



# Complexities of OLE Train Testing

PWI Lunch & Learn – 21st January 2025  
Simon Skinner C.Eng FIET FPWI



# Midland Mainline Contents

**The Project & Numbers**

**OLE Static Assurance**

**Legal Position and Test Train Requirements**

**Conclusion**

**Questions!**

**Join the Debate**



**Click the link and wait.  
Questions will pop up  
when ready!**





# Midland Mainline

## Kettering 2 Wigston Electrification

### Project Scope



STK



24miles  
Scheme  
Length



Substations



400kV  
Connection



Signal Head  
Changes



Track  
Interventions



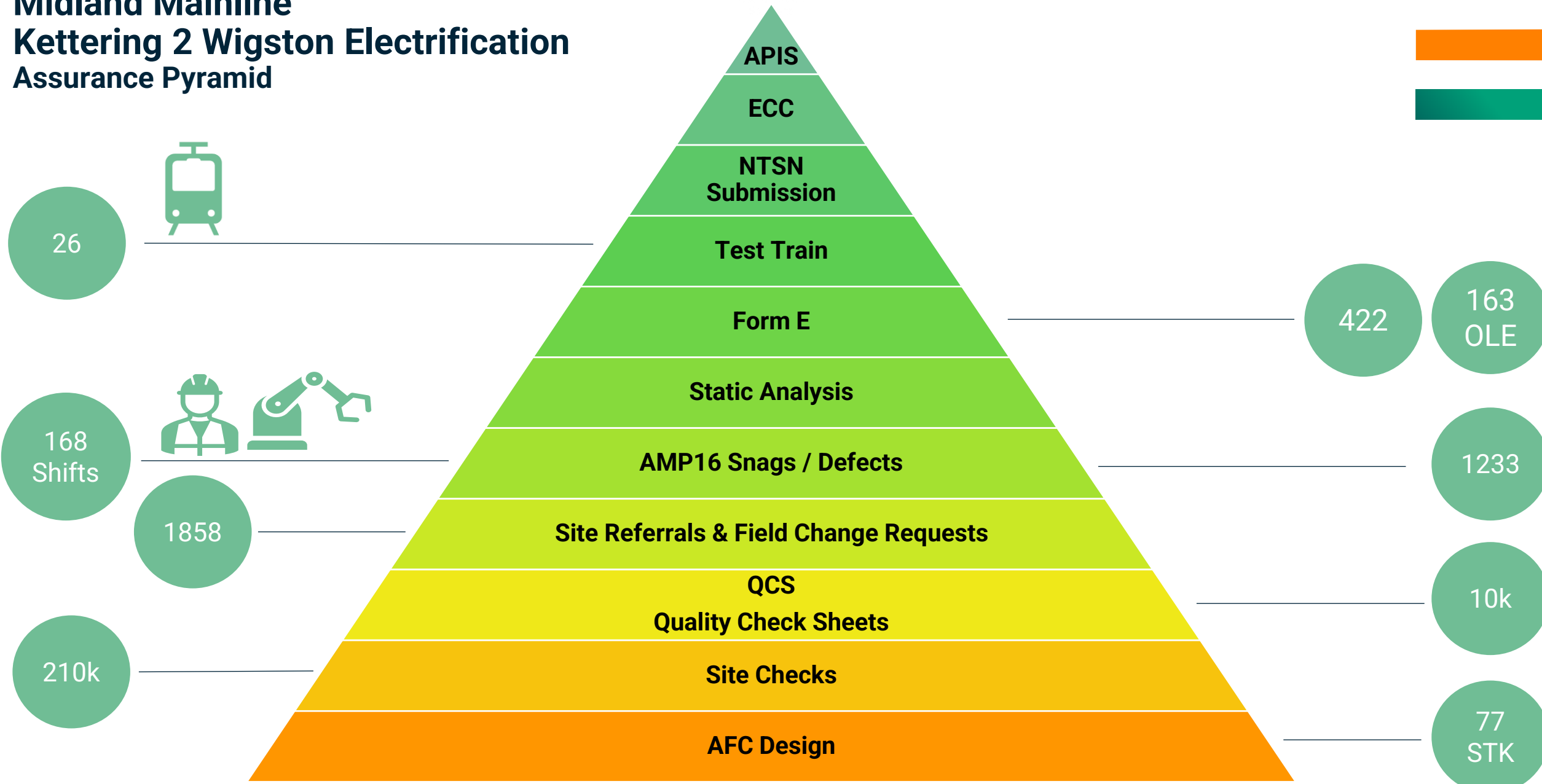
Voltage  
Controlled  
Clearance



Bridge  
Interventions



# Midland Mainline Kettering 2 Wigston Electrification Assurance Pyramid

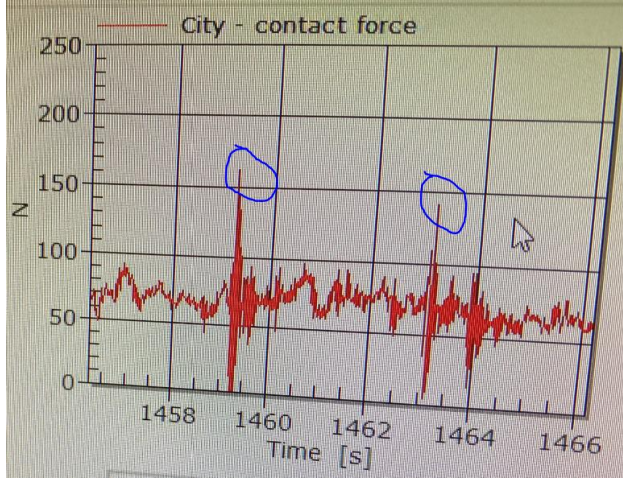


# Test Train

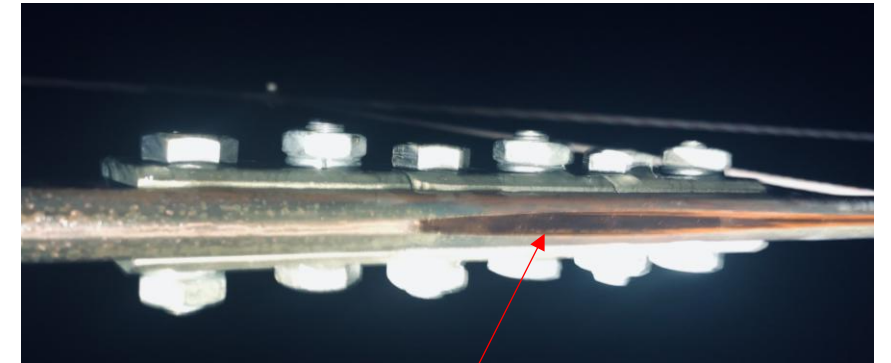
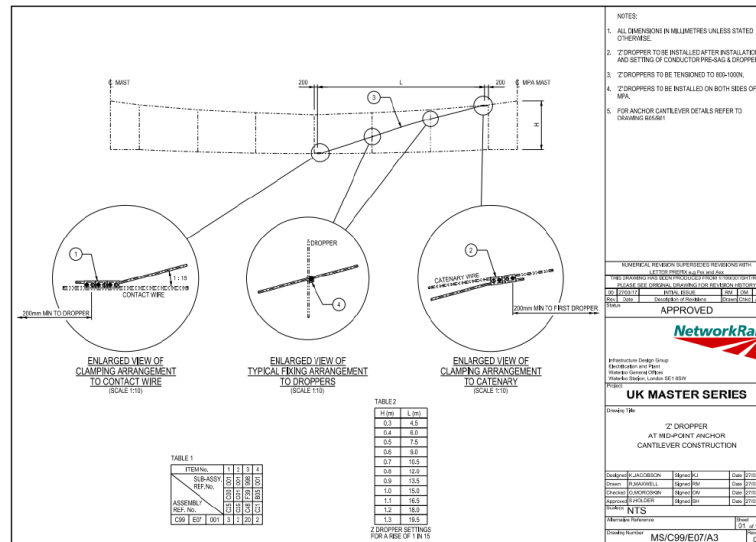
## Previous Industry Lessons Learnt

Prior to Test Train, SPL increased static assurance geometry checks at the following locations;

- Note: Droppers were Calculated to actual Spans (to nearest 0.1m)
- Tangential wiring (Cross Overs)
- Overlaps
- Inline Neutral Sections (AFNS)
- Section Insulators @ Cross Overs
- Bridge Arms & VCC measures implemented such as contact wire covers
- Cross Contact Bars
- “Z” Droppers (on legacy wire runs within UKMS)



Legacy Test Train Outputs indicated high peak forces at MPA Zeed dropper location

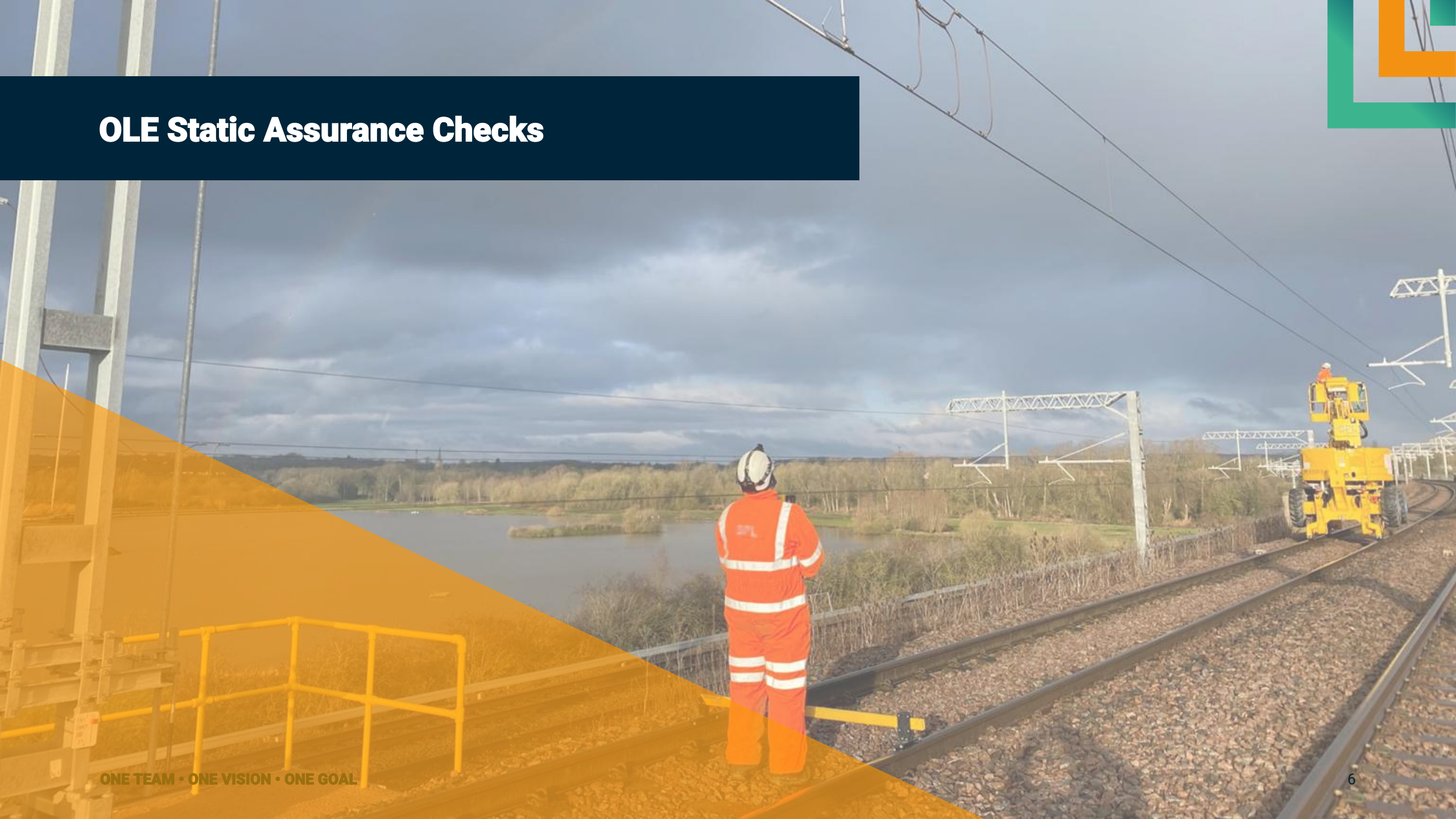


Worn Contact wire after 1 year's service indicating high wear





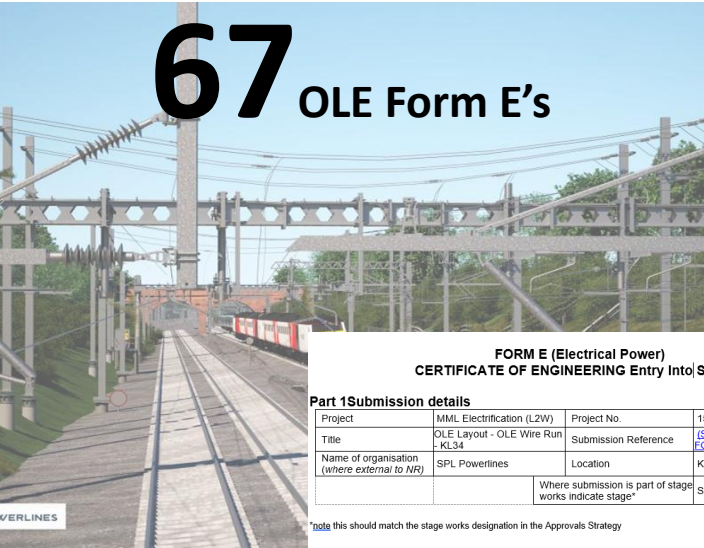
# OLE Static Assurance Checks



# Midland Mainline

## Kettering 2 Wigston Electrification

### OLE Form E's



#### FORM E (Electrical Power) CERTIFICATE OF ENGINEERING Entry Into Service

##### Part 1 Submission details

|                                                         |                                  |                      |                                                |
|---------------------------------------------------------|----------------------------------|----------------------|------------------------------------------------|
| Project                                                 | MML Electrification (L2W)        | Project No.          | 157897                                         |
| Title                                                   | OLE Layout - OLE Wire Run - KL34 | Submission Reference | (SPL) 157897-PLG-ZZZZ-ZZZZ-FOE-EOH-000018 (01) |
| Name of organisation (where external to NVR)            | SPL Powerlines                   | Location             | KL34                                           |
| Where submission is part of stage works indicate stage* |                                  | Stage                | 3                                              |

\*note this should match the stage works designation in the Approvals Strategy

##### Part 2 Recommendation for Entry Into Service

I certify that reasonable professional skill and care have been used in construction of the Scheme (or part of Scheme) and the requirements of the associated Form B have been met to allow entry into service.

|                                                                                                                                 |                                                                      |
|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| Signed:                                                                                                                         | Title: OLE Construction CRE                                          |
| Name (print): Sam Hinks                                                                                                         | Date: 08/07/24                                                       |
| List of relevant Form B documents:                                                                                              |                                                                      |
| CU KL34 Form B Design <a href="#">EOH - SPK3-152.470km to 153.208km - C04 - 01/02/24</a>                                        |                                                                      |
| Refer to the following documents in support of this Form E:                                                                     |                                                                      |
| KL34 - OLE DC QCS submission                                                                                                    | <a href="#">157897-PLG-ZZZZ-ZZZZ-CHK-EOH-000071 (Version: P01.1)</a> |
| KL33 Heights & Stagers                                                                                                          | <a href="#">157897-PLG-ZZZZ-ZZZZ-RCD-EOH-000021 (Version: P01.1)</a> |
| KL34 Heights & Stagers                                                                                                          | <a href="#">157897-PLG-ZZZZ-ZZZZ-RCD-EOH-000022 (Version: P01.1)</a> |
| Field Change Request (FCR) Register                                                                                             | <a href="#">MML FCR Register - Smartsheet.com</a>                    |
| Details of outstanding works required for Engineering Completion (including known deviations and/or dispensations from Form B): |                                                                      |
| None                                                                                                                            |                                                                      |
| This Form E certificate is complete and ready for the following:                                                                |                                                                      |
| Mechanical (Dynamic Pantograph Test Train)                                                                                      | Yes-No                                                               |
| Energisation (Electrical and section proving)                                                                                   | Yes-No                                                               |
| To be signed by the CRE                                                                                                         |                                                                      |
|                                                                                                                                 |                                                                      |

| SPS Final Reg Contact and Catenary support |                                                                            |                     |                       |                     |            |                 |
|--------------------------------------------|----------------------------------------------------------------------------|---------------------|-----------------------|---------------------|------------|-----------------|
| code                                       | Checklist                                                                  | Response            | State (PASS/WIP/FAIL) | Supervisor/Engineer | Date       | Attach an image |
| J1.2.1                                     | Style of registration (i.e. Bonomi, SIC, RESIC, UK1)                       | Bonomi straight arm | Pass                  | Patrick Thompson    | 24/10/2023 |                 |
| J1.2.2                                     | Registration arm length - Design                                           | 1300                | Pass                  | Patrick Thompson    | 24/10/2023 |                 |
| J1.2.3                                     | Registration arm length - Actual                                           | 1300                | Pass                  | Terry Davis         | 21/12/2023 |                 |
| J1.2.4                                     | State Contact & catenary alignment (mm) +/- 75mm                           | 0                   | Pass                  | Terry Davis         | 21/12/2023 |                 |
| J1.2.5                                     | State heel setting, see attached table for design heel setting & tolerance | 90mm                | Pass                  | Terry Davis         | 22/12/2023 |                 |
| J1.2.7                                     | State catenary swivel clamp centre to strut pin measurement (mm)           | 370                 | Pass                  | Terry Davis         | 22/12/2023 |                 |

### Construction Unit QCS Submission Snapshot

| HEIGHT & STAGGER RECORD SHEET           |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|-----------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------|--|-------------------------------|--|-----------------------------|--|
| IS HEIGHT AND STAGGER GAUGE CALIBRATED? |  | Yes                                                                                                                                                                     |  | X                            |  | (X) Pre-Height and Stagger    |  |                             |  |
| Checked & Approved by :                 |  | Signed:                                                                                                                                                                 |  | Listed speed                 |  | 125                           |  | (X) Post-Height and Stagger |  |
| Date                                    |  | 18/07/2024                                                                                                                                                              |  | Design submission reference: |  | 157897-PLG-ZZZZ-ECH112007-000 |  |                             |  |
|                                         |  |                                                                                                                                                                         |  | Design submission reference: |  | 157897-PLG-ZZZZ-ECH112007-000 |  |                             |  |
| CAUTION                                 |  | High rail to be indicated as follows: Left Rail High (L) Right Rail High (R)<br>Stagger direction to be shown in left and right columns & Negative stagger shown as (-) |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |
|                                         |  |                                                                                                                                                                         |  |                              |  |                               |  |                             |  |

### Construction Unit Height & Stagger Submission Snapshot





Midland Mainline  
Kettering 2 Wigston Electrification  
OLE Data Capture



The NMT Measurement  
Train wasn't available



Needed a quick way to  
scan infrastructure and  
remove "boots on ballast"



Required feature  
extraction to support  
lots of data



AMP16

As-Built

Bridle Positions  
Insurance Policy  
Static Analysis OCLZ Assessment

Continuous Wire Data

Vegetation Assessment



BIM

Signal Sighting  
Dropper Assessment and Extraction  
Clearance Gauging  
System Heights  
Electrical Clearance  
Video Flythroughs  
Height & Stagger  
Highway Surveys  
Federated Model

8pt Topo

Heel Settings

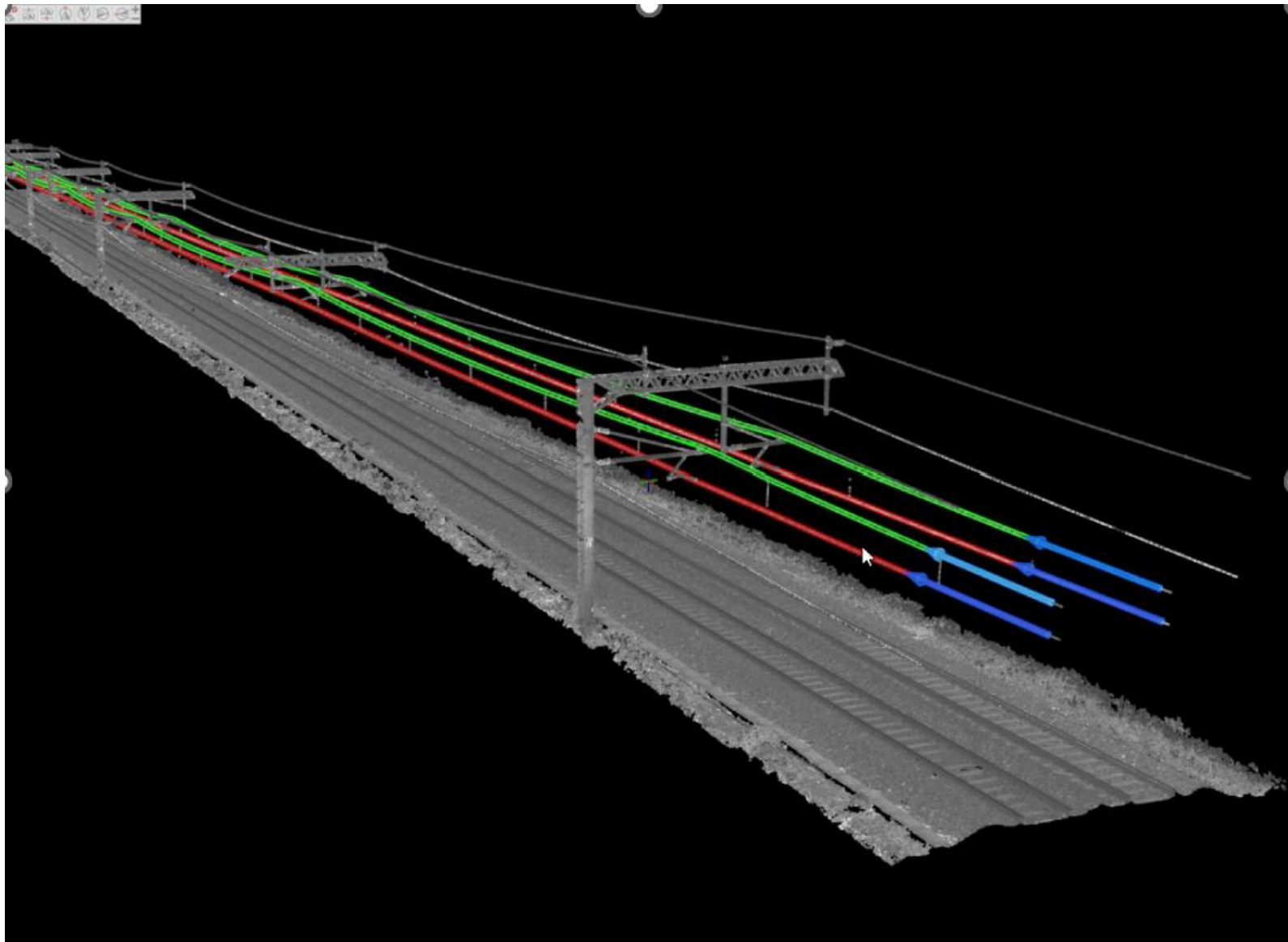
Mobile Mapping  
Credible Standing Surfaces

EviFile Support Cross Sections

Assurance

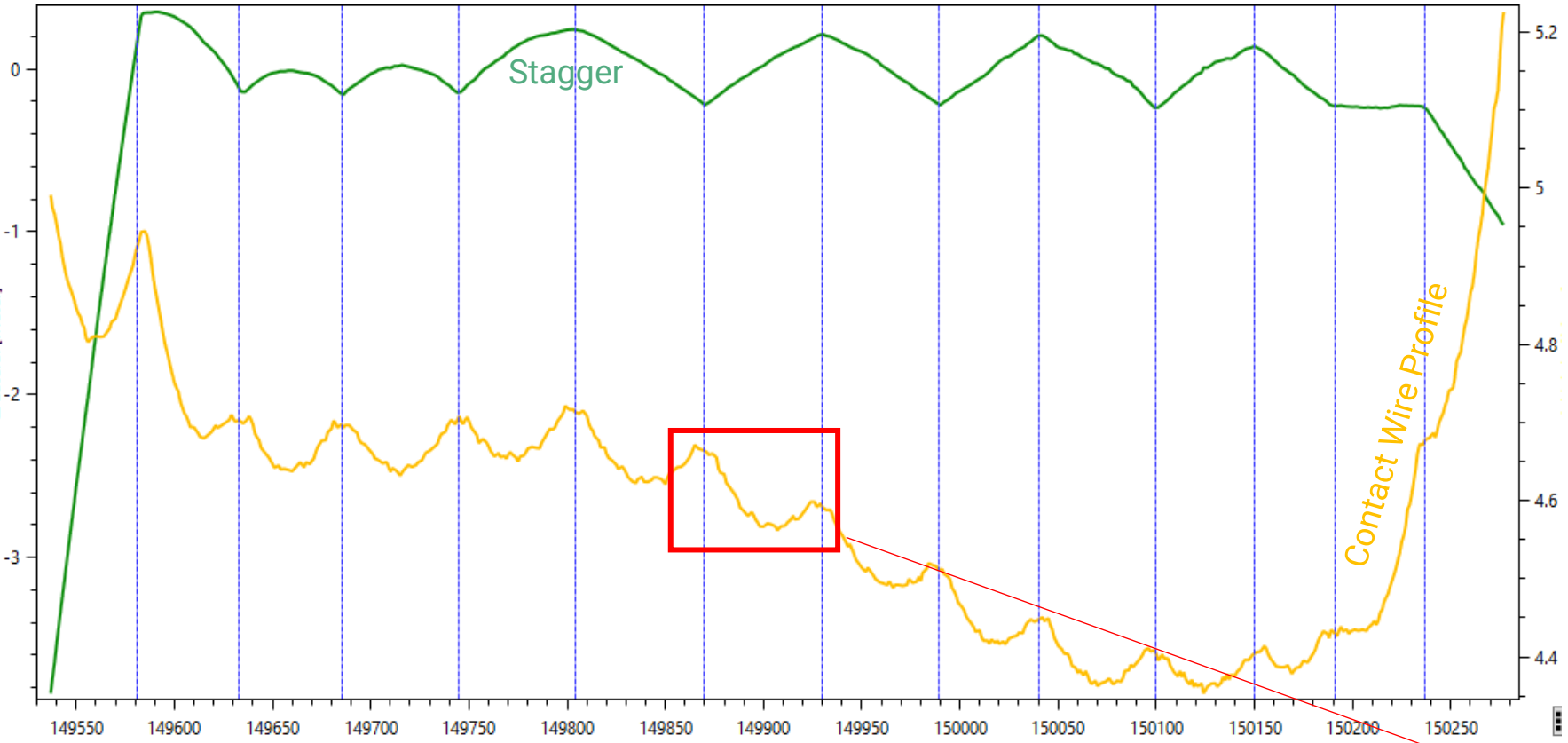


Midland Mainline  
Kettering 2 Wigston Electrification  
OLE Data Capture

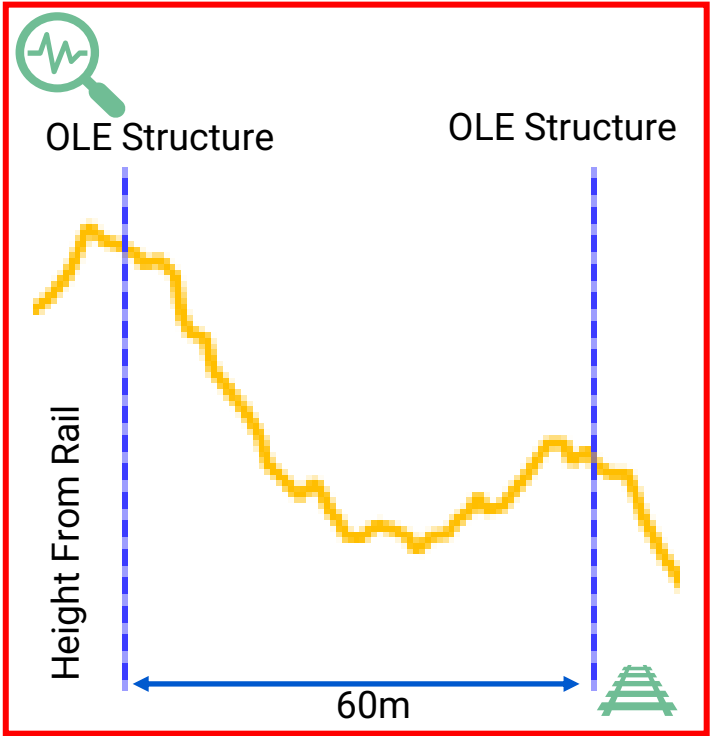


# Midland Mainline Kettering 2 Wigston Electrification

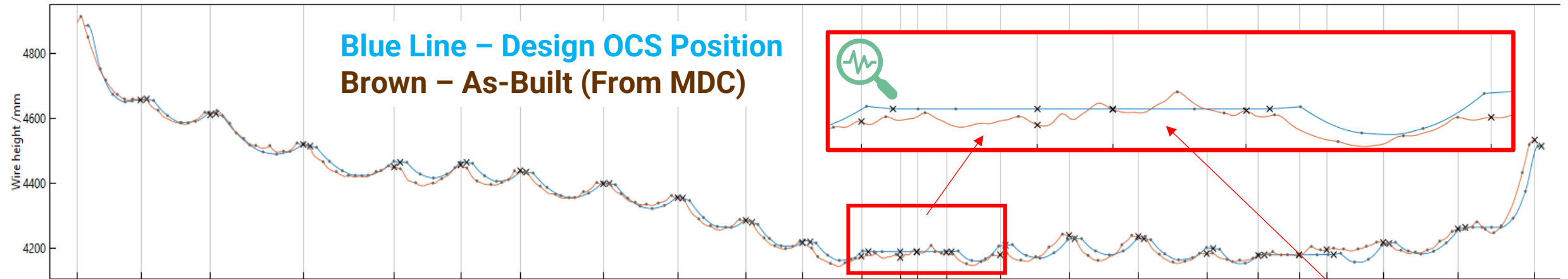
Raw data Mobile Mapping Output



Good quality contact and messenger wire output at 0.2m increment from a single pass to be analysed by OLE StAT for conformance.



# Midland Mainline Kettering 2 Wigston Electrification OLE StAT Analysis by T-RIS



## 3 Recommendations

The Phase 3B, Pre-NTSN 30/60/85 test runs of Week 1 have been analysed with all identified localised force peaks identified and passed on to SPL to inform 'snagging' activities to the infrastructure. The current report is a mid-way point leading to the final NTSN construction assurance of the following weeks' NTSN testing of Phase 3C and the reported exceedances are not classified as construction assurance interface performance failure points.





# Test Train Requirements



# Train Testing Why?

There are 2 legal Clauses applicable to Train Testing, as per ENE NTSN:

1. 6.1.4.1

- Assessment of dynamic behaviour and quality of current collection
- Commonly known as "IC Testing"

**Simplified : To validate and verify new OLE Systems**

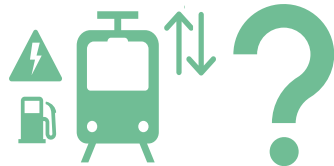
2. 6.2.4.5

- Assessment of dynamic behaviour and quality of current collection (integration into a subsystem)
- Commonly known as "Construction Assurance"
- Train Testing is needed for operational speeds that are above 120 km/h (75MPH)

**Simplified : To verify that the OLE has been installed correctly, for systems that have been tested already to 6.1.4.1**



Legal Requirement



The industry was  
unable to support the  
requirements



18

Months to Plan



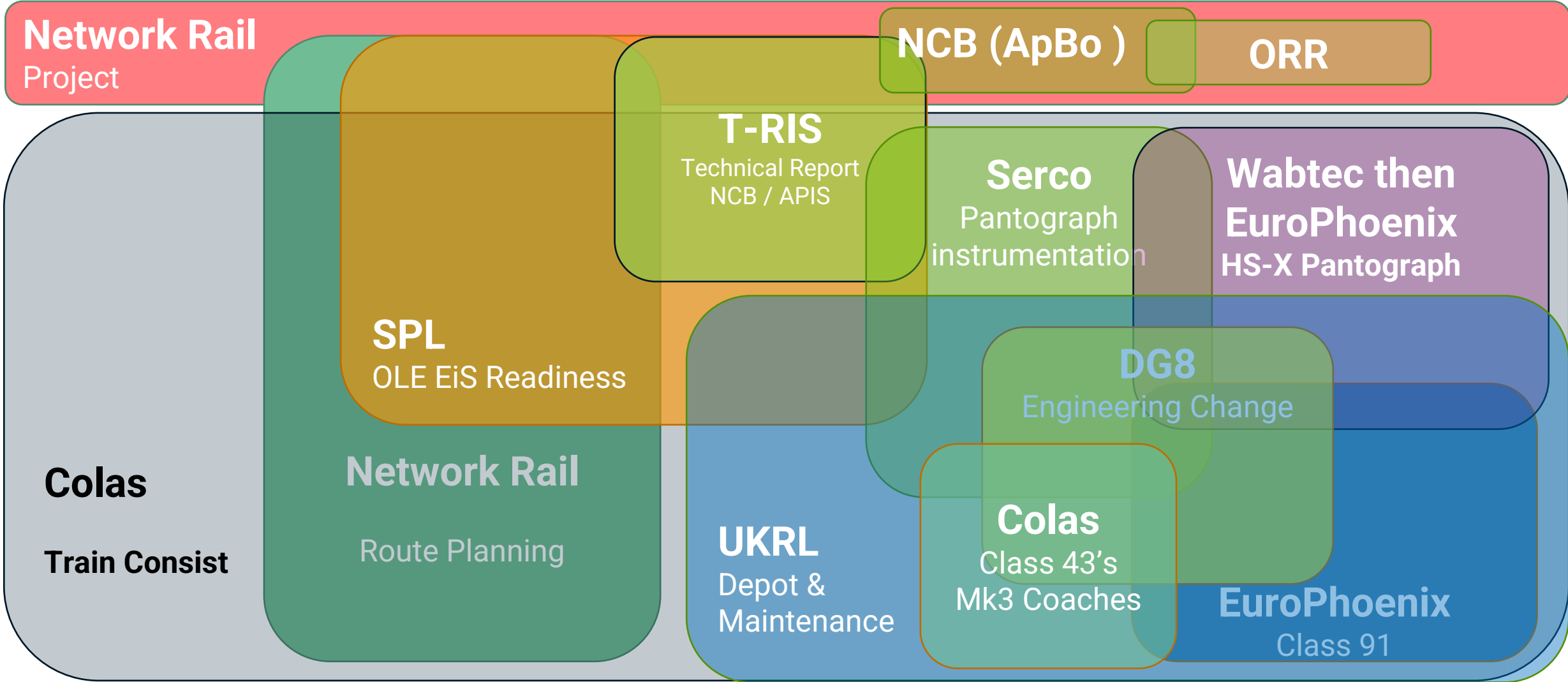
2

Months for the  
Test Train  
Programme





# Train Testing Who's Who





# Train Testing The Pantograph

## Pantograph

- A HS-X is an Interoperable (TSI) Pan
- The HS-X maximum speed is 125MPH
- HS-X has good historic performance
- HS-X are designed for IEP Class 80X Trains. Any HS-X or bespoke pan has a long procurement lead time



## Pantograph & Rolling Stock

- Procured a HS-X for a Class 90 Train in 2023



- Class 90's discontinued so alternatives had to be found
- Class 91 was chosen however Class 90 to 91 are not the same
- The HS-X Pantograph then changed to fit a Class 91



## Rolling Stock

- The 91 existing HS-A was removed and replaced with the HS-X "Hybrid"
- A new Vehicle Maintenance Instruction was created via Engineering Change for the new HS-X to fit the 91
- Modifications to the 91 undertaken to fit HS-X
- Further modifications to HS-X to support measurement equipment were required



## 91 Modifications

- Camera fitment to the Cab to enable a positive indication that pan had been raised / lowered.
- An auxiliary power supply installed (110V) to ensure the pan can be operated in addition to the existing batteries
- Installation of hard-wired communications between HST / Mk3 Coaches and 91
- Cable detail to allow monitoring of forces from 91 to Mk3 Coach
- Roof adjustments to allow VANE's to fit



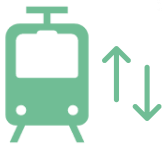
# Train Testing Requirements



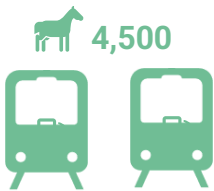
125MPH, the current maximum speed on the UK network



The Train Operator is introducing Bi-Mode Trains, both Diesel and 25kV Electric



The Pantograph had to be raised & lowered at speed during the operation



Electra was hauled by 2 x Diesel units from a non-electrified depot



Electra needed to use the Class 91 Electric "in tandem" with the Diesel units. This was the most powerful train on the network during testing

**Bi-Mode Location**



**2 Miles**

From 125-0MPH



**End of Wire**

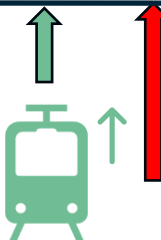


**Bi-Mode Location**



**7miles**

From 0-125MPH (Diesel only)



# Train Testing

## Number of Runs

| Test Train Stage             | Description                                                                                                                                                         | Linespeed MPH        | Number of Runs    |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------------|
| Vane Angle Adjustments       | To Setup and validate the “Vanes”                                                                                                                                   | 125                  | 6                 |
| Teather Testing              | Setup, validate and measure the aerodynamic effect on the knuckle of the pantograph. The results were incorporated into the final calculation of the contact force. | 50,75,90,100,110,125 | 6                 |
| Pre-NTSN Construction Checks | To check and verify the Dynamic Performance of the installed Pantograph with our Train Consist                                                                      | 30,60, 85, 110       | 10                |
| NTSN                         | For APiS (NCB / ORR) Submissions                                                                                                                                    | 110                  | 6                 |
| NTSN Uplift Testing          | For APiS (NCB / ORR) Submissions                                                                                                                                    | 110                  | 2 – Day Time Only |
| Electrical Testing (VI/Vt)   | For APiS (NCB / ORR) Submissions                                                                                                                                    | 85MPH & Varied       | 4                 |

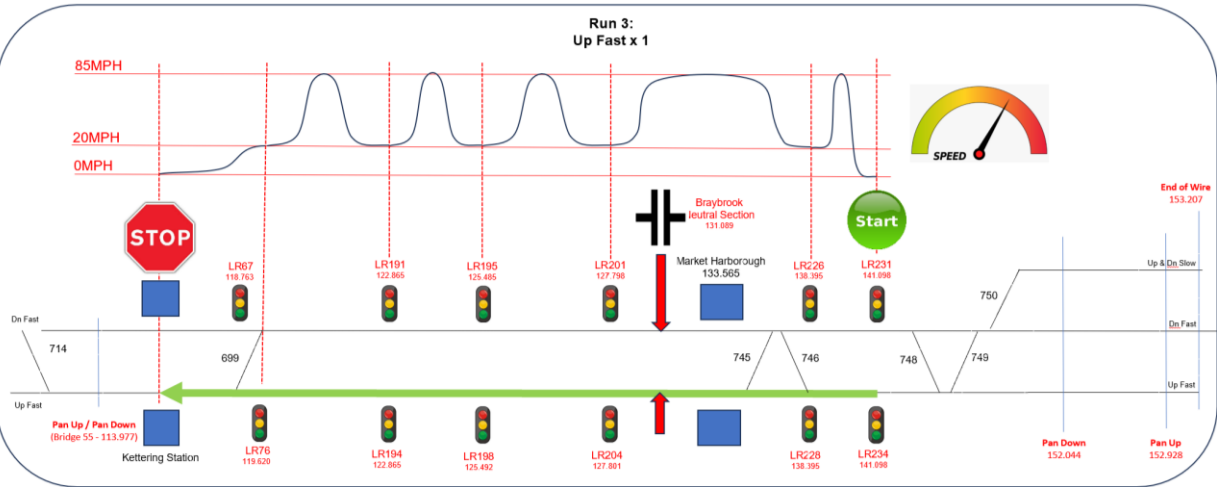
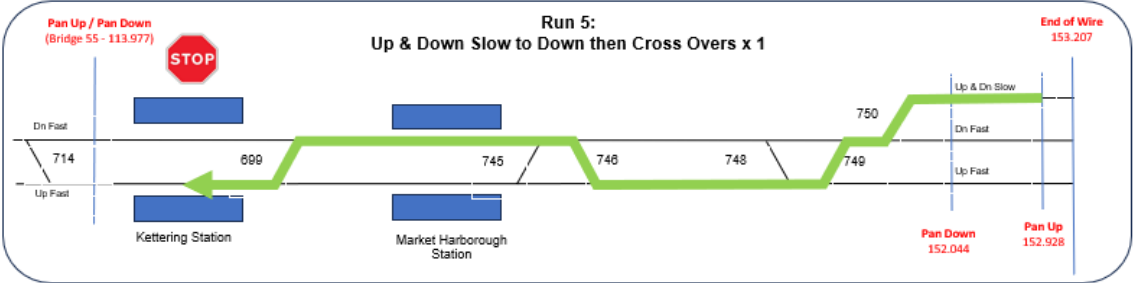
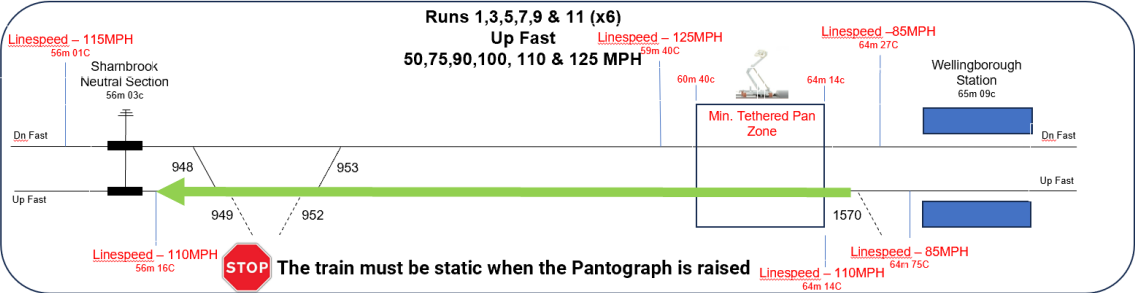


Validates the Pantograph to the Rolling Stock

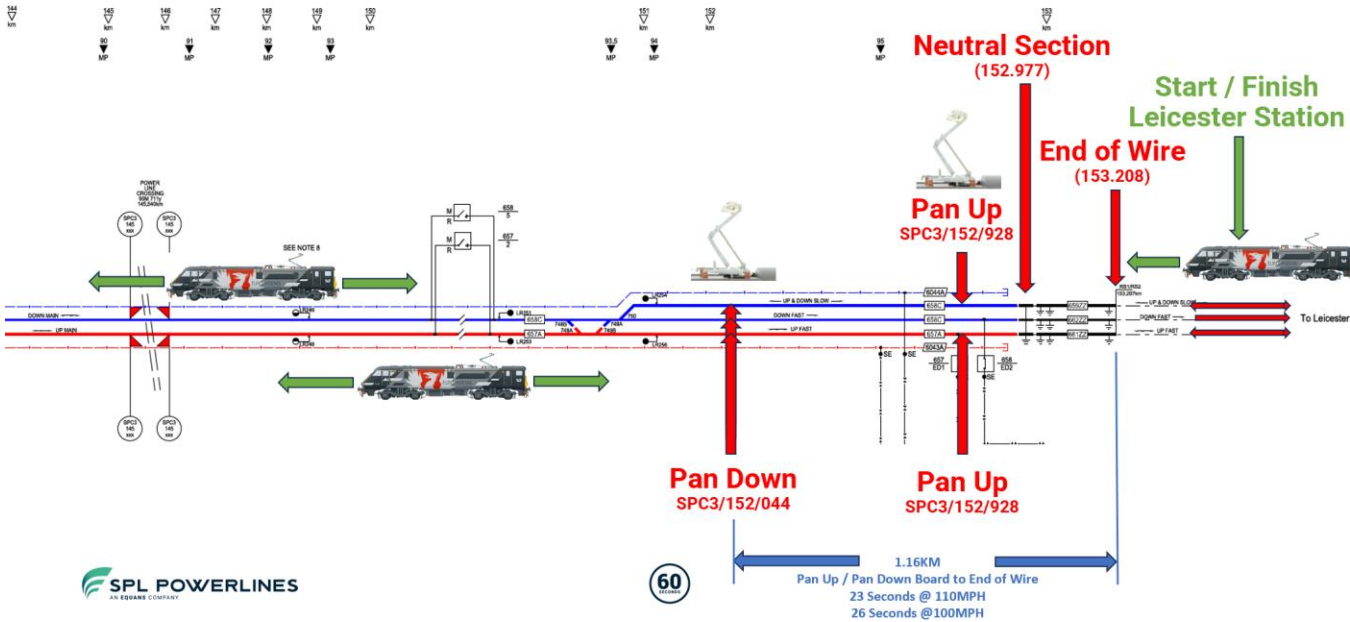




# Train Testing Planning Example



## Phase 3c – NTSN Testing Track Access (Northern End)



|              | UKRL<br>Keeping you on track |               |                     |                     |                                      |                                                       |                                  |                                    |
|--------------|------------------------------|---------------|---------------------|---------------------|--------------------------------------|-------------------------------------------------------|----------------------------------|------------------------------------|
| Company      | Depot                        | Class 43 Back | Mk3 Carriage Locked | Mk3 Carriage Locked | Class 91 Driver                      | Mk3 Carriage Instrumentation                          | Mk3 Carriage Visitor Opportunity | Class 43 Driver                    |
| Colas        | No                           | No            | No                  | No                  | Colas 91 Operator Needed for Phase 5 | Train Manager                                         | No                               | 1 x Driver<br>1 x 91 Ass. (5 only) |
| Europhoenix  | No                           | No            | No                  | No                  | Europhoenix 91 Operator              | No                                                    | No                               | No                                 |
| Serco        | No                           | No            | No                  | No                  | No                                   | Engineer<br>Engineer<br>Engineer                      | No                               | No                                 |
| Wabtec       | No                           | No            | No                  | No                  | No                                   | Engineer (3aP1)<br>Engineer (3aP1)<br>Engineer (3aP1) | No                               | No                                 |
| Jimmy London | No                           | No            | No                  | No                  | No                                   | Engineer (3aP1)<br>Engineer (3aP1)                    | No                               | No                                 |
| SPL          | No                           | No            | No                  | No                  | Engineer (On Train Technician)       | Engineer (On Train Technician)                        | No                               | No                                 |
| T-RIS        | No                           | No            | No                  | No                  | No                                   | Engineer (with Serco) Engineer                        | No                               | No                                 |
| UKRL         | P.I.C. Plant. maintenance    | No            | No                  | No                  | No                                   | No                                                    | No                               | No                                 |
| Visitor      | No                           | No            | No                  | No                  | No                                   | Adhoc                                                 | Adhoc                            | No                                 |



# Train Testing

## “Electra” was born





# Train Testing

## What do the outputs look like?



60MPH

Speed



110MPH

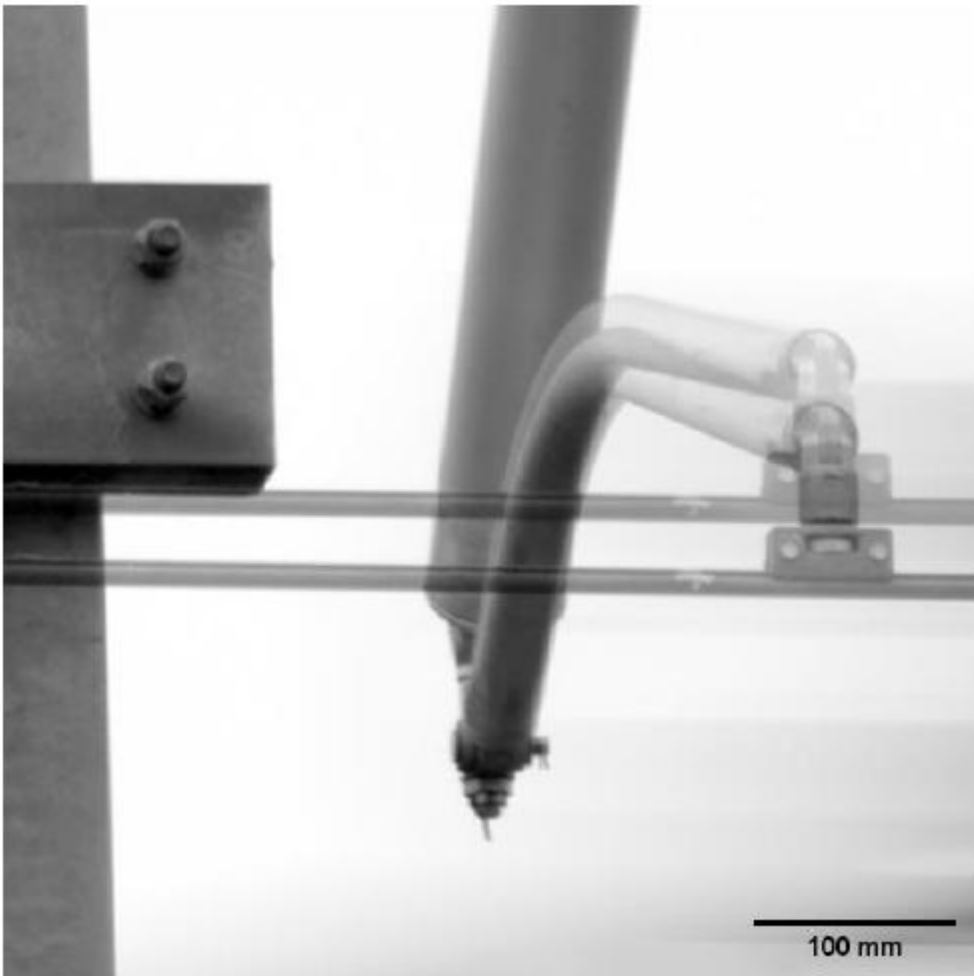
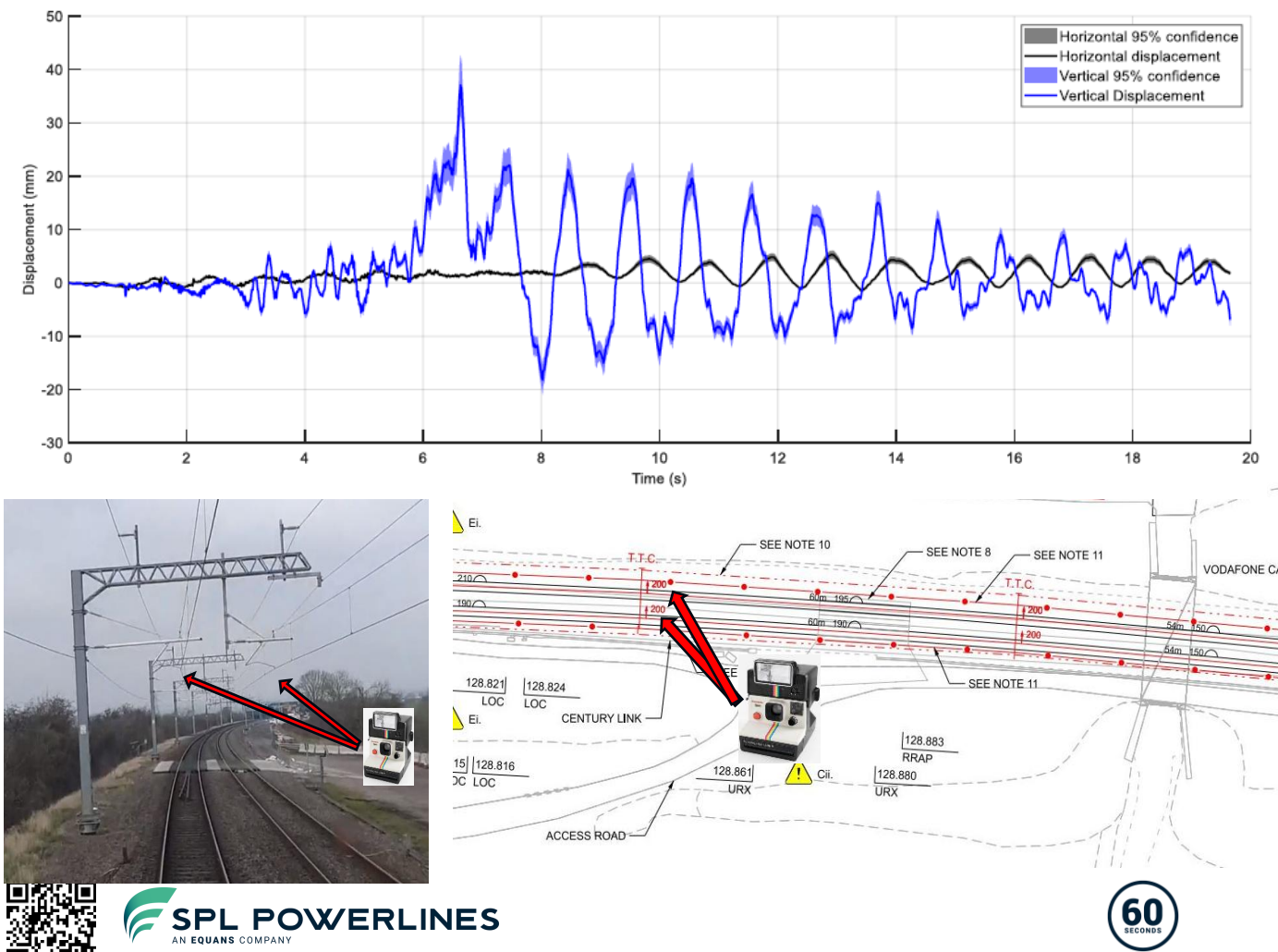
125MPH

Pantograph Force in Newtons



# Train Testing Uplift Assessment

There is a requirement to undertake uplift measurements to satisfy NTSN ENE Clause 4.2.12. (2) to measure uplift of the contact wire at operational linespeed.





# Conclusion



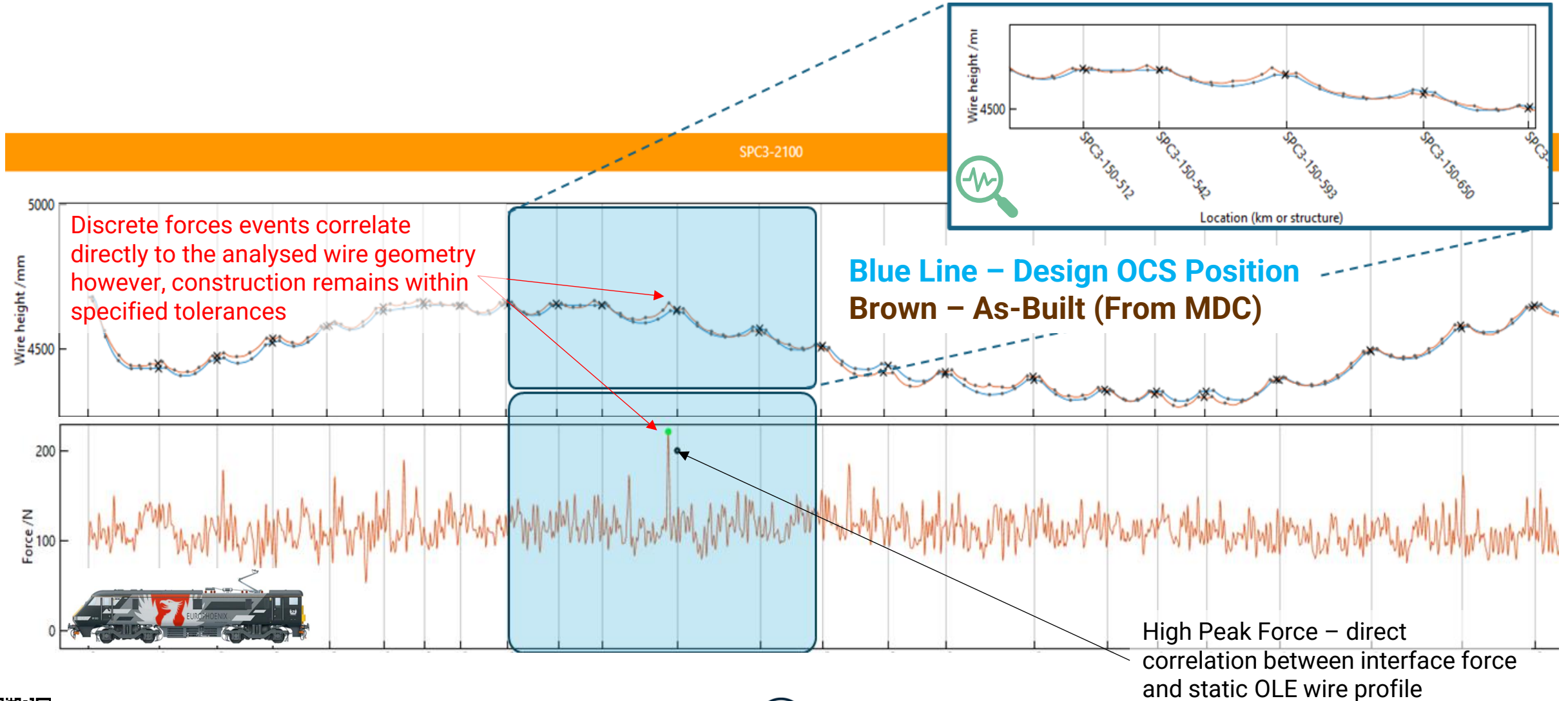




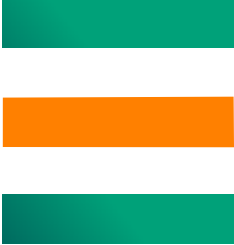
# Comprehensive root cause analysis - Example 2

## Perpetual-OLE by T-RIS

### Design Vs Static Analysis Vs Dynamic Test Train Force



# Test Train System Assurance Outputs



None of the tested wire-runs exceeded this standard deviation, Fmax, Fmin and dynamic uplift thresholds set out by the NTSN ENE and referenced standards.



Extract from NTSN Report to NCB to support APIS (Authorisation to Passenger Services)

**Evidence source:**

The assembly stage requirements of this clause have been adequately demonstrated and the following is provided as evidence:

- L2W Entry into Service Construction Assurance Report [ref. 51]
- Pantograph Aerodynamic Augment - Tether Test Report [ref. 52]
- Pantograph Instrumentation Calibration Report [ref. 53]
- OLE Layout - OLE Wire Run - KL03 Form E (Fasts & Crossover) [ref. 55]
- OLE Layout - OLE Wire Run - KL16 Form E [ref. 56]
- OLE Layout - OLE Wire Run - KL32 Form E [ref. 57]
- OLE Layout - OLE Wire Run - KL33 Form E [ref. 58]
- OLE Layout - OLE Wire Run - KL34 (including Neutral Section) Form E [ref. 59]

**Conclusion:** Compliant



Extract from Approved Body / DeBo  
Conformity Assessment Report and  
Technical File (CAR)

Join the Debate

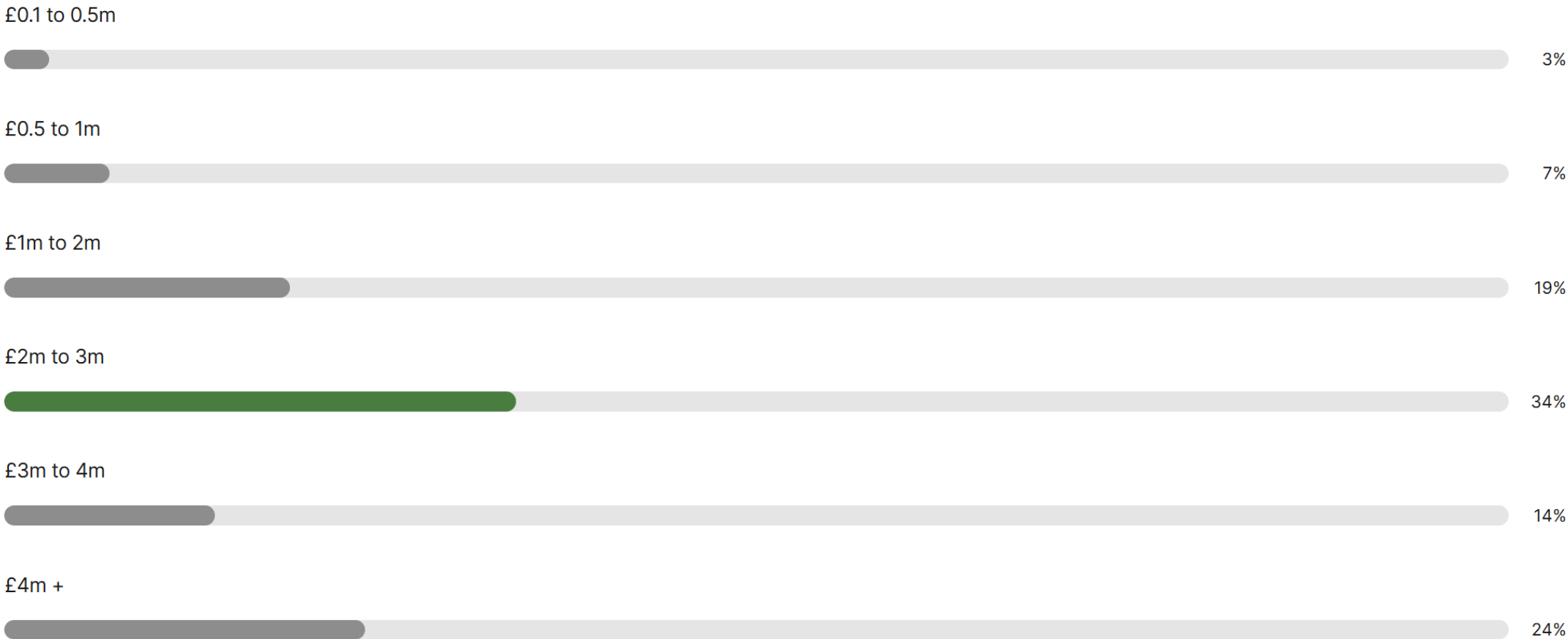




# Q1: How much did Train Testing Cost this project?

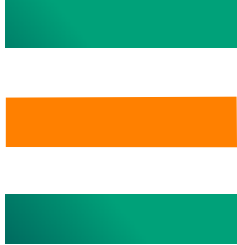
119  
Votes

How much did Train Testing Cost this project?



# Q2: For NTSN compliance, how many OLE adjustments were recommended after our train testing?

124  
Votes



For NTSN compliance, how many OLE adjustments were recommended after our train testing?



# Question Feed Back

**Q1: How much did Train Testing Cost this project?**



**Q2: For NTSN compliance, how many OLE adjustments were recommended after our train testing?**





# Is the NTSN fit for purpose for Construction Assurance? Now & the Future.....

Now

Appendix C - EPF/GEN009 Certificate of Engineering Entry into Service - Form E (Electrical Power)

FORM E (Electrical Power)  
CERTIFICATE OF ENGINEERING Entry into Service

Part 1 Submission details

| Submission Title                                                | Submission Reference | Submission Date |
|-----------------------------------------------------------------|----------------------|-----------------|
| Midland Main Line Electrification Programme - London to Wigston | NCB_N04888_CAR_5992  | 10/03/2025      |

Part 2 Recommendation for Entry into Service

I certify that responsible professional staff and care have been used in construction of the Scheme (or part of Scheme) and the requirements of the associated Form B have been met to allow entry into service.

Name: [Signature] Title: [Signature]

Date: [Signature]

Details of outstanding works required to allow Engineering Completion (including known deviations and/or suspensions from Form B):

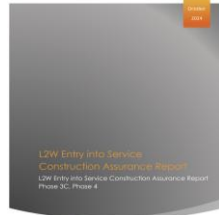
HEIGHT & STAGGER RECORD SHEET

| STAGGER | STAGGER NUMBER | STAGGER TYPE | STAGGER DATE | STAGGER TIME | STAGGER LOCATION | STAGGER STATUS |
|---------|----------------|--------------|--------------|--------------|------------------|----------------|
| 1       | 1              | 1            | 1            | 1            | 1                | 1              |

Form E +



8 Weeks



4 Weeks



Midland Main Line Electrification Programme - London to Wigston

Approved Body / DeBo Conformity Assessment Report and Technical File

Target Date for Authorisation: March 2025

Document and Technical File Reference: NCB\_N04888\_CAR\_5992



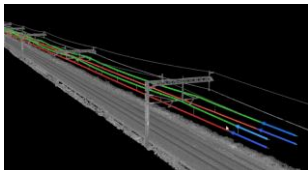
8 Weeks

5  
Months



= APIS

Future?



Enhanced Construction Assurance

Appendix C - EPF/GEN009 Certificate of Engineering Entry into Service - Form E (Electrical Power)

FORM E (Electrical Power)  
CERTIFICATE OF ENGINEERING Entry into Service

Part 1 Submission details

| Submission Title                                                | Submission Reference | Submission Date |
|-----------------------------------------------------------------|----------------------|-----------------|
| Midland Main Line Electrification Programme - London to Wigston | NCB_N04888_CAR_5992  | 10/03/2025      |

Part 2 Recommendation for Entry into Service

I certify that responsible professional staff and care have been used in construction of the Scheme (or part of Scheme) and the requirements of the associated Form B have been met to allow entry into service.

Name: [Signature] Title: [Signature]

Date: [Signature]

Details of outstanding works required to allow Engineering Completion (including known deviations and/or suspensions from Form B):

HEIGHT & STAGGER RECORD SHEET

| STAGGER | STAGGER NUMBER | STAGGER TYPE | STAGGER DATE | STAGGER TIME | STAGGER LOCATION | STAGGER STATUS |
|---------|----------------|--------------|--------------|--------------|------------------|----------------|
| 1       | 1              | 1            | 1            | 1            | 1                | 1              |

+ Form E



= APIS





**Thank you!**  
**Questions?**  
**What are your thoughts?**

**Are Test Trains Needed for NTSN Construction Assurance?**



Simon Skinner C.Eng FIET FPWI

+44 (0) 7919 595 068

[Simon.Skinner@powerlines-group.com](mailto:Simon.Skinner@powerlines-group.com)



The complexities of train testing Midland Mainlines' new overhead lines equipment - The PWI