Memo

To:		
From:		Email:
Date:		Phone:
Ref:	DP-04-23-TEN-EL-TTA-65461	cc:
Subject:	Assessment of bridges with limited clearance (Zone 7)	

1. Purpose

TTA has undertaken an initial OHLE assessment of 15 overline structures on the Kildare line; these being a mix of overbridges and station buildings. The purpose of the assessment is to determine – as far as possible at this stage – whether an OHLE solution is possible without structural or track intervention.

This assessment is based on the table of vertical clearances from the Design Statement Report issued 01.09.2020. This data was taken from the ITT documents supplied by Irish Rail. To date no survey data has been received for these bridges, and so the clearance assessment in this memo cannot be regarded as definitive.

It should also be noted that 4 bridges (OBC 10A, OBC 13A, OBC 20E and OBC 24) are listed as unknown clearance. Without this information, it is not possible to complete an OHLE assessment for these bridges.

The options assessed in the current document include track lowering, OHLE solutions with contact wire height of 4.7m, contact wire height of 4.4m, a reduced contact wire height of 4.2m, and special OHLE solutions.

2. Assessment

2.1. Methodology

A Bridge Hierarchy and Calculation Model has been developed using the OHLE parameters provided by Irish Rail. For the small number of parameters not provided by Irish Rail, TTA has used an assumption based on our experiences from previous projects, and these have previously been provided to Irish Rail.

The TTA model specifies soffit and clearance bands based on ICD response DP-04-23-REF-DM-IE-1081-v01.5 M-K:0042, for 1500V DC clearances and using vehicle gauges IRL2/2a. These have been used for all structures. According to TQ response TQ0152: for overbridges with limited clearance,

requirements for 25kV and taller IRL1 vehicle gauge should not be considered, as these apply only to new bridge construction. The existing clearance hierarchy will be used in this report to assess the clearance even for re-construction bridge.

The Model is only valid for flat deck bridges; for arch bridges and tunnels, our assessment is an estimate and will be confirmed once a pantograph gauging analysis is completed. To permit the assessment to proceed in advance of this work, spot soffit height measurements have been taken vertically over each rail, and these have been used to estimate the available clearance. The imposes a limitation on our assessment since the pantograph envelope extends beyond the rails.

After categorisation, TTA have analysed the potential solution for the 15 structures on the Northern Branch Line, classifying them into four categories:

Colour	Description
	Potential OHLE solution with contact wire height of 4.7m
	Potential OHLE solution with contact wire height of 4.4m
	Potential OHLE solution with contact wire height of 4.2m
	Potential OHLE solution with nominal 100mm track lower
	no OLE solution possible

2.2. Input Information

The assessment is based on the following information:

- DART Expansion Project – Kildare Line Design statement report table 5-12
- Bridge Photos;
- Atkins overbridge clearance calculator (see end of memo).

3. Assessment Findings

3.1. OBC 8B

This is a ~4m narrow flat deck footbridge with 5.06m minimum height. A fitted OHLE solution to the bridge is not possible due to the width of the bridge. Based on the current soffit height, minimum normal clearance can be achieved only with a fitted solution with 4.4m contact wire height. With a special OHLE solution of placing the bridge arms outside the bridge, it is possible to reduce the OHLE construction depth from 200mm to 15mm. No structural or track intervention is required.

3.2. OBC 9B

This is a flat deck bridge with 5.12m minimum soffit height. The bridge is positioned on top of Park West & Cherry Orchard Station. The length of the bridge and station building along the track is around 80m, and so fitment of OHLE to the bridge is unavoidable.

For an OHLE solution with a 4.4m contact wire height, the proposed arrangement will be a small cantilever fitted underneath the bridge and station building with small system height. No structural or track intervention is required.

3.3. OBC 10A

This is a flat deck soffit bridge carrying the motorway over the railway. However there is no data available for this bridge, so an OHLE assessment cannot be completed for this bridge.

3.4. OBC 11

This is a flat deck soffit bridge with a minimum soffit height of 5.04m. Therefore Minimum Normal Clearance can be achieved with a 4.4m contact wire height, bridge arm fitted to the bridge and 100mm droppers. No structural or track intervention is required.

3.5. OBC 13

This is a flat deck soffit bridge with a minimum soffit height of 4.89m. Therefore Special Reduced Clearance can be achieved with a 4.4m contact wire height, bridge arm fitted to the bridge and 100mm droppers. No structural or track intervention is required.

3.6. OBC 13A

This is a flat deck bridge with unknown minimum soffit height. The bridge is position between two station buildings at Clondalkin/Fonthill Station. The length of the bridge and station building along the track is around 95m, and so fitment of OHLE to the bridge is unavoidable.

There is no data available for this bridge, so an OHLE assessment cannot be completed. There are two measurements for the station buildings, indicating a vertical clearance of 5.14m, but without any indication that the bridge shares the same clearance as the station building.

3.7. OBC 14C

This is a flat deck bridge with 5.11m minimum soffit height. The bridge is positioned adjacent to the station building at Kishogue station. The length of the bridge and station building along the track is around 66m, and so fitment of OHLE to the bridge is unavoidable.

For an OHLE solution with a 4.4m contact wire height, the proposed arrangement will be a small cantilever fitted underneath the bridge and station building with small system height. No structural or track intervention is required.

3.8. OBC 16A

This is a ~7m narrow flat deck footbridge with 5.29m minimum height. Based on the current soffit height, minimum normal clearance can be achieved with a free running solution with 4.7m contact wire height. No structural or track intervention is required.

3.9. OBC 19

This is a flat deck soffit bridge with a minimum soffit height of 4.88m. Therefore Special Reduced Clearance can be achieved with a 4.4m contact wire height, bridge arm fitted to the bridge and 100mm droppers. No structural or track intervention is required.

3.10. OBC 20E

There is no data available for this bridge, so an OHLE assessment cannot be completed.

3.11. OBC 21

This is a flat deck soffit bridge with a minimum soffit height of 4.86m. Therefore Special Reduced Clearance can be achieved with a 4.4m contact wire height, bridge arm fitted to the bridge and 100mm droppers. No structural or track intervention is required.

3.12. OBC 23B

This is a ~5m narrow flat deck footbridge with 5.11m minimum height. A fitted OHLE solution to the bridge is not possible due to the width of the bridge. Based on the current soffit height, minimum normal clearance can be achieved only with a fitted solution with 4.4m contact wire height. With a special OHLE solution of placing the bridge arms outside the bridge, it is possible to reduce the OHLE construction depth from 200mm to 15mm. No structural or track intervention is required.

3.13. OBC 24

This bridge spans the two tracks which will remain non-electrified. No OHLE assessment is required for this bridge.

3.14. OBC 24A & OBC 25

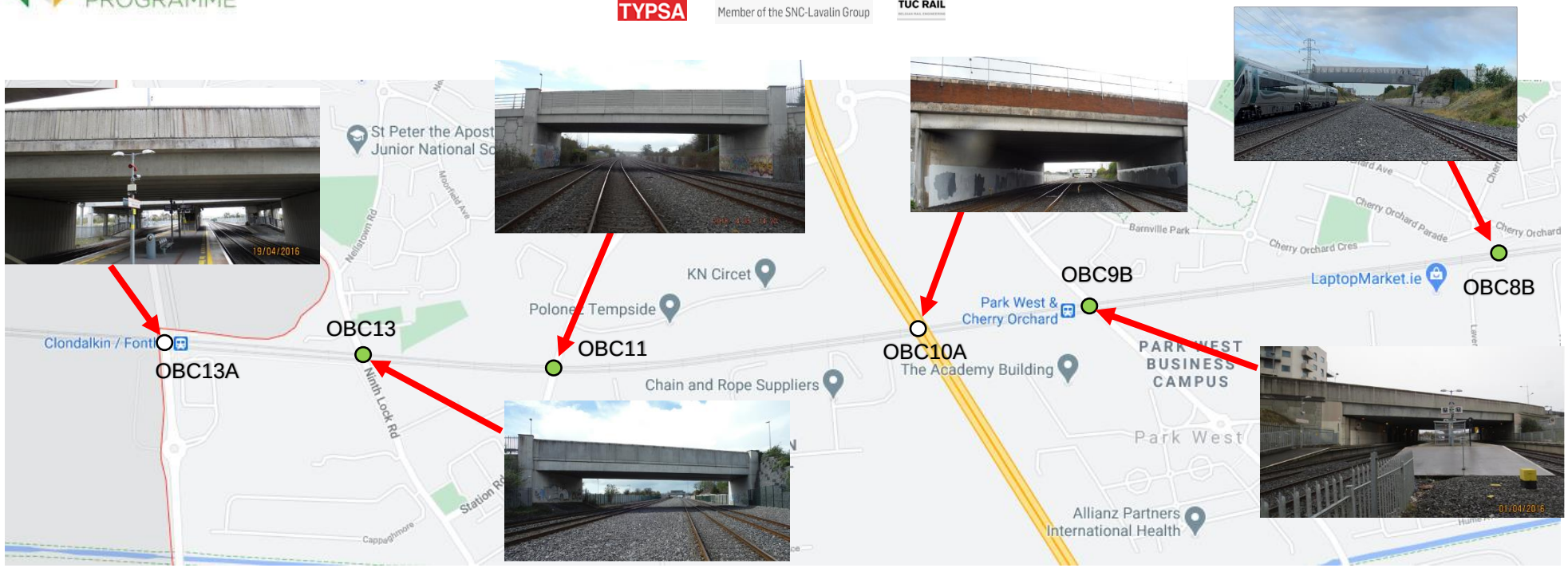
These two structures have been considered together due to their proximity.

OBC 24A is a flat deck footbridge with 5.47m minimum height. Therefore Minimum Normal Clearance can be achieved with a 4.7m contact wire height, and no structural or track intervention is required.

OBC 25 is a flat deck soffit bridge with a minimum soffit height of 5.01m. Therefore Minimum Normal Clearance can be achieved with a 4.4m contact wire height, bridge arm fitted to the bridge and 100mm droppers. No structural or track intervention is required.

Structure No	Name	Bridge Type	Soffit Height Assumption	OHLE Proposal underneath bridge	Conductive assembly	Clearance check	Band	Options
OBC 8B	Footbridge Cherry Orchard	Flat	5.069	Fitted bridge arm adjacent to the bridge	yes	Pass Band 6b	6b	Special OHLE solution, no action required
OBC9B	Parkwest Avenue Road Bridge	Flat with station building	5.126	Multiple fitted with cantilever	yes	Pass Band 6b	6b	Special OHLE solution, no action required
OBC10A	M50 Motorway Bridge	Flat	Unknown	Unknown	Unknown	Unknown		Waiting for soffit survey
OBC11	Station Road Bridge	Flat	5.046	Fitted bridge arm	yes	Pass Band 6b	6b	No action required
OBC13	Ninth Lock Road Bridge	Flat	4.897	Fitted bridge arm	yes	Pass Band 7	7	No action required
OBC13A	Nangor Road Bridge	Flat with station building	Unknown	Unknown	Unknown	Unknown		Waiting for soffit survey
OBC14C	Kishoge Road Bridge	Flat with station building	5.115	Multiple fitted with cantilever	yes	Pass Band 6b	6b	Special OHLE solution, no action required
OBC16A	Adamstown Footbridge	Flat	5.299	Free Running	no	Pass Band 2	2	No action required
OBC19	Road R120 near Finnstown	Flat	4.885	Multiple fitted bridge arm	yes	Pass Band 7	7	No action required

OBC20E	Crowley's Road Bridge	Flat	Unknown	Unknown	Unknown	Unknown		Waiting for soffit survey
OBC21	Stacummy Road Bridge	Flat	4.862	Fitted bridge arm	yes	Pass Band 7	7	No action required
OBC23B	New Footbridge STRALEEK	Flat	5.115	Fitted bridge arm adjacent to the bridge	yes	Pass Band 6b	6b	Special OHLE solution, no action required
OBC24	Hazelhatch Footbridge - Protected	Arch	Unknown	Not required		Not required		Non-electrify route, no OHLE solution required.
OBC24A	New Hazelhatch Footbridge	Flat	5.474	Free Running	no	Pass Band 1	1	No action required
OBC25	Hazelhatch R405 Road Bridge	Flat	5.014	Multiple fitted bridge arm	yes	Pass Band 6b	6b	No action required


19/04/2016
St Peter the Apost
Junior National Sc
Nellstown Rd
Moorfield Ave
KN Circet
Polonez Tempside
Clondalkin / Fonth
OBC13A
OBC13
Ninth Lock Rd
OBC11
Chain and Rope Suppliers
Station Rd
Cappaghmore
OBC10A
The Academy Building
Barnville Park
Cherry Orchard Cres
Cherry Orchard Parade
Park West &
Cherry Orchard
OBC9B
LaptopMarket.ie
OBC8B
PARK WEST
BUSINESS
CAMPUS
Park West
Allianz Partners
International Health
01/04/2016


OBC20E
OBC19
OBC16A
OBC14C
OBC21
OBC23B
OBC24
OBC24A
OBC25
COUNTY KILDARE
COUNTY DUBLIN
R120
R136
OLDCASTLEPA

Kildare Overbridge Hierarchy and Height Calculator

Atkins Band	IE Band	Type of Bridge	OLE Configuration	Electrical Clearance Category	System Height	Flat or Graded	Free or Fitted	Compromises	Situation	Typical Minimum Soffit Height (see notes)	Track level tolerance (TTL)	Track Maintenance Lift Allowance	Survey Tolerance (T_{su})	Vehicle Load Gauge (G_v)	Vehicle Bounce (B_v)	Track Profile Effect ($P_{...}$)	Passing electrical clearance to train	(S_{nce}) (see note 4)	Natural Sag (S_{ol})	Min design contact wire height	Actual design contact wire height (see note	OLE tolerance (TOC S) E100	Construction Depth (CD) OR System Height (SH) at	Design uplift (UCW) (see note 2) EB2-84	Catenary uplift (U_{CAT}) - %age of contact wire uplift	Passing electrical clearance to bridge	Static electrical clearance to bridge (C_{STATIC})	Catenary Rise Allowance (see note 3)	Conductive Assy Allowance (CAA)	Bridge Construction Tolerance
0	1F	All	Free running catenary, nominal contact wire height, no gradients, standard system height, standard droppers, Minimum Normal insulation, full TMLA, low track fixity	Minimum Normal	Standard	Flat	Free	Ideal position: standard contact wre height, standard system height, 500mm minimum dropper, normal electrical clearances		**≥ 5525**	25	75	5	4064	25	10	100	99	50	*4500?*	**4700**	50	500	110	100%	100	150	65	0	0
1	2F	All	Free running catenary, nominal contact wire height, no gradients, reduced system height, reduce dropper to 300mm, Minimum Normal insulation, full TMLA, low track fixity	Minimum Normal	Reduced with 300mm dropper	Flat	Free	Maintain contact height of 4700mm. Reduce system height to 600mm, Reduce minimum dropper length to 300mm. Maintain normal electrical clearances.		**≥ 5325**	25	75	5	4064	25	10	100	99	50	*4500?*	**4700**	50	300	110	100%	100	150	65	0	0
2	3F	All	Free running catenary, nominal contact wire height, no gradients, reduced system height, reduced dropper to 100mm, Minimum Normal insulation, full TMLA, low track fixity	Minimum Normal	Reduced with 100mm dropper	Flat	Free	Maintain contact height of 4700mm. Reduce system height to 600mm, reduce minimum dropper length to 100mm. Maintain normal electrical clearances.		**≥ 5125**	25	75	5	4064	25	10	100	99	50	*4500?*	**4700**	50	100	110	100%	100	150	65	0	0
3a	4F	Steel	Fitted contenary, nominal contact wire height, no gradients, zero system height,	Minimum Normal	Reduced with std droppers	Flat	Fitted	Maintain contact height. Replace catenary with contenary. Using Bridge/elastic arms and 0 system height.		**≥ 5185**	25	50	5	4064	25	10	100	99	0	*4428*	**4700**	50	200	70	100%	100	150	65	0	0
3b		Concrete	Minimum Normal insulation, full TMLA, low track fixity		Reduced with std droppers	Flat	Fitted	Maintain contact height. Replace catenary with contenary. Using Bridge/elastic arms and 0 system height.. Add conductive assembly.		**≥ 5230**	25	50	5	4064	25	10	100	99	0	*4428*	**4700**	50	200	70	100%	100	150	65	45	0
4a	5F	Steel	Free running contenary, graded down through bridge, reduced system height to 600mm, minimum flexible droppers, Minimum Normal insulation, full TMLA, low track fixity	Minimum Normal	Reduced with 300mm dropper	Graded	Free	Lower contact wire height taking into account gradient rules. Replace catenary with contenary, reduce the minimum dropper length by using 300mm dropper		**≥ 5289**	25	75	5	4064	25	10	100	99	50	4503	**4664**	50	300	110	100%	100	150	65	0	0
4b		Concrete			Reduced with 300mm dropper	Graded	Free	Lower contact wire height taking into account gradient rules. Replace catenary with contenary, reduce the minimum dropper length by using 300mm droppers. Add conductive assembly.		**≥ 5334**	25	75	5	4064	25	10	100	99	50	4503	**4664**	50	300	110	100%	100	150	65	45	0
5a	6F	Steel	Free running contenary, graded down through bridge, reduced system height to 600mm, uplift droppers,	Minimum Normal	Reduced with 100mm dropper	Graded	Free	Lower contact wire height taking into account gradient rules. Replace catenary with contenary, reduce the minimum dropper length by using 100mm droppers.		**≥ 5089**	25	75	5	4064	25	10	100	99	50	4503	**4664**	50	100	110	100%	100	150	65	0	0
5b		Concrete	Minimum Normal insulation, full TMLA, low track fixity		Reduced with 100mm dropper	Graded	Free	Lower contact wire height taking into account gradient rules. Replace catenary with contenary, reduce the minimum dropper length by using 100mm droppers. Add conductive assembly.		**≥ 5134**	25	75	5	4064	25	10	100	99	50	4503	**4664**	50	100	110	100%	100	150	65	45	0

Atkins Band	IE Band	Type of Bridge	OLE Configuration	Electrical Clearance Category	System Height	Flat or Graded	Free or Fitted	Compromises	Situation	Typical Minimum Soffit Height (see notes)	Track level tolerance (TTL)	Track Maintenance Lift Allowance	Survey Tolerance (T_{su})	Vehicle Load Gauge (G_v)	Vehicle Bounce (B_v)	Track Profile Effect (P_{vt})	Passing electrical clearance to train	(S_{TCE}) (see note 4)	Natural Sag (S_{ns})	Min design contact wire height	Actual design contact wire height (see note	OLE tolerance (TOCS) E100	Construction Depth (CD) OR System Height (SH) at	Design uplift (UCW) (see note 2) E82-84	Catenary uplift (U_{CAT}) - %age of contact wire uplift	Passing electrical clearance to bridge	Static electrical clearance to bridge (C_{STATIC})	Catenary Rise Allowance (see note 3)	Conductive Assy Allowance (CAA)	Bridge Construction Tolerance
6a		Steel	Fitted contenary, graded down through bridge, zero system height, uplift droppers, Minimum Normal insulation clearances, full TMLA, low track fixity	Minimum Normal	Reduced with uplift droppers	Graded	Fitted	Lower contact wire height taking into account gradient rules. Replace catenary with contenary, reduce the minimum dropper length by using uplift droppers. attach OLE to structure using bridge arms (not for speeds above 125mph).	At OLE supports	≥ 4966	25	50	5	4064	25	10	100	56	0	4385	4546	50	200	70	100%	100	150	0	0	0
									Between OLE supports	≥ 4781	25	50	5	4064	25	10	100	56	0	4385	4546	50	15	70	100%	100	150	0	0	0
6b	10F	Concrete						Lower contact wire height taking into account gradient rules. Replace catenary with contenary, reduce electrical clearance to 150mm static, reduce the minimum dropper length by using uplift droppers. attach OLE to structure using bridge arms (not for speeds above 125mph).	At OLE supports	≥ 5011	25	50	5	4064	25	10	100	56	0	4385	4546	50	200	70	100%	100	150	0	45	0
									Between OLE supports	≥ 4826	25	50	5	4064	25	10	100	56	0	4385	4546	50	15	70	100%	100	150	0	45	0
7		All	Fitted contenary, graded down through bridge, zero system height, uplift droppers,special reduced clearances,minimum TMLA, low track fixity	Special Reduced	Reduced with uplift droppers	Graded	Fitted	Reduce static electrical clearance to largest value available subject to a minimum of 100mm, passing electrical clearance to largest value available subject to a minimum of 50mm	At OLE supports	≥ 4861	25	0	5	4064	25	10	50	56	15	4300	4511	50	200	25	100%	50	100	0	0	0
					Reduced with uplift droppers	Graded	Fitted		Between OLE supports	≥ 4676	25	0	5	4064	25	10	50	56	15	4300	4511	50	15	25	100%	50	100	0	0	0
8	14F	All	Fitted contenary, graded down through bridge 4.2m minimum CW height, zero system height, uplift droppers, reduced clearances,minimum TMLA, low track fixity	Special Reduced	Reduced with uplift droppers	Graded	Fitted	Reduce static electrical clearance to largest value available subject to a minimum of 100mm, passing electrical clearance to largest value available subject to a minimum of 50mm	At OLE supports	≥ 4661	25	0	5	4064	25	10	50	56	15	4300	4311	50	200	25	100%	50	100	0	0	0
					Reduced with uplift droppers	Graded	Fitted		Between OLE supports	≥ 4476	25	0	5	4064	25	10	50	56	15	4300	4311	50	15	25	100%	50	100	0	0	0
9		Slab Track Tunnel with Rigid Catenary	Rigid overhead bar, low wire height through tunnel, zero system height, uplift droppers, reduced clearances,minimum TMLA, low track fixity	Special Reduced	Rigid overhead bar	Graded	Fitted	Introduce slab track and rigid overhead catenary system. Reduce static electrical clearance to largest value available subject to a minimum of 80mm, passing electrical clearance to largest value available subject to a minimum of 50mm	At OLE supports	≥ 4539	5	0	5	4064	25	0	50	0	15	4189	4214	25	200	0	100%	50	100	0	0	0
						Graded	Fitted		Between OLE supports	≥ 4539	5	0	5	4064	25	0	50	0	15	4189	4214	25	200	0	100%	50	100	0	0	0

Notes

1. Table is designed as an initial assessment of soffit heights for bridges which are not interacting with stations or level crossings. Minimum soffit height is indicative and given only for smooth horizontal flat deck bridges as a guide. Actual electrical clearances and OLE design to be confirmed by detailed designer. Table is not suitable for:
   - Tunnels or other locations where lateral electrical clearances are the limiting factor
   - Canopies
   - Locations where additional height is needed, e.g. S&C
   - Locations where wire height is driven by clearance requirements at nearby level crossings or stations
2. Use actual design uplift derived from system manual, or modelled uplift mulitplied by Factor of Safety of 2.
3. Catenary rise is a function of bridge width. Wider bridges need a greater rise. Use actual value calculated from system manual.
4. Actual sag from ice load will vary and shall be calculated. Ice load only required on exposed sections of wire. For fitted bridges, natural sag from bridge arm to bridge face structure
5. Other parameters are typical values and may be varied according to client preference. See document ELE-TI-018 for further guidance.
6. Contact wire heights: nominal height is 4.7m. Mi.nimum height in any scenario (including sag) is 4.4m for graded options. For Band 8 special reduced solution 4.2m minimum height is used, which requires derogation

Key Assumptions

1. Normal electrical clearance = 150mm static/100mm passing; Special Reduced = 100mm static/50mm passing
2. Survey tolerance = 5mm, based on IE preference
3. Track tolerance = 25mm
4. Static load gauges IRL2 and IRL2a have been allowed for. 25mm of dynamic vehicle bounce has been allowed for. These tables are only applicable to existing bridges.
5. Sag due to ice, natural sag and presag are approximate values - actual value will not be known until OHLE design is complete.
6. 9.5mm of ice thickness has been allowed for
7. OLE construction/maintenance tolerance of 50mm has been allowed for; 30mm OLE maintenance tolerance, 20mm construction. For band 9 this has been reduced to 25mm total.
8. Free running uplift allowance of 110mm, Based on IE calculation spreadsheet
9. Rigid overhead bar: bar depth 110mm, support depth 90mm; sag between supports of 15mm
10. Slab track: track maintenance tolerance of 5mm
11. Track Maintenance Tamping Allowance = 75mm for free running options, 50mm for fitted options, 0mm for special reduced clearance. Based on FRS 4.6.6 and IE calculation spreadsheet