

Saku vald, Harju maakond, Eesti

Saku district, Harju County, Estonia

RAIL BALTICA HARJUMAA PÕHITRASSI RAUDTEETARISTU IV ETAPP

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

TÖÖPROJEKT

DETAILED TECHNICAL DESIGN

RW070300
Raudtee kaablikanaliseerimine
SELETUSKIRI

RW070300
Railway cable channels
EXPLANATORY LETTER

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1. ÜLDOSA

Käesoleva projektiga on lahendatakse Rail Baltica põhitrassi raudteetaristu kaablikanalistatsiooni.

Käesoleva projekti aluseks on:

- Hankedokumendid (sh Tehniline kirjeldus, projekteerimise lähteülesanne, sideteenuste pakujate liitumiste tehnilised tingimused, tehniliste liidestuste vormid, dokument Tehnilised nõuded tehnovõrkudele ja -rajatistele v3.0, dokument Raudtee Tehniline Kirjeldus Osa 08: Kaablikanalistatsioon, 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 kaablikanalistatsioon põhiprojekt RW0700 (DPS2);
- IDOM-i poolt koostatud Saku ja Kurtna kohalike peatuste jaamahoonete (sh jaamahoonete välialad, platvormid, ülepääs/altpääs) eelprojektid.

Projekti erisused:

- Erinevalt projekteerimise lähteülesande punktide „11. Töövõtja tagab projektlahendusega, et kaablirenni all oleks vähemalt 0.3 m paksune ballasti aluskiht.“ ei tule arvestada truupide puhul, kus alusballasti kiht puudub. Kaablirenni paigaldatakse otse truubi kehendi peale;
- Seoses ökoduktide lahenduse muudatustega ei rajata ökodukti CC1 kanalit. Ökodukti on ettenähtud ainult CD1;
- Betoonkaevude ja kaablirennide veepidavust 0,5 bar ei ole vaja täita. Vastavus standarditele EN 1917 või EN 476 on asendatud standarditega EN 13369 (ja DIN 1045-40).
- Vastavalt dokumendi Design Guidelines General RBDG-MAN-012-0111 skeemile „Cableways at CCS system equipment locations“ on ette nähtud CCS süsteemiala kaevude vahe 30m. Ca PK16+770 on aga kaevude vahemaa 27m, mis on tingitud olukorrast kus viadukti ja pöörmete ala vahel pole 30m saavutamiseks piisavalt ruumi.
- Vana- Vääna silla (ca PK 9+820), Soo tee silla (ca PK 9+940) ja Koosi tunneli (ca PK 16+800) puhul on käesolevas projektis CC2 ja CC3 trassid ette nähtud ainult betoonrenni kaante ja torudena, kuna viidatud sildade ja tunneli konstruktsioonis on betoonrenni süvised juba ette nähtud.

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 RBDG-MAN-012-0111 Design guidelines General requirements 03.2024, document Technical conditions for ducts, multitubes and manholes v1.0);
- CCS railway cable duct master design project RW0700 (DPS2) prepared by IDOM;
- Preliminary designs of the station buildings of Saku and Kurtna local stops (incl. outdoor areas of station buildings, platforms, overpass/underpass) prepared by IDOM.

Distinctions of the project:

- Unlike the terms of reference for the design, "11. The contractor ensures with the design solution that there is a ballast base layer of at least 0.3 m thick under the cable tray." 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;
- Due to the changes in the ecoduct solution, the CC1 channel of the ecoduct will not be built. Only CD1 is prescribed for ecoducts;
- The water tightness of 0.5 bar for concrete manholes and cable trays is not required. Compliance with EN 1917 or EN 476 has been replaced by EN 13369 (and DIN 1045-40).
- According to the diagram "Cableways at CCS system equipment locations" in the Design Guidelines General RBDG-MAN-012-0111, a distance of 30m between the manholes in the CCS system area is prescribed. However, at about PK16+770, the distance between the manholes is 27m, which is due to the situation where there is not enough space between the viaduct and the turnout area to reach 30m.
- In the case of the Vana-Vääna bridge (ca PK 9+820), the Soo tee bridge (ca PK 9+940) and the Koosi tunnel (ca PK 16+800), the routes CC2 and CC3 are intended in this project only as concrete channel covers and pipes, as the concrete channels recesses are already provided in the construction of the bridges and the tunnel design.

2. MUUDATUSED VÕRRELDDES PÕHIPROJEKTIGA

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

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

- 1) PP muudatus plaanil nr 1.1 (ca PK 12+665), nr 1.2 (ca PK 15+037), nr 1.3 (ca PK 15+309), nr 1.5 (ca PK 16+720), nr 1.6 (ca PK 17+253) ja nr 1.7 (ca PK 18+060).
Süsteemialadele ette nähtud kaks VII tüüpi kaevud. Antud kaevud ühendatud CCS põhitrassiga 15-avalise torupaketiga. Muudatus vastavalt dokumendile Design Guidelines RBDG-MAN-012-0111 "Cableway at CCS system equipment locations".
- 2) PP muudatus plaanil nr 2.1 (ca PK 10+030) ja nr 2.2 (ca PK 16+340)
Lisatud tüüp VII kaev, vastavalt dokumendile Design Guidelines RBDG-MAN-012-0111 "Cableways on stopping points."
- 3) PP muudatus plaanil nr 3 (ca PK 14+165)
Süsteemiala ettenähtud nii CCS kui ka ENE jaoks. Muudatus vastavalt dokumendile Design Guidelines RBDG-MAN-012-0111 "Cableway system at joint CCS and ENE equipment locations". Sealhulgas lisatud süsteemialadele VII tüüpi kaevud.
- 4) PP muudatus plaanil nr 4.1 (ca PK 13+000) ja nr 4.2 (ca PK 17+850)
Kaevude vahele lisatud UTC1. Lahendus vastavalt dokumendile Design Guidelines General requirements RBDG-MAN-012-0111 „Cableways at culverts“.
- 5) PP muudatus plaanil nr 5.1 (ca PK 14+650) ja nr 5.2 (ca PK 18+400)
Seoses ökoduktide lahenduse muudatustega ei nähta ette ökodukti CC1 kanalit ja V2 kaeve. Ökodukti projekteeritud ainult CD1 kaablikanal ja V tüüpi kaevud (kaevud väljaspoole ökodukti rajatist).
- 6) PP muudatus plaanil nr 6 (ca PK 14+800)
Ristumisel truubiga CC3 asemel ette nähtud CC2. Lisatud kaks CC2 kanali üleminekut TCC-2 kaevude IV ja V vahele. Lahendus vastavalt dokumendile Design Guidelines General requirements RBDG-MAN-012-0111 „Cableways at culverts“.
- 7) PP muudatus plaanil nr 7 (ca PK 15+200)
Ette nähtud V tüüpi kaevud ja UTC, kuna tegu pöörangu lõpuga. Lahendus vastavalt dokumendile Design Guidelines General requirements RBDG-MAN-012-0111, peatükk 10.4.1.3.
- 8) PP muudatus plaanil nr 8.1 (ca PK 14+900), nr 8.2 (ca PK 15+400), nr 8.3 (ca PK 17+150) ja nr 8.4 (ca PK 17+450)
Ette nähtud IV2 tüüpi kaevud, kuna jaamaalade puhul maksimum kaevudevaheline kaugus 200m. Lahendus vastavalt dokumendile Design Guidelines General requirements RBDG-MAN-012-0111 „Cableways on station with side platforms“.
- 9) PP muudatus plaanil nr 9 (ca PK 19+100)
Võrreldes põhiprojektiga pole IV tüüpi kaeve ja UTC-d ette nähtud, kuna antud piirkonnas kaevude vahe on alla 1000m (Design Guidelines General requirements RBDG-MAN-012-0111, peatükk 10.4.1.3). Lisaks truubiga nr CU0980 ristumisel pole ette nähtud 0.5m sügavuse tagamist, kuna truubi sügavus maapinnast on 0.91m ja tagada saab multitorude sügavuse 0.8m.

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) MD amendment on plan no. 1.1 (ca PK 12+665), no. 1.2 (ca PK 15+037), no. 1.3 (ca PK 15+309), no. 1.5 (ca PK 16+720), no. 1.6 (ca PK 17+253) and no. 1.7 (ca PK 18+060).
Two Type VII manholes are intended for system areas. These manholes are connected to the CCS main line with a 15-hole conduit package. Amendment in accordance with Design Guidelines RBDG-MAN-012-0111 "Cableway at CCS system equipment locations".
- 2) MD amendment on plan no. 2.1 (ca PK 10+030) and 2.2 (ca PK 16+340)
Type VII manhole added, according to Design Guidelines RBDG-MAN-012-0111 "Cableways on stopping points."
- 3) MD amendment on plan no. 3 (ca PK 14+165)
System area provided for both CCS and ENE. Amendment according to Design Guidelines RBDG-MAN-012-0111 "Cableway system at joint CCS and ENE equipment locations". Including type VII manholes added to the system areas.
- 4) MD amendment on plan no. 4.1 (ca PK 13+000) and no. 4.2 (ca PK 17+850)
UTC1 has been added between the wells. Solution according to Design Guidelines General requirements RBDG-MAN-012-0111 "Cableways at culverts".
- 5) MD amendment on plan no. 5.1 (ca PK 14+650) and no. 5.2 (ca PK 18+400)
Due to the changes in the ecoduct solution, the CC1 channel and V2 wells of the ecoduct are not foreseen. Only CD1 cable duct and type V wells (wells outside the ecoduct facility) designed for the ecoduct.
- 6) MD amendment on plan no. 6 (ca PK 14+800)
At the crossing with the culvert, CC2 is prescribed instead of CC3. Added two CC2 channel transitions between manholes IV and V. Solution according to Design Guidelines General requirements RBDG-MAN-012-0111 "Cableways at culverts".
- 7) MD amendment on plan no. 7 (ca PK 15+200)
Type V manholes and UTC are foreseen, as it is the end of the turnout. Solution according to the document Design Guidelines General requirements RBDG-MAN-012-0111, chapter 10.4.1.3.
- 8) MD amendment on plan no. 8.1 (ca PK 14+900), no. 8.2 (ca PK 15+400), no. 8.3 (ca PK 17+150) and no. 8.4 (ca PK 17+450)
Type IV2 wells are intended, as the maximum distance between wells in station areas is 200 m. Solution according to Design Guidelines General requirements RBDG-MAN-012-0111 "Cableways on station with side platforms".
- 9) PP amendment on plan no. 9 (ca PK 19+100)
Compared to the main project, type IV wells and UTC are not foreseen, as the distance between wells in this area is less than 1000 m (Design Guidelines General requirements RBDG-MAN-012-0111, chapter 10.4.1.3). In addition, when crossing culvert no. CU0980, a depth of 0.5 m is not ensured, as the depth of the culvert from the ground is 0.91 m and the depth of the multi-pipes of 0.8 m can be ensured.

10) PP muudatus plaanil nr 10.1 (ca PK 9+970), nr 10.2 (PK 11+500) ja nr 10.3 (ca PK 16+940)

Võrreldes põhiprojektiga on vastavalt projekteerimise lähteülesande punkti 2.4 alampunktile 13 ette nähtud side kaablikanaliseerimise ühendused sideteenuse pakkujate kaevudega PK 9+970 ja PK16+940 (Telia Eesti AS ühendus), PK 11+500 (ELASA ühendus). PK 16+940 on lisatud CCS trassile ühenduseks kaevud.

11) PP muudatus plaanil nr 11.1 (ca PK 8+420)

IV kaevud vahetatud tüüp IV2 kaevude vastu, et kaevu sisseviigud vastaks CD3 torude pakstile.

12) PP muudatus plaanil nr 12.1 (ca PK 12+620), 12.2 (ca PK 14+100), 12.3 (ca PK 15+040), 12.4 (ca PK 15+320), 12.5 (ca PK 16+740), 12.6 (ca PK 17+300) ja 12.7 (ca PK 18+060)

CCS põhitrassi ja süsteemiala vahelise ühenduse loomiseks on plaanil viidatud kaevud asendatud sügavamatega.

13) PP muudatus plaanil nr 13.1 (ca PK 15+300), 13.2 (ca PK 15+520), 13.3 (ca PK 16+580) ja 13.4 (ca PK 16+780)

Raudteede vahele lisatud CC1 reserv väljumised kaevudest perspektiivsete raudtee seadmete jaoks.

14) PP muudatus plaanil nr 14.1 (ca PK 14+580) ja 14.2 (ca PK 18+450)

Ökoduktide vahetus- läheduses paiknevatest kaevudest lisatud ökoduktide suunal reserv CC1 väljumised.

15) Muutunud on kaevude mõõdud tulenevalt konkreetsetest toodetest. Lisatud on kaevude tüübid b, c ja d, mis on erinevad kaevude IV, IV2 ja VII sügavuste poolest.

16) Kaevud V2 ja IV3 ei ole enam kasutuses.

10) MD amendment on plan no. 10.1 (ca PK 9+970), no.10.2 (PK 11+500) and no.10.3 (ca PK 16+940)

Compared to the master design project, according to clause 2.4 sub-clause 13 of the terms of reference for design, communication cable duct connections are provided for with manholes PK 9+970 and PK16+940 (connection of Telia Eesti AS), PK 11+500 (ELASA connection) of communication service providers. PK 16+940 has been added to the CCS route to connect manholes.

11) MD amendment on plan no. 11.1 (ca PK)

IV manholes replaced with Type IV2 manholes so that the well inlets match the CD3 conduit package

12) MD amendment on plan no. 12.1 (ca PK 12+620), 12.2 (ca PK 14+100), 12.3 (ca PK 15+040), 12.4 (ca PK 15+320), 12.5 (ca PK 16+740), 12.6 (ca PK 17+300) and 12.7 (ca PK 18+060)

In order to create a connection between the CCS main line and the system area, the manholes referred to in the plan have been replaced with deeper ones.

13) MD amendment on plan no. 13.1 (ca PK 15+300), 13.2 (ca PK 15+520), 13.3 (ca PK 16+580) and 13.4 (ca PK 16+780)

CC1 reserve outlets from manholes for perspective railway equipment added between railways.

14) MD amendment on plan no. 14.1 (ca PK 14+580) and 14.2 (ca PK 18+450)

Reserve CC1 outlets have been added from the manholes located in the immediate vicinity of the ecoducts in the direction of the ecoducts.

15) The dimensions of the manholes have changed due to specific products. Types of manholes b, c and d have been added, which differ in the depths of manholes IV, IV2 and VII.

16) Manholes V2 and IV3 are no longer in use.

Võrreldes hankedokumentatsioonis esitatud projektlahendustega, on käesolevas tööprojekti tehtud ettepanekud alljärgnevat muudatuste sisseviimiseks:

1) Muudatuse ettepanek plaanil nr 1 (ca PK 16+720)

Raudtee süsteemiala uue paigutuse ettepanek. Nihutus seotud raudtee äärse kraavi ja süsteemiala asukohtade konfliktiga, sh CCS kaevude paigutamise võimalikkusega süsteemiala vahetuslähedusse.

Compared to the design solutions presented in the procurement documentation, the following proposals have been made in this working project for the introduction of the following changes:

1) Proposal for amendment to plan no. 1 (ca PK 16+720)

Proposal for a new layout of the railway system area. The displacement is related to the conflict between the locations of the ditch by the railway and the system area, including the possibility of placing CCS wells in the immediate vicinity of the system area.

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 kaevudesse.

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.
- HDPE kaitsetoru välisläbimõõduga 75 mm. Siseläbimõõt peab olema vähemalt 91 mm ja seina paksus – vähemalt 3 mm. Antud torud on ettenähtud paigaldamiseks raudtee sillal/viadukti konstruktsiooni ristumisel raudteega survetugevusega 1250N. Toru peab olema kollane värv.
- 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 vundamendist (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 valatud betooni või plaadiga

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.
- HDPE protection pipe with an external diameter of 75 mm. The internal diameter must be at least 91 mm and the wall thickness – at least 3 mm. These pipes are intended for installation on a railway bridge/viaduct structure at the intersection with the railway. Compressive strength of 1250N. Pipe must be yellow.
- 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 DUCT 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 DUCT PACKAGES

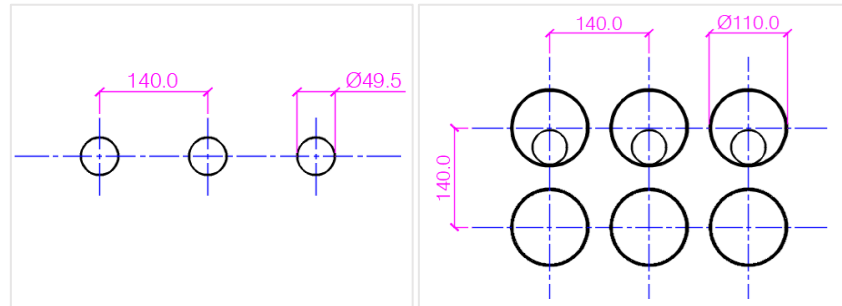
A distance of 140 mm must be ensured between the axes of the pipes both horizontally and vertically.

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 poured concrete or a plate

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.



Joonis 1. Kaablitorude paketid CD1 ja CD3

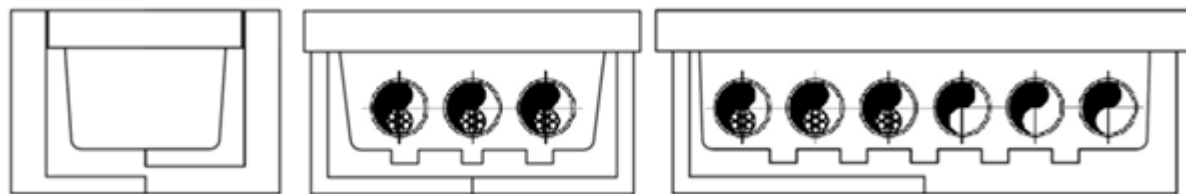
3.1.2 MAAPEALSED KAABLIRENNID

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 3 tüüpi kaablirenn:

- 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 HDPE D110 750N HDPE torudest kujuga 1 x 3, mille igas torus on sees D49,5 HDPE multitoru.
- Konfiguratsioon CC3 koosneb monteeritavast kaablikanalist integreeritud kaanega. Kaablikanali CC3 välismõõtmed on 800 x 330 mm (millele lisandub luugi paksus 60mm) ja sisemõõtmed on min 702 x 155 mm. Renni sisse on ettenähtud paigaldada konfiguratsioon CD3.



Joonis 2. Kaablirennid CC1, CC2 ja CC3

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.

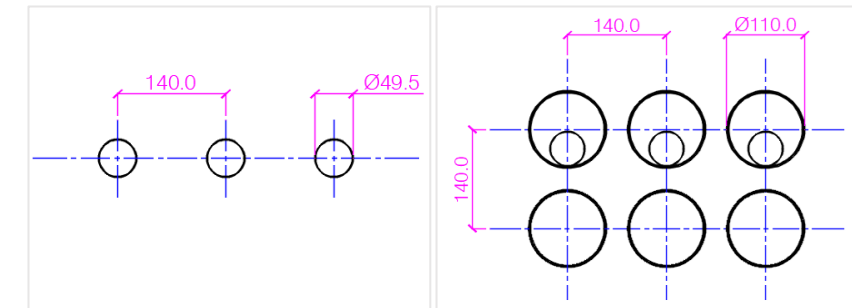


Figure 1. Cable duct packages CD1 and CD3

3.1.2 ON GROUND CABLE CHANNELS

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

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

There are 3 types of cable channels:

- Configuration CC1 consists of a prefabricated cable channels with an integrated cover. The external dimensions of the cable channels 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 channels with an integrated cover. The external dimensions of the cable channels 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 cable channels. CD2 - consists of 3 x HDPE D110 750N HDPE pipes in the shape of 1 x 3, each of which has an D49,5 HDPE multi-pipe inside.
- Configuration CC3 consists of a prefabricated cable channels with an integrated cover. The external dimensions of the cable channels CC3 are 800 x 330 mm (plus 60mm hatch thickness) and the internal dimensions are min. 702 x 155 mm. Configuration CD3 is intended to be installed inside the cable channels.

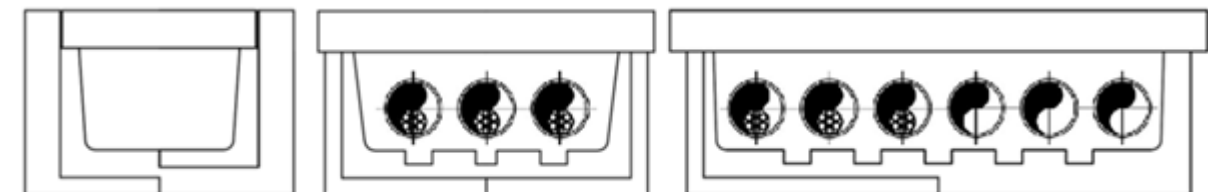
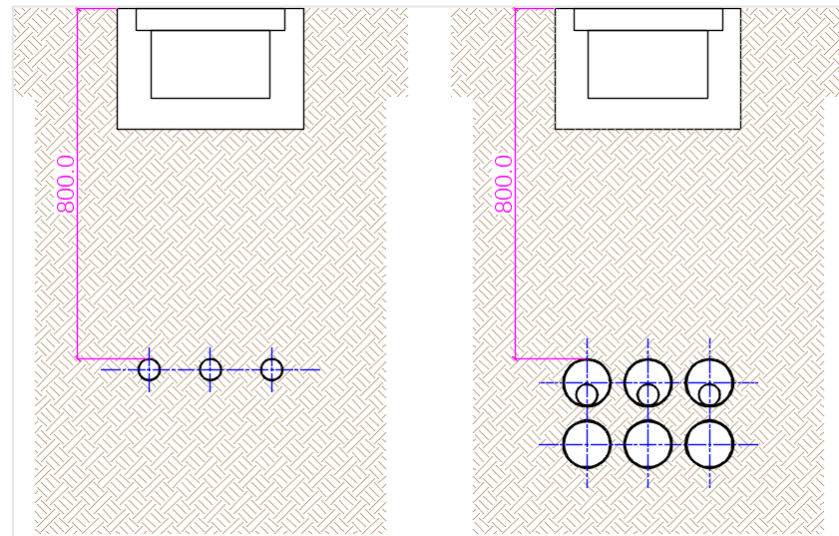


Figure 2. Cable channels CC1, CC2 and CC3

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 CD1 (edaspidi CD1+CC1);
- Kaablirenn CC1, mille alla paigaldada kaablitorude pakett CD3 (edaspidi CD3+CC1).



Joonis 3. Kaablirennide ja kaablitorupakettide kombinatsioonid CD1+CC1 ja 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:

- 2) Cable tray CC1, under which cable duct package CD1 (hereinafter referred to as CD1+CC1);
- 3) Cable tray CC1, under which cable duct package CD3 (hereinafter referred to as CD3+CC1).

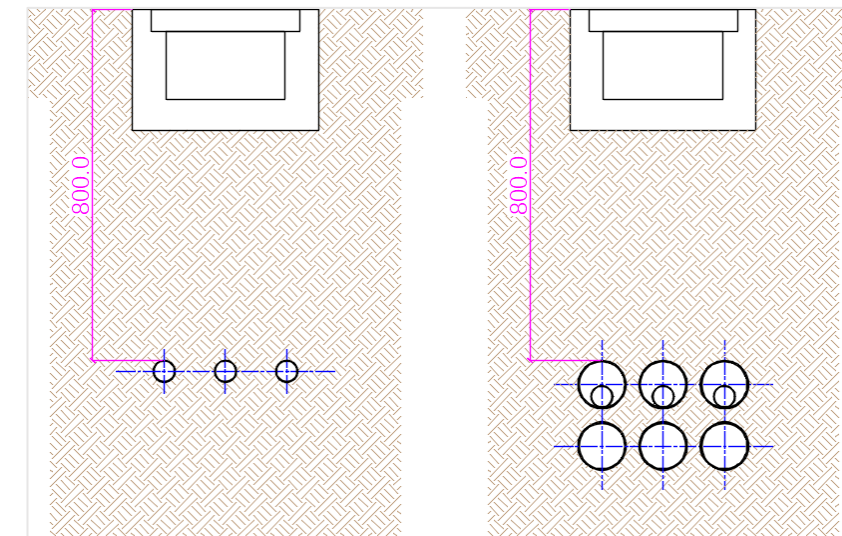


Figure 3. Figure 3. Combinations of cable channels and cable duct packages CD1+CC1 and CD3+CC1

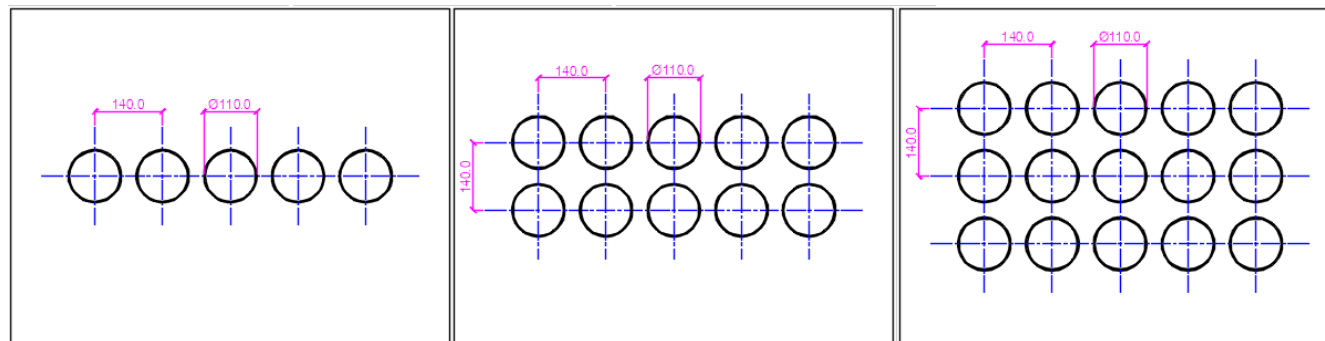
3.2 RÖÖBASTEEALUSED RISTMED

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;
- Konfiguratsioon UTC3 koosneb 15 x D110 1250N HDPE torudest kujuga 3 x 5.

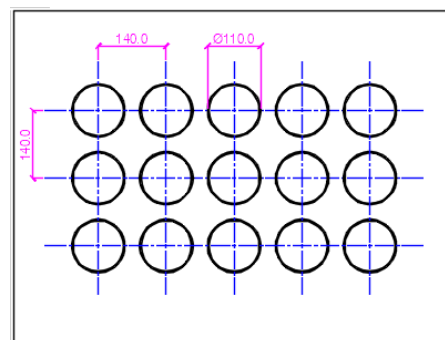


Joonis 4. Maa-alused kaablitorude pakettid ristumisel raudteega UTC1, UTC2 ja UTC3

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.



Joonis 5. UTC3 kaablitorude pakett

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;
- Configuration UTC2 consists of 15 x D110 1250N HDPE pipes in the shape of 3 x 5.

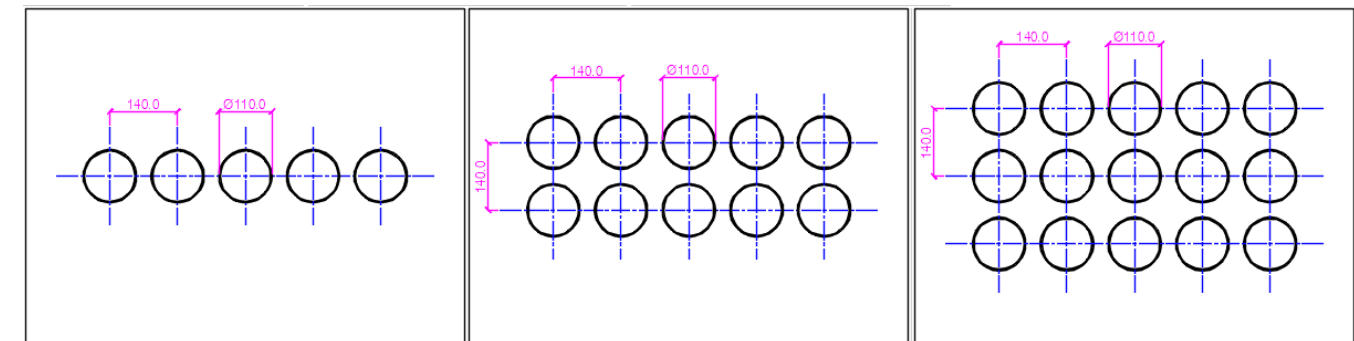


Figure 4. Underground cable pipe packages at the intersection with the railway UTC 1 and UTC2

3.3 CONNECTIONS WITH SYSTEM AREAS

For the system area interfaces, a cable duct 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.

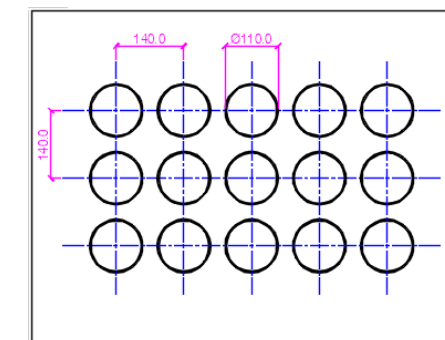


Figure 5. UTC3 cable duct package

3.4 ÜHENDUS SIDETEENUSE PAKKUJAGA

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.

3.5 PAIGALDAMISE ÜLDTINGIMUSED

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

3.6 NÕUDED MATERJALIDELE JA PAIGALDUSELE

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

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 duct (drilling pipe type). In the D110 duct, 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 duct 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 duct to the railway CCS duct manhole.

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

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

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;
- 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 1,0 m 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 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 IV või IV2 telje ja rööbastee telje vahel peab olema vähemalt 3,6 m. Kontrollkaevu V juhul antud vahekaugus on 3,62 m ning kontrollkaevu VII juhul - 3,8 m.

4.1 KAEVU MOODULELEMENDID

Kontrollkaevud koosnevad erinevatest moodulelementeist:

- [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 drenaažtoru ühendamiseks.
- [4] Vaheraam 200mm
- [5] Vaheraam 400mm

4.2 KAEVU TÜÜBID

Projektis kasutatud kaevud:

- IV väliste mõõtmatega 1,20 x 1,00 x 1,36 m (P x L x S)
- IV2 väliste mõõtmatega 1,20 x 1,00 x 1,56 m (P x L x S)
- V väliste mõõtmatega 1,64 x 1,04 x 1,56 m (P x L x S)
- VII väliste mõõtmatega 1,65 x 1,40 x 1,57 m (P x L x S)
- IVc väliste mõõtmatega 1,20 x 1,00 x 1,35 m (P x L x S)
- IV2b väliste mõõtmatega 1,20 x 1,00 x 2,36 m (P x L x S)
- VIIb väliste mõõtmatega 1,65 x 1,40 x 2,37 m (P x L x S)
- VIIc väliste mõõtmatega 1,65 x 1,40 x 2,77 m (P x L x S)
- VIId väliste mõõtmatega 1,65 x 1,40 x 3,17 m (P x L x S)

Täpsemad kaevude joonised on toodud projekti joonistel.

Töövõtja võib asendada moodulpõhised kaevud monoliitsete kaevude vastu eeldusel, et järgitakse projektis RBDG-MAN-012-0111 Design guidelines General requirements dokumendis toodud kaevude sisemõõte ja projektis toodud väljaviiude ja kaevude kõrgusi. Sealhulgas võib vähendada projektipõhiseid kaevude alumiste osade kõrgusi, järgides, et kaevu sisepõhja kõrgus kõige alumise läbiviiguni oleks tagatud 200mm. Monoliitsete kaevude puhul peatükis 4.3 kirjeldatud läbiviigumooduleid ette ei nähta. Konkreetne kaevu toode kooskõlastada Tellijaga enne ehituse algust.

Design guidelines toodud sisemõõdud:

- Kaev IV siseste mõõtmatega 0,9 x 0,8 m (P x L)
- Kaev V siseste mõõtmatega 1,4 x 0,8 m (P x L)
- Kaev VII siseste mõõtmatega 1,4 x 1,2 m (P x L)

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 axis of manhole IV or IV2 and the track axis must be at least 3,6 m. In the case of manhole V, the distance is 3,62 m, and in the case of manhole VII – 3,8 m.

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 200m
- [5] Intermediate frame 400m

4.2 MANHOLE TYPES

Used manholes in project:

- IV with external dimensions 1,20 x 1,00 x 1,36 m (L x W x D)
- IV2 with external dimensions 1,20 x 1,00 x 1,56 m (L x W x D)
- V with external dimensions 1,64 x 1,04 x 1,56 m (L x W x D)
- VII with external dimensions 1,65 x 1,40 x 1,57 m (L x W x D)
- IVc with external dimensions 1,20 x 1,00 x 1,35 m (L x W x D)
- IV2b with external dimensions 1,20 x 1,00 x 2,36 m (L x W x D)
- VIIb with external dimensions 1,65 x 1,40 x 2,37 m (L x W x D)
- VIIc with external dimensions 1,65 x 1,40 x 2,77 m (L x W x D)
- VIId with external dimensions 1,65 x 1,40 x 3,17 m (L x W x D)

More detailed drawings of manholes are provided in the project drawings.

The contractor may replace element-based wells with monolithic manholes, provided that the internal dimensions of the wells specified in the design guidelines General requirements of the project RBDG-MAN-012-0111 and the heights of the outlets and wells specified in the project are followed. Among other things, the project-based heights of the lower parts of wells can be reduced, ensuring that the height of the inner bottom of the well to the lowest inlet is ensured by 200 mm. In the case of monolithic wells, penetration inlets modules are not provided. In the case of monolithic wells, the penetration inlet modules described in Chapter 4.3 are not provided. The specific well must be coordinated with the Client before the start of construction.

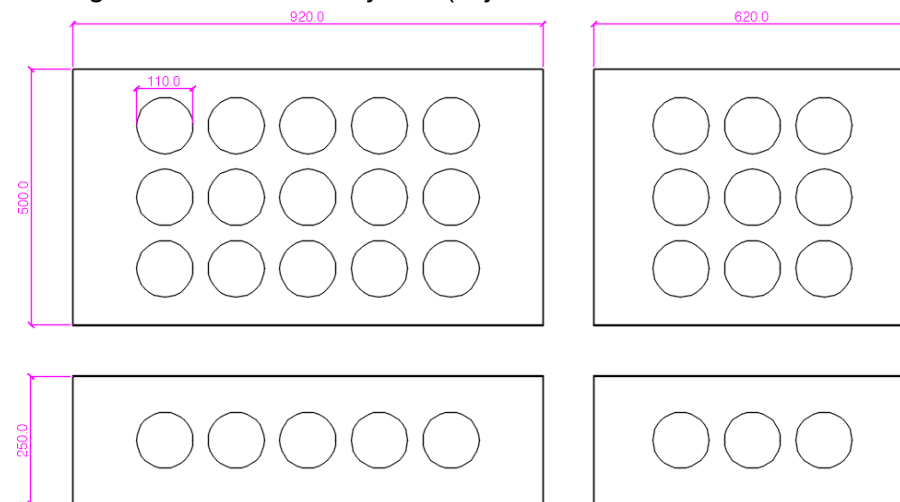
Design guidelines for interior dimensions:

- Well IV with internal dimensions 0.9 x 0.8 m (L x W)
- Well V with dimensions inside 1.4 x 0.8 m (L x W)
- Well VII with internal dimensions 1.4 x 1.2 m (L x W)

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

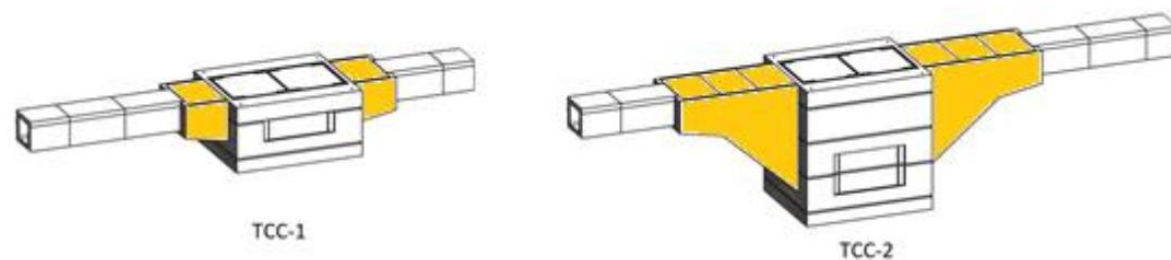
Mitte kasutatavad avad on vaja sulgeda korkidega ja korralikult tihendada. Multitorude puhul kasutada $\varnothing 49,5 \rightarrow \varnothing 110$ üleminekut.

4.4 ÜLEMINKEUELEMENDID 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 S).
- Konfiguratsioon TCC-2 kasutatakse kaablikanalile CC2 ja CC3. Ülemineku TCC-2 välismõõtmed on 1,58 x 0,84 x 1,30 m (P x L x S).



Joonis 7. Ülemineku elemendid

4.3 INLETS

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

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

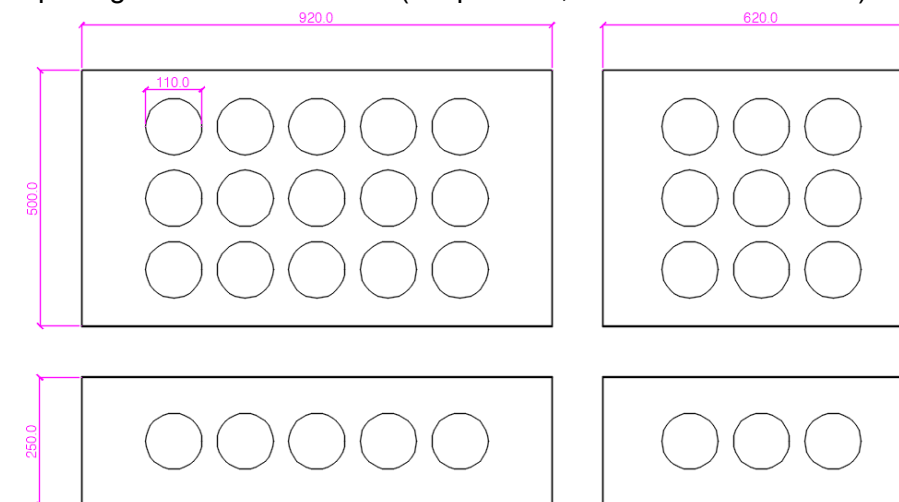


Figure 6. Inlet plates

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 D).
- Configuration TCC-2 is used for cable channel CC2 ja CC3. The outer dimensions of the transition TCC-2 are 1,58 x 0,84 x 1,30 m (L x W x D).

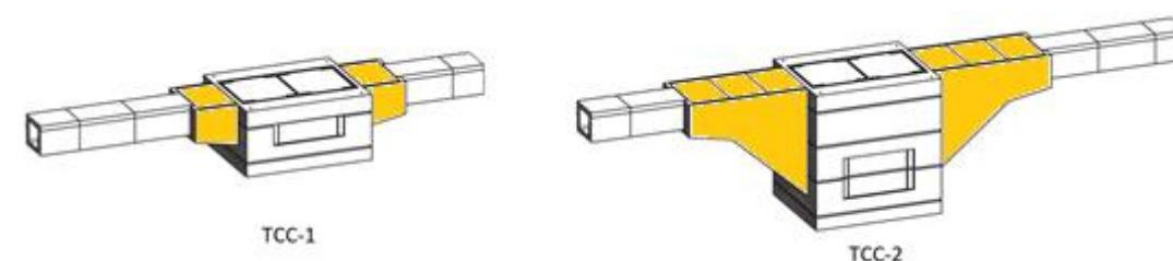


Figure 7. Transition elements

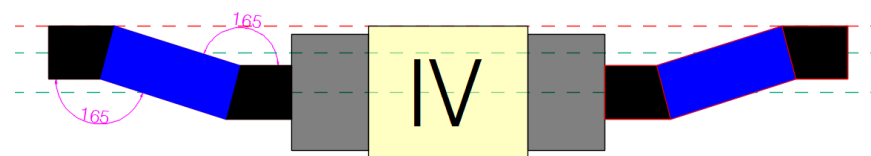
4.5 PÖÖRDE ELEMENDID

4.5.1 VASAKULE JA PAREMALE PÖÖRAMISE ELEMENDID

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

Kaevude IV, IV2 ja V puhul on kasutatud järgmist kombinatsiooni:

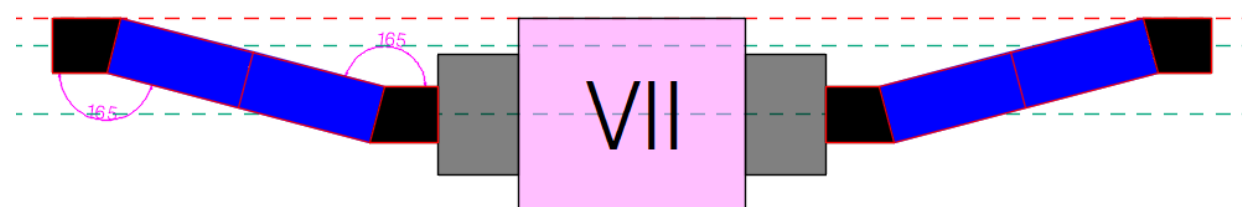
- 15 kraadi pöörang
- CC1 / CC2 / CC3 element
- 15 kraadi pöörang



Joonis 8. Kaablirenni pöörde elemendid kaevude IV, IV2 ja V puhul

Kaevu VII puhul on kasutatud järgmist kombinatsiooni:

- 15 kraadi pöörang
- CC1 / CC2 / CC3 element
- CC1 / CC2 / CC3 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, IV2 and V, the following combination has been used:

- 15 degree rotation
- CC1 / CC2 / CC3 element
- 15 degree rotation

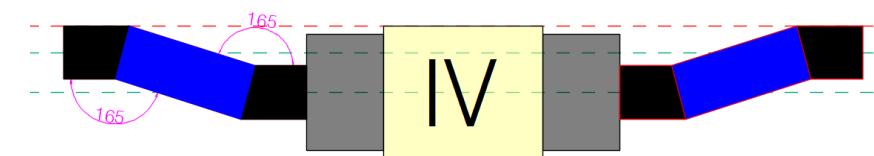


Figure 8. Cable tray turn elements for manholes IV, IV2 and V

The following combination has been used for Manhole VII:

- 15 degree rotation
- CC1 / CC2 / CC3 element
- CC1 / CC2 / CC3 element
- 15 degree rotation

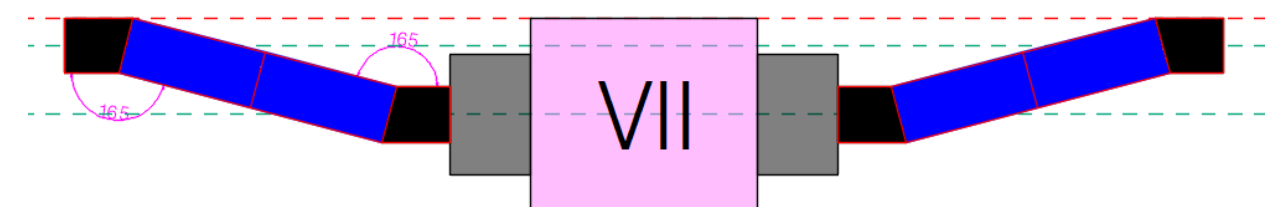


Figure 9. Cable tray rotation elements for manhole VII

4.5.2 ÜLES JA ALLA LIIKUMISE ELEMENDID

Taoliselt üleval kirjeldatud printiiptidele on lahendatud järgmised vertikaalsed tõusud ja langused kasutades erinevad 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 – alusballast 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:

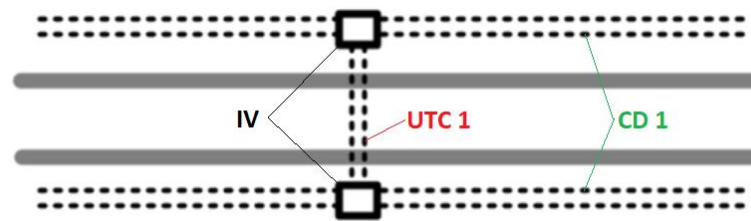
- Up and down due to the difference in the height of the subballasts
- Going to and coming down to culverts, where the cable tray is installed directly on top of the concrete body of the culvert and the hatch of the cable tray is not flush with the subballast
- Going up the bridge and coming down
 - 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 kaablikanalistsioon 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

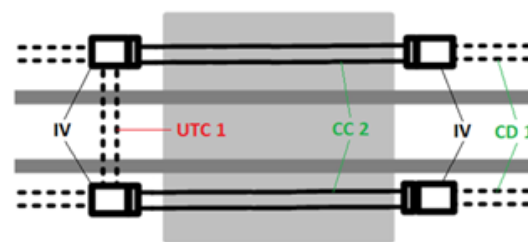
Liinilõikudel, kus kahe süsteemiala vaheline kaugus on üle 3 km, paigaldada lõigu keskele (kuid mitte vähem kui iga 2 km) kaev VII. Juhul kui 3 km lõigu sees on juba ettenähtud väiksemate mõõtmetega kaev, siis piisab antud kaevu vahetamisest kaevu VII vastu. Antud kaevud on vajalikud kaablivarude tekitamiseks.

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.

5.2.1 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. 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.

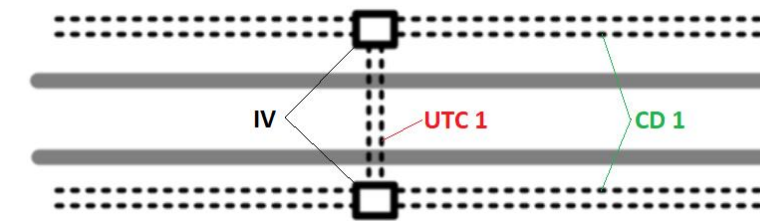


Figure 10. Cable duct system for pulling cables

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 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.

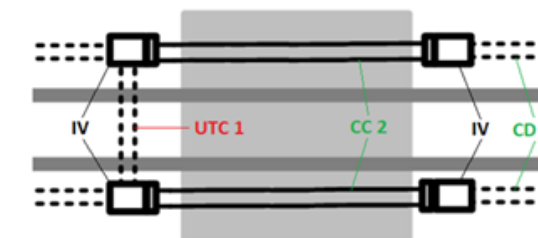
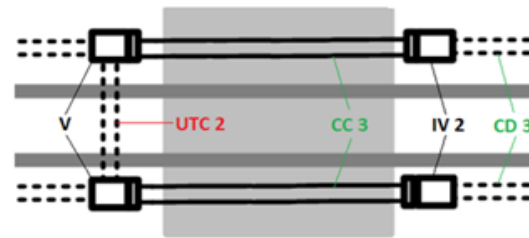


Figure 11. Crossing with culverts on an open line

5.2.2 JAAMA PIIRKOND

Ristumisel truubiga paigaldada ühele poole raudteed kaevud V ning teisele poole kaevud IV2. Kaevude vahele piki raudteed paigaldada kaablirenn CC3. Kaevud V ühendada kaablitorude paketiga UTC2.



Joonis 12. Ristumine truubiga jaama piirkonna korral

5.2.2 STATION AREA

At the crossing with the culvert, manholes V should be installed on one side of the railway and manholes IV2 on the other side. Between the manholes along the railway, a cable tray CC3 must be installed. Connect manholes V with the cable pipe package UTC2.

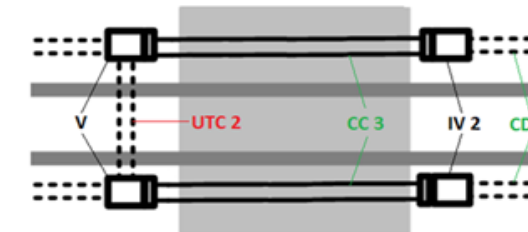
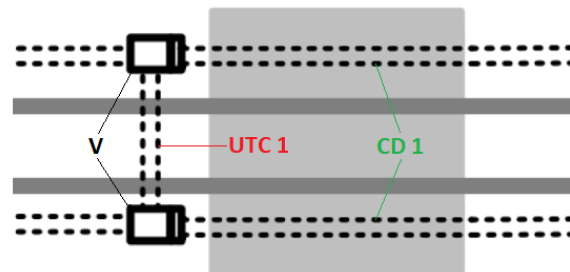


Figure 12. Crossing with culverts in the station area

5.3 ÖKODUKTID

Ökoduksi sees paigaldada kaablitorude pakett CD1 mõlemale poole raudteed. Väljaspool ökoduksi paigaldada mõlemale poole raudteed kaev V, mille vahele paigaldada UTC1.

Läbi ökoduksi konstruktsiooni paigaldad läbiviigud kaablitorude jaoks. Läbiviigud võib paigaldada konstruktsioonide valamisel või hilisemal läbi puurimisel.



Joonis 13. Kaablikanalite süsteem ökoduksi kohas

5.3 ECODUCTS

Inside the ecoduct, install the CD1 cable pipe package on both sides of the railway. Outside the ecoduct, install manhole V on both sides of the railway, between which UTC1 must be installed.

Penetrations for cable duct installed through the ecoduct structure. Penetrations can be installed when pouring the structures or by drilling through them later.

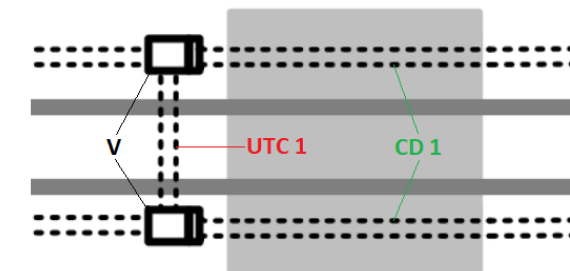
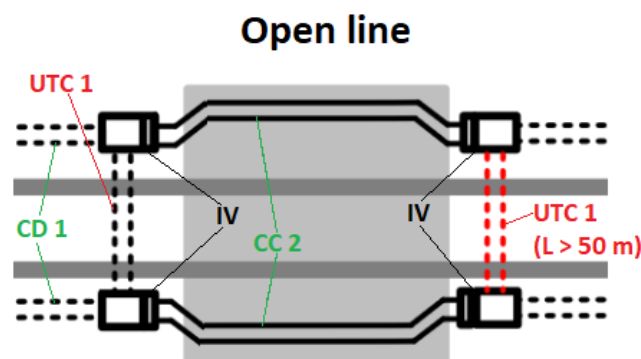


Figure 13. Cable duct system at the site of the ecoduct

5.4 SILLAD JA VIADUKTID

5.4.1 JAAMAVAHE

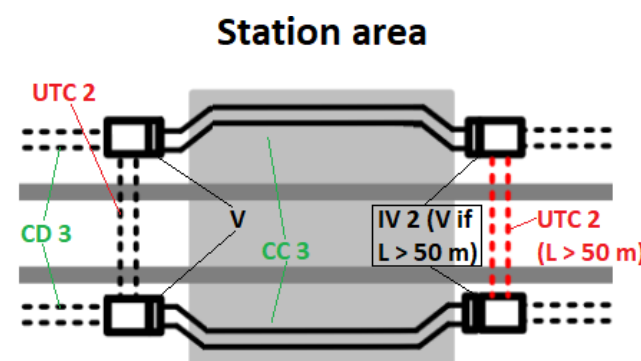
Piki raudtee sildasid ja viadukte paigaldada mõlemale poole raudteed kaablirenn CC2.
Juhul kui sild on lühem kui 50m paigaldada mõlemale poole silda/viadukti kontrollkaevud IV. Kontrollkaevude vahele risti raudteed paigaldada UTC1 ainult ühele poole silda/viadukti.
Juhul kui sild on pikem kui 50m paigaldada mõlemale poole silda/viadukti kontrollkaevud IV. Kontrollkaevude vahele risti raudteed paigaldada UTC1 mõlemale poole silda/viadukti.



Joonis 14. Kaablikanalite süsteem raudtee sillal/viaduktil jaamavahe

5.4.2 JAAMA PIIRKOND

Piki raudtee sildasid ja viadukte paigaldada mõlemale poole raudteed kaablirenn CC3.
Juhul kui sild on lühem kui 50m paigaldada ühele poole silda/viadukti kontrollkaevud V ja teisele poole IV2.
Kontrollkaevude V vahele risti raudteed paigaldada UTC2.



Joonis 15. Kaablikanalite süsteem raudtee sillal/viaduktil jaama piirkonnas

5.4 BRIDGES AND VIADUCTS

5.4.1 OPEN LINE

Along the railway bridges and viaducts, a cable tray CC2 must be installed on both sides of the railway.
If the bridge is shorter than 50 m, install manholes IV on both side of the bridge/viaduct. Between the manholes, perpendicular to the railways, install UTC1 on only one side of the bridge/viaduct.
If the bridge is longer than 50 m, install manholes IV on both sides of the bridge/viaduct. Between the manholes, perpendicular to the railways, install UTC1 on both side of the bridge/viaduct.

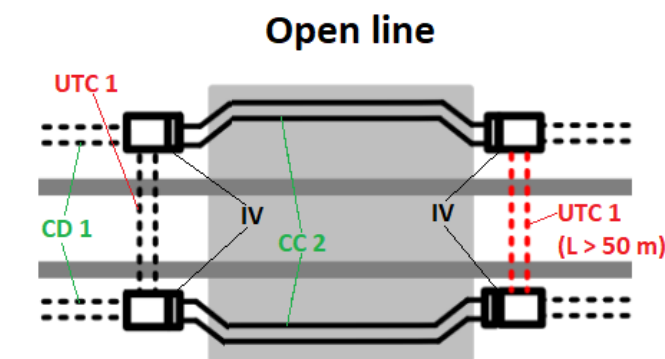


Figure 14. Cable duct system on a railway bridge/viaduct on an open line

5.4.2 STATION AREA

Along the railway bridges and viaducts, a cable tray CC3 should be installed on both sides of the railway.
If the bridge is shorter than 50 m, install manholes V on one side of the bridge/viaduct and IV2 on the other side. Between the manholes V, perpendicular to the railways, install UTC2.
If the bridge is longer than 50 m, install manholes V on both sides of the bridge/viaduct. Between the manholes V, perpendicular to the railways, install UTC2.

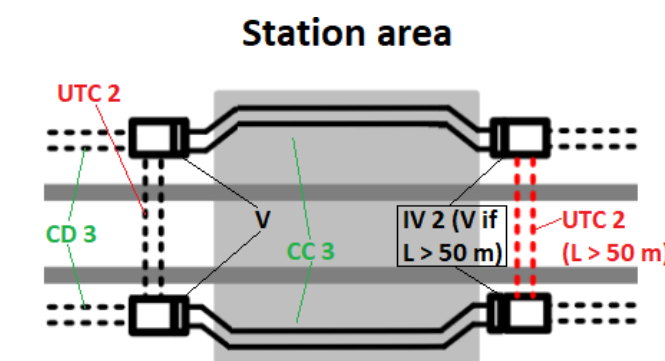


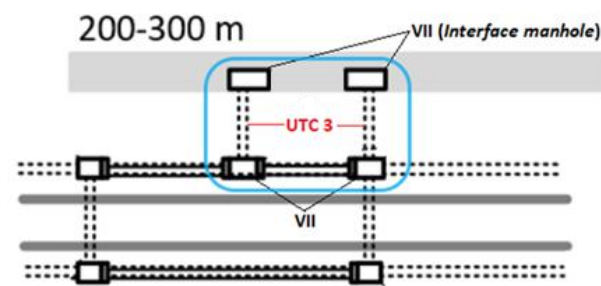
Figure 15. Cable duct system on railway bridge/viaduct in the station area

5.5 SÜSTEEMIALAD

5.5.1 ÜLDINE PRINTSIIP

Raudtee seadmete jaoks on ettenähtud süsteemialad. Raudtee ääres olevate kaablikanalite ja süsteemialade liidestamiseks 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.



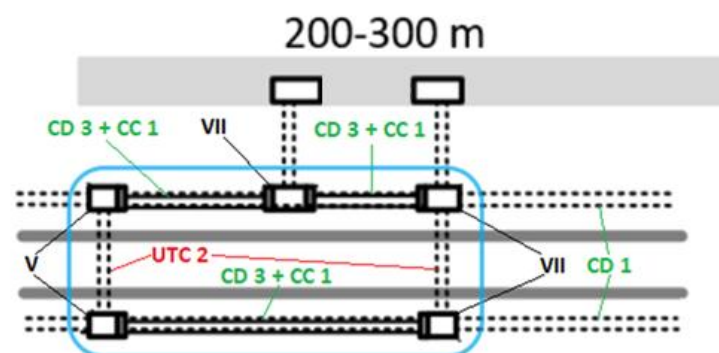
Joonis 16. Süsteemiala ühendus

5.5.2 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.

Ristumisel raudteega on ettenähtud kaevude VII ja V vahele UTC2.

Piki raudteed paiknevate kontrollkaevude vahele paigaldada kaablikanalite kombinatsioon CD3+CC1.



Joonis 17. Kaablikanalite süsteem seadmete asukohas

5.5 SYSTEM AREAS

5.5.1 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.

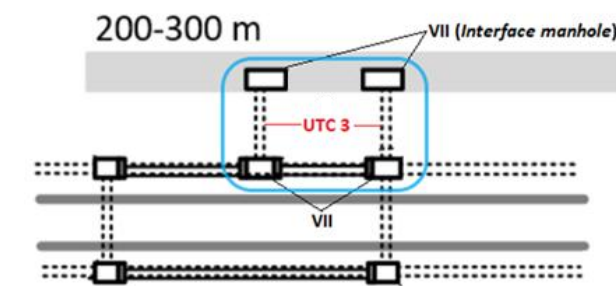


Figure 16. System area Connection

5.5.2 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.

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.

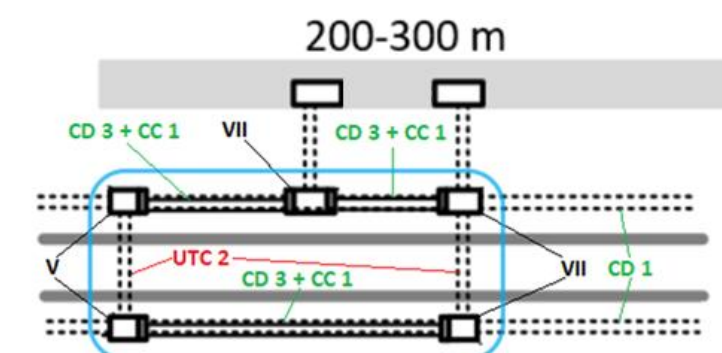
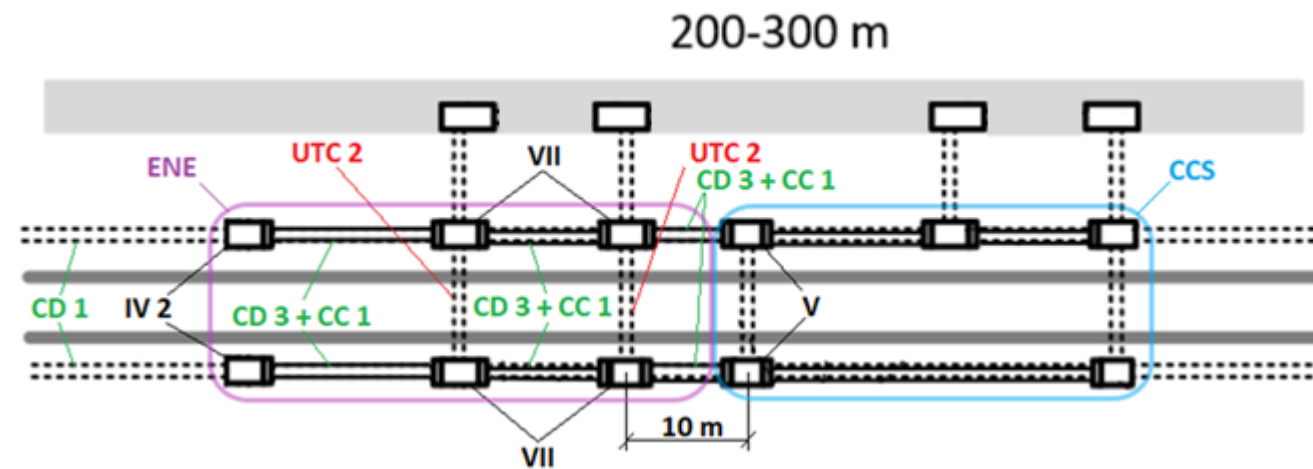


Figure 17. Cable duct system at the location of the equipment

5.5.3 CCS JA ENE ÜHISEL SÜSTEEMIALAL

Juhul kui süsteemialal asuvad nii CCS kui ka ENE seadmed, tuleb ENE tarbeks raudtee suhtes süsteemiala poolsesse külge paigaldada mõlemale poole raudteed veel kaks kontrollkaevu VII ja üks kontrollkaev IV2. Kontrollkaevude VII ja IV2 vahe peab olema 50 m. ENE kontrollkaevud VII paigaldada 10 m kaugusele CCS kaevudest.

Ristumisel raudteega paigaldada kaevude VII vahel UTC2. Piki raudteed paiknevate kaevude vahele paigaldada kombineeritud lahendu CD3+CC1.



Joonis 18. Kaablikanalite süsteem CCS ja ENE seadmete asukohas

5.5.3 CCS AND ENE IN THE COMMON SYSTEM AREA

If both CCS and ENE equipment are located in the system area, two more manholes VII and one manhole IV2 shall be installed on both sides of the railway on the side of the system area for ENE purposes. The distance between manholes VII and IV2 shall be 50 m. ENE manholes VII shall be installed at a distance of 10 m from CCS manholes.

At the crossing with the railway, install manholes VII between UTC2. Between the manholes located along the railway, a combined solution CD3+CC1 should be installed.

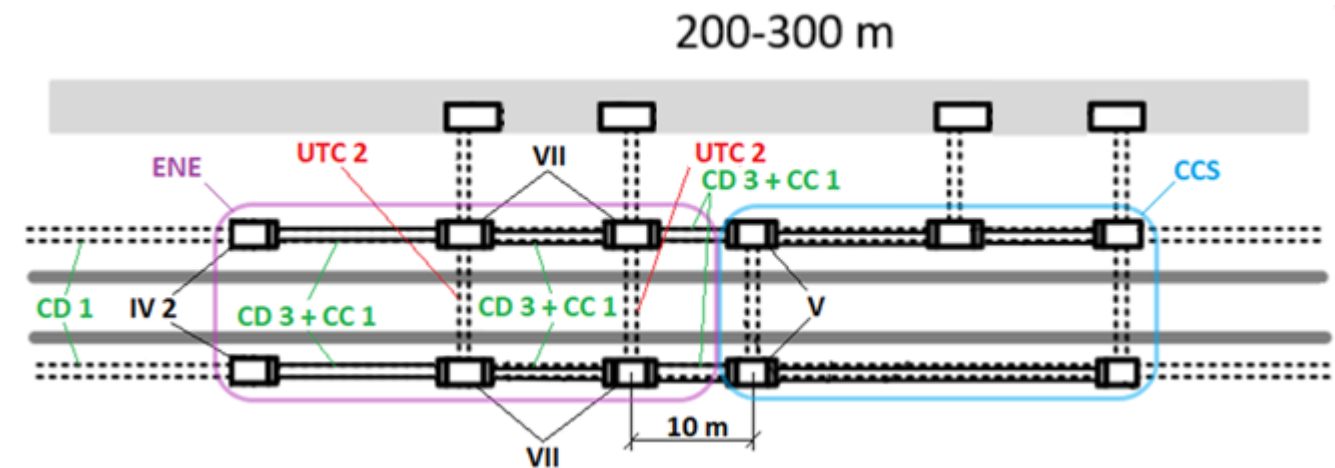
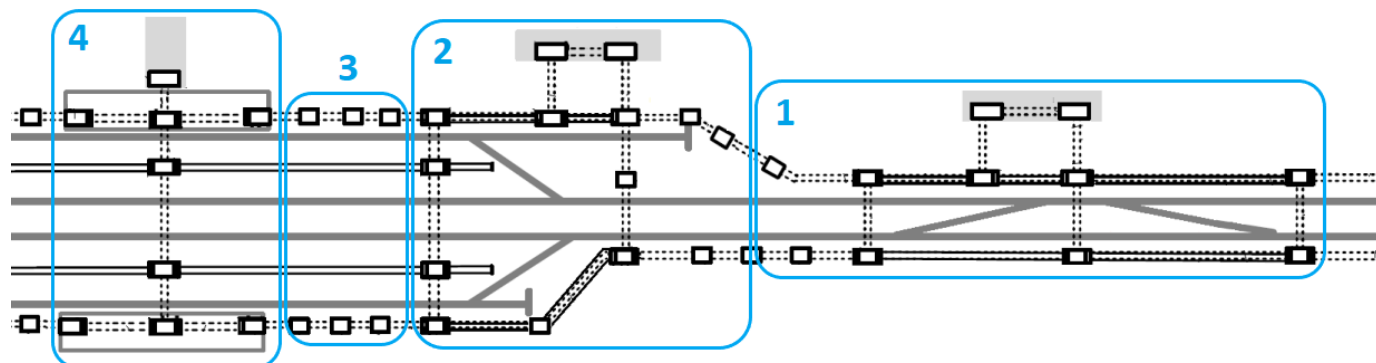


Figure 18. Cable duct system at the location of CCS and ENE equipment

5.6 JAAMA PIIRKOND

Kaablikanalite projekti mõistes on jaama piirkond jaotatud neljaks alaks

1. Ala 1
2. Ala 2
3. Ala 3
4. Ala 4



Joonis 19. Jaama piirkond

5.6 STATION AREA

For the purposes of the cable duct project, the area of the station is divided into four areas

- 8) Area 1
- 9) Area 2
- 10) Area 3
- 11) Area 4

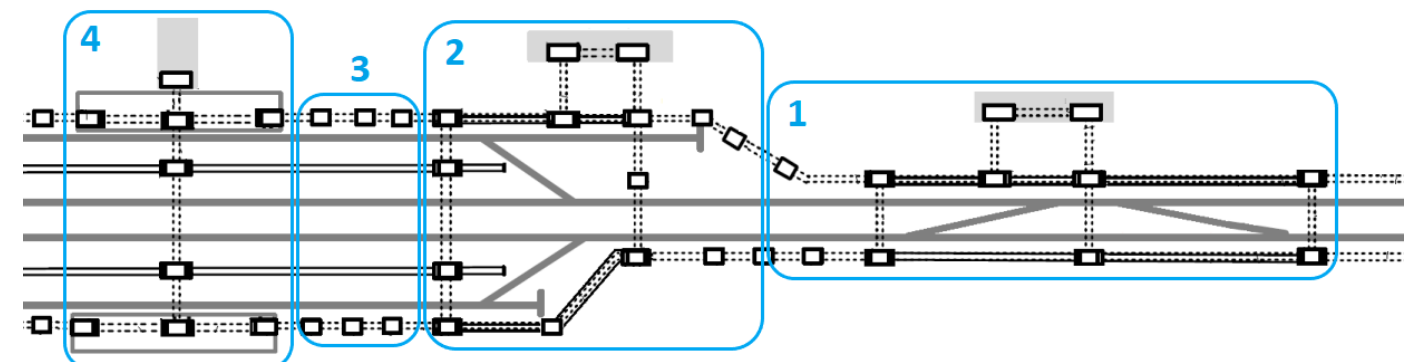


Figure 19. Station area

Jaama piirkonnas kasutatakse CD1 asemel CD3 kaablitorude paketti. Vaskaablite paigaldamiseks on vaja paigaldada CD3 trassi puhul iga 200 m tagant kontrollkaev IV2. Antud nõue kehtib ka kombineeritud lahenduse CD3+CC1 puhul.

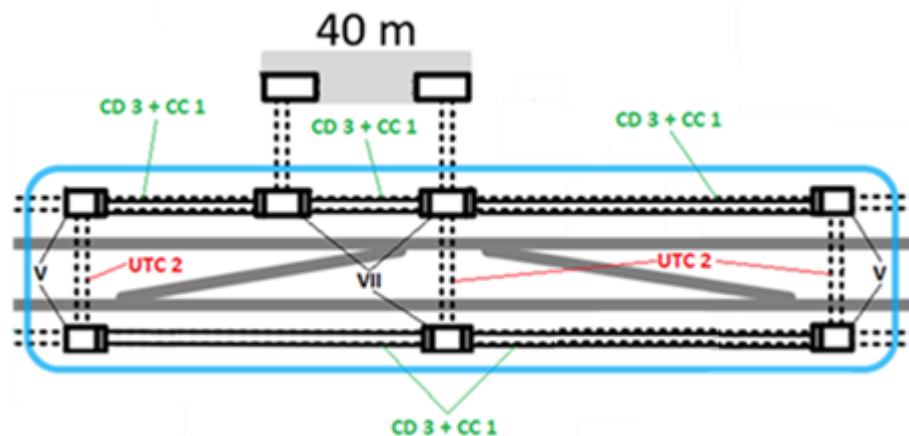
In the vicinity of the station, a CD3 cable pipe package will be installed instead of CD1. In order to install the copper cables, it is necessary to install the IV2 manhole every 200 m in the case of the CD3 route. This requirement also applies to the cobinary solution CD3+CC1.

5.6.1 ALA 1

Raudtee suhtes süsteemiala poolsesse külge paigaldada kaks kontrollkaevu VII. Kaevud asetsema süsteemialal asuvate kaevudega kohakuti. Teisele poole raudtee tuleb paigaldada kontrollkaev VII, mis peab paiknema kohakuti süsteemiala ühe kaevuga. Mõlemale poole pöörangute piirkonda paigaldada kaks kontrollkaevu V vähemalt 2 m kaugusele pöörangu alguskohalt.

5.6.1 AREA 1

Two manholes VII should be installed on the side facing the system area in relation to the railway. The manholes should be located in line with the manholes 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. On both sides of the turnout area, install two manholes V at a distance of at least 2 m from the starting point of the turnout.



Joonis 20. Kaablikanalite süsteem ristmike alas

Kontrollkaevude V ja VII vahel paigaldada kaablitorude paketid UTC2 risti raudteega. Piki raudteed paiknevate kontrollkaevude vahele paigaldada kaablikanalid CD3 koos CC1-ga.

Between manholes V and VII, install cable pipe packages UTC2 perpendicular to the railway. Between the manholes located along the railway, cable ducts CD3 with CC1 should be installed.

5.6.2 ALAL 2

Raudtee suhtes süsteemiala poolsesse külge paigaldada kaks kontrollkaevu VII. Kaevud peavad asetsema kohakuti süsteemiala kaevudega. Teisele poole raudtee tuleb paigaldada kontrollkaev VII, mis peab samuti paiknema kohakuti süsteemiala ühe kaevuga. Pöörmeala alguses või lõpus (olenevalt süsteemiala asukohast) paigaldada kontrollkaevud V mõlemale poole raudteed. Paigaldatavate kaevude vastu paigaldada veel kontrollkaevud V põhi- või kõrvalteede vahele.

5.6.2 AREA 2

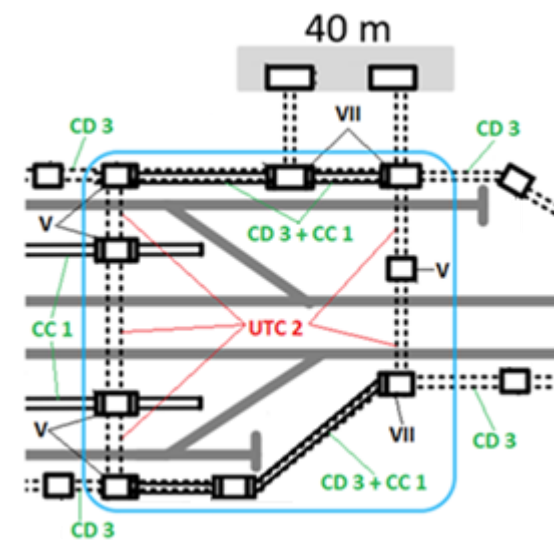
Install two manholes VII on the side facing the system area in relation to the railway. The manholes must be located flush with the manholes in the system area. On the other side of the railway, manhole VII must be installed, which must also be located flush with one of the manholes in the system area. At the beginning or end of the turning area (depending on the location of the system area), install manholes V on both sides of the railway. Against the manholes to be installed, additional manholes V should be installed between the main or secondary roads.

Kontrollkaevude V ja VII vahel paigaldada kaablitorude paketid UTC2 risti raudteega. Piki raudteed paiknevate kontrollkaevude vahele paigaldada kaablikanalid CD3 koos CC1-ga.

Between manholes V and VII, install cable pipe packages UTC2 perpendicular to the railway. Between the manholes located along the railway, cable ducts CD3 with CC1 should be installed.

Põhitrassi ja kõrvaltrassi vahele või kahe kõrvaltrassi vahele paigaldada CC1 kaablikanalid. CC1 kanalid algavad ja lõppevad kaevudes V või IV2.

Install CC1 cable ducts between the main line and the adjacent line or between two side lines. CC1 channels start and end in manholes V or IV2.



Joonis 21. Kaablikanalite süsteem pöörmealas

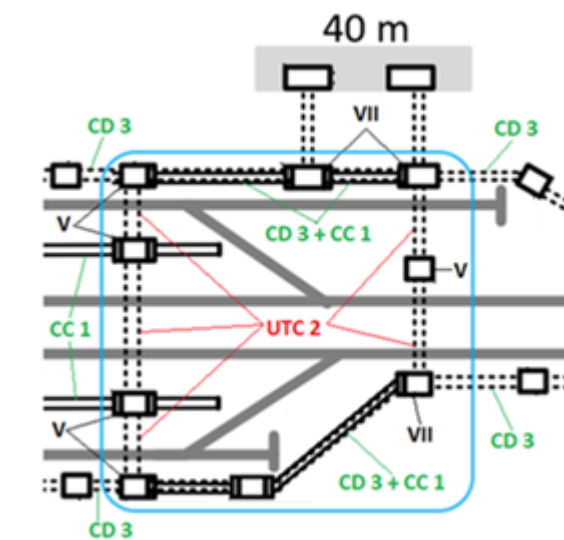


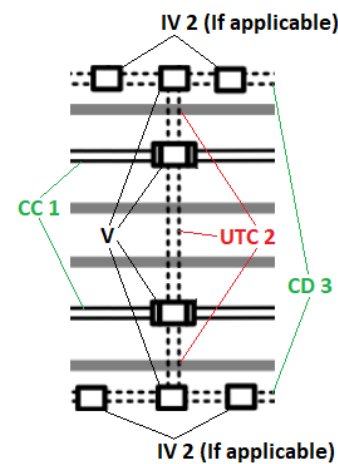
Figure 21. Cable duct system in the turning area

5.6.3 ALA 3

Juhul kui kaevude vahe on üle 400 m tuleb paigaldada risti raudteega UTC2, mis tuleb ühendada peatee ja kõrvaltee kaablikanalitstsiooniga. Kaevudena kasutada tüüp V.

5.6.3 AREA 3

If the distance between the manholes is more than 400 m, it must be installed perpendicular to the UTC2 railway, which must be connected to the cable duct of the main road and the secondary road. Use type V as manholes.



Joonis 22. UTC2 ristumine, kui kaevude vahel üle 400m

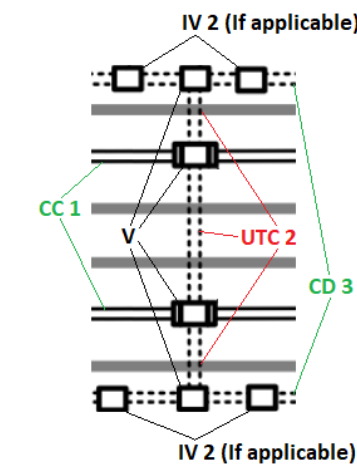


Figure 22. UTC2 crossing when more than 400m between manholes

5.6.4 ALA 4

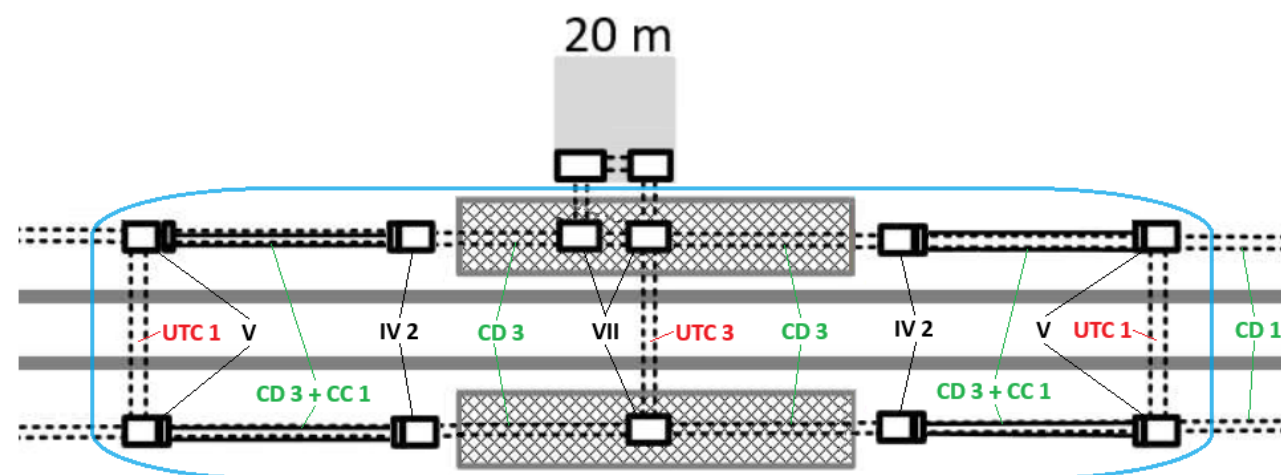
Vastavalt peatuste platvormide lahendusest sõltub ka kaablikanalitsatsiooni lahendus. Eristatud on kül- või saareplatvormid.

Peatuse platvormide tugevoolupaigaldised (sh valgustus) ja nõrkvoolusüsteemid (videovalve-, helindus-, valve- läbipääsu- ja kutsungisüsteemid) on lahendatud platvormide projektiga. Lisaks on peatuste tugevoolupaigaldisega lahendatud CCS ruumi ja platvormide all asuvate kaevude ühendamine.

5.6.4.1 KÜLGPLATVORMID JAAMAVAHEL

Platvormi alla paigaldada kaks kontrollkaevu VII. Platvormi keskeosale lähima kaevu vastu paigaldada kontrollkaev VII teise platvormi alla. Platvormi otstest välja poole paigaldada kontrollkaev IV2. Kontrollkaevud V paigaldada 100m kaugusel platvormi servast.

Risti raudteega paigaldada kaablitorude paketid UTC3 kontrollkaevude VII vahele ja kaablitorude paketid UTC1 kontrollkaevude V vahele. Piki raudteed kontrollkaevude IV2 ja V vahele paigaldada kombineeritud lahendus CD3+CC1. Kontrollkaevude IV2 ja VII vahele paigaldada kaablitorude paketid CD3 0,8 m sügavusele platvormialusest maapinnast.



Joonis 23. Külglatvormi kaablikanalite põhimõtte jaamavaHEL

5.6.4.2 KÜLGPLATVORMID JAAMA PIIRKONNAS

Platvormi alla paigaldada kaks kontrollkaevu VII. Platvormi keskeosale lähima kaevu vastu paigaldada kontrollkaevud V pea- ja kõrvalteede vahele ja kontrollkaev VII süsteemia alast kaugema platvormi alla. Ca 5 m väljaspoole platvormi paigaldada kaevud IV2.

Risti raudteega paigaldada kaablitorude paketid UTC3 kontrollkaevude VII ja V vahele. Piki raudteed kontrollkaevude IV2 ja V vahele paigaldada kaablitorude pakett CD3 0,8 m sügavusele platvormialusest maapinnast. Rööbasteede vahel paigaldada maapealne kaablikanal CC1 kontrollkaevudest V.

5.6.4 AREA 4

According to the solution of the station platforms, the cable duct solution also depends. Side or island platforms are distinguished.

The high-current installations (including lighting) and low-current systems (video surveillance, sound, surveillance, access and call signals) of the station platforms have been solved with the platform project. In addition, the connection of the CCS room and the manholes under the platforms has been solved with the high-current installation of the station platforms.

5.6.4.1 SIDE PLATFORMS ON AN OPEN LINE

Two manholes VII should be installed under the platform. Against the manhole closest to the middle of the platform, install a manhole VII under the second platform. From the ends of the platform to the outside, install the manhole IV2. Manholes V should be installed 100 m from the edge of the platform.

Perpendicular to the railway, install cable pipe packages UTC3 between manholes VII and cable pipe packages UTC1 between manholes V. Along the railway between manholes IV2 and V, a combined solution CD3+CC1 will be installed. Between manholes IV2 and VII, install cable pipe packages CD3 at a depth of 0,8 m from the ground under the platform.

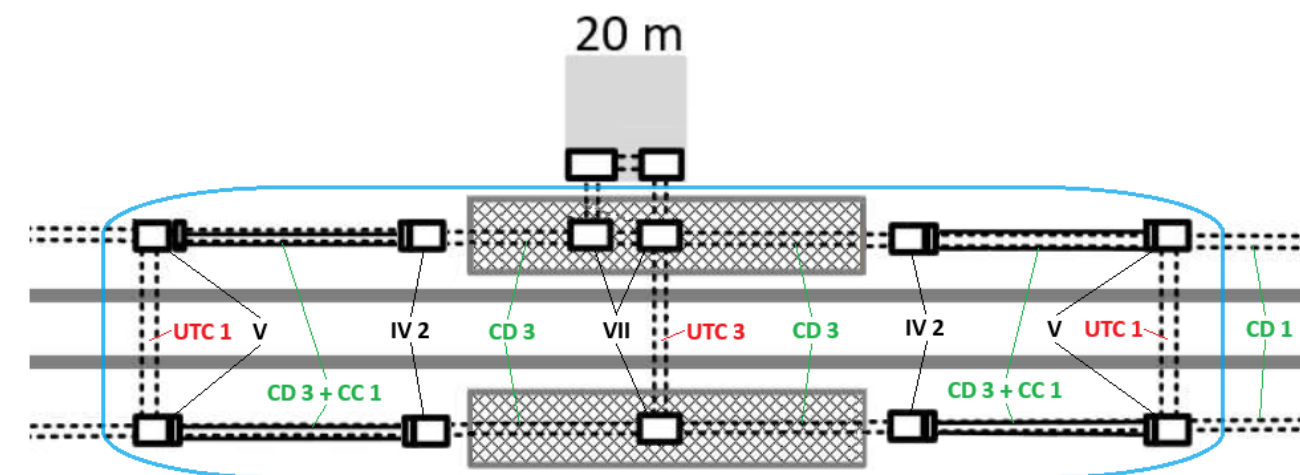
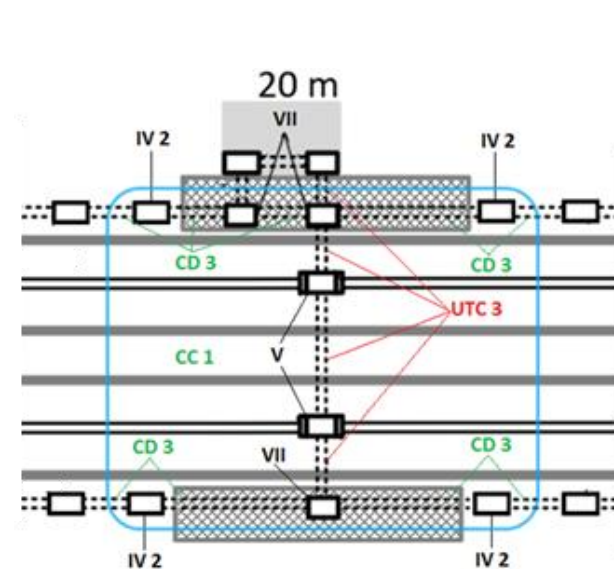


Figure 23. Cable duct system in the stopping point area

5.6.4.2 SIDE PLATFORMS IN THE STATION AREA

Two manholes VII should be installed under the platform. Against the manhole closest to the centre of the platform, manholes V shall be installed between the main and secondary tracks and the manhole VII under the platform further from the area of the system. About 5m outside the platform install manholes IV2.

Perpendicular to the railway, install cable pipe packages UTC3 between manholes VII and V. Along the railway, between the manholes IV2 and V, install the cable pipe package CD3 to a depth of 0,8 m from the ground under the platform. Between the tracks, install an above-ground cable channel CC1 from manholes V.



Joonis 24. Kaablikanalite süsteem külgsplatvormide alas

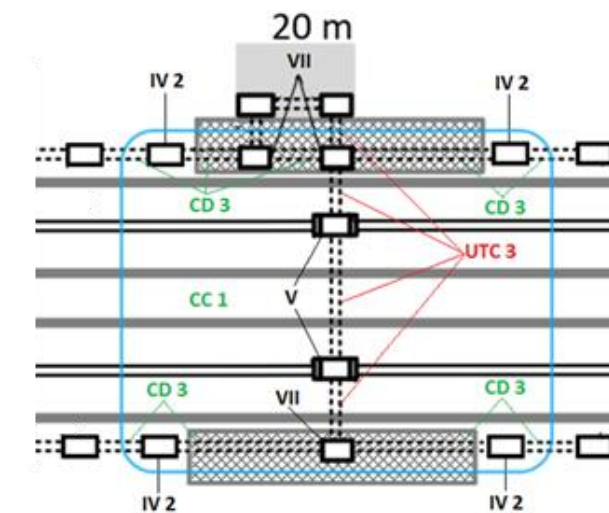


Figure 24. Cable duct system in the area of side platforms