

Annex 1 List of Parameters and Requirements for Placing in Service Light Rail Infrastructure, Energy and Command-Control Subsystems			Proposed requirements in the State
Ref.	Parameter	Detailed Parameter	Requirements for NWA related subsystems
01.00	General Information on project scope		
01.01	General	Summary of General Arrangement and Type and Purpose of Project (e.g. Line, chainage/ section, Project boundary, Location/ class/ type/length of: track, switches, crossings, max speed, tram frequency, stops, platforms, structures, type of RST, RST-depots, freight hubs, permitted paths, stabling tracks)	RSC-G-032
01.02	General	Definition of Scope relating New Build/ Upgrade / Renewal (general description)	RSC-G-032
01.03	General	Declaration of intended design life for each aspect of the project	RSC-G-032
01.04	General	Absence and/or control of hazardous materials during installation, operation, maintenance, de-commissioning. At min. declaration on absence of Asbestos, PCB, radioactive material (e.g. inside ionising smoke detectors), mercury, etc.	1907/2006 REACH
02.00	Tramway Integration		
02.01	Tramway Integration	General guidance	RSC-G-008 cl 7.1.1
02.02	Tramway Integration	Alignment considerations	RSC-G-008 cl 7.1.2
02.03	Tramway Integration	Provisions for line of sight driving	Risk Assessment
02.04	Tramway Integration	Roadway intersections	RSC-G-008 cl 7.1.3
02.05	Tramway Integration	On-street and off-street tramway intersections with the road	RSC-G-008 cl 7.1.4 & 7.1.5
02.06	Tramway Integration	Shared running	Risk Assessment
02.07	Tramway Integration	Pedestrian footways and crossings (including crossing layout, crossings linked with tramway signals and crossings with signals linked to approaching trams, uncontrolled pedestrian crossings)	RSC-G-008 7.1.6, 7.1.7, 7.1.8 & 7.1.9
02.08	Tramway Integration	Cycle tracks and cycle movements	RSC-G-008 cl 7.1.10
02.09	Tramway Integration	Frontages and access requirements	RSC-G-008 cl 7.1.11
02.10	Tramway Integration	Public utilities (including ducts, chambers and cabinets)	RSC-G-008 cl 7.1.12
02.11	Tramway Integration	Changes between segregated and integrated on-street tramways and off-street tramways	RSC-G-008 cl 7.1.13
02.12	Tramway Integration	Tramway Path	RSC-G-008 7.1.14
02.13	Tramway Integration	Pedestrian zones and protection arrangements	RSC-G-008 cl 7.1.15 & 7.1.16
02.14	Tramway Integration	Access control	RSC-G-008 cl 7.3.9
02.15	Tramway Integration	Landscape works (hard and soft)	Risk assessment including visibility lines)
02.16	Tramway Integration	Boundary works	RSC-G-008-B cl 7.1.1 (7.1.1.5), 7.1.13, 7.1.14, 7.1.16 (7.1.16.2), 7.2 (clearances) Risk assessment
02.17	Tramway Integration	Public lighting	RSC-G-008-B cl 7.4.9 (lighting at tramstops) I.S. EN 13201-2:2003 - Road Lighting BS 5489-8: Road Lighting Risk assessment
03.00	Tramway Clearance		
3.01	Tramway Clearance	General guidance, including kinematic envelope and clearances between trams	Bo Strab Guidance on alignment Bo Strab Guidance on clearance RSC-G-008 cls 7.2.1, 7.2.2 and 7.2.3
3.02	Tramway Clearance	Clearances between trams and roadway features or structures	RSC-G-008 cl 7.2.4
3.03	Tramway Clearance	Clearances on roadways	RSC-G-008 cl 7.2.5
3.04	Track alignment	Evidence of available Structure Gauge	BO Strab Guidance on gauging RSC-G-008 cl 7.2
04.00	Track alignment	All values to include nominal values and tolerances.	
04.01	Track alignment	Track geometry including maximum gradients, minimum radii of horizontal and vertical curves, geometric limits of reverse curve (must be evaluated in conjunction with Structure Gauge and Guidance Function)	BO Strab Guidance on alignment RSC-G-008 cl 7.3.2
04.02	Track alignment	Nominal track gauge including tolerances	BO Strab Guidance on Guidance Function
04.03	Track alignment	Cant, Rate of change of cant. Permitted cant deficiency (plain track, switches, crossings, abrupt change of cant deficiency in switches)	BO Strab Guidance on Guidance Function BO Strab Guidance on alignment
04.04	Track alignment	Equivalent conicity - design limits (only for speeds above 60km/h)	BO Strab Guidance on Guidance Function BO Strab Guidance on alignment EN 15302
05.00	Track parameters		
05.01	Track parameters	Rail head profile for plain line	EN13674 series EN14811
05.02	Track parameters	Rail hardness	EN13674 series EN14811
05.03	Track parameters	Rail inclination (plain line)	BO Strab Guidance on Guidance Function + BO Strab Guidance on alignment. EN 15302 EN 13848-1:2003+A1:2008
05.04	Track parameters	Rail fastening systems (static longitudinal loads, dynamic loads, definition of interfaces for application)	EN 13146 series + EN 13481 series

05.05	Track parameters	Track sleepers (geometry, resistance to applied loads, permitted combinations with rail, rail inclination, rail fastening systems, permitted axle loads, permitted bending moments)	EN 13230-1 EN 13230-2 EN 13230-3 EN 13145
05.06	Track parameters	Slab track systems (geometry, resistance to applied loads, permitted combinations with rail, rail inclination, rail fastening systems, permitted axle loads, permitted bending moments)	EN 13230-1 EN 13230-2 EN 13230-3 EN 13145 RSC-G-008 cl 7.3.2
05.07	Track parameters	Drainage	RSC-G-008-B cl 7.3.1.4, 7.3.2.3, 7.3.2.4 IS EN124, EN 1433, HA 40 of the UK DMRB, Design Manual for Urban Roads and Streets (2012) (the DMURS), Building Regulations 1997 - 2013, Technical Guidance Document H: Drainage and Waste Water Disposal, NRA HD 33/06, HA 102/00 Spacing of Road Gullies, IS EN 752: Parts 1 to 7, IS EN 858: Parts 1 and 2, The Planning System and Flood Risk Management - Guidelines for Planning Authorities, November 2009, The Planning System and Flood Risk Management - Guidelines for Planning Authorities, Technical Appendices, November 2009., HA 102/00 Spacing of Road Gullies.
06.00	Switches, crossings, expansion devices, derailment devices	All values to include nominal values and tolerances.	
06.01	Switches and crossings	Tram track points in the roadway	RSC-G-008 cl 7.3.3
06.02	Switches and crossings	Geometry - design values (including Maximum unguided length of fixed obtuse crossings, rail inclination, checkrails)	BO Strab Guidance on Guidance Function + BO Strab Guidance on alignment. EN 15302:2008 EN 13232
06.03	Switches and crossings	Means of locking	Network Specific Rules + EN13232 series (part 4 in particular)
06.04	Expansion devices	Geometry - design values	BO Strab Guidance on Guidance Function + BO Strab Guidance on alignment
06.05	Derailment devices (derailers)	Geometry - design values means of locking	BO Strab Guidance on Guidance Function + BO Strab Guidance on alignment
07.00	Structures resistance to applied loads		
07.01	General requirements for any new or modified structure		
07.01.01	General requirements for any new or modified structure	Vertical loading for earthworks and earth pressure effects	EN1991 series
07.02	New bridges/viaducts over the railway or other new structures over or adjacent to track		
07.02.01	New bridges/viaducts over the railway or other new structures over or adjacent to track	Resistance of sub structure to relevant loads (vertical, nosing, traction/braking forces, resulting track twist, etc.)	EN1991 series EN1990 RSC-G-008 cl 7.3.6 & 7.3.7
07.02.02	New bridges/viaducts over the railway or other new structures over or adjacent to track	Resistance of super structure to relevant loads (vertical, nosing, traction/braking forces, resulting track twist, etc.)	EN1991 series EN1990 RSC-G-008 cl 7.3.6 & 7.3.7
07.02.03	New bridges/viaducts over the railway or other new structures over or adjacent to track	Parapet containment	EN1317 NRA BD 52
07.02.04	New bridges/viaducts over the railway or other new structures over or adjacent to track	Nominal parapet height + OCS protection	1800mm or Risk Assessment

07.02.05	New bridges/viaducts over the railway or other new structures over or adjacent to track	Safety barriers on approach and exit	EN1317 NRA TD 19
07.02.06	New bridges/viaducts over the railway or other new structures over or adjacent to track	Resistance of supports to rail vehicle impact	EN1991 series RSC-G-008 cl 7.3.7
07.02.07	New bridges/viaducts over the railway or other new structures over or adjacent to track	Provisions for maintenance	NRA DMRB BD2, sections 3.1(k), 3.3.11, 3.34; BD52 section 5, BD63 Risk Assessment
07.02.08	New bridges/viaducts over the railway or other new structures over or adjacent to track	Drainage	Culvert Design and Operation Guide (CIRIA Report C689, 2010), HA 107/04 Design of Outfall and Culvert Details, The Planning System and Flood Risk Management - Guidelines for Planning Authorities, November 2009, The Planning System and Flood Risk Management - Guidelines for Planning Authorities, Technical Appendices, November 2009.
07.03	Modification of existing bridges/viaducts or other structures over or adjacent to the track		
07.03.01	Modification of existing bridges/viaducts or other structures over or adjacent to the track	Resistance of sub structure to relevant loads (vertical, nosing, traction/braking forces, resulting track twist, derailment containment, etc.)	EN15528 EN1991 series EN1990 RSC-G-008 cl 7.3.6 & 7.3.7 Risk assessment
07.03.02	Modification of existing bridges/viaducts or other structures over or adjacent to the track	Resistance of super structure to relevant loads (vertical, nosing, traction/braking forces, resulting track twist, derailment containment, etc.)	EN15528 EN1991 series EN1990 RSC-G-008 cl 7.3.6 & 7.3.7 Risk assessment
07.03.03	Modification of existing bridges/viaducts or other structures over or adjacent to the track	Parapet containment	EN1317 NRA BD 52 Risk Assessment
07.03.04	Modification of existing bridges/viaducts or other structures over or adjacent to the track	Nominal parapet height + OCS protection	1800mm Risk Assessment
07.03.05	Modification of existing bridges/viaducts or other structures over or adjacent to the track	Safety barriers on approach and exit	EN1317 NRA TD 19
07.03.06	Modification of existing bridges/viaducts or other structures over or adjacent to the track	Resistance of supports to rail vehicle impact	EN1991 series RSC-G-008 cl 7.3.7 Risk assessment
07.03.07	Modification of existing bridges/viaducts or other structures over or adjacent to the track	Provisions for maintenance	NRA DMRB BD2, sections 3.1(k), 3.3.11, 3.34; BD52 section 5, BD63 Risk Assessment
07.03.08	Modification of existing bridges/viaducts or other structures over or adjacent to the track	Drainage	Culvert Design and Operation Guide (CIRIA Report C689, 2010), HA 107/04 Design of Outfall and Culvert Details (which is in the UK DMRB), The Planning System and Flood Risk Management - Guidelines for Planning Authorities, November 2009, The Planning System and Flood Risk Management - Guidelines for Planning Authorities, Technical Appendices, November 2009.
07.04	New bridges/viaducts or other structures under the railway		
07.04.01	New bridges/viaducts or other structures under the railway	Resistance of sub structure to relevant loads (vertical, nosing, traction/braking forces, resulting track twist, derailment containment, etc.)	RSC-G-008 7.3.5 EN1991 series EN1990
07.04.02	New bridges/viaducts or other structures under the railway	Resistance of super structure to relevant loads (vertical, nosing, traction/braking forces, resulting track twist, derailment containment, etc.)	EN1991 series EN1990

07.04.03	New bridges/viaducts or other structures under the railway	Resistance of structures, sub/super to fixtures (e.g. OCS support, signals, inspection walkway)	EN 1991 series
07.04.04	New bridges/viaducts or other structures under the railway	Derailment containment	RSC-G-008 cl 7.3.5.1 & 7.3.5.2
07.04.05	New bridges/viaducts or other structures under the railway	Provision of walkway/handrails/access	Risk Assessment
07.04.06	New bridges/viaducts or other structures under the railway	Head room for public road bridges	NRA TD 27
07.04.07	New bridges/viaducts or other structures under the railway	Requirements for maintenance	NRA DMRB BD2, sections 3.1(k), 3.3.11, 3.34; BD52 section 5, BD63 Risk Assessment
07.04.08	New bridges/viaducts or other structures under the railway	Drainage	Culvert Design and Operation Guide (CIRIA Report C689, 2010), HA 107/04 Design of Outfall and Culvert Details, The Planning System and Flood Risk Management - Guidelines for Planning Authorities, November 2009, The Planning System and Flood Risk Management - Guidelines for Planning Authorities, Technical Appendices, November 2009, NRA DMRB
07.05	Modification of existing bridges/viaducts or other structures under the railway		
07.05.01	Modification of existing bridges/viaducts or other structures under the railway	Resistance of sub structure to relevant loads (vertical, nosing, traction/braking forces, resulting track twist, etc.)	EN15528:2008 EN1991 series EN1990 RSC-G-008 cl 7.3.5 Risk assessment
07.05.02	Modification of existing bridges/viaducts or other structures under the railway	Resistance of super structure to relevant loads (vertical, nosing, traction/braking forces, resulting track twist, etc.)	EN15528:2008 EN1991 series EN1990 RSC-G-008 cl 7.3.5
07.05.03	Modification of existing bridges/viaducts or other structures under the railway	Resistance of structures, sub/super to fixtures (e.g. OCS support, signals, inspection walkway)	EN 1991 series
07.05.04	Modification of existing bridges/viaducts or other structures under the railway	Derailment containment	RSC-G-008 cl 7.3.5.1 & 7.3.5.2 Risk assessment
07.05.05	Modification of existing bridges/viaducts or other structures under the railway	Provision of walkway/handrails/access	Risk Assessment
07.05.06	Modification of existing bridges/viaducts or other structures under the railway	Head room for public road bridges	Risk Assessment
07.05.07	Modification of existing bridges/viaducts or other structures under the railway	Provisions for maintenance	NRA DMRB BD2, sections 3.1(k), 3.3.11, 3.34; BD52 section 5, BD63 Risk Assessment
07.05.08	Modification of existing bridges/viaducts or other structures under the railway	Drainage	Culvert Design and Operation Guide (CIRIA Report C689, 2010), HA 107/04 Design of Outfall and Culvert Details, The Planning System and Flood Risk Management - Guidelines for Planning Authorities, November 2009, The Planning System and Flood Risk Management - Guidelines for Planning Authorities, Technical Appendices, November 2009, NRA DMRB
07.06	Embankments/ Cuttings		
07.06.01	Embankments/ Cuttings	Resistance to vertical loading and earth pressure effects or other applied loads	EN1991 series
07.06.02	Embankments/ Cuttings	Drainage	Risk Assessment
07.06.03	Embankments/ Cuttings	Protection of track from falling material, road vehicles etc.	Risk Assessment
07.06.04	Embankments/ Cuttings	Provisions for maintenance	NRA DMRB BD2, sections 3.1(k), 3.3.11, 3.34; BD52 section 5, BD63 Risk Assessment
07.07	Retaining Walls		
07.07.01	Retaining Walls	Resistance to vertical loading and earth pressure effects or other applied loads	EN1991

07.07.02	Retaining Walls	Parapet/handrail details/vehicle containment/Protection of track from falling material, road vehicles etc.	Risk Assessment Structural design: IS EN1990, IS EN 1991, IS EN 1997 and IS EN 1992 or IS EN 1993 for concrete or steel structures respectively. Parapet and containment: NRA DMRB BD52, TD19, IS EN 1991 Part 2 and EN50122 Part 1.
07.07.03	Retaining Walls	Provisions for maintenance	NRA DMRB BD2, sections 3.1(k), 3.3.11, 3.34; BD52 section 5, BD63 Risk Assessment
07.07.04	Retaining Walls	Drainage	Risk Assessment to Eurocodes (IS EN) requirements
7.08	Tunnels and Underground structures		
07.08.01	Tunnels		Risk Assessment
07.08.02	Underground structures		Risk Assessment
07.08.03	Tunnels/Underground structures	Drainage	Risk assessment NRA DMRB, The Planning System and Flood Risk Management - Guidelines for Planning Authorities, November 2009, The Planning System and Flood Risk Management - Guidelines for Planning Authorities, Technical Appendices, November 2009.
08.00	Tramstops	Planning criteria, levels of service, provision for PRM	
08.01	Tramstops	General guidance	RSC-G-008 7.4.1 UN A/61/611
08.02	Tramstops	Tramstop location	RSC-G-008 7.1.2, 7.4.2, 7.4.3
08.03	Tramstops	Lighting at tramstops	RSC-G-008 7.4.9
08.04	Tramstops	Access to tramstops (including tactile paving)	RSC-G-008 7.4.10 UN A/61/611
08.05	Tramstops	Parking facilities for PRM	UN A/61/611
08.06	Tramstops	Transparent obstacles	Building Regulations
08.07	Tramstops	Furniture and free standing devices	Risk Assessment
08.08	Tramstops	Ticketing, Ticket Control and Customer Assistance Points	UN A/61/611
08.09	Tramstops	Visual information, Signage, Tactile Information, Audible information, Stop Passenger Information Display (PIS) System	ISO 3864
08.10	Tramstops	Spoken Information	IEC 60268-16
08.11	Tramstops	Emergency Exits, Alarms	UN A/61/611 Building Regulations
08.12	Tramstops	Escalators, lifts, travelators	EC Directives
08.13	Tramstops	Pedestrian Footways & Crossings	RSC-G-008 7.1.6
08.14	Tramstops	Fencing / Guidance of Passengers	RSC-G-008 7.1.16, 7.3.9
08.15	Tramstops	Provisions for maintenance	Risk Assessment
09.00	Platforms		
09.01	Platforms	General guidance (including platform surface, edge identification, end identification & length of platform)	RSC-G-008 - 7.4.4
09.02	Platforms	Platform height, width, clearances	RSC-G-008 - 7.4.5, 7.4.6 and 7.4.7
09.03	Platforms	Overhead clearances at platforms	RSC-G-008 - 7.4.8
09.04	Platforms	Drainage	Risk Assessment
09.05	Platforms	Provisions for maintenance	Risk Assessment
10.00	Additional requirements for steps, ramps, landings and handrails.		
10.01	Additional requirements for steps, ramps, landings and handrails.	Additional requirements for steps, ramps, landings and handrails.	Building Regulations
10.02	Additional requirements for steps, ramps, landings and handrails.	Provisions for maintenance	Risk Assessment
11.00	Control Room/RST-Depots		
11.01	Safe Working Environment	Communications	EN 50126-50129 EN 50159
11.02	Safe Working Environment	Control room(safety/security)	EN 50126-50129 EN 50159
11.03	Safe Working Environment	Staff facilities (staff areas, sanitary equipment, HSE)	Health, Safety and Welfare at Work Act Risk Assessment

11.04	Safe Working Environment	Tram cleaning (external/internal)	Health, Safety and Welfare at Work Act Risk Assessment
11.05	Safe Working Environment	Electrical safety including OCS and shore supply	Health, Safety and Welfare at Work Act Risk Assessment
11.06	Safe Working Environment	Pits and roof inspection	Health, Safety and Welfare at Work Act Risk Assessment
11.07	Safe Working Environment	Provisions for maintenance	Health, Safety and Welfare at Work Act Risk Assessment
11.08	Safe Working Environment	Ergonomics / human factors.	Health, Safety and Welfare at Work Act Risk Assessment
12.00	Performance parameters of Power Supply		
12.01	General arrangement	Design, management and safe operation of power supply	RPA Traction Power Systems Design Standard RSC-G-008 cl 7.5.5
12.02	Substations General	Design: specific requirements, permitted normal and degraded operational conditions,	EN 50126 - 50129 Risk Assessment
12.03	Substations	Medium Voltage (10 kV.) Switchgear	IEC60298 MV Sw.Gear IEC60056 MV Sw.Gear
12.04	Substations	Medium Voltage Traction Transformer	BSEN/IEC60076 Power Trafos BS 171 Power Trafos
12.05	Substations	Medium Voltage to LV Transformer	BSEN/IEC60076 Power Trafos BS 171 Power Trafos
12.06	Substations	Traction Rectifier	BSEN/IEC60146 SemiCond. Conv.
12.07	Substations	DC Switchgear	EN 50123
12.08	Substations	Low Voltage Switchgear and Equipment	IEC60364 LV Elec. Inst. ET 101 Wiring Regs.
12.09	Substations	Substation SCADA Equipment	BSEN 60870
12.10	Substations	MV and LV Cables	IEC60502 MV Power Cables IEC60287 Cable Current Ratings ET 101 Wiring Regs.
12.11	Substations	Building Services	Chartered Institute of Building Services Engineers (CIBSE) Codes
12.12	Substations	Substation 48 V. DC System	IEC 60623 NiCad Batteries EN 60146 Battery Chargers
12.13	Substations	Substation UPS System	EN 50091
12.14	Substations	Substation Earthing and Bonding	EN 50122-1 ET 101 IEEE 80 Substation Grounding BSEN 7430 COP for Earthing
12.15	Substations	Substation Stray Current	EN 50122-2
12.16	Substations	Electromagnetic Compatibility of Substation	EN 50121 EMC EN 61000 EMC
12.17	Substations	Nominal values and permitted limits of the current at the terminals of a substation and at any pantograph contact point supplied from that substation	EN 50388 Risk Assessment
12.18	Substations	Electrical protection coordination (incl. performance of automatic circuit breakers (immediate limits for over/under voltage, max. instantaneous voltage change over time, thermal limits, immediate limits for over current, max. instantaneous current change over time, lightning surge arrestors, protection of autotransformer systems, etc.)	EN 50388 EN 50367 Risk Assessment
12.19	Substations	Harmonic emissions towards the power utility and for DC systems	ESB Distribution Code 2007
12.20	Voltage and Frequency	Nominal values and permitted limits of the voltage and frequency at the terminals of a substation and at any pantograph contact point supplied from that substation. Calculated mean useful voltage at pantograph contact point.	EN 50163
12.21	Current	Max. permitted current/single pantograph standstill or moving	EN 50367 EN50119
12.22	Current	<i>Parameter not in use.</i>	<i>Parameter not in use.</i>
12.23	Stray Current protection/Touch Potentials	Stray current protection to railway equipment and any other parties	EN 50122 RSC-G-008 cl 7.5.8, 7.5.9 and 7.5.10
12.24	Tunnel Installation	Continuity of power supply in case of disturbances in tunnels (sectioning)	Risk Assessment
12.25	Regenerative braking	Regenerative braking concept for DC systems (including substations and their feed, power storage devices, etc.)	Risk Assessment
12.26	Harmonics	Harmonics and dynamic effects for DC/AC systems, power factor	EN 50121 Risk assessment
12.27	Adjacent Structures	Electrical protection, bonding of adjacent conducting structures	EN 50122-1 EN 50163 EN 50119 Risk Assessment
13	Signalling		
13.01	Signalling System		
13.01.01	Operational modes	Normal operational modes (normal, reverse direction, permitted degraded, back up)	Risk Assessment Operator SMS RSC-G-008 cl 7.6.1, 7.6.2 & 7.6.7
13.01.02	Operational modes	Concept for remote operation/ control	Risk Assessment Operator SMS RSC-G-008 cl 7.6.1, 7.6.2 & 7.6.7

13.01.03	Operational modes	Track layout, line speeds, gradients, points, road junctions	Risk Assessment Operator SMS RSC-G-008 cl 7.6.1, 7.6.2, 7.6.7, 7.6.10.2 & 7.6.10.3
13.01.04	General	Lineside signals (location, spacing, co-location, avoidance of reading-through), route indicators, sign/board, type/ positions	Operator SMS RSC-G-008 cl 7.6.4
13.01.05	General	<i>Parameter not in use.</i>	<i>Parameter not in use.</i>
13.01.06	General	Tram detection equipment, type/ positions	Operator SMS RSC-G-008 7.6.5 RPA Signalling Design Standard PSD-PS-005 section 4.4.2
13.01.07	General	Local data communication links (electrical/ mechanical) between interlockings(vehicle and interlocking, vehicle and RTC, signalling controls, and points, signals, counters, tram detection etc.	EN 50126 EN 50128 EN 50129 EN 50159
13.01.08	General	Long range data communication links (electrical/ radio) between interlockings, signalling controls, CTC, (e.g. time signal, tram ID, route setting, CCTV, SCADA)	EN 50126 EN 50128 EN 50129 EN 50159
13.01.09	General	Voice communication links (cable/ radio) between line side phones, signalling controls, CTC, emergency communication	EN 50126 EN 50128 EN 50129 EN 50159
13.01.10	Structural	EN 1991 series	EN 1991 series
13.01.11	Structural	Risk Assessment Operator SMS	Risk Assessment Operator SMS
13.01.12	Interlocking	Table of permitted routes/paths, block margins/overlaps, wrongside working, speed limits, interlocking type and requirements and permitted normal/permitted degraded operational conditions (e.g. normal operations, shunting), Specific Interlocking Application Data, control table requirements, road traffic controller requirements.	EN 50126 EN 50128 EN 50129 EN 50159
13.01.13	Interlocking	Interface specification (functional/physical/logical): user interface, remote control, data transmission, power supplies, control & display systems, other interlocking systems, trackside signalling equipment, other equipment, etc.	EN 50126 EN 50128 EN 50129 EN 50159
13.01.14	Interlocking	Signalling controls, interlocking facilities, type/position, road traffic controller	EN 50126 EN 50128 EN 50129 EN 50159
13.01.15	Interlocking	Data recording concept	EN 50126 EN 50128 EN 50129 EN 50159 Risk Assessment
13.01.16	Tram ID and routing management system	Specific requirements, tram ID management system (permitted normal and degraded operational conditions, interface spec. (functional/physical/logical): to data generation, interlocking, data transmission, power supplies, local and remote control & display systems, other equipment	EN 50126 EN 50128 EN 50129 EN 50159 Risk Assessment Operator SMS
13.01.17	Tram detection	Specific requirements, type of detection system (detection loops, axle counters, etc.) (e.g. including impedance bonding))	EN 50126 EN 50128 EN 50129 EN 50159 RSC-G-008 cl 7.6.5
13.01.18	Tram detection	Permitted normal and degraded operational conditions (e.g. degraded operation concept, emergency& engineering controls)	EN 50126 EN 50128 EN 50129 EN 50159 RSC-G-008 cl 7.6.5
13.01.19	Tram detection	Interface spec. (functional/physical/logical): to interlocking, data transmission, power supplies, local and remote control & display systems, other equipment	EN 50126 EN 50128 EN 50129 EN 50159 RSC-G-008 cl 7.6.5
13.01.20	Tram detection	Specific interface requirements to rolling stock (wheel to wheel continuity, axle load, minimum metal masses, sanding, magnetic track brakes, wheel impedance, metal free space around wheels, wheel geometry, vehicle geometry, position of first/ last /intermediate wheelsets in train, requirements on wheel diameters etc.)	EN 50126 EN 50128 EN 50129 EN 50159 RSC-G-008 cl 7.6.5
13.02	Tram Protection System		
13.02.01	ATP System	Specific requirements, type of signalling system	EN 50126 EN 50128 EN 50129 EN 50159
13.02.02	ATP System	Permitted normal and degraded operational conditions (e.g. degraded operation concept, emergency& engineering controls)	EN 50126 EN 50128 EN 50129 EN 50159
13.02.03	ATP System	Interface spec.(functional/physical/logical), e.g. to interlocking, braking rates, block length/ overlap, data transmission, power supplies, local control & display systems, other equipment	EN 50126 EN 50128 EN 50129 EN 50159
13.02.04	Overspeed detection	Type of detection system - permitted normal and degraded operational conditions (e.g. degraded operation concept, emergency& engineering controls)	EN 50126 EN 50128 EN 50129 EN 50159 Risk Assessment

13.02.05	Overspeed detection	Interface spec.(functional/physical/logical): to interlocking, data transmission, power supplies, local control & display systems, other equipment	EN 50126 EN 50128 EN 50129 EN 50159 Risk Assessment
13.02.06	Overspeed detection	Interface spec.(functional/physical/logical), e.g. to interlocking, data transmission, power supplies, local control & display systems, to tram detection, other equipment	EN 50126 EN 50128 EN 50129 EN 50159 Risk Assessment
13.02.07	Variable aspect signals	Specific requirements, type of signal	EN 12368 EN 50126 EN 50128 EN 50129 EN 50159 Road Traffic Legislation Traffic Signs Manual RSC-G-008 cl 7.6.8 Operator SMS
13.02.08	Variable aspect signals	Permitted normal and degraded operational conditions (e.g. remotely controlled, local setting, route indicator, degraded operation concept, emergency& engineering controls)	EN 50126 EN 50128 EN 50129 EN 50159 Road Traffic Legislation Operator SMS
13.02.09	Variable aspect signals	Interface spec.(functional/physical/logical): to interlocking, data transmission, power supplies, local control & display systems, other equipment	EN 50126 EN 50128 EN 50129 EN 50159 Road Traffic Legislation Traffic Signs Manual Operator SMS
13.02.10	Fixed aspect signals	Specific requirements, type of signal/fouling point marker/catenary signs (retroreflective properties, design, size, etc.),	EN 50126 EN 50128 EN 50129 EN 50159 Road Traffic Legislation Traffic Signs Manual RSC-G-008 cl 7.6.10.1 Operator SMS
13.03	Point equipment - motorised/spring/manual (point machine, detection, heating, etc.)		
13.03.01	Point equipment	Specific requirements, type of point equipment (actuator, locking, detection, heater, etc.)	EN 50126 EN 50128 EN 50129 EN 50159 Operator SMS
13.03.02	Point equipment	Permitted normal and degraded operational conditions (e.g. remotely controlled, local setting, emergency and engineering controls, point securing, position indication, degraded operation concept, emergency& engineering controls)	EN 50126 EN 50128 EN 50129 EN 50159 RSC-G-008 cl 7.6.6 Operator SMS
13.03.03	Point equipment	Interface spec.: remote control, data transmission, power supplies, control & display systems, interlocking systems, other equipment	EN 50126 EN 50128 EN 50129 EN 50159 Operator SMS
13.04	Control of Tram Signals		
13.04.01	General	Interface with road traffic controller, interlocking, point detection	EN 50126 EN 50128 EN 50129 EN 50159 RSC-G-008 cl 7.6.11 & 7.6.19.1
13.05	Signalised Road and Pedestrian Crossings		
13.05.01	Signalised Road and Pedestrian Crossings	Specific requirements, type of crossing, speed limits, interlocking/RT controller requirements and permitted (normal) operational conditions (e.g. normal operations, CCTV surveillance, automatic working)	EN 12368 EN 50126 EN 50128 EN 50129 EN 50159 Risk Assessment Operator SMS RSC-G-008 cl 7.6.2, 7.6.8, 7.6.9,7.6.11.9, 7.6.14, 7.6.15, 7.6.16, 7.6.17, 7.6.18, 7.6.19, 7.6.20, 7.6.21, 7.6.22 & 7.6.23
13.05.02	Signalised Road and Pedestrian Crossings	Permitted degraded operational conditions (e.g. degraded operation concept, emergency& engineering controls)	EN 12368 EN 50126 EN 50128 EN 50129 EN 50159 Risk Assessment Operator SMS RSC-G-008 cl 7.6.2, 7.6.8, 7.6.9,7.6.11.9, 7.6.14, 7.6.15, 7.6.16, 7.6.17, 7.6.18, 7.6.19, 7.6.20, 7.6.21, 7.6.22 & 7.6.23

13.05.03	Signalised Road and Pedestrian Crossings	Interface spec.: remote control, data transmission, power supplies, control & display systems, interlocking systems/RT controller, external roadside and trackside signalling equipment, other equipment	EN 12368 EN 50126 EN 50128 EN 50129 EN 50159 Risk Assessment Operator SMS RSC-G-008 cl 7.6.2, 7.6.8, 7.6.9,7.6.11.9, 7.6.14, 7.6.15, 7.6.16, 7.6.17, 7.6.18, 7.6.19, 7.6.20, 7.6.21, 7.6.22 & 7.6.23
13.05.04	Signalised Road and Pedestrian Crossings	Positioning of associated equipment (road signals , track signals , traffic signs and road markings, track side boards, equipment housing, etc.)	Road Traffic Legislation Risk Assessment Operator SMS RSC-G-008 cl 7.6.2, 7.6.8, 7.6.9, 7.6.11.9, 7.6.14, 7.6.15, 7.6.16, 7.6.17, 7.6.18, 7.6.19, 7.6.20, 7.6.21, 7.6.22 & 7.6.23
14.00	OCS		
14.01	General performance	Maximum speed permitted for OCS, generic types of electric trams permitted to operate, max permitted power demand of trams at pantograph inside one section	Risk Assessment
14.02	General	OCS on the street	RSC-G-008 cl 7.5.2, 7.5.3
14.03	OCS height/lateral deviation	Nominal height (min. /max.), permitted tolerances (design min, absolute min., design max., absolute max.) (considering sag, creep, ice loading, uplift, etc.) Max permitted lateral deviation from centre line (under cross wind, curves, track tolerances, pantograph movement, etc.) OCS clearances	EN 50121-1 EN 50122 EN 50119 RSC-G-008 cl 7.5.12 Clearance requirements Risk Assessment
14.04	OCS gauge	Contact line gauge, Pantograph gauge and air isolation distance element within INF gauge	EN 50119
14.05	Current collection	Mean contact force. Dynamic behaviour and quality of current collection	EN 50317 EN 50318 EN 50119 EN 50367
14.06	Current collection	Pantograph spacing (min. spacing between adjacent raised pantograph.) Max no of permitted pantographs per tram	Risk Assessment
14.07	Contact wire	Contact wire material, cross-section, permitted pantograph contact strip material (AC/DC)	EN 50149:2001
14.08	Feeder lines	Feeder, negative feeder, primary feeders parallel to the railway, material, cross-section, etc.	BS 5467
14.09	Line crossings	Electric protection concept of line crossings (OCS, national grid, telecoms, etc.)	EN 50122-1 ESB Code of Practice for Avoiding Danger from Overhead Electricity Lines HSA COP for Avoiding Danger from Underground Services Other Utility Specific Requirements Risk Assessment
14.10	Road crossings	Electric protection concept of road crossings (signage, goal frames, etc.)	EN 50119 Risk assessment
14.11	Switch gear for OCS	Local and remote switching (incl. SCADA, etc.)	EN 50126 EN 50128 EN 50129 EN 50159
14.12	Mechanical properties of mast systems	Mast systems, cantilevers, OCS support systems (standardised solutions, specific solutions, foundations/fixing to structures, drainage, etc.)	EN 1990 EN 1991 series
14.13	Mechanical properties of OCS	Outriggers and Catenary systems (incl. isolators, carrying wire, suspension wires, fittings, clamps, outrigger hinges, over-head rails, feeders, jumpers, equipment mounted on OCS structures, etc.)	EN 1990 EN 1991 series RA
14.14	Mounted electrical equipment	Equipment mounted on OCS poles or other structures	EN 50119 EN 50163 ET 101
15.00	Return Current System		
15.01	Return current conductor	Return conductors, bonding, earthing, impedance bonding, material, mechanical protection, etc.	EN 50121 EN 50122-1 EN 50163 RSC-G-008 cl 7.5.10 ET101, EN 50119 EN50163
16.00	Phase and System Separations		
16.01	Phase/system separations	Local and remote control/ status detection functions. Switchgear of system separation sections (to allow re-start of trams)	EN 50367 Ann.A1 EN 50388 EN 50126-1 EN 50128 EN 50129 EN 50159 EN 50119
16.02	System separations	Geometry and general design concept of system separation sections	EN 50119 EN 50122 Risk assessment
17.00	Central Control		
17.01	Central Control	Central control facilities	EN 50126 EN 50128 EN 50129 EN 50159 RSC-G-008 cl 7.5.7
17.02	Central Control	Video monitoring system	RSC-G-008 cl 7.6.12 & 7.6.13. RPA Communication & Control Systems Design Standard PSD-PS-0006 section 1.13

17.03	Central Control	Radio Transmission	RSC-G-008-B cl 7.6.13. RPA Communication & Control Systems Design Standard PSD-PS-0006 section 1.19
17.04	Central Control	Telephone system	RSC-G-008 cl 7.6.12.3. RPA Communication & Control Systems Design Standard PSD-PS-0006 section 1.11
17.05	Central Control	Emergency Help Points	RPA Communication & Control Systems Design Standard PSD-PS-0006 section 1.11
17.06	Central Control	Visual display, communication systems	RSC-G-008 cl 7.6.12 & 7.6.13. RPA Communication & Control Systems Design Standard PSD-PS-0006 section 1.13
18.00	Data recording equipment		
18.01	Data recording	Specific requirements, type of equipment (normal) permitted normal and degraded operational conditions, positioning of associated equipment, information/signals/frequency to be recorded. Interface spec: remote control, data transmission, power supplies, control/display/read-out systems, other equipment	EN 50126 EN 50128 EN 50129 EN 50159
19.00	Additional requirements for protection of systems		
19.01	Protection of systems	Environmental factors	BS EN 60529 IP Ratings Risk Assessment
19.02	Protection of systems	Mechanical enclosure, tamper / vandalism protection / Road vehicle containment	BS EN 60529 IP Ratings Risk Assessment
19.03	Protection of systems	Locking arrangement and access management to safety related equipment Appropriate tamper protection for all parameters (including mechanical enclosure, locking arrangements, access management, intrusion detection, CCTV, etc.)	Risk Assessment
19.04	Protection of systems	CCTV, intrusion detection	Risk Assessment
20.00	Additional Electrical/ Electromagnetic Safety		
20.01	EMC (Emissions and Susceptibility)	Compatibility with operating environment - rolling stock, signalling and telecommunication system equipment and other railways, specific requirements for special locations, evaluation to include credible fault conditions, susceptibility and radiation, (incl. EMC plan). Shielding from electromagnetic radiation	EMC Directives (89/336/EC, 2004/108/EC) EN 50121 series EN 50119 EN 50163 ET 101
20.02	Electrical/ Electromagnetic Safety	Electrical safety (e.g. touch potential, protection of electric equipment/ cabling against damage, isolation coordination, cable sizing, circuit protection, RCD, repercussions into safety critical equipment, etc.)	EN 50122-1 EN 50163 ET 101 Risk assessment
20.03	Electrical/ Electromagnetic Safety	Bonding, earthing concept (incl. lightning protection and earthing of equipment near OCS equipment)	EN 50122-1 EN 50163 ET 101 Risk assessment
21.00	Fire protection, detection, suppression, safe degradation		
21.01	General concept	Overall fire performance evaluation, concept of fire barriers and concept of evacuation (e.g. Emergency Plan)	Building Regulations Risk Assessment
21.02	Fire detection & suppression	Fixed fire detection & suppression equipment	Building Regulations Risk Assessment
21.03	Fire detection & suppression	Portable fire-fighting equipment	Building Regulations Risk Assessment
21.04	Specification, application conditions	Specific requirements, type of telecommunication system and permitted (normal) operational conditions (e.g. Telephone, Radio, Fax, data-transmission)	EN 50126 EN 50128 EN 50129 EN 50159 Risk assessment
21.05	Fire and evacuation	Fire performance and evacuation concept (incl. material properties, detection, suppression, safe degradation of safety critical equipment, portable fire fighting equipment, etc.)	Building Regulations Risk Assessment
22.00	Health, Safety and Environment		
22.01	Health, Safety and Environment	Protection of workers from aerodynamic effects, tram movements	Health, Safety, Welfare at work Act 2005, General Application Regulations 2007, Construction Regs 2013
22.02	Health, Safety and Environment	Noise and vibration suppression	Environmental Impact Statement Risk Assessment
22.03	Health, Safety and Environment	Protection against electric shock	EN 50122-1 EN 50153 ET 101
22.04	Health, Safety and Environment	Lineside walkways, positions of safety, access and egress, signage	Risk assessment
22.05	Environmental factors	Environmental factors and related protection for all parameters (including drainage and ventilation)	Risk assessment
23.00	Maintenance Requirements		
23.01	General requirements	All maintenance limits must be co-ordinated with other subsystem requirements.	Risk Assessment

23.02	Safety Critical Maintenance	Concept on scope, intervals, maintenance records, tools, training	Risk Assessment
23.03	Traceability of Safety Critical Components, Configuration Management	Component identifiers (unique ID, type, version, origin)	Risk Assessment
23.04	Traceability of SW Components	Software identifiers (unique ID, type, version, origin)	Risk Assessment
24.00	Provisions during construction work		
24.01	Provisions during construction work	Health and safety at worksite	Health, Safety, Welfare at work Act 2005, General Application Regulations 2007, Construction Regs 2013 Risk Assessment
24.02	Provisions during construction work	Protection of passengers/ members of the public / running rail traffic/ other parties during execution of work	Health, Safety, Welfare at work Act 2005, General Application Regulations 2007, Construction Regs 2013 Risk Assessment
24.03	Provisions during construction work	Protection of environment	Health, Safety, Welfare at work Act 2005, General Application Regulations 2007, Construction Regs 2013 Risk Assessment
24.04	Provisions during construction work	Temporary Works Design (Structural evaluation of scaffolding or any non-permanent structural works or earthworks during construction)	Health, Safety, Welfare at work Act 2005, General Application Regulations 2007, Construction Regs 2013 Risk Assessment
24.05	Provisions during construction work	Specific operating rules update during planned work	Health, Safety, Welfare at work Act 2005, General Application Regulations 2007, Construction Regs 2013 Risk Assessment
24.06	Provisions during construction work	Roadworks	Health, Safety, Welfare at work Act 2005, General Application Regulations 2007, Construction Regs 2013 Risk Assessment
24.07	Provisions during construction work	Drainage	Health, Safety, Welfare at work Act 2005, General Application Regulations 2007, Construction Regs 2013 Risk Assessment
24.08	Provisions during construction work	Demolition of structures	Health, Safety, Welfare at work Act 2005, General Application Regulations 2007, Construction Regs 2013 Risk Assessment
25	Provisions for operation		
25.01	Provisions for operation	Foul point markers	Risk Assessment
25.02	Provisions for operation	Operating rules / specific training requirements for normal operations + degraded operations + emergency operations	Operator SMS