Rail Baltica
Coordinated by RB Rail

TECHNICAL SPECIFICATIONS

UTILITY REQUIREMENTS

RBCN-ROA-SPC_RQ-R-00001

Revision: 3.0

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Date: 2023-06-21

Co-financed by the Connecting Europe Facility of the European Union

DOCUMENT DEVELOPMENT AND APPROVAL

Ownership	
Document Owner	Road Team (Civil Works and Stations, CTO)

Approved by	Decision No.	Date
Technical Reference Group	TRG Meeting No.	
Technical Reference Group	TRG Meeting No.53	2023-02-21
Technical Reference Group	TRG Meeting No.10	2019-03-20

DOCUMENT HISTORY

This document has been issued and amended as follows:

Revision	Issue Date	Author	Issue purpose	Description of changes
1.0	2019-03-20	Kaur Laansalu	First issue	
2.0	2022-01-24	Jānis Štekels, Valdis Polmanis	Second issue	Document template adjustments according to Document Control guidelines. Content improvements.
3.0	2023-06-21	Jānis Štekels, Valdis Polmanis	Third issue	Updates regarding underground cable protection measures, Point 15. / 19. / 20. / 123.

CONTENTS

ACRONYMS AND ABBREVIATIONS

A full list of acronyms and abbreviations can be found in RBR Glossary of Abbreviations. The following acronyms and abbreviations are used throughout this document:

Abbreviation	Definition
ATEX	Directive on equipment for use in explosive atmospheres (Directive 94/9/EC)
CPTD	Design of the railway (for the entire line) in conceptual level, which is based on national level Environmental Impact Assessment studies, preliminary design and spatial planning studies, complies with Technical Specification of Interoperability and Design Guidelines of the railway
DN	Diameter Nominal, alphanumeric designation of size for reference purposes followed by a dimensionless whole number which is indirectly related to the physical size in millimetres of the bore (ID) or outside diameter (OD) of the end connections
DTD	Detailed Technical Design
GSM-R	International wireless communications standard for railway communication and applications
LDS	Leakage detection system, system to detect and notify about leakage in carrier pipe
LoG	Level of Geometry set out by BIM documentation
LoI	Level of Information set out by BIM documentation
PLC	A programmable logic controller is a small, modular solid-state computer with customized instructions for performing a particular task
SCADA	Supervisory control and data acquisition is a control system architecture that uses computers, networked data communications and graphical user interfaces for process supervisory management
SMAS	Status monitoring and alarm system, system to detect anomalies in systems or in part of the systems work compared to normal behaviour and notifies via alarm of such of event
VRC	Variable-resistance conductor system using three parallel strands of conductor, represented by resistors.

DEFINITIONS

The following terms are used throughout this document:

Term	Definition
Cable insulation	External cover of cable protecting conduit and internal layers of cable from climate and physical/chemical damage.
Detailed Technical Design	DTD phase consists of preparation of detailed drawings and specifications establishing the requirements for the construction of the project. DTD describes the quality, configuration, size, and relationship of all components to be incorporated into the project. DTD must be consistent

	with the project program, the construction budget, and the project schedule. DTD is basis for starting Construction.
Direct bury cables	Communications or transmissions electrical cable which is especially designed to be buried under the ground without any kind of extra covering, sheathing, or piping to protect it.
Master Design	During the Master Design phase, the project design is further refined including field studies, especially of a topographical, geological, geotechnical, hydrological and hydraulic nature. In the engineering project, details are provided of the unit costs of the materials and of the different construction phases. All design decisions are completed during this phase in order to prepare the subsequent construction documents and to start procuring construction works.
Rail Baltica coordinator	During Project implementation phase the Project Co-Ordinator and after completion of the project the Infrastructure Manager of the railway.
Railway Right-of-Way (Estonia)	An area of land which is an integral part of the railway infrastructure, and which is intended for the placement of railway infrastructure objects in order to ensure the development of the railway infrastructure and the safe operations, and also to protect people and the environment from harmful effects of the railway. The boundaries of the railway right of way in designs shall be determined in compliance with current building standards in effect for the relevant construction facility and in compliance with the cross-section drawings provided in the Design Guidelines.
Railway Right-of-Way (Latvia)	An area of land which is an integral part of the railway infrastructure, and which is intended for the placement of railway infrastructure objects in order to ensure the development of the railway infrastructure and the safe operations, and also to protect people and the environment from harmful effects of the railway. The boundaries of the railway right of way in designs shall be determined in compliance with current building standards in effect for the relevant construction facility and in compliance with the cross-section drawings provided in the Design Guidelines.
Railway Right-of-Way (Lithuania)	An area of land which is an integral part of the railway infrastructure, and which is intended for the placement of railway infrastructure objects in order to ensure the development of the railway infrastructure and the safe operations, and also to protect people and the environment from harmful effects of the railway. The boundaries of the railway right of way in designs shall be determined in compliance with current building standards in effect for the relevant construction facility and in compliance with the cross-section drawings provided in the Design Guidelines.
Spatial Plan (Estonia)	Spatial Planning of Harju County "Determining the location of the Rail Baltic corridor" Ministry of Finance decree 13.02.2018 no 1.1-4/41 (EE- "Harju maakonnaplaneeringu „Rail Baltic raudteetrassi koridori asukoha määramine" kehtestamine. Riigihalduse ministri käskkiri 13.02.2018 nr 1.1-4/40) Spatial Planning of Rapla County "Determining the location of the Rail Baltic corridor" Ministry of Finance decree 14.02.2018 no 1.1-4/43 (EE- "Rapla maakonnaplaneeringu „Rail Baltic raudteetrassi koridori asukoha määramine" Riigihalduse ministri käskkiri 13.02.2018 nr 1.1-4/40) Spatial Planning of Pärnu County "Determining the location of the Rail Baltic corridor" Ministry of Finance decree 13.02.2018 no 1.1-4/40 (EE- "Pärnu maakonnaplaneering „Rail Baltic raudteetrassi koridori asukoha määramine" Rahandusministeeriumi käskkiri 13.02.2018 nr 1.1-4/40)
Spatial Plan (Lithuania)	Spatial Plan of European Standard Railway Line Kaunas - State Border of Lithuania and Latvia, approved by the Decision of the Government of the Republic of Lithuania No. 31, dated 11 January 2017.
Utilities	Infrastructure services provided to consumers (public) and are important for the normal functioning of society. Including but not limited to railway operation communication and energy supply networks, communication networks, sewage networks, water supply networks, drainage

	networks, oil and gas networks, heating supply networks, land melioration networks, electrical supply networks, lighting networks etc.

1 Introduction

1.1 Purpose

1. The intention of this document is to describe requirements for utilities construction, maintenance, rehabilitation and re-construction in railway right-of-way and in relation to railway. It is mainly directed to third parties who would like to build new or reconstruct existing utilities transverse or parallel to railway. Also, the same principals must be followed by designer of the Rail Baltica. This document does not describe requirements for third-party non-utility related structures and buildings.

1.2 Application

2. This document describes the requirements for construction, maintenance, rehabilitation and re-construction of typical utilities according to common practices in contact with Rail Baltica railway. This document does not cover specialized utility engineering networks and structures such as for toxic chemicals, nuclear power stations, windfarms etc. For those special conditions will be developed by Rail Baltica coordinator case-by-case.
3. If special environmental, landscape, geologic or other conditions exist that do not allow utility to be designed and constructed according to this document then this shall be applied for exception. Rail Baltica coordinator engineering team will evaluate plead for exception and will decide if to grant exception or to decline it. Rail Baltica coordinator engineering team has the right to ask for any kind of additional information and if such is not submitted then the exception will be automatically declined.

1.3 Policies of this document

4. Protect the Rail Baltica facilities and right-of-way against damage caused by presence of a utility.
5. To the extent that is reasonable and feasible, exclude access points for utilities from within access-controlled right-of-way. This policy is intended to provide a safe environment for operations, minimize inconvenience to the traveling public, and eliminate conditions detrimental to the safety of utility employees during maintenance of its facilities.
6. Provide a means of inspection, maintenance, and repair of utilities, as may be required, without disruption of train service.
7. Satisfy requirements and criteria of the affected utility owners, however, no betterment and no changes in the railway design in favour of the utility installation shall be included unless specifically agreed between the utility owner and the Rail Baltica coordinator.

2 Common requirements

2.1 Overall requirements

8. Along the railway (parallel to railway line) inside the railway right-of-way third party utilities and the related structures and equipment/structures (also even when utility itself is transverse to railway line) can be design and built only in exceptional circumstances. For this the third party must submit a carefully reasoned and

reported proof that there is no other way to realize their project. The before named report must be approved by Rail Baltica coordinator before commencing with Design and technical approval and must in minimum demonstrate the following:

8.1. An alternate location is not feasible, from the standpoint of providing efficient utility services in a manner conducive to safety, durability, and economy of maintenance and operations.

8.2. The accommodation will not adversely affect the design, construction, operation, maintenance, safety, or stability of the railway facility.

8.3. The accommodation will not interfere with or impair the proposed use or future expansion of the railway facility.

8.4. The disapproval of the use of the right-of-way does not result in an immitigable impact to the owner, the environment, or the public.

8.5. Utilities parallel to the railway must be located outside railway fence and if placed outside railway fence but still within railway RoW, then an agreement with the railway infrastructure owner or design coordinator must be reached before the utility design development.

8.6. When the utility is put out of service then the utility owner is obliged to remove the utility from railway right-of-way and restore the affected area to its prior state. It shall be noted that only trenchless methods after construction of the railway has started can be used (backfilling with foamed concrete etc.).

9. Placing of third-party utilities parallel along the railway under the railway storm management ditches and waterways is not allowed in any circumstances.

10. Placing of third-party utilities under and on to the facility sites, such as traction power facility and communications' tower sites, GSM-R facilities is not allowed in any circumstances.

11. In no circumstance's utilities can be placed in location of unstable ground or areas with high risk of landslides.

12. All buried utilities carrying liquids shall be placed below the freezing point of the ground.

13. Transverse crossings of utilities that are at less than 60-degrees from the railway longitudinal alignment shall be classified as longitudinal encroachment.

14. When crossing Rail Baltica railway with new utilities, the crossing shall be designed at a perpendicular 90 degree angle to minimize the crossing distance. If solution is not possible then any deviations from 90 degrees shall be properly justified and an exceptional approval shall be received from Rail Baltica coordinator.

15. Crossings with existing utilities built before Rail Baltica tracks may remain at an angle that is not perpendicular (90 degrees) to the designed railway. The necessity of casing pipes shall be evaluated by the designer and the appropriate protective and safety measures provided for these utilities. Solution shall be agreed with utility owners and Rail Baltica coordinator.

16. Outside the railway right-of-way all the utilities should be placed as far away from the railway as possible but any time not closer than stipulated with current document.

17. All the new utilities must be placed as close to the existing non-railway utilities as possible respecting other conditions stipulated in this document.

18. It is preferred to use the trenchless method for the construction of all the buried utilities transverse to the railway line that shall be built before the railway construction has started. Open trench method shall be pre-aligned with Rail Baltica coordinator case-by-case if trenchless method is found to be non-feasible due to specific circumstances.

19. All the buried utilities transverse to the railway line and built after the railway construction has started shall be designed to and built only using the trenchless method. Appropriate safety measures (e.g. protective casing pipes) shall be provided for all the buried utilities.
20. All casing pipes shall be selected to withstand the applied loads, taking into account the final deformations of the pipes. Designer shall provide static load calculations for each type of undertrack crossing solution. The casing pipes may not deform beyond the limits specified according to applicable standards by the designer/supplier. All casing pipes must have stiffness rating of at least 30kN/m2.
21. For trenchless method the design must include in minimum following and be in line with EN 12889:
    21.1. Soil investigation and interpretation
    21.2. Method selection
    21.3. Soil stabilizing design
    21.4. Pipe design incl pipe shield design
    21.5. Pipe installation design and requirements for machinery
    21.6. Fracture Mitigation Plan
    21.7. Pipe installation control measures and documenting
    21.8. Shaft design (when applicable)
    21.9. Health and Safety measures to be applied
22. Rail Baltica design coordinator or infrastructure owner reserves the rights to decide if utility location on structures shall be permitted or not after reviewing the design documentation of the proposed utilities. Rail Baltica coordinator will take into account CAPEX-OPEX impact, legal acts and propose cost sharing schema.
23. For utilities crossing the railway there must be foreseen means to take them out of use (valves, circuit breaks etc.) when their malfunction, breaking or other circumstances related to them will cause danger to railway.
24. All trenches with depth over 1,5m must be supported. Design or Work organisation project must give the solution for supporting the trench. If soft soil is encountered, then support may be necessary also for trenches less than 1.5 m deep. Such solutions shall be proposed based on case-by-case approach.
25. If metal carrier or casing pipes are used then they must have protective coating, cathodic protection or the calculated thickness must be increased to allow the casing pipe to withstand the loads during full 100-year life span taking account loss of thickness from corrosion. Corrosion evaluation monitoring system needs to be implemented. When stipulating the protection requirements EN 12501 must be followed. For cathodic protection EN 12954 must be followed. For protective coating reference to applicable European standard used must be made. Casing pipe calculations must meet EN 13480-6, Annex A.
26. Metal casing pipe installed under a railway shall have a specified minimum yield strength of 250 MPa or greater and their thickness must be calculated according to the imposed loads and ground conditions.
27. Concrete casing pipe installed under a railway shall have a specified minimum specified strength class of 30/37 and with minimum exposure class XC4 XF4 or greater and their thickness must be calculated according to the imposed loads and ground conditions.
28. Metal casing pipes and carrier pipes shall be grounded and bonded. Possible solutions shall be analysed by the designer of utility network case by case and integrated with the earthing and bonding systems applied to different facilities in railway environment. Solutions shall be approved by Rail Baltica Coordinator.

29. If other materials are used for casing pipes, they shall fulfil all the life-cycle requirements set out for steel and concrete casing pipes.
30. All utilities buried or overhead which might be compromised by lightning shall be grounded for lightning outside the railway right-of-way.
31. Grounding of third-party utilities must be at 20m away of any grounding points and structures of railway. Grounding of any facility or equipment must be confirmed with Rail Baltica Coordinator in every specific point separately.
32. All the utilities related to electronic and electric devices shall meet the EMC requirements set in Rail Baltica Design Guidelines (see APPENDIX 1).
33. To minimize the possibility that utility pipelines become part of the Traction Power Return System, insulated joints or couplings shall be installed at or adjacent to the shut-off valves or at a similar location where shut-off valves are not required.
34. Casing and carrier pipe joints under the railway shall be of leakproof construction and capable of withstanding railway loads (axel load 25 tons). For the load calculation methodology described by EN 1991-2 paragraph 6.3.6.2 must be applied above the reference plane in upper load distribution zone.
35. **Note:** For standard sleeper spacing 1666 pc/km with sleeper width 290 mm and total combined ballast and sub-ballast layer thickness of 620 mm, the interference reference plane is at the boundary of sub-ballast layer and embankment, in other cases it must be calculated accordingly.
36. Below the interference reference plane, the methodology utilizing the Boussinesq principal of elastic half-space theory for a uniformly loaded strip is used. The method assumes that the soil is a homogenous, isotropic mass within a semi-infinite geometry and the loads applied are within the linear elastic range for the substrate strength. Therefore, it is important to check that the bearing capacity ultimate limit sate condition is satisfied before proceeding.
37. The data is provided for the design of utilities below a loaded section of the running track and interference reference plane. The following graph and associated tabulated data present a profile of total stresses with depth.
38. The calculated stresses must be factored using the appropriate design approach according to EC7.
39. For sections of the embankment which adopt light-weight fill, the stresses may produce a conservative design. It is up to the designer to adopt the appropriate parameters or use the chart provided (Currently a unit weight of 18kN/m3 and 22kN/m3 is assumed for the ballast and embankment material respectively).
40. Buoyancy has not been accounted for as ground water depths are location specific. This must be assessed on a section-by-section basis by the designer.
41. **Note:** Stresses can be obtained either by reading directly from the graph, or alternatively by the process of interpolation using the tabulated data. Stresses account the rail, sleeper and live loading respectively. The sum of the imposed and overburden pressures is presented as the blue profile within the graph.

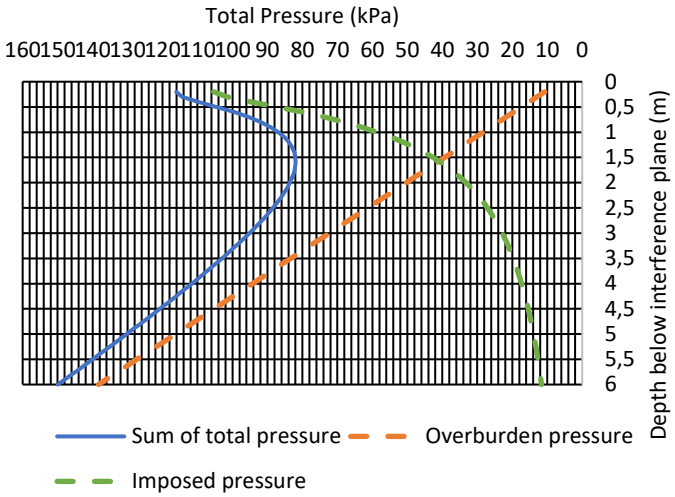


Exhibit 1: Pressure based on casing pipe depth

Table 1: Pressure based on casing pipe depth

Depth below interference reference level, Z (m)	Sum of total pressure (kPa)
0.2	116
0.3	114
0.4	110
0.5	105
0.6	100
0.7	95
0.8	92
0.9	89
1	87
1.1	85
1.2	84
1.3	83
1.4	82
1.5	82
1.6	82
1.7	82
1.8	82
1.9	83
2	84
2.1	84
2.2	85
2.3	86
2.4	87

42. Rail Baltica coordinator leaves itself possibility to change, update or imply additional conditions without any prior explanations. Informing of the parties will be implemented on need basis.
43. There is not allowed to set additional easement at the railway right-of-way.
44. For utility installation Work Monitoring Plan must be implemented. Design of the utility needs to include the Work Monitoring Plan which in minimum must consist of:
    - 44.1. Monitoring of existing surface anomalies
    - 44.2. Dust and air pollution monitoring
    - 44.3. Contamination monitoring
    - 44.4. Ground water monitoring
    - 44.5. Vibration monitoring
    - 44.6. Monitoring of sensitive operational structures and equipment
    - 44.7. Monitoring quantity and quality of excavated soil comparing it to design information
45. The utility contractor is obliged to reinstate the area affected by construction works to its prior state, when reinstating the affected area after completion of works, the guidance and demands of Rail Baltica Design coordinator shall be respected.
46. All crossing buried utilities shall be marked with marking posts and signs above ground just outside the railway right-of-way. All longitudinal buried utilities shall be marked by a marking posts and sign every 150 m and at every road crossing, streambed, other utility crossing, and at locations of major change in direction of the line. Signage shall identify each utility, its owner, emergency phone number, Rail Baltica kilometer, and depth of utility from the ground relative and absolute.
47. All buried utilities must be marked with warning tape which is to be placed 0,3m above the utility.
48. Minimum vertical and horizontal clearances for safety of the railway are given in APPENDIX TABLES 1 to 4.
49. **All applicable laws, standards and norms in related country and European Union must be followed. If demands set in those are more stringent than in current document, then the more stringent demands must be followed.**

2.2 Requirements for the design documentation

50. All the designs must be presented in two equal copies from which one copy is in pdf format and another copy in dwg (drawings), xlsx (tables) and docx (text files) and BIM model data according to DG RBDG-MAN-030. BIM LOD will be agreed case-by-case with the objective to obtain the minimum model definition for referencing in the asset database.

51. Design must include at least following documents: layout, cross-sections, longitudinal profile and explanatory note. Rail Baltica coordinator leaves itself possibility to demand any additional drawings and documents if needed for the design validation and clash check with railway design.
52. In the design the railway alignment stations must be marked with the accuracy of 1m.
53. The dwg drawings must be in metric units (meters) and in residing country coordinate and altimetry systems.
54. In design the railway must be shown on profile, sections and layouts. Also, the distances in metric units must be shown- both in plan, sections and profile. For the trenchless method the start and end excavation locations, depth and incline of the slopes must be shown.
55. The owner of the third-party utility is fully responsible for their design and confirms that they are aware of the prevailing ground conditions, loads from railway its structures and embankment and their suitability for installation of their utility and the methods of installations designed.
56. All the known existing and future utilities, buildings, roads, railways and nature objects must be shown on the design drawings.
57. Designer shall submit a utility protection and monitoring plan for utilities within the zone of influence of excavation limits.
58. The Designer shall include in the utility design a requirement to contact Rail Baltica coordinator at least 10 working days before any excavation inside railroad's right-of-way.
59. As-Built Documentations must be submitted to Rail Baltica coordinator not later than 30 days after completion of construction works.
60. For designs where RB Rail is the Client, design documentation must meet the Rail Baltica 2d CAD Standard as long as it doesn't contradict with Utility Owner's requirements. For Other designs where the Client is the utility owner, RB Rail 2d CAD standards shall be followed as far as they do not contradict with the Designing company's internal CAD standards and Utility owner's requirements. 3d CAD standard shall be followed to the extent as instructed by Rail Baltica coordinator case-by-case for each specific utility type.
61. As-built documentation has to meet the Rail Baltica BIM Manual LoI and LoG set for as-built models and CAD Standard (both available online).
62. Utility owner shall provide all the "As built-data" according to DG RBDG-MAN-040 to Rail Baltica Coordinator's AIM for uploading in the RBR Asset register system. Third party models shall be used for reference purposes.
63. For Utility construction works done in Rail Baltica existing or designed RoW, Contractor must submit time schedule for planned works and they can carry out works only after Rail Baltica coordinator's acceptance.
64. It will not be Rail Baltica project responsibility if any unknown utility will show up or will be damaged that was not presented by utility owners

2.3 Responsibility of the utility owner

65. The owner of the utilities will be responsible that all the works are carried out according to documentation approved by Rail Baltica coordinator. Rail Baltica coordinator will not be liable for any damages to the utilities that are not constructed according to the documentation approved by Rail Baltica coordinator. Allowed deflections during construction from the design are given in SPECIFIC REQUIREMENTS chapter of this document.
66. Third-party owner will be fully responsible for the good condition, warranty, up-keep, maintenance and repairs of their utilities throughout period of exploitation and acknowledges that the utilities are placed in high risk zone and they will have no demands later to the owner of the railway.

67. When the utility is put out of service then the utility owner is obliged to remove the utility from railway right-of-way and restore the affected area to its prior state. It shall be noted that only trenchless methods after construction of the railway has started can be used (backfilling with foamed concrete etc.).
68. Owner of the Railway will carry no liability for safe keeping the third-party utilities inside the railway right-of-way.
69. Contract must be concluded between the railway owner and the utility owner setting out the exact specific conditions that are applied for construction, warranty, up-keep, maintenance and repairs of the utility.
70. Utility owner when carrying out work inside the railway right-of-way must include in his team certified railway engineer, technician, mechanic or signalling engineer who is trained and authorized to work inside railway right-of way by the laws of the Country.

2.4 Demand and right for independent third-party expertise

71. For newly designed utilities before approval of design Rail Baltica coordinator has the right to demand that the utility owner will present an Independent Third-Party Expertise for the design. If Rail Baltica coordinator foresees that the expertise provided by the utility owner is not performed correctly then Rail Baltica coordinator leaves itself a right to order additional Independent Third-Party Expertise before giving approval of design.

2.5 Supervision of construction works

72. Inside the railway right-of-way Rail Baltica coordinator (or a party named to represent Rail Baltica coordinator) has full rights to inspect and supervise that the construction works are carried out according to approved design and applicable Health and Safety policy is followed. If any discrepancies are found, then Rail Baltica coordinator has the right to stop the construction works and to demand the rectification the constructions already built if they do not meet the agreed design. In case of severe violation Rail Baltica coordinator has right do ban the Contractor from railway right-of-way.
73. At the completion of construction sign-off on the completion act by Rail Baltica coordinator is needed before pursuing the Permit of Use. Copy of as-built documentation must be provided to Rail Baltica coordinator and meeting the demands set out in the REQUIREMENTS FOR THE DESIGN DOCUMENTATION chapter of this document.

3 Specific requirements

3.1 High risk buried utilities (gas, oil, district heating, steam, chemicals, other pressurized pipes)

74. None of the buried pipelines can be placed under cross-overs and turnouts and railway system equipment locations.
75. For gas pipelines it must be stipulated the make and type of gas that is to be transported by the pipeline.

76. Casing pipe must be at least 2xDe of carrier pipe for pipes up to DN200 and 1,5xDe of carrier pipe for pipes over DN200.

77. Using open trench construction, the minimum bedding under the utilities must always be built according to manufacturer's specification and applicable European Standard but never less than 15cm thick from rock material and compacted to compaction level 0,98. If the excavated material in the trench is of quality class Q0 or Q1 according to UIC 719R, it cannot be backfilled and needs to be replaced by a suitable material. The back-fill of the trench must be made from QS2 and QS3 class material in accordance with UIC 719R. The backfills from QS2 soils shall be compacted in 200-300mm lifts to a compaction level not less than 0.97 for each lift, furthermore, at the final surface level the bearing capacity ratio shall not exceed Ev2/Ev1 ≤2.6. The backfills from QS3 soils shall be compacted in 200-300mm lifts to a compaction level not less than 0.98 for each lift, furthermore, at the final surface level the bearing capacity ratio shall not exceed Ev2/Ev1 ≤2.5. The bearing capacity Ev2 determined by a plate loading test shall be at least as high as those for upper embankments set out in the Technical Specifications. Trench must always be wide enough to allow machined compaction. Minimum thickness of initial back fill before starting machined compaction must be at least 300mm. Filtration of the soils used for back-fill must be the same as for railway construction and be frost heave safe and shall not include any ice or snow and cannot be frozen. Maximum stone size allowed is 64mm.

78. Trench shall always be de-watered.

79. Casing pipes must extend at least 5m out from the railway right-of-way. High embankment and deep cut situations shall be assessed case-by-case where the previous requirement is not appropriate.

80. All pipes carrying liquids and their casing pipes and cables, and their casing pipes must have grade of at least 0,4% and end in retention/service manhole. Grade must be towards the manhole. If inside the casing pipes are to be allowed to be carried out maintenance works then the retention/service manholes must be placed at each end of the casing pipe.

81. Retention/service manholes must be watertight and with internal diameter of at least 1000mm with lockable lid. Manholes must to be designed to applicable loads (traffic, soil etc.). Placing of soils and their compaction same rules must be followed as for pipe installations.

82. All pressurized pipes shall have shut valves each side of the railway. Shut valves must be placed outside the railway right-of-way and casing pipe (at least in length allowing their repairs and replacement) and have appropriate signage.

83. For gas pipelines casing pipes vent pipes must be built allowing to remove gas from inside the casing pipe in emergency and to prevent build-up of gas inside the casing pipe. Venting pipes must be brought through the ground outside the railway right-of-way and must extend at least 1,5m above the ground surface.

84. All the fuel storage areas must be placed as far away from the railway as possible but not closer than stipulated in APPENDIX TABLES table 3. All fuel storages above or below ground and their appliances/equipment in radius of 50m from railway right-of-way must meet ATEX Zone 0 requirements and be grounded.

85. Emergency response procedures shall be developed by the applicant to handle a situation. in which a pipeline leak or railway derailment or incident may jeopardize the integrity of the pipeline. Local conditions shall be considered when developing these procedures.

86. Ends of casing pipes not ending in retention manhole must be sealed to prevent intrusion of soil and debris. Seal must consider thermal/heat expansion of the pipelines.

87. All crossing pressurized pipelines shall have valve manholes for closing the pipeline section under the railway. The valves must be located outside the railway right-of-way.

88. Section of pipeline to be grounded (within railway right-of-way) shall be separated by isolators from other sections of the pipeline. Grounding of any facility or equipment must be confirmed with Rail Baltica Coordinator in every specific point separately.

89. All hydrants that are not designed for railway must be placed outside the railway right-of-way.

90. All pressure pipelines must be equipped with leakage detection system (LDS) or status monitoring and alarm system (SMAS) which telemetry must comply with IEC 60870-5 and applicable EU legislation and standards for connection to Rail Baltica SCADA. At least two output ports must be foreseen for hardwired connection to railway SCADA from LDS. Only secure ha one-way telemetry is allowed- emergency/information signals from controller or PLC only. LDS control box with data output module must be placed right outside the railway right-of-way. It shall be noted if Rail Baltica will develop new interface for the SCADA then 3rd Party has to upgrade their solutions to achieve fill compliancy with Rail Baltica SCADA.

91. Tolerances for construction (incl casing pipes) for open trench construction per ICS group 23.040 and 93 standards:

    91.1. Bedding height difference to design ±30 mm

    91.2. Centerline location difference from design ±50 mm

    91.3. Grade difference from design ±0,15 x design grade

    91.4. Alignment at joints ±5mm

92. Tolerances for construction (incl casing pipes) for trenchless construction ICS group 23.040 and 93 standards :

    92.1. Centerline location difference from design ±10 mm

    92.2. Grade difference from design ±0.05%

    92.3. Alignment at joints ±5mm

93. When support structures are used in trench during construction (retention walls, ties etc.) then they need to be removed before backfilling.

3.2 Low risk buried utilities (gravity sewage, gravity drainage, gravity storm water)

94. None of the buried pipelines can be placed under crossovers and turnouts and railway system equipment locations.

95. Casing pipe must be at least 2xDe of carrier pipe for pipes up to DN200 and 1,5xDe of carrier pipe for pipes over DN200.

96. Using open trench construction, the minimum bedding under the utilities must always be built according to manufacturer's specification and applicable European Standard but never less than 15cm thick from rock material and compacted to compaction level 0,98. If the excavated material in the trench is of quality class Q0 or Q1 according to UIC 719R, it cannot be backfilled and needs to be replaced by a suitable material. The back-fill of the trench must be made from QS2 and QS3 class material in accordance with UIC 719R. The backfills from QS2 soils shall be compacted in 200-300mm lifts to a compaction level not less than 0.97 for each lift, furthermore, at the final surface level the bearing capacity ratio shall not exceed Ev2/Ev1 ≤2.6. The backfills from QS3 soils shall be compacted in 200-300mm lifts to a compaction level not less than 0.98 for each lift, furthermore, at the final surface level the bearing capacity ratio shall not exceed Ev2/Ev1 ≤2.5. The bearing capacity Ev2 determined by a plate loading test shall be at least as high as those for upper embankments set out in the Technical Specifications. Trench must always be wide enough to allow machined compaction.

Minimum thickness of initial back fill before starting machined compaction must be at least 300mm. Filtration of the soils used for back-fill must be the same as for railway construction and be frost heave safe and shall not include any ice or snow and cannot be frozen. Maximum stone size allowed is 64mm.

97. Trench shall always be de-watered.

98. Casing pipes must extend at least 5m out from the railway right-of-way. High embankment and deep cut situations shall be assessed case-by-case where the previous requirement is not appropriate.

99. All pipes carrying liquids and their casing pipes and cables, and their casing pipes must have grade of at least 0,4% and end in retention/service manhole. Grade must be towards the manhole. If inside the casing pipes are to be allowed to be carried out maintenance works then the retention/service manholes must be placed at each end of the casing pipe.

100. Retention/service manholes must be watertight and with internal diameter of at least 1000mm with lockable lid. Manholes must to be designed to applicable loads (traffic, soil etc.). Placing of soils and their compaction same rules must be followed as for pipe installations.

101. Emergency response procedures shall be developed by the applicant to handle a situation. in which a pipeline leak or railway derailment or incident may jeopardize the integrity of the pipeline. Local conditions shall be considered when developing these procedures.

102. Ends of casing pipes not ending in retention manhole must be sealed to prevent intrusion of soil and debris. Seal must consider thermal/heat expansion of the pipelines.

103. Section of pipeline to be grounded (within railway right-of-way) shall be separated by isolators from other sections of the pipeline.

104. For gravity pipes leakage detection sensors must be place in the down grade manholes which telemetry must comply with IEC 60870-5 and applicable EU legislation and standards for connection to Rail Baltica SCADA. At least two output ports must be foreseen for hardwired connection to railway SCADA from sensors. Only secure ha one-way telemetry is allowed- emergency/information signals from controller or PLC only. Sensors control box with data output module must be placed right outside the railway right-of-way. It shall be noted if Rail Baltica will develop new interface for the SCADA then 3rd Party has to upgrade their solutions to achieve fill compliancy with Rail Baltica SCADA.

105. Tolerances for construction (incl casing pipes) for open trench construction per ICS group 23.040 and 93 standards:

    105.1. Bedding height difference to design ±30 mm

    105.2. Centerline location difference from design ±50 mm

    105.3. Grade difference from design ±0,15 x design grade

    105.5. Alignment at joints ±5mm

106. Tolerances for construction (incl casing pipes) for trenchless construction per ICS group 23.040 and 93 standards:

    106.1. Centerline location difference from design ±10 mm

    106.2. Grade difference from design ±0.05%

    106.3. Alignment at joints ±5mm

107. When support structures are used in trench during construction (retention walls, ties etc.) then they need to be removed before backfilling.

3.3 Overhead and buried cables

108. None of the buried cables can be placed under crossovers and turnouts.

109. At the span, where the wires cross the railway, the cable utility shall be double-dead ended to avoid a single point of failure so that the wires are not dropped onto the tracks.

110. Overhead utility facilities shall have the supporting poles, masts, towers, and guy-wires located outside the railway right-of-way and designed in such manner that falling towards railway in accidental situation is avoided. Where such condition is impractical, a design variance shall be submitted to the Rail Baltica coordinator and at no times the before named structures can be closer to railway than specified in APPENDIX TABLES 2 and 4.

111. For overhead power lines principal should be followed that the lower voltage cables should be placed lower than the higher voltage ones. As an exception 10kV and 20kV cables can cross railway 25kV catenary lines from above. All cables below 10kV must be foreseen buried. Distances in APPENDIX TABLES tables 2 and 4 must be respected.

112. For overhead power lines means for de-icing during exploitation must be designed. Specific methodology (electro-thermal, ice rolling, VRC, passive-solar etc.) must be presented with maintenance and operations manuals. If physical de-icing is to be foreseen (e.g. Ice rolling) then this must be possible to execute without need to enter railway right-of-way. Solution must be approved by Rail Baltica coordinator.

113. Status monitoring and alarm system must be put in place to discover cable breaking over the railway. Systems telemetry must comply with IEC 60870-5 and applicable EU legislation and standards for connection to Rail Baltica SCADA. At least two output ports must be foreseen for hardwired connection to railway SCADA from sensors. Only secure ha one-way telemetry is allowed- emergency/information signals from controller or PLC only. Sensors control box with data output module must be placed right outside the railway right-of-way. It shall be noted if Rail Baltica will develop new interface for the SCADA then 3rd Party has to upgrade their solutions to achieve fill compliancy with Rail Baltica SCADA.

114. Always buried installation of cable lines shall be preferred when crossing the railway.

115. All power cables over 1kV must be at least 5m away from any railway signalling or communication cables.

116. All cable laying shall be executed at temperatures -5°C or above. For installing cables in temperatures below -5°C a proof must be presented that cable insulation and cable conduit is suitable for installing in temperatures below -5°C.

117. All cables passing the railway or closer to railway than 10m shall have at least 1,5mm thick insulation cover.

118. Direct bury cables shall not be used.

119. To make it easier to replace cables under railway right-of-way it is recommended to use manholes on cables at each side of the railway outside the railway right-of-way if approval is obtained from the utility owner.

120. Emergency response procedures shall be developed by the applicant to handle a situation in which a railway derailment or incident may jeopardize the integrity of the cable lines. Local conditions shall be considered when developing these procedures.

121. If a reserve for the cable needs to be foreseen, then it must be left inside a cable manhole outside of railway right-of-way if utility owner approves the use of manholes in their utility network, if not, then the reserve needs to be left as instructed by the utility owner and agreed with Rail Baltica coordinator.

122. Buried cables shall not have deep bends (less than 60x diameter of cable) in railway right-of-way.

123. If it is decided by the utility owner or designer to place a cable carrier pipe (or multiple cable carrier pipes) within a casing pipe then the casing pipe must be at least 1,5xDe of carrier pipe for pipes up to DN110 and 1,2xDe of carrier pipe for pipes over DN110.
124. Using open trench construction, the minimum bedding under the utilities must always be built according to manufacturer's specification and applicable European Standard but never less than 15cm thick from rock material and compacted to compaction level 0,98. If the excavated material in the trench is of quality class Q0 or Q1 according to UIC 719R, it cannot be backfilled and needs to be replaced by a suitable material. The back-fill of the trench must be made from QS2 and QS3 class material in accordance with UIC 719R. The backfills from QS2 soils shall be compacted in 200-300mm lifts to a compaction level not less than 0.97 for each lift, furthermore, at the final surface level the bearing capacity ratio shall not exceed Ev2/Ev1 ≤2.6. The backfills from QS3 soils shall be compacted in 200-300mm lifts to a compaction level not less than 0.98 for each lift, furthermore, at the final surface level the bearing capacity ratio shall not exceed Ev2/Ev1 ≤2.5. The bearing capacity Ev2 determined by a plate loading test shall be at least as high as those for upper embankments set out in the Technical Specifications. Trench must always be wide enough to allow machined compaction. Minimum thickness of initial back fill before starting machined compaction must be at least 300mm. Filtration of the soils used for back-fill must be the same as for railway construction and be frost heave safe and shall not include any ice or snow and cannot be frozen. Maximum stone size allowed is 64mm.
125. Trench shall always be de-watered.
126. Casing pipes must extend at least 5m out from the railway right-of-way. High embankment and deep cut situations shall be assessed case-by-case where the previous requirement is not appropriate.
127. If reserve casing pipes will be added for future use, then their heads must be sealed tight and marked in nature as for other utilities.
128. In no circumstances can be cable splicers be located or cables be spliced inside railway right-of-way.
129. Tolerances for construction (incl casing pipes) for open trench construction per ICS group 23.040 and 93 standards:
    129.1. Bedding height difference to design ±30 mm
    129.2. Centerline location difference from design ±50 mm
    129.3. Grade difference from design ±0,15 x design grade
    129.4. Alignment at joints ±5mm
130. Tolerances for construction (incl casing pipes) for trenchless construction per ICS group 23.040 and 93 standards:
    130.1. Centerline location difference from design ±10 mm
    130.2. Grade difference from design ±0.05%
    130.3. Alignment at joints ±5mm
131. When support structures are used in trench during construction (retention walls, ties etc.) then they need to be removed before backfilling.

REVIEW AND UPDATE OF THE DOCUMENT

Revision 2.0: Document formatting has been updated in compliance with company document management requirements. Document content updates can be traced in Utilities Requirements content updates Comment Sheet RBCN-ROA-SPC_AP-R-00001.

REFERENCES

Ref:	Document Number:	Document Title:
1.	RBDG-MAN-033-0101	BIM Manual
2.	RBDG-MAN-034-0101	CAD Standard
3.	RBGL-CRS-TPL-Z-00001	Internal Governance Document template (MS Word)
4.	RBCN-ROA-SPC_AP-R-00001	Utility Requirements content updates

ANNEX 1

Annex 1 to the UTILITY REQUIREMENTS

BURIED UTILITIES VERTICAL PLACEMENT		
Utility	**Minimum buried depth from top of the rail and/or existing ground to the top of the utility casing pipe (including ditches)**	**Minimum buried depth from top of the road pavement and/or existing ground to the top of the utility casing pipe (including ditches)**
Water pipelines	2,5m open trench, 4,0m for trenchless methods and only up to De1500	2,0m open trench, 3,0m for trenchless methods and only up to De1500
Sewage and drainage pipelines	2,0m open trench, 4,0m for trenchless methods and only up to De1500	1,5m open trench, 3,0m for trenchless methods and only up to De1500
Pressure sewage pipelines	2,5m open trench, 4,0m for trenchless methods and only up to De1500	2,0m open trench, 3,0m for trenchless methods and only up to De1500
Gas pipe	3,0m open trench with 2,0m wide concrete slab cover 0,5m deep from existing ground, 4,0m for trenchless methods and only up to De1500	2,0m open trench with 1,0m wide concrete slab cover 0,5m deep from existing ground, 3,0m for trenchless methods and only up to De1500
Oil and fuel pipelines	3,0m open trench with 2,0m wide concrete slab cover 0,5m deep from existing ground, trenchless methods not allowed	2,0m open trench with 1,0m wide concrete slab cover 0,5m deep from existing ground, trenchless methods not allowed
District heating and steam pipelines	2,0m open trench, trenchless methods not allowed	1,2m open trench, trenchless methods not allowed
Industrial pipelines	2,0m open trench, trenchless methods not allowed*	1,2m open trench, trenchless methods not allowed*
Electricity cables up to 20kV	2,0m; 4,0m for trenchless methods and only up to De160	0,7m; 2,0m for trenchless methods and only up to De160
Electricity cables 20-110kV	2,0m; 4,0m for trenchless methods and only up to De160	1,0m ; 2,0m for trenchless methods and only up to De160
Electricity cables 110kV and over	2,5m; 4,0m for trenchless methods and only up to De160	1,5m ; 2,5m for trenchless methods and only up to De160

Communication cables	1,5m; 4,5m for trenchless methods and only up to De160	1,0m; 2,0m for trenchless methods and only up to De160
REMARK: **-Additionally load calculations have to be carried out according to A.3.3. EN 13480-6*		

ANNEX 2

Annex 2 to the UTILITY REQUIREMENTS

OVERHEAD UTILITIES VERTICAL PLACEMENT			
Utility	**Minimum vertical clearances between overhead lines and electrified railway catenary contact line and from top of the rail*.**	**Minimum vertical clearances between overhead lines and electrified railway catenary contact line at railway ramps, stations and loading areas**	**Minimum vertical clearance with roads and structures**
Tele-communication cable	Only buried installation allowed	Only buried installation allowed	8,0m
Electricity cables up to 10 kV (included) crossing with railway	Only buried installation allowed	Only buried installation allowed	8,0m
Electricity cables from 10 kV (not included) up to 20 kV (not included) overhead line crossing with railway	13,1m from track and 5,1m from highest electrified part of the catenary system	17,1m	8,0m
Electricity cables from 20 kV (included) to 45 kV (not included) overhead line crossing with railway	13,3m from track and 5,3m from highest electrified part of the catenary system	17,3m	8,0m
Electricity cables from 45kV (included) to 110 kV (not included) overhead line crossing with railway	14,0m from track and 6,0m from highest electrified part of the catenary system	18,0m	8,5m
Electricity cables from 110 kV (included) to 330 kV (not included) overhead line crossing with railway	14,5m from track and 6,5m from highest electrified part of the catenary system	18,5m	9,0m
Electricity cables starting from 330 kV (included) and over overhead line crossing with railway	15,9m from track and 7,9m from highest electrified part of the catenary system	19,9m	12,0m

Fixed electrical installations (isolators, conductors etc.)	4,5m in every direction	4,5m in every direction	4,5m in every direction

REMARK:

1) *Crossing of other overhead utilities (fuel lines, district heating lines, steam lines, gas lines and others) with railway except electric cables, is strictly not permitted (also within the structures as viaducts and overpasses)*

2) For all of the vertical distances indicated, the electric cables should be calculated for ambient external environment temperatures:

-Minimum temperature with no other climatic action -40C°

-Normal ambient temperature (every day temperature) +5C°

-Maximum temperature +35C°

3) All suspensions and deflections have to be proved by calculations

4) Design must meet requirements set in this document, EN 50341-1 If there is conflict in demands between this document and the EN 50341-1 then the most stringent demands shall prevail. If EN 50341-1 reference to National Normative Aspects (NNA) then EVS-EN 50341-2-20 shall be considered as the prevailing NNA.

5) In location where the railway vertical profile has not been defined and/or can change during future designs and/or construction Rail Baltica coordinator *can define additional safety clearance.*

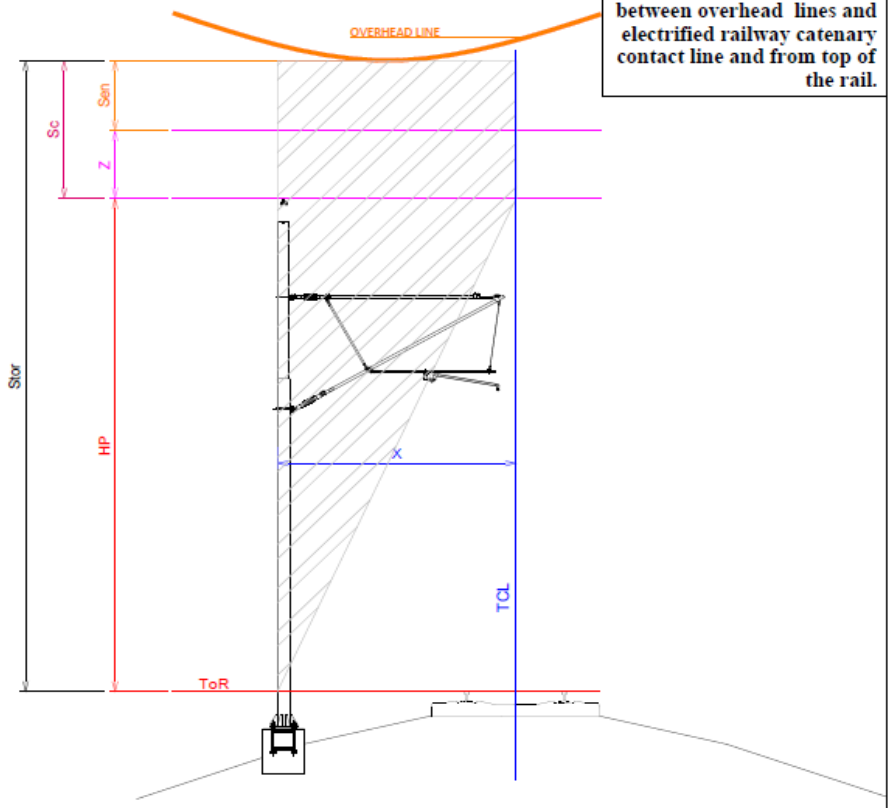
6) LV/MV Electrical cables cannot be implemented with overhead technical solution (only crossing under railway). Only 110 and 330 kV could be implemented with overhead technical solution.

*7) *-Please see schematic1 on next page for measurements description*

ANNEX 3

Annex 3 to the UTILITY REQUIREMENTS

Minimum vertical clearences between overhead lines and electrified railway catenary contact line and from top of the rail.



X- Overhead contact line zone horizontal extent from track centerline
TCL- Track Center Line
ToR- Top of rail level
HP- Highest point of over head contact line in normal condition
Z- maximum height of overhead contact line and current collector in accidental situation
Sen- Electrical safety distance
Sc- Complete safety distance from highest point of contact line in normal condition
Stor- Complete safety distance from top of rail level

-Catenary system safety zone for vertical clearance (half)

	MEASURMENTS					
Voltage of the crossing line	X	HP	Z	Sen	Sc	Stor
up to 20 kV (not included	5m	8m	2,5m	2,6m	5,1m	13,1m
From 20 kV (included) to 45 kV (not included)	5m	8m	2,5m	2,8m	5,3m	13,3m
from 45kV(included) to 110 kV (not included)	5m	8m	2,5m	3,5m	6,0m	14,0m
from 110 kV (included) to 330 kV (not included)	5m	8m	2,5m	4,0m	6,5m	14,5m
starting from 330 kV (included) and over	5m	8m	2,5m	5,4m	7,9m	15,9m

ANNEX 4

Annex 4 to the UTILITY REQUIREMENTS

BURIED UTILITIES HORIZONTAL PLACEMENT						
Utility type	**Horizontal distance (m) from underground utilities to:**					
	Structures and railway related buildings (bridges, overpasses, tunnels etc.) and their foundations	**Fence and ramp foundations**	**Railway catenary pole foundations and grounding system foundations**	**Road/street curb stone, road edge, road verge with reinforcement**	**Highway ditch outer edge or highway embankment cut line with existing ground (natural subgrade)**	**1435 railway embankment cut line with existing ground (natural subgrade) or railway ditch outer edge**
Water and pressurized sewage pipelines	5	3	10	1,5	1	10
Gravity sewage and gravity stormwater pipelines	3	1,5	10	1,5	1	10
Gravity drainage collectors	3	1	5	1,5	1	5,8
Gravity drainage pipelines	0,4	0,4	0,6	0,4	0,4	5,8
Gas pipelines with the following pressure (MPa):						
Low pressure ≤0,005 MPa	2	1	10	2	1	10
Middle pressure 0,005≤0,4 MPa	2	1	10	2	1	10
High pressure 0,4≤1,6 MPa	7	1	10	1,5	1	10,8

Very high pressure Over 1,6 MPa	50	25	50	50	50	50
District heating pipelines	2	1,5	10	1	4	10
All types Electrical power supply cables	1	1	5	1,5	1	10,8
Electricity masts, poles, towers, and guys	Mast, pole, tower or guy height from ground + 10m	Mast, pole, tower or guy height from ground + 10m	Mast, pole, tower or guy height from ground + 10m	Mast, pole, tower or guy height from ground + 10m	Mast, pole, tower or guy height from ground + 10m	Mast, pole, tower or guy height from ground + 10m
Railway technological electric power supply cables	0,6	0,6	0,6	1,96	1	1,9
Telecommunication cables	0,6	0,6	2	1	1	10,8
Railway technological telecommunication network cables	0,6	0,6	0,6	1,5	5	1,9
Utility canals and utility tunnels	2	1,5	1,5	1,5	1	5,8
Fuel pipelines and fuel handling storages (both above and below ground)	30	5	30	15	15	30

ANNEX 5

Annex 5 to the UTILITY REQUIREMENTS

OVERHEAD UTILITIES HORIZONTAL PLACEMENT			
Utility type	**Horizontal distance (m) from underground utilities to:**		
	Railway catenary pole foundations and grounding system foundations	**Road ditch outer edge or highway embankment cut line with existing ground (natural subgrade)**	**1435 railway embankment cut line with existing ground (natural subgrade) or railway ditch outer edge**
Up to 35 kV (included) electricity guyed masts, poles, towers in rural areas	15m	8m	15m
Over 35 kV (not included) electricity guyed masts, poles, towers in rural areas	30m	8m	30m
Up to 35 kV (included) electricity un- guyed masts, poles, towers in rural areas	Height of the mast measured from ground level + 10m	15m	Height of the mast measured from ground level + 10m
Over 35 kV (not included) electricity un-guyed masts, poles, towers in rural areas	Not allowed inside of railway right-of-way	Not allowed inside of railway and road right-of-way	Not allowed inside of railway right-of-way
Up to 110 kV (included) electricity guyed masts, poles, towers in urban areas	Not allowed inside of railway right-of-way	Not allowed inside of railway and road right-of-way	Not allowed inside of railway right-of-way
Over 110 kV (not included) electricity guyed masts, poles, towers in urban areas	8m	3m	8m
Up to110 kV (included) electricity un- guyed masts, poles, towers in urban areas	Not allowed inside of railway right-of-way	Not allowed inside of railway and road right-of-way	Not allowed inside of railway right-of-way

Over 110 kV (not included) electricity un-guyed masts, poles, towers in rural areas	Not allowed inside of railway right-of-way	Not allowed inside of railway and road right-of-way	Not allowed inside of railway right-of-way

ANNEX 6. DESIGN GUIDELINES, RAILWAY ENERGY: PART 4, ELECTROMAGNETIC COMPATIBILITY (19-03-2018)