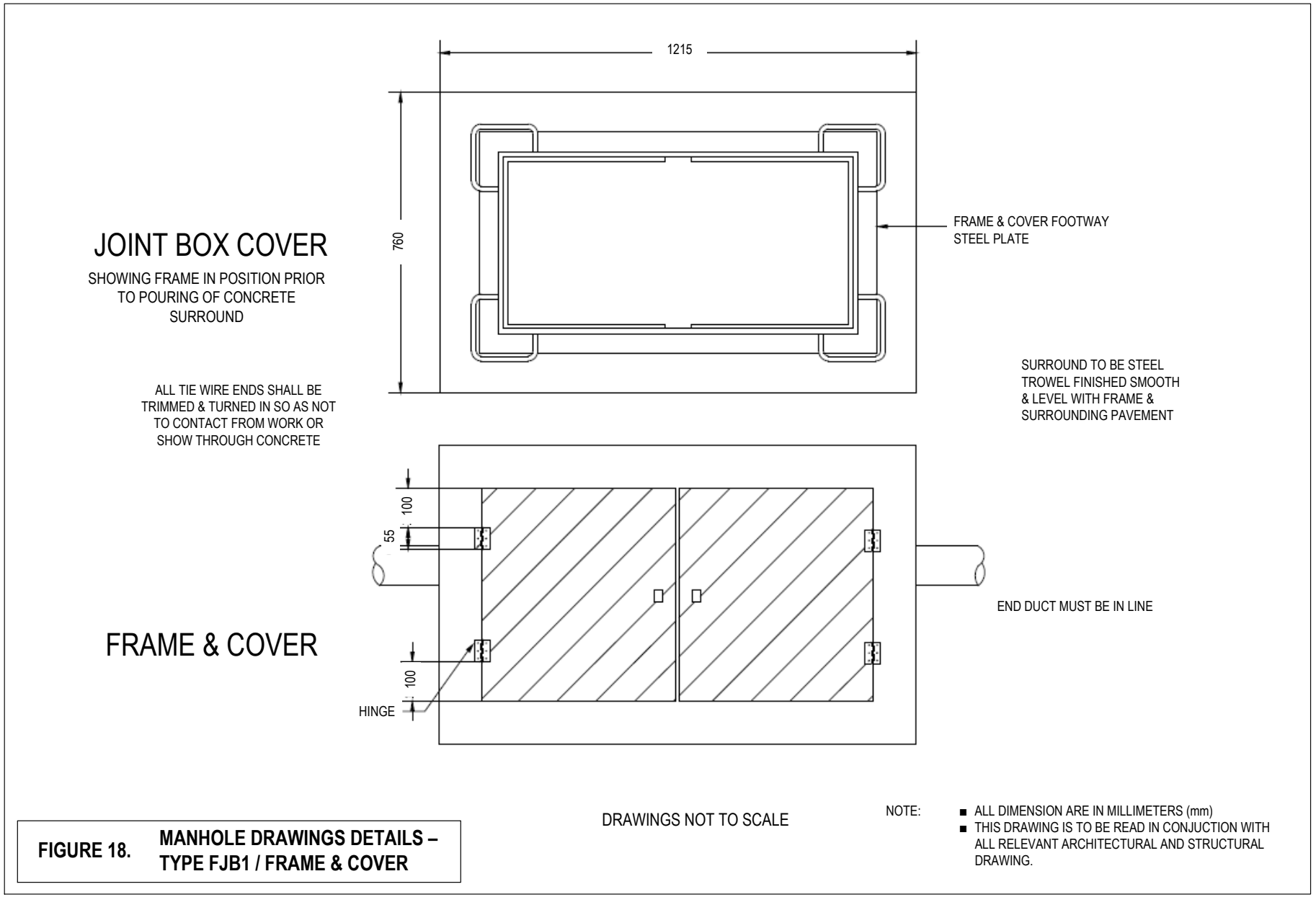


Figure 18: Manhole drawings details – Type FJB1 / Frame and cover

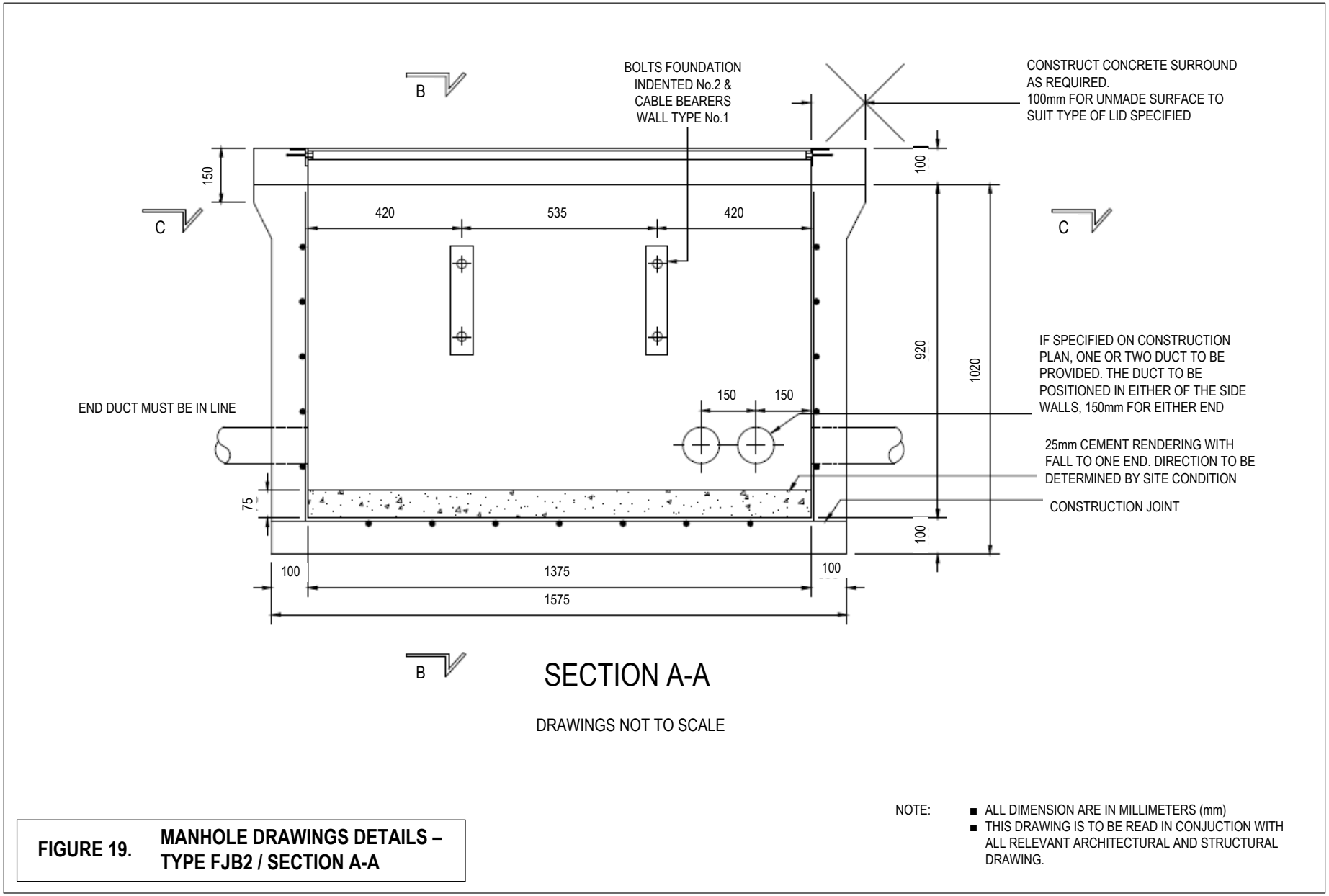
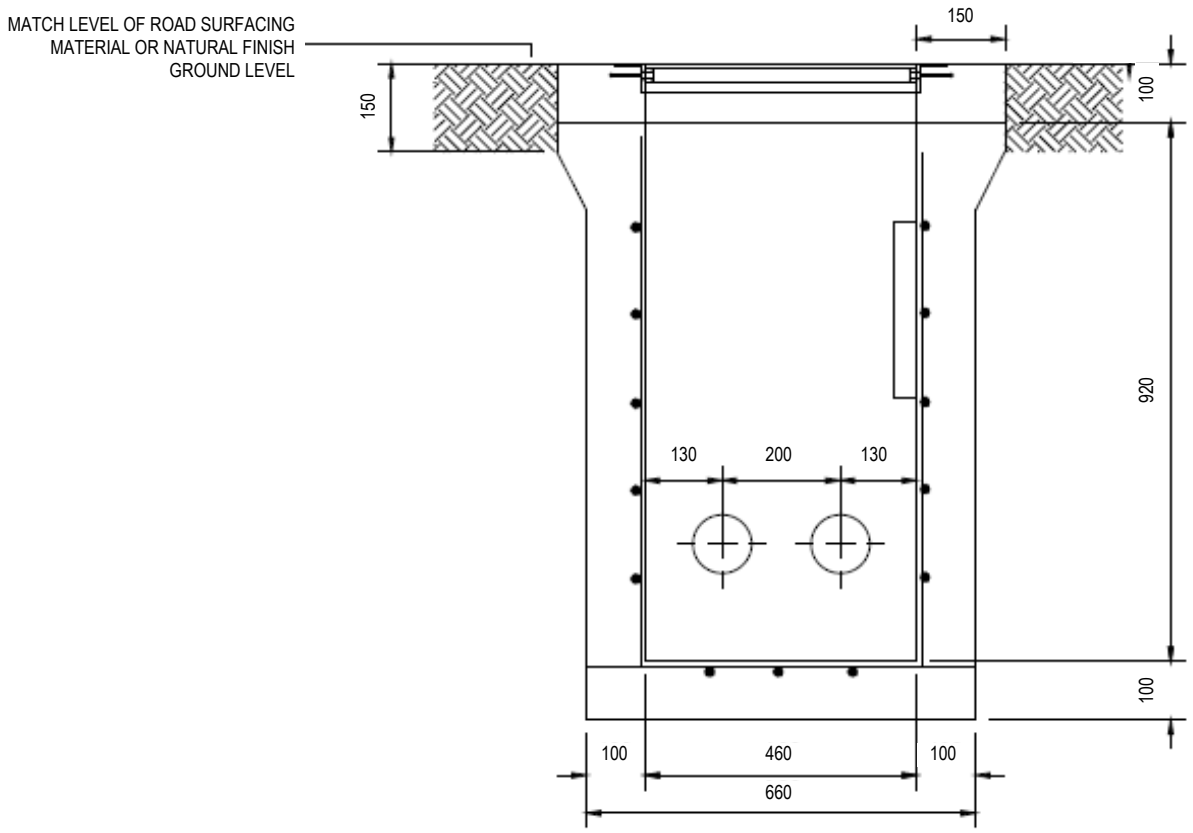


FIGURE 19. MANHOLE DRAWINGS DETAILS – TYPE FJB2 / SECTION A-A

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

Figure 19: Manhole drawings details – Type FJB2 / section A-A



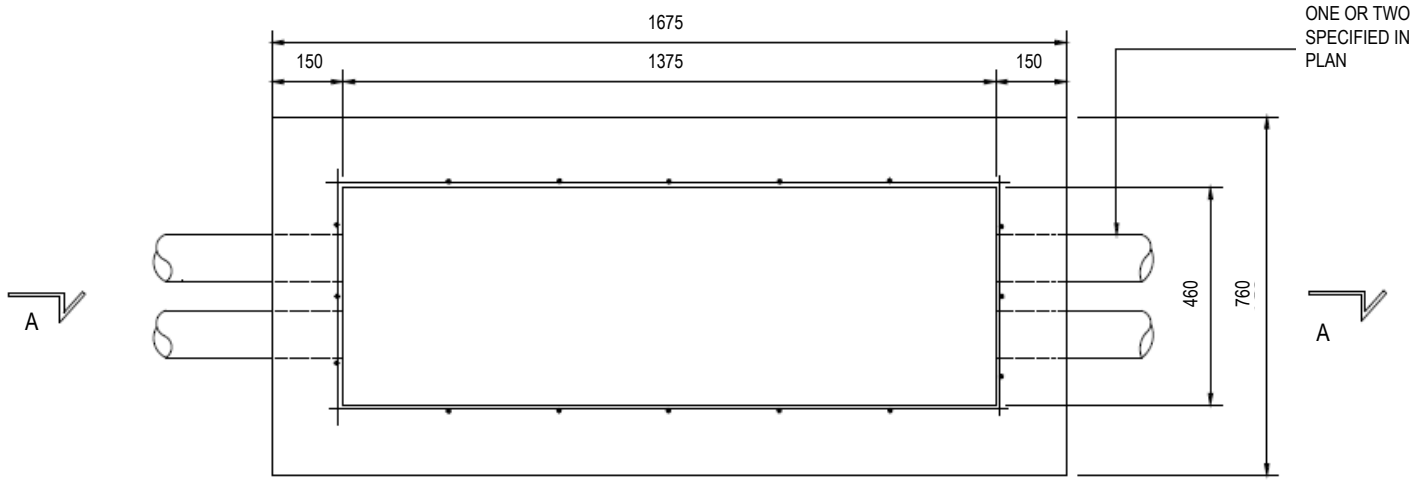
SECTION B-B

DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 20. MANHOLE DRAWINGS DETAILS – TYPE FJB2 / SECTION B-B

Figure 20: Manhole drawings details – Type FJB2 / section B-B



SECTION C-C

DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 21. MANHOLE DRAWINGS DETAILS – TYPE FJB2 / SECTION C-C

Figure 21: Manhole drawings details – Type FJB2 / section C-C

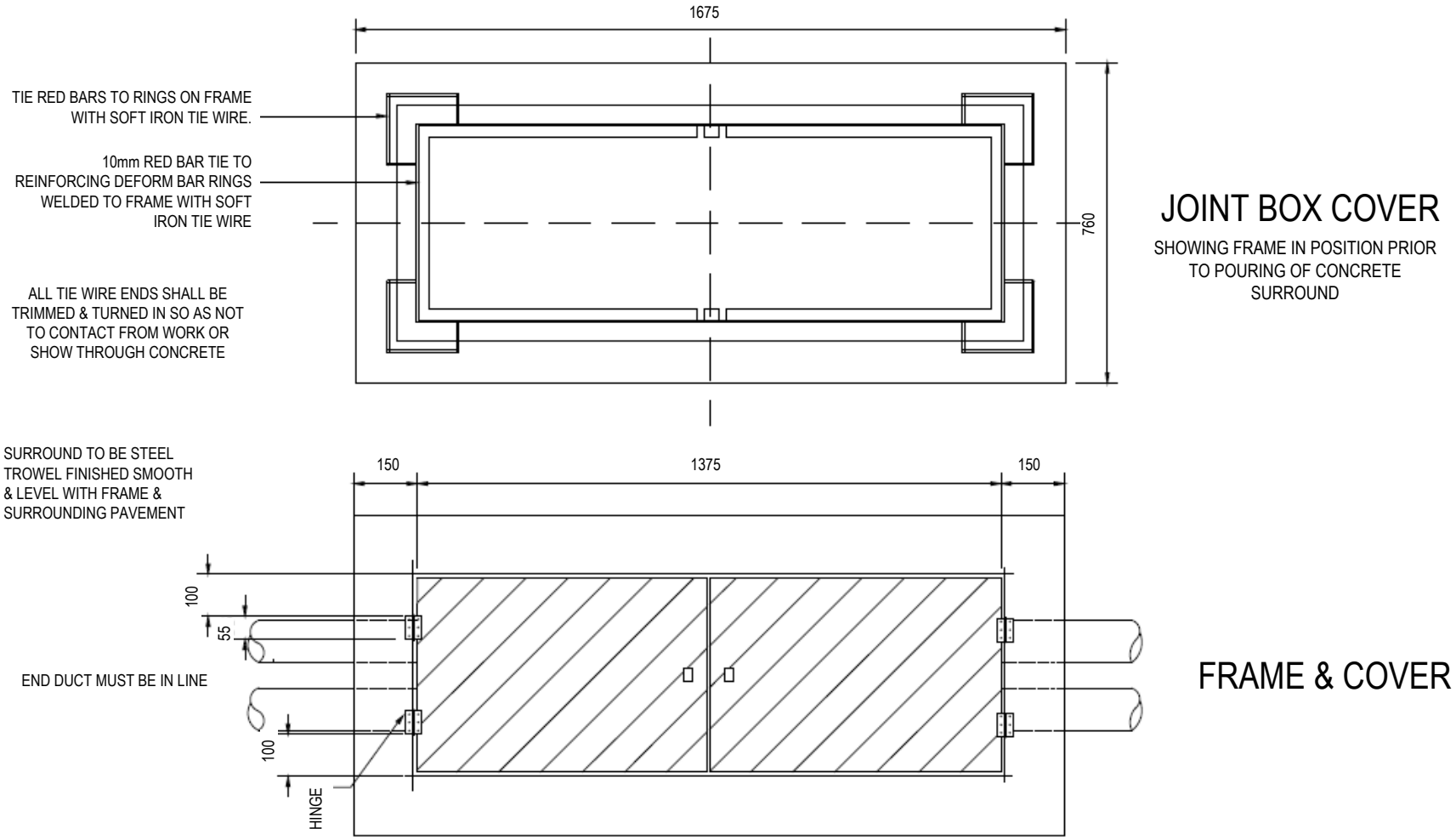


FIGURE 22. **MANHOLE DRAWINGS DETAILS – TYPE FJB2 / FRAME & COVER**

Figure 22: Manhole drawings details – Type FJB2 / Frame and cover

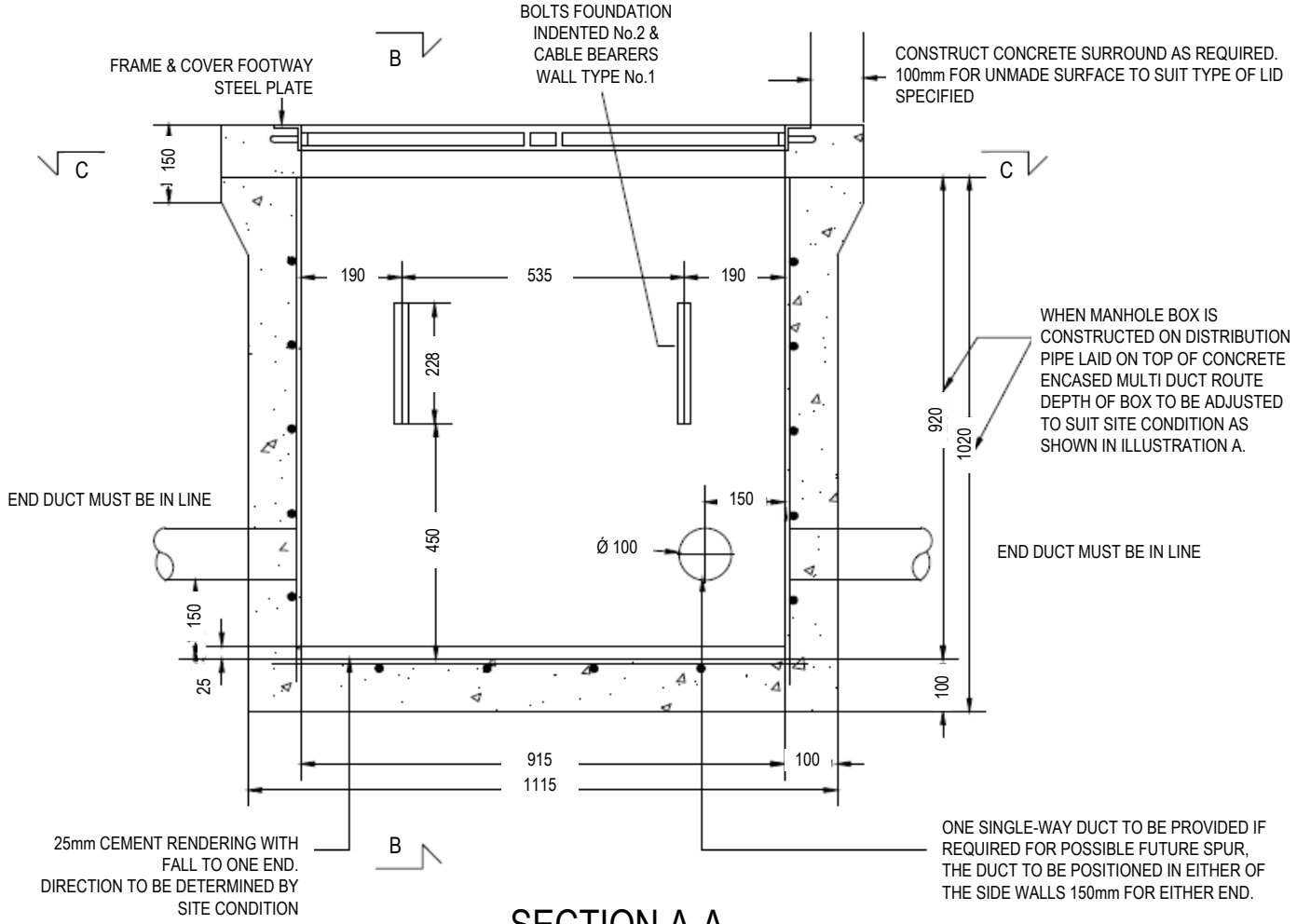
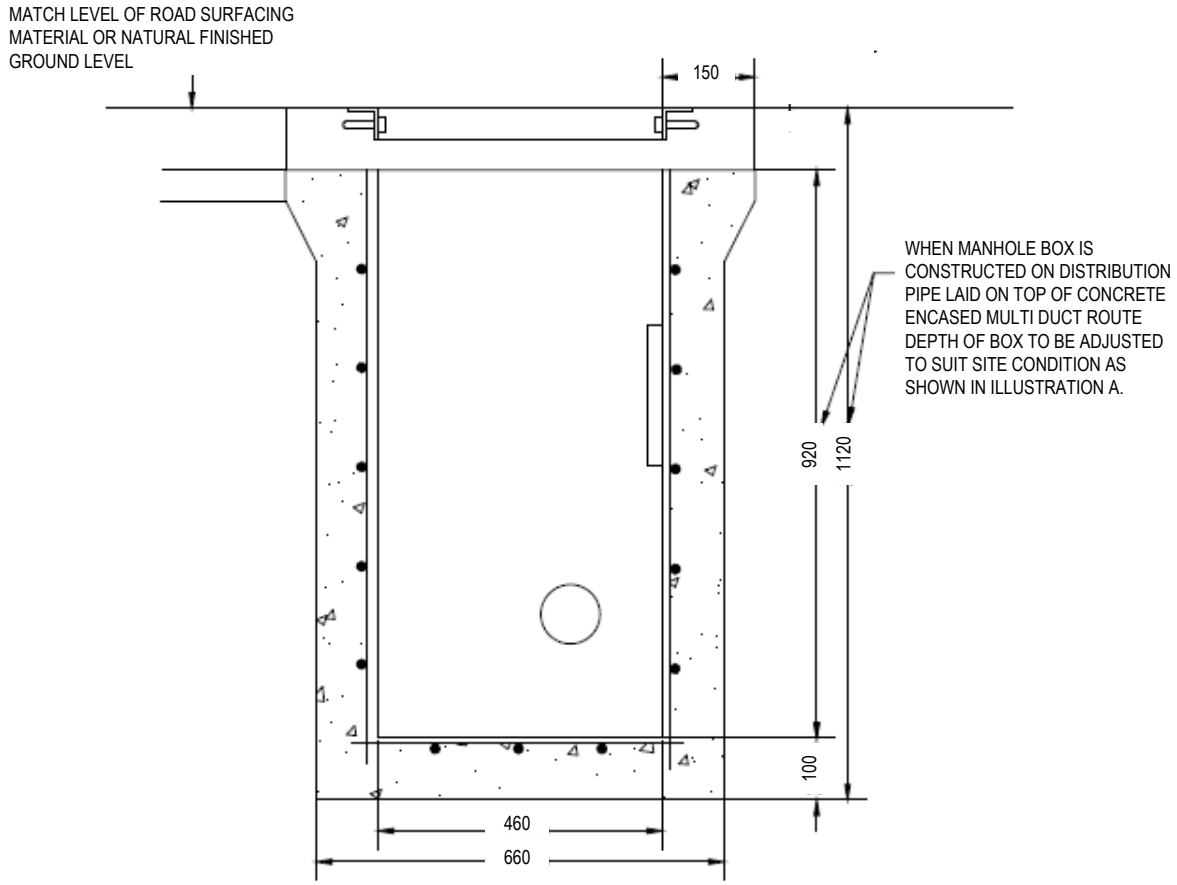


FIGURE 23. MANHOLE DRAWINGS DETAILS – TYPE FJB3 / SECTION A-A

Figure 23: Manhole drawings details – Type FJB3 / section A-A



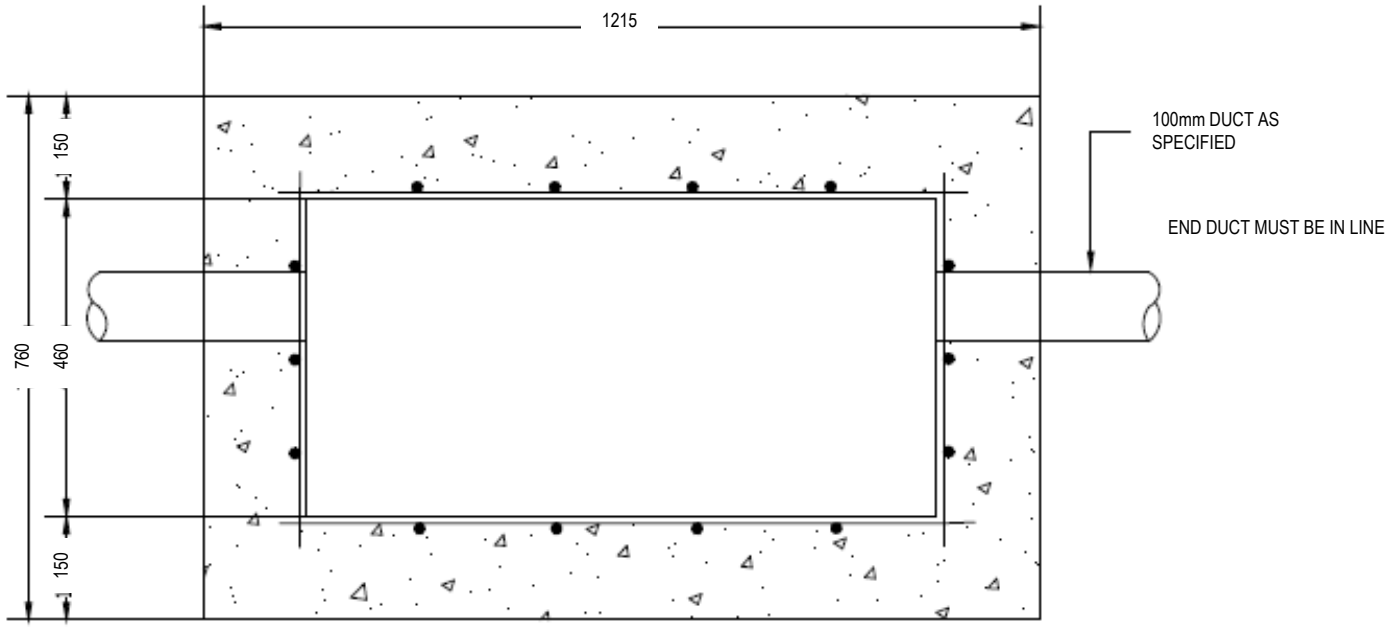
SECTION B-B

DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 24. MANHOLE DRAWINGS DETAILS – TYPE FJB3 / SECTION B-B

Figure 24: Manhole drawings details – Type FJB3 / section B-B



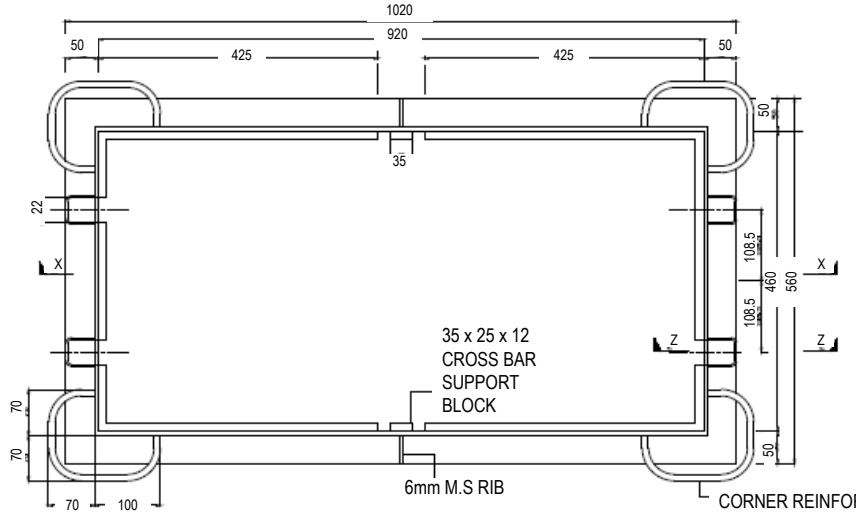
SECTION C-C

DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 25. MANHOLE DRAWINGS DETAILS – TYPE FJB3 / SECTION C-C

Figure 25: Manhole drawings details – Type FJB3 / section C-C

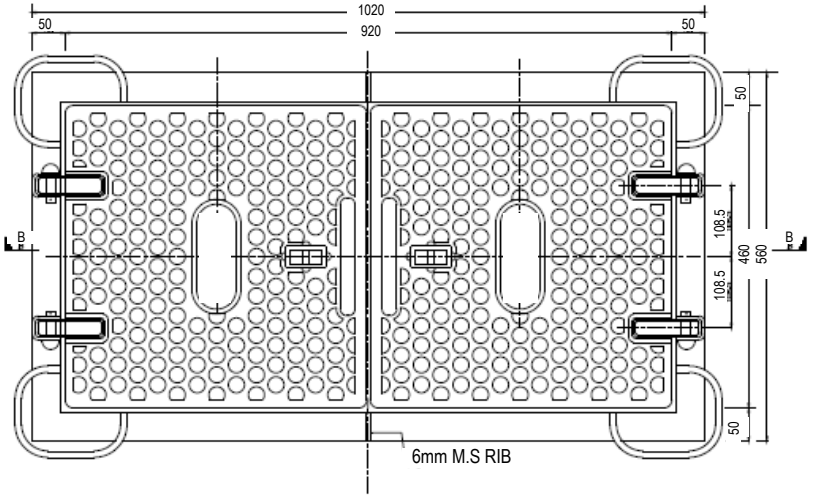


PLAN VIEW

JOINT BOX FRAME

ALL TIE WIRE ENDS SHALL BE TRIMMED & TURNED IN SO AS NOT TO CONTACT FROM WORK OR SHOW THROUGH CONCRETE

SURROUND TO BE STEEL TROWEL FINISHED SMOOTH & LEVEL WITH FRAME & SURROUNDING PAVEMENT



PLAN VIEW
JOINT BOX COVER
& FRAME

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

DRAWINGS NOT TO SCALE

FIGURE 26. MANHOLE DRAWINGS DETAILS – TYPE FJB3 / FRAME & COVER

Figure 26: Manhole drawings details – Type FJB3 / Frame and cover

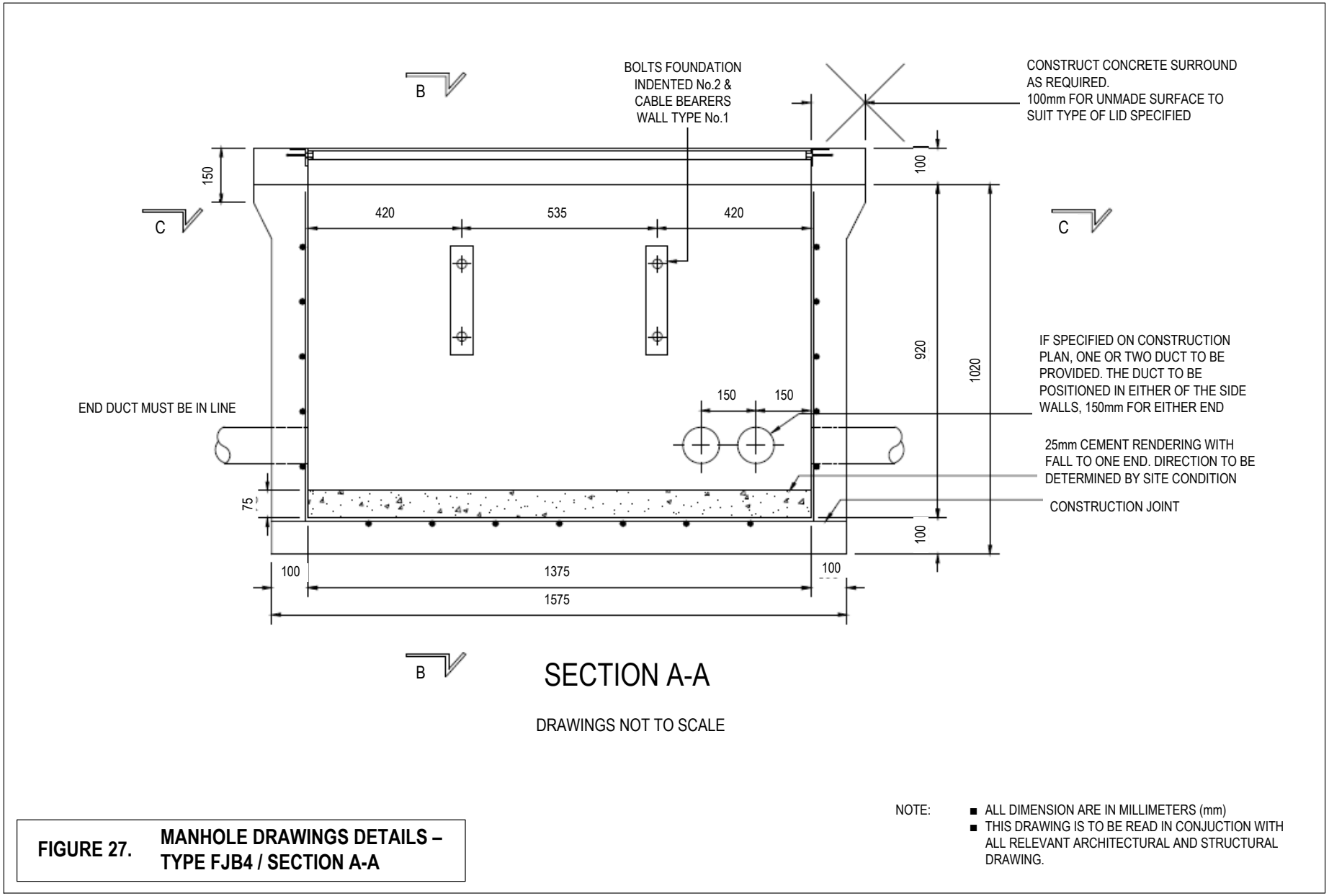
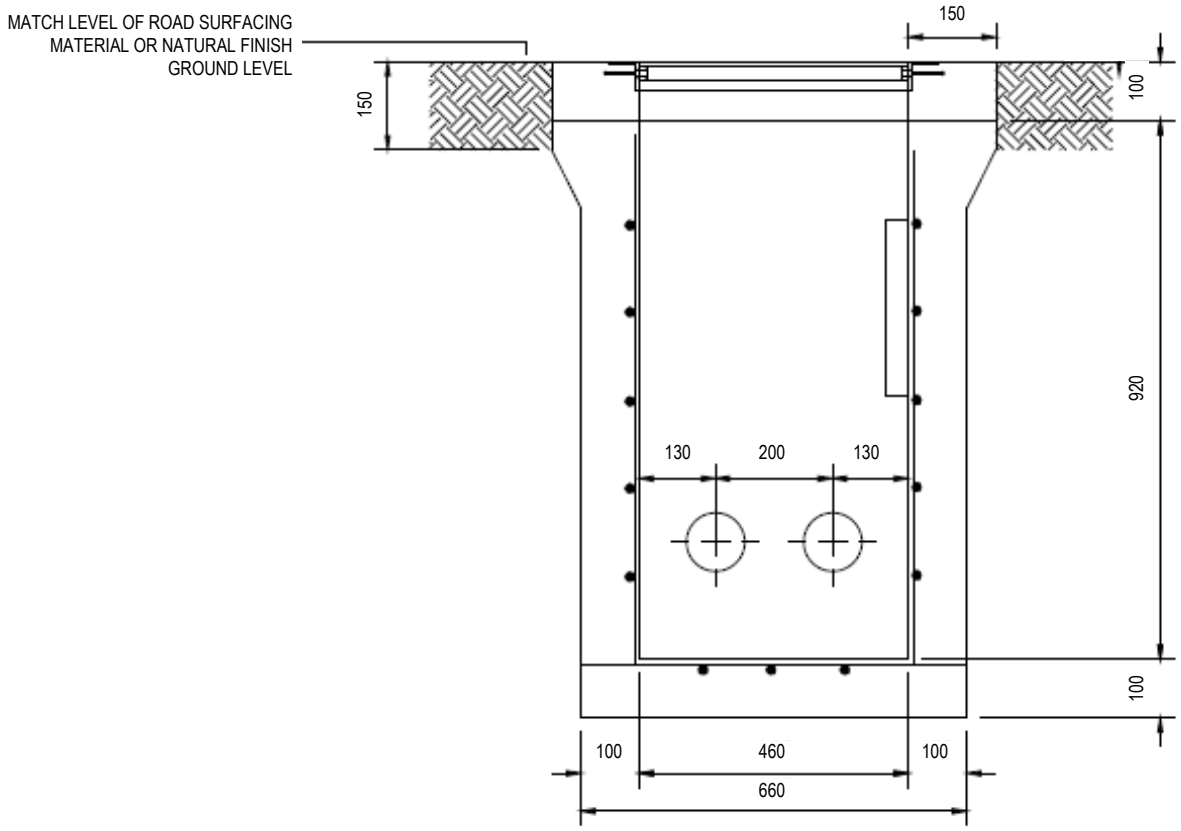


FIGURE 27. MANHOLE DRAWINGS DETAILS – TYPE FJB4 / SECTION A-A

Figure 27: Manhole drawings details – Type FJB4 / section A-A



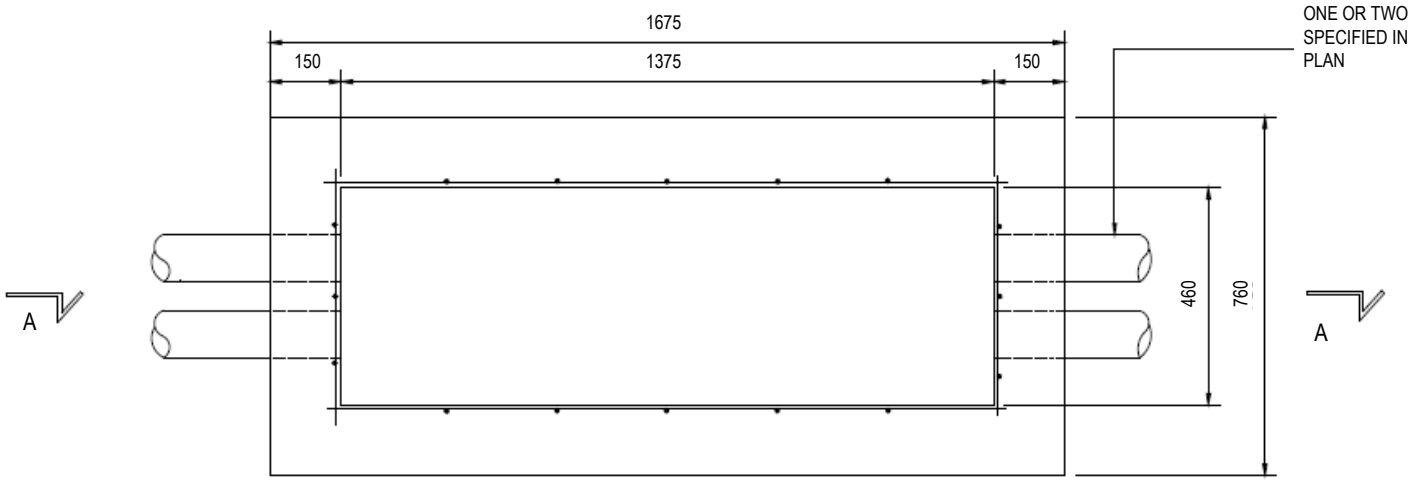
SECTION B-B

DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 28. MANHOLE DRAWINGS DETAILS – TYPE FJB4 / SECTION B-B

Figure 28: Manhole drawings details – Type FJB4 / section B-B



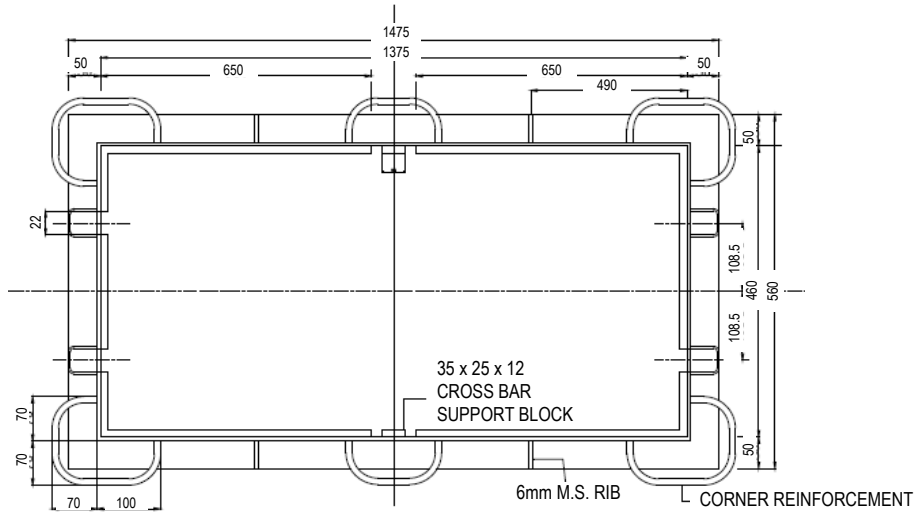
SECTION C-C

DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 29. MANHOLE DRAWINGS DETAILS – TYPE FJB4 / SECTION C-C

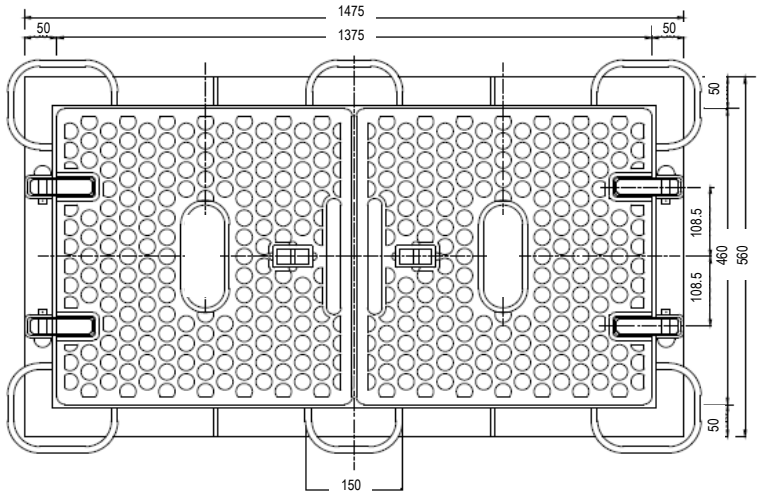
Figure 29: Manhole drawings details – Type FJB4 / section C-C



ALL TIE WIRE ENDS SHALL BE TRIMMED & TURNED IN SO AS NOT TO CONTACT FROM WORK OR SHOW THROUGH CONCRETE

PLAN VIEW

JOINT BOX FRAME



SURROUND TO BE STEEL TROWEL FINISHED SMOOTH & LEVEL WITH FRAME & SURROUNDING PAVEMENT

PLAN VIEW
JOINT BOX COVER
& FRAME

FIGURE 30. MANHOLE DRAWINGS DETAILS – TYPE FJB4 / FRAME & COVER

DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

Figure 30: Manhole drawings details – Type FJB4 / Frame and cover

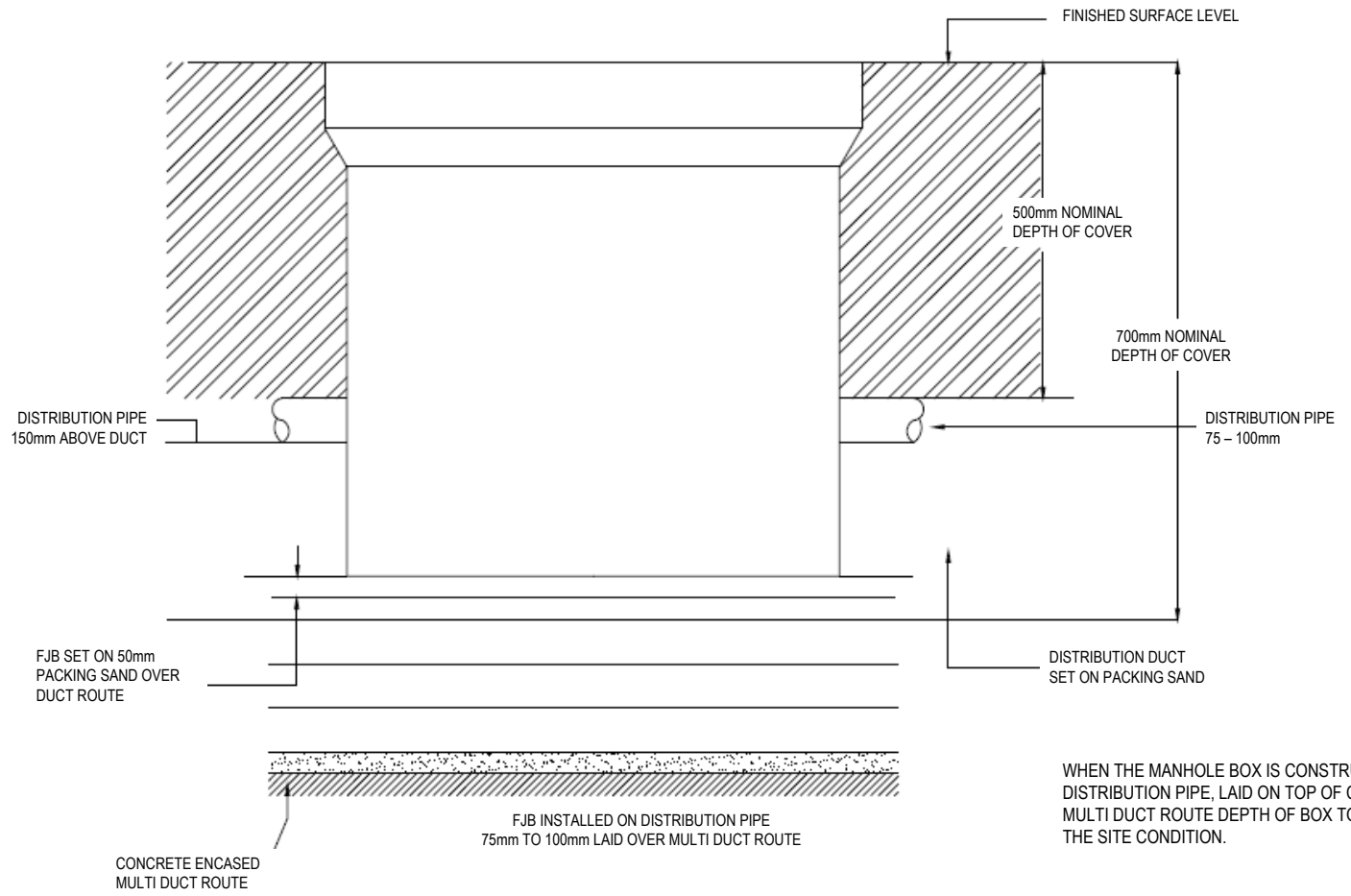
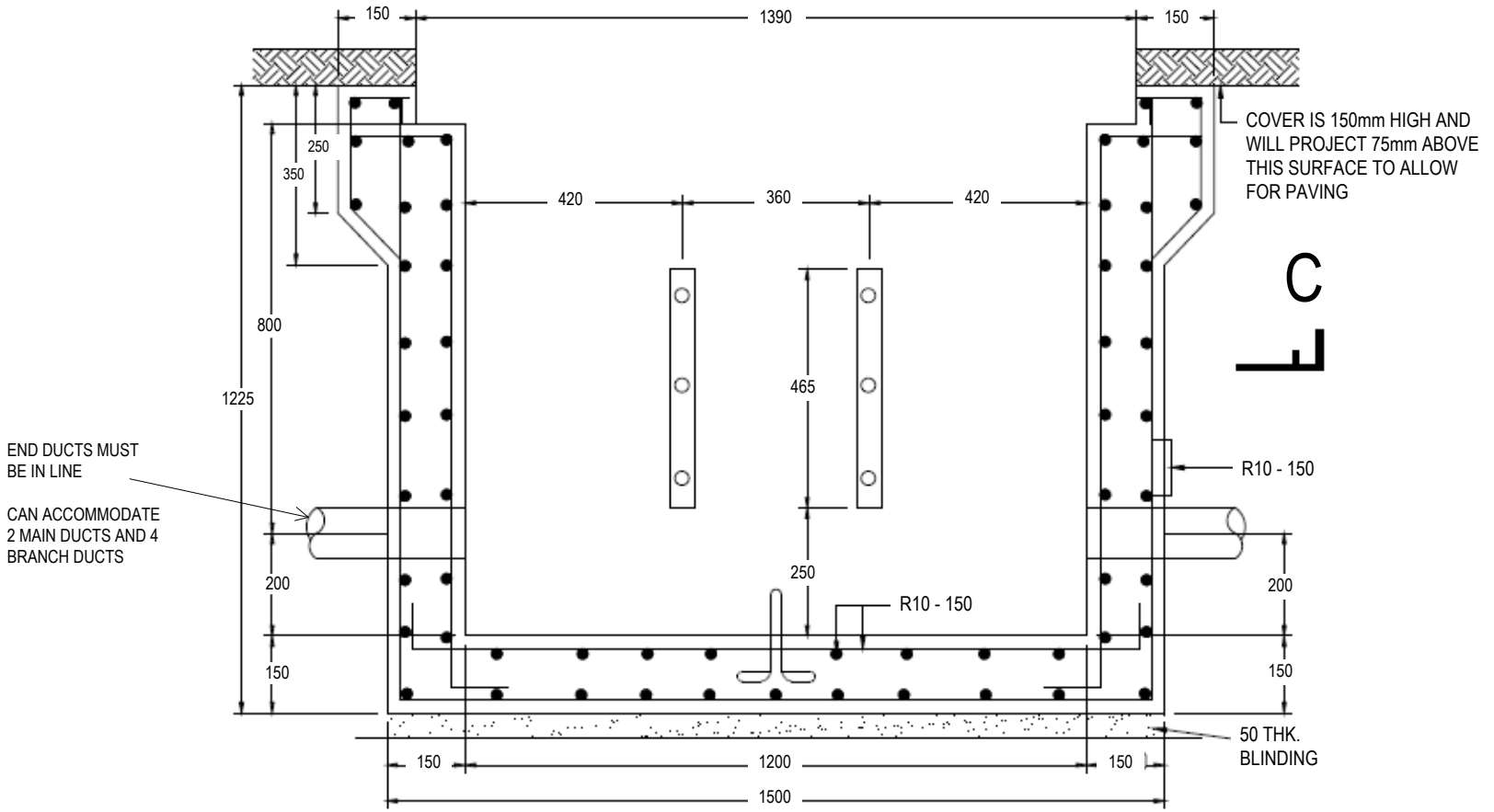


FIGURE 31. MANHOLE DRAWINGS ILLUSTRATION – FJB0, FJB1 & FJB3

DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

Figure 31: Manhole drawings illustrations – Type FJB0, FJB1 and FJB3



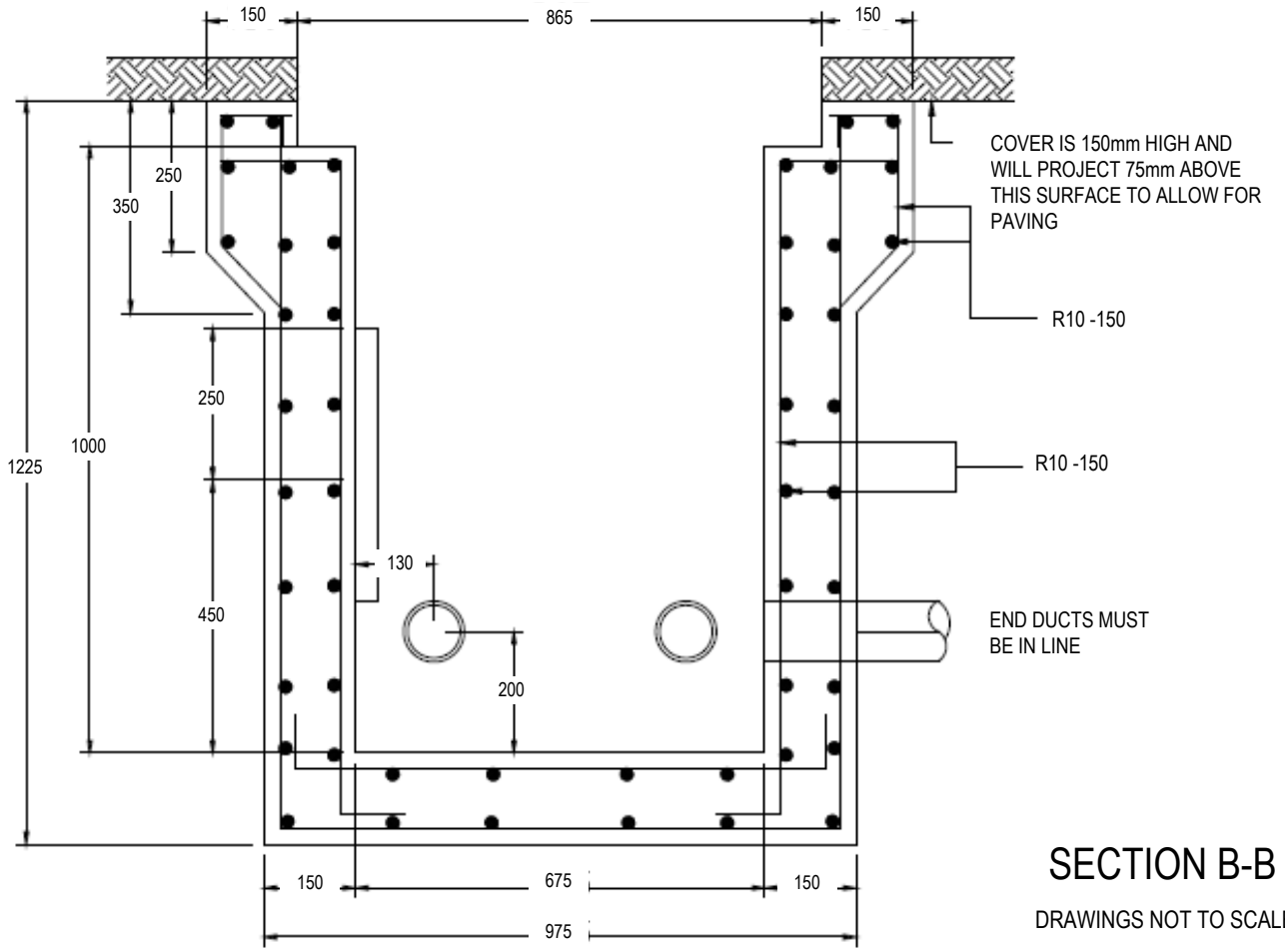
SECTION A-A

DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 32. MANHOLE DRAWINGS DETAILS– TYPE CJB / SECTION A-A

Figure 32: Manhole drawings details – Type CJB / section A-A

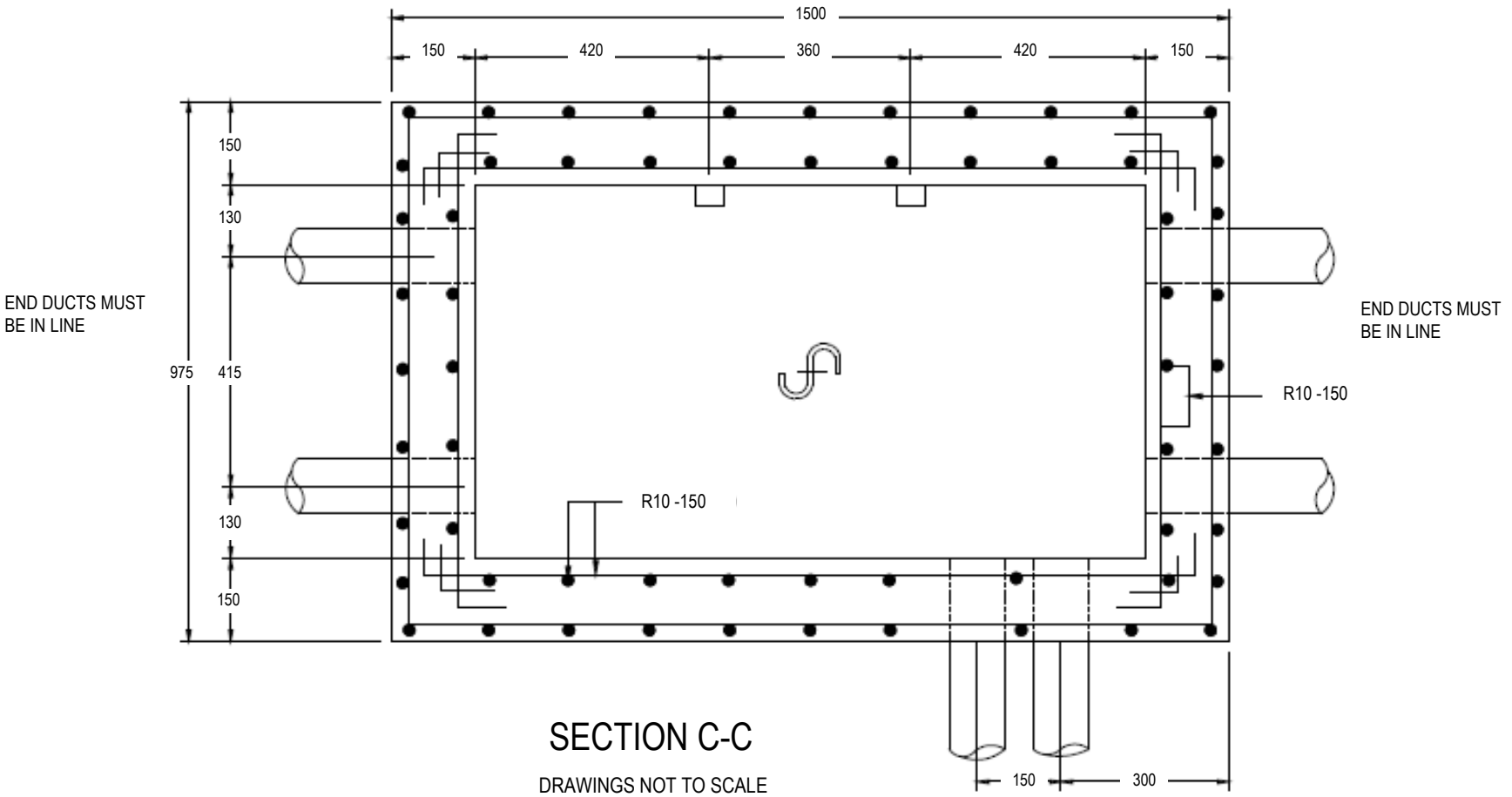


NOTE:

- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 33. MANHOLE DRAWINGS DETAILS– TYPE CJB / SECTION B-B

Figure 33: Manhole drawings details – Type CJB / section B-B



NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 34. MANHOLE DRAWINGS DETAILS– TYPE CJB / SECTION C-C

Figure 34: Manhole drawings details – Type CJB / section C-C

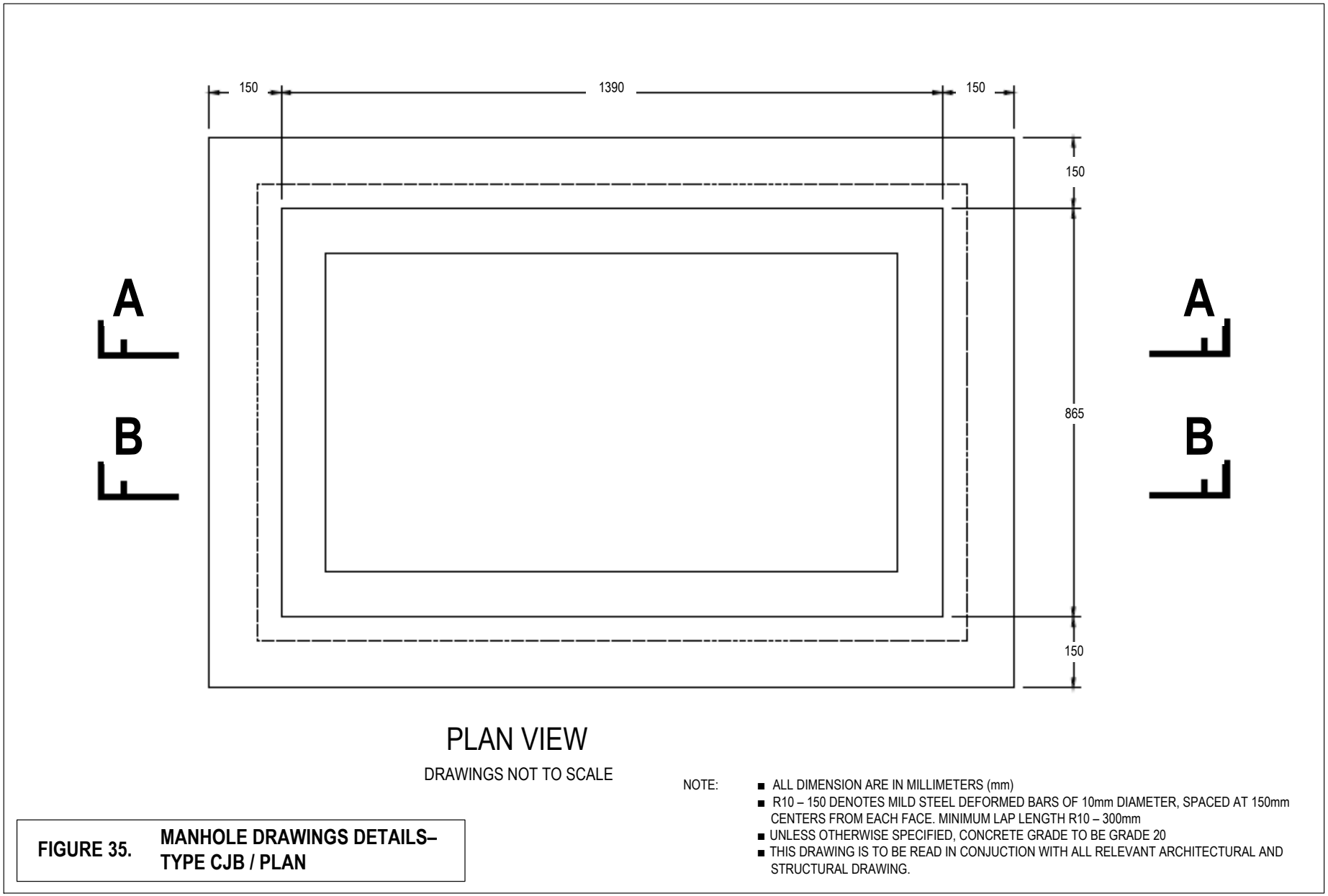
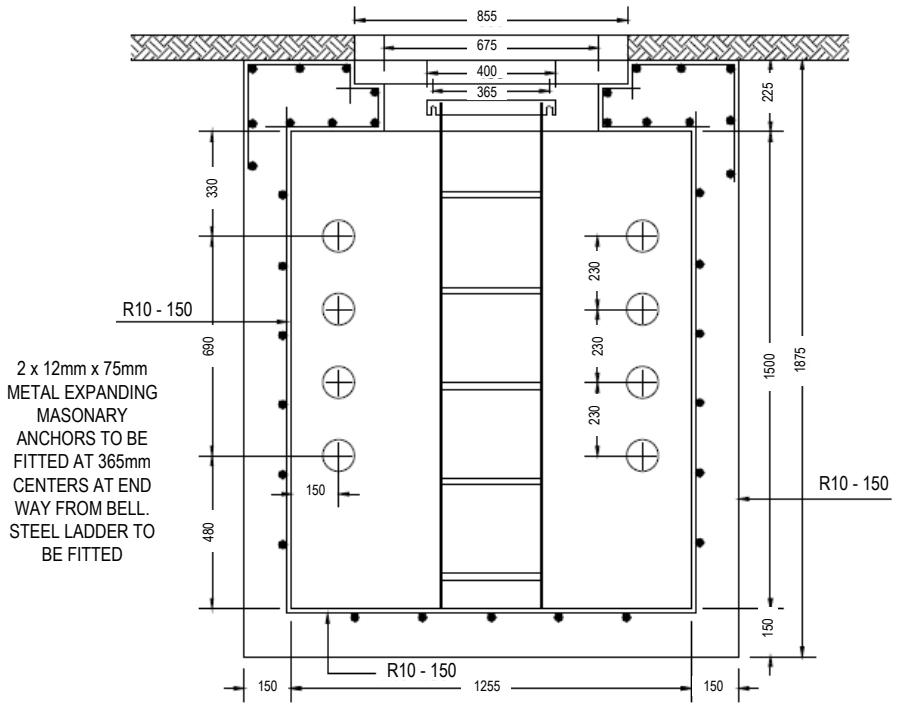
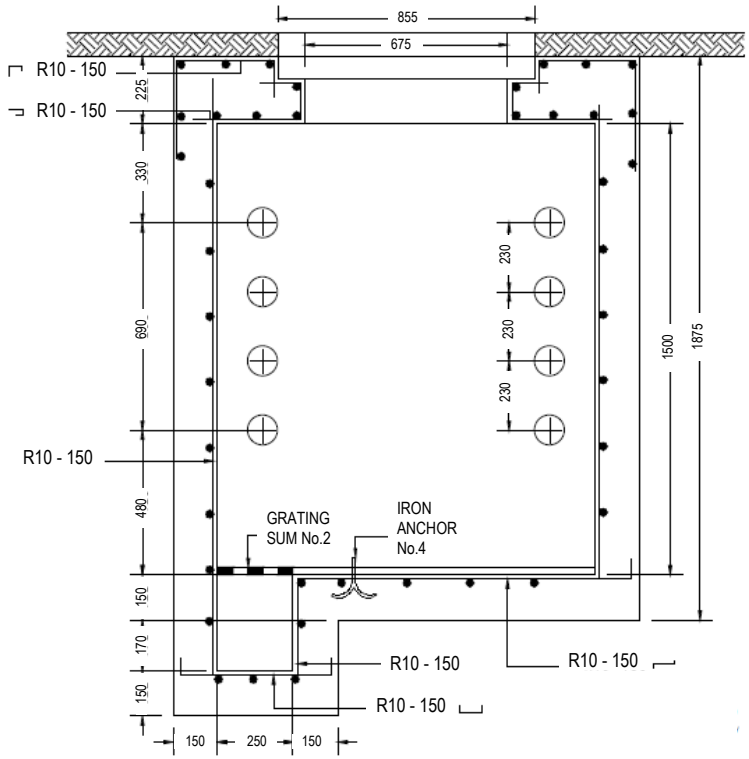


Figure 35: Manhole drawings details – Type CJB / Frame and cover



SECTION 1-1



SECTION 2-2

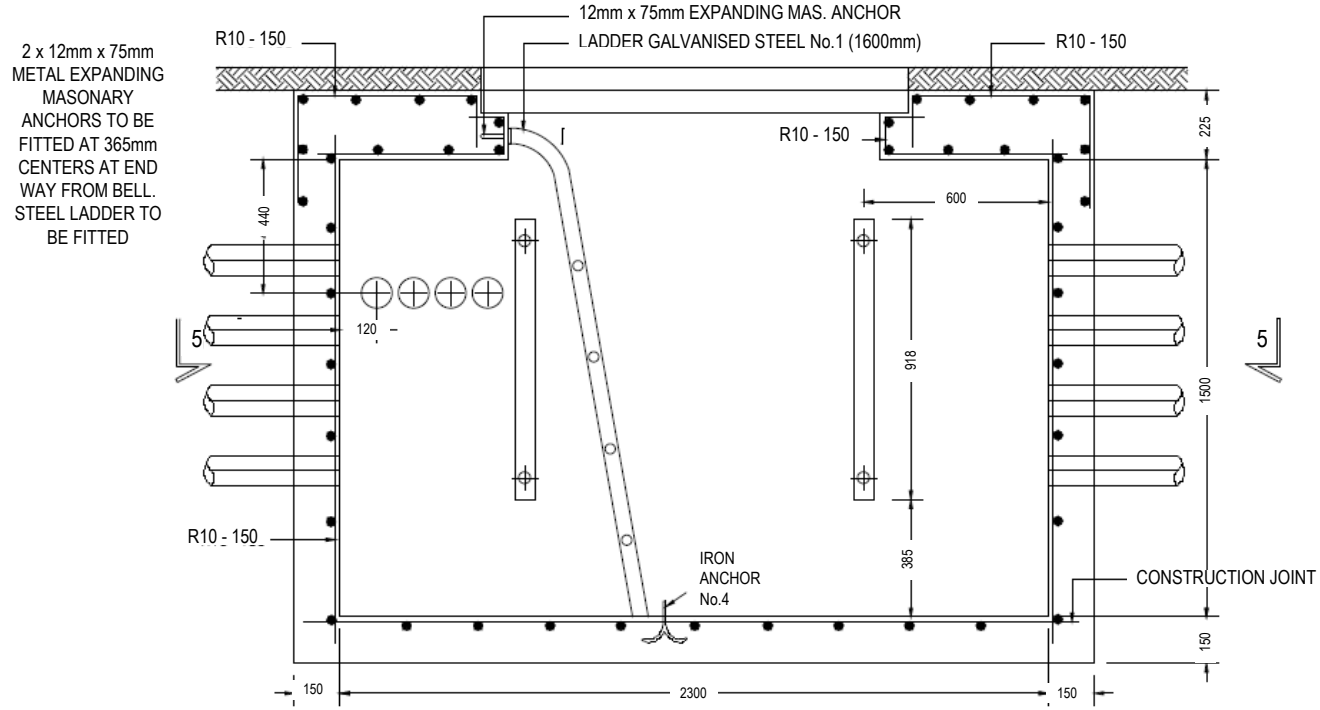
DRAWINGS NOT TO SCALE

NOTE:

- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- INVERT LEVEL OF BOTTOM DUCT SHALL BE 430mm FROM BASE OF MANHOLE
- END DUCTS MUST BE IN VERTICAL LINE C/L 150mm FROM ADJACENT WALL
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 36. MANHOLE DRAWINGS DETAILS– TYPE STD1 / SECTION 1-1 & 2-2

Figure 36: Manhole drawings details – Type STD1 / section 1-1 and 2-2



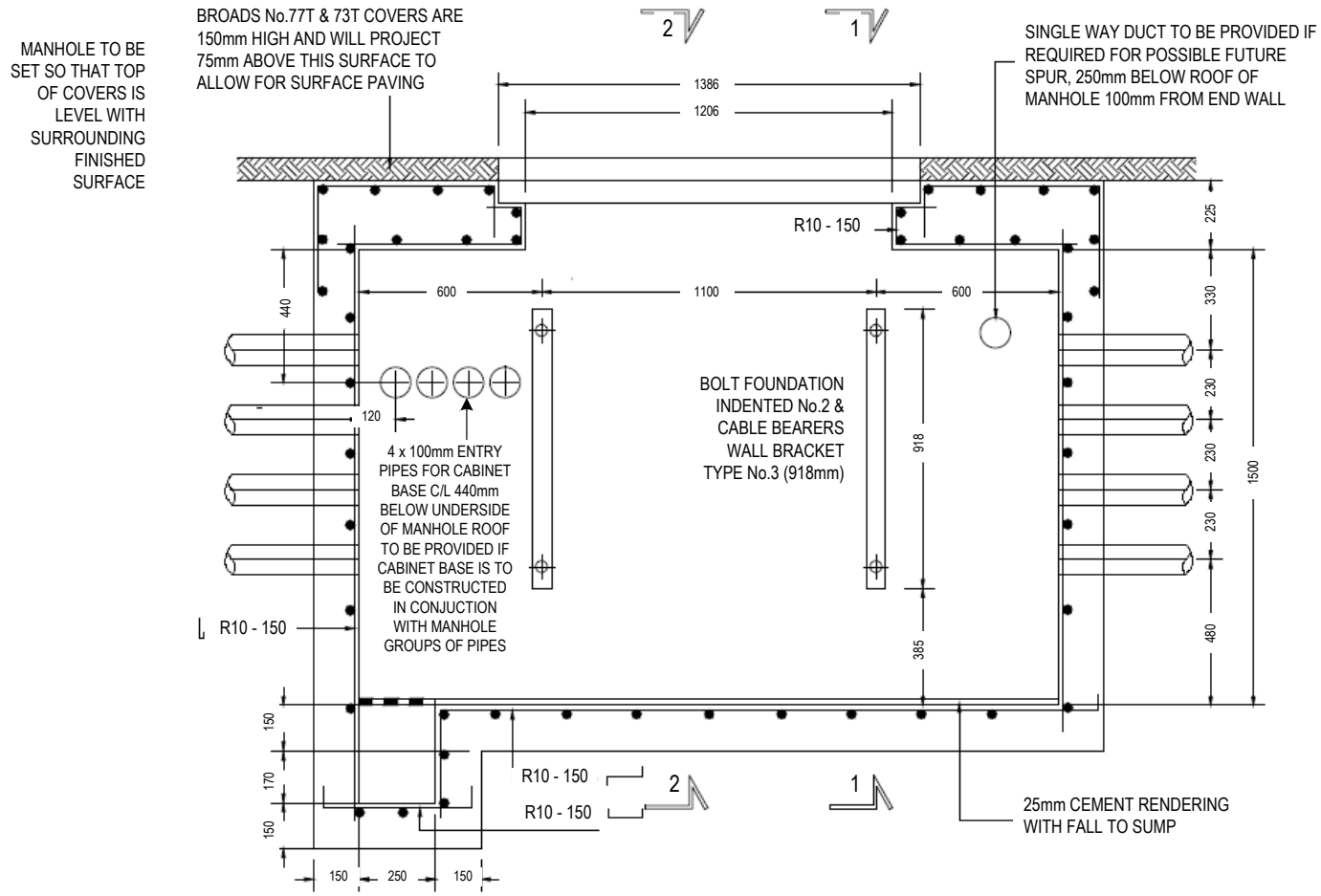
SECTION 3-3

DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- INVERT LEVEL OF BOTTOM DUCT SHALL BE 430mm FROM BASE OF MANHOLE
- END DUCTS MUST BE IN VERTICAL LINE C/L 150mm FROM ADJACENT WALL
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 37. MANHOLE DRAWINGS DETAILS– TYPE STD1 / SECTION 3-3

Figure 37: Manhole drawings details – Type STD1 / section 3-3



SECTION 4-4

DRAWINGS NOT TO SCALE

NOTE:

- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- INVERT LEVEL OF BOTTOM DUCT SHALL BE 430mm FROM BASE OF MANHOLE
- END DUCTS MUST BE IN VERTICAL LINE C/L 150mm FROM ADJACENT WALL
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

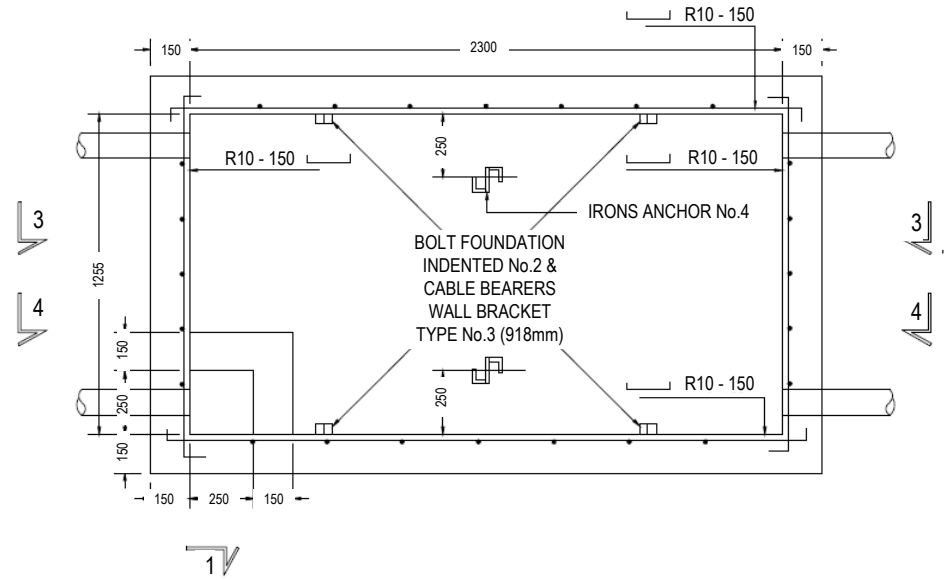
FIGURE 38. MANHOLE DRAWINGS DETAILS– TYPE STD1 / SECTION 4-4

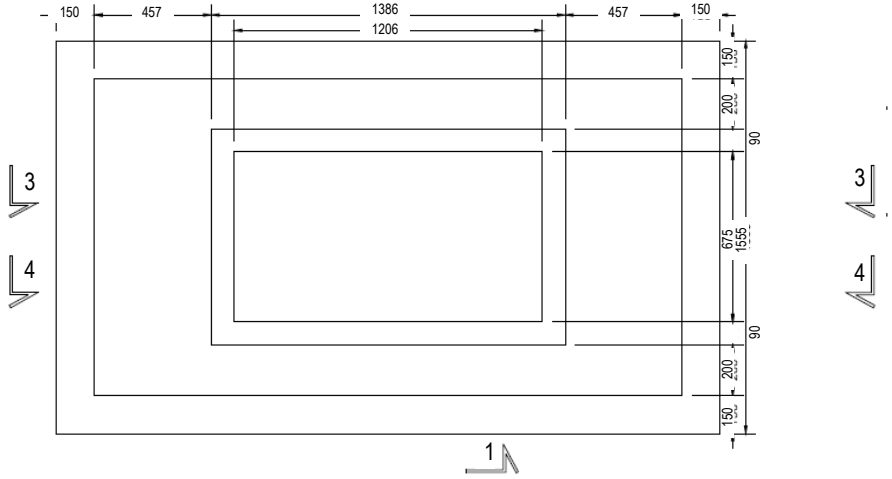
Figure 38: Manhole drawings details – Type STD4 / Plan

SECTION 5-5

DRAWINGS NOT TO SCALE

WHEN MANHOLE IS LOCATED IN GRASS VERGE OR IN HAND SHOULDER OF ROAD, WHERE IT WILL NOT BE PAVED OVER WITH ASPHALT, A CONCRETE SURROUND IS TO BE PROVIDED AFTER FITTING OF THE COVERS AND FRAME.
THE ROOF OF THE MANHOLE SHALL BE COVERED WITH EARTH OR CORE WHERE APPROPRIATE





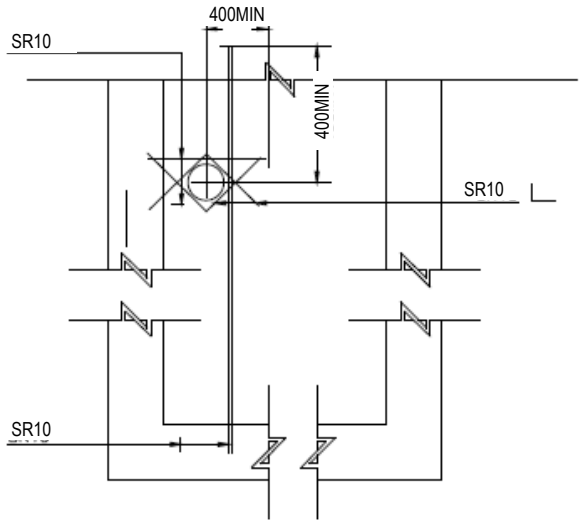
STANDARD PLAN

DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 39. MANHOLE DRAWINGS DETAILS– TYPE STD1 / SECTION 5-5 & PLAN

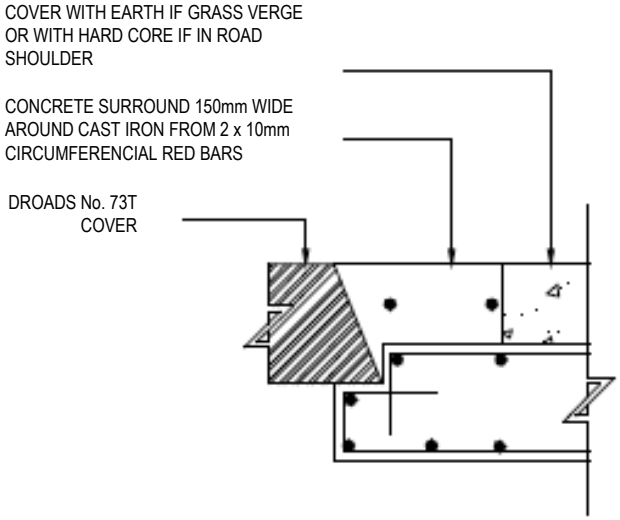
Figure 39: Manhole drawings details – Type STD1 / section 5-5 and plan



DETAILS FOR HOLE IN WALL

(TYPICAL TRIMMING)

DRAWINGS NOT TO SCALE



DETAILS OF CONCRETE SURROUND

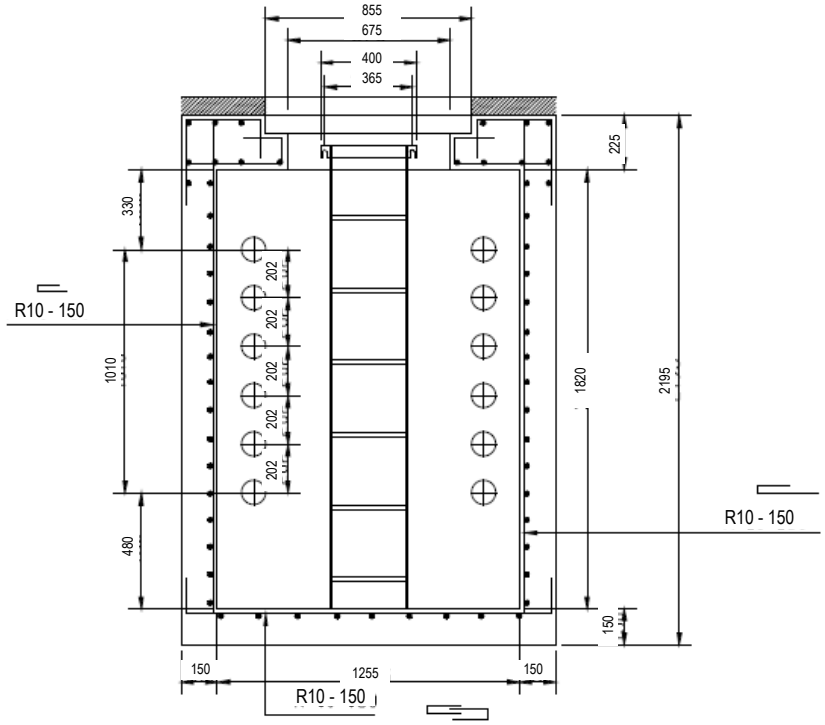
DRAWINGS NOT TO SCALE

WHEN MANHOLE IS LOCATED IN GRASS VERGE OR IN HAND SHOULDER OF ROAD, WHERE IT WILL NOT BE PAVED OVER WITH ASPHALT, A CONCRETE SURROUND IS TO BE PROVIDED AFTER FITTING OF THE COVERS AND FRAME.
THE ROOF OF THE MANHOLE SHALL BE COVERED WITH EARTH OR CORE WHERE APPROPRIATE

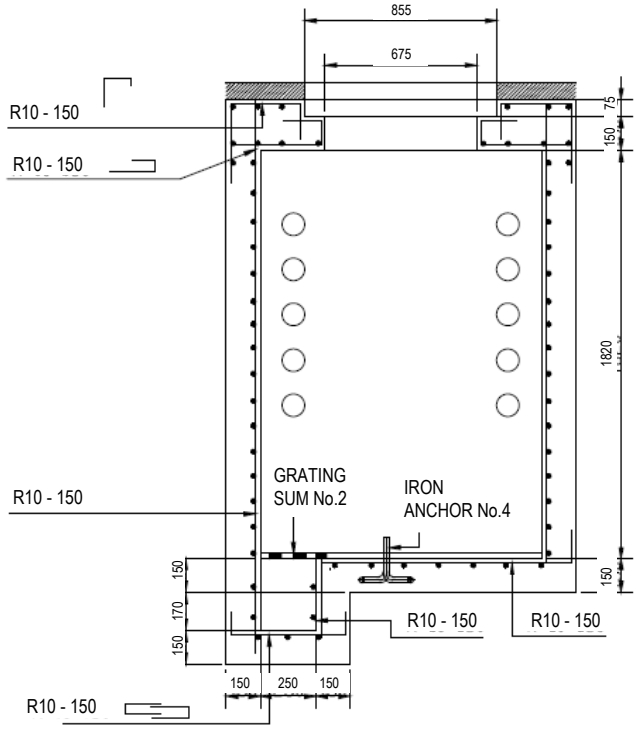
NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 40. MANHOLE DRAWINGS DETAILS– TYPE STD1 / OTHER DETAILS

Figure 40: Manhole drawings details – Type STD1 / other details



SECTION 1-1



SECTION 2-2

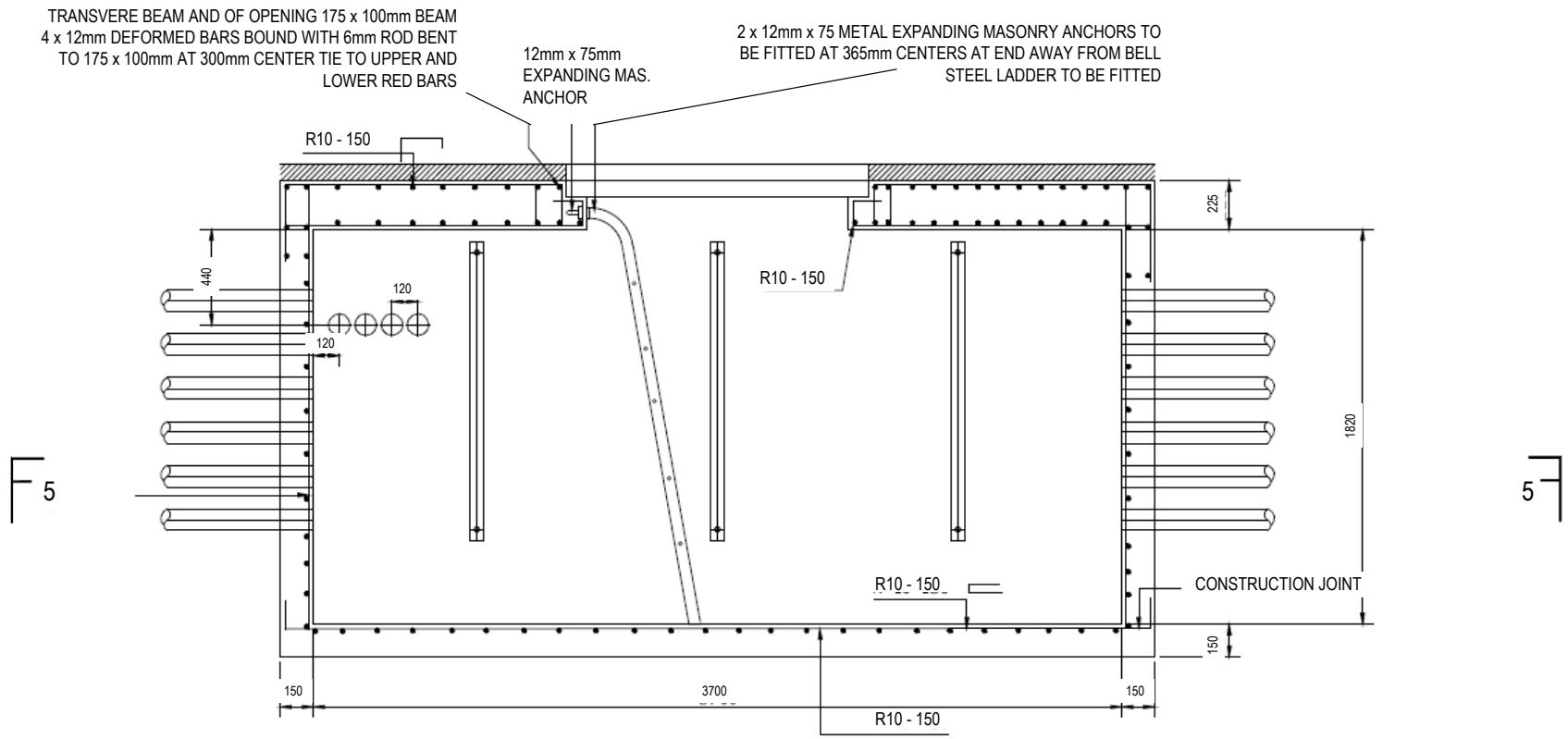
DRAWINGS NOT TO SCALE

2 x 12mm x 75mm METAL EXPANDING MASONARY
ANCHORS TO BE FITTED AT 365mm CENTERS AT END WAY
FROM BELL. STEEL LADDER TO BE FITTED

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 41. MANHOLE DRAWINGS – TYPE STD2 / SECTION 1-1 & 2-2

Figure 41: Manhole drawings details – Type STD2 / section 1-1 and 2-2



SECTION 3-3

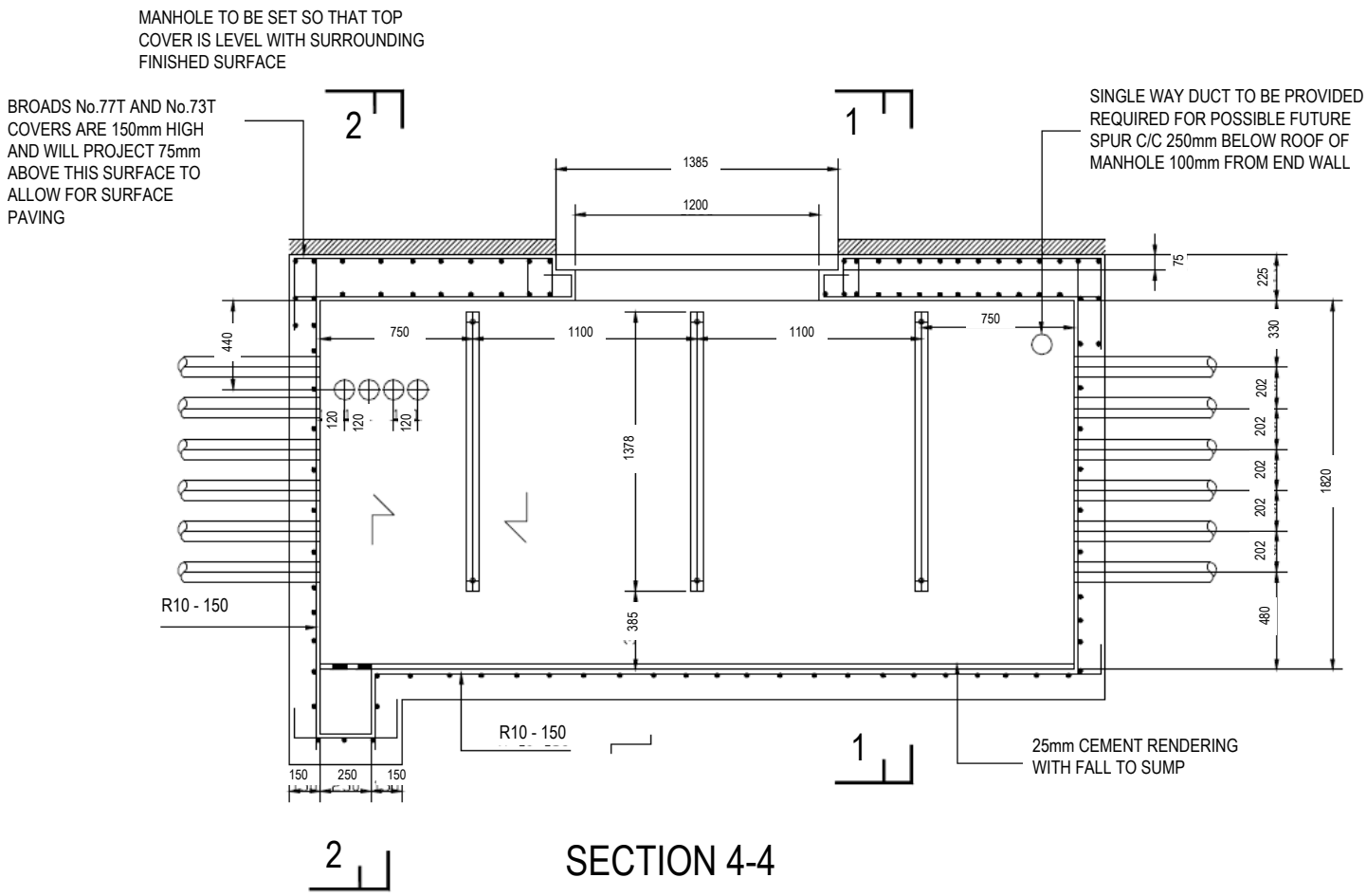
DRAWINGS NOT TO SCALE

NOTE:

- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 42. MANHOLE DRAWINGS DETAILS– TYPE STD2 / SECTION 3-3

Figure 42: Manhole drawings details – Type STD2 / section 3-3

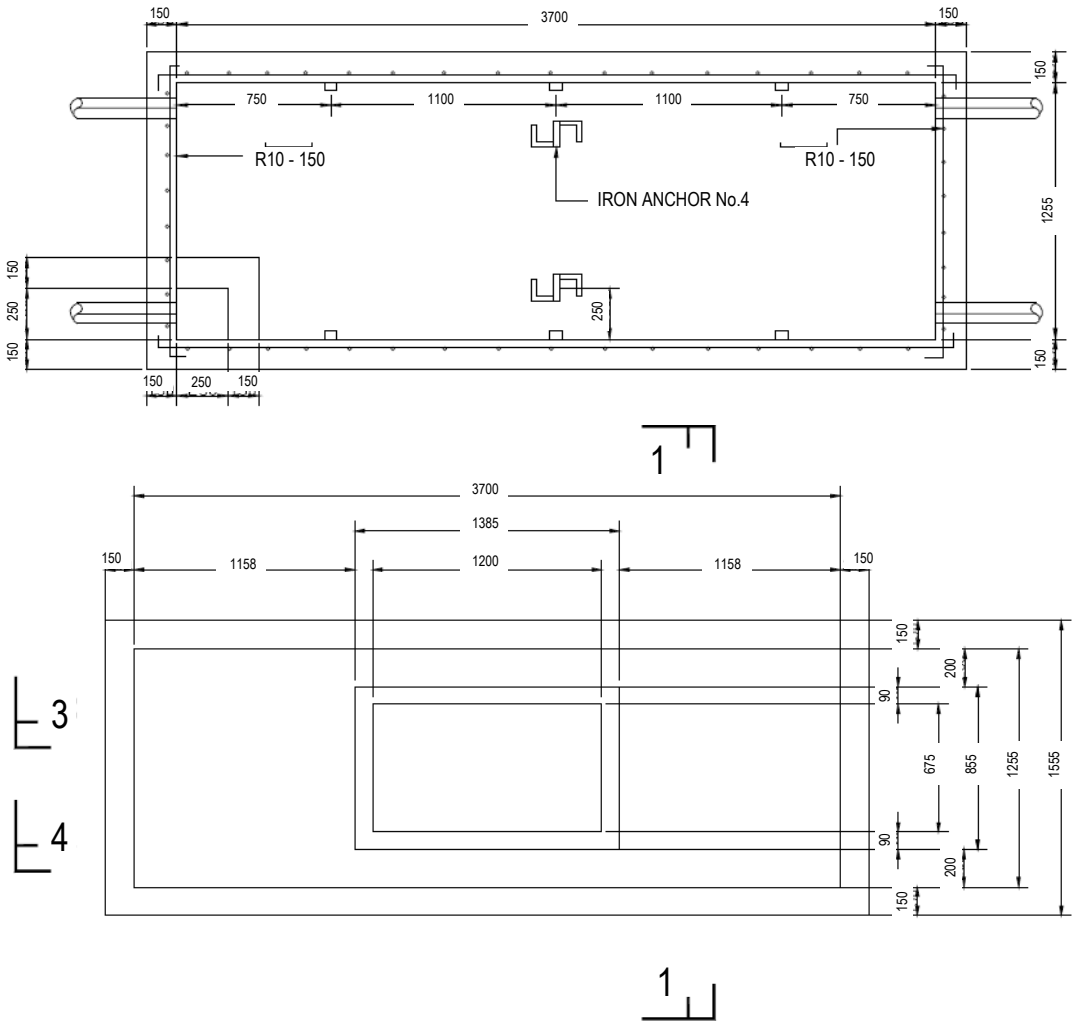


NOTE:

- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 43. MANHOLE DRAWINGS DETAILS– TYPE STD2 / SECTION 4-4

Figure 43: Manhole drawings details – Type STD2 / section 4-4



3

SECTION 5-5

DRAWINGS NOT TO SCALE

4

WHEN MANHOLE IS LOCATED IN GRASS VERGE OR IN HAND SHOULDER OF ROAD, WHERE IT WILL NOT BE PAVED OVER WITH ASPHALT, A CONCRETE SURROUND IS TO BE PROVIDED AFTER FITTING OF THE COVERS AND FRAME.
THE ROOF OF THE MANHOLE SHALL BE COVERED WITH EARTH OR CORE WHERE APPROPRIATE

STANDARD PLAN

3

DRAWINGS NOT TO SCALE

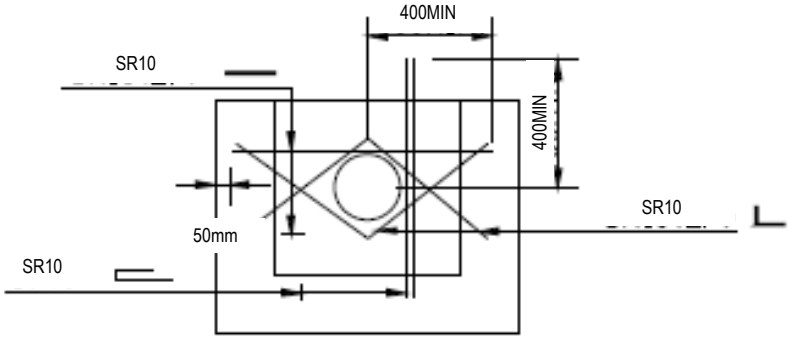
4

NOTE:

- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 44. MANHOLE DRAWINGS DETAILS– TYPE STD2 / SECTION 5-5 & PLAN

Figure 44: Manhole drawings details – Type STD2 / section 5-5 and plan

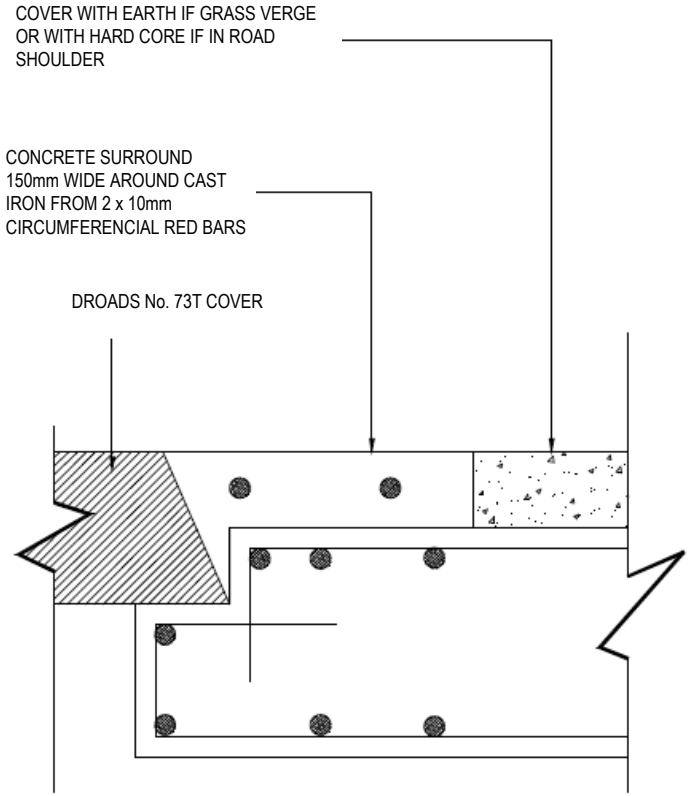


DETAILS FOR HOLE IN WALL

(TYPICAL TRIMMING)

DRAWINGS NOT TO SCALE

WHEN MANHOLE IS LOCATED IN GRASS VERGE OR IN HAND SHOULDER OF ROAD, WHERE IT WILL NOT BE PAVED OVER WITH ASPHALT, A CONCRETE SURROUND IS TO BE PROVIDED AFTER FITTING OF THE COVERS AND FRAME.
THE ROOF OF THE MANHOLE SHALL BE COVERED WITH EARTH OR CORE WHERE APPROPRIATE



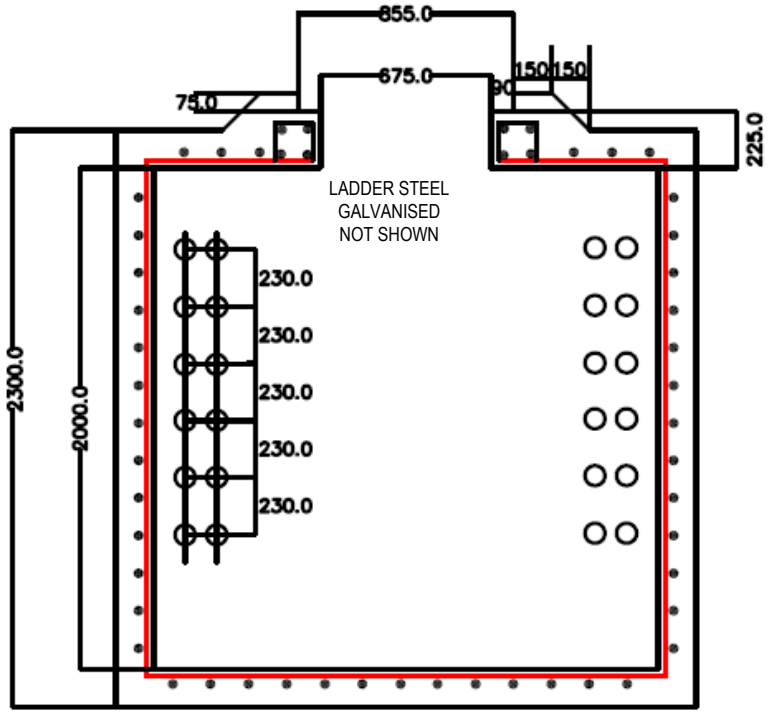
DETAILS OF CONCRETE SURROUND

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 45. MANHOLE DRAWINGS DETAILS– TYPE STD2 / OTHER DETAILS

Figure 45: Manhole drawings details – Type STD2 / other details

DUCTS SHALL ENTER MANHOLE IN POSITION SHOWN WITH CENTRE DISTANCE OF 230mm VERTICAL AND 125mm HORIZONTAL SPACING WITH 100mm CLEARANCE TO WALLS. ALL TOP DUCTS SHALL BE 330mm C/L BELOW ROOF



TWO GALVANISED STEEL LADDERS TO BE FITTED WITH EXPANDING MASONRY ANCHOR BOLTS (12mm) TWO PER LADDER.

DUMMY DUCTS TO PROJECT 150mm OUTSIDE WALLS TO FACILITATE LATER EXTENSION OF PIPES

SECTION A-A

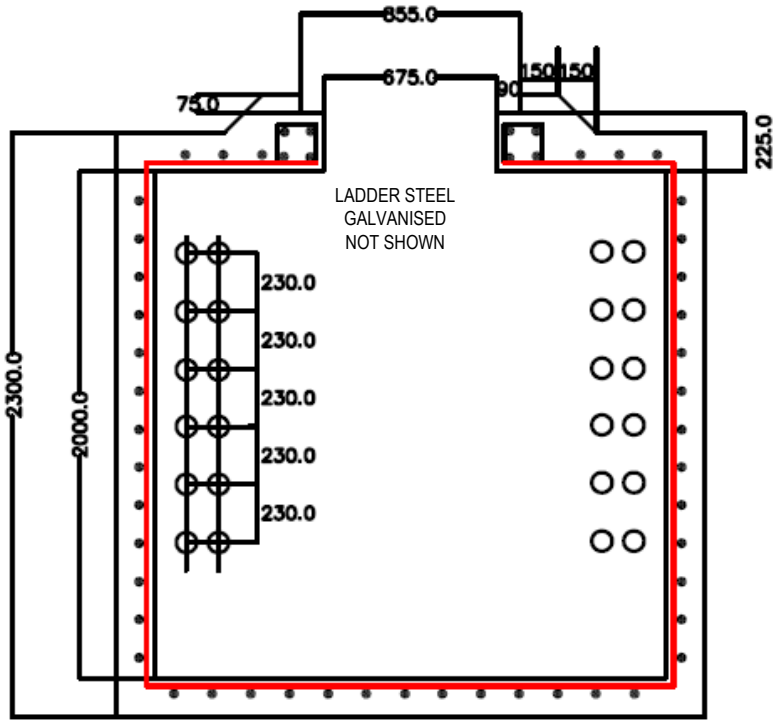
DRAWINGS NOT TO SCALE

NOTE:
- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 46. MANHOLE DRAWINGS DETAILS– TYPE STD4 / SECTION A-A

Figure 46: Manhole drawings details – Type STD4 / section A-A

DUCTS SHALL ENTER MANHOLE IN POSITION SHOWN WITH CENTRE DISTANCE OF 230mm VERTICAL AND 125mm HORIZONTAL SPACING WITH 100mm CLEARANCE TO WALLS. ALL TOP DUCTS SHALL BE 330mm C/L BELOW ROOF



TWO GALVANISED STEEL LADDERS TO BE FITTED WITH EXPANDING MASONRY ANCHOR BOLTS (12mm) TWO PER LADDER.

DUMMY DUCTS TO PROJECT 150mm OUTSIDE WALLS TO FACILITATE LATER EXTENSION OF PIPES

SECTION B-B

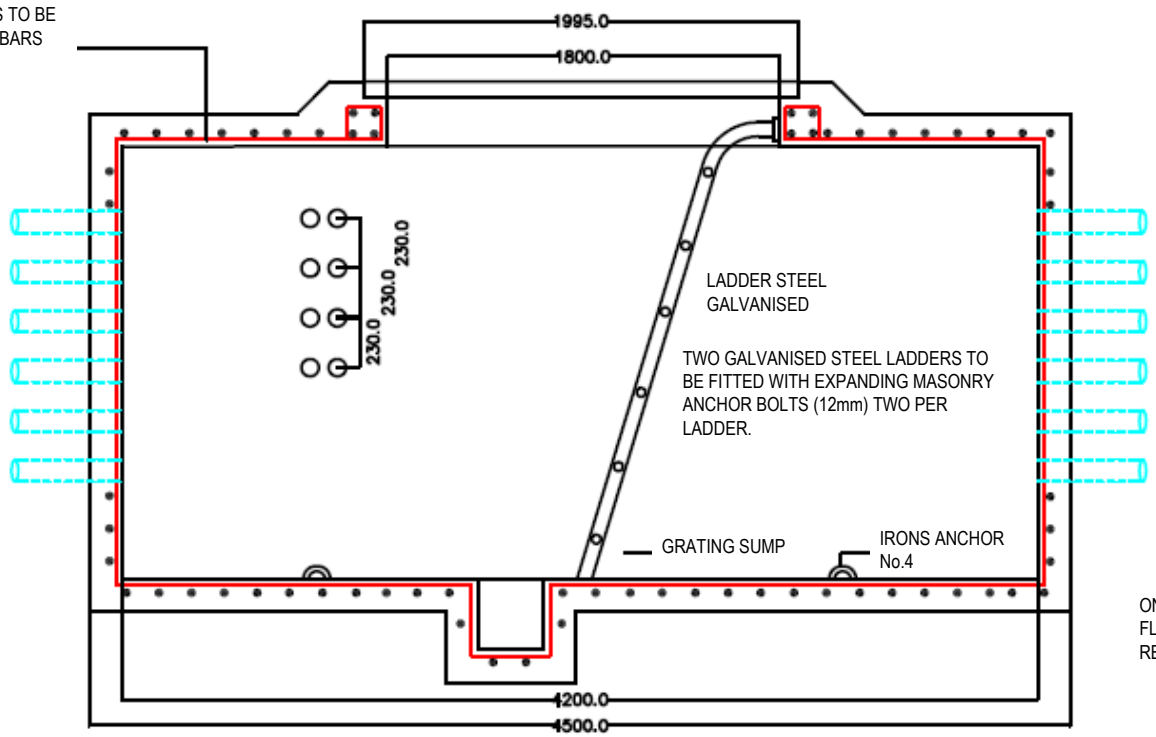
DRAWINGS NOT TO SCALE

NOTE:

- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 47. MANHOLE DRAWINGS DETAILS– TYPE STD4 / SECTION B-B

Figure 47: Manhole drawings details – Type STD4 / section B-B



SECTION C-C

DRAWINGS NOT TO SCALE

NOTE:

- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 48. MANHOLE DRAWINGS DETAILS– TYPE STD4 / SECTION C-C

Figure 48: Manhole drawings details – Type STD4 / section C-C

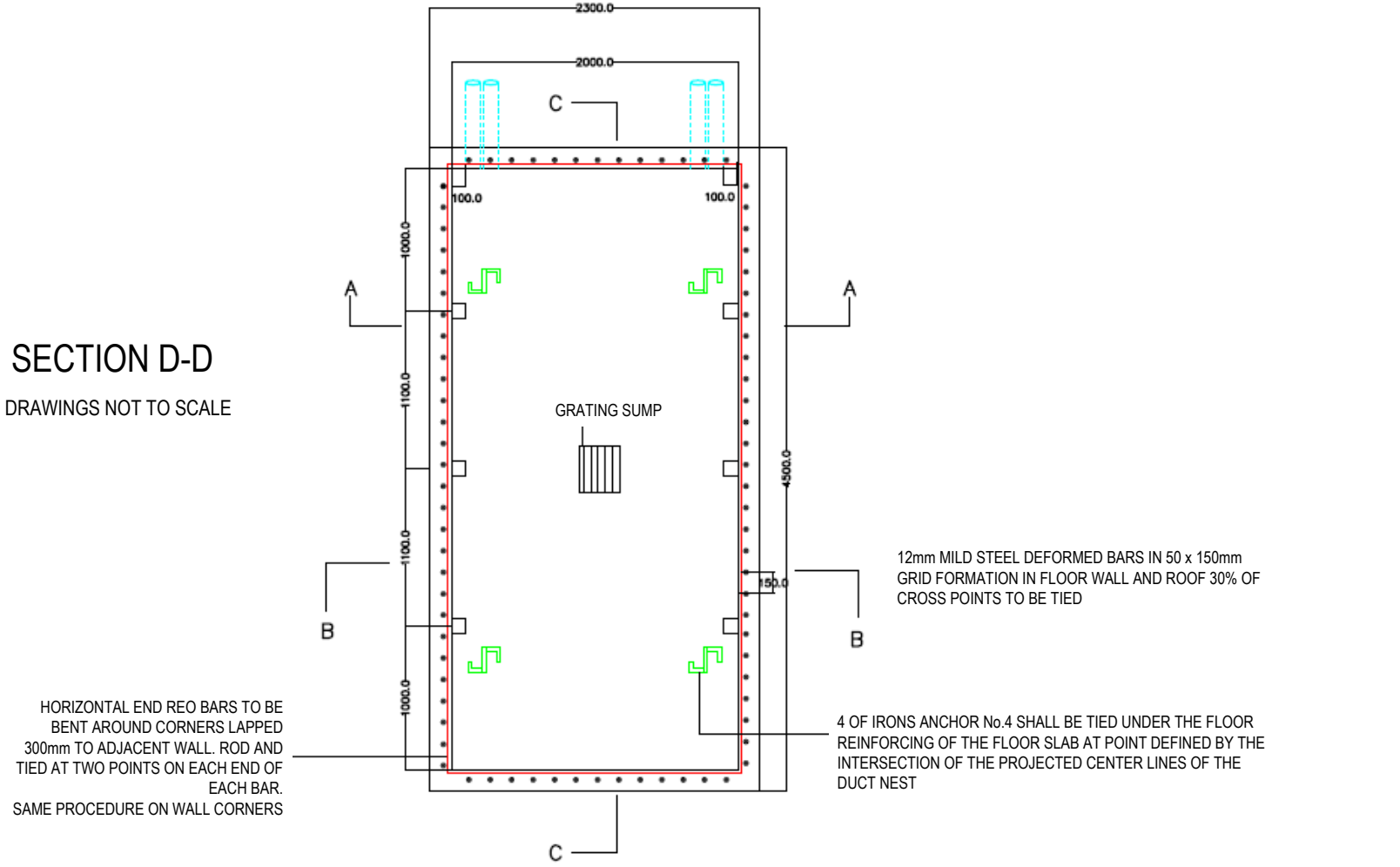
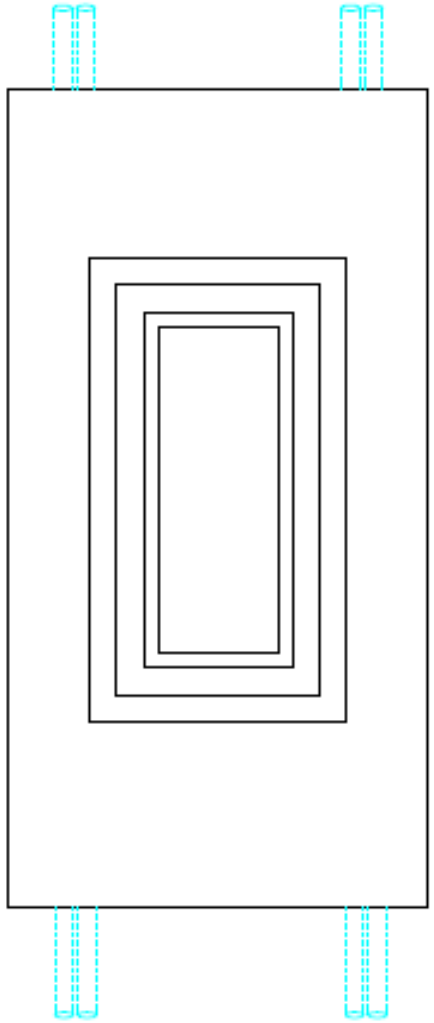


Figure 49: Manhole drawings details – Type STD4 / section D-D

PLAN VIEW

DRAWINGS NOT TO SCALE



"BROADS" No.77T FRAME IS 150mm HIGH AND WILL PROJECT 75mm ABOVE CONCRETE SURROUND TO ALLOW 75mm SURFACE PAVING OR FINISHING SURROUND OF 75mM x 150mm

IF MANHOLE IS SET IN GRASS VERGE, 75 x 150mm SURROUNDS NEATLY BOXED AND STEEL TROWEL FINISH WITH 2 x 12mm REO BARS ON ALL SIDES AT 100mm ARE TO BE PROVIDED. CENTERS 25mm BELOW TOP SURFACE, ALL JOINTS TIED AND LAPPED BY 300mm REO SUPPORTED ON BAR CHAIRS AT CORRECT HEIGHT

MANHOLE TO BE SET TO SUCH LEVEL THAT TOP OF COVERS WILL BE LEVEL WITH FINISHED SURROUNDING GROUND SURFACE. WHEN SET IN GRASS VERGE, MANHOLE SHALL BE COVERED WITH "EARTH FREE FROM STONES" TO LEVEL OF COVERS.

NOTE:

- ALL DIMENSION ARE IN MILLIMETERS (mm)
- R10 – 150 DENOTES MILD STEEL DEFORMED BARS OF 10mm DIAMETER, SPACED AT 150mm CENTERS FROM EACH FACE. MINIMUM LAP LENGTH R10 – 300mm
- UNLESS OTHERWISE SPECIFIED, CONCRETE GRADE TO BE GRADE 20
- THIS DRAWING IS TO BE READ IN CONJUCTION WITH ALL RELEVANT ARCHITECTURAL AND STRUCTURAL DRAWING.

FIGURE 50. MANHOLE DRAWINGS DETAILS– TYPE STD4 / PLAN

Figure 50: Manhole drawings details – Type STD4 / Plan

CHAPTER 8. TELECOMMUNICATION ROOM AND MOBILE DEPLOYMENT SPACE

8.1 OBJECTIVE

8.1.1 The objective of this segment is to set out the additional requirements for the provision of telecommunication room and mobile deployment space. The Authority reserves the right to require any developer or owner to provide such rooms or spaces of larger size or additional telecommunication rooms or mobile deployment spaces in those buildings where there is greater demand for telecommunication services, if such additional provision is necessary.

8.2 LOCATION

8.2.1 Every developer or owner who is required to provide a telecommunication room and/or mobile deployment space shall –

(a) locate the telecommunication room and/or mobile deployment space as close as possible to the telecommunication risers;

(b) not locate the telecommunication room –

i. in an area through which any system or network of water pipes, gas pipes or electrical trunking is running;

ii. under any area that is susceptible to dampness or moisture such as a vehicle washing bay, swimming pool, washroom or toilet;

iii. in any area which will subject the plant deployed therein to vibration of more than 0.05 G, where G is the acceleration due to gravity (G=9.81 m/s2); or

iv. in any area where it will be directly subjected to the discharge of water, steam, fumes, gases or dust; and

(c) not locate the mobile deployment space –

i. in any area which will subject the plant deployed therein to vibration of more than 0.05 G, where G is the acceleration due to gravity (G=9.81 m/s2);

ii. in any area where it will be directly subjected to the discharge of water, steam, fumes, gases or dust;

iii. in any area within or near the bin center; or

iv. in any area where the concrete floor is not able to withstand a loading of 1.5 kN/m2 or more.

8.3 CONSTRUCTION

8.3.1 Every developer or owner who is required to provide a telecommunication room shall –

(a) construct the room using reinforced concrete or brick wall;

(b) finish the surface of the room with cement plaster and ensure that it is free of cracks, blisters or other defects;

(c) paint the walls of the room with a light colour paint;

(d) ensure that the room is of a minimum height of 3.5 m (measured from the floor to the ceiling) throughout the entire room save that where it is not practicable to provide a minimum height of 3.5 m, the developer or owner shall provide a cable ladder from the lead-in pipes which is to –

i. run vertically to a height of at least 2.5 m and subsequently run horizontally to all sides of the walls of the room with a height clearance of at least 300 mm from any obstruction above it; and

ii. have a width which is similar to the collective width of all the pipes entering the room;

(e) finish the floor of the room with vinyl tiles or screed;

(f) ensure that the concrete floor of the room is able to withstand a loading of 480 kg/m2;

(g) ensure that all doors of the room open outwards fully;

(h) ensure that the door frames for the doors of the room have a 150 mm high concrete skirting/kerb to prevent the ingress of water;

(i) where the cable tray enters the room from the floor, ensure that the floor opening has a width that is not more than 1.25 times the width of the cable tray and a depth ranging between 180 mm to 220 mm; and

(j) where the cable tray enters the room from the floor, construct the floor opening with a kerb around the opening, extending vertically upwards and adjoining the opening, with a height of 150 mm and a thickness of 50 mm.

8.3.2 Where the developer or owner provides a telecommunication room in the form of a standalone structure, such developer or owner shall, in addition to the requirements specified in the paragraph 8.3.1, ensure that –

a) the floor of the telecommunication room is at least 150 mm above the immediate external final road or driveway level;

b) the floor of the telecommunication room is waterproofed;

c) the walls of the telecommunication room are waterproofed;

d) the emulsion painting system used for the outside wall of the telecommunication room is suitable for external application;

e) the ceiling of the telecommunication room is smoothly finished and emulsion painted;

f) the roof of the telecommunication room is constructed of flat reinforced concrete, suitably waterproofed and constructed to a fall of approximately 1:80 away from the direction of the door;

g) proper drainage is provided around the telecommunication room such as hinged hot-dipped galvanized mild steel gratings;

h) where applicable, the gate and perimeter fencing is of a minimum height of 1.8 m;

i) the driveway to the telecommunication room is of a minimum width of 4 m and designed to withstand a minimum vehicular load of a three (3)-tonne vehicle; and

j) all vacant space from the telecommunication room to the perimeter fencing is paved using tarmac or weld-mesh reinforced concrete with fall designed for quick dispersion of water to the surrounding drains.

8.4 VENTILATION AND AIR -CONDITIONING

8.4.1 Every developer or owner of a non-residential building who is required to provide a telecommunication room shall provide for ventilation of the telecommunication room by way of:

(a) air-conditioning from the central system (where central air-conditioning system is provided in the relevant development), provided that the developer or owner shall:

i. ensure that the temperature in the telecommunication room is 22 °C ± 2 °C;

ii. ensure that the relative humidity in the telecommunication room is less than 70 %; and

iii. prior to issuance of the temporary certificate of fitness for occupation permit for the relevant building, seal all the underground pipes at the point of entry into the telecommunication room, with a material that is durable, can be easily removed, and will not cause damage to the underground pipes and any telecommunication cable that may be used in the underground pipes, such that no foreign gaseous matter (which may be toxic or flammable) will pass through the underground pipes into the telecommunication room; or

(b) louvers on the wall above the door, along the whole of that side of the wall, of the telecommunication room, and where it is necessary to further ventilate the room, the developer or owner shall install exhaust fans at the top corners of the telecommunication room.

8.4.2 Every developer or owner of a residential building who is required to provide a telecommunication room shall –

(a) provide louvers on the wall above the door, along the whole of that side of the wall, of the telecommunication room; and

(b) where it is necessary to further ventilate the room, install exhaust fans at the top corners of the telecommunication room.

8.5 ELECTRICAL

8.5.1 Every developer or owner who is required to provide a telecommunication room shall –

(a) provide electrical mains to the telecommunication room from the main electrical distribution panels which shall be successfully tested by qualified persons licensed or certified by the competent authority or electricity company; and

(b) ensure that the mean lighting illuminance in the telecommunication room is at least 450 lux at floor level.

8.6 EARTHING

8.6.1 Every developer or owner who is required to provide a telecommunication room shall –

(a) ensure that the earthing point is connected to the earth electrode system via earth cable with a cross section area of not less than 50 mm^2;

(b) ensure that the pure copper earth bar has screw holes that are spaced 50 mm apart measured from center to center; and

(c) place the certified test result of the earth system together with actual layout diagrams showing the earth system arrangement in the telecommunication room.

CHAPTER 9. TELECOMMUNICATION RISERS

9.1 OBJECTIVE

9.1.1 The objective of this segment is to set out the additional requirements for the provision of telecommunication riser.

9.2 GENERAL REQUIREMENTS

9.2.1 Every developer or owner who is required to provide telecommunication risers shall -

(a) provide a single-leaf door (the width of which shall be in accordance with the requirements set out in the relevant chapters in this Code) that can be opened fully outwards and is approximately 2.1 m in height, on the width side of each telecommunication riser on every floor;

(b) if the width of the riser exceeds 1.2 m, provide a double-leaf door (the width of which shall be in accordance with the requirements set out in the relevant chapters in this Code) that can be opened fully outwards and is approximately 2.1 m in height, on the width side of each telecommunication riser on every floor;

(c) ensure that the fire-rating of the doors and compartment walls of the telecommunication risers complies with the requirements of the relevant authorities;

(d) provide a 150 mm high concrete skirting or kerb behind the doors of the telecommunication risers;

(e) ensure that a label with the words “Telecoms Riser” with appropriate numbering for identification purpose is affixed to the door of the telecommunication riser on every floor;

(f) provide adequate lighting to enable licensees to carry out their installation and maintenance work in the telecommunication risers;

(g) ensure that the dimensions of the inter-floor openings in the telecommunication risers are as follows (and as shown in **Figure 51**):

i. the width of the inter-floor opening shall be equivalent to 1.25 times the width of the cable trays; and

ii. the depth shall be between 180 mm to 220 mm;

(h) ensure that the inter-floor openings for the telecommunication risers are sealed with fire resistant material (as shown in **Figure 51**), which can be easily removed, in compliance with the Director of Brunei Fire and Rescue Department requirement, no earlier than one month prior to the expected date of issuance of the temporary certificate of fitness for occupation permit (the “Due Date”), regardless whether the licensees have completed the installation of their cables by the Due Date. For the avoidance of doubt, licensees who install their cables after the developer or owner has completed the sealing of inter-floor openings, will have to remove the seal and re-seal the inter-floor openings at their own cost;

(i) ensure that the concrete floor in the telecommunication riser (as shown in **Figure 51**) is able to withstand the same loading as the floor outside the riser;

(j) ensure that the walls of the telecommunication risers are smoothly plastered and painted with a light colour;

(k) where copper and optical fibre cables are laid from the tenant or residential units in the building to the telecommunication risers, ensure that such cables are terminated at the appropriate termination or distribution boxes located in the telecommunication risers; and

(l) ensure that the internal wiring to all units is performed strictly by licensed telecommunication wiring contractors.

9.3 INTERNAL WIRING SCHEDULE

9.3.1 Every developer or owner who provides internal wiring shall –

(a) prominently display an internal wiring schedule in the telecommunication room indicating the unit numbers of the tenants or residential units to be served by the applicable telecommunication riser;

(b) ensure that the internal wiring schedule is in the format shown in **Table 30** below; and

Table 30: Internal wiring schedule

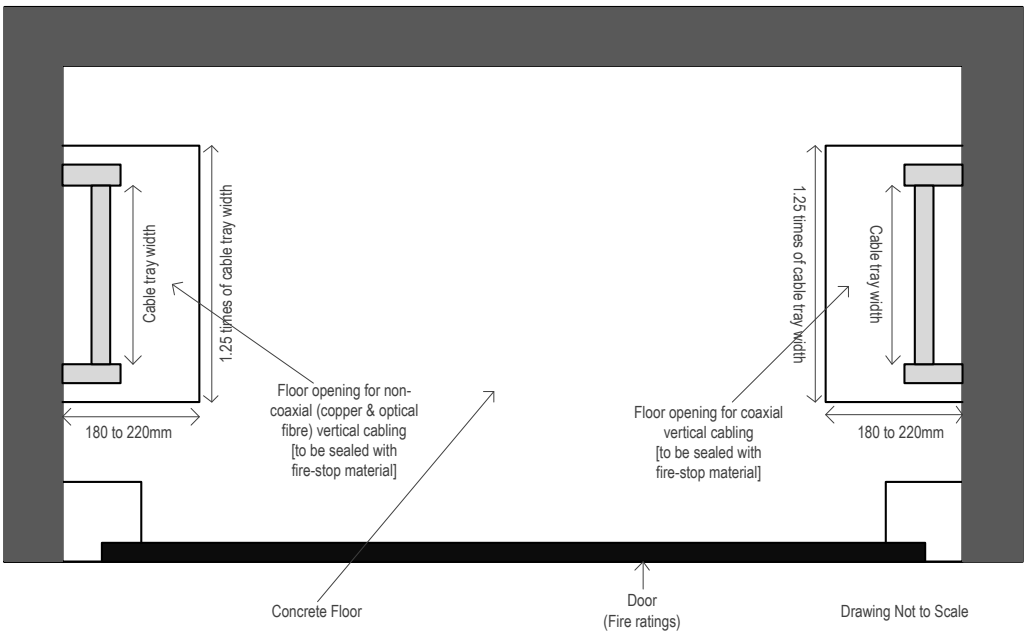
Telecom riser number	Address of unit served

(c) extend a copy of the internal wiring schedule to licensees upon their request.

9.4 PLACEMENT OF CABLES IN TELECOMMUNICATION RISER

9.4.1 Every developer or owner who is required to provide telecommunication riser shall ensure that the cables and associated cabling facilities for non- coaxial (copper and optical fibre) cables and coaxial cables are placed on opposite side walls of the telecommunication riser as shown in **Figure 51** below.

Figure 51: Typical Layout in Telecommunication Riser



CHAPTER 10. REQUIREMENTS FOR INSTALLATION OF OPTICAL FIBRE CABLES IN RESIDENTIAL DEVELOPMENTS

10.1 OBJECTIVE

10.1.1 The objective of this segment is to set out the requirements for the construction, cabling, installation, safety and performance of an optical fibre cable from the telecommunication riser of a building or from the Termination Box (TB) to each residential unit within a residential development as specified in Chapter 4 and Chapter 5 of this Code.

10.2 INSTALLATION OF OPTICAL FIBRE CABLE FROM FIBRE INTERFACE POINT TO EACH RESIDENTIAL UNIT

10.2.1 A minimum of one (1) two (2)-core optical fibre cable shall be installed in the conduit or underground pipe designated for an optical fibre cable system, as specified in the relevant chapters of this Code.

10.2.2 The two (2)-core optical fibre cable shall be terminated, with an additional 2 m length as “slack”, at each end into:

(a) a Fibre Distribution Terminal (FDT) which is located in the telecommunication riser for a multi dwelling unit (MDU);

(b) a Termination Box (TB) which is located at either at the front or back of the outside wall of the house for a single dwelling unit (SDU); and

(c) an Access Termination Box (ATB) which is located in the residential unit.

10.2.3 The Fibre Distribution Terminal (FDT) shall be utilizing SC/APC connectors.

10.2.4 Both the Termination Box (TB) and Access Termination Box (ATB) shall each be a minimum of a set of SC/APC connector.

10.2.5 Where the Fibre Distribution Terminal (FDT) is located in the telecommunication riser, the FDT shall be located on the same floor as the residential unit.

10.2.6 The Fibre Distribution Terminal (FDT) should be clearly labeled, indicating the corresponding residential unit where the 2-core optical fibre cable is installed.

10.3 OPTICAL FIBRE CABLE SPECIFICATIONS FOR INSTALLATION IN CONDUITS

10.3.1 The optical fibre cable used shall:

(a) Comply with the G.657 (Category A2) specifications in the ITU-T Recommendations;

(b) Comprise an outer sheath of fire retardant polyethylene or Low Smoke Free of Halogen (LSFH) material;

(c) Have a central strength member that is made of Aramid Yarn (Kevlar Yarn) or its equivalent; and

(d) Be able to withstand a maximum tensile load of at least 500 N.

10.4 OPTICAL FIBRE CABLE SPECIFICATIONS FOR INSTALLATION IN UNDERGROUND PIPE

10.4.1 The optical fibre cable used shall:

(a) Comply with the specifications in sub-category G.652.D in the ITU-T Recommendations;

(b) Have a loose tube with filled jelly compound and polyethylene sheath;

(c) Have a central strength member that is made of Aramid Yarn (Kevlar Yarn) or its equivalent; and

(d) Use water blocking tape to enhance prevention of water armouring.

10.5 FIBRE DISTRIBUTION TERMINAL

10.5.1 The Fibre Distribution Terminal (FDT) shall be securely mounted:

(a) at the side of the telecommunication riser facing the door;

(b) in closer proximity to the cables and associated cabling facilities for non-coaxial cables; and

(c) shall have SC/APC connectors.

10.6 TERMINATION BOX

10.6.1 The Termination Box (TB) shall have a minimum of one (1) set of SC/APC connector.

10.6.2 The Termination Box (TB) shall securely mounted on either at the front or back of the outside wall of the house and be installed at a height of 1.5 m from the floor of the house.

10.7 ACCESS TERMINATION BOX

10.7.1 The Access Termination Box (ATB) shall have a minimum of one (1) set of SC/APC connector.

10.7.2 The Access Termination Box (ATB) shall:

(a) be securely mounted adjacent to the RJ-45 patch panel (which may be located in the utility room or closet) and 13 A switch socket outlet;

(b) be securely mounted at a height of 0.3 m above ground level; and

(c) a clear space of 50 mm from the SC/APC connectors to allow the connection of patch cords.

10.8 SAFETY REQUIREMENTS

10.8.1 The optical fibre cable from the telecommunication riser to each residential unit shall be designed, constructed and installed to present no hazard or danger, be it for normal usage or under fault conditions, to subscribers, personnel working on or inspecting the system, or to any other person.

10.8.2 The following precautions shall be taken into consideration while handling or working with any optical fibre cable:

(a) Keep all food and beverages out of the work area as ingesting optical fibre particles may cause internal hemorrhage;

(b) Work on a black work surface for better visibility of optical fibre scraps;

(c) Wear disposable aprons to prevent optical fibre particles from coming into contact with clothing;

(d) Always wear safety glasses with side shields and protective gloves;

(e) Never look directly into the end of fibre optic cables unless necessary. If there is a need to look into the end of the fibre optical fibre, confirm that there is no light source at the other end. Use a fibre optic power meter to make certain the fibre optical cable is dark. When using an optical tracer or continuity checker, look at the fibre from an angle at least 6 inches away from the eyes to determine if visible light is present;

(f) All work areas must be well ventilated;

(g) Contact lens wearers must not handle their lenses until they have thoroughly washed their hands;

(h) Do not touch the eyes with hands while working with optical fibre cables until the hands have been thoroughly washed;

(i) All cut optical fibre pieces must be placed in a properly marked container for disposal;

(j) All work areas must be thoroughly cleaned upon the completion of work; and

(k) No smoking while working with optical fibre cables.

10.9 TESTING CRITERIA FOR THE OPTICAL FIBRE CABLE FROM FIBRE INTERFACE POINT TO EACH RESIDENTIAL UNIT

10.9.1 To ensure that the optical fibre cable is in good working condition upon completion of installation works, both of the following methods of testing must be carried out:

(a) Continuity testing (1)

- This involves checking that the optical fibre cable is not physically broken at any point, and that the optical fibre cable does indeed go from one location to the correct destination using a powerful visible red laser;

(b) Continuity testing (2)

– This involves checking the optical fibre cable using a pair of optical light source and power meter or/and with an optical loss test set (OLTS) to measure for insertion loss (IL) and optical return loss (ORL); and

(c) Scanning at the fibre interface/termination point with an Optical Time Domain Reflectometer (OTDR)

– An OTDR is capable of measuring the fibre lengths, losses, connector losses, splice losses and fibre defects, and works by sending a pulse of light into the fibre and measuring how much light is reflected back and detected at the OTDR. It will produce a line or graph on a screen and by measuring how much light is

reflected, the OTDR can determine the loss associated with each of these anomalies.

10.10 FIBRE READINESS CERTIFICATION

10.10.1 Prior to obtaining temporary certificate of fitness for occupation permit from the relevant authority, the developer or owner shall obtain fibre readiness certification from an operator licensed to provide passive optical fibre connectivity service.

10.10.2 There should not be any significant wiring change after the optical fibre cable and its associated fibre interface and termination points have been certified “fibre-ready”.

CHAPTER 11. USE OF SPACE AND FACILITIES BY LICENSEES

11.1 OBJECTIVE

11.1.1 The objective of this segment is to specify the requirements to be observed by every licensee that deploys its installation, plant or system within the space and facilities of any development provided pursuant to this Code or any previous codes.

11.1.2 For the purposes of this segment of the Code, where a licensee connects its pipes to the lead-in pipes of a development, such connection shall be regarded as a deployment of plant by such licensee.

11.2 ELIGIBILITY TO USE

11.2.1 Only licensees who –

(a) provide telecommunication services via fixed-line method or fixed-wireless method may deploy their installation, plant or system in the relevant space and facilities (save for the mobile deployment space) of a development; and

(b) provide public cellular mobile telecommunication services may deploy their installation, plant or system in the relevant space and facilities (save for the telecommunication) of a development.

11.3 ACCESS TO RELEVANT SPACE AND FACILITIES

11.3.1 Every licensee who wishes to deploy its installation, plant or system in the relevant space and facilities of any development to provide telecommunication services to that development shall give notice to the developer or owner of that development, stating:

(a) as fully and accurately as possible the nature and extent of the acts intended to be done; and

(b) a reasonable timeframe (which shall in any case be no less than fourteen (14) days) for the developer or owner to raise its objection (if any) to the licensee's intended use of the space and facilities.

11.3.2 Every licensee who wishes to access the relevant space and facilities of any development for the purpose of inspecting, maintaining, repairing or upgrading any installation, plant or system which it has deployed in such space and facilities shall give reasonable notice to the developer or owner of that development to obtain grant of access.

11.3.3 Every licensee who accesses the relevant space and facilities to deploy installation, plant or system used for telecommunication purposes, shall take such action as may be necessary to render such installation, plant or system safe and efficient.

11.4 RULES OF USAGE

11.4.1 Every licensee who deploys its installation, plant or system in the relevant space and facilities of any development shall –

(a) ensure that it deploys its installation, plant or system in the most efficient manner possible;

(b) only deploy such installation, plant or system as is reasonably necessary to meet the demand for its services and where the licensee is a public telecommunication licensee, to also meet its basic service obligations;

(c) not deploy its installation, plant or system in a manner which unreasonably prevents any other licensee who wishes to deploy its installation, plant or system within the same space and facilities from doing so;

(d) co-operate in good faith with any other licensee who wishes to deploy its installation, plant or system within the same space and facilities to enable such licensee to carry out its deployment in an expedient manner;

(e) not make any structural alteration to the relevant space and facilities without the approval of the developer or owner of that development;

(f) take due care to maintain the cleanliness and condition of the relevant space and facilities in which it deploys its installation, plant or system, and those parts of the land which it accesses in connection with such deployment;

(g) where it causes any damage to the relevant space and facilities in which it deploys its installation, plant or system, or to those parts of the land which it accesses in connection with such deployment, inform the developer or owner of that development and make good the damage caused;

(h) when carrying out any activities in connection with its deployment of installation, plant or system in the relevant space and facilities, take reasonable steps to minimize the disturbance and inconvenience caused to the occupants of the building and comply with all requirements imposed by the relevant authorities including any limits on noise levels and safety;

(i) subject to paragraphs 11.4.3 to 11.4.6, pay for all utility charges incurred for the operation of the installation, plant or system deployed in the relevant space and facilities unless otherwise agreed with the developer or owner of that development;

(j) where it is necessary to drill through any concrete floor or wall of buildings for the laying of its installation, plant or system, consult and obtain the written approval of the developer or owner of that development, and be responsible for any such drilling works at its own cost;

(k) where it is necessary for the laying of its installation, plant or system, be responsible for the removal and replacement of the fire resistant material used to seal the inter-floor openings for the telecommunication risers, at its own expense; and

(l) where it ceases to provide any service to that building, remove, within a reasonable timeframe, any installation, plant or system deployed in the relevant space and facilities which is no longer required.

11.4.2 For the purposes of paragraph 11.4.1, all references to the act of deployment of any installation, plant or system shall include the act of inspecting, maintaining or repairing such installation, plant or system.

11.4.3 Where the developer or owner has served a notice requiring any licensee to bear utility charges for the operation of any installation, plant or system deployed by the licensee in the relevant space and facilities, the licensee shall bear the utility charges on a prospective basis commencing no earlier than a period of one (1) month from the date of service of such notice.

11.4.4 Where such notice as specified in paragraph 11.4.3 is served on the licensee, the developer or owner and the licensee shall reach an agreement on the basis upon which to compute the utility charges to be borne by the licensee. Where the developer or owner and the licensee are unable to agree on such basis, the utility charges to be borne by the licensee shall be based on the estimated power consumption of the licensee's installation, plant or system.

11.4.5 Notwithstanding paragraph 11.4.4, where it is physically feasible, the licensee may, at its own cost, install the necessary electrical installations (including cables, a separate utility meter and any other accessories) to enable the utility charges to be computed on an "as incurred" basis and paid directly to the utility provider.

11.4.6 For the avoidance of doubt, the developer or owner shall not require the licensee to bear any utility charges incurred prior to the commencement date referred to in paragraph 11.4.3.

11.5 SEALING OF UNDERGROUND PIPES LEADING INTO AN AIR-CONDITIONED OR UNVENTILATED TELECOMMUNICATION ROOM

11.5.1 Where a licensee has, prior to the Effective Date, taken over from any developer or owner any underground pipes leading into –

(a) any telecommunication room that is air-conditioned; or

(b) any telecommunication room that is not air-conditioned and which has no free-flowing ventilation (such as a room with no louvers or exhaust fans or their equivalent) (collectively referred to in this section as an "Enclosed Room"), the licensee shall ensure that it seals the relevant underground pipe at its point of entry into such Enclosed Room with the Appropriate Sealing Material (as defined in paragraph 11.5.3) within two (2) years from the Effective Date.

11.5.2 From the Effective Date, every licensee that deploys its telecommunication cables into any underground pipe leading into any Enclosed Room shall ensure that it seals the relevant underground pipe at its point of entry into such room with the Appropriate Sealing Material (as defined in paragraph 11.5.3). Where the underground pipes are already sealed prior to the licensee deploying its telecommunication cables, the licensee shall be responsible for removing the existing seal and re-sealing the pipes upon completion of its cable installation work.

11.5.3 For the purposes of this section, "Appropriate Sealing Material" means a material that is able to prevent foreign gaseous matter (which may be toxic or flammable) from passing through the underground pipes into the Enclosed Room and which shall be durable, easily removable to facilitate installation of cables, and not cause damage to the underground pipes or any telecommunication cables that may be installed therein.

11.6 DEPLOYMENT OF INSTALLATION, PLANT OR SYSTEM

11.6.1 Where a licensee (the "Existing Licensee") has deployed its installation, plant or system in a manner which does not efficiently optimize the use of the relevant space and facilities (save for mobile deployment space), the Existing Licensee shall co-operate in good faith with any other licensee (the "Requesting Licensee") who wishes to deploy its installation, plant or system within the same space and facilities to:

(a) rearrange, remove or alter, at the Existing Licensee's own expense, such installation, plant or system or any part thereof; and

(b) perform any such rearrangement, removal or alteration within a reasonable timeframe to facilitate deployment by the Requesting Licensee.

11.6.2 In the event that the licensees are unable to reach agreement on the rearrangement, removal or alteration that should be effected, they may refer the matter to the Authority for a decision which shall be binding on the licensees.

11.6.3 Subject to paragraphs 11.6.4 and 11.6.5, each mobile telecommunication licensee may deploy its installation, plant or system for the provision of public cellular mobile telecommunication services in the mobile deployment space of a development.

11.6.4 Where a mobile telecommunication licensee (the "Earlier MTL") has occupied more than the allocated space ("Allocated Mobile Deployment Space") for each mobile telecommunication licensee in accordance with the dimensions specified in **Table 31** (based on the deployment space provided by the developer or owner as required under the relevant chapters), and if another mobile telecommunication licensee (the "Later MTL") wishes to deploy its installation, plant or system in the mobile deployment space for the provision of public cellular mobile telecommunication services, the Earlier MTL shall:

(a) remove, within a reasonable timeframe, the Earlier MTL's deployed installation, plant or system to the extent that the Later MTL is able to deploy the Later MTL's installation, plant or system in the Later MTL's Allocated Mobile Deployment Space; and

(b) bear all costs in connection with any such removal.

Table 31: Allocated Mobile Deployment Space for each mobile telecommunication licensee

Mobile deployment space (m^2)	Allocated Mobile Deployment Space (m^2)
18 or 24 (as the case may be)	6 or 8 (as the case may be)
36	12
54	18
72	24

11.6.5 All mobile telecommunication licensees who have deployed their installation, plant or system in the mobile deployment space shall share among themselves on an equal basis (unless otherwise agreed), any remaining mobile deployment space which is in excess of their total Allocated Mobile Deployment Space.

11.7 CONNECTIONS TO LEAD-IN PIPES

11.7.1 Every licensee that connects its pipes to the lead-in pipes of a development shall only make such number of connections as are necessary to meet the demand for its services.

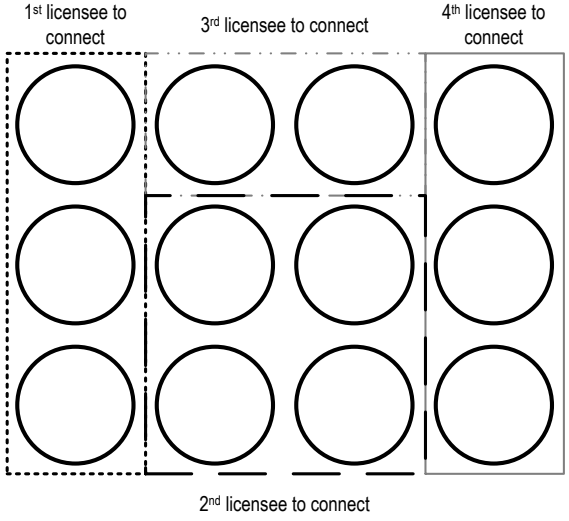
11.7.2 Where a licensee has connected its pipes to the lead-in pipes of any development but is not using any of its pipes ("Unused Pipe") or is using less than 50 % of the space in any of its pipes ("Partially Used Pipe"), and the Requesting Licensee requires the use of the licensee's Unused Pipe or the space in the licensee's Partially Used Pipe, that licensee shall allow the Requesting Licensee to use the licensee's Unused Pipe or the space in the licensee's Partially Used Pipe, including the use of the associated lead-in manholes, at cost-based prices.

11.7.3 Every licensee that connects its pipes to the lead-in pipes of a development shall –

(a) ensure that the pipes and the associated lead-in manholes which it connects to the lead-in pipes are grouped together and not placed in a manner which obstructs any other licensee from connecting its own pipes to the lead-in pipes; and

(b) connect its pipes to the lead-in pipes in a left-to-right or right-to-left method (depending on where the previous connection has been made) or in a bottom-up manner as illustrated in **Figure 52**.

Figure 52: Method in which licensees are to connect to lead-pipe



11.7.4 The Authority may require any licensee who fails to comply with paragraph 11.7.3 to remove or re-position its connections to the lead-in pipes or to remove or re-position its manholes at its own expense.

11.7.5 Every licensee who deploys multiple telecommunication cables to the same development shall, where practicable, install sub-ducts or their equivalent in the lead-in pipes such that each lead-in pipe is able to accommodate multiple telecommunication cables.

11.8 CONCURRENT DEPLOYMENT OR CONNECTIONS BY TWO (2) OR MORE LICENSEES

11.8.1 Where two or more licensees concurrently seek to deploy their installation, plant or systems in the relevant space and facilities or concurrently seek to connect their pipes to the lead-in pipes of any development, and such relevant space and facilities are insufficient to accommodate all the installation, or plant or systems sought to be deployed or the lead-in pipes are insufficient to accommodate all the connections sought to be made, the licensees shall first attempt to reach a voluntary sharing arrangement in good faith.

11.8.2 In the event that the licensees are unable to reach a sharing arrangement, they may refer the matter to the Authority for a decision which shall be binding on the licensees.

11.8.3 In determining the sharing arrangement, the Authority will generally grant priority as follows –

(a) public telecommunication licensees who require use of the relevant space and facilities to provide services to the development in accordance with their basic service obligations shall have first priority;

(b) telecommunication system licensees who require use of the relevant space and facilities to provide services to the development shall have second priority; and

(c) telecommunication system licensees who require use of the relevant space and facilities for any other purpose shall have last priority.

11.9 CO-OPERATION TO RESOLVE INTERFERENCE

11.9.1 Where any installation, plant or system deployed by a licensee in the relevant space and facilities of a development causes interference to the operation of installation, plant or system deployed by any other licensee in the same space and facilities, such licensees shall co-operate in good faith to resolve the interference to ensure minimal disruption to service provisioning.

11.10 CONTRAVENTION BY LICENSEE

11.10.1 Where any licensee contravenes any requirement in this chapter, the Authority may require such licensee to rearrange, remove, alter or disconnect any of the installation, plant or system which it has deployed in the relevant space and facilities of any development at its own expense.

11.11 PROVISION OF ADDITIONAL SPACE OR FACILITIES

11.11.1 Where a licensee requires additional facilities (beyond the minimum requirements as set out in this Code) for the purposes of provision of its services to the relevant development, the licensee shall consult and obtain the approval of the developer or owner for the licensee to provide the same and shall do so at the licensee's own cost.

11.11.2 Where a licensee requires additional space (beyond the minimum requirements as set out in this Code) for the purposes of provision of its services to the relevant development, the

licensee shall consult and obtain the approval of the developer or owner for the developer or owner to provide the same at the licensee's cost.

CHAPTER 12. USE OF SPACE AND FACILITIES WITHIN A DEVELOPMENT FOR THE PROVISION OF TELECOMMUNICATION SERVICES TO PROPERTIES OUTSIDE OF THE DEVELOPMENT

12.1 OBJECTIVE

12.1.1 The objective of this segment is to set out –

(a) the procedures to be observed by a licensee that intends to use the space and facilities provided within a development to serve properties outside of the development;

(b) the procedures to be observed by a developer or owner who is notified by a licensee of such intended use of the space and facilities; and

(c) the principles that the Authority may adopt in resolving disputes between the parties where the Authority determines that such use of the space and facilities is reasonable.

12.2 OVERVIEW

12.2.1 The space and facilities provided by a developer or owner of a development pursuant to this Code or any previous codes are primarily intended for licensees to deploy installation, plant or systems to serve the telecommunication needs of the development. Accordingly, insofar as the use of the Code's space and facilities is concerned, priority should be accorded to the needs of the development at all times.

12.2.2 Nevertheless, there may be situations where it would be reasonable for a licensee that is providing telecommunication services to a development and using that development's Code's space and facilities to also use such Code's space and facilities to provide telecommunication services to properties located outside of the development (hereinafter referred to as "external properties").

12.2.3 In these cases, the licensee is required to notify the developer or owner of its intention to use the Code's space and facilities to serve the external properties. If the developer or owner objects to such intended use, the licensee may refer the matter to the Authority for determination. Where the Authority is satisfied that the licensee's use of the Code's space and facilities to serve the external properties would be reasonable, the Authority may issue directions to the parties to give effect to the same on such terms and conditions as THE AUTHORITY may impose.

12.3 PROCEDURES TO BE OBSERVED IN RELATION TO THE USE OF THE CODE'S SPACE AND FACILITIES TO SERVE EXTERNAL PROPERTIES

12.3.1 Where a licensee intends to use the Code's space and facilities in a development to serve any external properties, the licensee shall notify the developer or owner of such intention. The notice shall minimally include the following –

(a) clear indication of the licensee's intention to use the Code's space and facilities in the development to serve external properties;

(b) description of the installation, plant or system that the licensee will be deploying in the Code's space and facilities to serve the external properties;

(c) proposed dates of the deployment of the installation, plant or system and the duration of the deployment period;

(d) material implications regarding the deployment and use of the installation, plant or system to serve the external properties, including the likely frequency of access for the purpose of undertaking any activities in connection with such installation, plant and systems; and

(e) a reasonable timeframe (which shall in any case be no less than fourteen (14) days) for the developer or owner to raise its objection (if any) to the licensee's intended use of the Code's space and facilities to serve the external properties.

12.3.2 Where the developer or owner objects to the licensee's intended use of the Code's space and facilities to serve the external properties, the developer or owner shall raise its objection to the licensee within the stipulated timeframe in the notification and state the reasons for its objection.

12.3.3 The licensee and the developer or owner shall co-operate in good faith and seek to arrive at a mutually acceptable agreement on the use of the Code's space and facilities to serve the external properties.

12.3.4 Where the developer or owner objects to the licensee's use of the Code's space and facilities to serve the external properties, the licensee may refer the matter to THE AUTHORITY for determination.

12.3.5 The Authority will provide an opportunity for the parties to make representations to the Authority in accordance with such process as the Authority may specify.

12.3.6 The Authority's determination of –

(a) whether it would be reasonable for a licensee to use the Code's space and facilities to serve the external properties; and/or

(b) the terms and conditions to be imposed on the parties where the Authority assesses that such use should be allowed,

will be undertaken by the Authority on a case-by-case basis having regard to all relevant facts, including factors such as the availability of the Code's space and facilities for such intended use, as well as any safety and security considerations which the Authority considers to be relevant.

12.3.7 Where the Authority determines that the licensee's intended use of the Code's space and facilities is reasonable, the Authority may issue directions to –

(a) require the developer or owner to allow the licensee to use the Code's space and facilities to serve the external properties; and

(b) require the licensee to install and operate any installation, plant or systems within the Code's space and facilities to serve the external properties,

in such manner and on such terms and conditions as the Authority may specify in the directions.

12.3.8 Without prejudice to paragraph 12.3.6 above, where the Authority considers that it would be reasonable to allow a licensee to use the Code's space and facilities to serve any external properties, the Authority may (but is not bound to) adopt the principles set out in paragraph 12.4 below when specifying the terms and conditions to be complied with by the licensee and the developer or owner in relation to such use of the Code's space and facilities. Parties are therefore encouraged to refer to the said principles with a view to arriving at a mutually acceptable agreement without the need for the Authority's intervention.

12.4 GUIDING PRINCIPLES ON THE USE OF THE CODE SPACE AND FACILITIES TO SERVE EXTERNAL PROPERTIES

12.4.1 In all instances, priority in the use of the Code's space and facilities within a development must be accorded to the immediate and foreseeable needs of the development before such space and facilities may be used to serve external properties.

12.4.2 In the event that the installation, plant or system deployed by a licensee to serve external properties impedes or causes obstruction to any future deployment of installation, plant or system by other licensees to serve the needs of the development, the licensee shall –

(a) remove its installation, plant or system at its own costs and reinstate as far as reasonably practicable to their original condition the Code's space and facilities which were used; or

(b) pay for the costs of any additional space and facilities required to accommodate such future deployment needs where it is feasible for such additional space and facilities to be provided.

12.4.3 The licensee shall comply with any reasonable measures that the developer or owner may impose to safeguard the safety and security of the development, in connection with the licensee's activities relating to the installation, plant or system that are deployed to serve the external properties.

12.4.4 The licensee shall bear all risks in relation to the installation, plant or system that are deployed to serve the external properties. In this regard, the licensee (and all persons claiming under it) shall waive the right to make any claims against the developer or owner and any occupants of the development for any loss or damage caused to such installation, plant or system howsoever arising save where such loss or damage is willfully caused by such persons.

12.4.5 The licensee shall –

(a) fully compensate the developer or owner and the occupants of the development for any loss or damage caused to the development or its occupants; and

(b) fully indemnify the developer or owner and the occupants of the development against any claims whatsoever made against them by any person,

arising out of or in connection with the licensee's activities relating to the installation, plant or system that are deployed to serve the external properties.

12.4.6 The licensee shall comply with the rules of usage set out in Chapter 11 of this Code, which shall equally apply to the licensee's use of the Code's space and facilities to serve external properties.

12.4.7 Where it is reasonably necessary for the installation, plant or system that are deployed by the licensee to serve the external properties to be altered, removed, relocated or diverted (for example, where the development is being redeveloped), the licensee shall bear the costs of all such alteration, removal, relocation or diversion works.

12.4.8 Save where otherwise provided in this Code, the developer or owner shall not impose any charges, fees or rent for the licensee's use of the Code's space and facilities to serve any external properties.

12.4.9 Where the developer or owner is required to incur any additional costs in granting access to the licensee to carry out any activities relating to the installation, plant or system that are deployed to serve the external properties, the developer or owner may recover these costs from the licensee subject to the developer or owner demonstrating that it is reasonable for such costs to be incurred.

12.4.10 In addition to allowing the licensee to deploy its installation, plant or system to serve the external properties, the developer or owner shall co-operate in good faith with the licensee to grant the licensee such continuing access to the development as the licensee may from time to time require to carry out any activities relating to such installation, plant or system, including the activation and deactivation of services, inspection, maintenance and repair.