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Rae, Kiili and Saku district, Harju county, Estonia

RAIL BALTICA HARJUMAA PÕHITRASSI RAUDTEETARISTU III ETAPP

STAGE III OF RAILWAY INFRASTRUCTURE OF THE RAIL BALTIC MAIN LINE IN HARJU COUNTY

TÖÖPROJEKT

DETAILED TECHNICAL DESIGN

RW060301
Raudtee kaablikanaliseerimine
PK 0+000 - 2+000

RW060301
Railway cable ducting
PK 0+000 - 2+000

SELETUSKIRI

EXPLANATORY LETTER

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1. ÜLDOSA

Käesoleva projektiga on lahendatakse Rail Baltica põhitrassi raudteetaristu kaablikanalistsioon.

Käesoleva projekti aluseks on:

- Hankedokumendid (sh Tehniline kirjeldus, projekteerimise lähteülesanne, sideteenuste pakkuja liitumiste tehnilised tingimused, tehniliste liidestuste vormid, dokument Tehnilised nõuded tehnovõrkudele ja -rajatistele v3.0, dokument Raudtee Tehniline Kirjeldus Osa 08: Kaablikanalistsatsioon, dokument RBDG-MAN-012-0111 Design guidelines General requirements 03.2024, dokument Kaablikanalite, multitorude ja vaatluskaevude tehnilised tingimused v1.0);
- IDOM-i poolt koostatud CCS kaablikanalistsioon põhiprojekt RW0600 (DPS2);
- Skepast & Puhkim OÜ poolt koostatud tööprojekt OR0350 „DPS2 Kangru. Kangru liiklussõlm (OR0345, OR0347, OR0350, OR0545)“.

Projekti erisused:

- Erinevalt projekteerimise lähteülesande punktile „11. Raudtee muldkehas näha projektlahendusega ette, et kaablirenni all oleks vähemalt 0,3 m paksune ja rennist mõlemalt poolt 0,3 m laiem ballastialuse nõuetega aluskiht või 10 cm paksune ja rennist mõlemalt poolt 10 cm laiem killustikualus fr 8/16. Kaablirenn peab olema raudtee muldkeha ballastialuse kihi sees.“ ei tule arvestada truupide puhul, kus alusballasti kiht puudub. Kaablirenni paigaldatakse otse truubi kehandi peale.
- Betoonkaevude ja kaablirennide veepidavust 0,5 bar ei täideta, kuna selliseid tooteid ei eksisteeri.

2. MUUDATUSED VÕRRELDES PÕHIPROJEKTIGA

Tööprojekti tehtud muudatuste aluseks on peatükis 1 toodud hankedokumentide info. Eeskätt info projekteerimise lähteülesandest, tehniliste liidestuste vormidest, sideteenuste pakkuja liitumiste tehnilistest tingimustest ja dokumendist Design guidelines General requirements.

Võrreldes hankedokumentatsioonis esitatud varasema kaablikanalite projektlahendusega, on käesolevas tööprojekti sisse viidud alljärgnevad muudatused:

- 1) Võrreldes põhiprojektiga on vastavalt projekteerimise lähteülesande punktile 4 ette nähtud kaks VII tüüpi kaevud süsteemialadele PK 0+890. Antud kaevud ühendatud CCS põhitrassiga 15-avalise torupaketiga.
- 2) Võrreldes põhiprojektiga on vastavalt projekteerimise lähteülesande punktile 13 ette nähtud alljärgneval positsioonil side kaablikanalistsiooni ühendus sideteenuse pakkuja kaevudega: PK 1+051 (Telia Eesti AS ühendus). Ühenduste teostamiseks CCS trassile (tüüp CD1) lisatud tüüp IVb kaevud.
- 3) Süsteemialale PK 0+890 kaablikanalite süsteemi orientatsioon muudetud vastavalt süsteemiala asukohale raudtee suhtes.
- 4) PK 0+890 kaevud VII asendatud kaevude VIIc vastu võimaldamiseks 15-avalise torupaketi paigaldust kuni süsteemialani koos nõutud paigaldussügavustega.

1. GENERAL

This project will solve the cable ducts of the railway infrastructure of the Rail Baltica main route.

This project is based on:

- Procurement documents (incl. Technical specifications, design terms of reference, technical conditions for connections of communication service providers, forms of technical interfaces, document Technical requirements for utility networks and facilities v3.0, document Railway Technical Description Part 08: Ducts, document Design guidelines General requirements 03.2024, document Technical conditions for ducts, multitubes and manholes v1.0)
- CCS railway cable duct master design project RW0600 (DPS2) prepared by IDOM;
- Detailed technical design OR0350 „DPS2 Kangru. Kangru junction (OR0345, OR0347, OR0350, OR0545)“ prepared by Skepast & Puhkim OÜ.

Distinctions of the project:

- In contrast to point in terms of reference "11. In the railway embankment, the design solution should provide that under the cable channel there will be a base layer at least 0,3 m thick and 0,3 m wider than the gutter on both sides with ballast base requirements, or 10 cm thick and 10 cm wider on both sides of the gutter on both sides of the rubble base fr 8/16. The cable channel must be inside the ballast base layer of the railway embankment." will not be taken into account in the case of culverts where there is no subballast. The cable tray will be installed directly on top of the culvert body.
- The waterproofness of concrete manholes and cable trays is not met to 0,5 bar, as such products do not exist.

2. CHANGES COMPARED TO MASTER DESIGN

The changes made to the detailed technical design are based on the information provided in the procurement documents in Chapter 1. In particular, information about the initial design task, forms of technical interfaces, technical conditions for connections of communication service providers and the Design guidelines General requirements document.

Compared to the previous cable duct design solution presented in the procurement documentation, the following changes have been introduced in this work project:

- 1) Compared to the master design project, according to clause 4 of the terms of reference of the design, two type VII manholes provided for system areas PK 0+890. These manholes are connected to the CCS main line with a 15 piece conduit package.
- 2) Compared to the master design project, according to clause 13 of the terms of reference of the design, the following positions provide for connections to the manholes of communication service providers: PK 1+051 (connection of Telia Eesti AS). Type IVb manholes has been added to the CCS route (type CD1) to make connections.
- 3) The orientation of the cable duct system for system area PK 0+890 has been changed according to the location of the system area in relation to the railway.
- 4) PK 0+890 manholes VII replaced with manholes VIIc to enable installation of a 15 piece conduit package up to the system area with the required installation depths.

3. KAABLITORUD JA BETOONRENNID

Projektis kasutatakse erinevaid tüüpi kaablitorude pakette ja kaablirenne. Sõltuvalt raudtee süsteemi piirkonnast kasutatakse erinevaid aablikanaliseerimise konfiguratsioone. Täpsemad nõuded on toodud raudtee tehniline kirjeldus „Osa 08: Kaablikanaliseerimine“, mis on lisatud ka projekti lisadesse.

Maa-alused torud tähistada märkelindiga „Ettevaatust sidekaabel“. Märkelint paigaldada 30 cm kõrgusele ülemiste torude lagedest.

Maa-aluste kaablitorudega ühisesse trassi tuleb paigaldada tuvastuskaabel. Tuvastuskaabli osas tuleb jätta vähemalt 1 m kaablivaru kaevusesse.

Kaablitorudest ja rennidest on üksikelementidena toodu järgmised elemendid:

- HDPE multitoru, mis koosneb 7 mikrotorudest 16/12 mm. Multitoru välisläbimõõt on 49,5 mm. Nõutud survetugevus on 750N. Multitoru peab olema oranži värvi
- HDPE kaitsetoru välisläbimõõduga 110 mm. Siseläbimõõt peab olema vähemalt 91 mm ja seina paksus – vähemalt 3 mm. Paigaldamisel raudtee alla kasutatakse torusid survetugevusega 1250N, mujal survetugevusega 750N. Torude värvused vastavalt kollane ja oranž.
- Maapealsed kaanega kaablirennid, mis koosneb modulaarsetest elementidest. Kaablikanali paigaldussuuna muutmiseks nii horisontaalselt kui vertikaalselt kasutatakse spetsiaalseid 7,5° ja 15° elemente.

3.1 PIKISUUNALISED KAABLITORUDE PAKETID

Kaablitorude paketid paigaldada piki raudteed nii, et raudteele lähim serv asub vähemalt 3,1 m kaugusel lähimast rööbastee teljest.

Kaablikanalid peavad olema vähemalt 5 m kaugusel kontaktliini masti maandusest ja vähemalt 2 m kaugusel rajatiste vundamendilt (nt. sild).

3.1.1 MAA-ALUSED KAABLITORUDE PAKETID

Torude telgede vahel nii horisontaalselt kui vertikaalselt tuleb tagada vahekaugus 140 mm.

Kaablitorude paketid paigaldada vähemalt 0,8 m sügavusele maapinnast, mõõdetuna ülemise toru ülemisest servast. Ristumisel raudtee maa-aluste struktuurelementidega (nt. truupidega), mis ei võimalda tagada paigaldussügavust 0,8 m, saab kasutada erandeid:

- 0,5 m sügavusel, märgistada kaablikanalite asukoht hoiatuslindiga
- 0,3 m sügavusele, kaitsta kaablikanalid betoonplaatidega 500 x 500 x 60 mm (P x L x K)

Pikki raudteed on eristatud 2 tüüpi kaablitorude pakette:

- CD1 – koosneb 3 x HDPE multitorust kujuga 1 x 3
- CD3 – koosneb 6 x HDPE 750N kaitsetorudest kujuga 2 x 3. Ülemistesse kaitsetorudesse on ettenähtud multitorud.

3. PROTECTION PIPES AND CONCRETE CHANNELS

The project includes different cable duct packages and concrete channels. Different cable ducting configurations are used in different areas of the railway system. More detailed requirements are given in the railway technical specifications “Part 08: Cable ducting”, which are also included in the project annexes.

Underground pipes must be marked with the sign tape "Ettevaatust sidekaabel". The marking tape must be installed 30 cm above the the upper pipes.

A signal cable must be installed in the same route as underground cable pipes. With regard to the signal cable, at least 1 m of cable spare must be left in the wells.

The following elements are presented as individual elements of cable pipes and ducts:

- HDPE multi-pipe, consisting of 7 micro-pipes 16/12 mm. The external diameter of the multi-pipe is 49,5 mm. The required compressive strength is 750N. Multi-pipe must be orange.
- HDPE protection pipe with an external diameter of 110 mm. The internal diameter must be at least 91 mm and the wall thickness – at least 3 mm. When installing under the railway, pipes with a compressive strength of 1250N are used, elsewhere with a compressive strength of 750N. The colors of the tubes must be respectively yellow and orange.
- Above-ground cable trays with a cover, consisting of modular elements. Special 7,5° and 15° elements are used to change the installation direction of the cable duct both horizontally and vertically.

3.1 LONGITUDINAL CABLE CONDUIT PACKAGES

Cable duct packages are installed along the railway so that the edge closest to the railway is at least 3,1 m from the nearest track axis.

Cable ducts must be at least 5 m from the grounding of the contact line mast and at least 2 m from the foundation of the structures (e.g. bridge).

3.1.1 UNDERGROUND CABLE CONDUIT PACKAGES

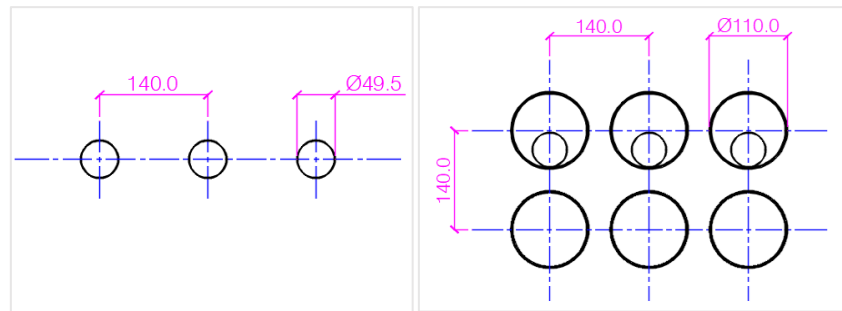
A distance of 140 mm must be ensured between the axes of the pipes both horizontally and vertically.

Cable pipe packages are installed at a depth of at least 0,8 m from the ground, measured from the upper edge of the upper pipe. When crossing underground structural elements of the railway (e.g. culverts), which do not allow ensuring an installation depth of 0,8 m, exceptions can be used:

- At a depth of 0,5 m, mark the location of the cable ducts with warning tape
- At a depth of 0,3 m, protect the cable ducts with a concrete plates 500 x 500 x 60 mm (L x W x H)

2 types of cable pipe packages have been distinguished along the railway:

- CD1 – consists of 3 x HDPE multi-pipes in the shape of 1 x 3
- CD3 – consists of 6 x HDPE 750N protective pipes in the shape of 2 x 3. Multi-pipes are provided in the upper protective pipes.



Joonis 1. Kaablitorude paketid CD1 ja CD3

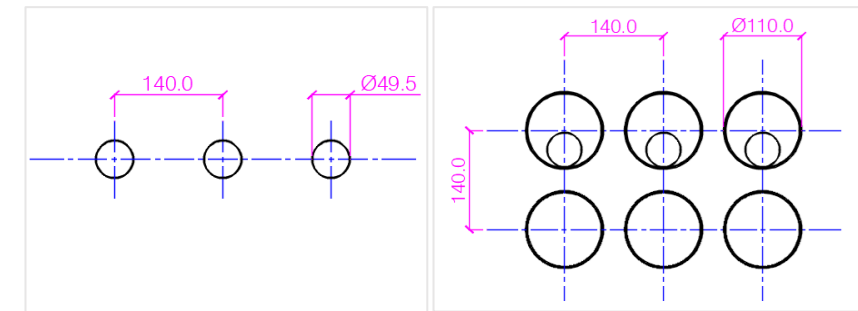


Figure 1. Cable conduit packages CD1 and CD3

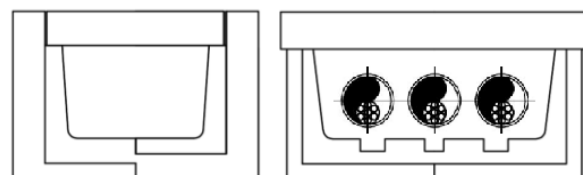
3.1.2 MAAPEALSED KAABLIRENNID

Kaablirenn paigaldada maa sisse nii, et kaablirenni kaaned jäävad maapinnaga tasa.

Kaablirenni alla paigaldada fr 8/16 killustik, mis ulatub 10 cm väljapoole kaablirennist ning 10 cm paksune.

Eristatud on 2 tüüpi kaablirenne:

- Konfiguratsioon CC1 koosneb monteeritavast kaablikanalist integreeritud kaanega. Kaablikanali CC1 välismõõtmed on 400 x 275 mm ja sisemõõtmed on min 242 x 155 mm. CC1 kaablirenn jääb seest tühjaks.
- Konfiguratsioon CC2 koosneb monteeritavast kaablikanalist integreeritud kaanega. Kaablikanali CC2 välismõõtmed on 500 x 330 mm (millele lisandub luugi paksus 60mm) ja sisemõõtmed on min 372 x 155 mm. Renni sisse on ettenähtud paigaldada konfiguratsioon CD2. CD2 - koosneb 3 x D110 HDPE 750N kaitsetorudest kujuga 1 x 3, mille igas torus on sees D49,5 HDPE multitoru.



Joonis 2. Kaablirennid CC1 ja CC2

3.1.2 ON GROUND CABLE CHANNELS

Cable channel is installed underground so that the cable duct covers are flush with the ground.

Install fr 8/16 crushed stone under the cable tray, which extends 10 cm outside the cable tray and is 10 cm thick.

There are 2 types of cable ducts:

- Configuration CC1 consists of a prefabricated cable duct with an integrated cover. The external dimensions of the cable duct CC1 are 400 x 275 mm and the internal dimensions are at least 242 x 155 mm. The CC1 cable duct remains empty on the inside.
- Configuration CC2 consists of a prefabricated cable duct with an integrated cover. The external dimensions of the cable duct CC2 are 500 x 330 mm (plus 60mm hatch thickness) and the internal dimensions are at least 370 x 155 mm. Configuration CD2 is intended to be installed inside the duct. CD2 - consists of 3 x D110 HDPE 750N protective pipes in the shape of 1 x 3, each of which has an D49,5 HDPE multi-pipe inside.

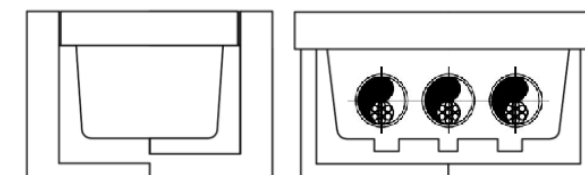


Figure 2. Cable channels CC1 and CC2

3.1.3 KOMBINEERITUD LAHENDUSED

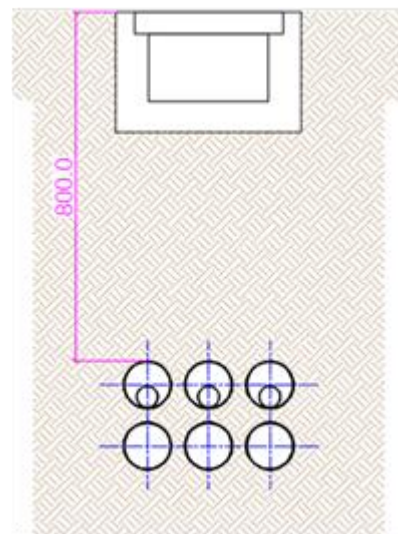
Kombineeritud lahenduste all on mõeldud maa-aluste kaablitoru pakettide ja maapealsete kaablirennide paigaldust teineteise kohal. Eristatud on kombinatsioonid:

- Kaablirenn CC1, mille alla paigaldada kaablitorude pakett CD3 (edaspidi CD3+CC1).

3.1.3 COMBINED SOLUTIONS

Combined solutions refer to the installation of underground cable duct packages and on-ground cable channels above each other. The following combinations are distinguished:

- Cable tray CC1, under which cable duct package CD3 (hereinafter referred to as CD3+CC1).



Joonis 3. Kaablirennide ja kaablitorupakettide kombinatsioonid CD3+CC1

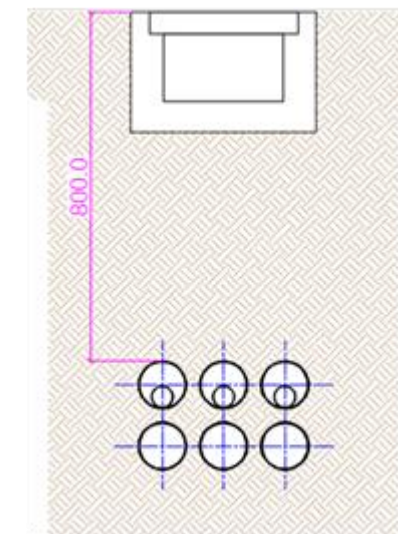


Figure 3. Combinations of cable channels and cable duct packages CD3+CC1

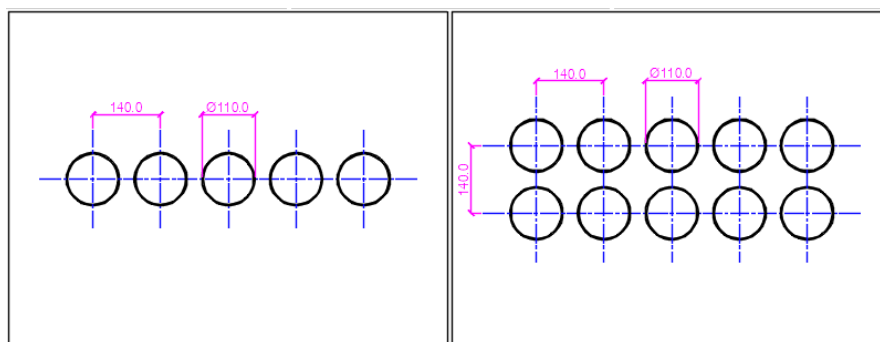
3.2 RÕÖBASTEEALUSED RISTMED

Toru telgede vahel nii horisontaalselt kui vertikaalselt tuleb tagada vahekaugus 140 mm

Ristumisel raudteega paigaldada kaablitorude pakettid täisnurkselt. Minimaalne sügavus ülemise toru ülemise ääre ja liipri alumise serva vahel on 1,2 m.

Ristumisel raudteega maa-aluste kaablitorude pakettide jaoks kasutada konfiguratsioone UTC1 ja UTC2.

- Konfiguratsioon UTC1 koosneb 5 x D110 1250N HDPE torudest kujuga 1 x 5
- Konfiguratsioon UTC2 koosneb 10 x D110 1250N HDPE torudest kujuga 2 x 5



Joonis 4. Maa-alused kaablitorude pakettid ristumisel raudteega UTC1 ja UTC2

3.2 UNDER-RAIL CROSSINGS

The distance between the pipe axes is ensured both horizontally and vertically by 140 mm

At the railway crossing, the cable pipe packages are installed at right angles. The minimum depth between the upper edge of the upper pipe and the lower edge of the sleeper is 1.2 m.

At the railway crossing, use the configurations UTC1 and UTC2 for underground cable pipe packages.

- Configuration UTC1 consists of 5 x D110 1250N HDPE pipes in the shape of 1 x 5
- Configuration UTC2 consists of 10 x D110 1250N HDPE pipes in the shape of 2 x 5

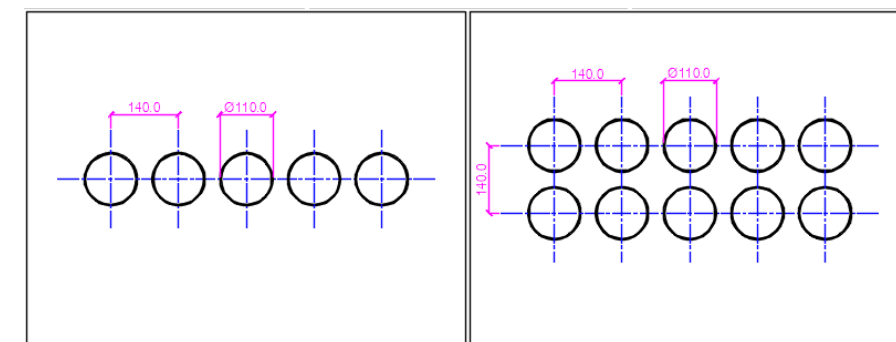


Figure 4. Underground cable pipe packages at the intersection with the railway UTC 1 and UTC2

3.3 SÜSTEEMIALADE LIIDESTUMISED

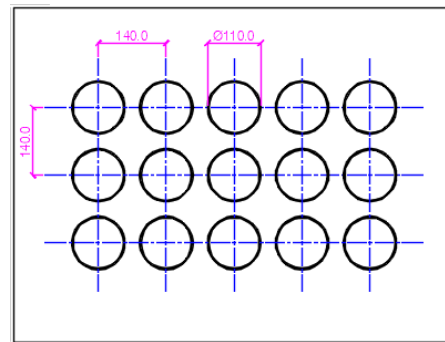
Süsteemialade liidestumiste jaoks on raudteemuldkehal asuvast kaevust süsteemialal olevasse kaevu ettenähtud kaablitorude pakett UTC3. Konfiguratsioon UTC3 koosneb 15 x D110 1250N HDPE torudes kujuga 3 x 5.

Süsteemialadele väljaviikude tegemisel paigaldada kaablitorude pakettid 1m sügavusele raudteekraavi põhjast.

3.3 CONNECTIONS WITH SYSTEM AREAS

For the system area interfaces, a cable conduit package UTC3 is provided from a manhole located on the railway embankment to a manhole located in the system area. The UTC3 configuration consists of 15 x D110 1250N HDPE pipes in a 3 x 5 shape.

When making exits to system areas, install the cable pipe packages at a depth of 1 m from the bottom of railway trench.



Joonis 5. UTC3 kaablitorude pakett

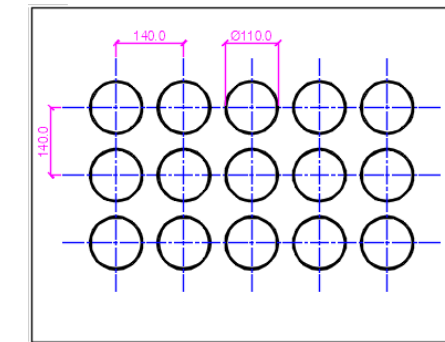


Figure 5. UTC3 cable duct package

3.4 ÜHENDUS SIDETEENUSE PAKKIJAGA

Rail Baltica põhitrassi raudteetaristu CCS kaablikanaliseerimine ühendada sideteenuse pakkujate kaablikanaliseerimisega. Ühendus teenusepakkujaga D110 HDPE 1250N toruga (puurtoru tüüp). D110 torusse paigaldada 4-avaline multitoru (4x14/10+Cu).

Teenusepakkuja maapeale luugiga kaevu korral paigaldada D110 toru alates teenusepakkuja kaevust kuni raudtee CCS kaablikanaliseerimise kaevuni.

Teenusepakkuja maa-aluse optikakaevu korral ette nähtud selle vahetus- lähedusse KKS3 raudbetoon täiskaev (antud kaevude vahele paigaldada ainult multitoru). Alates KKS3 kaevust paigaldada D110 toru kuni raudtee CCS kaablikanaliseerimise kaevuni.

Teenusepakkuja kaevu projekteeritud toru mitte ühendada (toru paigaldada kaevu seinani).

Ühendused teenusepakkujaga teostada mõlemal pool raudteed.

Ristumisel raudteekraaviga paigaldada kaablitorud 1m sügavusele kraavipõhjast.

3.4.1 PAIGALDUS TRANSPORDIAMETI TEEMAA-ALAL

Kõrvalmaantee katte ja mulde alla paigaldada kaablitoru D110 HDPE 1250N min 1,5 m sügavusele. Lähemal kui 1,0 m muldkeha nõlvast $\geq 1,2$ m sügavusele ümbritsevast maapinnast, $\geq 1,0$ m sügavusele haljasribal (vastavalt Transpordiameti nõuetele tehnoorkude ja -rajatiste teemaale paigaldamise kavandamisel).

Ristumisel Kangru teega kaitsetoru D110 HDPE 1250N paigaldus teostada lahtise meetodiga ning enne tee-ehitust (Skepast & Puhkim OÜ projekt „DPS2 Kangru. Kangru liiklussõlm“, töö nr OR0350).

3.4.2 PAIGALDUS KOV MAA-ALAL

Sõiduteede alla paigaldada kaablitorud $\geq 1,0$ m sügavusele. Haljasala ning kergliiklusteede alla paigaldada kaablitorud $\geq 0,7$ m sügavusele.

3.5 PAIGALDAMISE ÜLDTINGIMUSED

- Maa-alused kaablitorude pakettid paigaldada koos signaalkaabliga ja märgistada hoiatuslindiga;
- Torude paigaldamisel pidada kinni tootjapoolsetest painderaadiustest;

Töö nimetus / Project name: RAIL BALTICA HARJUMAA PÕHITRASSI RAUDTEETARISTU III ETAPP
Töö nr - Staadium / Proj no - Stage: RW060301 – tööprojekt
Asukoht / Location: Rae, Kiili ja Saku vald, Harju maakond, Eesti
Koostaja / Compiler: Reaalprojekt OÜ
Vastutav isik / Responsible person: Artjom Klibanov

3.4 CONNECTION TO THE COMMUNICATION SERVICE PROVIDER

The CCS ducts of the rail infrastructure of the Rail Baltica main line will be connected to the ducts of communication service providers. Connection to the provider with D110 HDPE 1250N conduit (drilling pipe type). In the D110 conduit, install a 4-hole multiduct (4x14/10+Cu).

In the case of a manhole with a hatch on the ground of the service provider, install a D110 conduit from the service provider's manhole to the railway CCS duct manhole.

In the case of an underground optics access chamber of the service provider, a KKS3 type reinforced concrete cable manhole is provided in its immediate vicinity (install only a multiduct between the manhole and chamber). From the KKS3 manhole install the D110 conduit to the railway CCS duct manhole.

Do not connect the conduit in the service provider manhole/chamber (install the conduit to the wall of the manhole/chamber).

Connections with the service provider to be carried out on both sides of the railway.

Under railway culverts install cable pipe to a depth of 1m from the bottom of the ditch.

3.4.1 INSTALLATION IN THE TRANSPORT BOARD AREA

Cable pipe D110 HDPE 1250N should be installed under the surface and embankment of the secondary road to a depth of at least 1,5 m. Closer than 1,0 m from the slope of the embankment to a depth of $\geq 1,2$ m from the surrounding ground, to a depth of $\geq 1,0$ m on the green strip (according to the requirements of the Transport Board when planning the installation of utility networks and facilities).

At the intersection with Kangru road, the installation of the protective pipe D110 HDPE 1250N should be carried out using an open method and before road construction (Skepast & Puhkim OÜ design "DPS2 Kangru. Kangru junction", work no. OR0350).

3.4.2 INSTALLATION IN THE LOCAL GOVERNMENT AREA

Cable pipes should be installed under the roadways to a depth of $\geq 1,0$ m. Cable pipes should be installed under the green area and light traffic roads to a depth of $\geq 0,7$ m.

3.5 GENERAL INSTALLATION CONDITIONS

- Underground cable pipe packages are installed with signal cable and marked with warning tape;
- When installing pipes, adhere to the manufacturer's bending radius;

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- Multitorud paigaldada nii, et seadmete asukohtade vahel oleks võimalusel minimaalne multitorude ühenduste arv. Multitoru soovitatav pikkus 1 – 1,2 km kahe avatud otsade vahel kontrollkaevudes;
- Multitorud paigaldada ilma ühendamise või lõikumiseta juhul, kui need läbivad vahekontrollkaeve lühikese paigalduskaugusega. Multitoru soovitatav pikkus saavutatakse multitoru tõmbamise meetodil lahtisesse kaevikusse või kaablikanalisse;
- Kõik torud tuleb sulgeda otsakorkidega kuni kaablite paigaldamise ajani. Mitte kasutatavad kanalid peavad olema otsest suletud otsakorkidega;
- Torude läbiviigid kaevudesse peavad olema liivatihedad;
- Kaablikaitse torude liitmikud peavad tagama 0,5 bar veetihedust;
- Ristumisel raudtee kraaviga paigaldada toru(d) minimaalselt 1,0m sügavusele kraavipõhjast;
- Ristumisel raudteega minimaalne paigaldussügavus raudtee liiprist on 1,2m;
- Piki raudteed paigaldatavate kaablitorude minimaalne sügavus on 0,8m.

- Multipipes are installed so that there is a minimum number of multipipe connections between the locations of the equipment. The recommended length of the multipipe is 1 – 1,2 km between two open ends in inspection pits;
- Multipipes are installed without joining or cutting if they pass through intermediate inspection pits with a short installation distance. The recommended length of the multipipe is achieved by pulling the multipipe into an open trench or cable duct;
- All pipes must be closed with end caps until the time of cable installation. Unused pipes must be directly closed with end caps;
- Pipe penetrations into manholes must be sand-tight;
- The fittings of cable protection pipes must ensure a water tightness of 0,5 bar;
- At the intersection with a railway ditch, install the pipe(s) at a minimum depth of 1.0m from the bottom of the ditch;
- At railway crossings, the minimum installation depth from the railway sleeper is 1,2 m;
- The minimum depth of cable ducts installed along the railway is 0,8 m.

3.6 NÕUDED MATERJALIDELE JA PAIGALDUSELE

Kõikidele CCS projektis kasutatud elementidele on esitatud materjali ja paigalduse nõuded. Nõuded on toodud raudtee tehniline kirjelduses „Osa 08: Kaablikanaliseerimine“, mis on lisatud ka projekti lisadesse.

3.6 REQUIREMENTS FOR MATERIALS AND INSTALLATION

All elements used in the CCS project have material and installation requirements. The requirements are given in the railway technical specification “Part 08: Cable Ducting”, which is also included in the project annexes.

4. KONTROLLKAEVUD

Kontrollkaevud paigaldada piki raudteed nii, et raudteele lähim serv asub vähemalt 3,1 m kaugusel lähimast rööbastee teljest. Kontrollkaevu telje ja rööbastee telje vahel peab olema vähemalt 3,6 m. Kontrollkaevu VII juhul antud vahekaugus on 3,8 m.

Kõikidesse kaevudesse on ettenähtud 4 kaevu krontsteini pikkusga 400mm ja 4 kahest konsooli.

4. MANHOLES

Manholes are installed along the railway line so that the edge closest to the railway line is at least 3,1 m from the nearest track axis. The distance between the manhole axis and the track axis must be at least 3,6 m. In the case of manhole VII, the distance given is 3,8 m.

All wells are equipped with 4 well brackets with a length of 400mm and 4 double consoles.

4.1 KAEVU MOODULELEMENDID

Kontrollkaevud koosnevad erinevatest moodulelementidest:

- [1] Laeplaat, mille sisse paigaldada kaevukaaned. Tüübi V ja VII puhul kasutada kahe kaanega luuki.
- [2] Läbiviiguraam, kus on ettenähtud murdepunktid raami igal küljel
- [3] Põhjaplaat, mille keskel on avaus drenaažitoru ühendamiseks.
- [4] Vaheraam 200mm
- [5] Vaheraam 400mm

Kaevude kaaned varustatakse kolmnurkse lukuga. Kaevudesse paigaldada kaabliiriulid.

4.1 MODULAR ELEMENTS OF THE MANHOLE

The manholes consist of various modular elements:

- [1] Ceiling plate, into which the manhole covers are installed. For types V and VII, a manhole with two covers is used.
- [2] A penetration frame with predetermined break points on each side of the frame
- [3] A bottom plate with an opening in the middle for connecting the drainage pipe.
- [4] Intermediate frame 200mm
- [5] Intermediate frame 400mm

The manhole covers are equipped with a triangular lock. Cable racks should be installed in the manholes.

4.2 KAEVU TÜÜBID

Kaevud:

4.2 MANHOLE TYPES

Manholes:

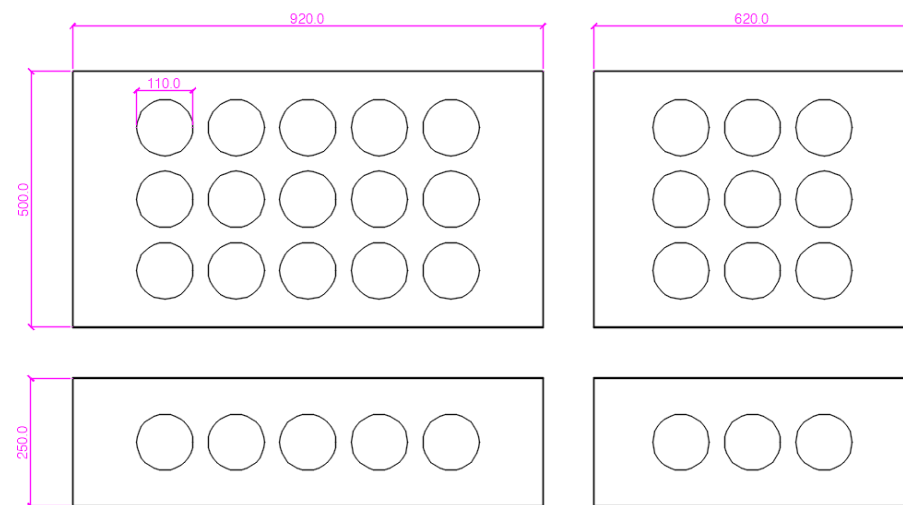
- IV välismõõtmatega 1,20 x 1,00 x 1,36 m (P x L x K)
- IVb välismõõtmatega 1,20 x 1,00 x 2,16 m (P x L x K)
- V välismõõtmatega 1,64 x 1,04 x 1,56 m (P x L x K)
- VII välismõõtmatega 1,65 x 1,40 x 1,57 m (P x L x K)
- VIIc välismõõtmatega 1,65 x 1,40 x 2,77 m (P x L x K)

Kaevude joonised on toodud projekti joonistel.

4.3 LÄBIVIIGUD

Kaablirennide ja kaablitorude sisseviimiseks kontrollkaevu kasutatakse järgmised läbiviike:

- Läbiviik koos 15 avaga kanalite $\varnothing 110$ mm jaoks (kuju 3 x 5, kontrollkaevu pikk külg).
- Läbiviik koos 5 avaga kanalite $\varnothing 110$ mm jaoks (kuju 1 x 5, kontrollkaevu pikk külg).
- Läbiviik koos 9 avaga kanalite $\varnothing 110$ mm jaoks (kuju 3 x 3, kontrollkaevu lühike külg).
- Läbiviik koos 3 avaga kanalite $\varnothing 110$ mm jaoks (kuju 1 x 3, kontrollkaevu lühike külg).



Joonis 6. Läbiviiguplaadid

Mitte kasutatavad avad on vaja sulgeda korkidega ja korralikult tihendada. Multitorude puhul kasutad $\varnothing 49,5 \rightarrow \varnothing 110$ üleminekut.

4.4 ÜLEMINEKUELEMENDID KAEVUDEST KAABLIRENNIDELE

Ühenduse teostamiseks maapealsete kaablikanalite ja kontrollkaevude vahel paigaldada raudbetoonüleminekud. Üleminekud ja nende kaaned valmistatakse C30/37 betoonist. Kaaned peavad olema 500 mm pikkusega.

Ülemineku jaoks kasutatakse konfiguratsioon TCC-1 ja TCC-2:

- Konfiguratsioon TCC-1 kasutatakse kaablikanalile CC1. Ülemineku TCC-1 välismõõtmed on 0,58 x 0,84 x 0,50 m (P x L x K).
- Konfiguratsioon TCC-2 kasutatakse kaablikanalile CC2. Ülemineku TCC-2 välismõõtmed on 1,58 x 0,84 x 1,30 m (P x L x K).

- IV with external dimensions 1,20 x 1,00 x 1,36 m (L x W x H)
- IVb with external dimensions 1,20 x 1,00 x 2,16 m (L x W x H)
- V with external dimensions 1,64 x 1,04 x 1,56 m (L x W x H)
- VII with external dimensions 1,65 x 1,40 x 1,57 m (L x W x H)
- VIIc with external dimensions 1,65 x 1,40 x 2,77 m (L x W x H)

Manhole drawings are provided in the project drawings.

4.3 INLETS

The following inlet configurations are used to introduce ducts into the manhole:

- Inlet with 15 openings for ducts $\varnothing 110$ mm (shape 3 x 5, long side of manhole).
- Inlet with 5 openings for ducts $\varnothing 110$ mm (shape 1 x 5, long side of manhole).
- Inlet with 9 openings for ducts $\varnothing 110$ mm (shape 3 x 3, short side of manhole).
- Inlet with 3 openings for ducts $\varnothing 110$ mm (shape 1 x 3, short side of manhole).

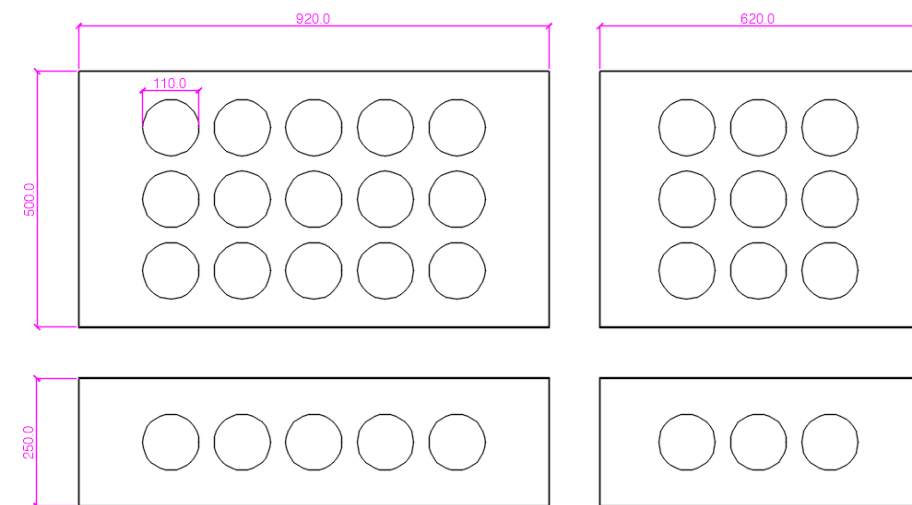


Figure 6. Inlet plates

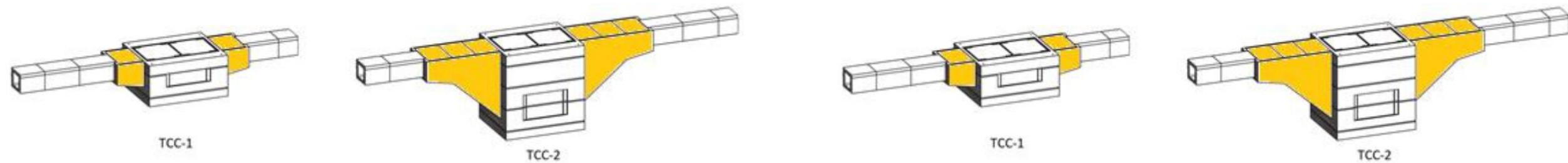
Unused openings must be closed with caps. A connector must be used for installation multiducts (with an outer diameter of 49,5 mm) in the opening intended for ducts $\varnothing 110$ mm.

4.4 TRANSITION ELEMENTS FROM MANHOLES TO CABLE CHANNELS

Reinforced concrete transitions are installed to make the connection between terrestrial cable channels and manholes. Transitions and their lids are made of C30/37 concrete. The lids must be 500 mm long.

The configuration TCC-1 and TCC-2 is used for the transition:

- Configuration TCC-1 is used for cable channel CC1. The outer dimensions of the transition TCC-1 are 0,58 x 0,84 x 0,50 m (L x W x H).
- Configuration TCC-2 is used for cable channel CC2. The outer dimensions of the transition TCC-2 are 1,58 x 0,84 x 1,30 m (L x W x H).



Joonis 7. Ülemineku elemendid

Figure 7. Transition elements

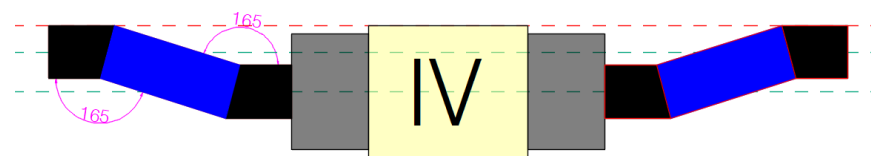
4.5 PÖÖRDE ELEMENDID

4.5.1 VASAKULE JA PAREMALE PÖÖRAMISE ELEMENDID

Kaevu sisenenavad kaablirennid peavad jõudma kaevu tsentrisse, kus asuvad ka, mistõttu tuleb kasutada selleks ettenähtud pöörde elemente.

Kaevude IV ja V puhul on kasutatud järgmist kombinatsiooni:

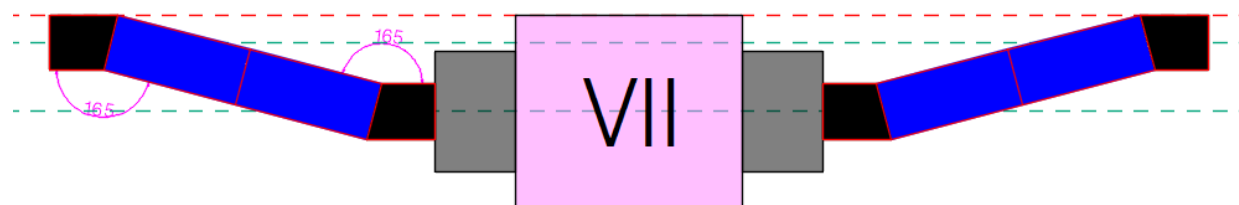
- 15 kraadi pöörang
- CC1 / CC2 element
- 15 kraadi pöörang



Joonis 8. Kaablirenni pöörde elemendid kaevude IV ja V puhul

Kaevu VII puhul on kasutatud järgmist kombinatsiooni:

- 15 kraadi pöörang
- CC1 / CC2 element
- CC1 / CC2 element
- 15 kraadi pöörang



Joonis 9. Kaablirenni pöörde elemendid kaevu VII puhul

4.5 ROTATION ELEMENTS

4.5.1 LEFT AND RIGHT ROTATION ELEMENTS

The cable trays entering the manhole must reach the centre of the manhole, where the inlets are located, which is why the designated turning elements must be used.

For manholes IV and V, the following combination has been used:

- 15 degree rotation
- CC1 / CC2 element
- 15 degree rotation

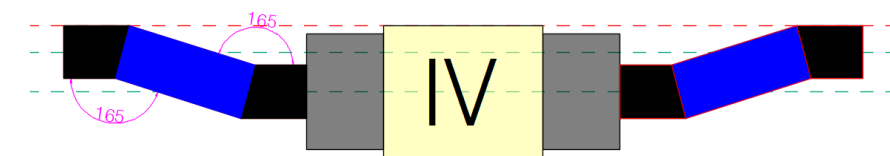


Figure 8. Cable tray turn elements for manholes IV and V

The following combination has been used for Manhole VII:

- 15 degree rotation
- CC1 / CC2 element
- CC1 / CC2 element
- 15 degree rotation

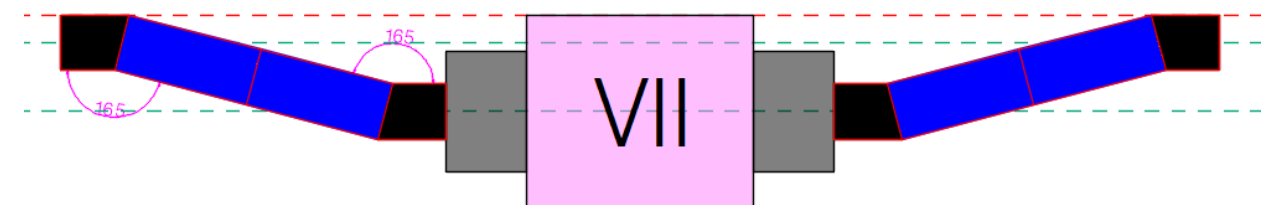


Figure 9. Cable tray rotation elements for manhole VII

4.5.2 ÜLES JA ALLA LIIKUMISE ELEMENDID

Taoliselt üleval kirjeldatud printsiipidele on lahendatud järgmised vertikaalsed tõusud ja langused kasutades erinevaid kombinatsioone:

- Alusballastide kõrguste erinevusest tingitud üles-alla
- Truupidele minek ja allatulek, kus kaablirenn on paigaldatud otse truubi betoon kehendi peale ning kaablirenni lagi ei ole tasa alusballastiga
- Sildele minek ja alla tulek
 - A – sillale on paigaldatud ainult betoonrenni kaas, mistõttu allaviigu elementi sillale ei paigaldata
 - B – sillal on paigaldatud kaablirenn ja kasutatakse kõiki elemente
 - C – alusballasti ja sild on projekteeritud nii, et eraldi elemente vaja ei ole.

NB! Elementide kasutamine ei välista betoontoodete kohapealset lõikamist kaablirennide kokkuviiimisel.

4.5.2 ELEMENTS OF UP AND DOWN MOVEMENT

The following vertical rises and falls are solved for the principles described above, using different combinations:

- Up and down due to the difference in the height of the subballasts
- Going to and coming down to culverts, where the cable tray is installed directly on top of the concrete body of the culvert and the hatch of the cable tray is not flush with the subballast
- Going up the bridge and coming down
 - A – only the cover of the concrete channel is installed on the bridge, so the underpass element is not installed on the bridge
 - B – a cable tray is installed on the bridge and all elements are used
 - C – The base ballast and axle are designed in such a way that no separate elements are needed.

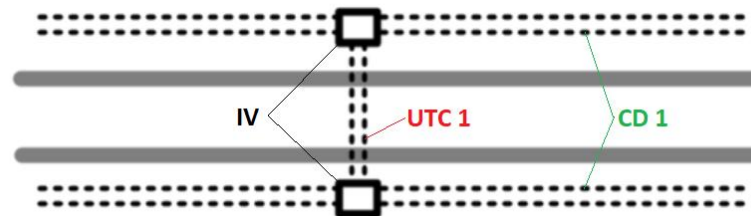
NB! The use of elements does not preclude the on-site cutting of concrete products when connecting cable trays.

5. KAABLIKANALISATSIOONI LAHENDUSED

5.1 PÕHITRASSI LAHENDUS

Põhitrassil koosneb kaablikanalistatsioon konfiguratsioonist CD1, mis paigaldada mõlemale poole raudteed.

Iga 1km tagant paigaldada kaev IV. Kaevude vahele paigaldada kaablitorude pakett UTC1. Antud lahendus on ettenähtud ka igas raudtee ja sõidutee viadukti ristumiskohas.



Joonis 10. Kaablikanalite süsteem kaabli tõmbamiseks

Liinilõikudel, kus kahe süsteemiala vaheline kaugus on üle 3 km, paigaldada lõigu keskele (kuid mitte vähem kui iga 2 km) kaev VII. Juhul kui 3 km lõigu sees on juba ettenähtud väiksemate mõõtmetega kaev, siis piisab antud kaevu vahetamisest kaevu VII vastu. Antud kaevud on vajalikud kaablivarude tekitamiseks.

5.2 TRUUBID JA LOOMATUNNELID

Juhul kui ristumisel truubiga ei ole võimalik tagada nõuetekohast kuja kaablitorude paketi ja alusballasti vahel on ettenähtud paigaldada mõlemale poole truupi kaevud. Piki raudteed tuleb kaevud ühendada kaablirenniga ning ühel pool truupi tuleb kaevud ristumisel raudteega ühendada kaablitorude paketiga.

5. CABLE DUCT SOLUTIONS

5.1 MAIN LINE SOLUTION

On the main line, the cable duct consists of configuration CD1, which is installed on both sides of the railway.

Every 1 km, install a manhole IV. Install the UTC1 cable pipe package between the manholes. This solution is also provided at every intersection of a railway and a carriageway overpass.

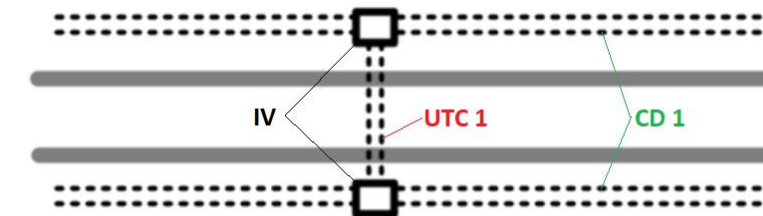


Figure 10. Kaablikanalite süsteem kaabli tõmbamiseks

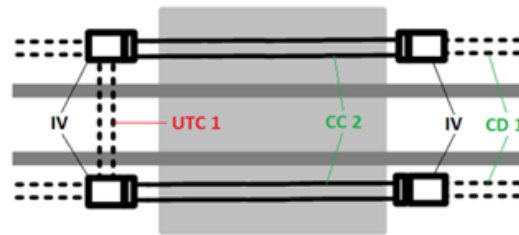
On sections where the distance between two system areas is more than 3 km, manhole VII must be installed in the middle of the section (but not less than every 2 km). If there is already a smaller manhole within the 3 km section, it is enough to replace the given manhole with a manhole VII. These manholes are necessary to create cable reserves.

5.2 CULVERTS AND ANIMAL PASSAGES

In the event that it is not possible to ensure a proper gap between the cable pipe package and the subballast at the crossing, manholes are intended to be installed on both sides of the culvert. Along the railway, the manholes must be connected with a cable tray, and on one side of the culvert, the manholes must be connected to a cable pipe package when crossing the railway.

5.2.1 JAAMAVAHE

Ristumisel truubiga paigaldada mõlemale poole raudteed kaevud IV. Kaevude vahele piki raudteed paigaldada kaablirenn CC2. Ühel pool truupi ühendada kaevud IV kaablitorude paketiga UTC1.



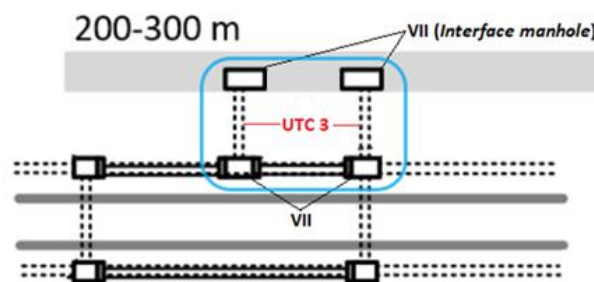
Joonis 11. Ristumine truubiga jaamavahe korral

5.3 SÜSTEEMIALAD

5.3.1 ÜLDINE PRINTSIIP

Raudtee seadmete jaoks on ettenähtud süsteemialad. Raudtee ääres olevate kaablikanalite ja süsteemialade liidestumiseks on ettenähtud paigaldada süsteemialal keskele kaks kontrollkaevu VII (*interface manhole*), nii et kaevude vahel oleks 30 m. Antud kaevud peavad paiknema kohakuti raudtee kaablikanalite kontrollkaevudega VII.

Maasisene kaablikanali pakett UTC3 paigaldada süsteemiala ja raudtee kaevude vahele.



Joonis 12. Süsteemiala ühendus

5.3.2 CCS SÜSTEEMIALA

Raudtee suhtes süsteemiala poolsesse külge paigaldada kaks kontrollkaevu VII. Kaevud asetsema kohakuti süsteemialal paiknevate kaevudega (*interface manhole*). Teisele poole raudteed tuleb paigaldada kontrollkaev VII, mis peab paiknema kohakuti süsteemiala ühe kaevuga. Viimasest kontrollkaevust 75 m kaugusele paigaldada kontrollkaev V. Kohakuti selle kaevuga tuleb paigaldada veel üks kontrollkaev V.

5.2.1 OPEN LINE

At the crossing with the culvert, manholes IV should be installed on both sides of the railway. Between the manholes along the railway, a cable tray CC2 should be installed. On one side of the culvert, connect the manholes IV with the cable pipe package UTC1.

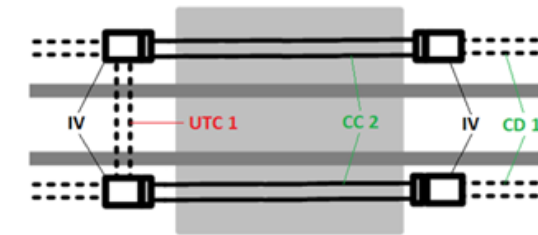


Figure 11. Crossing with culverts on an open line

5.3 SYSTEM AREAS

5.3.1 GENERAL PRINCIPLE

System areas are provided for railway equipment. In order to interface the cable ducts and system areas along the railway, it is planned to install two manholes VII (*interface manhole*) in the middle of the system area, so that there is 30 m between the manholes. These manholes must be located in line with the manholes VII of the railway cable ducts.

Underground cable duct package UTC3 to be installed between the system area and the railway manholes.

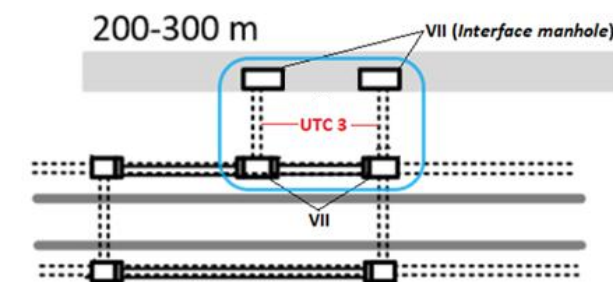
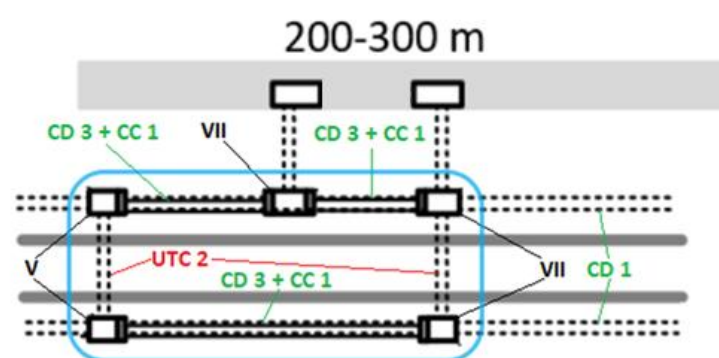


Figure 12. System area Connection

5.3.2 CCS SYSTEM AREA

Two manholes must be installed on the side facing the system area in relation to the railway. The manholes must be placed in line with the manholes (*interface manhole*) located in the system area. On the other side of the railway, manhole VII must be installed, which must be located flush with one of the manholes in the system area. Install an manhole V at a distance of 75 m from the last manhole. Another manhole V must be installed in parallel with this manhole.



Joonis 13. Kaablikanalite süsteem seadmete asukohas

Ristumisel raudteega on ettenähtud kaevude VII ja V vahele UTC2. Piki raudteed paiknevate kontrollkaevude vahele paigaldada kaablikanalite kombinatsioon CD3+CC1.

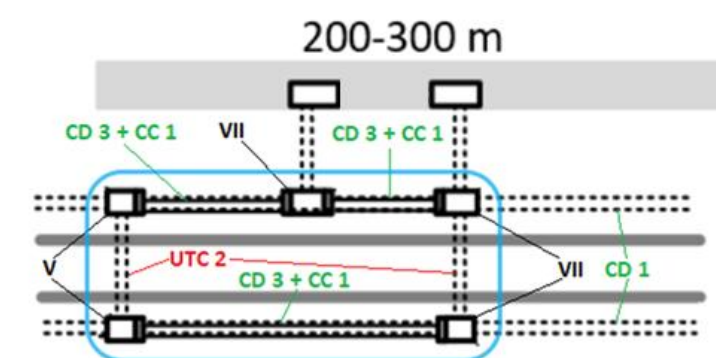


Figure 13. Cable duct system at the location of the equipment

At the crossing with the railway, UTC2 is prescribed between manholes VII and V. Between the manholes located along the railway, a combination of cable channels CD3+CC1 should be installed.