



ANNEX 3.2

Technical Optioneering Report:
Electrification of the Northern Line
between Malahide and Drogheda

SECTION H

Fencing and lineside safety

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Appendix A

Fencing Tracker

Abbreviations

Abbreviation	Definition
CCE	Chief Civil Engineer's Department
CIÉ	Córas Iompair Éireann
IÉ	Iarnród Éireann / Irish Rail
MCA	Multi-criteria analysis
OCLZ/CCZ	Overhead Contact Line and Current Collector Zones
OHLE	Overhead line equipment
OLE	Overhead line electrification
RO	Railway Order
SAC	Special Area of Conservation
SET	Signalling, Electrification and Telecoms
SP	Security purpose
SPA	Special Protected Area
VLD	Voltage limiting device

1 Introduction

The purpose of this report is to provide the technical input to the Preliminary Option Selection Report. This report contains the details necessary for safety improvement works to lineside fencing due to the introduction of overhead line electrification equipment (OHLE). As this aspect of works is defined solely by standards, it is not subject to the same optioneering process of longlist creation, sifting and multi-criteria analysis (MCA) as outlined in the Preliminary Option Selection Report.

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.

The report sets out general principles and constraints. Preliminary design work will follow completion of topographical survey and any further investigatory works necessary.

1.1 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.

This document is a section of the overarching optioneering report for the electrification of the Northern Line between Malahide and Drogheda. Please refer to Table 1-1 for a list of the different sections which make up the electrification package of work.

Table 1-1: List of key documents associated with Electrification of the Northern Line between Malahide and Drogheda

Annex	Section	Title
3.2	A	OHLE system
	B	OHLE foundation solution
	C	OHLE foundation solution at underbridges
	D	Bridge parapet modifications
	E	OHLE Bridge Clearance works
	F	Traction Power Supply (will form part of Public Consultation 2)
	G	User worked level crossing south of Donabate
	H	Fencing and lineside safety

1.2 References

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

Table 1-2: List of key documents associated with this report

Annex	Title	Description
N/A	DART+ Coastal North Preliminary Option Selection Report	This is the main report which summarises the optioneering process and the different packages of proposed works on the DART+ Coastal North project.
N/A	DART+ Coastal North Preliminary Option Selection Report – Executive Summary	This report summarises the main Preliminary Option Selection Report.
1	Emerging Preferred Option Maps	Includes drawings for each Emerging 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.
3.2	Technical Optioneering Report: Electrification of the Northern Line between Malahide and Drogheda.	The Technical Optioneering Report for the Electrification of the Northern Line between Malahide and Drogheda. The report is divided into a series of sections, as described in Table 1.
3.3	Technical Optioneering Report: Works around Drogheda MacBride Station	The Technical Optioneering Report for Works around Drogheda MacBride Station. The report addresses track and station modifications to allow for the increased number of DART services.

Annex	Title	Description
3.4	Technical Optioneering Report: Works around Malahide Station	The Technical Optioneering Report for Works around Malahide Station. The report addresses track modifications required to allow trains to be turned back clear of through running services.
3.5	Technical Optioneering Report: Works around Clongriffin Station	The Technical Optioneering Report for Works around Clongriffin Station. The report addresses track modifications required to allow trains to be turned back clear of through running services.
3.6	Technical Optioneering Report: Works around Howth Junction & Donaghmede Station	The Technical Optioneering Report for Works around Howth Junction & Donaghmede Station. The report addresses the addition of tracks to allow a higher frequency shuttle service.
3.7	Technical Optioneering Report: Howth Branch Level Crossings	The Technical Optioneering Report for the Howth Branch Level Crossings. The report addresses the impacts of all proposed increases in train frequency on existing level crossings on the Howth Branch.

1.3 Option Assessment Approach

In line with the Option Selection Process section of the Preliminary Option Selection Report, elements can be scoped out of the Multi-criteria Analysis (MCA) process based on a number of criteria, one of which is as follows:

‘If the type of system to be used is solely governed by IÉ standards and specified by technical requirements, then the CAF/MCA process will not be utilised.’

Since this is true for the selection and placement of fencing, the draft emerging preferred options described in this report are not subject to the MCA process and are instead proposed based upon technical requirements as set out within this document.

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. A fencing tracker schedule showing existing fencing types along the route is provided in Appendix A. It should be noted that this is currently a work in progress and the outcome of a desk study only, as outlined in Section 5.2.

2.2 Permanent Way

The rail 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 Other Railway Facilities

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

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

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, as outlined within Section A of Annex 3.2 (OHLE System). 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 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 set 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. (See next paragraph for further details)
- I-ETR-4703 – Earthing and Bonding Guidelines (refer to Section 6.4.2 of the 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);
- NR/L2/OTK/5100/MOD03 ISSUE 1 - Boundary Measure Management Manual: Boundary Measure Specification;

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

- 2.4m Security Purpose (SP) Palisade Fencing;
- Open mesh steel pane for general purposes;
- Concrete post and wire;
- Timber post and wire;
- Deer Proof Fencing;
- Horse Fencing;
- Acoustic Fencing.

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 4-1 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.

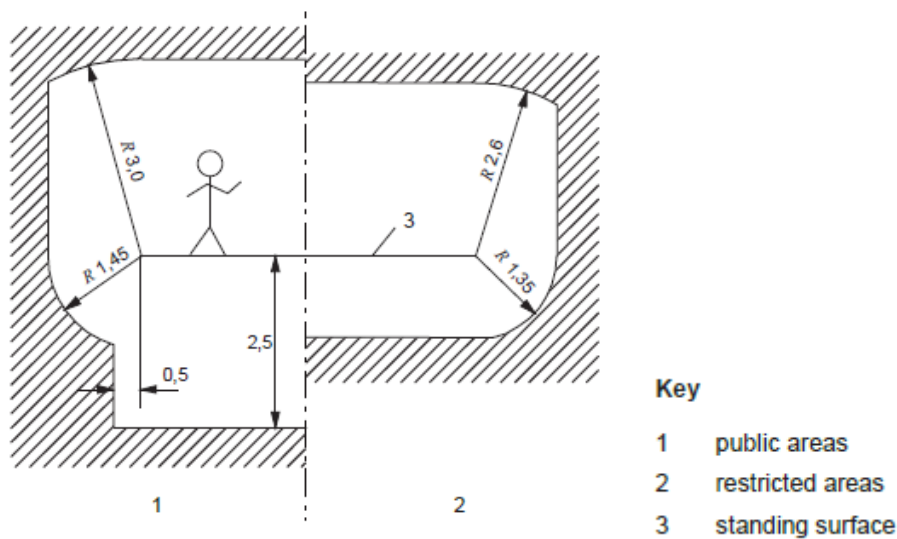
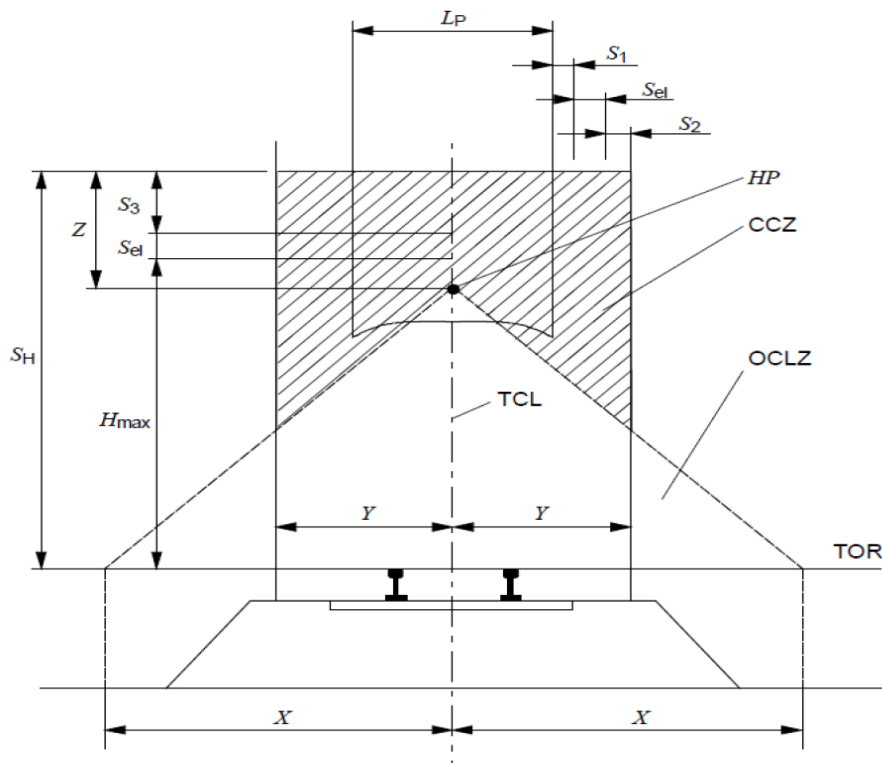


Figure 4-1: Minimum clearances to accessible live parts on the outside of vehicles and overhead contact line systems from standing surfaces accessible to persons for low voltages (EN 50122-1)

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 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 4-2: . 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.

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 in Section D of Annex 3.2 (Bridge Parapet Modifications for OHLE).



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 4-2: Overhead contact line zone and current collector zone

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 Options

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;
- Further data collection required.

Since the interventions are selected purely based upon safety and technical feasibility, this entity does not go through the same optioneering process of longlisting, shortlisting and MCA as other subsections of the overarching electrification report.

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:
 - The type of fence is to be determined following 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 Special Cases

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. This work will be carried out in subsequent design stages but may include bespoke fencing/higher rated fencing than otherwise mandated. Examples of this could be route crime hotspots in a rural setting or areas where an elevation difference could create a touch potential (e.g. a footpath adjacent the rail corridor in a steep cutting).

5.2 Data collection

Currently, data on the existing boundary measures has been collected via a desktop study utilising cab driver footage, IÉ inspection photos, available aerial imagery and Google Streetview information. This methodology has been mostly successful at identifying fencelines in urban areas, however it has proven more difficult to identify boundary fencing in more densely vegetated and rural sections of the route. Appendix A contains the current fencing tracker and lists regions where fences have not been identified as ‘Dense Vegetation’.

The desktop study exercise shall be concluded following receipt of topographical survey information. Where areas of missing information exist, which could be used for preliminary design, it is recommended that location-specific site walkovers are carried out by the DART+ Coastal North project team.

Additionally, any available route crime hotspot data should be considered in subsequent design stages such that specific high-risk areas can be noted and relevant security purpose fencing can be specified.

6 Summary and conclusions

The report has highlighted the requirements, constraints and data collection to date associated with lineside fencing. It is noted that the completion of assessment so far is limited by the available information and as such, this entity of works is reliant on the following next steps:

- Completion of topographical survey to further populate the fencing tracker;
- Targeting any remaining areas of missing information for site assessment;
- Development of OHLE design and other DART+ Coastal North work packages to determine areas and locations of new required fencing, along with any relevant earthing and bonding.

The following key risks have been identified:

- Landowner permission will need seeking where installation of fencing cannot be carried out utilising trackside access;
- Environmental assessment will be required to determine appropriate fencing type in rural areas and mitigate any negative impact;
- Relevant electrical clearances and earthing and bonding will have to be checked and provided for areas which are to be electrified as part of the project.

Appendix A

Fencing Tracker

ID	UP/DOWN	Type	Description	Start Mileage	Start Mileage+yards	End Mileage	End Mileage+yards	Height	Setting	Notes
F0032	DOWN	Parapet	Metal railing	9	884	9	1054	1.35-1.8m	Rural	
F0033	UP	Parapet	Metal railing	9	884	9	1054	1.35-1.8m	Rural	
F0034	UP	Fence	Concrete post and wire	9	1054	10	442	1.35-1.8m	Rural	Post material unclear, assumed concrete
F0035	DOWN	Fence	Palisade	10	399	10	481	>1.8m	Rural	
F0036	DOWN	DenseVegetation	N/A	10	483	10	896	N/A	Rural	
F0037	UP	DenseVegetation	N/A	10	442	10	1416	N/A	Rural	
F0038	DOWN	Fence	Timber post and wire	10	896	10	951	1.35-1.8m	Rural	
F0039	DOWN	DenseVegetation	N/A	10	951	10	1093	1.35-1.8m	Rural	
F0040	DOWN	Fence	Timber post and rail	10	1093	10	1279	1.35-1.8m	Rural	Not very clear from cab driver video, type may vary along length.
F0041	DOWN	DenseVegetation	N/A	10	1279	10	1416	N/A	Rural	
F0042	DOWN	Parapet	Metal railing	10	1416	10	1432	1.35-1.8m	Rural	
F0043	UP	Parapet	Metal railing	10	1416	10	1432	1.35-1.8m	Rural	
F0044	UP	Fence	Palisade	10	1430	10	1440	>1.8m	Rural	Fence around stair adjacent to bridge preventing pedestrian access from road
F0045	DOWN	DenseVegetation	N/A	10	1432	10	1689	1.35-1.8m	Rural	
F0046	UP	DenseVegetation	N/A	10	1432	10	1689	1.35-1.8m	Rural	
F0047	DOWN	Fence	Palisade	10	1689	11	11	>1.8m	Rural	Tagged location may be slightly incorrect due to aerial imagery before construction of bridge
F0048	UP	Fence	Palisade	10	1689	11	11	>1.8m	Rural	Tagged location may be slightly incorrect due to aerial imagery before construction of bridge
F0049	DOWN	DenseVegetation	N/A	11	11	11	383	1.35-1.8m	Urban	Dense vegetation, map imagery in this area is outdated. Cab driver appears to show some concrete wall but location is unclear, not tagged. Aerial imagery shows boundary transition to top of cutting, but boundary type unclear. Maybe hedge.
F0050	UP	DenseVegetation	N/A	11	11	11	563	1.35-1.8m	Urban	Aerial imagery shows boundary transition to top of cutting, but boundary type unclear. Maybe hedge.
F0051	DOWN	Fence	Timber panel	11	383	11	711	>1.8m	Urban	Shows only on streetview, appears new, likely associated with new development. May continue further, extents is all that was visible from streetview
F0052	UP	Fence	Palisade	11	563	11	711	>1.8m	Urban	Visible from streetview, full extents unclear. Start location is approximate. May be a couple of steel fence of different quality along the tagged length
F0053	DOWN	Fence	Palisade	11	826	11	826	>1.8m	Urban	Perpendicular to tracks at end of car park
F0054	DOWN	Wall	Masonry	11	826	11	930	>1.8m	Urban	Type unclear, may also be fence closer
F0055	UP	Fence	Palisade	11	930	11	1017	>1.8m	Urban	Surrounding storage compound area claimed from end of station car park. Appears separated from car park by temporary heras fencing, not marked
F0056	DOWN	DenseVegetation	N/A	11	930	11	1159	>1.8m	Urban	
F0057	UP	DenseVegetation	N/A	11	1030	11	1159	Unknown	Urban	
F0058	DOWN	Parapet	Metal railing	11	1159	11	1170	1.35-1.8m	Urban	
F0059	UP	Parapet	Metal railing	11	1159	11	1170	1.35-1.8m	Urban	
F0060	DOWN	DenseVegetation	N/A	11	1170	12	422	>1.8m	Urban	
F0061	UP	DenseVegetation	N/A	11	1170	11	1635	1.35-1.8m	Urban	Parts appear potentially timber panel fence, unclear due to slope away from tracks towards properties.
F0062	UP	Fence	Timber panel	11	1635	12	132	>1.8m	Urban	Transition from F0062 to F0063 unclear, assumed to transition from timber fence to masonry wall based upon housing developments' boundaries
F0063	UP	Wall	Masonry	12	132	12	422	>1.8m	Urban	
F0064	DOWN	DenseVegetation	N/A	12	430	12	761	>1.8m	Urban	
F0065	UP	DenseVegetation	N/A	12	430	12	761	>1.8m	Rural	
F0066	DOWN	Parapet	Metal railing	12	952	12	1028	1.35-1.8m	Rural	
F0067	UP	Parapet	Metal railing	12	952	12	1028	1.35-1.8m	Rural	
F0068	DOWN	Fence	Concrete post and mesh	12	1028	13	204	>1.8m	Urban	Urban chosen as adjacent to rogerstown park
F0069	DOWN	Fence	Palisade	13	210	13	210	>1.8m	Urban	Atop wingwall
F0070	UP	Fence	Palisade	13	210	13	210	>1.8m	Rural	Atop wingwall
F0071	DOWN	Parapet	Masonry	13	210	13	220	>1.8m	Rural	
F0072	UP	Parapet	Masonry	13	210	13	220	>1.8m	Rural	
F0073	DOWN	Fence	Palisade	13	220	13	220	>1.8m	Rural	Atop wingwall
F0074	UP	Fence	Palisade	13	220	13	220	>1.8m	Rural	Atop wingwall
F0075	DOWN	DenseVegetation	N/A	13	220	13	986	Unknown	Rural	
F0076	UP	DenseVegetation	N/A	13	220	13	986	Unknown	Rural	
F0077	DOWN	DenseVegetation	N/A	13	991	13	1417	Unknown	Rural	
F0078	UP	DenseVegetation	N/A	13	991	13	1417	Unknown	Rural	
F0079	UP	Fence	Palisade	13	1417	13	1417	>1.8m	Urban	Fence and gate perpendicular to platform and car park end
F0080	DOWN	Fence	Timber post and rail	13	1631	13	1641	1.35-1.8m	Urban	May extend further, disappears into dense vegetation. Viewed from streetview. Top of cutting.
F0081	DOWN	DenseVegetation	N/A	13	1641	14	412	Unknown	Rural	
F0082	UP	DenseVegetation	N/A	13	1631	14	412	Unknown	Rural	

ID	UP/DOWN	Type	Description	Start Mileage	Start Mileage+yards	End Mileage	End Mileage+yards	Height	Setting	Notes
F0083	DOWN	DenseVegetation	N/A	14	420	14	1019	Unknown	Rural	
F0084	UP	DenseVegetation	N/A	14	420	14	1019	Unknown	Rural	
F0085	DOWN	Parapet	Metal railing	14	1019	14	1030	1.35-1.8m	Rural	
F0086	UP	Parapet	Metal railing	14	1019	14	1030	1.35-1.8m	Rural	
F0087	DOWN	DenseVegetation	N/A	14	1030	14	1413	Unknown	Rural	
F0088	UP	DenseVegetation	N/A	14	1030	14	1413	Unknown	Rural	
F0089	DOWN	DenseVegetation	N/A	14	1430	15	823	Unknown	Rural	
F0090	UP	DenseVegetation	N/A	14	1430	15	823	Unknown	Rural	
F0091	DOWN	DenseVegetation	N/A	15	834	16	24	Unknown	Rural	
F0092	UP	DenseVegetation	N/A	15	834	15	1736	Unknown	Rural	
F0093	DOWN	Fence	Concrete post and mesh	16	24	16	155	1.35-1.8m	Urban	Seen from streetview, far side of dense vegetation (away from rail)
F0094	UP	Wall	Masonry	15	1736	16	155	1.35-1.8m	Urban	Wall down to access point/compound
F0095	DOWN	DenseVegetation	N/A	16	165	16	1019	Unknown	Rural	
F0096	UP	DenseVegetation	N/A	16	165	16	1010	Unknown	Rural	
F0097	UP	Fence	Timber post and mesh	16	1010	16	1019	1.35-1.8m	Rural	Poor condition timber post and mesh fence into parapet at top of cutting. Viewed from streetview
F0098	UP	Fence	Timber post and mesh	16	1030	16	1040	1.35-1.8m	Rural	Poor condition timber post and mesh fence into parapet at top of cutting. Viewed from streetview
F0099	DOWN	DenseVegetation	N/A	16	1030	17	90	Unknown	Rural	
F0100	UP	DenseVegetation	N/A	16	1040	17	90	Unknown	Rural	
F0101	DOWN	Parapet	Metal railing	17	90	17	100	1.35-1.8m	Rural	
F0102	UP	Parapet	Metal railing	17	90	17	100	1.35-1.8m	Rural	
F0103	DOWN	DenseVegetation	N/A	17	100	17	430	Unknown	Rural	
F0104	DOWN	Fence	Timber panel	17	430	17	490	1.35-1.8m	Urban	Timber fencing adjacent to golf course car park, top of cutting. End near bridge has wooden gate to access stair
F0105	DOWN	Fence	Palisade	17	490	17	495	>1.8m	Urban	Individual panel
F0106	UP	DenseVegetation	N/A	17	100	17	495	Unknown	Rural	
F0107	UP	Fence	Palisade	17	505	17	505	>1.8m	Urban	Appears a gated walkway down to track surrounded by palisade fencing. Dense vegetation.
F0108	DOWN	Fence	Palisade	17	505	17	505	>1.8m	Urban	Individual panel
F0109	DOWN	DenseVegetation	N/A	17	505	17	1135	Unknown	Rural	
F0110	UP	Fence	Palisade	17	505	17	1255	>1.8m	Urban	
F0111	DOWN	Fence	Concrete post and wire	17	1135	17	1255	1.35-1.8m	Rural	Post material unclear, assumed concrete. Start point unclear from cab driver video
F0112	DOWN	DenseVegetation	N/A	17	1260	17	1545	Unknown	Rural	
F0113	UP	DenseVegetation	N/A	17	1260	17	1545	Unknown	Urban	
F0114	DOWN	DenseVegetation	N/A	17	1758	18	91	Unknown	Rural	
F0115	UP	Fence	Palisade	17	1758	18	605	>1.8m	Urban	
F0116	DOWN	Fence	Palisade	18	9	18	42	>1.8m	Rural	Around GSM-R or some form of equipment substation zone, square fenced off area
F0118	DOWN	DenseVegetation	N/A	18	179	18	1414	Unknown	Rural	
F0119	UP	DenseVegetation	N/A	18	605	18	930	Unknown	Urban	May be some concrete post and mesh near to road in dense vegetation, difficult to see location and extents.
F0120	UP	Fence	Palisade	18	930	18	1220	>1.8m	Urban	
F0121	UP	Fence	Paladin	18	1220	18	1414	>1.8m	Urban	Shopping complex fencing, assumed to end at edge of property boundary
F0122	DOWN	Parapet	Metal railing	18	1414	18	1431	1.35-1.8m	Rural	
F0123	UP	Parapet	Metal railing	18	1414	18	1431	1.35-1.8m	Urban	
F0124	DOWN	DenseVegetation	N/A	18	1431	19	520	Unknown	Rural	
F0125	DOWN	Fence	Palisade	19	520	19	547	Unknown	Rural	
F0126	DOWN	DenseVegetation	N/A	19	547	19	684	Unknown	Rural	
F0127	UP	DenseVegetation	N/A	18	1431	19	684	Unknown	Urban	
F0128	DOWN	Parapet	Metal railing	19	684	19	694	1.35-1.8m	Rural	
F0129	UP	Parapet	Metal railing	19	684	19	694	1.35-1.8m	Rural	
F0130	DOWN	DenseVegetation	N/A	19	694	19	760	Unknown	Rural	
F0131	UP	Wall	Masonry	19	694	19	908	1.35-1.8m	Rural	Retaining wall, retaining railway side, adjacent to road. Some parts very heavily vegetated.
F0132	DOWN	Wall	Masonry	19	760	19	1034	<1.35m	Rural	May start earlier, unclear due to vegetation
F0133	UP	Fence	Concrete post and mesh	19	908	19	1034	1.35-1.8m	Rural	
F0134	UP	Fence	Palisade	19	1034	19	1039	>1.8m	Rural	Infill gate made from palisade fence
F0135	DOWN	Wall	Masonry	19	1039	19	1640	<1.35m	Rural	
F0136	UP	Fence	Concrete post and mesh	19	1039	19	1558	1.35-1.8m	Rural	
F0137	DOWN	Fence	Palisade	19	1640	19	1668	>1.8m	Rural	Fence to walkway for ladies stair footbridge
F0138	DOWN	Wall	Masonry	19	1668	20	624	<1.35m	Rural	Low level masonry wall under vegetation

ID	UP/DOWN	Type	Description	Start Mileage	Start Mileage+yards	End Mileage	End Mileage+yards	Height	Setting	Notes
F0139	UP	Wall	Masonry	19	1558	20	264	1.35-1.8m	Rural	
F0140	UP	Fence	Palisade	20	264	20	271	>1.8m	Rural	Infill gate made from palisade fence
F0141	UP	Wall	Masonry	20	271	21	250	1.35-1.8m	Urban	
F0142	DOWN	DenseVegetation	N/A	20	624	20	1084	Unknown	Rural	
F0143	DOWN	Fence	Concrete post and mesh	20	1084	20	1122	>1.8m	Rural	Tall, localised fence at gap in hedge
F0144	DOWN	DenseVegetation	N/A	20	1122	20	1587	Unknown	Urban	Railway in cutting, unable to see cutting top from cab driver video. Likely some timber panel fences to garden rears at top of cutting
F0145	DOWN	Fence	Palisade	20	1587	21	275	>1.8m	Urban	Start location approx, based off streetview. May start earlier in gardens
F0146	UP	Fence	Metal railing	21	250	21	275	1.35-1.8m	Urban	At top of cutting, transitions into overbridge parapet (masonry)
F0147	DOWN	DenseVegetation	N/A	21	286	21	336	Unknown	Urban	
F0148	UP	Wall	Masonry	21	286	21	800	1.35-1.8m	Urban	
F0149	DOWN	Wall	Masonry	21	336	21	749	>1.8m	Urban	Rear of housing development and gardens, assumed continues through gardens where not visible in streetview
F0150	DOWN	DenseVegetation	N/A	21	749	21	809	Unknown	Urban	Likely a wall here as boundary to park, unclear from cab video/streetview
F0151	UP	Fence	Paladin	21	800	21	1019	>1.8m	Urban	Atop masonry wall
F0152	DOWN	Fence	Palisade	21	809	21	920	>1.8m	Urban	
F0153	DOWN	Fence	Metal railing	21	920	21	1019	>1.8m	Urban	
F0154	DOWN	Parapet	Metal railing	21	1019	21	1166	Unknown	Urban	
F0155	UP	Parapet	Metal railing	21	1019	21	1166	Unknown	Urban	
F0156	DOWN	Fence	Palisade	21	1369	21	1685	>1.8m	Urban	
F0157	UP	Fence	Paladin	21	1396	21	1605	>1.8m	Urban	
F0158	UP	Fence	Palisade	21	1605	21	1685	>1.8m	Urban	
F0159	DOWN	Parapet	Masonry	21	1685	21	1696	Unknown	Urban	
F0160	DOWN	Parapet	Masonry	21	1685	21	1696	Unknown	Urban	
F0161	DOWN	Fence	Palisade	21	1696	22	125	>1.8m	Urban	
F0162	UP	Fence	Palisade	21	1696	22	125	>1.8m	Urban	
F0163	DOWN	Parapet	Metal railing	22	125	22	130	Unknown	Urban	
F0164	UP	Parapet	Metal railing	22	125	22	130	Unknown	Urban	
F0165	DOWN	DenseVegetation	N/A	22	130	22	656	Unknown	Urban	Likely a palisade fence on park side, unclear from cab driver video
F0166	UP	Fence	Palisade	22	130	22	656	Unknown	Urban	
F0167	DOWN	Parapet	Metal railing	22	656	22	671	Unknown	Urban	
F0168	UP	Parapet	Metal railing	22	656	22	671	Unknown	Urban	
F0169	DOWN	DenseVegetation	N/A	22	671	22	1546	Unknown	Rural	
F0170	UP	Fence	Palisade	22	671	22	1170	>1.8m	Rural	Initial portion visible as palisade from cab driver video, then assumed based upon aerial imagery
F0171	UP	DenseVegetation	N/A	22	1170	22	1546	Unknown	Rural	Some indication of concrete post and wire, unclear where this starts
F0172	DOWN	DenseVegetation	N/A	22	1546	23	615	Unknown	Rural	
F0173	UP	DenseVegetation	N/A	22	1546	23	615	Unknown	Rural	
F0174	DOWN	DenseVegetation	N/A	23	625	23	1095	Unknown	Rural	
F0175	UP	DenseVegetation	N/A	23	625	23	1095	Unknown	Rural	
F0176	DOWN	Parapet	Metal railing	23	1095	23	1115	Unknown	Rural	
F0177	UP	Parapet	Metal railing	23	1095	23	1115	Unknown	Rural	
F0178	DOWN	DenseVegetation	N/A	23	1115	23	1258	Unknown	Rural	
F0179	UP	DenseVegetation	N/A	23	1115	23	1258	Unknown	Rural	
F0180	DOWN	Parapet	Metal railing	23	1258	23	1312	Unknown	Rural	
F0181	UP	Parapet	Metal railing	23	1258	23	1312	Unknown	Rural	
F0182	DOWN	DenseVegetation	N/A	23	1312	23	1711	Unknown	Rural	
F0183	UP	DenseVegetation	N/A	23	1312	23	1372	Unknown	Rural	
F0184	UP	Fence	Timber post and rail	23	1372	23	1531	1.35-1.8m	Rural	Type unclear from cab driver video, used as placeholder only
F0185	UP	DenseVegetation	N/A	23	1531	23	1673	Unknown	Rural	
F0186	DOWN	Fence	Palisade	24	176	24	318	>1.8m	Urban	
F0187	UP	Fence	Timber post and rail	24	198	24	537	1.35-1.8m	Rural	Fence visible in field from aerial view. Assumed insignificant timber fence, not visible from cab driver video due to vegetation.
F0188	DOWN	Fence	Concrete post and wire	24	318	24	361	1.35-1.8m	Rural	
F0189	DOWN	DenseVegetation	N/A	24	361	24	924	Unknown	Rural	
F0190	UP	DenseVegetation	N/A	24	537	24	924	Unknown	Rural	
F0191	DOWN	Parapet	Metal railing	24	924	24	936	Unknown	Rural	
F0192	UP	Parapet	Metal railing	24	924	24	936	Unknown	Rural	

ID	UP/DOWN	Type	Description	Start Mileage	Start Mileage+yards	End Mileage	End Mileage+yards	Height	Setting	Notes
F0193	DOWN	DenseVegetation	N/A	24	936	24	1718	Unknown	Rural	
F0194	UP	Fence	Concrete post and wire	24	936	24	1718	1.35-1.8m	Rural	
F0195	DOWN	DenseVegetation	N/A	24	1728	25	1185	Unknown	Rural	
F0196	UP	DenseVegetation	N/A	24	1728	25	1185	Unknown	Rural	
F0197	DOWN	Parapet	Metal railing	25	1185	25	1205	Unknown	Rural	
F0198	UP	Parapet	Metal railing	25	1185	25	1205	Unknown	Rural	
F0199	DOWN	Fence	Palisade	25	1205	25	1306	>1.8m	Urban	
F0233	DOWN	Fence	Concrete post and mesh	25	1306	25	1650	1.35-1.8m	Urban	
F0234	DOWN	DenseVegetation	N/A	25	1650	25	1721	Unknown	Urban	
F0235	UP	DenseVegetation	N/A	25	1205	25	1721	Unknown	Rural	
F0236	DOWN	Fence	Palisade	25	1721	25	1721	>1.8m	Rural	Atop wingwall, start unclear from cab driver video
F0237	DOWN	Parapet	Metal railing	25	1721	25	1745	Unknown	Rural	
F0238	UP	Parapet	Metal railing	25	1721	25	1745	Unknown	Rural	
F0239	DOWN	Fence	Palisade	25	1745	25	1745	>1.8m	Rural	Atop wingwall, start unclear from cab driver video
F0240	DOWN	DenseVegetation	N/A	25	1745	26	782	Unknown	Rural	In cutting, top not always visible from cab driver video
F0241	UP	DenseVegetation	N/A	25	1745	26	782	Unknown	Rural	In cutting, top not always visible from cab driver video
F0242	DOWN	Parapet	Metal railing	26	782	26	793	Unknown	Rural	
F0243	UP	Parapet	Metal railing	26	782	26	793	Unknown	Rural	
F0244	DOWN	DenseVegetation	N/A	26	793	26	1536	Unknown	Rural	
F0245	UP	Fence	Palisade	26	793	26	891	Unknown	Urban	Assumed to be palisade, for most, only top visible in part on cab driver footage. Location from aerial imagery. End unclear.
F0246	UP	DenseVegetation	N/A	26	891	26	1084	Unknown	Urban	
F0247	UP	Fence	Palisade	26	1084	26	1536	>1.8m	Urban	
F0248	DOWN	BuildingFace	N/A	26	1536	26	1563	N/A	Urban	
F0249	DOWN	Fence	Timber panel	26	1563	26	1591	>1.8m	Urban	Rear of garden
F0250	DOWN	DenseVegetation	N/A	26	1591	26	1651	Unknown	Urban	
F0251	DOWN	Wall	Masonry	26	1651	26	1651	Unknown	Urban	Perpendicular to bridge, runs into private wall
F0252	UP	Wall	Masonry	26	1536	26	1651	Unknown	Urban	Low level, dense vegetation
F0253	DOWN	Parapet	Metal railing	26	1651	26	1733	Unknown	Urban	
F0254	UP	Parapet	Metal railing	26	1651	26	1733	Unknown	Urban	
F0255	DOWN	DenseVegetation	N/A	26	1733	27	77	Unknown	Urban	
F0256	UP	Fence	Timber panel	26	1733	27	77	Unknown	Urban	Low timber panel wall, some under vegetation. May just be a decorative facing to a masonry retaining wall.
F0257	DOWN	Parapet	Metal railing	27	77	27	93	Unknown	Urban	
F0258	UP	Parapet	Metal railing	27	77	27	93	Unknown	Urban	
F0259	DOWN	DenseVegetation	N/A	27	93	27	132	Unknown	Urban	Likely a wall here, unclear
F0260	UP	Wall	Masonry	27	93	27	132	Unknown	Urban	
F0261	DOWN	DenseVegetation	N/A	27	339	28	1461	Unknown	Rural	
F0262	UP	Wall	Masonry	27	339	27	619	>1.8m	Urban	
F0263	UP	Fence	Palisade	27	619	27	946	>1.8m	Urban	
F0264	UP	Fence	Timber panel	27	946	27	1264	>1.8m	Urban	Exact position of transition from palisade unclear
F0265	UP	DenseVegetation	N/A	27	1264	28	1001	Unknown	Rural	
F0266	UP	Wall	Masonry	28	1001	28	1053	>1.8m	Urban	Wall likely continues past this point. Type unclear.
F0267	UP	DenseVegetation	N/A	28	1053	28	1461	Unknown	Urban	
F0268	DOWN	Parapet	Metal railing	28	1461	28	1477	Unknown	Rural	
F0269	UP	Parapet	Metal railing	28	1461	28	1477	Unknown	Urban	
F0270	DOWN	Fence	Palisade	28	1477	28	1521	>1.8m	Rural	
F0271	DOWN	DenseVegetation	N/A	28	1521	29	1423	Unknown	Rural	
F0272	UP	Wall	Masonry	28	1477	28	1615	>1.8m	Urban	
F0273	UP	DenseVegetation	N/A	28	1615	29	1433	Unknown	Rural	
F0274	DOWN	Fence	Palisade	29	1423	29	1433	>1.8m	Rural	Short section around access gate
F0275	DOWN	Fence	Paladin	29	1433	29	1433	>1.8m	Rural	Atop lower section of parapet
F0276	UP	Fence	Paladin	29	1433	29	1433	>1.8m	Rural	Atop lower section of parapet and continues for 2 panels
F0277	DOWN	Fence	Paladin	29	1443	29	1443	>1.8m	Rural	Atop lower section of parapet and continues for 2 panels
F0278	UP	Fence	Paladin	29	1443	29	1443	>1.8m	Rural	Atop lower section of parapet and continues for 2 panels
F0279	DOWN	DenseVegetation	N/A	29	1443	30	214	Unknown	Rural	
F0280	UP	DenseVegetation	N/A	29	1443	30	214	Unknown	Rural	
F0281	DOWN	Fence	Palisade	30	240	30	245	>1.8m	Urban	

ID	UP/DOWN	Type	Description	Start Mileage	Start Mileage+yards	End Mileage	End Mileage+yards	Height	Setting	Notes
F0282	UP	Fence	Palisade	30	240	30	901	>1.8m	Rural	Approximate end location assumed based upon aerial imagery. Fence type may change along length. May continue further
F0283	DOWN	Wall	Masonry	30	245	30	847	>1.8m	Urban	
F0284	DOWN	Fence	Palisade	30	847	30	1149	>1.8m	Urban	
F0285	DOWN	Fence	Palisade	30	1149	30	1378	Unknown	Urban	Seen going into/emerging from hedgeline, assumed to carry on through
F0286	UP	DenseVegetation	N/A	30	901	30	1378	Unknown	Rural	
F0287	UP	Fence	Palisade	30	1378	30	1378	>1.8m	Rural	Seen atop wingwall from bridge inspection photos, unclear where starts.
F0288	DOWN	Parapet	Metal railing	30	1378	30	1390	Unknown	Urban	
F0289	UP	Parapet	Metal railing	30	1378	30	1390	Unknown	Rural	
F0290	DOWN	Fence	Palisade	30	1390	30	1390	>1.8m	Urban	Seen atop wingwall from bridge inspection photos, unclear where ends.
F0291	UP	Fence	Palisade	30	1390	30	1390	>1.8m	Rural	Seen atop wingwall from bridge inspection photos, unclear where ends.
F0292	DOWN	Fence	Paladin	30	1390	30	1461	>1.8m	Urban	Seen from streetview, start position not clear, unclear where transitions from palisade
F0293	DOWN	Fence	Palisade	30	1461	30	1476	>1.8m	Urban	
F0294	DOWN	Wall	Masonry	30	1476	30	1534	>1.8m	Urban	
F0295	DOWN	Fence	Palisade	30	1534	31	64	>1.8m	Urban	
F0296	DOWN	Fence	Paladin	31	64	31	125	>1.8m	Urban	Small paladin fence atop masonry wall to improve overall height
F0297	DOWN	DenseVegetation	N/A	31	125	31	852	Unknown	Urban	Likely a wall at rear of gardens but unclear from cab driver video/aerial imagery. Type unclear.
F0298	UP	DenseVegetation	N/A	30	1390	31	541	Unknown	Rural	
F0299	UP	Wall	Masonry	31	541	31	690	>1.8m	Urban	
F0300	UP	Fence	Palisade	31	690	31	852	>1.8m	Urban	

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