
Great Eastern OLE Renewals
A Swiss-Italian design for the overhead line upgrade project in
the UK

Collegio ingegneri ferroviari italiani
28th of March 2012

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Content

1. Objectives and history of the project
2. The designer's scope and challenges
3. System Design
4. Allocation Design
5. Conclusion and outlook



Objectives and history of the project

1500V

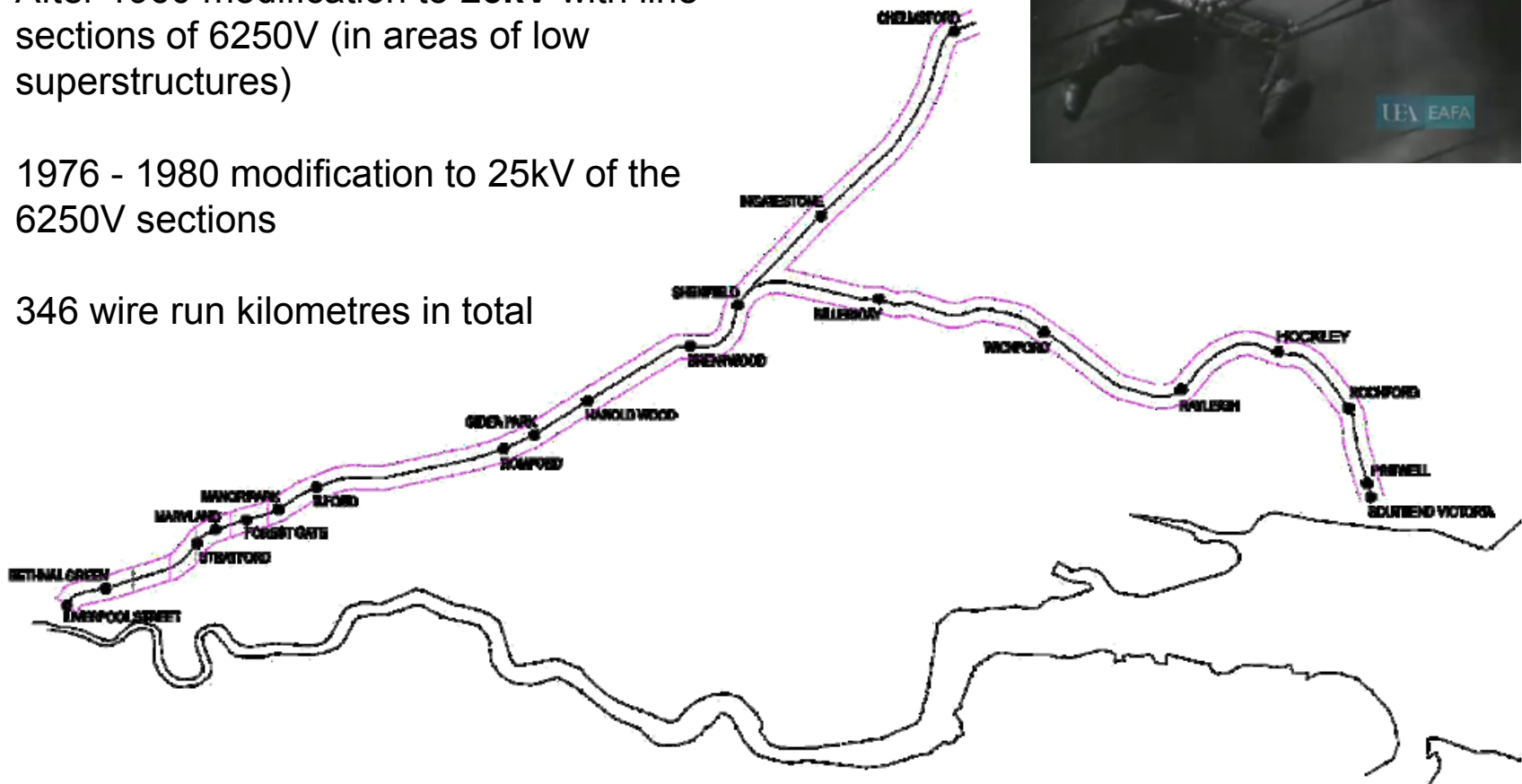
London-Shenfield 1949

Shenfield-Chelmsford 1956

After 1960 modification to **25kV** with line sections of 6250V (in areas of low superstructures)

1976 - 1980 modification to 25kV of the 6250V sections

346 wire run kilometres in total



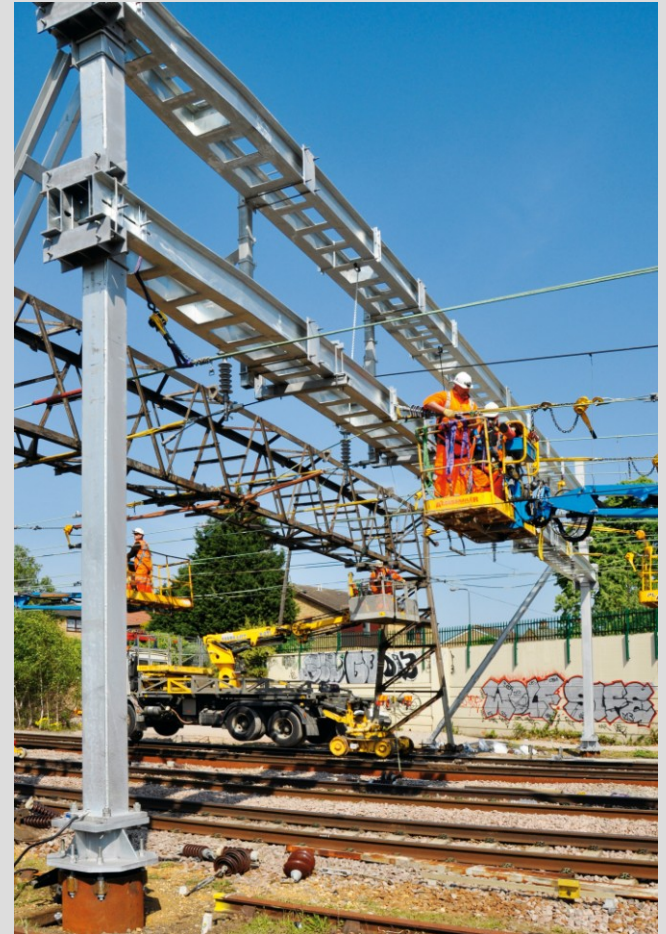
Objectives and history of the project

Why is the overhead line (OHL) renewal necessary?

- Increasing failure frequency
- Wire height depending on temperature
- Poor dynamic behaviour between the OHL and pantograph at high temperatures
- High overhead line wind drift
- Frequent flashovers between the catenary wire and superstructures
- Additional traffic at the Olympics 2012 → Request of a higher system availability
- Increase in train speed up to 100mph (160km/h)

Overview

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The designer's scope and challenges

Work scope of the designer:

- System design of the overhead line equipment (OLE)
- Allocation design
- Material procurement of the overhead line equipment

Technical requirements:

- Electrical clearances
 - dynamic >200mm
 - static >270mm
 - distance between the catenary wire and OHL structures > 600mm

The designer's scope and challenges

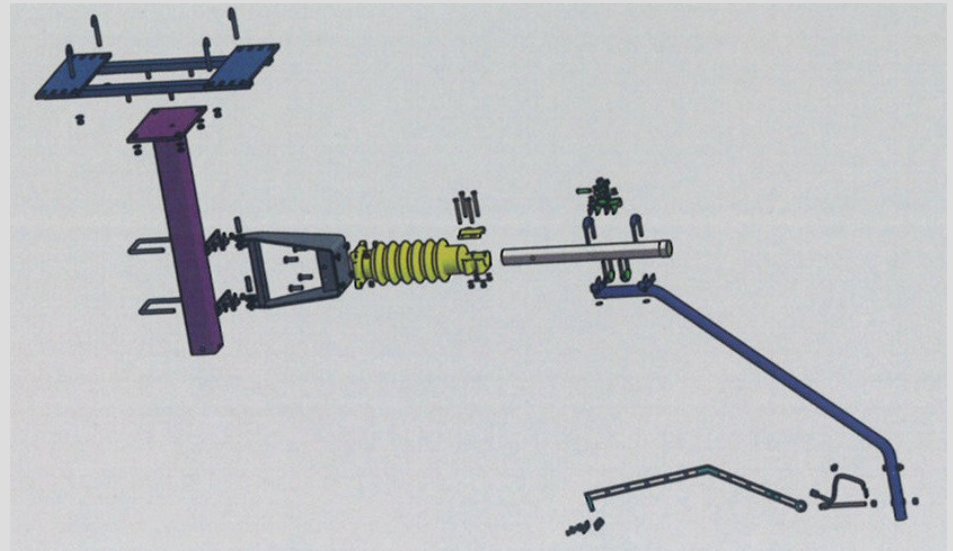
Technical requirements:

- Operational train speed 160 km/h
- W12 clearance gauge
- Maintenance; one track pair has to be in operation during maintenance works (four track)
- Availability 99.5%
- GE equipment compatibility for staging works
- Reuse of the existing OHL structures where possible. Big variety of existing structures
- Etc.



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System Design

Design process overview:

System specification → System design → Allocation design



The key element in the system design is:

Simulation of the dynamic interaction between the OLE and the pantographs by Politecnico di Milano.

The mathematical model of pantograph-overhead line dynamic interaction has been developed at Politecnico di Milano, by the group of “Meccanica dei sistemi”, for 25 years. The program pan9 is validated according to EN 50318 for speed up to 300 km/h, by Italcertifer.

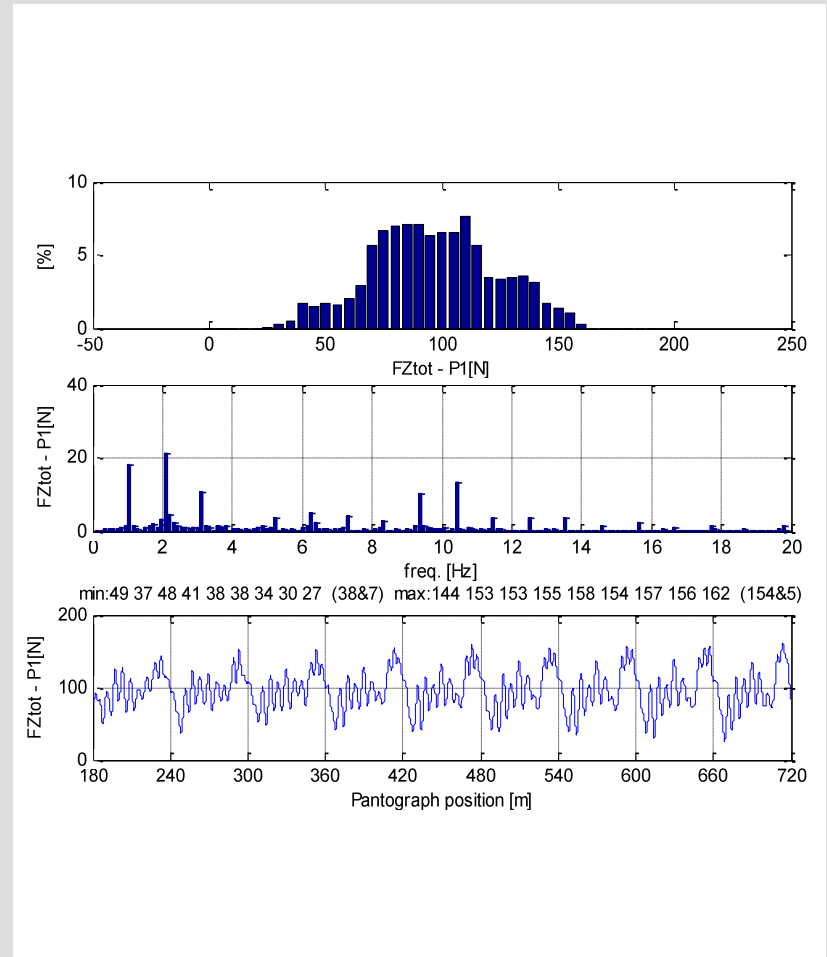
It has been used for design of the Italian high speed line (in dc and ac).

System Design

The key element in the system design is:

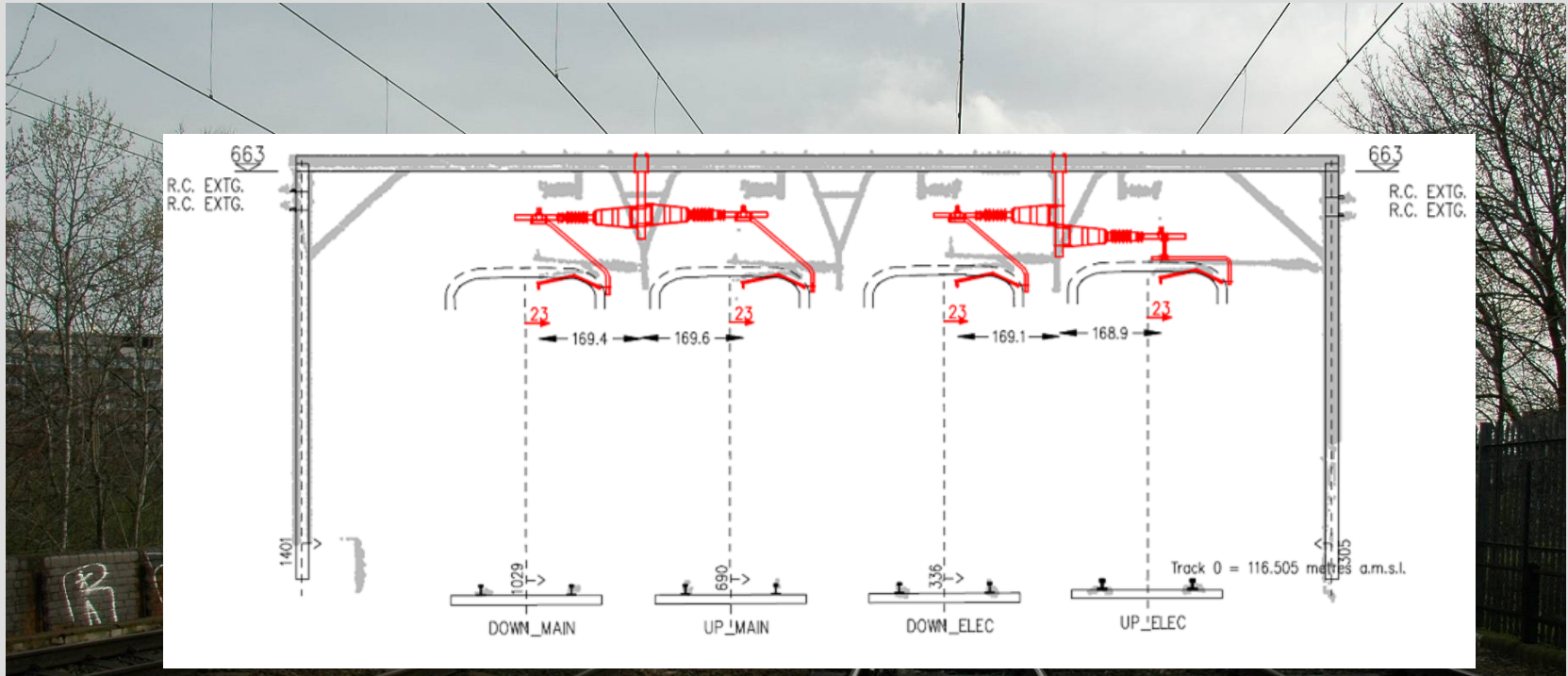
Characteristics of the GEF system:

Max. train speed: 160km/h
Span length OLE: up to 70m
System height: 1.4m
Contact wire: 120mm², CuAg, 13.2kN
Catenary wire: 70mm², BzII, 12.0kN



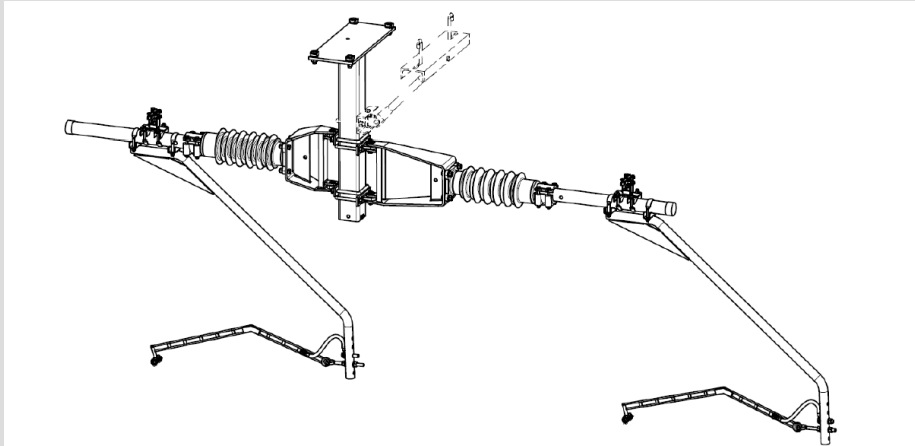
System Design

Cantilever design four track sections:

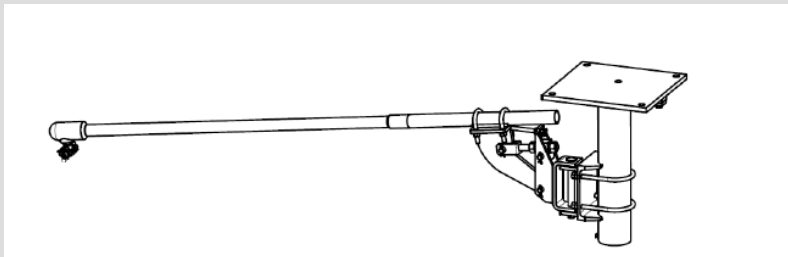


System Design

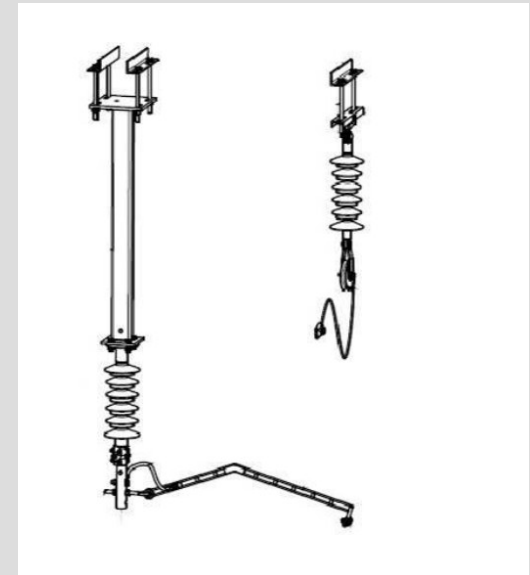
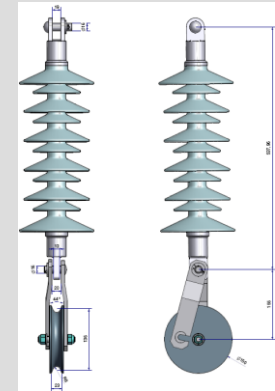
Cantilever design four track sections:



Single Insulator cantilever „SIC“



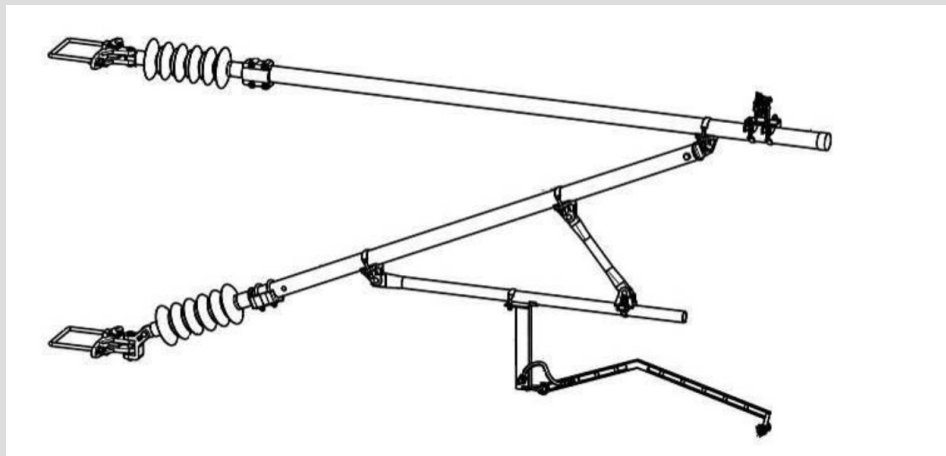
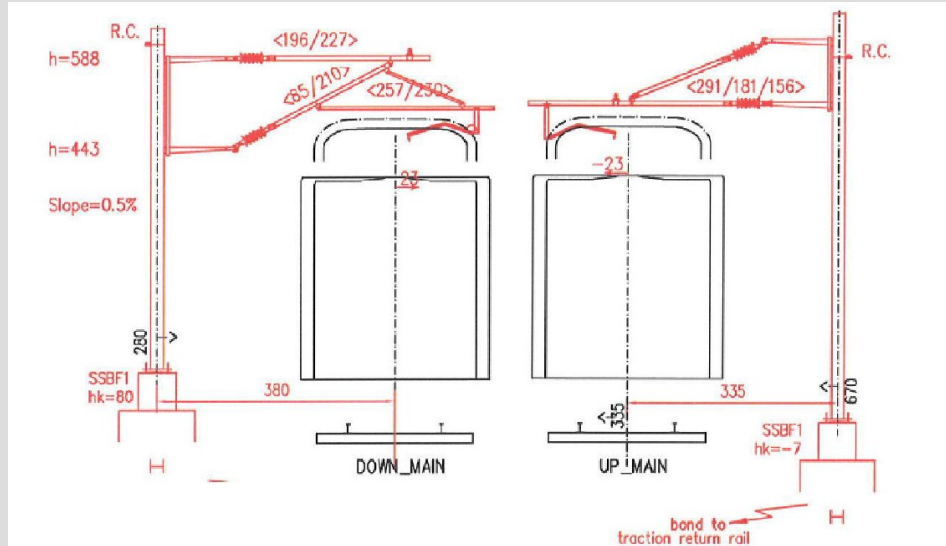
Underbridge arm



Catenary suspension with pulley wheel

System Design

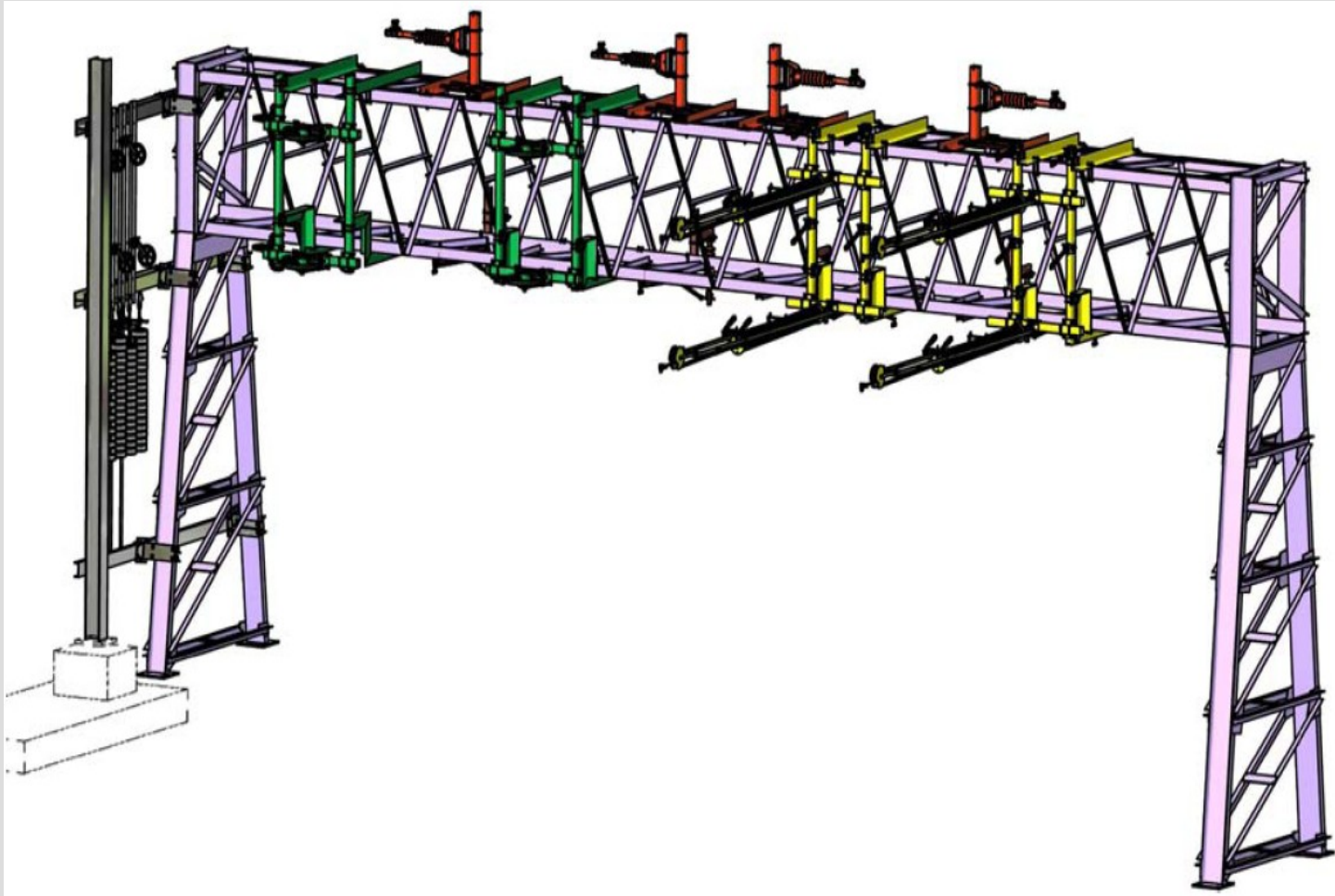
Cantilever design two track sections:



Cantilever „Type C“

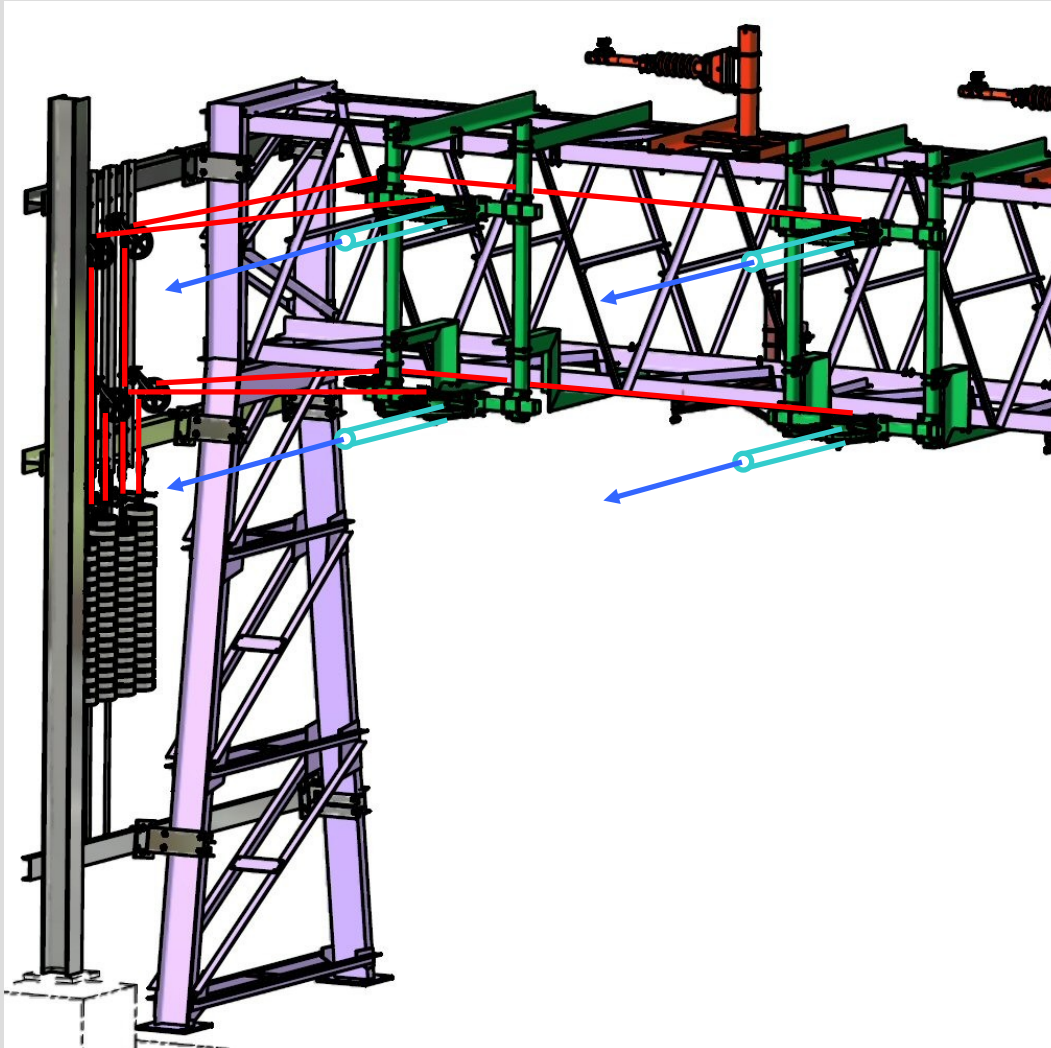
System Design

Overhead line portal structures (existing):

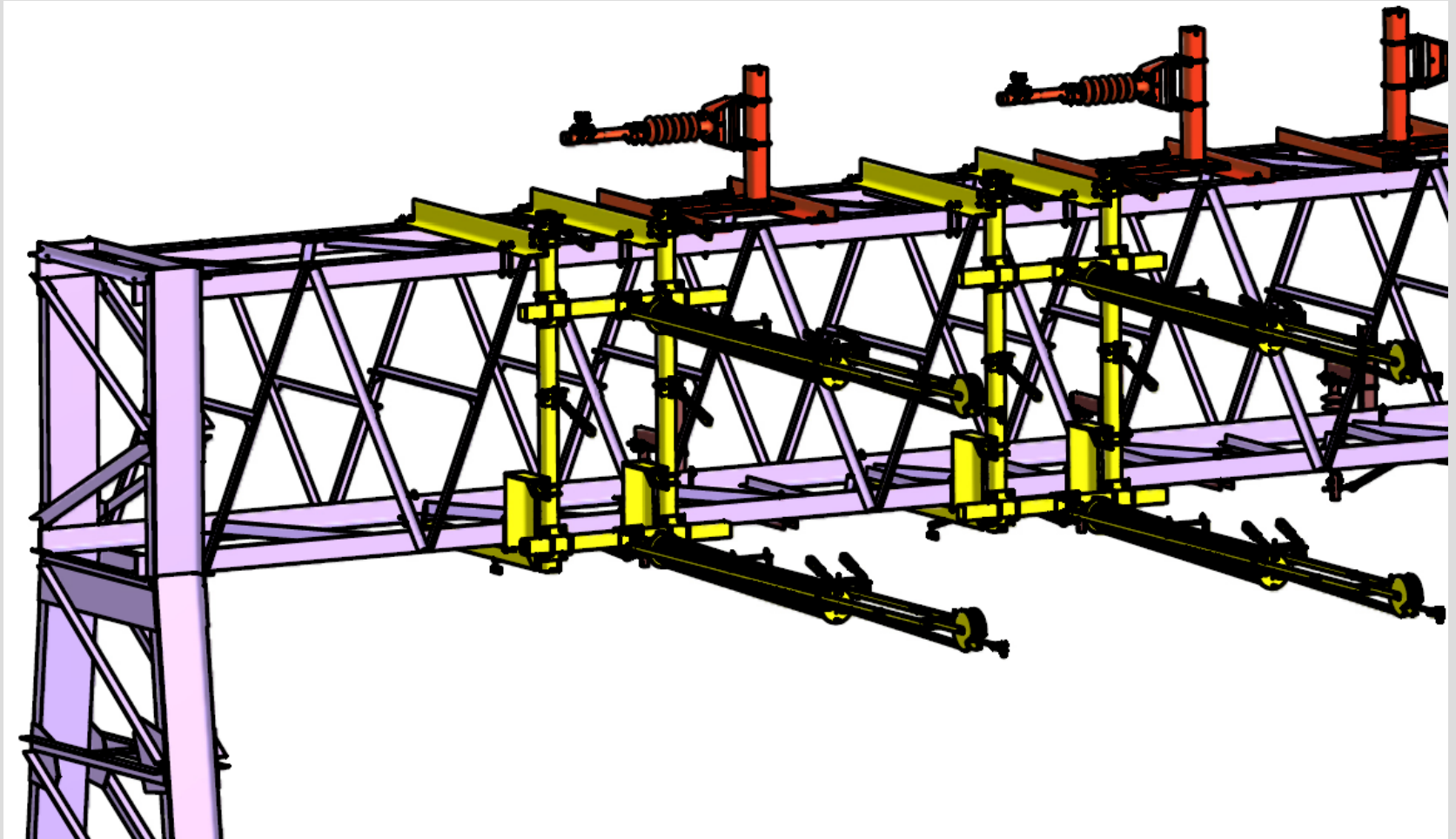


System Design

Auto tensioning devices with balance weights:

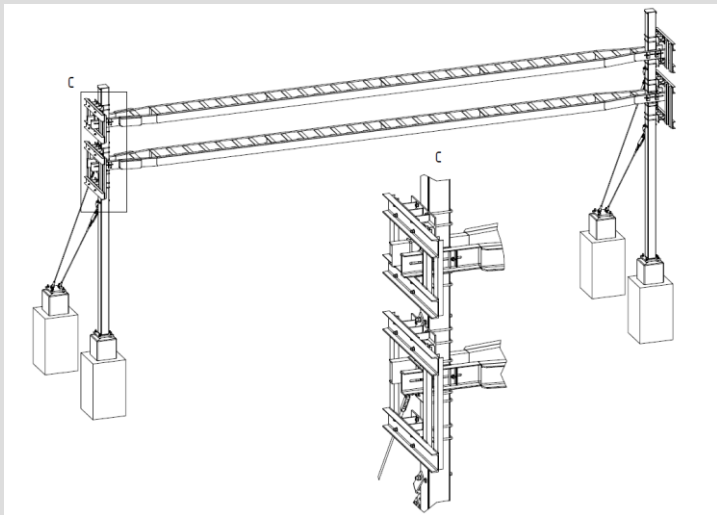
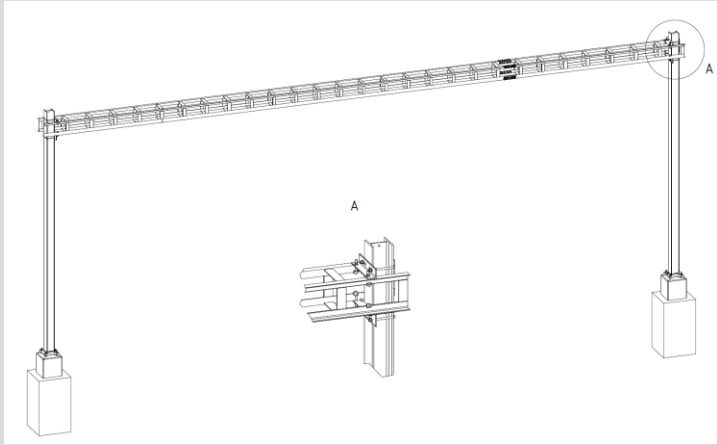


Spring auto tensioning devices (Tensorex®)



System Design

New overhead line portal structures:



System Design

Foundation types:

- Side bearing foundations
- Gravity pad foundations
- Tubular piles
- Wall brackets
- Screw piles

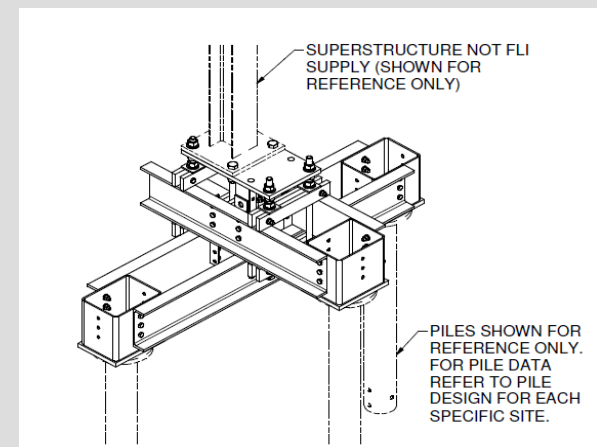
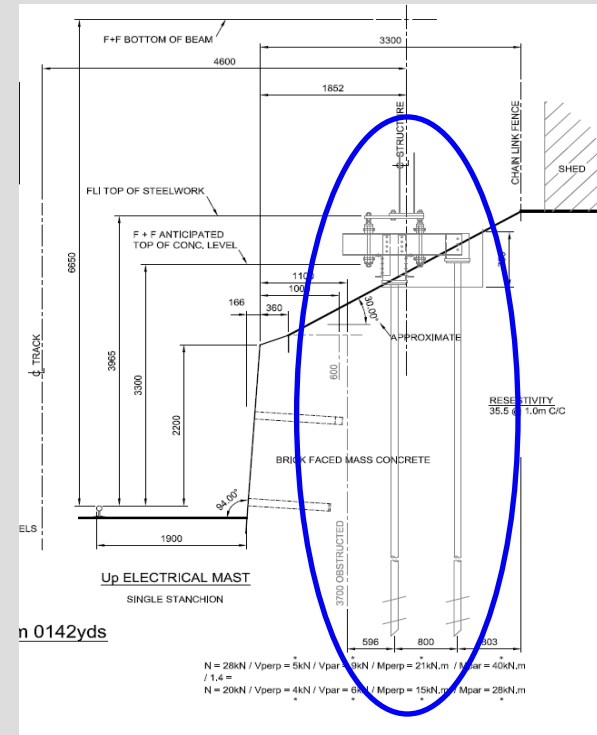


System Design

Screw piles:



Screw pile foundations by FLI



Overview

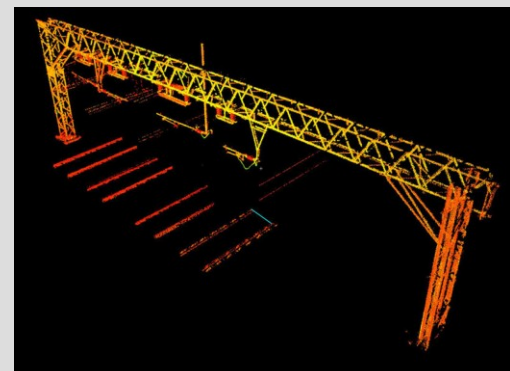
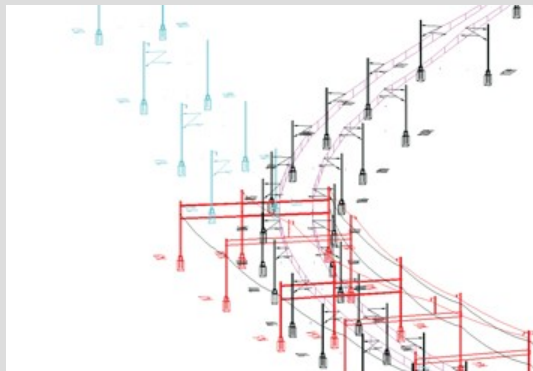
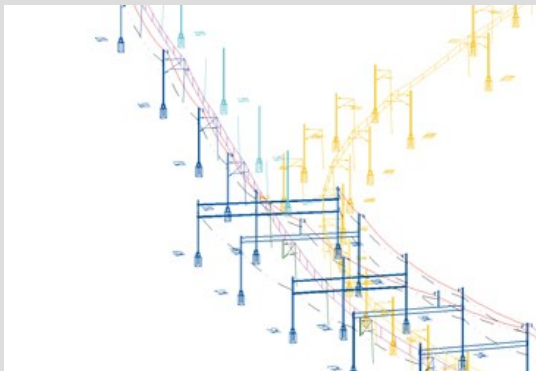
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Allocation Design

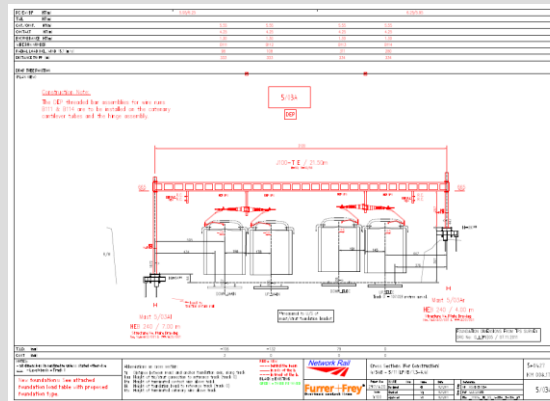
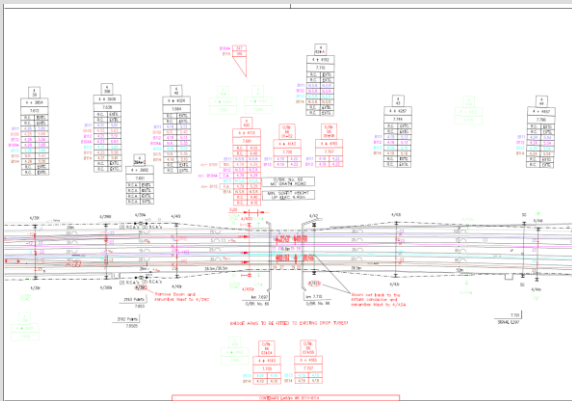
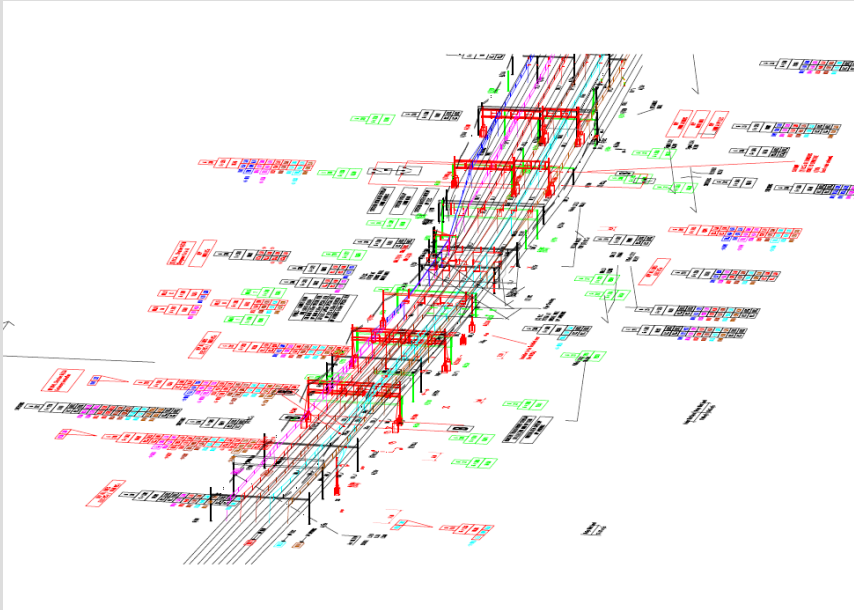
One key element in the allocation design - ELFF:

- 3D model
- Layout plan and cross sections
- List of components and bill of quantity
- Structural analysis for structures and wiring
- Phase plans for staging design
- Integration of 3D point clouds from laser scans
- Easily adaptable for new OLE systems



Allocation Design

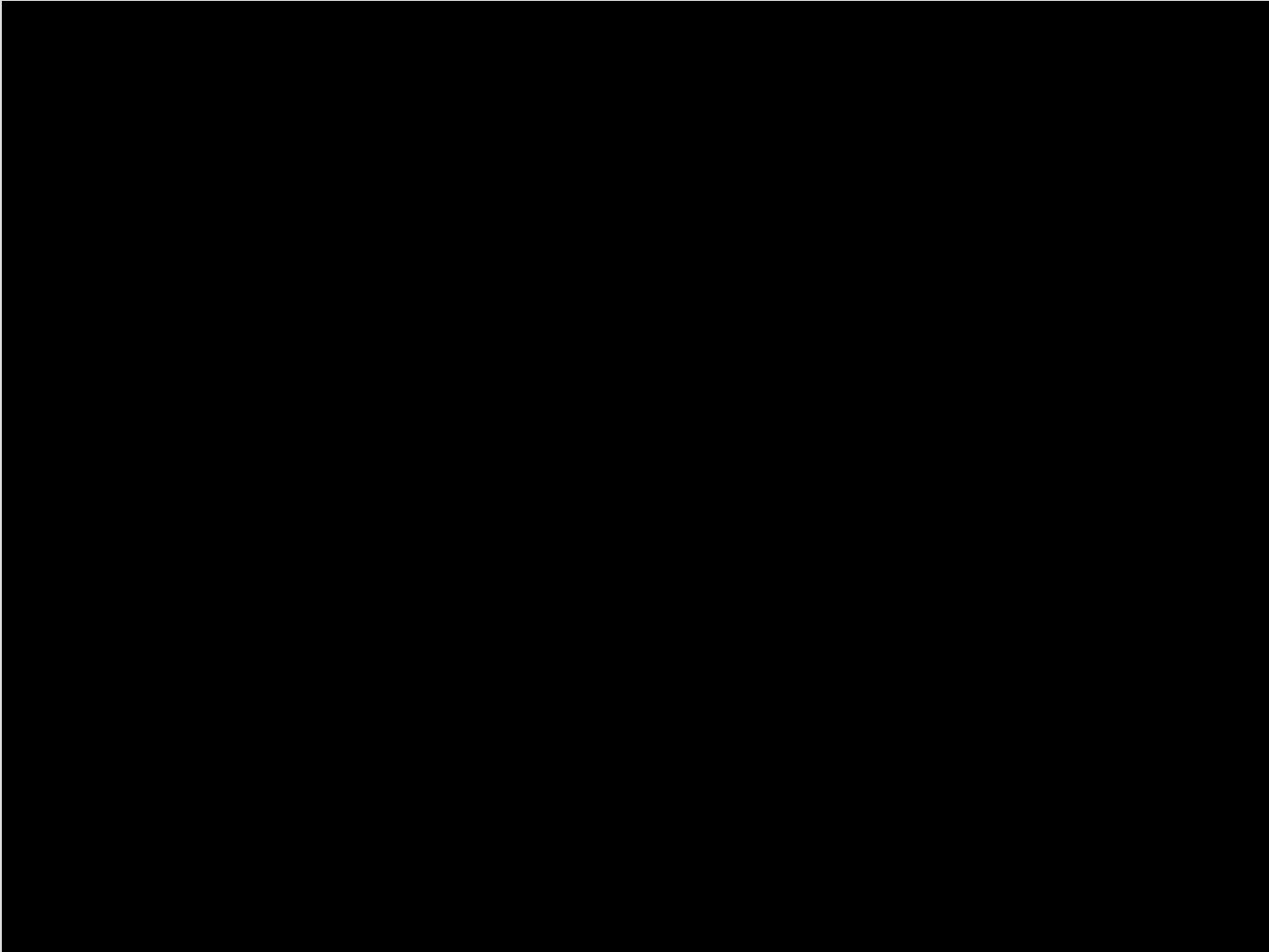
One key element in the allocation design - ELFF:



Art. Nr.	Label	Amount	Wirenr. / Notes
KM008177 S/03A (BPS)			
ARTICLE NO.	DESCR	QTY	NOTES NONAME B111 B112 B113 B114
5557	Cont. wire swivel clip groove type	4	1 1 1 1
G348.077.80.180	Drop tube 120/120 reinforced f. 800-J130	1	1
G348.077.80.180	Drop tube 120/120 reinforced f. 800-J130	1	1
G371.1442.08	Cam-lever tube types 03 - 22	2	1 1 1 1
G371.1442.10	Cam-lever tube types 03 - 22	2	1 1 1 1
G371.254	Reinforced registration tube ø48.3 ass.	4	1 1 1 1
G372.249	Hinge assembly type 770	3	1 1 1 1
G372.251	Hinge assembly type 560	1	1 1 1 1
G424.154	Strut insulator strong, 25kV	4	1 1 1 1
G431.0253	Cable clamp assembly 6x13	4	1 1 1 1
G442.096-10	Curved register, arm with ring stiffened	2	1 1 1 1
G442.096-12	Curved register, arm with ring stiffened	2	1 1 1 1
G442.097	Registration arm ring fitting for ø48	4	1 1 1 1
G472.056	DEP earthing bolt	6	2 2 2 2
G472.057.12	Earthing Bolt Assembly	2	2
G983.9804	Flexible copper continuity jumper L360	4	1 1 1 1
OL-148/861/001	DEP marker	2	2
OL-199/820/001	Marker plate fastening	2	2
KM008177 S/03A (STEEWORK)			
ARTICLE NO.	DESCR	QTY	NOTES NONAME
1212.24.040	Mast with base plate HEB240, L=4.0m	1	1
1212.24.070	Mast with base plate HEB240, L=7.0m	1	1
2221.100.215	Gantry beam w. par. ends, sq. beam J=100	1	1
G348.076.80.090	Drop tube 120/120 for 800-J130	2	2
G433.103.2.1100.24	Support bracket for gantry beam 800-J130	4	4
G472.055.12	Return Conductor Insulator Assembly	4	4
OL-148/820/001	RC Liner for Copper RC	4	4
OL-148/820/001	RC Liner for Copper RC	4	4
GBONDING	Bonding see special list	1	1
OL-148/820/001	Structure number plate	2	2
OL-199/820/001	Marker plate fastening	2	2
Bill of Quantity (For Construction) 4/108 - S/103 (B-3-A-U) 8th page of 11 R01 008.177			
5/03A			

Allocation Design

One key element in the allocation design - ELFF:



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Grazie per l'attenzione!

