ITS specification

Jointing Chambers and Pull Pits (ITS-02-02)

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More information …

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Document management plan

1) Purpose

The purpose of this document is to specify the supply and installation requirements for ITS power and communications jointing chambers, pull pits, cable pits and toby boxes.

2) Document information

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3) Key words

ITS Jointing Chambers and Pull Pit Cable Pit and Toby Box Supply and Installation Specification.

Record of amendments

Amendment number	Section amended	Description of change	Updated by	Effective date
0	All	ITS Draft Specifications Issue	TLH	20/9/2010
Draft R1	All	AMA Specifications Review	JF & TLH	25/1/2011
Final R1	2.2	Access Chamber detail included	JF	24/06/2011
Final R2	2.2.3	Additional paragraph	PTA	09/01/2012
Final R3	All	Final	BW & JS	14/02/2012
Final R4	All	Additional information provided plus addition of DAS fibre and air-blown fibre	KF	02/12/2014
Final R5	All	Provisional	KF & TLH	11/2/2015

Contents

1.0 General

1.1 Scope

This section sets out the requirements for the design and construction of the ITS Communications Infrastructure cable pull pits and jointing chambers and the local power, fibre optic and control cable and feeder cable pits and toby boxes.

1.2 Drawings

The attached standard drawings are provided for information to provide a basis for design.

Site specific detailed design drawings for all duct routes and details shall be provided for review prior to commencement of installation:

000-0000-0-7104-01-R2 Jointing Chamber and Pulling Pit

000-0000-0-7104-02-R2 Detail of Duct Installation Highways and Motorways

000-0000-0-7104-09-R1 Kerbside Junction Box and Local Cable Pit

2.0 Chamber and Pits

2.1 ITS Backbone Chambers

2.1.1 Chamber Locations

The Contractor shall provide jointing chambers and/or pull pits as indicated on the design drawings.

Jointing chambers shall be provided where required to make a joint in the optical fibre cable.

On motorways ITS backbone jointing chambers shall be provided adjacent to the noses of on-ramps and off-ramps and at the head of on-ramps.

Pull pits shall be provided at intermediate locations along the ITS backbone duct run to ensure that a single run does not exceed 300m and where the ITS backbone is making a transition from underground to overhead, or vice-versa.

Pull pits shall be provided on both sides of all carriageway crossings and at both ends of all bridge crossings.

Pull pits and ducts connecting to the ITS backbone jointing chambers shall be provided adjacent to the noses of on-ramps and off-ramps and at the head of on-ramps on the opposite side of the carriageway from the ITS backbone.

Where fibre is the only service in the duct line and the ITS assets are widely spaced (such as along rural motorways or expressways), pull pits may be provided at intervals of up to 1km, depending on the straightness of the duct, or omitted altogether if jointing chambers are provided instead.

For dedicated Distributed Acoustic Sensing fibre ducts, chambers may be spaced at the upper limit of fibre installation, which may be as much as 3km apart.

2.1.2 Design and Layout Considerations

The top surface of the chamber and the adjacent finished surface shall be level, or such as not to pose a danger to pedestrian or vehicular traffic.

The chambers shall be located so that the duct line is as straight as possible to limit the amount of friction placed on cables as they are placed into the ducts. Any bends located along the duct line shall be slow (long radius) and continuous.

The Contractor shall ensure that the correct chamber components are installed in each location - roadway components in roadway sites, and footway components in footway sites.

Jointing chambers and/or pull pits shall not be located where running water can flow over the lid (such as a swale) or where mud and debris can fall or be washed onto the lid

The longer side of the jointing chamber and pull pit shall be in line with the path of the ducts.

2.1.3 Chamber Size

As a general rule, chambers that are to house joint closures, or fibre coils for future joint closures, should be larger than chambers in which cables are simply hauled through, such as pull pits or turning pits.

Chambers need to be deep enough to ensure that the duct line does not have to change its horizontal angle in order to enter the chamber.

The table below shows standard chamber sizes for different applications. The NZTA's approval must be obtained where the size of chamber needs to be varied to suit a specific location or application.

Chamber Purpose	Chamber Size (mm)
Joint closure	1200 L x 900 W x minimum 1200 D
Fibre coil	1200 L x 900 W x minimum 1200 D
All other (e.g. pull pit)	1200 L x 600 W x minimum 900 D
Turning pit	600 L x 600 W x 600 D

2.1.4 Jointing Chambers

ITS Backbone jointing chambers shall be of concrete construction with the internal dimensions of 1200mm (L) x 900mm (W) x 1200mm (D).

Jointing chambers shall have cable management brackets installed.

The cable management brackets shall consist of three L shaped brackets in a triangular formation. They shall be installed on the long side of the chamber. The brackets shall protrude into the chamber by 100mm. The triangle formed by the brackets shall be 600mm on each side. The bottom of the triangle shall be 100mm from the base of the chamber.

A bracket to hold the fibre joint enclosure shall be attached to the long wall of the chamber and located in such a way that the joint may be retrieved and replaced easily.

A jointing chamber may have a 1200mm x 600mm coverset provided the chamber is capped with a suitable concrete collar. The collar will need to meet all the loading requirements in this standard.

Jointing chambers shall be identified on the drawings with the prefix “J”.

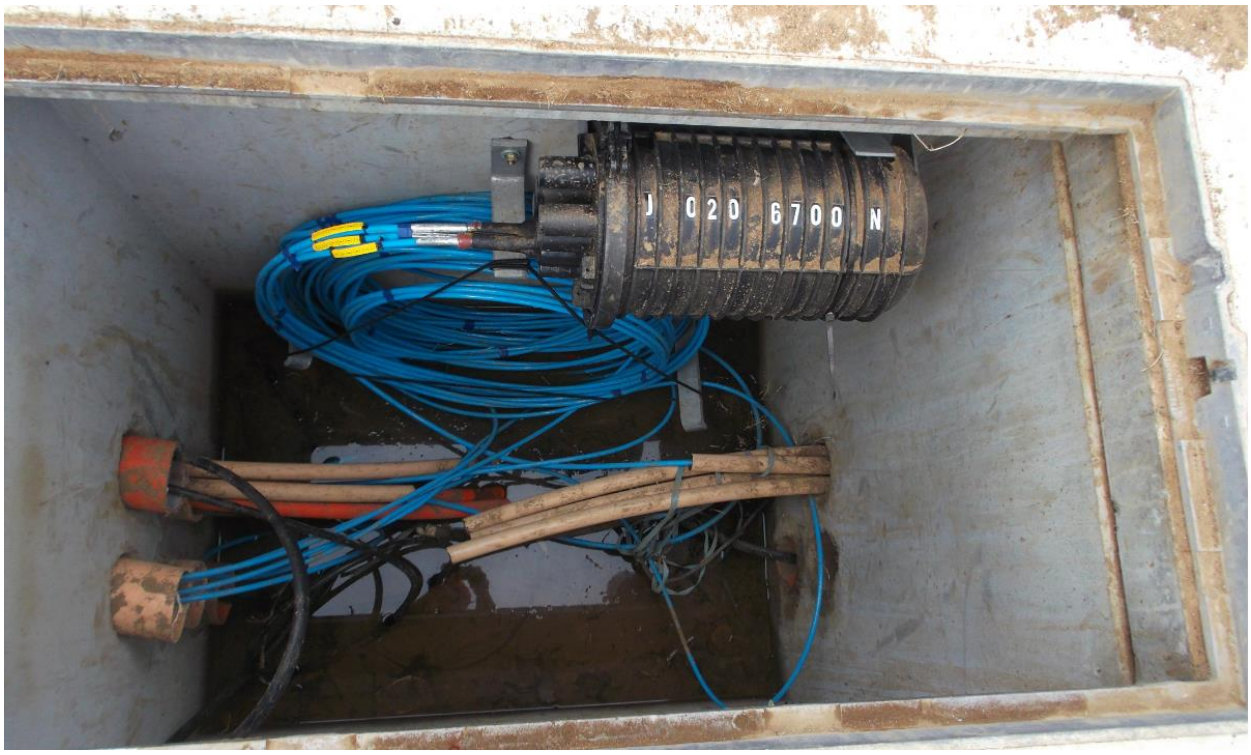


Figure 1. Example of a 1200mm x 900mm jointing chamber with a 1200mm x 600mm coverset. The joint is attached to a wall mounted bracket and there are cable management brackets attached to the same wall. The backbone duct has protruding sub-ducts and the chamber also contains local fibres and detector/power cables.

2.1.5 Pull Pits

ITS Backbone fibre pull pits shall be of concrete construction with the internal dimensions of 1200mm (L) x 600mm (W) x 900mm (D).

Fibre Pull Pits shall be identified on the drawings with the prefix “P”.

Cable management brackets are not required in pull pits.

Where an air-blown fibre system is used, the fibre is blown from jointing chamber to jointing chamber within micro-ducts. Therefore, pull pits may not be required.

2.1.6 Distributed Acoustic Sensing Median Duct Chambers

Chambers may be provided at intervals of up to 3km depending on the length of fibre that can be blown and route the duct takes; the straighter the duct, the longer the distance the chambers may be apart.

Fibre will be blown into the duct, so there is no necessity for a draw wire.

The chambers feeding the duct may be of a shape that is appropriate to the depth of the duct (100mm to 130mm) and the type of fibre passing through. A 2f or 6f fibre cable is all that is expected to be used.

Median chambers must not be installed in a location where they will be trafficked; they are to be as far from the running lane as feasible. However, chambers must be capable of being trafficked and the lid must not accidentally open or flip-up.

Where air blown fibre is used for a median Distributed Acoustic Sensing fibre, jointing (Toby) boxes as illustrated in drawing 0000-000-7104-09-R1 may be considered.

2.1.7 Cover Set Lids and Aprons

The type and strength of chamber to be used will depend on the location of the chamber, i.e. on roadways or footpaths.

Jointing chambers and pull pits shall have cast aluminium coverset lids with slip resistance surface complying with AS/NZS 3661-1-1993. The coverset load rating shall be in compliance with AS 3996 and the following:

Class	Test Load	Loading Conditions
A	10kN	Footways and areas accessible only to pedestrians and cyclists (Extra Light Duty)
B	80kN	Footways that may be mounted by vehicle or livestock and light tractor paths (Light Duty)
C	150kN	Grass verges or other areas open to slow moving commercial vehicles, such as tractor mowers etc. (Medium Duty)
D	210kN	Carriageway of roads and areas open to commercial vehicles (Heavy Duty)

Composite coversets are being increasingly used by utility providers. If a composite coverset is rated at the required loading, they may be used for footways.

If a coverset is not available to the required loading classification, the next available higher loading shall be used.

Jointing chambers and pull pit lids shall have a cast aluminium plate with the NZ Transport Agency (NZTA) logo and “NZTA” securely fixed to the lid.

Existing chambers with galvanised steel tread plate covers are secured with Torx-Post Buttonhead T45 stainless steel M10 x 40mm bolts.

Cast aluminium coversets shall be secured with an approved security access lock. See 2.1.8

The concrete surround to the cover set on chambers installed in a paved area shall be designed to carry traffic loading equivalent to 0.85HN wheel loading from the NZTA's *Bridge manual* (SP/M/022).

All chambers not installed in paved areas shall have a concrete apron a minimum of 500mm wide at its narrowest point surrounding the chamber lid. The apron shall be able to take a minimum 1-tonne wheel loading where in a verge or grassed area without cracking or breaking.

Where the coverset is located in a cycleway or where cyclists are likely to ride, the slip resistance of the coverset shall be equal to, or better than, that of the surrounding cycleway surface.

Galvanised steel coversets shall not be used where cyclists or pedestrians are likely to be, due to their a low wet slip resistance.

Pre-cast aluminium coverset 1200 x 600mm, Class B

Pre-cast aluminium coverset 1200 x 600mm, Class D

Galvanised tread plate with torx bolts 1200 x 600mm, Class C

Figure 2. Coverset examples

2.1.8 Securing of Chamber Coversets

Careful installation of coversets is essential to provide a long service. However, careful maintenance is the way to achieve this.

When installing, care shall be taken not to allow concrete overspill to foul the seating lip or locating holes of the frame.

Figure 3. Over-concreted and poorly installed coverset frame with concrete on the seating lip and in the locating holes.

Over time, the locking systems of coversets can seize up or become damaged, making it difficult to open covers or to re-secure them after opening. It is important that coversets are correctly replaced and

secured after accessing a chamber. It is common for detritus to collect on the seating lip for the cover, so care shall be taken to remove any accumulated material on the lip, in the corners and in the locating-pin recesses in order for the cover to be securely closed. Failure to ensure the lid is correctly seated may result in a pedestrian or vehicle hazard, or the cover becoming loose (and noisy) in the frame as traffic further compresses any foreign material left in the frame. An insecure lid is also a security hazard.

Where locking systems are damaged, the Contractor must notify the NZTA immediately to arrange for repair or replacement. Care shall be taken to avoid damaging coversets when accessing chambers and Contractors must ensure that workers have the appropriate lifting device(s) before they attend sites. Any cover damaged in the process of opening shall be replaced by the Contractor at the Contractor's expense.

In the case where the bolts of a galvanised steel tread type cover have seized and need to be ground off in order to access the chamber, the bolts shall be replaced with Torx-Post Buttonhead T45 stainless steel M10x40 bolts. All four bolts shall be of the same type.

The final tension of 65 ft-lbs (88 N-m) on the Torx-Post Buttonheads shall be applied using a standard torque wrench and the security torque wrench coupling. Only this tension procedure guarantees that each cover is correctly secured.

The rubber dust covers or protective caps shall be replaced over locking systems on coversets.

In the case of the pre-cast aluminium covers, the spring latch locking system shall be replaced with the same type. The Contractor shall contact the manufacturer of the coverset for replacement details. Periodic greasing of the spring latch locking system is recommended in order to prolong the service life of the locking mechanism.

Under no circumstances must a cover be bent. This can become a dangerous hazard for pedestrians, cyclists, lawnmowers, and motorists where chambers are located in shoulders. A protruding cover corner can puncture tyres and damage mower blades. In the event that a Contractor discovers that a cover is already damaged, it shall be reported to the NZTA immediately.

Figures 4 and 5. Coverset latch in the open position (left). When locked, the notch should be in the same position. The example on the right shows the chamber closed, but not correctly locked.

2.2 ITS Equipment Access Cable Pits

2.2.1 Location

Local duct connections to the roadside control cabinets for ramp signals, CCTV, variable message signs, loop detectors and other roadside equipment shall be separate from the main fibre backbone duct run. These ducts may contain power cables, co-axial cables, detector cables and fibre spurs and links.

Where these local ducts intersect or where there is a sharp change in direction of a duct (greater than 30 degrees with a radius less than 1m) an access chamber shall be installed on the local ducts.

No joints in fibres or power cables shall be made in these access chambers.

Access chambers shall not be located where running water can flow over the lid (such as a swale) or where mud and debris can fall or be washed onto the lid.

2.2.2 Access Chambers

Access chambers shall not be installed on the fibre backbone route.

Access chambers shall have minimum internal dimensions of 600mm diameter or 600mm x 600mm square. Where 2f to 12f fibres are used, the chamber access may be an absolute minimum of 400mm in diameter.

Cable management brackets are not required in access chambers

The cable pit depth shall be 900mm where ducts are connected from under the motorway pavement and 600mm deep where ducts are connected only from under berms or footpaths.

The chamber may be formed of brick or concrete block construction (on a 150mm thick concrete base with drainage hole), or from reinforced concrete pipe sections, or round plastic pre-formed chambers, or rotationally moulded plastic chamber units.

The chamber type must be able to be of variable depth.

All chambers not installed in paved areas shall have a concrete apron a minimum of 500mm wide at its narrowest point surrounding the chamber lid. The apron shall be able to take a minimum 1-tonne wheel loading where in a verge or grassed area without cracking or breaking.

Where concrete-ring chambers are used the chamber shall have a lip around the top in which the coverset can be located.

The cover frame may also be adhered to the chamber with adhesive epoxy in locations where a concrete apron will not be possible.

2.2.3 Duct Entry Points

Ducts shall be connected perpendicular to the chamber wall and shall not protrude more than 20mm into the jointing chamber when finished.

If a long duct run precedes the chamber (>100m), the duct entry point may be angled up at 30 degrees in the last 200mm to assist with cable pulling and to minimise cable damage.

Ducts shall never enter the chamber through the floor of the chamber.

2.2.4 Cable Chamber Lids

The chamber, roof panel, collar and lid shall be designed to carry traffic loading equivalent to 0.85HN wheel loading from the NZTA's *Bridge manual* (SP/M/022)..

In footpath locations cable pit lids shall have a high wet slip resistance.

The chamber lid shall be flush with the surrounding ground level.

3.0 Loop Cable Jointing (Toby) Boxes

3.1 Location

Loop cable jointing boxes, also known as Toby boxes, shall normally be located adjacent to the sealed surface of the carriageway, in the footpath where provided or in the sealed surface of the carriageway outside the normal running area. Where possible, loop cable jointing boxes shall be positioned 5m from any live traffic lane to minimise the amount of traffic management required for maintenance access. For loop cable jointing boxes in this position, it is desirable to have a cable entry slot, Refer sketch in Appendix A.

If the loop cable jointing box is to be located on the back side of a concrete barrier, a duct of appropriate size to feed all the loop tails through shall run under or through the barrier from a marked location in front of the barrier in order that the team cutting the loops can position the loop tails to intersect with the duct from the cable jointing box.

If the loop cable jointing box is required to be divorced from the edge of the carriageway, a length of 50mm diameter galvanised steel conduit shall be installed to connect the edge of seal to the loop cable jointing box. This conduit shall be concreted into the ground with a minimum of 100mm concrete surround.

The loop cable jointing box lid and concrete apron shall be flush with the surrounding ground level in grass, concrete or asphalt areas.

The loop cable jointing box lid shall be a maximum of 100mm above ground level with a sloping concrete apron where the chamber is located in a planted area so that mud, bark and mulch do not cover the lid.

The loop cable jointing box lid shall be capable of being locked or bolted down. It shall be hinged at one end. The hinge end must face the oncoming traffic.

The loop cable jointing box shall not be located where running water can flow over the lid (such as a swale) or where mud and debris can fall or be washed onto the lid.

3.2 Loop Cable Jointing Box Size

The size of the cable jointing box shall be determined by the number of loop tails, the number of joints and the type of joint it is required to house:

a. If up to three crimped joints are to be housed, minimum dimensions of 250mm x 170mm x 200mm deep shall be used.

b. If up to eight crimped joints are to be housed, minimum dimensions of 450mm x 300mm x 200mm deep shall be used.

c. If any re-useable joints are to be housed, minimum dimensions of 450mm x 300mm x 200mm deep required to house the re-useable joints shall be used.

A standard kerbside loop cable jointing box is shown in drawing 000-000-0-7104-09-R1

3.3 Loop Cable Jointing Box Construction

The cable jointing box may be formed of steel, ductile iron, aluminium, plastic, brick, and concrete block or pre-formed concrete.

Loop cable jointing boxes shall be installed on a 150mm minimum thickness concrete base which extends 150mm beyond the loop cable jointing box in each direction. Drainage shall be provided by a 20mm diameter drainage hole in the base. The base shall be cast onto a 150mm thickness free draining hard compacted granular sub base

The loop cable jointing box shall be cast into the ground with 150mm concrete surround for the full depth of the box.

3.4 Loop Cable Jointing Box Lid and Frame

Where there is any possibility of the cable jointing box being trafficked, the lid and frame shall be designed to carry traffic loading equivalent to 0.85HN wheel loading from the NZTA Bridge Manual (SP/M/022). The lid shall have a high wet slip resistance.

The lid of the cable jointing box shall either be hinged, with the hinged edge on the side of the box facing the oncoming traffic, or shall be a snug and secure fit into a lipped frame and capable of being secured down, with the unit as a whole designed to be trafficked.

Loose-lid cable jointing boxes traditionally used at traffic signal intersections shall not be used in a high-speed environment under any circumstances.

3.5 Duct Entry Points

The duct entry points shall be perpendicular to the side of the cable jointing box.

The loop feeder cable duct from the roadside cabinet plinth shall be terminated inside the cable jointing box with a 50mm N.B. uPVC long radius bend.

If a long duct run precedes the chamber (>100m), the duct entry point may be angled up at 30 degrees in the last 300mm to assist with cable pulling and to minimise cable damage.

The finished duct shall protrude no more than 20mm into the cable jointing box and shall be sealed into the chamber using a suitable epoxy resin to ensure water tight seal. This resin shall form a continuous seal over the perimeter of the duct which penetrates the chamber wall, and shall be neatly smoothed off at each end to form a fillet between the duct and the chamber wall.

Figure 6. The importance of securely concreting a cable jointing box into the ground is demonstrated in this illustration

Figure 7. The loose lid of traditional traffic signal cable jointing boxes can form dangerous projectiles in high speed locations and must not be used

Figures 8 and 9. A purpose-designed cable jointing box has been designed and strength tested for use on the network.

4.0 Chamber and pit installation

4.1 Installation

4.1.1 Chamber Location

The chamber lid and concrete apron shall be flush with the surrounding ground level in grass, concrete or asphalt areas.

In planted areas the chamber lid shall be a maximum of 100mm above ground level with a sloping concrete apron where the chamber is located so that mud, bark and mulch do not cover the lid.

Where the chamber is located on a slope of ten to thirty degrees, the lid shall be flush with the ground on the upper side.

Where the slope is greater than thirty degrees, the lid shall either

- be up to 100mm above the ground level on the upper side, so as to prevent mud washing across and into the chamber and debris settling on the lid, or
- a retaining wall constructed around the side of the chamber in order to prevent debris washing onto the clamber lid.

Figure 10. Example of a double jointing chamber and a hinged galvanised hinged steel 250mm x 170mm cable jointing box constructed into a steep slope.

4.1.2 Bedding and Backfill

Chambers and pits shall be installed on top of a bedding comprising 150mm compacted GAP 40 hard-fill, covered with 20mm of compacted sand. The chambers or pits shall be carefully lifted into place and lined up with the ducts to penetrate the chamber.

The appropriate soft-spots in the chamber walls shall be punched out and the ducts shall then be made off to the chamber as required.

Once the duct installation is complete, the backfilling around the chamber can be completed taking care not to damage the ducts.

Plastic chambers shall be cast into the ground with 150mm concrete surround. This will form a load bearing surface for the frame apron.

The ground around concrete chambers shall be backfilled and compacted and the top 300mm of the chamber shall be concreted in to a width of 150mm. This will form a load bearing surface for the frame benching.

The roof, collar and lid of the chambers shall be installed strictly in accordance with the manufacturer's requirements.

4.2 Connection of Ducts

4.2.1 Jointing Chambers and Pull Pits

Ducts shall be connected into the jointing chambers at the buried depth of the duct.

Ducts shall be connected perpendicular to the chamber wall and shall not protrude more than 20mm into the jointing chamber when finished.

4.2.2 Cable Pit Duct Entry Points

If brick or concrete block construction is used, stub-ducts shall be mortared into the construction so that the ducting can be installed without damage to the chamber.

If concrete pipe is used, duct holes shall be neatly cored into the chamber wall and the duct inserted. The concrete pipe section chamber shall not be laid directly onto any ducts unless those ducts are cast into a concrete base with 150mm up stand

If a plastic chamber is used, duct entry shall be provided with the use of knock-outs (where provided) or neatly cut into the side of the chamber

4.2.3 Sealing Ducts

Ducts shall be sealed to the jointing chamber, pull pit or cable pit wall using a suitable epoxy resin to ensure water tight seal.

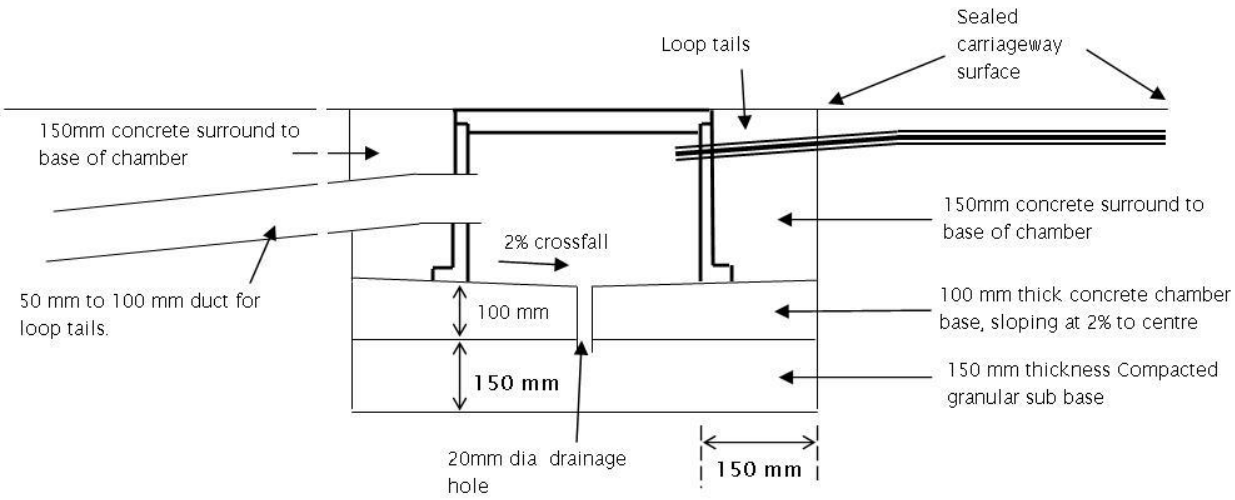
This resin shall form a continuous seal over the perimeter of the duct which penetrates the chamber wall, and shall be neatly smoothed off at each end to form a fillet between the duct and the chamber wall.

4.3 Chamber Clean-up

At the completion of works, the Contractor shall clean out all jointing chambers pull pits and cable pits so that they are free of dirt, mud, water, and any foreign materials.

5.0 Appendices

5.1 Appendix A: Standard Toby Box Installation Detail



5.2 Appendix B: Drawings

Jointing Chamber and Pulling Pit	000-0000-0-7104-01-R2
Detail of Duct Installation Highways and Motorways	000-0000-0-7104-02-R2
Kerbside Junction & Local Cable Pit	000-0000-0-7104-09-R1

Jointing Chamber and Pulling Pit

Detail of Duct Installation Highways and Motorways

Kerbside Junction & Local Cable Pit