



Public Consultation No.2

Annex 3.2 H: Fencing, Lineside Safety and Lineside Equipment Report



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1. INTRODUCTION

1.1 Purpose of the report

The purpose of this report is to provide the technical input to the Preferred Option Report. This report contains the details necessary for safety improvement works to lineside fencing due to the introduction of overhead line electrification equipment (OHLE). The report includes:

- An introduction and description of the study;
- A summary of the option assessment approach undertaken;
- A description of the existing situation;
- The requirements;
- The constraints
- The assessment, data collection and proposed fencing details

1.2 Packages of work

The scope of work for DART+ Coastal North covers a wide range of interventions on the Northern Line needed in order to meet the Train Service Specification (TSS) requirements. To appropriately assess options against each other, the works have been split into separate work packages. Where appropriate, the works have then been further split down into sections which define the system which has been subject to the optioneering and design process.

1.3 References

This report should be read in conjunction with the following related optioneering reports:

Table 1: List of key documents associated with the report

Annex	Title	Description
N/A	DART+ Coastal North Option Selection Report: Preferred Option Report	This report summarises the Preferred Option.
N/A	DART+ Coastal North Option Selection Report: Technical Report	This is the report which summarises the preferred options for the different packages on the DART+ Coastal North project.
1	Schematic Drawings	Schematic drawings of each preferred option, to support the Preliminary Option Selection Report.
2.1	Policy Context	This presents a detailed review of the European, National, Regional and Local policy context for the DART+ Programme and the DART+ Coastal North Project
2.2	Useful Links	Useful links to documents/websites relating to the DART+ Coastal North project.
3.1	Constraints Report	This report reviews the DART+ Coastal North constraints.

2. EXISTING SITUATION

2.1 Overview

The section of route to be electrified is through a mixture of rural and urban settings. The majority of the route has been classified as rural, through which boundaries are often densely vegetated. Through urban settings, the railway boundary is predominantly a mix of timber, masonry and palisade fences, backing onto domestic properties. In more densely populated areas palisade fencing is more extensively used.

2.2 Permanent Way

The railway corridor typically contains a twin track arrangement throughout the section from Malahide to Drogheda. This is with the exception of sidings at Skerries Station, Drogheda Depot, Drogheda Station and Boyne Viaduct.

2.3 Existing Stations

The section of route which is to be electrified contains the following stations:

- Donabate;
- Rush and Lusk;
- Skerries;
- Balbriggan;
- Gormanston;
- Laytown;
- Drogheda MacBride.

It should be noted that fencing within stations has been excluded from this portion of the assessment, where it is deemed that fencing already exists for the purposes of revenue protection and trespass prevention. Electrical clearances and earthing and bonding will be considered within stations. Additionally, where material amendments are proposed to stations as part of the scope of works, fencing alterations to suit will be produced as part of these designs.

3. FENCING REQUIREMENTS

The requirement for fencing and safety works for the DART+ Coastal North project stem from mitigating the increased risks posed by the 1500V DC overhead electrification as well as the localised track and lineside modifications proposed along the route.

3.1 Specific Requirements

Whilst Irish Rail provide standards for the typology of new fencing, no specific standard exists which defines the necessary lineside fencing requirements within areas of electrified railway, given the perceived increase in risk in the event of trespass onto the line. It has been agreed between Arup and Irish Rail to adopt a risk-assessment-based methodology. In line with the methodology adopted for DART+ West, the required fencing can be broadly defined by whether it sits within the following areas:

- Rural;
- Urban.

The methodology for assessment is provided in section 5.1. Any existing/proposed fencing must adhere to relevant standing surface clearances from EN 50122-1 and electrical clearances in accordance with the system-wide Electricity Functional Requirements Specification. All proposed fencing shall be in line with the typologies as provided in Irish Rail standard CCE-TRK-SPN-037, unless otherwise agreed with Irish Rail.

3.2 Design Standards

The following standards and reference documents are to be considered in the design. It should be noted that this list provides key documentation but is not exhaustive.

- CCE-TRK-SPN-037 v1.5 – Fencing Specification.
- I-ETR-4703 – Earthing and Bonding Guidelines
- I-PWY-1101 – Requirements for Track and Structures Clearances
- EN 50122-1:2011; Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 1: Protective provisions against electric shock
- Electricity Functional Specifications System-Wide (MAY-MDC-ELE-DART-SP-E-0002)

4. CONSTRAINTS

4.1 Technical

As part of the detailed overhead line electrification design, electrical safety distances between standing surfaces and live parts must be adhered to in accordance with EN 50122-1. The required clearances are shown diagrammatically in Figure 1 below. Where these values cannot be met, lateral fencing and parapets accessible to persons must be at least 1.8m high and sufficiently long such as to ensure that the minimum electrical clearance according to EN 50122-1 is achieved from any standing position.

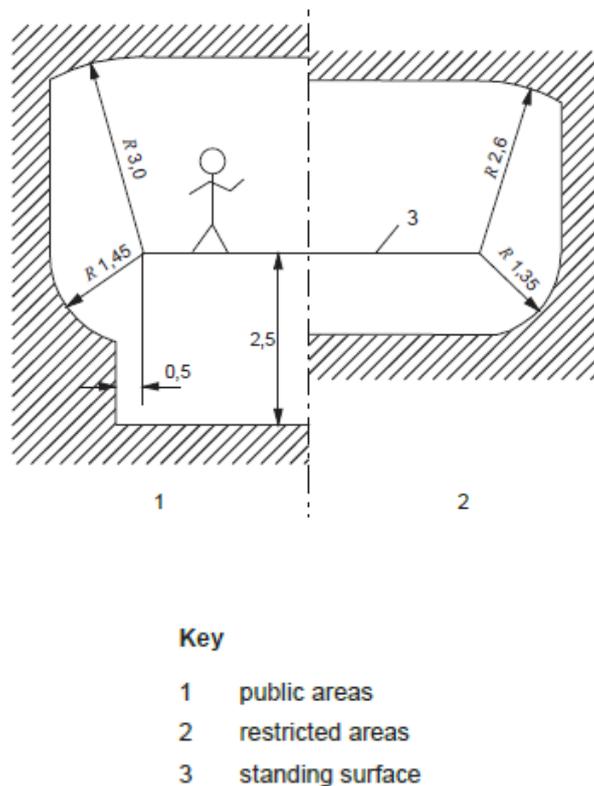


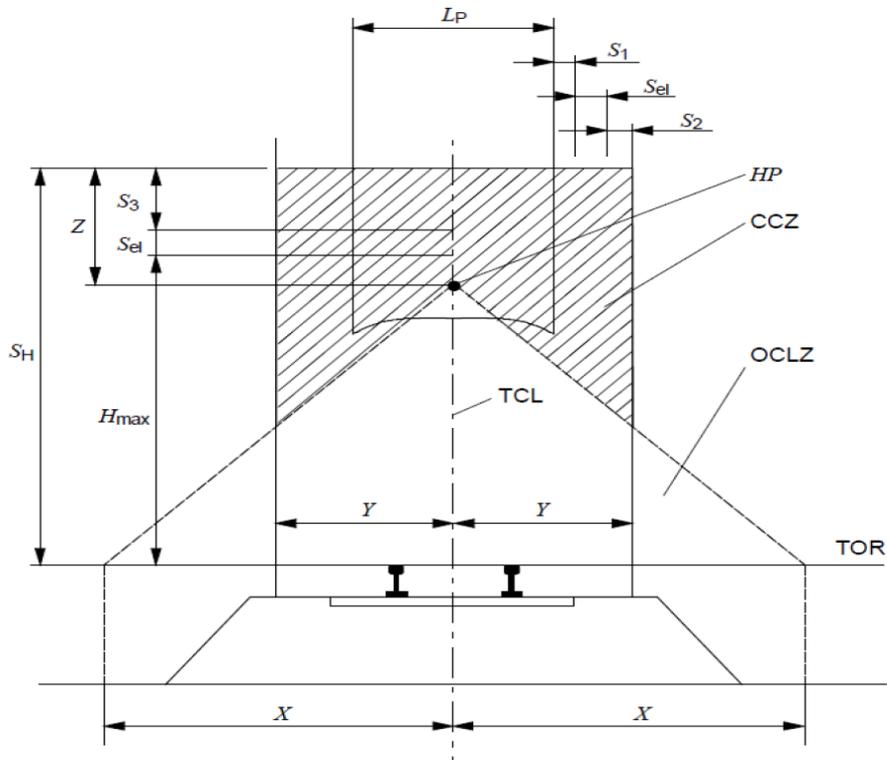
Figure 1: Required clearances from EN 50122-1

In general, metallic structures on the line which could pose a safety hazard as a result of high touch potential shall be earthed via voltage limiting devices (VLDs). All Earthing and Bonding shall be in accordance with IÉ standard I-ETR-4703, with particular reference to Section 6.4.2 of the standard for separation issues.

Fencing which requires earthing is defined by zones referred to as the Overhead Contact Line and Current Collector Zones (OCLZ/CCZ). These zones are shown in Figure 2. They represent areas where structures or equipment may accidentally come into contact with a live broken overhead contact line. In this case, and in accordance with the Electricity Functional Requirements Specification, the value for the parameter X is given as 4 m, Y is given as 2 m and Z as 2 m.

The stagger of OHLE wires shall be taken into consideration within the dimension of X. Electrical safety of the OHLE and protection against electric shock shall be achieved by compliance with EN 50122-1. In this context, OHLE stagger refers to the horizontal alignment of the OHLE contact wire, which is deliberately not kept in a straight alignment to prevent excessive wear in the train's pantograph.

Overbridges along the route can increase the risk of touch potential. It should be noted that the suitability of current parapets and necessary improvement works are assessed separately.



Key

- TOR top of rail
- HP highest point of the overhead contact line
- OCLZ overhead contact line zone
- CCZ current collector zone
- TCL track centre line
- X maximum unidirectional (half) horizontal OCLZ, top of rail level
- Y maximum unidirectional (half) horizontal CCZ
- Z distance between HP and S_H
- S_1 width of lateral movement of the current collector
- S_2 lateral safety distance for the broken or dewired current collector
- S_3 vertical safety distance for the broken or dewired current collector
- S_{el} electrical clearance in accordance with EN 50119
- S_H maximum height of current collector zone
- L_p current collector width
- H_{max} maximum height of the fully uplifted current collector

Figure 2: OCLZ zones from EN 50122-1

4.2 Environmental, Heritage and Visual Impact

Installation of fencing should consider and mitigate adverse environmental impacts as far as reasonably practicable.

It is noted that a number of environmentally sensitive areas exist along the route, including Special Areas of Conservation (SACs), Special Protected Areas (SPAs) and proposed Natural Heritage Areas (pNHA). These are predominantly located within the estuarine areas of the route. For an overview of the existing environmental constraints for DART+ Coastal North refer to Annex 3.1 Constraints Report

There is also the need to consider the visual impact of fencing installation, particularly in areas of protected architectural heritage significance – e.g. in the vicinity of protected structures such as many of the bridges and viaducts along the route.

4.3 Permissions

It is noted that some fencing installation may be impractical to complete from trackside, for example in areas where fencing is required at the top of a steep cutting. At such locations, landowner permissions will need seeking prior to works being carried out. This will be identified as part of the RO process.

Any proposed fencing shall be discussed and agreed with CCE as well as other stakeholders such as IÉ Architecture and CIÉ Property. Where access will be altered or new access required, proposals shall be discussed with CCE and SET Maintenance. Boundaries shall be confirmed with CIÉ Property. It is noted that stakeholder engagement shall be included in the subsequent design stages.

If access is needed to carry out fencing works, then the lands shall be referenced as temporary land take in the RO such that access is guaranteed.

5. INTERVENTION IDENTIFICATION

This section outlines the process for assessing necessary areas of intervention. It outlines:

- The method used for assessment;
- Data that has been obtained from a desktop study;
- Any environmental or archaeological constraints are also assessed.

5.1 Assessment Methodology

The assessment methodology, carried out across areas to be electrified, is dependent upon the area under consideration, as follows:

1. Areas without fencing
2. Areas with existing fencing

5.1.1 Areas without fencing

Where no boundary measure currently exists, the chosen fencing typology is based upon the location and risk of trespass.

- Urban areas:
 - For those areas with a perceived high risk of trespass, a security purpose (SP) steel palisade fence shall be installed.
 - Where risk of trespass is lower and the fencing is required only as either a boundary marker or to deter a casual intruder, an open mesh steel panel for general purposes shall be installed.
- Rural areas:
 - Where required, the type of fence chosen for rural areas is discussed here. It should be noted that for sections of the line in rural areas, there is no existing fencing. However, the line is bounded by a thick impenetrable hedge/vegetation. In many cases the removal of this vegetation to install a mesh fence will not improve the security of the railway and will only make unauthorised access easier than that provided previously. In addition, the existing boundary hedges and thickets provide an important environment for wildlife, and any proposed removal should be subject to an Environmental Assessment.

Any new fencing must also consider the OHLE arrangement, ensuring that it meets all clearance and earthing and bonding requirements, including those within Section 6.4.2 of Irish Rail standard I-ETR-4703. Fencing chosen shall be in line with the typologies as provided in Irish Rail standard CCE-TRK-SPN-037, unless otherwise agreed with Irish Rail.

5.1.2 Areas with existing fencing

For areas with existing fencing, the following checks will be carried out:

1. Electrical clearances shall be checked in accordance with I-ETR-4703 Earthing and Bonding Guidelines, EN50122-1:2011 and the Electricity Functional Requirements Specifications, as outlined in Section 4.1.

2. Earthing and bonding requirements relating to the OCLZ/CCZ shall be checked in accordance with EN50122-1:2011 as outlined in Section 4.1.

Should either check show existing fencing to fail, appropriate remedial works will be proposed. This shall be addressed within subsequent design stages.

No assessment of condition of existing fencing or current level of trespass prevention is included – e.g. fence height or typology - unless it relates to confirming points 1 or 2 above.

5.1.3 Proposed fencing details

The fence types available for selection, as detailed in CCE-TRK-SPN-037 v1.5, are as follows:

- 2.4m Security Purpose (SP) Palisade Fencing;



Figure 3: Palisade fencing

- Concrete post and chainlink fence



Figure 4: Concrete post and chainlink fence

- Concrete post and wire



Figure 5: Concrete post and wire fence

- Timber post and wire



Figure 6: Timber post and wire fence

- Acoustic Fencing



Figure 9: Typical acoustic fencing

Areas perceived as presenting a higher risk than typical, given the installation of OHLE, will be given special consideration, independent of whether they are in a rural/urban setting.

Within the DART network it has been noted that paladin fencing can be found regularly. Though not within the current fencing standard, it is proposed as an alternative fencing type in agreement with IÉ.

- Paladin Fencing (1.8m high)



Figure 10: Paladin fencing

5.2 Risk Assessment Methodology

The risk assessment for the requirement of intervention has been separated into two elements.

All existing fencing will be reviewed against the requirements of EN50122-1:2011 for clearances for bonding purposes. The results of this will be absolute, in terms of the fencing being within or outside the Overhead Contact Line and Current Collector Zones (OCLZ). Areas of fencing within the OCLZ will be recorded, and suggestions made as to the relocation of the fencing, or bonding of the fencing.

All existing fencing will also be assessed across the route for an increase in risk from the installation of the Overhead Line Equipment (OHLE) to the public. Areas of concern will be noted, and the risk assessment process applied via a summation of the risk scores.

5.2.1 Risk Scoring

The following criteria have been used to provide a risk score (as the severity of the risk was the same for each scenario, this was not included in the scoring):

5.2.1.1 Accessibility to the public

This criterion assessed the likely numbers of the public which would pass the location. Factors which affected the scoring were locations in urban areas, locations next to footpaths and housing etc.

Scoring of 1 (low risk) to 5 (high risk).

5.2.1.2 Current boundary measure

This criterion assessed the current boundary measure and its effectiveness as a deterrence.

Scoring of 1 (low risk) to 5 (high risk).

5.2.1.3 Risk Results

The scores assessed from the previous two criteria are multiplied to provide a total score. This is then ranked a priority based on the following scale:

Table 2: Risk results scale

Score	Priority
0 to 5	Low
6 to 10	Medium
11 to 25	High

6. RESULTS OF COMPLIANCE AND RISK ASSESSMENT

6.1 Compliance Assessment Results

The extents of the proposed OHLE infrastructure have been compared with the extents of the existing fencing. The checks have been in accordance with those listed in Section 5.1. The checks looked to identify clashes with existing fencing, or locations where the fencing was within recommended clearances or the OCLZ. Where existing metallic fencing falls within these zones, bonding will be required as a remedial detail.

The results of the assessment can be found in Appendix A2.

Included within the results are fencing located at stations and on viaducts, though these are outside the scope of this report. Modifications to stations and viaducts will be included in their respective packages to adapt the fencing to suit the OLE infrastructure.

6.2 Risk Assessment Approach – Proposed Interventions

The following represents the results of a study, where the extents of the proposed OHLE infrastructure has been assessed against the current provision of fencing as outlined in Section 5.1.

The following locations have been identified as locations of possible interventions where the installation of new fencing is recommended.

6.2.1 Location 1

Mileage Start	10M 442 yds ¹
Mileage End	10M 564 yds
Line	Up
Proposed Fence Type	Concrete post and wire
Priority	Low
Access from track	Yes
Existing fencing	No existing fencing
Type	Rural
Reason for works	Risk assessment approach

¹ Mileage based on lineside Mile Posts

Constraints	Proposed Natural Heritage Area adjacent
Drawing Reference	D+WP56-ARP-P3-NL-DR-CX-112401



Figure 11: Fencing Location 1²

Location 1 was determined as requiring intervention due to the lack of natural barrier on the shore side specifically. Although public access from the estuary is unlikely, the relative of access to the tracks from the surrounding land deemed having additional measures as a requirement.

6.2.2 Location 2

Mileage Start	14M 600 yds
Mileage End	14M 677 yds
Line	Up
Proposed Fence Type	Palisade
Priority	Medium
Access from track	Yes
Existing fencing	Existing natural barrier
Type	Rural
Reason for works	
Drawing Reference	

² Image from IE train mounted camera



Figure 12: Fencing Location 2³

Location 2 was deemed to require additional fencing due to the proximity of the commercial greenhouses. Between the greenhouses and the railway line, there is a narrow access road for vehicles accessing the greenhouses. It was deemed that a palisade fence would provide additional protection from accidental incursions from forklift trucks and heavy goods vehicles in and around the greenhouses.

³ Image from IÉ train mounted camera

6.2.3 Location 3

Mileage Start	17M 445 yds
Mileage End	17M 523 yds
Line	Down
Proposed Fence Type	Paladin
Priority	Medium
Access from track	No
Existing fencing	Approx. 900mm high timber
Type	Urban
Reason for works	Risk assessment approach
Drawing Reference	D+WP56-ARP-P3-NL-DR-CX-112602



Figure 13: Fencing Location 3⁴

Location 3 is on the boundary with a golf club car park. There is also an existing track access point at this location. The current boundary measure is a 900mm high timber fence. It is proposed that a 1.8m high green paladin fence be installed as an additional boundary measure to counter the additional risk from the installation of the OHLE infrastructure. The green paladin fencing would match in appearance the existing steel parapet fencing on the overbridge.

⁴ Image from Google Maps

6.2.4 Location 4

Mileage Start	19M 870 yds
Mileage End	19M 970 yds
Line	Down
Proposed Fence Type	Paladin
Priority	Medium
Access from track	Yes
Existing fencing	Existing low masonry wall
Type	Urban
Reason for works	Possible non-compliance with OCLZ.
Drawing Reference	D+WP56-ARP-P3-NL-DR-CX-112701



Figure 14: Fencing Location 4⁵

At Location 4 the boundary between the properties and the railway line comprises a low stone wall of approximately 600mm height (Figure 15). It is deemed that with the additional risk posed by the OHLE installation, a more robust boundary measure is required. It is proposed that a green 1.8m high paladin fence would provide suitable security while having the least visual impact.

⁵ Image from IÉ train mounted camera



Figure 15: Location 4 from the access road⁶

⁶ Image from Google Maps

6.2.5 Location 5

Mileage Start	21M 440 yds
Mileage End	21M 870 yds
Line	Up
Proposed Fence Type	Extension above masonry wall
Priority	Medium
Access from track	Yes
Existing fencing	Masonry wall
Type	Urban
Reason for works	Risk assessment approach
Drawing Reference	D+WP56-ARP-P3-NL-DR-CX-112702



Figure 16: Fencing Location 5⁷

Location 5 is on Seapoint road in Balbriggan. The proposal is to extend the current masonry wall in a similar fashion to that already undertaken further to the north along Seapoint road (Figure 17). The purpose of the extension is to mitigate against the additional risk imposed by the installation of the OHLE.

⁷ Image taken from Google Maps



Figure 17: Existing masonry wall extension at Balbriggan⁸

⁸ Image from Google Maps

6.2.6 Location 6

Mileage Start	25M 900 yds
Mileage End	25M 1700 yds
Line	Up and Down
Proposed Fence Type	Concrete post and wire
Priority	Low
Access from track	Yes
Existing fencing	None
Type	Rural
Reason for works	Risk assessment approach
Constraints	Located adjacent to historic well ⁹
Drawing Reference	D+WP56-ARP-P3-NL-DR-CX-112801



Figure 18: Fencing Location 6¹⁰

At Location 6 the natural boundary is not as defined as in other locations. In addition, the proximity of the Mosney Accommodation Centre will increase the numbers of the public making use of the adjacent footpaths. To mitigate against the risk of lineside access, concrete post and wire fencing is proposed.

⁹ Reference ME028-063 (National Monuments Service)

¹⁰ Image from IÉ train mounted camera

6.2.7 Location 7

Mileage Start	26M 1580 yds
Mileage End	26M 1580 yds
Line	Down
Proposed Fence Type	To be confirmed. Balcony on residence.
Priority	High
Access from track	Yes
Existing fencing	Approx. 900mm high timber
Type	Urban
Reason for works	Compliance
Drawing Reference	D+WP56-ARP-P3-NL-DR-CX-112803



Figure 19: Fencing Location 7¹¹

Location 7 relates to the risk of the balcony of a property which is located adjacent to the railway line. With the construction of the OHLE, the balcony will be in close proximity to the wires. Some physical screening will be required to adhere to the requirements of EN 50122-1 (Figure 1).

¹¹ Image from IÉ train mounted camera

6.3 Risk Assessment Results

The following table provides the results of the risk assessment.

Table 3: Fencing Risk Assessment Results

Location	Accessibility to the public score (1 to 5) (A)	Current boundary measures score (1 to 5) (B)	Product (AxB)	Priority
1	1	4	4	Low
2	3	3	9	Medium
3	4	2	8	Medium
4	3	3	9	Medium
5	5	2	10	Medium
6	1	3	3	Low
7	3	5	15	High

Scoring of 1 (low risk) to 5 (high risk).

Table 3 above demonstrates that Location 7 has a High priority for the implementation of fencing measures be installed prior to the installation and operation of the OHLE system. Locations 2, 3, 4 and 5 have a Medium priority. It is recommended that fencing is installed at all locations.

7. CONCLUSION

This section of the report has assessed the existing fencing and the proposed OHLE infrastructure for compliance against standards. The fencing has also been assessed using a risk assessment methodology to identify where the risks imposed by the proposed OHLE require fencing interventions.

The results demonstrate that locations requiring intervention are few relative to the extent of the proposed OHLE works. Where interventions are required, they mostly require bonding of the existing fencing, as the fencing sits within the OCLZ zones. Bonding and fencing interventions will be required at stations and on bridges and viaducts, but these will be addressed in their respective packages.

Large sections of the proposed electrification of the line pass through a rural environment. Through much of these areas, there is currently no formal fencing, but the railway boundary is formed of thick vegetation, comprising impenetrable hedges and thickets. As noted in the report, this natural boundary performs an effective barrier in preventing unauthorised access to the railway. The option of removing this vegetation, to install fencing may not improve the security of the railway and may be of detriment. Also to be considered is the environmental impact of clearing large swathes of vegetation, which forms an important ecosystem and habitat for wildlife. IÉ should consider how they wish to proceed with areas that contain no formal fencing and whether the implementation sits outside of the scope of this particular project.

Appendix A

A.1 Accompanying Drawings

Drawing Number	Title
D+WP56-ARP-P3-NL-DR-CX-112401	Lineside Civils Fencing Location 1
D+WP56-ARP-P3-NL-DR-CX-112601	Lineside Civils Fencing Location 2
D+WP56-ARP-P3-NL-DR-CX-112602	Lineside Civils Fencing Location 3
D+WP56-ARP-P3-NL-DR-CX-112701	Lineside Civils Fencing Location 4
D+WP56-ARP-P3-NL-DR-CX-112702	Lineside Civils Fencing Location 5
D+WP56-ARP-P3-NL-DR-CX-112801	Lineside Civils Fencing Location 6
D+WP56-ARP-P3-NL-DR-CX-112802	Lineside Civils Fencing Location 7



Rialtas
na hÉireann
Government
of Ireland

Tionscadal Éireann
Project Ireland
2040



Iarnród Éireann
Irish Rail

ARUP



DART+
Coastal North

A.2 Fencing Compliance

Location of Fences Requiring Intervention			Distance Between OLE Stanchion to Fence (m)	Remarks
	OLE Stanchion Name	Description		
1	44DN952 ¹²	Within 2.0m bonding zone	1.321	At Laytown Station
2	44UP895	Within 2.0m bonding zone	1.815	At Laytown Station



Image A1: Laytown Station

¹² Stanchion name is based on the OLE chainage beginning at Pearce Station and is in Km's.

Location of Fences Requiring Intervention		Distance Between OLE Stanchion to Fence (m)	Remarks
	OLE Stanchion Name	Description	
3	44UP783	Within 2.0m bonding zone	Bonding of fence required



Image A2: 44Km 783m

Location of Fences Requiring Intervention			Distance Between OLE Stanchion to Fence (m)	Remarks
	OLE Stanchion Name	Description		
4	39UP962	Within 2.0m bonding zone	1.128	At Gormanston Station
5	39DN912	Within 2.0m bonding zone	1.317	
6	39UP912	Within 2.0m bonding zone	0.885	
7	39DN808	Within 2.0m bonding zone	0.732	



Image A3: Gormanston Station

Location of Fences Requiring Intervention			Distance Between OLE Stanchion to Fence (m)	Remarks
	OLE Stanchion Name	Description		
8	39UP435	too close to wall	0.087	Fences/wall are close to Rail Track between these OHLE (distance varies but less than 4m). Special case where the viaduct design will capture the fencing requirements.
9	39UP377	too close to wall	Clashing	
10	39DN377	too close to wall	Clashing	



Image A4: Viaduct 39 Km 377m

Location of Fences Requiring Intervention			Distance Between OLE Stanchion to Fence (m)	Remarks
	OLE Stanchion Name	Description		
11	36DN032	Crossing over head to the Fence/Wall	Clashing	Fences/wall are close to Rail Track between these OHLE (distance varies but less than 4m). Special case where the viaduct design will capture the fencing requirements.
12	36UP032	Crossing over head to the Fence/Wall	Clashing	
13	35DN986	Crossing over head to the Fence/Wall	Clashing	
14	35DN986	Crossing over head to the Fence/Wall	Clashing	
15	35DN936	Crossing over head to the Fence/Wall	Clashing	
16	35UP936	Crossing over head to the Fence/Wall	Clashing	
17	35DN897	Crossing over head to the Fence/Wall	Clashing	
18	35UP897	Crossing over head to the Fence/Wall	Clashing	
19	35DN 867	Crossing over head to the Fence/Wall	Clashing	
20	35UP 867	Crossing over head to the Fence/Wall	Clashing	



Image A5: Viaduct at 35Km 897m

Location of Fences Requiring Intervention			Distance Between OLE Stanchion to Fence (m)	Remarks
	OLE Stanchion Name	Description		
21	35DN831	Within 4.0m of track centre line.	0.606	Bonding of metallic section of fence required.
22	35DN803		0.708	
23	35DN774		Clashing	
24	35DN738		Clashing	
25	35DN698		1.156	



Image A6: Fencing at 35Km 774m

Location of Fences Requiring Intervention			Distance Between OLE Stanchion to Fence (m)	Remarks
	OLE Stanchion Name	Description		
26	33UP271	Within 2.0m bonding zone	1.645	Fences beyond the vegetation (Not visible)
27	33UP221	Within 2.0m bonding zone	1.266	
28	33UP171	Within 2.0m bonding zone	0.962	
29	33UP114	Within 2.0m bonding zone	0.964	
30	33UP054	Within 2.0m bonding zone	1.203	
31	32UP994	Within 2.0m bonding zone	1.32	
32	32UP934	Within 2.0m bonding zone	1.12	
33	32UP879	Within 2.0m bonding zone	0.953	
34	32UP824	Within 2.0m bonding zone	1.05	
35	32UP769	Within 2.0m bonding zone	0.503	
36	32UP714	Within 2.0m bonding zone	0.868	
37	32UP659	Within 2.0m bonding zone	0.806	
38	32UP604	Within 2.0m bonding zone	0.752	
39	32UP559	Within 2.0m bonding zone	1.714	



Image A7: Fencing at 32Km 879m

Location of Fences Requiring Intervention		Distance Between OLE Stanchion to Fence (m)	Remarks
	OLE Stanchion Name	Description	
40	32DN259	Clashing with Fence	Clashing Within 4m to CL of track



Image A8: Fencing at 32Km 259m

Location of Fences Requiring Intervention			Distance Between OLE Stanchion to Fence (m)	Remarks
	OLE Stanchion Name	Description		
41	30UP658	Within 2.0m bonding zone	1.069	Fence requires bonding.
42	30UP618	Within 2.0m bonding zone	0.835	
43	30UP573	Within 2.0m bonding zone	0.896	
44	30UP523	Within 2.0m bonding zone	0.974	



Image A9: Fencing at 30Km 573m

Location of Fences Requiring Intervention			Distance Between OLE Stanchion to Fence (m)	Remarks
	OLE Stanchion Name	Description		
45	29UP635	Within 2.0m bonding zone	1.01	Within 4m to CL of track.
46	29DN577	Within 2.0m bonding zone (TTC)	1.788	Free end of TTC cantilever. Bonding of fence required.



Image A10: Fencing at 29Km 635m

Location of Fences Requiring Intervention			Distance Between OLE Stanchion to Fence (m)	Remarks
	OLE Stanchion Name	Description		
47	29UP348	Within 2.0m bonding zone	0.658	Bonding of fence required.
48	29UP293	Within 2.0m bonding zone	0.758	
49	29UP237	Within 2.0m bonding zone	0.857	
50	29UP192	Within 2.0m bonding zone	1.127	
51	29UP157	Within 2.0m bonding zone	1.438	
52	29UP125	Within 2.0m bonding zone	1.85	
53	29UP100	Within 2.0m bonding zone	1.843	
54	29UP065	Within 2.0m bonding zone	1.474	



Image A11: Fencing at 29Km 192m

Location of Fences Requiring Intervention		Distance Between OLE Stanchion to Fence (m)	Remarks
	OLE Stanchion Name	Description	
55	26UP978	Within 2.0m bonding zone	Bonding of fence required.



Image A12: Fencing at 26Km 978m

Location of Fences Requiring Intervention			Distance Between OLE Stanchion to Building face (m)	Remarks
	OLE Stanchion Name	Description		
56	23UP593	Proposed masts are adjacent to the building façade.	<0.5m	At Rush & Lusk Station. Interface of OHLE and building to be considered.
57	23UP554		<0.5m	
58	23UP526		<0.5m	
59	23UP554		<0.5m	
60	23UP526		<0.5m	
61	23DN526		<0.5m	
62	23UP479		<0.5m	



Image A13: Rush and Lusk Station

Location of Fences Requiring Intervention			Distance Between OLE Stanchion to Fence (m)	Remarks
	OLE Stanchion Name	Description		
63	22DN305	Within 2.0m bonding zone	0.758	Bonding of fence required.
64	22DN245	Within 2.0m bonding zone	0.749	
65	22DN185	Within 2.0m bonding zone	0.768	
66	22DN125	Within 2.0m bonding zone	0.748	
67	22DN065	Within 2.0m bonding zone	0.762	
68	22DN005	Within 2.0m bonding zone	0.582	
69	21DN955	Within 2.0m bonding zone	0.7	
70	21DN905	Within 2.0m bonding zone	0.841	
71	21DN855	Within 2.0m bonding zone	0.757	
72	21DN800	Within 2.0m bonding zone	0.947	
73	21DN740	Within 2.0m bonding zone	0.95	
74	21DN680	Within 2.0m bonding zone	1.003	
75	21DN620	Within 2.0m bonding zone	1.006	
76	21DN570	Within 2.0m bonding zone	0.645	
77	21DN520	Within 2.0m bonding zone	1.27	

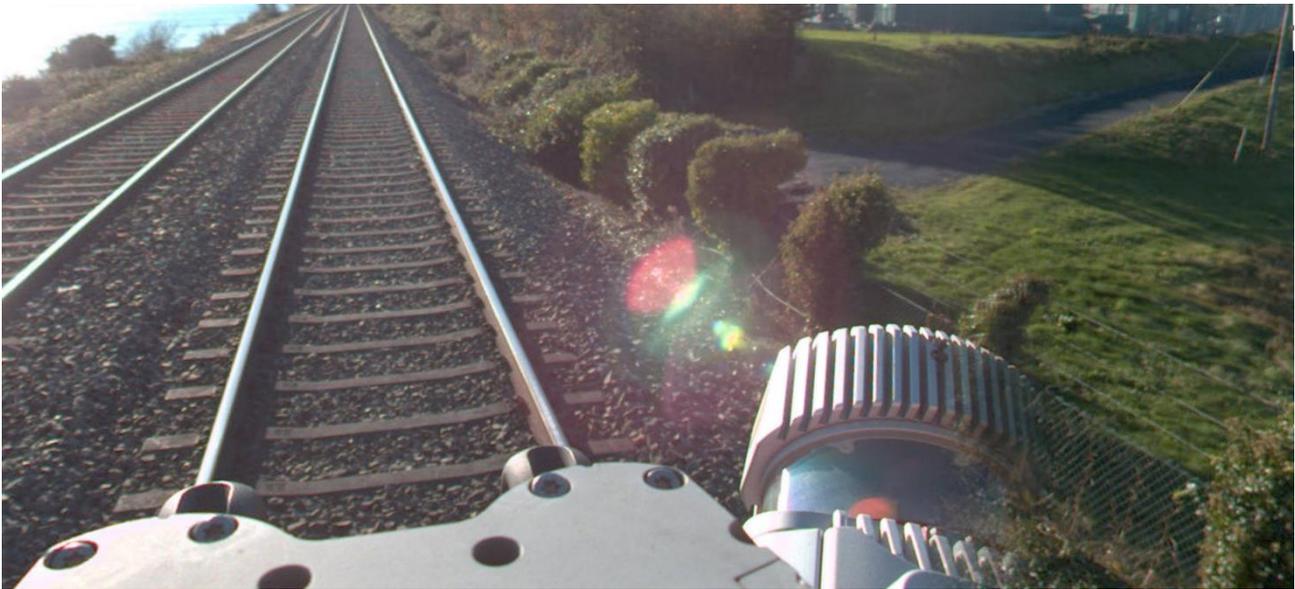


Image A14: Fencing at 22Km 125m



Image A15: Fencing at 21Km 620m

Location of Fences Requiring Intervention			Distance Between OLE Stanchion to Fence (m)	Remarks
	OLE Stanchion Name	Description		
78	18UP827	Within 2.0m bonding zone	1.207	Bonding of fence required.
79	18UP775	Within 2.0m bonding zone	1.328	



Image A16: Fencing at 18Km 827m