USING TAMPING MACHINES

Graham Penfold
Route On Track Machine Engineer (Western)

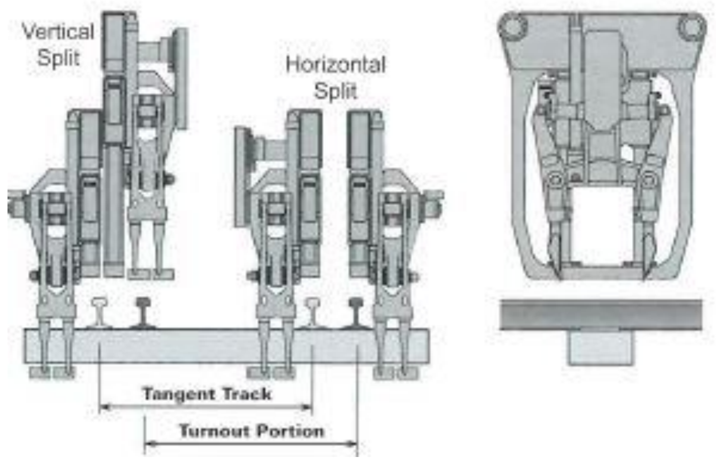
USING TAMPING MACHINES

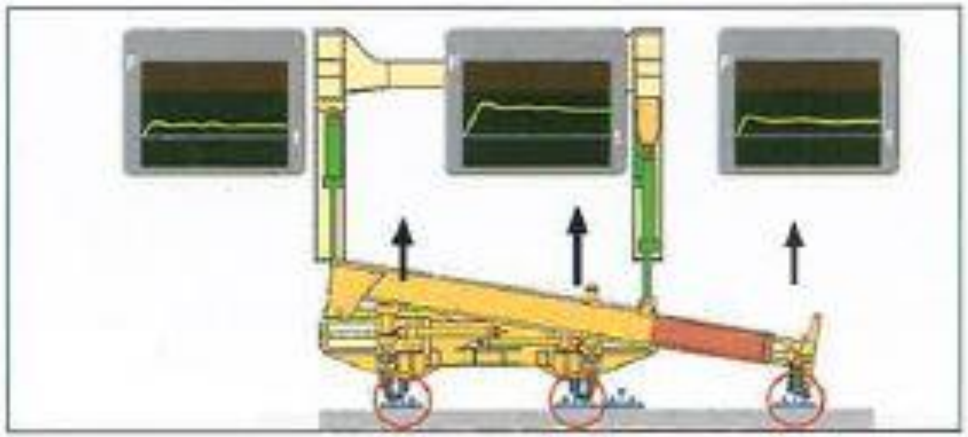
- **OTM STRATEGY** - FLEET, S & C STRATEGY, ALLOCATION OF SHIFTS
- **TAMPING PARAMETER** - FREQUENCY, LIFT, TINE DEPTH, PRESSURE, SQUEEZE TIME
- **HOW TAMPERS WORK** - MEASUREMENT & COMPENSATION, GEOMETRY, OVERLIFT
- **TAMPING S & C**
  - MANUAL PREPARATION
  - TAMPING PARALLEL
  - TAMPING TURNOUTS
  - UNTAMPABLE BEARERS / TIMBERS
  - TAMPABLE BEARERS
  - STRESS TRANSFER / HEEL BLOCK MISALIGNMENTS
- **09 4x4 / 4s DYNAMIC** - CURVE ASSISTED LASER, SMART ALC, DRP, DTS

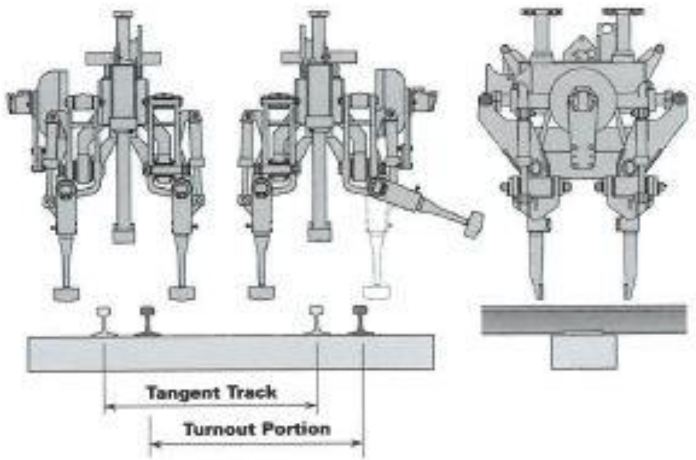
OTM STRATEGY – FLEET

- **S & C Machines:** Plasser 08 4 x 4, Matisa B41
- **Higher Speed Continuous S & C & machine:** 09 4x4 / 4s, Matisa B66
- **High Speed Plain Line Machines** – 09 3x, 09 2x
- **Plain Line Machines** – Plasser 08 Compact higher speed mixed sleeper machine, flexible tines but not S & C machine
- **PLSB / MPSB** – sections that do not respond to tamping
- **Specialist Technology** – Sprinter Tamping, CAL, DRP, System 7, Dynamic (DTS)

S & C MACHINES







- Split tines – Horizontal and / or Vertical
- Tilting Tines
- 3rd Arm – 3rd lifting point for turnouts

OTM STRATEGY – S & C

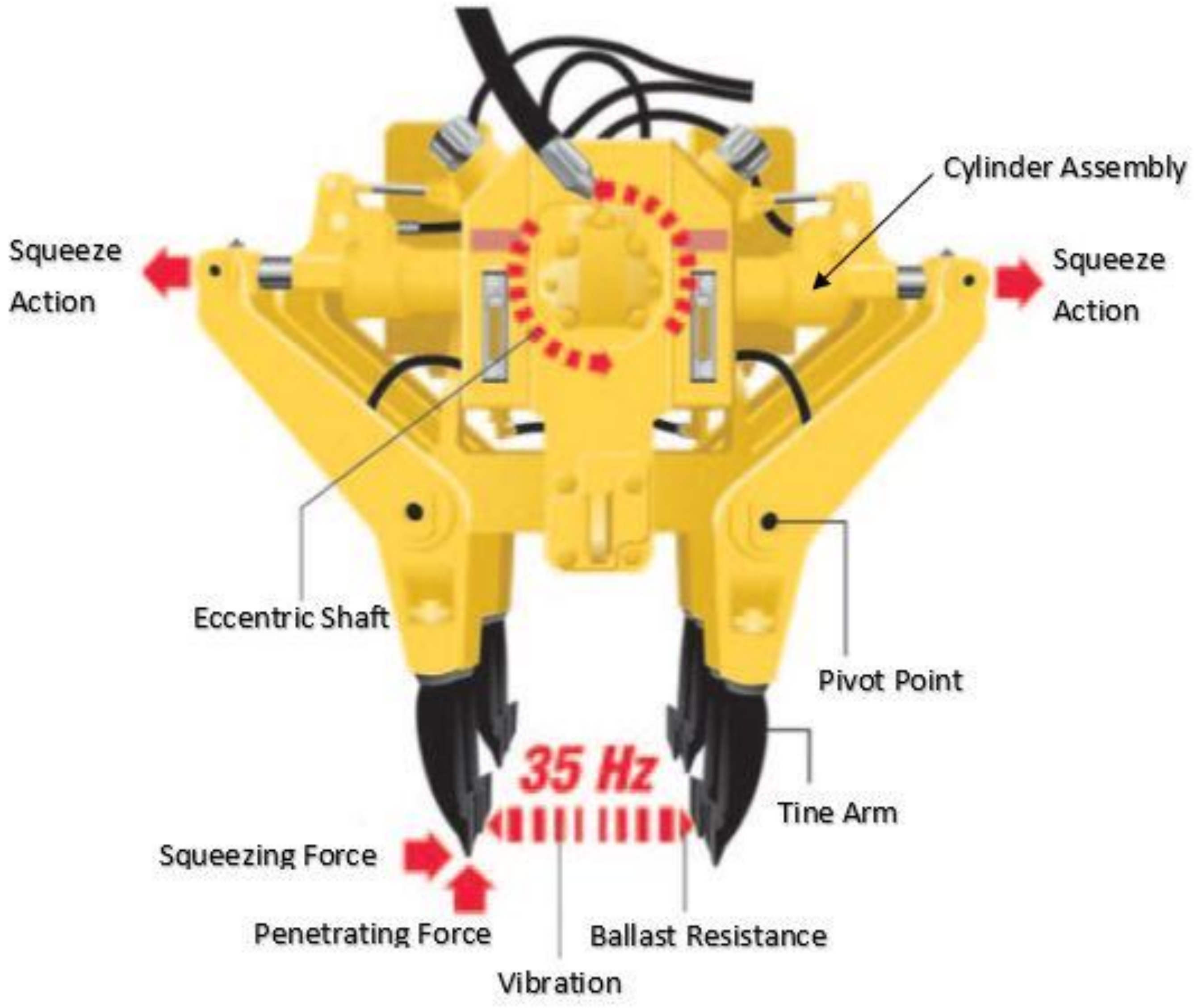
NetworkRail

Location	No.of Un	Total	Sat/Sun	Sun/Mon	M/W	Freque	Machine Typ	No.of Machi	Next Intervent	2019-20	09 4s	08 Uni	MPSB	2020-21	09 4s	08 Uni	MPSB	2021-22	09 4s	08 Uni	MPSB	2022-23	09 4s	08 Uni	MPSB	2023-24	09 4s	08 Uni	MPSB	Direction
Airport Jcn Ladder	8	2	2	0	0	3	Tamp	2	2022/23													46	4							High Mileage (Country)
Airport Jcn 8201 DN DA	1	1	0	0	1	3	Tamp	1	2021/22									X	1											High Mileage (Country)
Stockley Bridge 8206A/B, 8207A/B, 8218A/B	6	3	3	0	0	3	Tamp	2	2019/20	9	6											45	6							High Mileage (Country)
Stockley Bridge 8208A/B	2	2	2	0	0	3	MPSB	2	2019/20	33			2									X			2					Low Mileage (London)
Dawley Loop	2	2	0	0	2	3	Tamp	1	2019/20	9	1											X	1							High Mileage (Country)
West Drayton East Jcn	4	1	0	1	0	4	Tamp	1	2019/20	9	2															X		1		Alternate
West Drayton West	6	1	1	0	0	3	Tamp	2	2020/21					34	2											X		2		High Mileage (Country)
West Drayton Yard	3	2	0	0	2	4	Tamp	1	2023/24																	X		1		High Mileage (Country)
Heathrow Tunnel Jcn	5	2	2	0	0	3	Tamp	2	2019/20	39	4											39	4							Alternate
Langley Goods Loop (East)	4	2	0	0	2	4	Tamp	2	2019/20	13	2															X		2		Low Mileage
Langley Goods Loop (West)	4	2	0	0	2	4	Tamp	2	2019/20	13	2															X		2		High Mileage
Dolphin Jcn (East)	8	3	3	0	0	2	Tamp	2	2020/21					27	8							29	8							Low Mileage (London)
Dolphin Jcn (West)	6	3	3	0	0	2	Tamp	2	2019/20	50	6							46	6							51	6			High Mileage (Country)
Slough East Mains	2	1	1	0	0	3	MPSB	2	2019/20	24			2									X			2					Alternate
Slough East Reliefs	4	1	1	0	0	3	Tamp	2	2020/21					4	2											50	2			Alternate
Slough Middle (Tamper sidings)	2	0	0	0	0	4	Tamp	1	2021/22									X	1											Low Mileage (London)
SloughMiddle (Windsor branch)	2	0	0	0	0	3	Tamp	1	2021/22									X	1											Low Mileage (London)
Slough West Goods Loop (East end)	2	0	0	0	0	4	Tamp	1	2021/22									X	1											Low Mileage (London)
Slough West (Ladder)	8	2	2	0	0	3	Tamp	4	2021-22									39	4											High Mileage (Country)
Slough Farnham Road	2	1	0	0	1	4	Tamp	1	2023/24									X												High Mileage (Country)
Maidenhead East	7	2	3	0	0	2	Tamp	1	2020/21					28	8							33	8							High Mileage
Maidenhead West	6	3	0	0	3	3	Tamp	1	2021/22									X	6											Low Mileage (London)
Ruscombe	6	3	3	0	0	2	Tamp	2	2020/21					29	8							35	8							Alternate
Twyford East	2	1	0	0	1	3	Tamp	2	2020/21					48	2											X	2			Low Mileage (London)
Twyford Station	2	2	0	0	2	3	Tamp	1	2019/20	41	1											X	1							Low Mileage (London)
Twyford West	6	3	3	0	0	2	Tamp	2	2020/21					30	8							37	8							Alternate

OTM STRATEGY – S & C

Location	Possession Hours	Stabling Point	Axle Coyunters Y / N	TPA	GUF	IMDM	TME	SM[T]	Ladder UM to DR Conne
Airport Jcn Ladder	UAR + UR 0 - 5.5hrs / DR + UA 0 - 16hrs / UM + DAR 6.5 - 16hrs	Southall	Y	Y	N	Reading	West Ealing	West Ealing	N / A
Airport Jcn 8201 DN DA	DM + DA 5hrs	Southall	Y	Y	N	Reading	West Ealing	West Ealing	N / A
Stockley Bridge 8206A/B, 8207A/B, 8218A/B	DM 0 - 8hrs / UM 0 - 16hrs / DR 9 - 23.5hrs / UR 17 - 23.5hrs	Southall	Y	Y	N	Reading	West Ealing	West Ealing	N / A
Stockley Bridge 8208A/B	UR + UGL 7hrs	Southall	Y	Y	N	Reading	West Ealing	West Ealing	N
Dawley Loop	UR + UGL 5hrs	Southall	Y	Y	N	Reading	West Ealing	West Ealing	N / A
West Drayton East Jcn	UR(UGL) + DR 5hrs	Up Lines Reading / |Dn Lines Southall	Y	Y	N	Reading	West Ealing	West Ealing	N / A
West Drayton West	UGL + UR + DR 8hrs	Up Lines Reading / |Dn Lines Southall	Y	Y	N	Reading	West Ealing	West Ealing	N / A
West Drayton Yard	DR + UR + UGL+ STA 5hrs	Up Lines Reading / |Dn Lines Southall	Y	Y	N	Reading	West Ealing	West Ealing	N
Heathrow Tunnel Jcn	Up Airport + Dn Airport + DAR 12 hrs	Up Lines Reading / |Dn Lines Southall	Y	Y	N	Reading	West Ealing	West Ealing	N / A
Langley Goods Loop (East)	DR + UR + LS 7hrs	Up Lines Reading / |Dn Lines Southall	Y	Y	N	Reading	Reading	Reading	N
Langley Goods Loop (West)	DR + UR + LS 7hrs	Up Lines Reading / |Dn Lines Southall	Y	Y	N	Reading	Reading	Reading	N
Dolphin Jcn (East)	DM + UM 0 - 12hrs / DR + UR 13 - 24 hrs / DR + UM 24hrs - 28hrs	Slough	Y	Y	N	Reading	Reading	Reading	N
Dolphin Jcn (West)	DM + UM 0 - 8hrs / UR + DR 9 - 17hrs / DR + UM 18 - 21hrs	Slough	Y	Y	N	Reading	Reading	Reading	N
Slough East Mains	UM + DM 8rs	Slough	Y	Y	Y	Reading	Reading	Reading	N
Slough East Reliefs	DR + UR 10hrs	Slough	Y	Y	N	Reading	Reading	Reading	N
Slough Middle (Tamper sidings)	UR + Tamper Sidings 7hrs	Slough	Y	Y	N	Reading	Reading	Reading	N
SloughMiddle (Windsor branch)	DM + Windsor Branch 7hrs	Slough	Y	Y	N	Reading	Reading	Reading	N
Slough West Goods Loop (East end)	UR + Slough Goods 7 hrs	Slough	Y	Y	N	Reading	Reading	Reading	N
Slough West (Ladder)	DM + UM + DR + UR 16hrs	Slough	Y	Y	N	Reading	Reading	Reading	Y
Slough Farnham Road	UR 7hrs	Slough	Y	Y	N	Reading	Reading	Reading	N
Maidenhead East	DM + UM 0 - 8hrs / UM + DR 9 - 17hrs / DR + UR 18 - 29hrs	Maidenhead	Y	Y	N	Reading	Reading	Reading	Y
Maidenhead West	DR / UR 7hrs	Maidenhead	Y	Y	N	Reading	Reading	Reading	N
Ruscombe	DM + UM 0 - 8hrs / UM + DR 9 - 17hrs / DR + UR 18 - 26hrs	Reading	Y	Y	N	Reading	Reading	Reading	Y
Twyford East	DR + UR 7hrs	Reading	Y	Y	N	Reading	Reading	Reading	N
Twyford Station	UR + Henley Branch 5hrs	Reading	Y	Y	N	Reading	Reading	Reading	N
Twyford West	DM + UM 0 - 8hrs / UM + DR 9 - 17hrs / DR + UR 18 - 26hrs	Reading	Y	Y	N	Reading	Reading	Reading	Y

TAMPING PARAMETERS



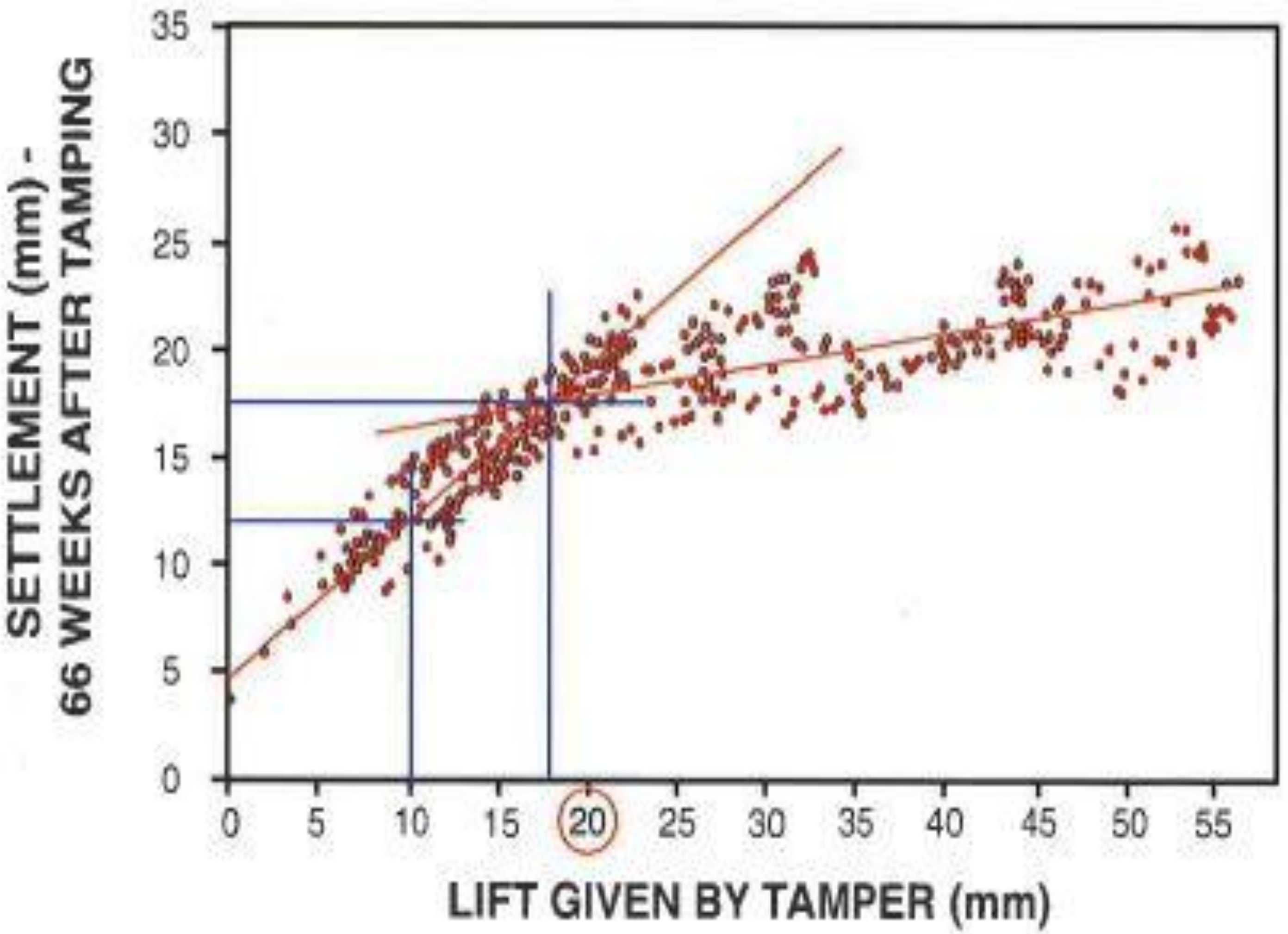
TAMPING PARAMETERS

1. Vibration Frequency	-	35 Hz	Machine Default Setting
2. Vibration Amplitude	-	5mm (10mm Vibration)	Machine Default Setting
3. Squeeze Speed / Time	-	0.8 -1.2 secs	Operator
4. Squeeze pressure	-	115 – 125 Bar	Operator

5. Magnitude Of Lift - Track Geometry Supervisor / Technical Staff / Specifications
6. Tamping Tine Depth - Track Geometry Supervisory / Technical Staff

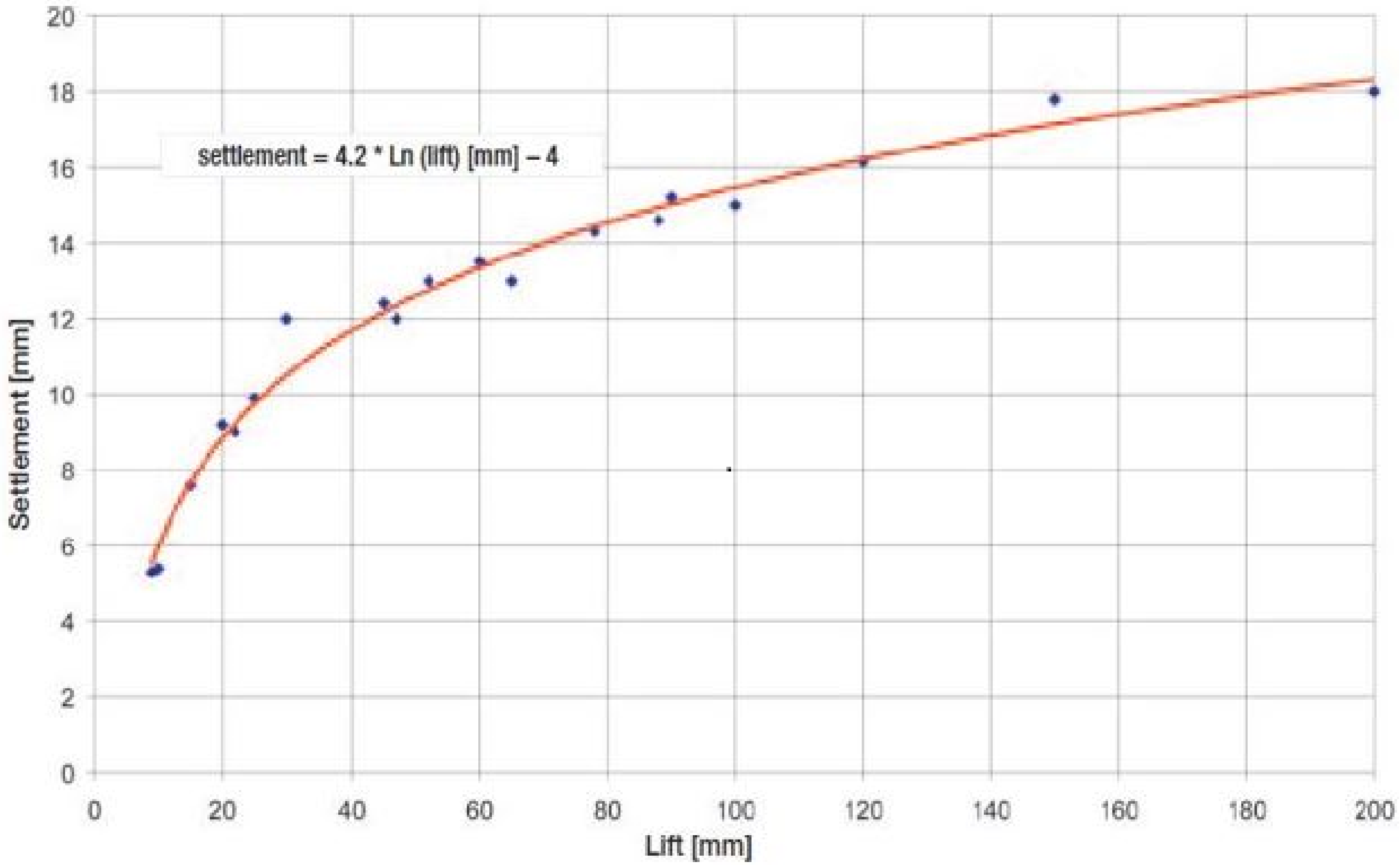
TAMPING PARAMETERS

Magnitude Of Lift - Settlement



TAMPING PARAMETERS

Magnitude Of Lift - Settlement

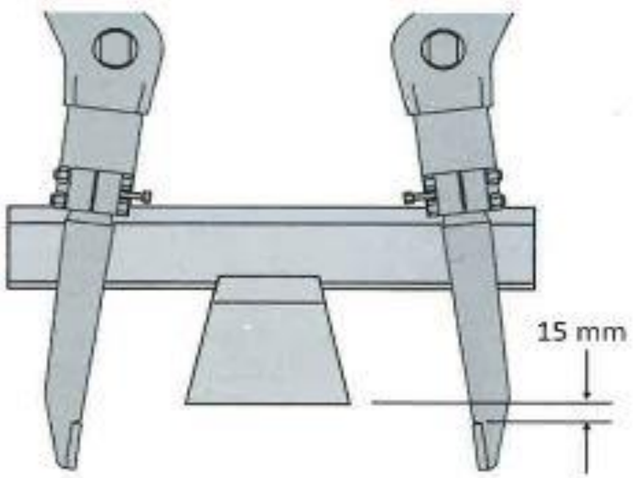


NetworkRail

TAMPING PARAMETERS

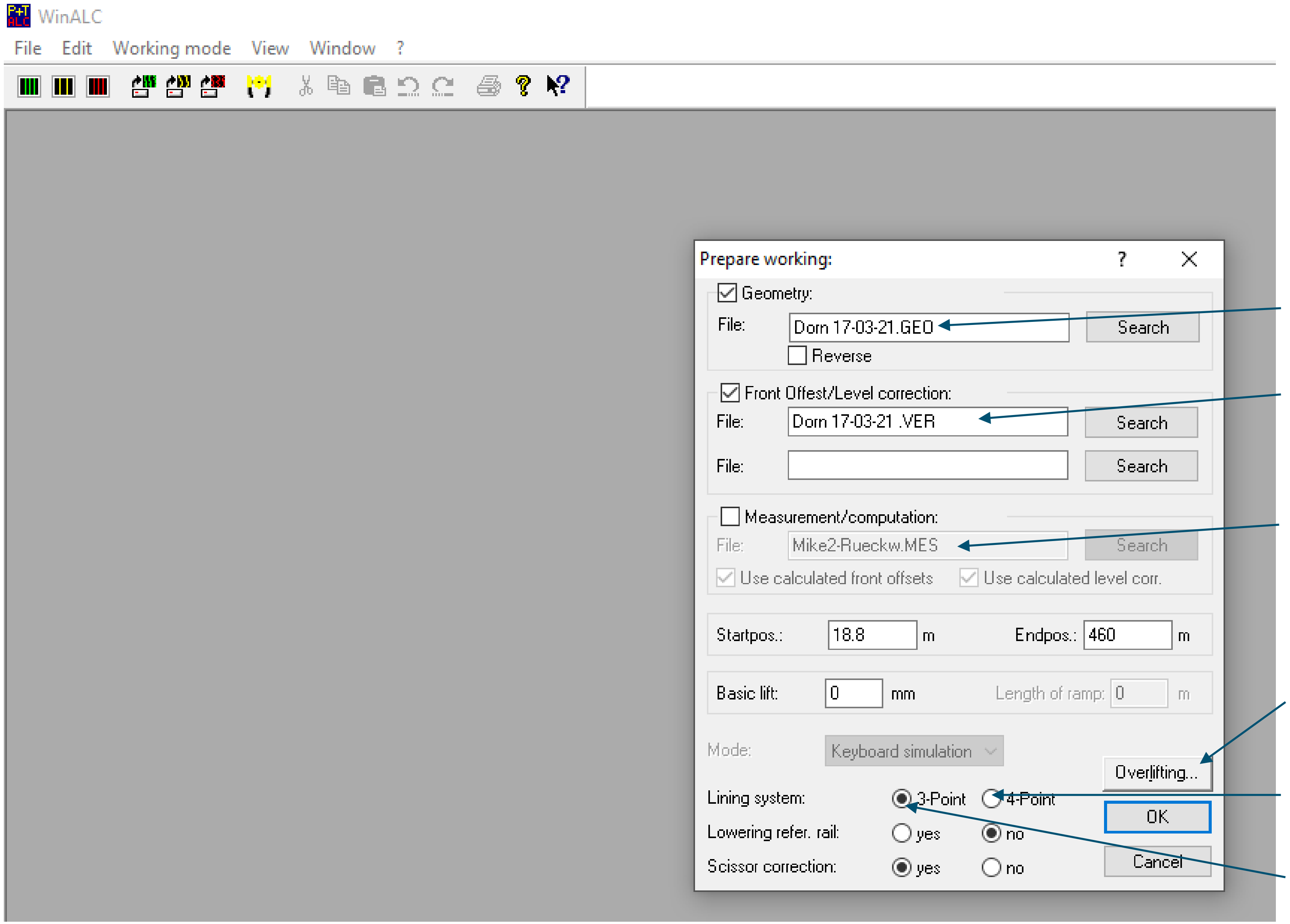
Tamping Depths

- Too shallow – poorly compacted ballast and cause damage to sleeper, bearer, timber soffit
- Too deep – compaction too far below sleeper, bearer, timber decreases durability
- Construction Depth – Top of rail to bottom of sleeper, bearer, timber (TRK3241)
- Machine adds 15mm



Construction Depth

HOW TAMPERS WORK



Geometry

Front Offset / Level Correction

Measurement & Compensation

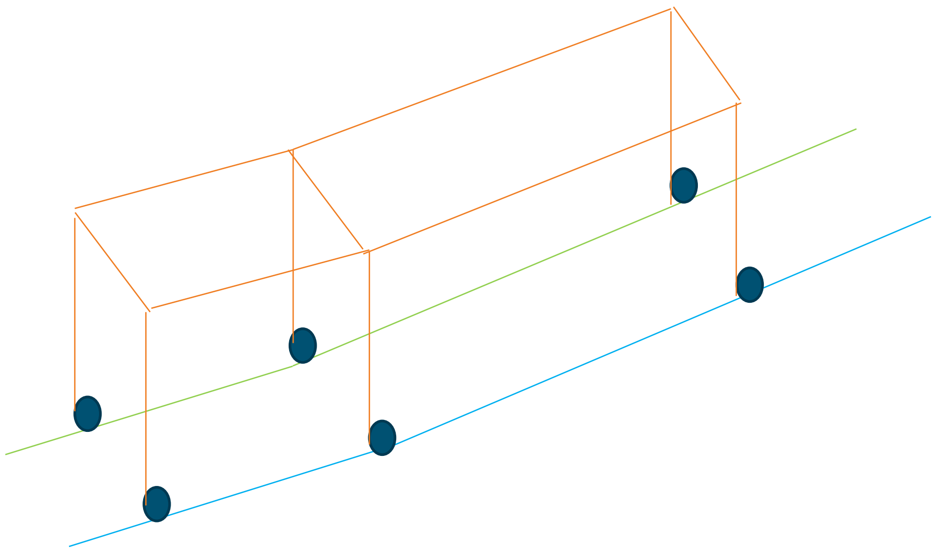
Overlift

4-Point Lining

3-Point Lining

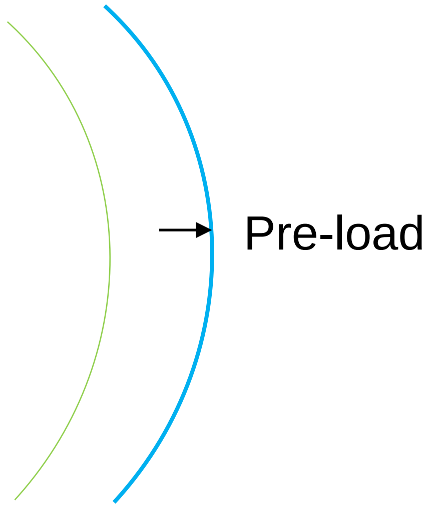
TAMPING BASICS

Level / Top



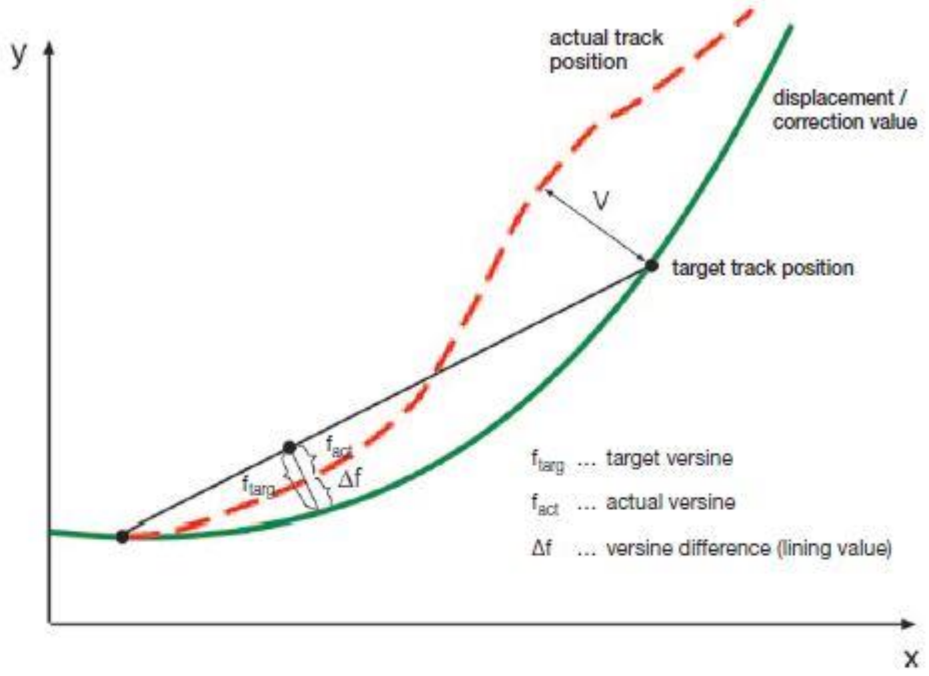
- Datum Rail – Measurement or Design Rail
- Float Rail – Cant applied

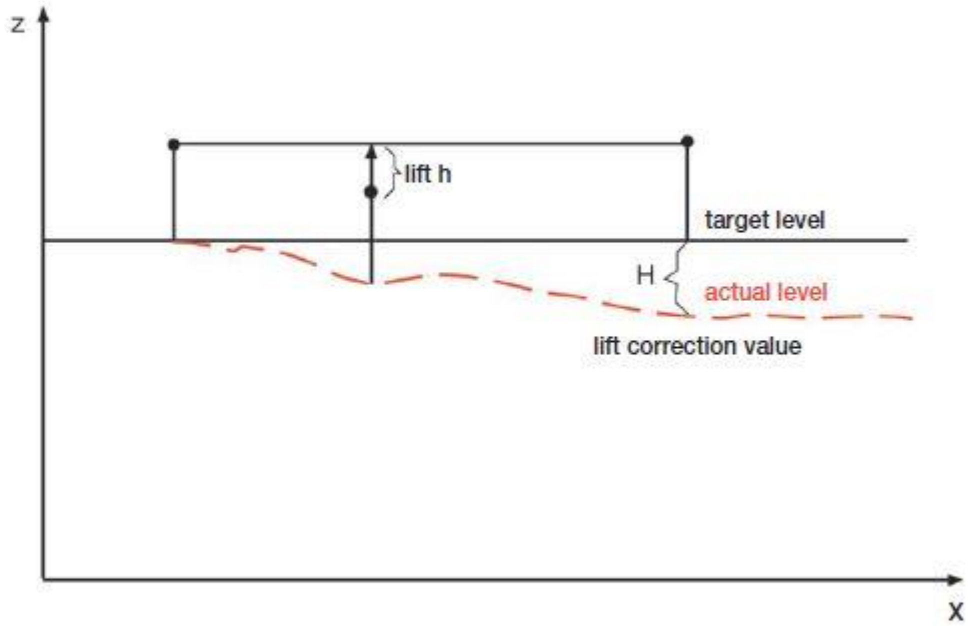
Alignment



- Pre-load - Rail for alignment measurement outside of curve or where versines taken

Front Offsets / Level Corrections





Fronts Offsets and Level Corrections applied on the front feeler trolley

Working area then lifts until levelling transduce is zero and slues the track until target versine is reached

TAMPER SOFTWARE

- Plasser Machines

  - Win ALC
    - Measurement & Compensation
    - Geometry

  - Smart ALC
    - Measurement & Compensation
    - Geometry

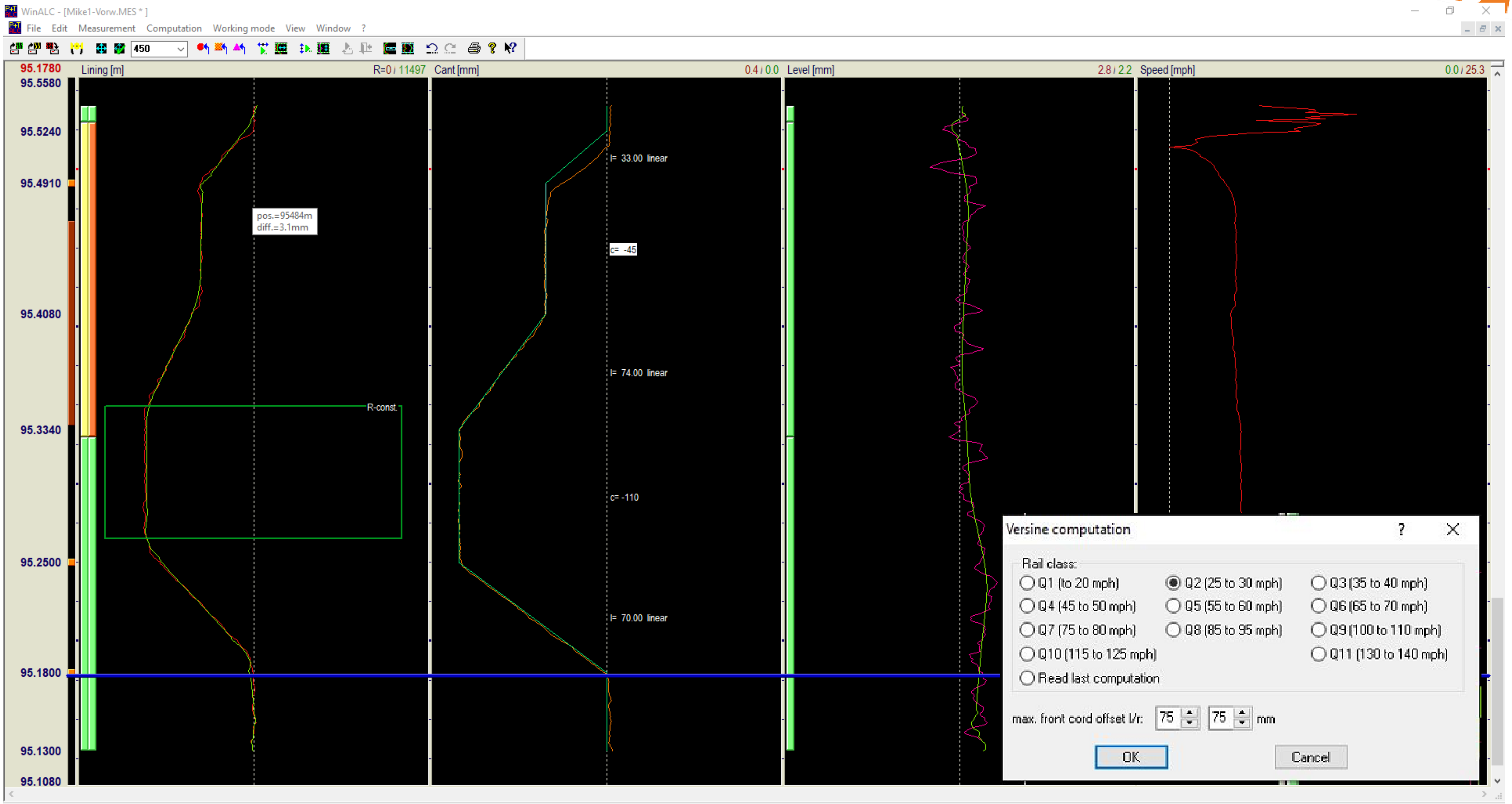
- Matisa
  - TGCS - Measurement & Compensation*
  - GECO – Geometry

- All Vertical & Horizontal Adjustments made automatically

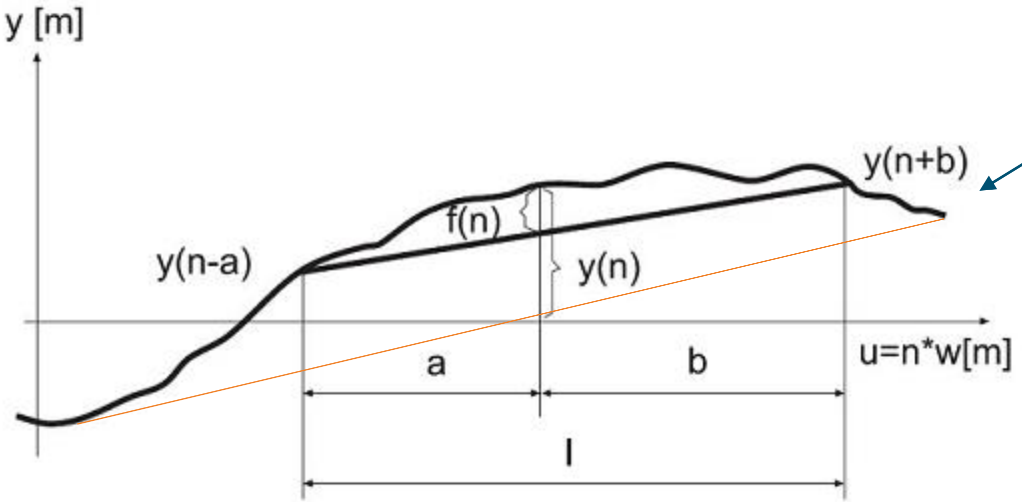
MEASUREMENT & COMPENSATION

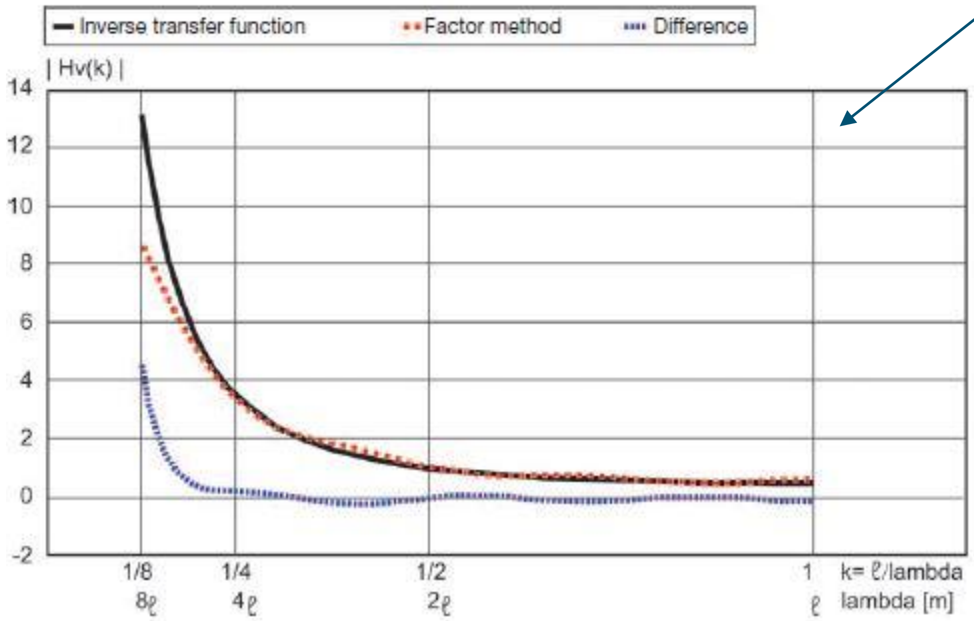
- Measures Vertical and Horizontal Versines throughout sites and smooths / compensates them
- Elements can be added – set curve to single radii or vertical to specific gradient
- Insert Virtual Transitions (Optional)
- Insert Cant Transitions
- Insert Vertical Curve Tangent Points (Optional)
- Fixed Point
- Fixed Area (with tolerance)
- Entered desired speed class – important the actual speed class is selected

MEASUREMENT & COMPENSATION



ALC AND CHORD SYSTEMS





- Distort the Amplitude and Phase Displacement of a defect – known as the Transfer Function
- ALC has in-built algorithms to define Inverse Transfer Function and evalate correction values
- Uses Factor Method / Algorithm for defects of larger wavelength
- Each speed class is compensated using algorithms to mimic different chord lengths until good band for SD is met (or warning if not)
- Works up to 5 x chord length or 90-95m and therefore corrects long wave defects if unrestrained
- Lift & slue constraints impede results – 70m
- Fixed points and areas severely restricts results over long areas due to ramping out and back in

Standard Deviations

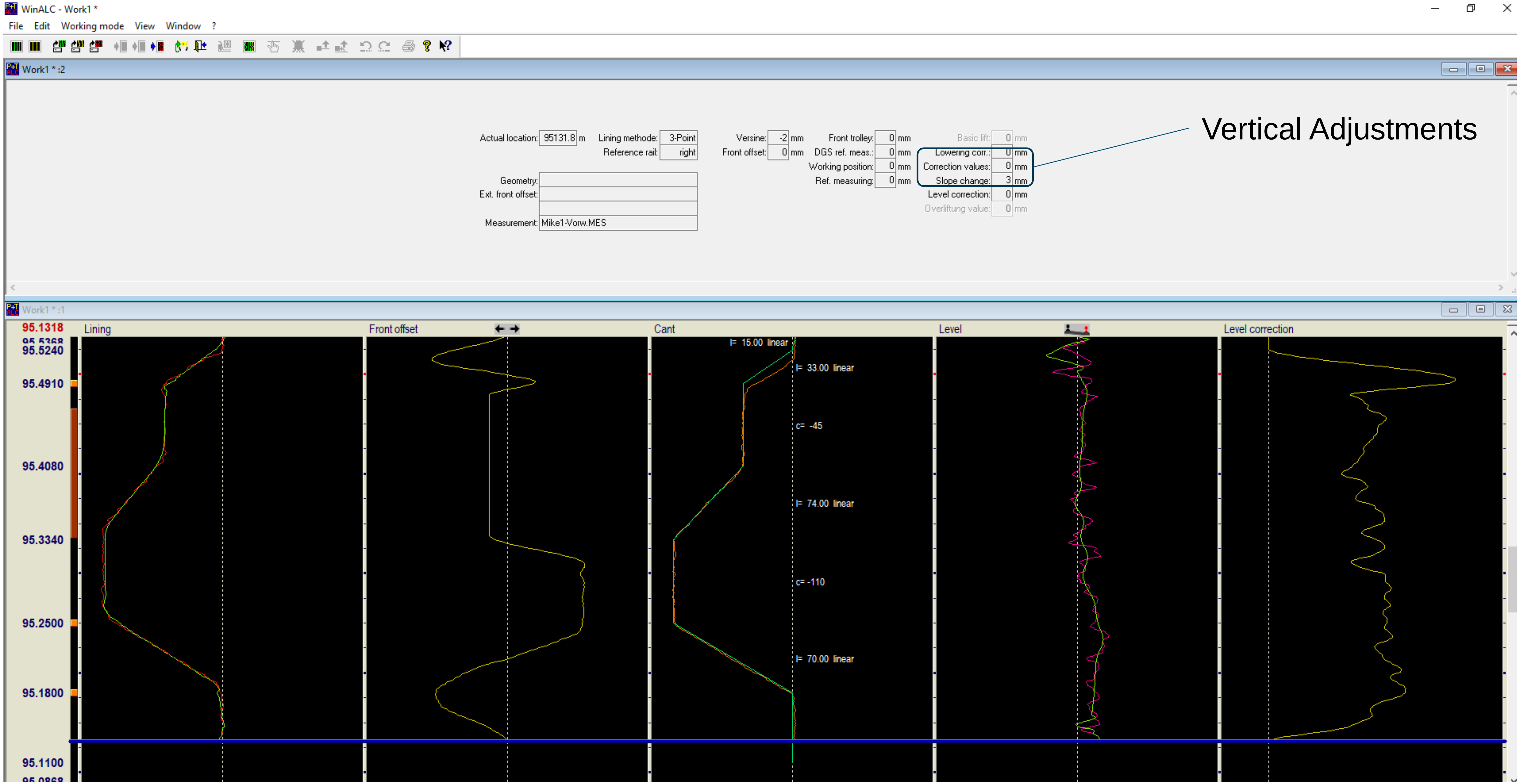
Standard deviation

Versine computation: Rail class Q9 | Level computation: Rail class Q6

	Versine measured		Versine computed		Level measured		Level computed	
Position	StdDiv 35m	StdDiv 70m	StdDiv 35m	StdDiv 70m	StdDiv 35m	StdDiv 70m	StdDiv 35m	StdDiv 70m
95130.00	0.96 satisfactory	1.01 good	0.74 good	0.95 good	0.74 good		0.13 good	
95330.00	1.32 poor	2.08 poor	0.95 satisfactory	1.84 poor	0.97 good		0.13 good	
95530.00	0.72 good	0.83 good	0.66 good	1.42 good	0.57 good		0.32 good	

- Speed Banded Network Rail SDs for Good, Satisfactory, Poor imported into tamping machines
  - ➢ Problem
- Tampers SDs are Versine derived
- Network Rail SDs are measured on an inertia based systems – NMT, PLPR
- SDs give an idea of improvement but cannot be used to assess CCQ Track Quality Banding

MEASUREMENT & COMPENSATION



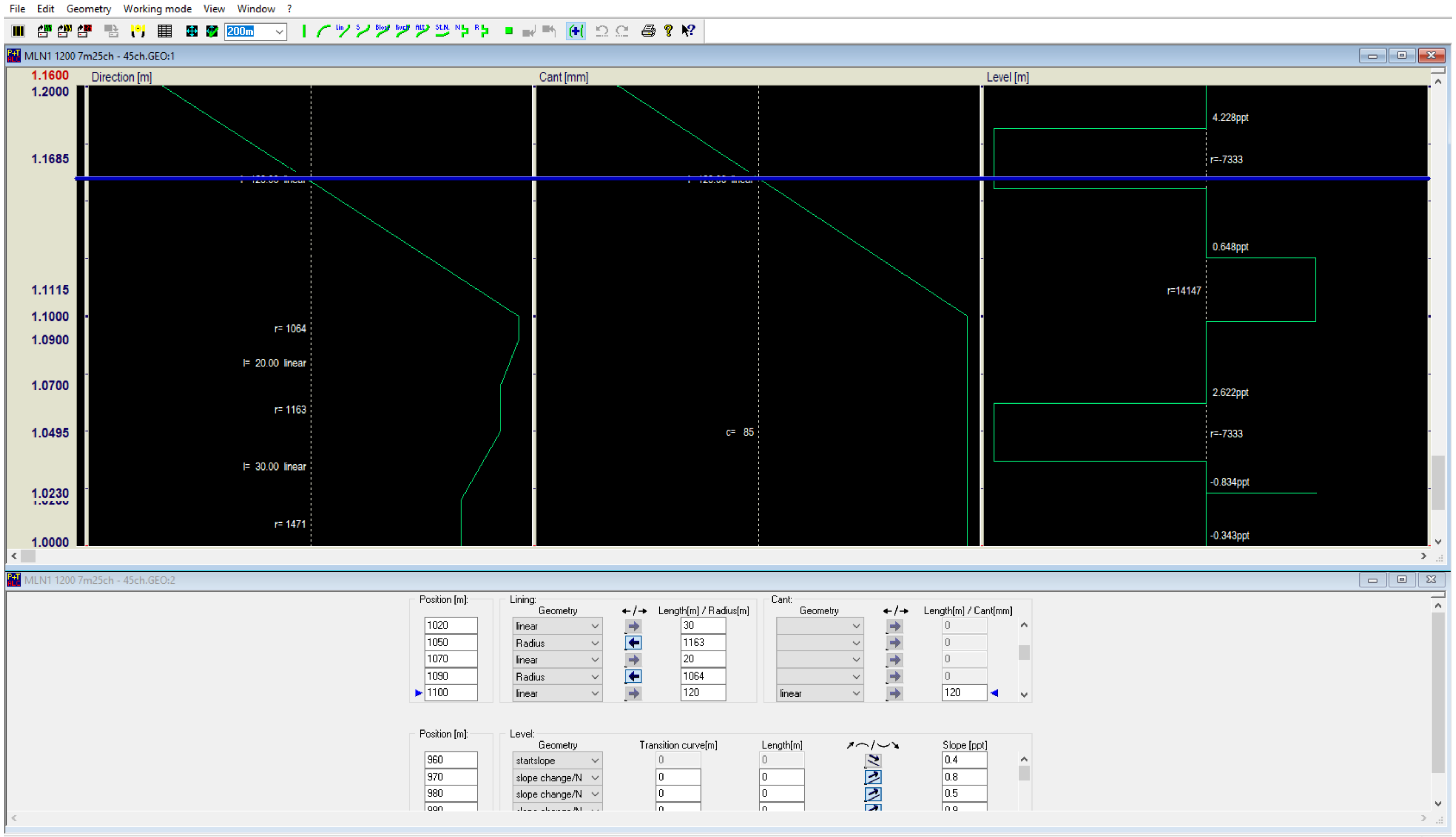
GEOMETRY TAMPING

GEODETIC SURVEY

- Total Station
- Hallade Survey – normally on 20m Symmetrical Chord
- Theodolite
- Dumpy Level
- Gauging Pole / Lasersweep
- Platform Gauge
- Tape Measure
- Accurate disciplined surveys

GEOMETRY FILES

Horizontal Geometry — Cant — Vertical Geometry



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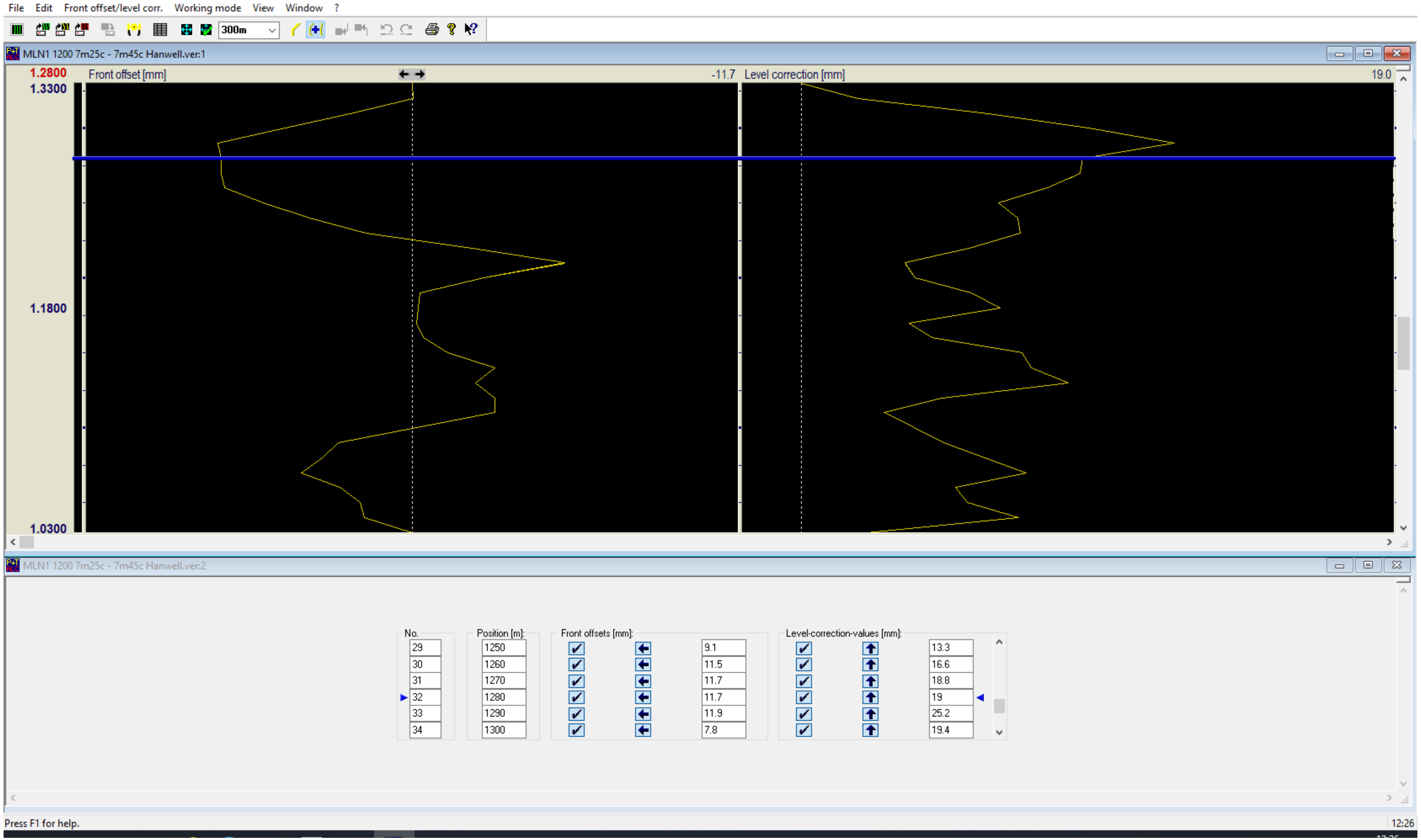
- Entered via table

VERCHE FILES

Front Offsets

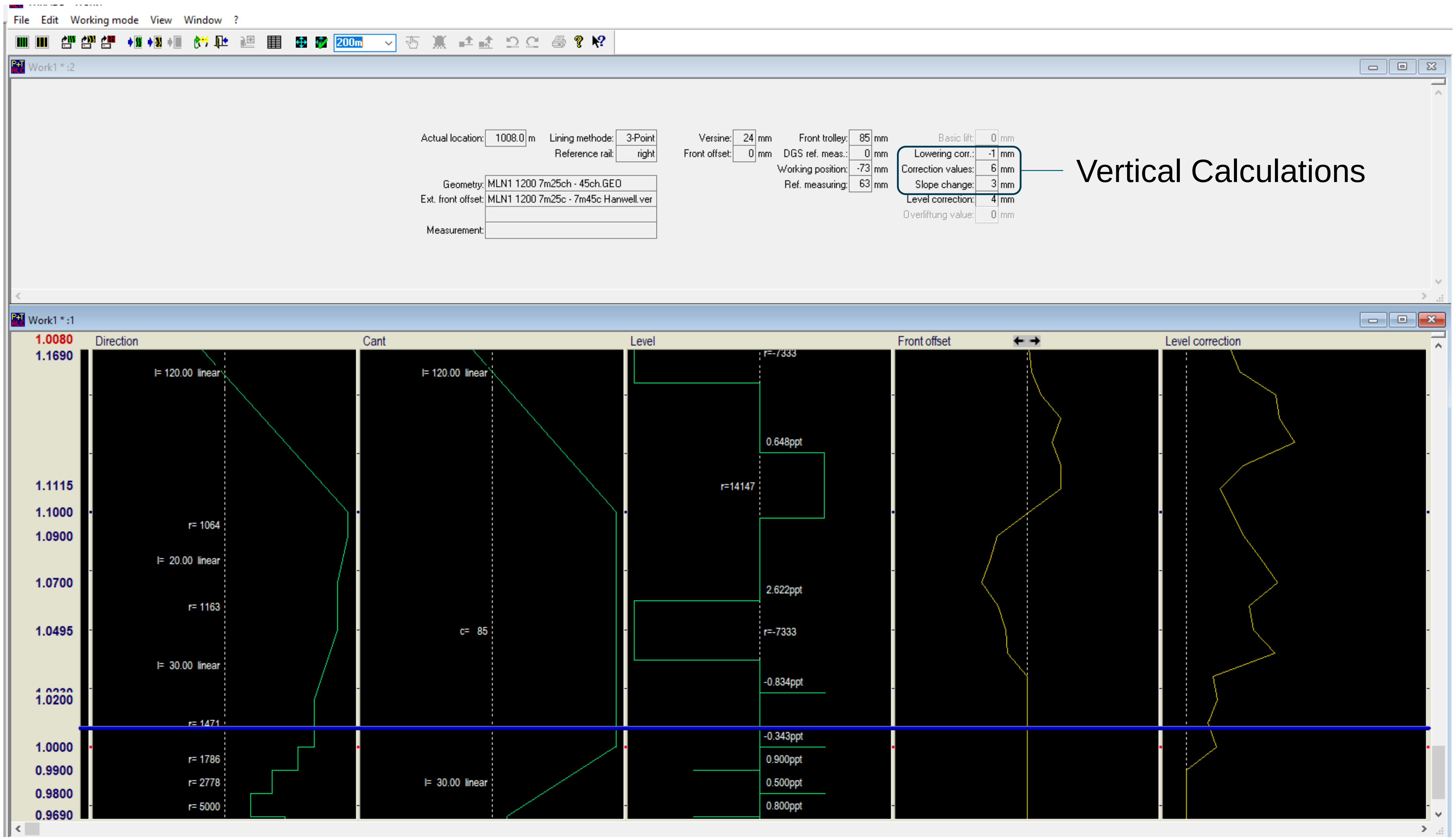
Level Corrections



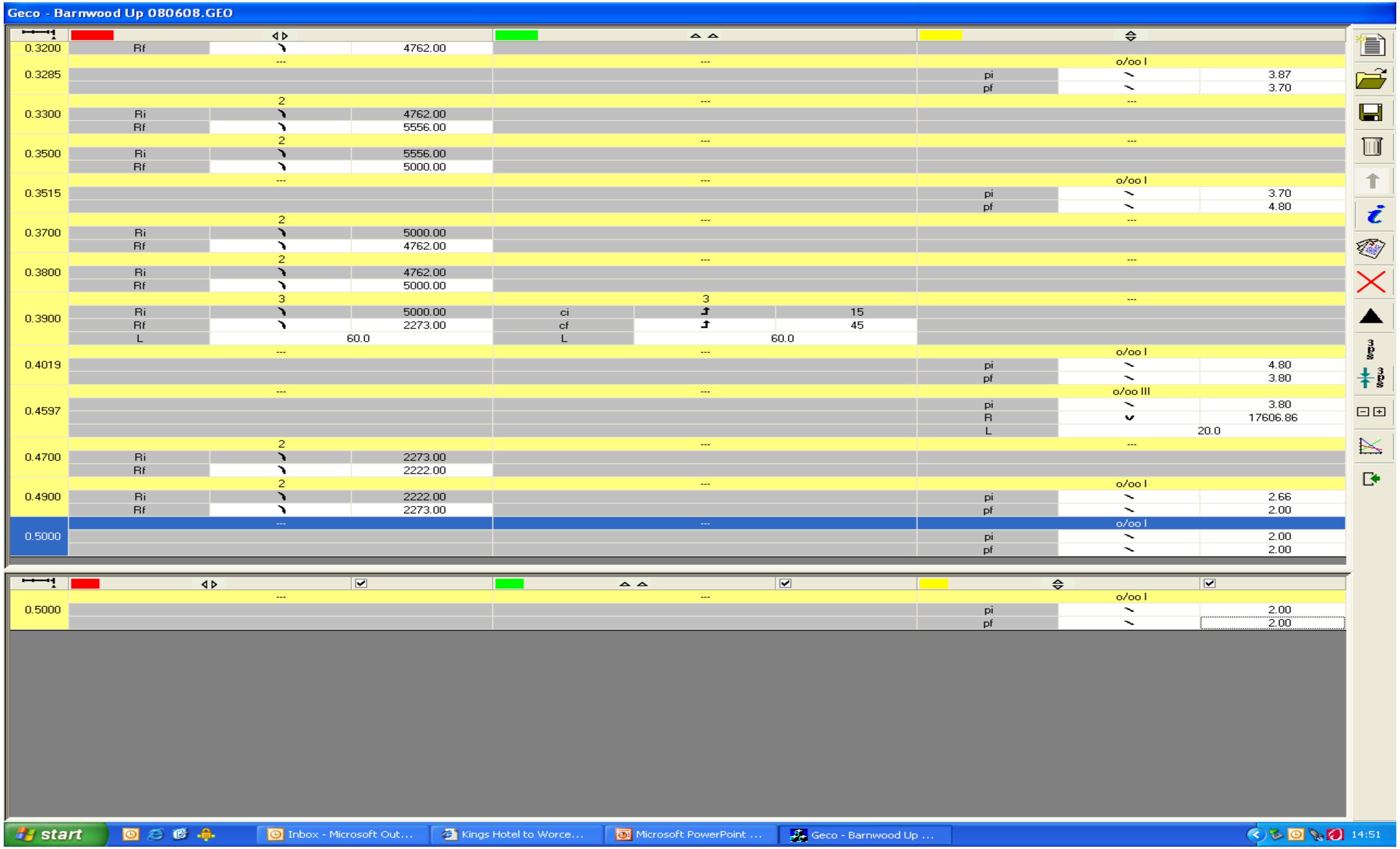
- Entered via graph

- Entered via table

GEOMETRY WORKING MODE



CREATING FILES – MATISA GECO GEOMETRY



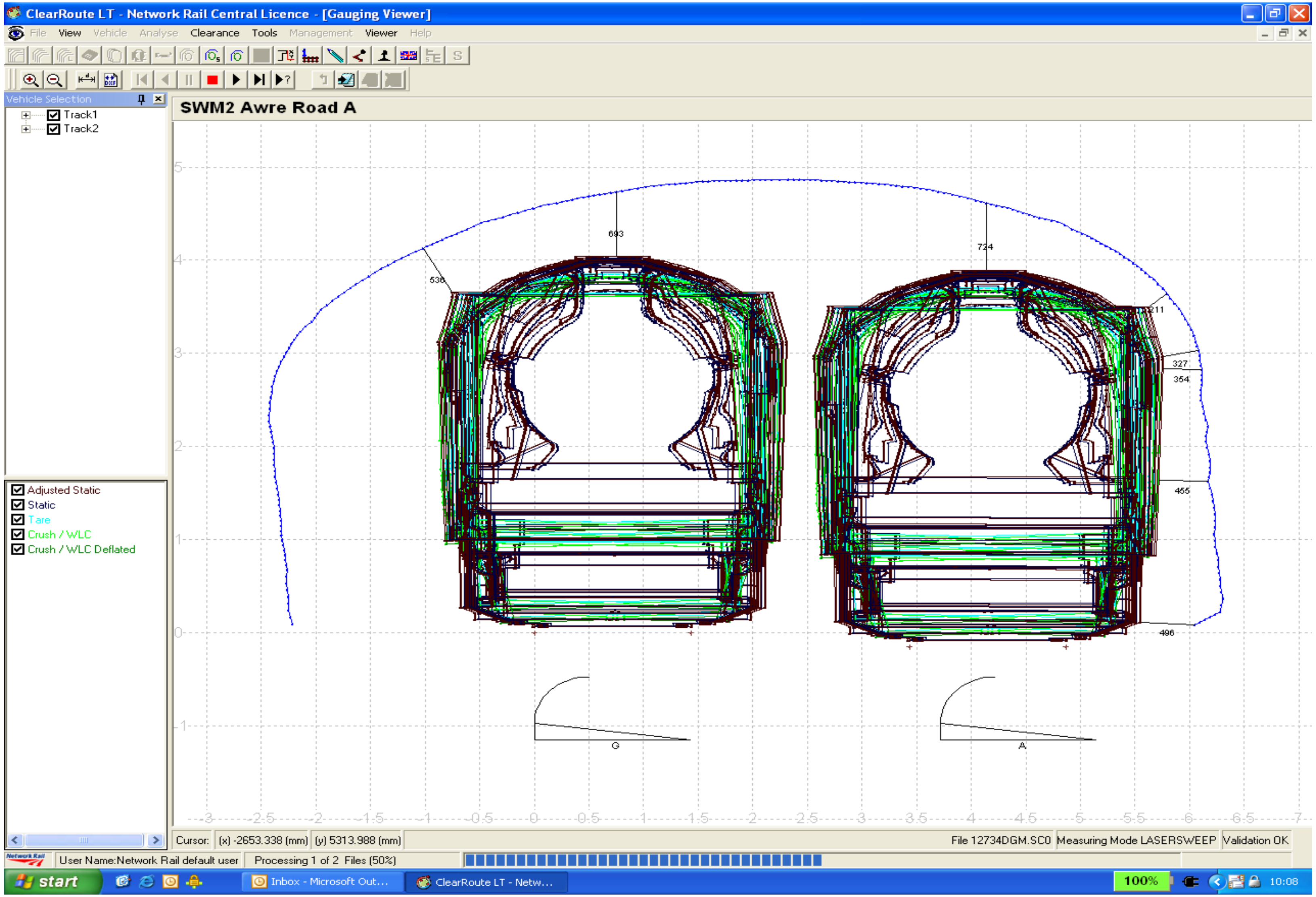
Lifts And Slues Entered Here

BENEFITS OF GEOMETRY

- **Precise Control Through Tight Structures** - Clear Route
- **Essential for S & C** - Harmonious slues through Tied Areas, complainer levels over Tied Areas
- Palliative lift and / or slues - 100mm lifts over formation failures
- Advanced Tamping – ATG, EMSAT, Curve Assisted Laser
- Control (Design) Over Lifts for settlement issues
- Improved Quality – Less intervention, greater durability, economic
- No manual marking of track – 07 Series Lifts & Slues had to be marked on sleepers
- Cost is minimal - free

CONTROL THROUGH STRUCTURES

- Combine software and run design through ClearRoute to precisely tamp through structures and platforms eg Ledbury Tunnel, Awre Road Bridge



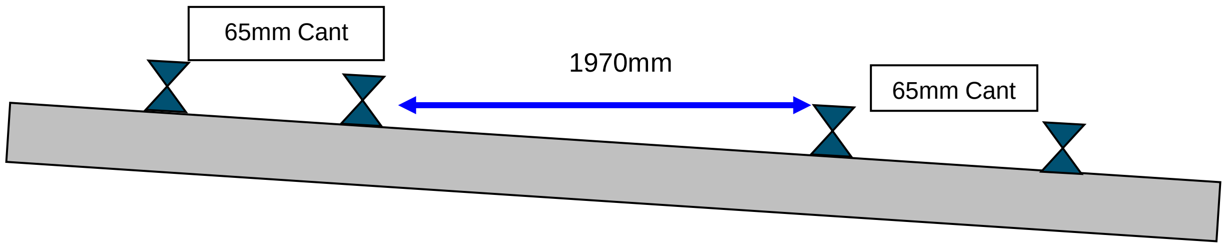
S & C CROSS LEVEL OVER TIED BEARERS / TIMBERS

- **S & C Cross Levels**
  - Level of adjacent track can be calculated used into design over tied timbers / bearers

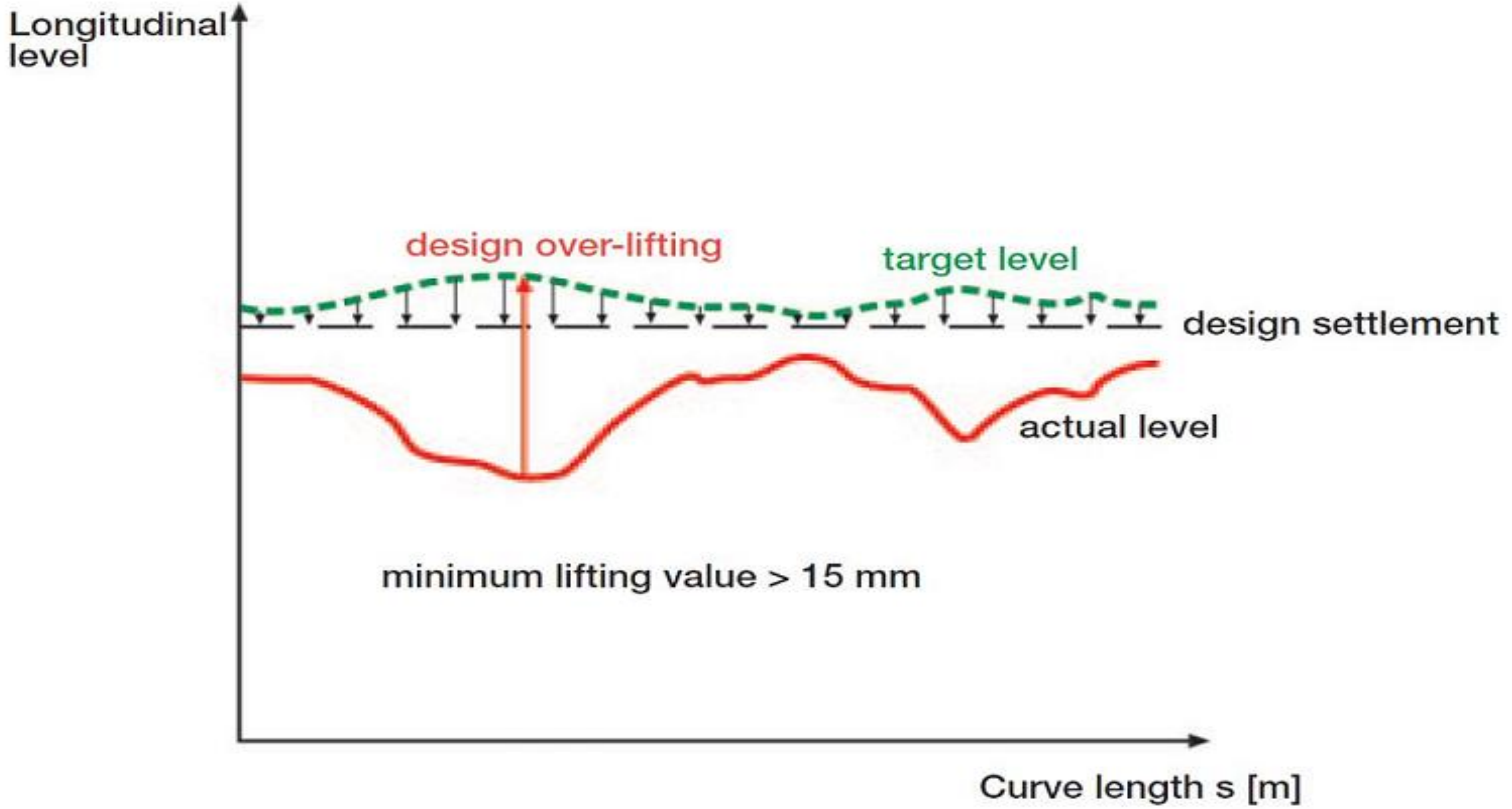
Level difference between centres of 6’ rails on Vertical S & C = Gradient x Interval

65 / 1432 = 0.045 x 1900(rail centres) = 86mm

Both low rails = 151mm



OVERLIFT


Longitudinal level
design over-lifting
target level
design settlement
actual level
minimum lifting value > 15 mm
Curve length s [m]

OVERLIFT

- Design Overlift – design lifts adjusted to compensate for settlement using Empirical Curve formula, Overlift Graphs

- Mechanised Overlift

  - WinALC – % of lift or BR Graph

  - Smart ALC – % of lift or Mean Value over rolling 30m section (or % thereof)

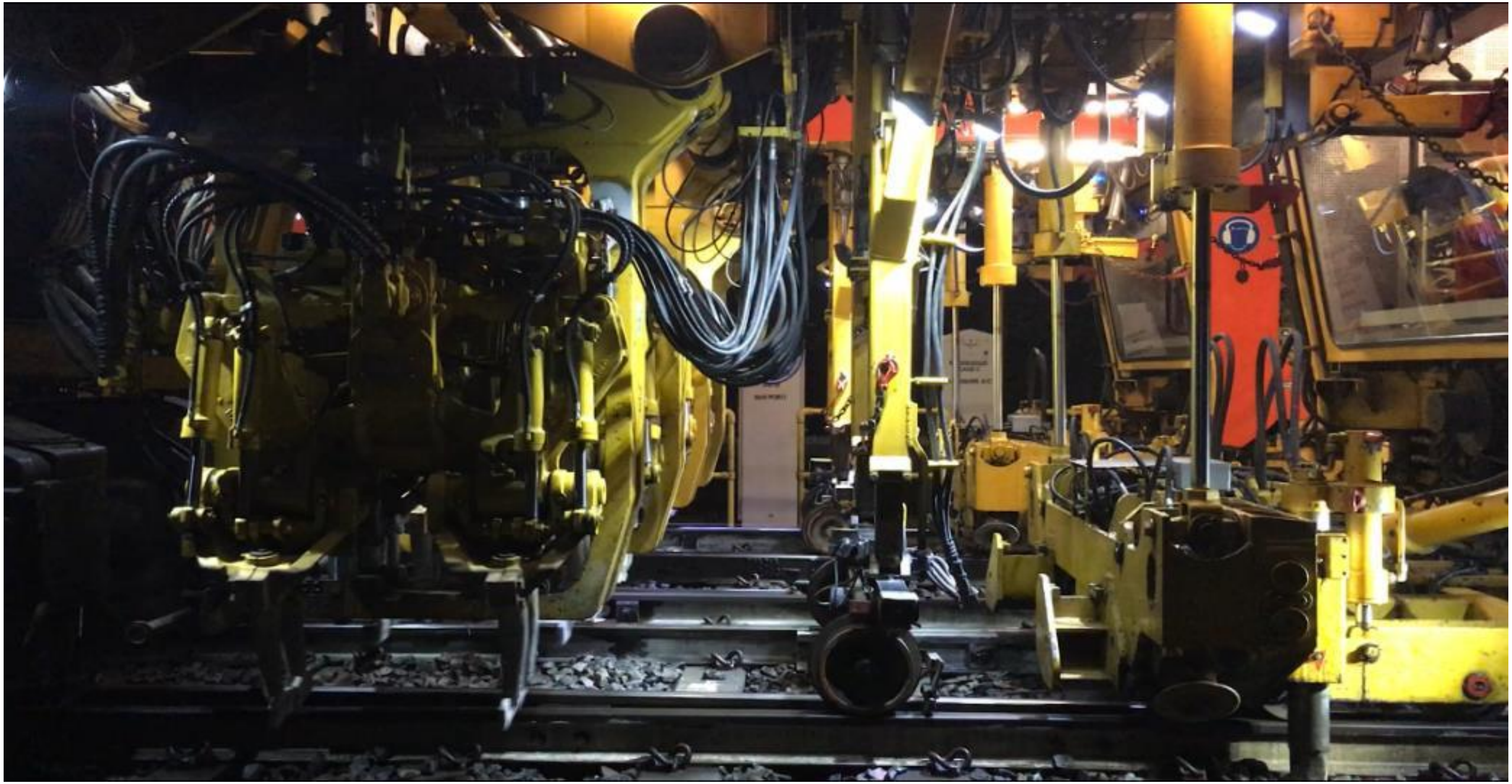
  - Variable / Intelligent DTS Overlift – 09 4x4 / 4s Dynamic Machines DTS Graph

  - CMS DTS Overlift – 09 3x, 09 2x Machines

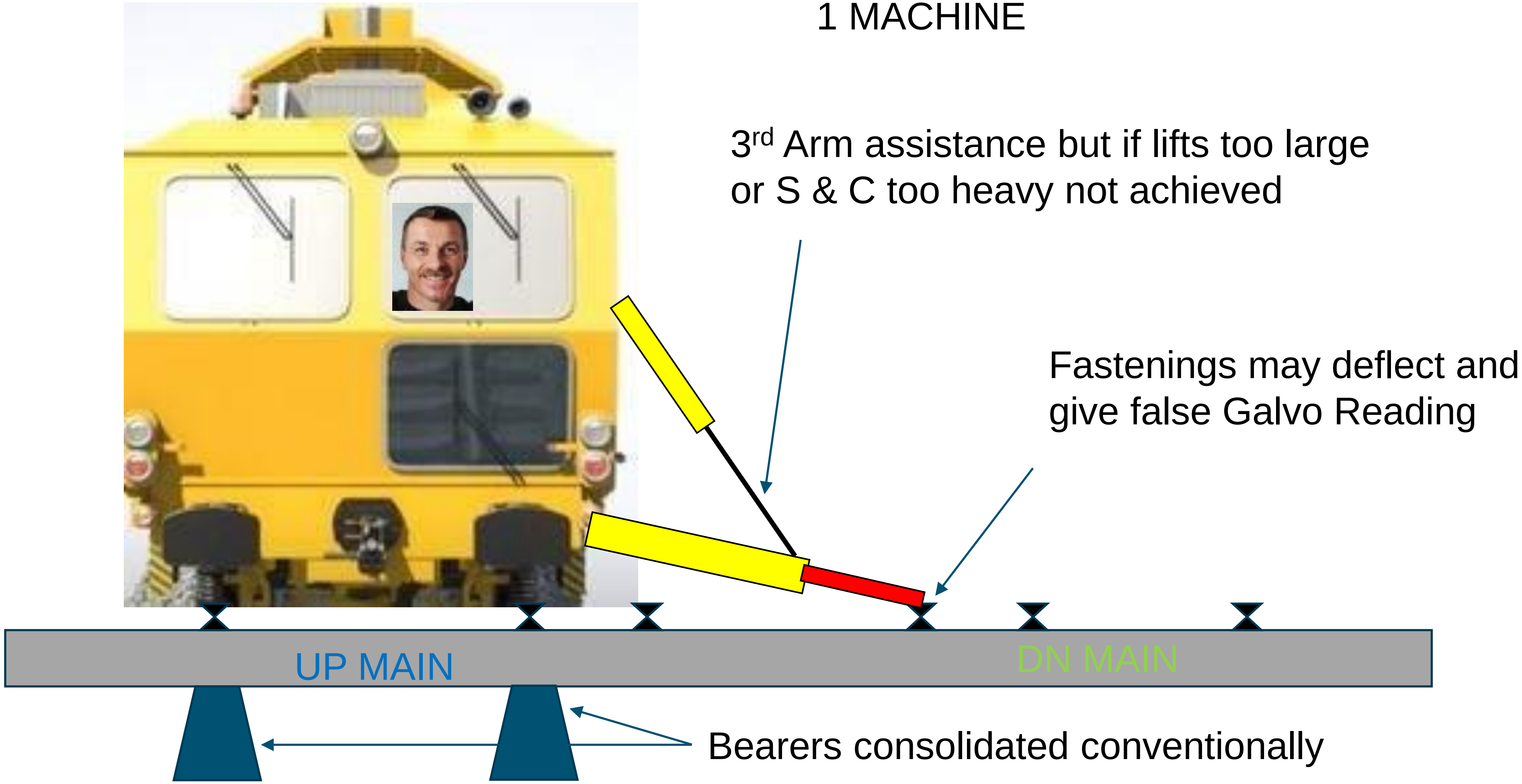
  - Sprinter / Spot Tamp Overlift

S & C TAMPING

TAMPING PARALLEL

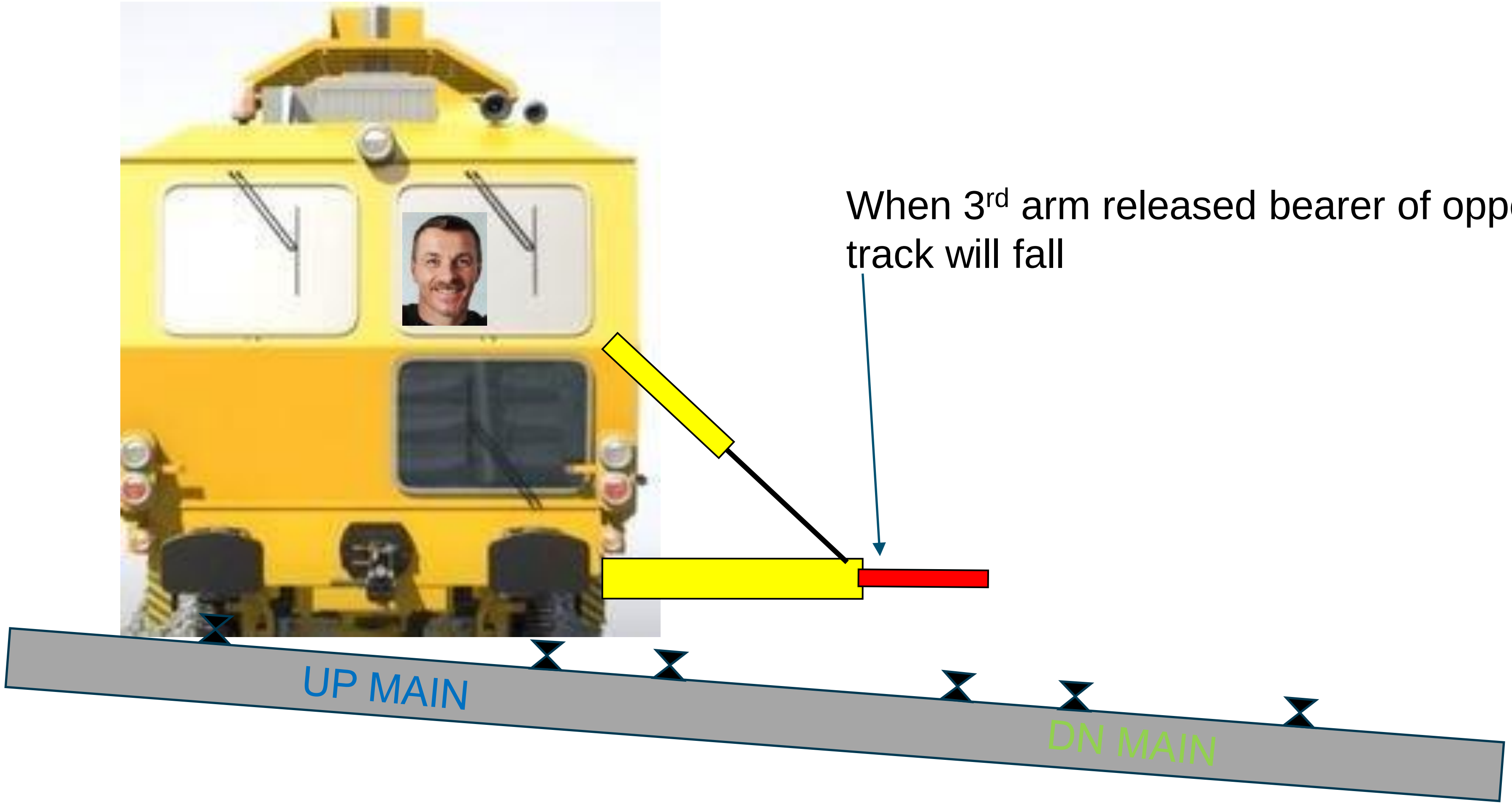


TAMPING PARALLEL – TIED BEARERS



TAMPING PARALLEL – TIED BEARERS

When 3rd arm released bearer of opposite track will fall



TAMPING PARALLEL – TIED BEARERS

Labour intensive

Time consuming

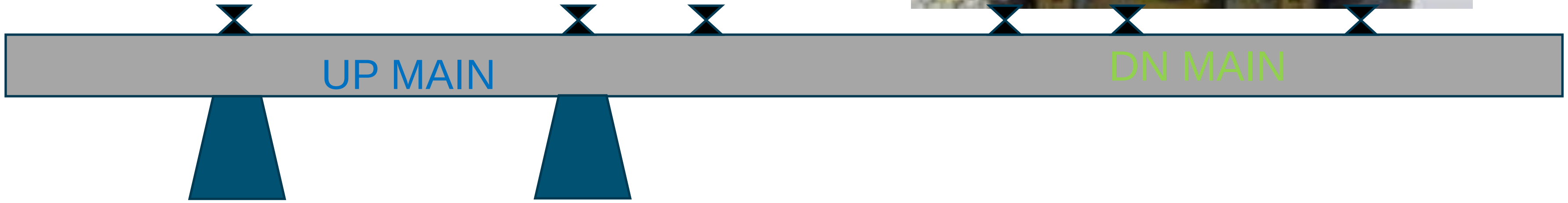
Accuracy difficult to achieve

Hard To Control

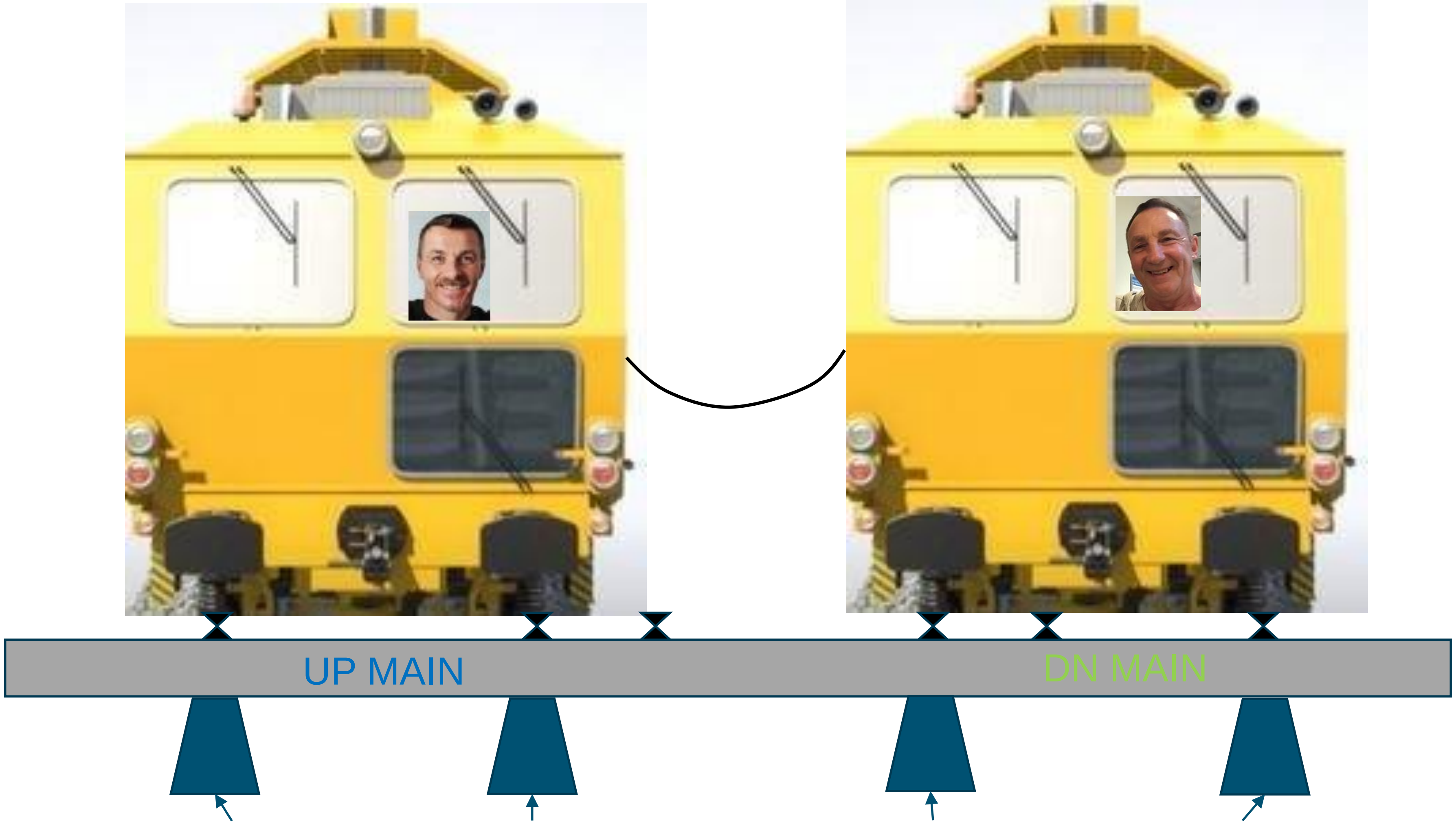
May result in re-survey / re-measure

Damage components – clips

Quality is not assured and normally poor



TAMPING PARALLEL – TIED BEARERS



Bearers consolidated conventionally on both lines simultaneously

TAMPING PARALLEL – TIED BEARERS

Primary Machine – Uses Horizontal & Vertical Geometry

Connected to Secondary Machine via Umbilical cord

Ensures simultaneous tamping and lining

Secondary Machine – also uses Geometry but turns off lining at first tied bearer / timber

Lining reinstated after last tied bearer / timber tamped and lined

Requires harmonious lifts and slues through tied area

Primary Machine

Secondary Machine

TAMPING PARALLEL – AGEING OR POOR TIED BEARERS / TIMBERS

Ageing Timber (applies to poor concrete layouts)

Shuffle, movement over rail seat, rail / baseplate gall, low resistance fastening Pandrol Pr Clips 4.5kN will result in **slues not being applied to tied track**

Turning off lining will result in alignment faults in and out of tied area

Still requires 2 Machine Parallel tamping for top and cross level

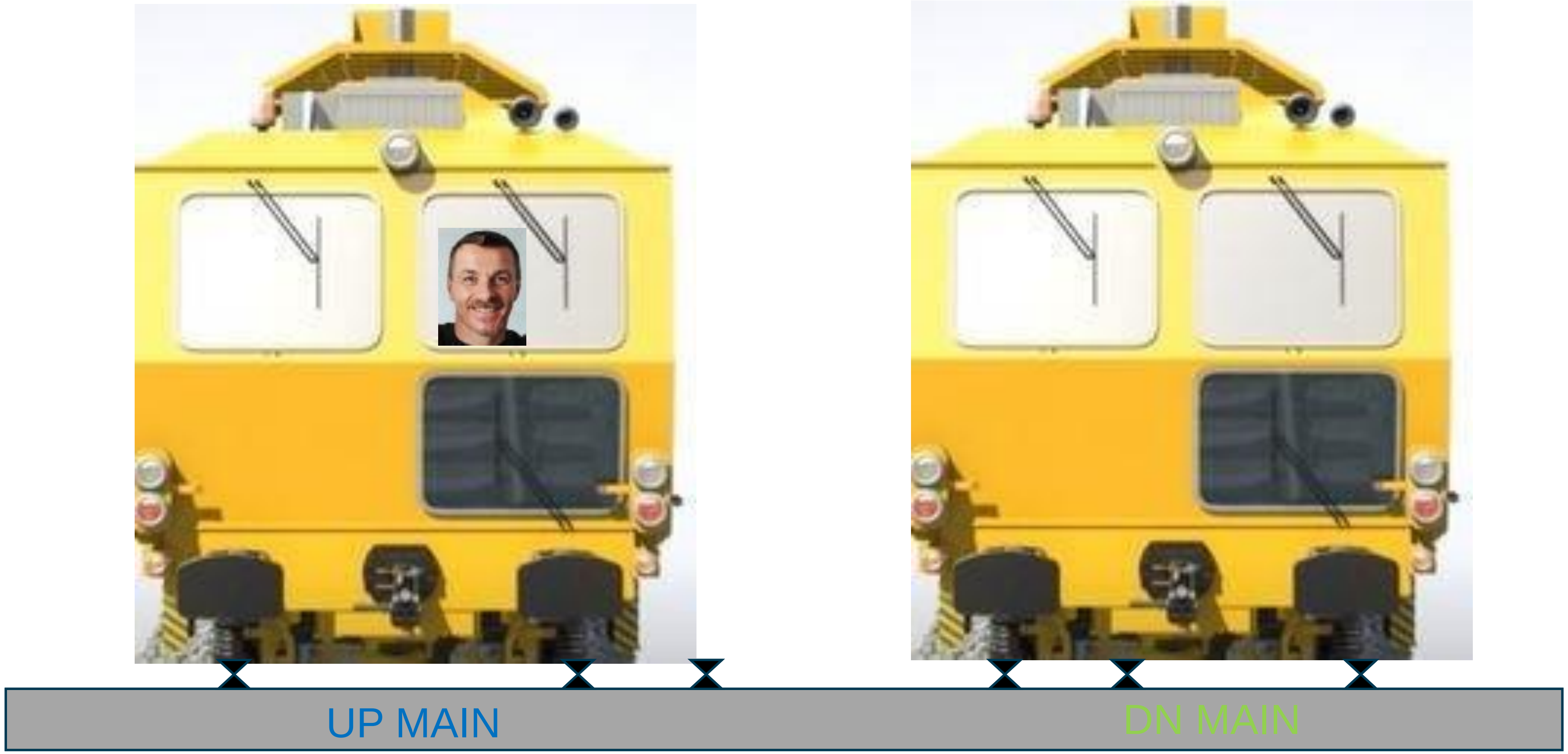
No Primary or Secondary Machine

Independent Working – slues should be keep within 5mm connected track through tied area

Independent Machine

Independent Machine

TAMPING PARALLEL – AGEING OR POOR TIED BEARERS / TIMBERS

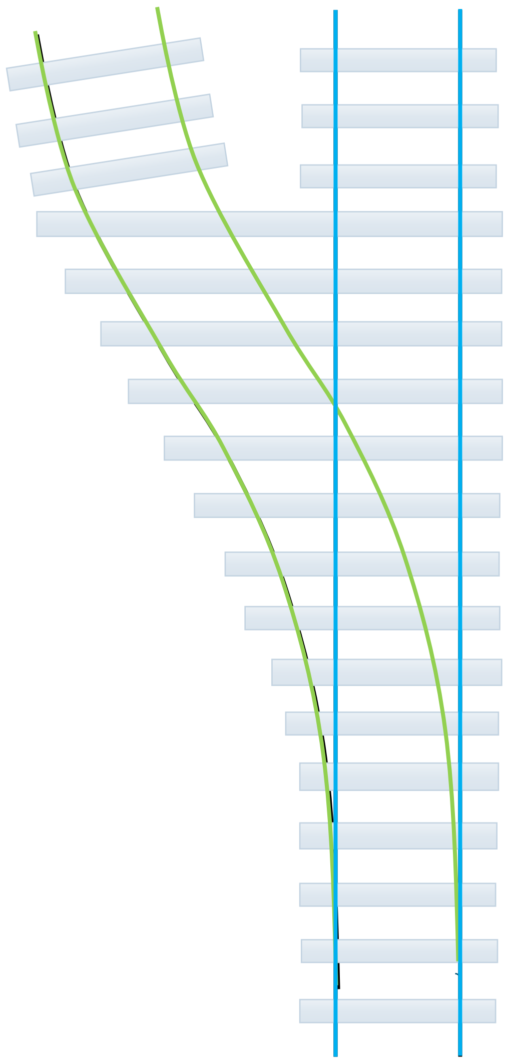


Independent Machine

Independent Machine

TAMPING TURNOUTS

TAMPING TURNOUTS



Conventional tamping would involve through route (Blue)

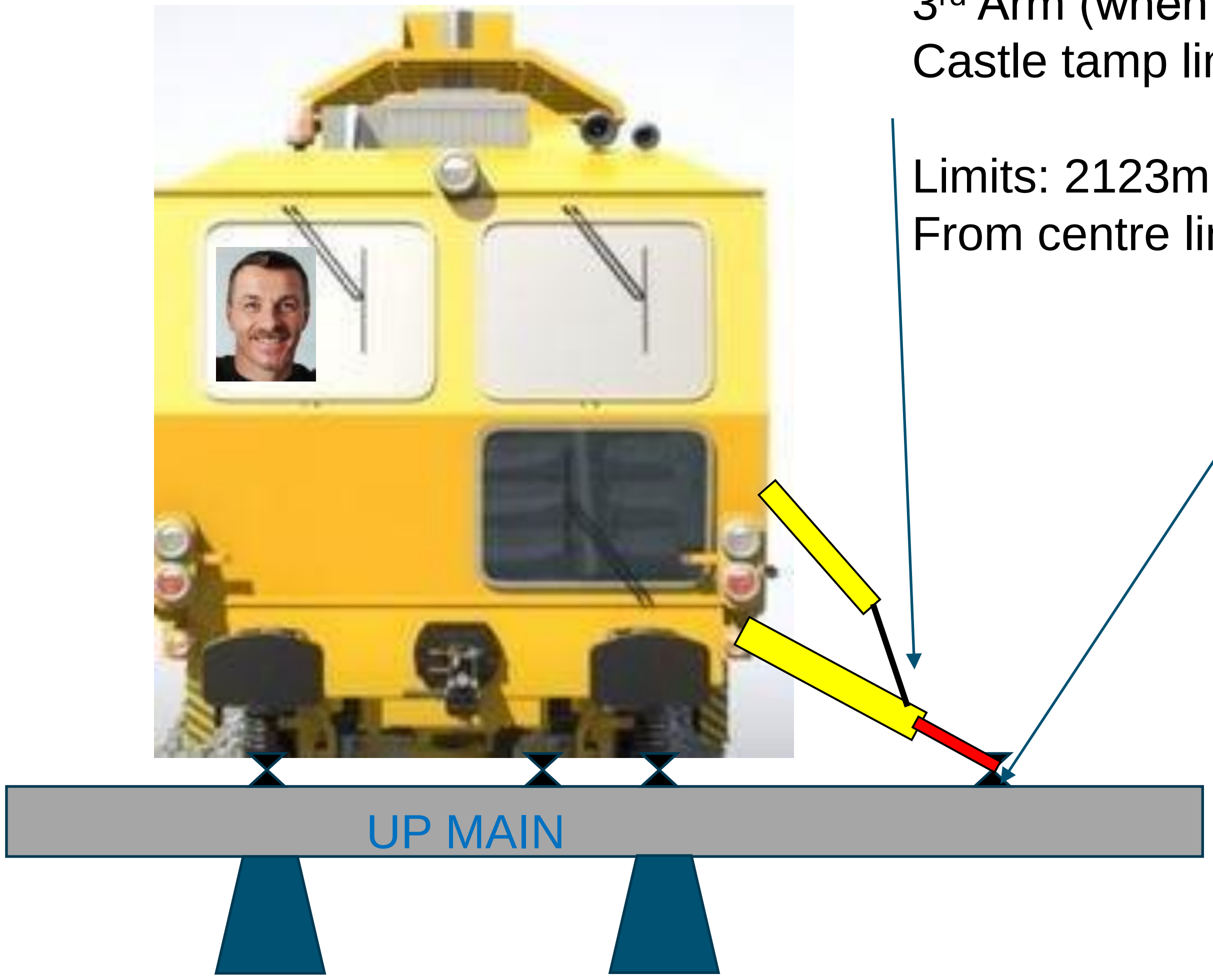
Followed by turnout route (Green)

TAMPING TURNOUTS

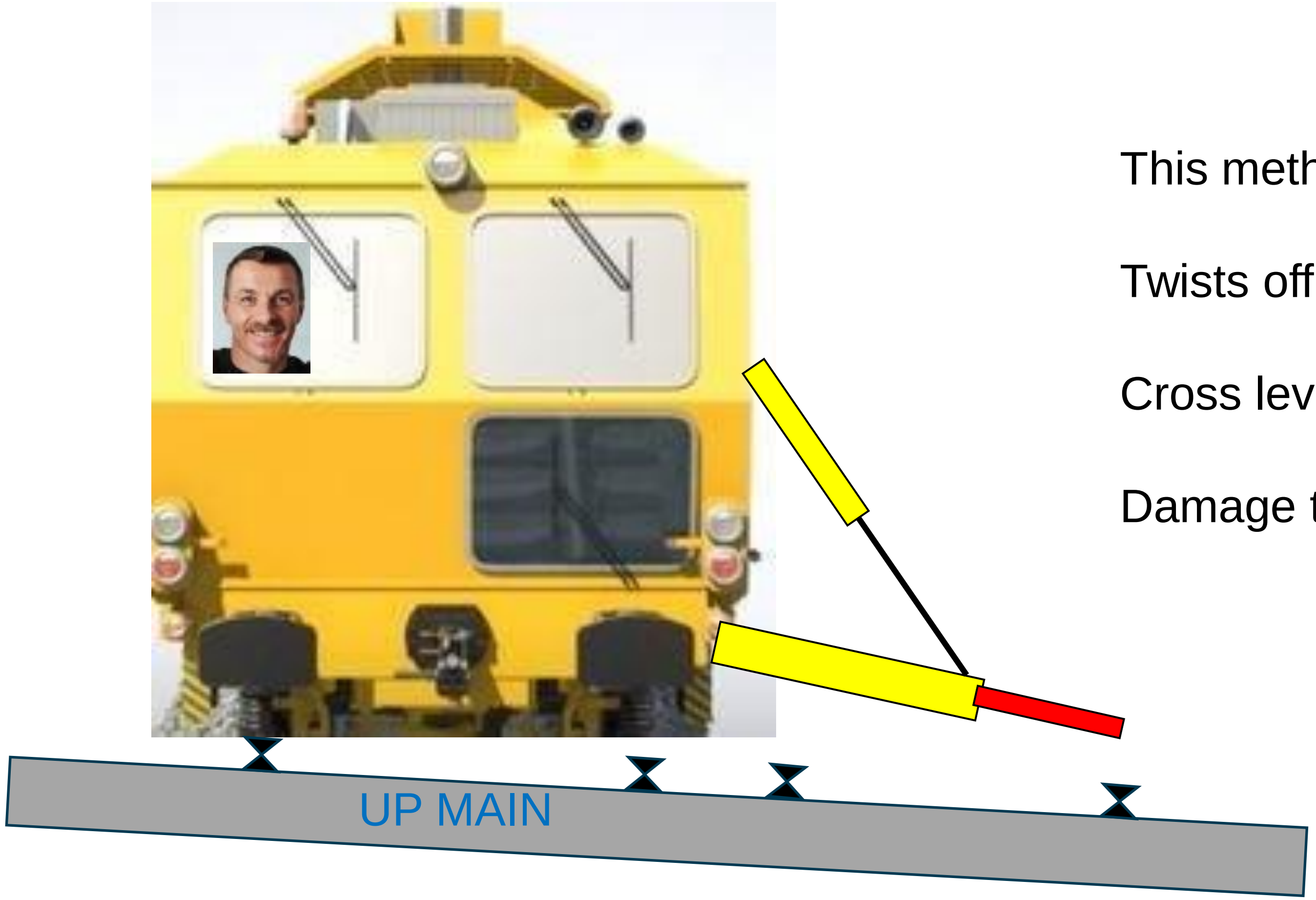
3rd Arm (when it's used) only effective up to Castle tamp limit

Limits: 2123mm Plasser 08 4x4 / 1900mm Matisa B41 From centre line

Fastenings may deflect and give false Galvo Reading



TAMPING TURNOUTS



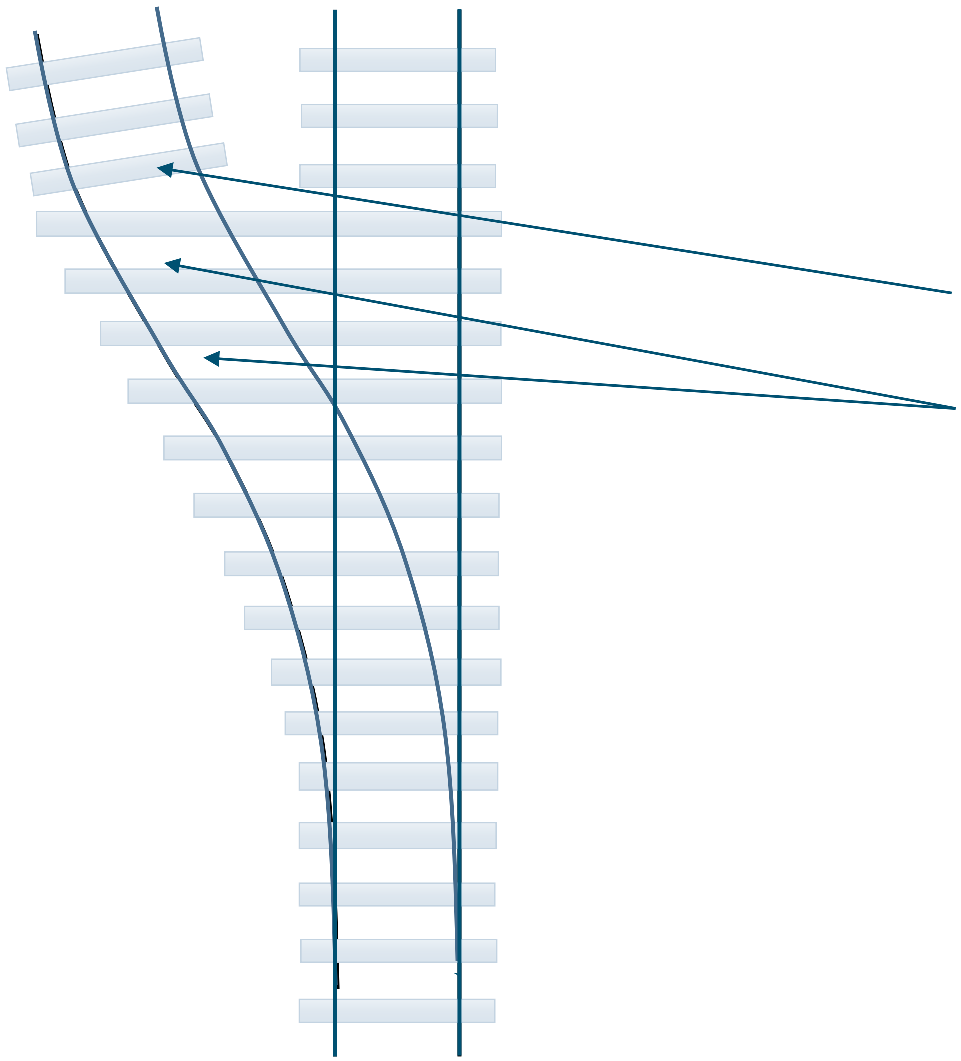
This method can induce:

Twists off tied area

Cross level errors through turnout

Damage to Fastenings

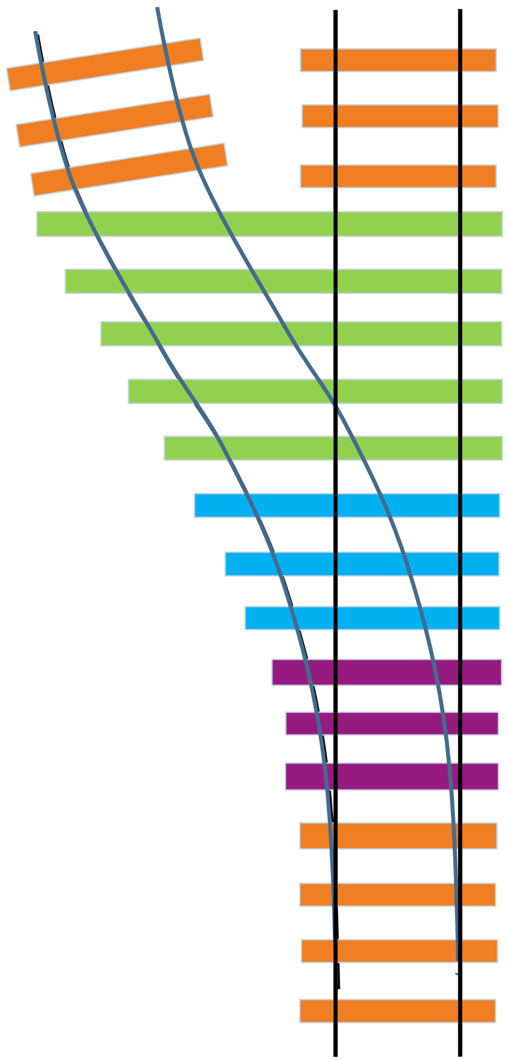
TAMPING TURNOUTS



Twist & top faults running off tied area

Cross level errors through turnout

TAMPING TURNOUTS – THROUGH ROUTE



Geometry has to be used

Design has to be conducive with through route adjustments and new design position

Orange bearers tamped conventionally

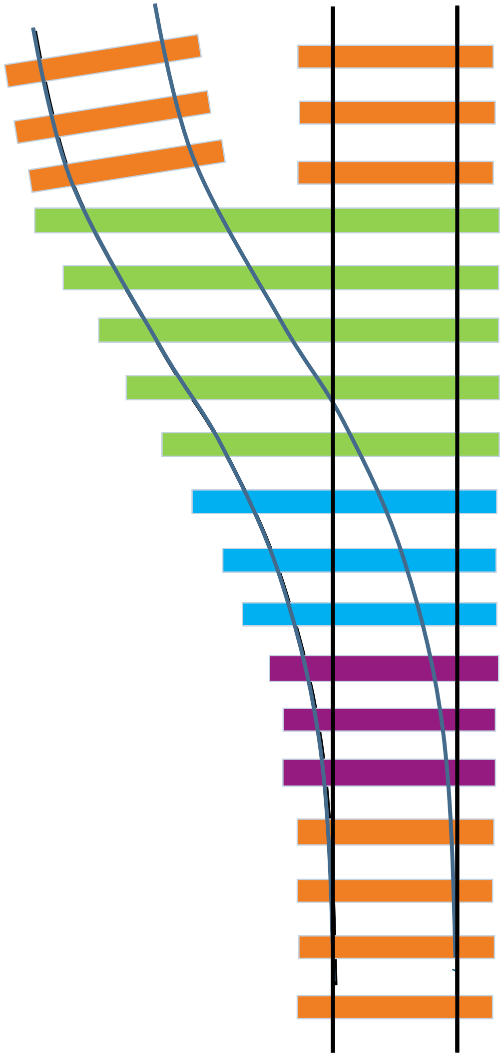
Purple bearers castle tamped

TAMPING TURNOUTS – THROUGH ROUTE

Purple bearers

Castle tamping

TAMPING TURNOUTS – THROUGH ROUTE



<u>Geometry</u> has to be used

Design has to be conducive with through route adjustments and new design position

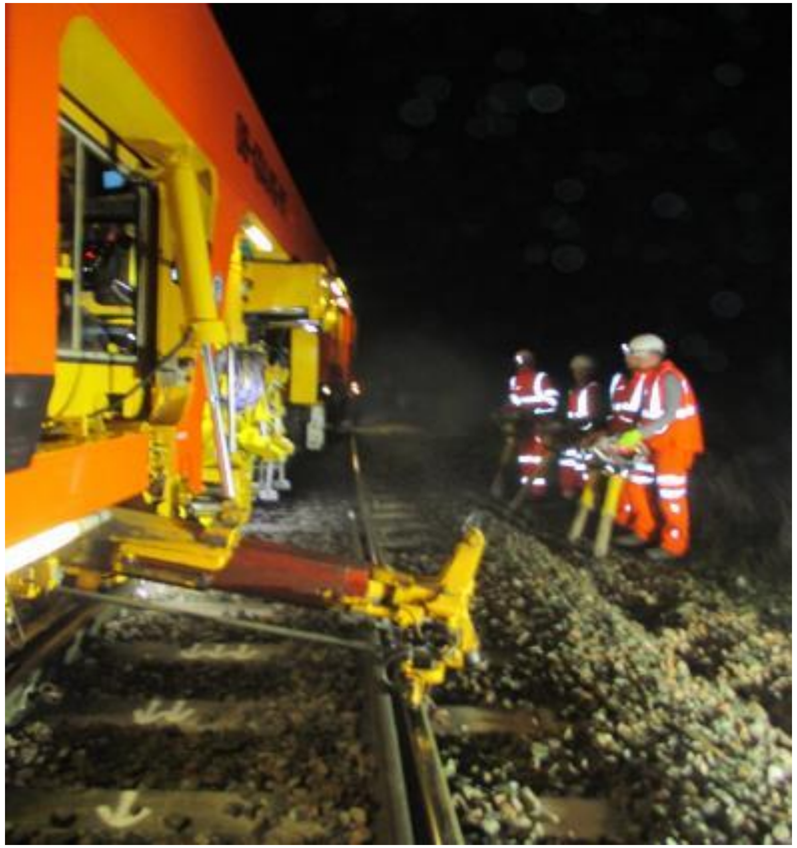
Orange bearers tamped conventionally

Blue bearers castle tamped with 3rd arm and packed on turnout route

TAMPING TURNOUTS – THROUGH ROUTE

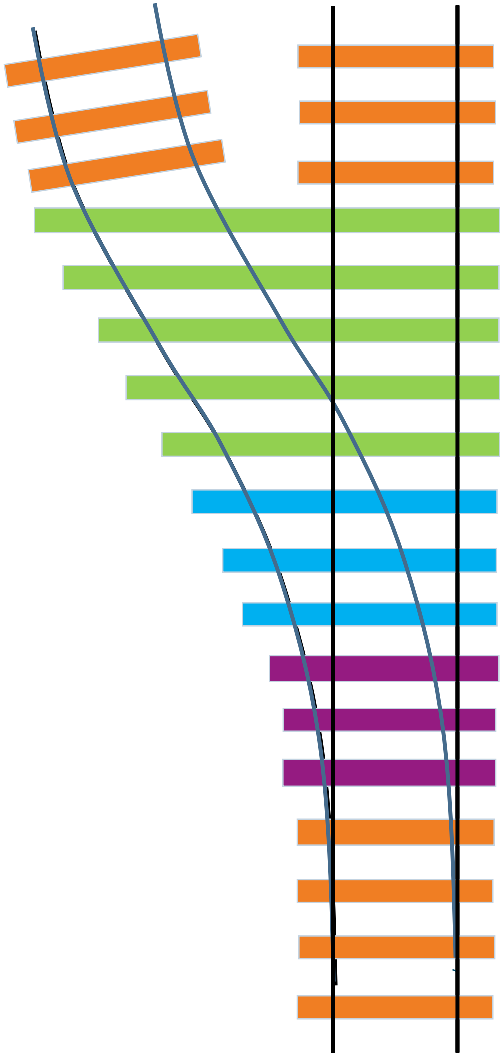
Blue bearers

3rd Arm tamping



3rd Arm tamping with packing

TAMPING TURNOUTS – THROUGH ROUTE



Geometry has to be used

Design has to be conducive with through route adjustments and new design position

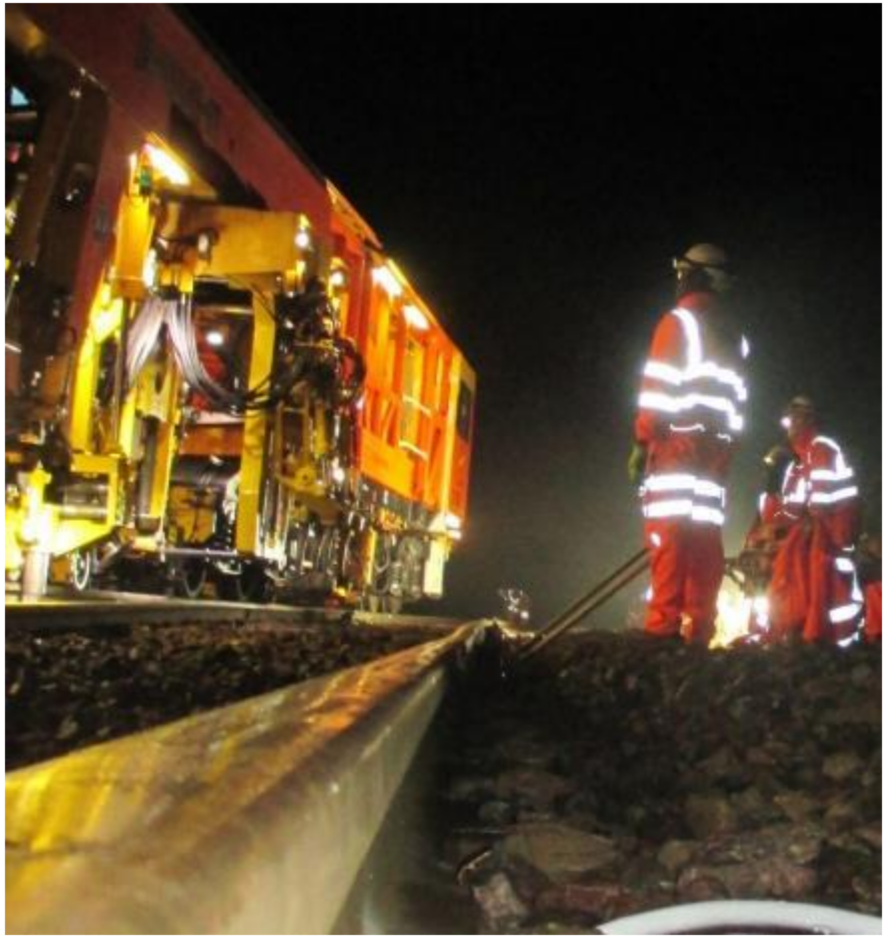
Orange bearers tamped conventionally

Green bearers tamped while cross level achieved on Turnout through jacking

TAMPING TURNOUTS – THROUGH ROUTE

Green bearers

Jacking to achieve cross level



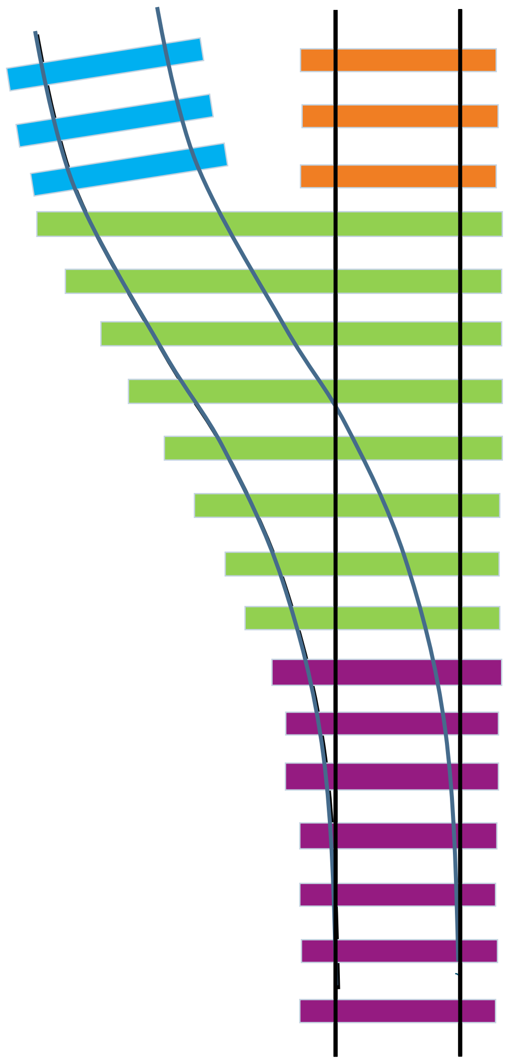
Packing to maintain cross level until turnout tamped

TAMPING TURNOUTS – THROUGH ROUTE

Jack until design Cross Level attained

12 O’Clock on Cross Level Galvo

TAMPING TURNOUTS – TURNOUT ROUTE



Once through route complete machine set back

Design has to be conducive with through route adjustments and new design position

Previous tamped bearers during through route

Bearers squeezed for consistent and stronger compaction (cross level corrected) – not lifted or lined

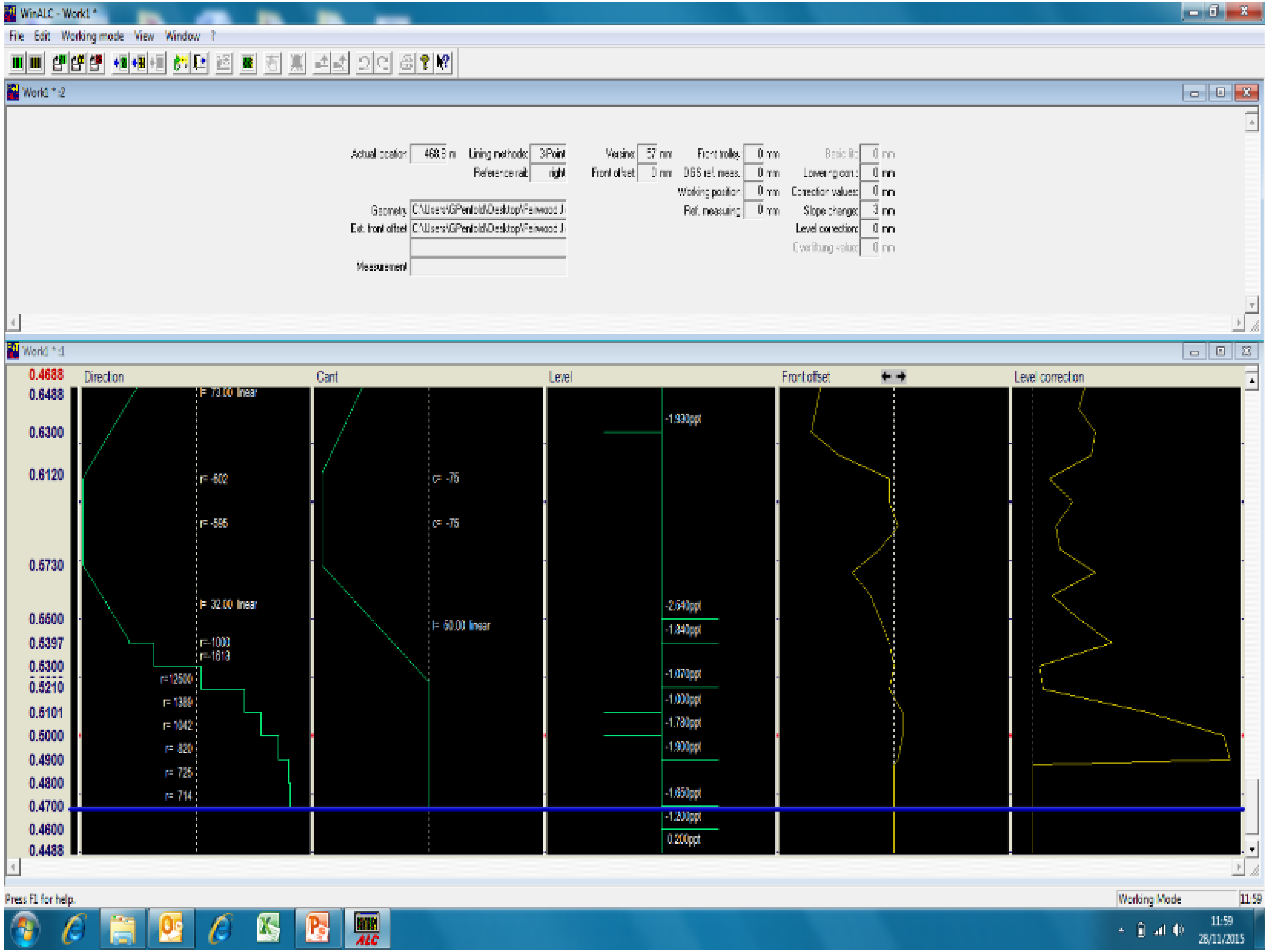
Bearers tamped and lined to **geometry design conducive** to through route

OFFICIAL

TAMPING TURNOUTS – THROUGH ROUTE

OFFICIAL

TAMPING TURNOUTS – TURNOUT ROUTE

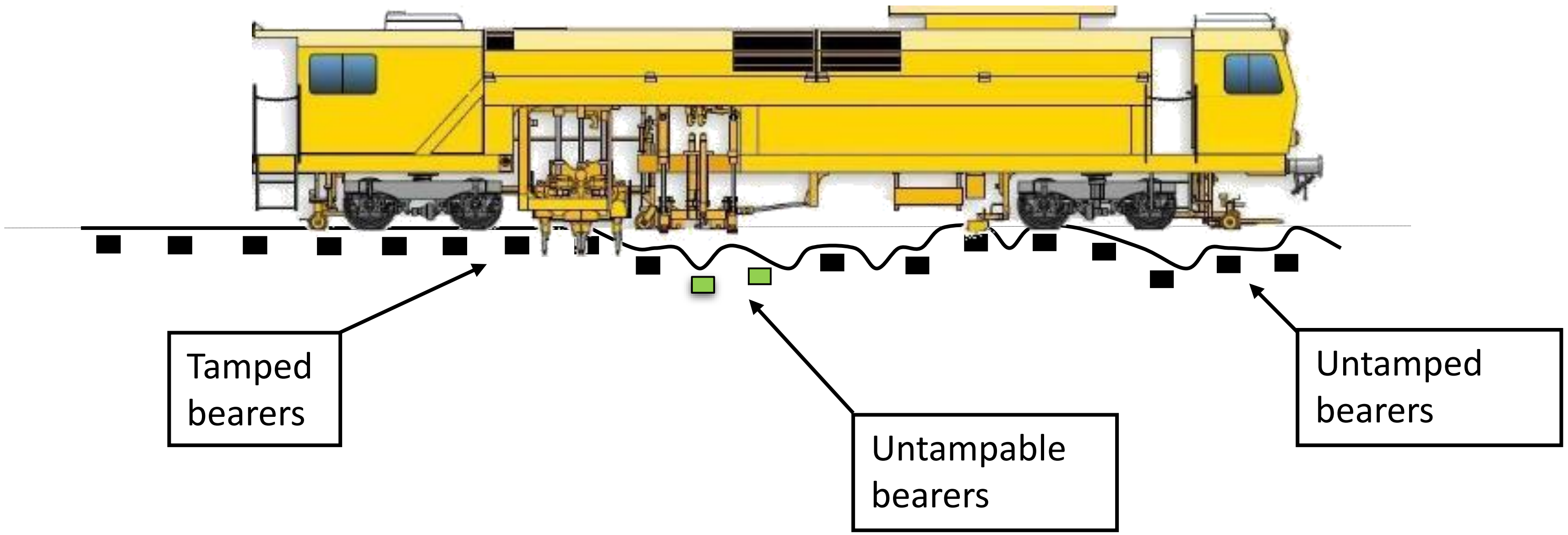


TAMPING TURNOUTS – TURNOUT ROUTE

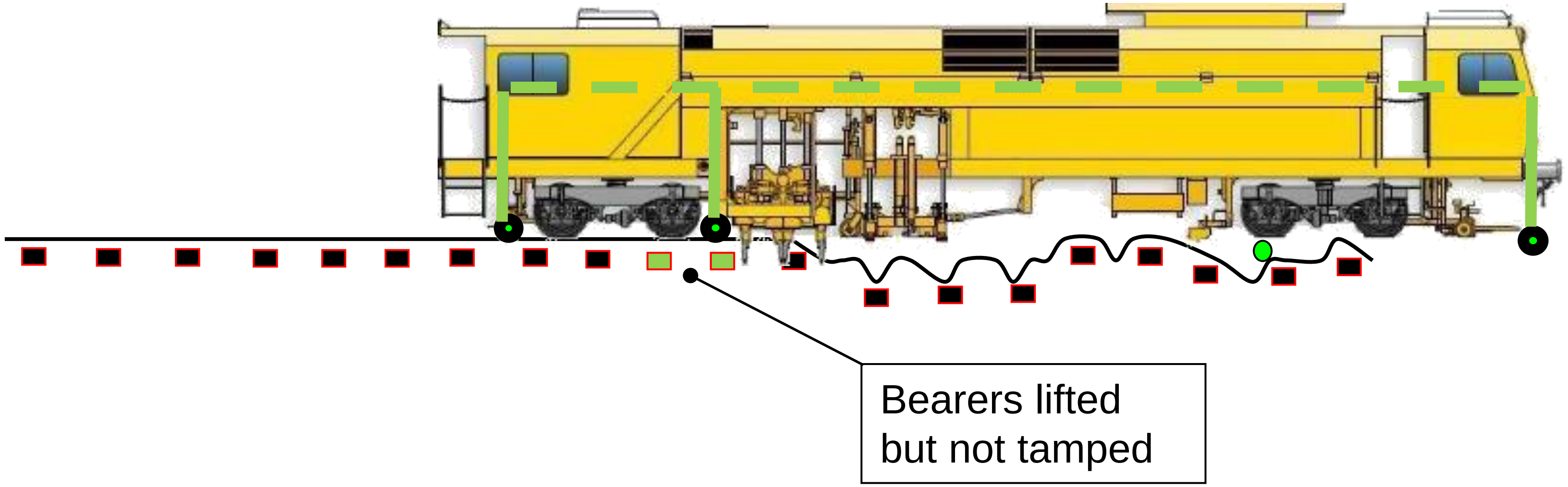
First plain bearer off tied bearers – 0mm Lift (cross level correction) to 57mm lift

UNTAMPABLE BEARERS

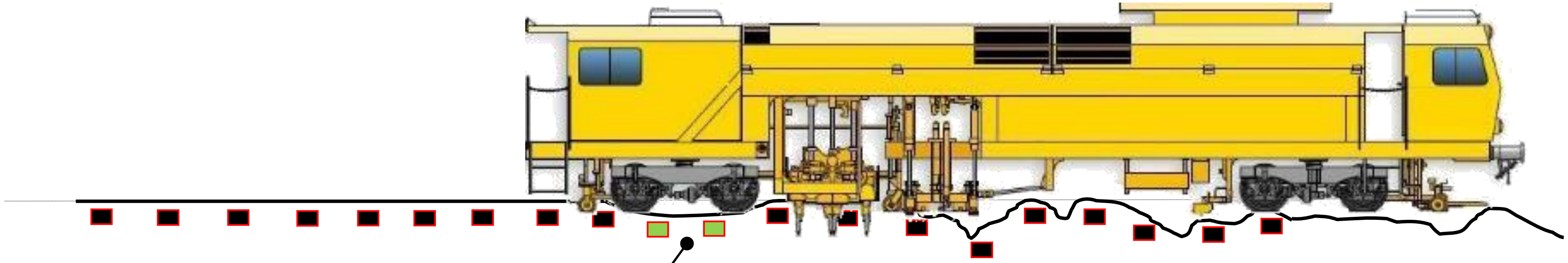
UNTAMPABLE BEARERS



UNTAMPABLE BEARERS

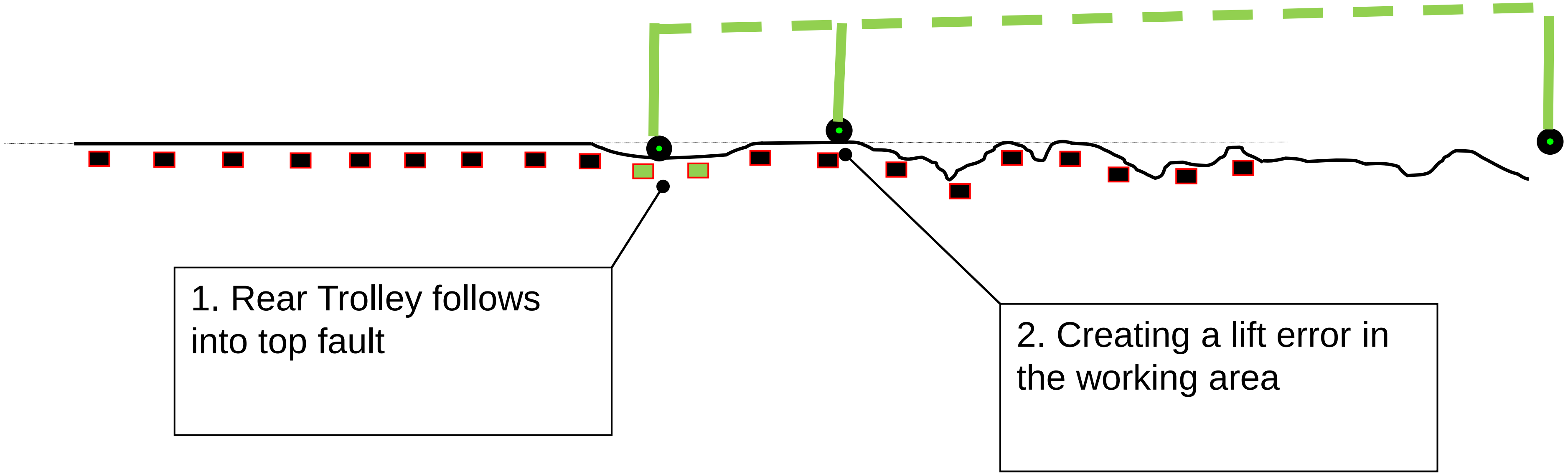


UNTAMPABLE BEARERS

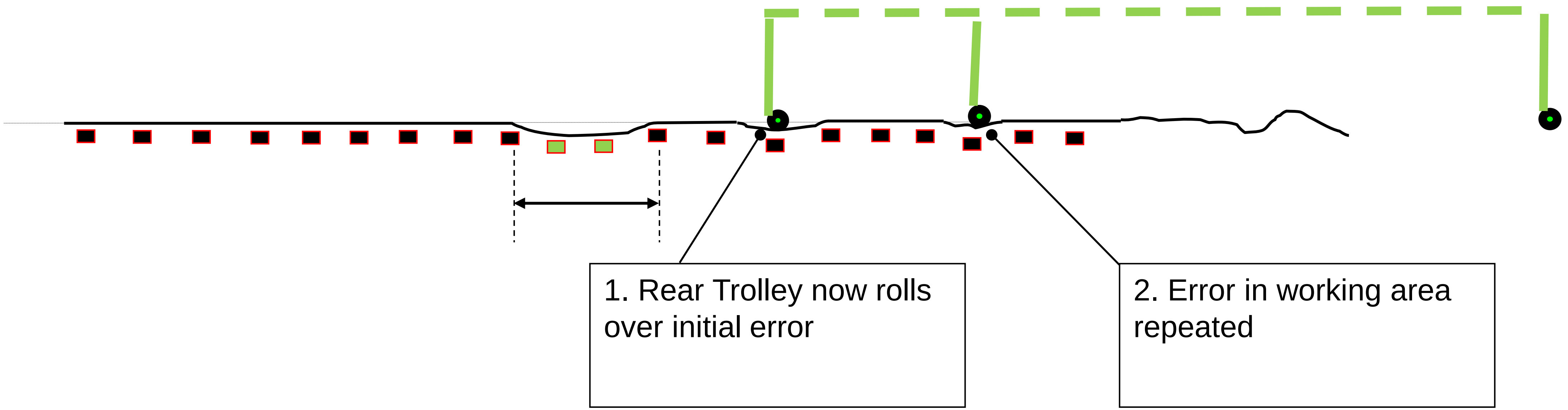


Rear Bogie moves over un-tamped track and forces bearers down into void creating top fault (slack)

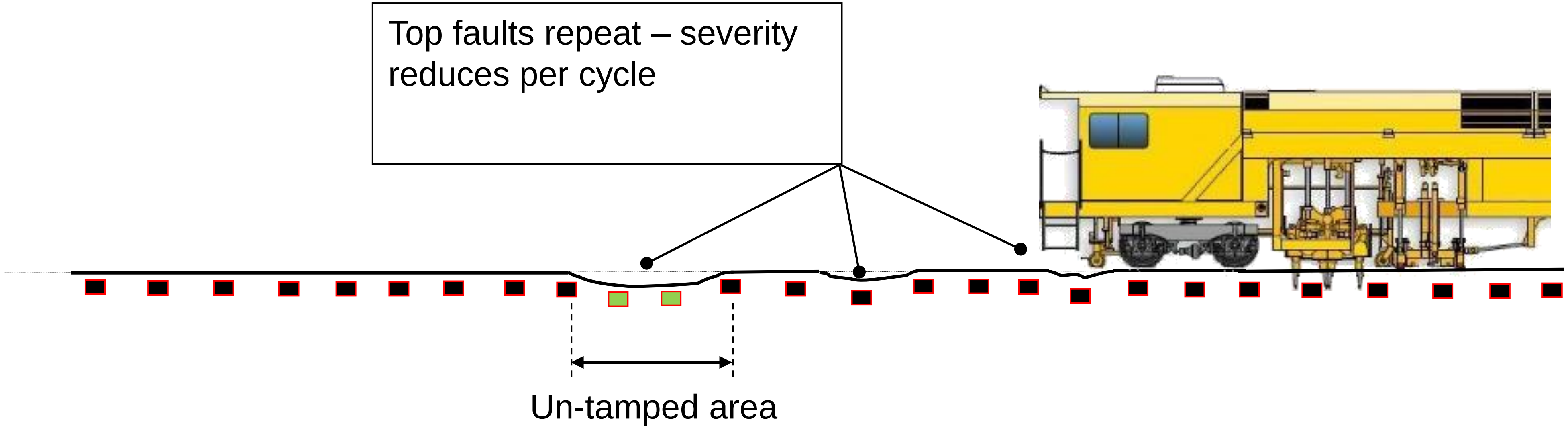
UNTAMPABLE BEARERS



UNTAMPABLE BEARERS



UNTAMPABLE BEARERS



UNTAMPABLE BEARERS

Remove POE -

- RPCL
- HW2000
- Mechanical

UNTAMPABLE BEARERS

Tamp to correct depths

Double / Treble tamp

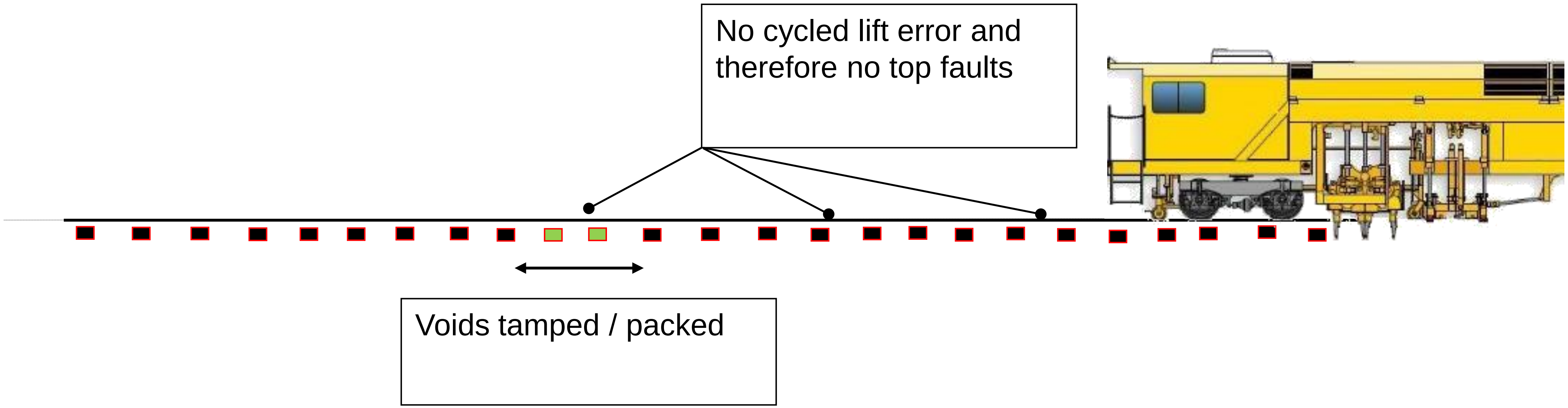
Box in Ballast (without fouling POE)

UNTAMPABLE BEARERS

Lift & Hold – Ensure tamping banks are raised and locked before proceeding with Robel Orbital Tamper Packers, Kango Hammers (Cobras), etc

*Picture taken 2004 when full PPE Non Mandatory
*Internal ear protection being used

UNTAMPABLE BEARERS



P

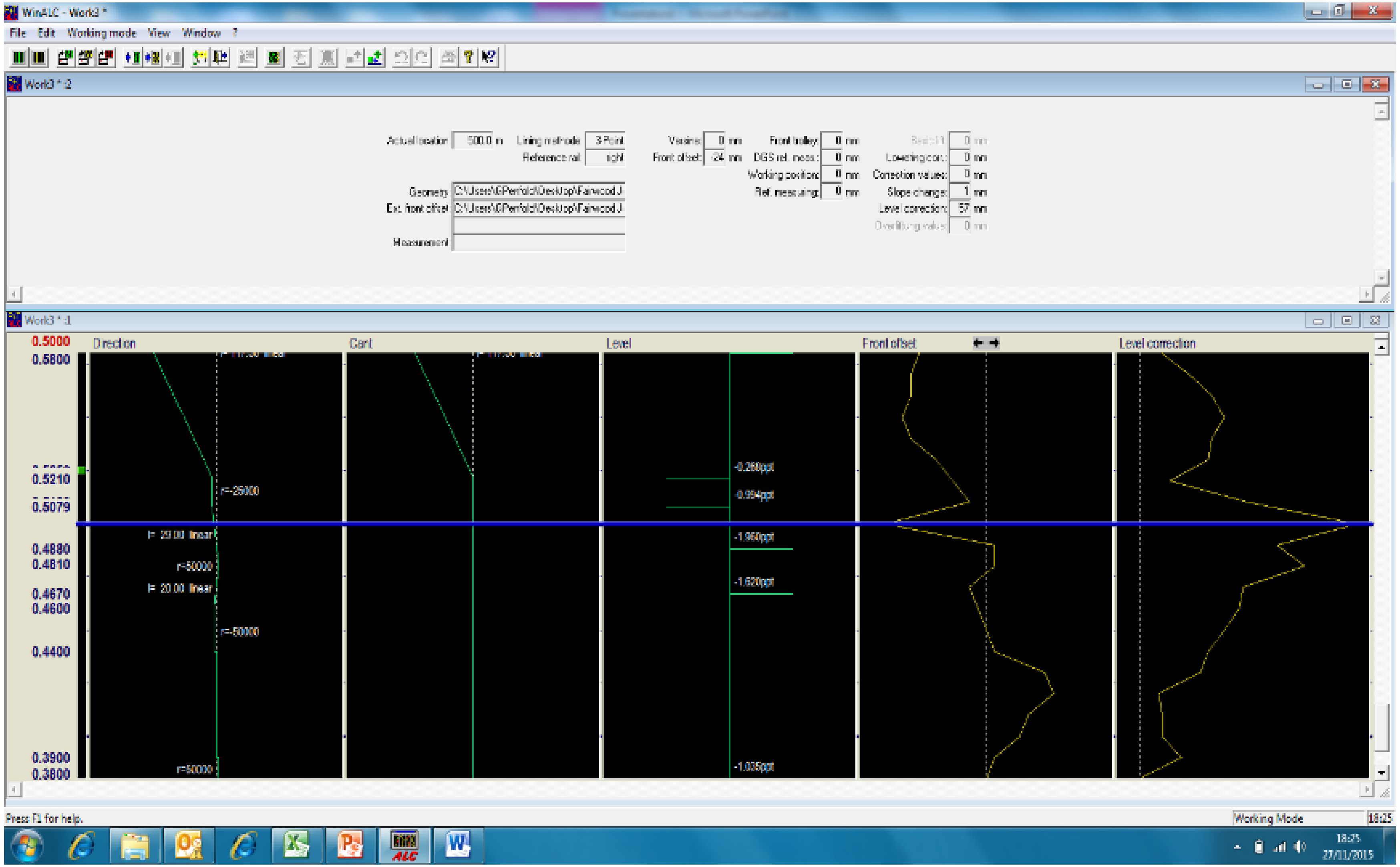
TAMPING SWITCH DIAMONDS

TAMPING SWITCH DIAMONDS

FOR NEW OR LAYOUTS WITH GOOD BALLAST CONDITION WHERE POE HAS BEEN REMOVED FOR INTERVENTION:

- USE GEOMETRY
- ENSURE POE IS REMOVED – THIS IS CRITICAL
- TREBLE TAMP TO CORRECT CONSTRUCTION DEPTH
- BOX IN BALLAST – AS MUCH AS POSSIBLE WITHOUT FOULING POE

TAMPING SWITCH DIAMONDS



TAMPING SWITCH DIAMONDS

- **IF POE NOT REMOVED FOR CONSIDERABLE TIME / BALLAST MEMORY REDUCES DURABILITY**

- USE LIFT & HOLD IN DESIGN POSITION

- HAND HELD STONEBLOW

  - USE 6mm CHIPPINGS
  - BLOW TO REJECTION
  - ENSURE WHOLE OF BEARER IS PACKED

TAMPING SWITCH DIAMONDS

LIFT & HOLD APPLIED – TAMPING BANKS LOCKED IN UP POSITION

TAMPING SWITCH DIAMONDS

CHIPPINGS BLOWN IN BY HAND HELD STONEBLOWER

P

HOLLOW BEARER S & C SYSTEMS

There are 3 sorts of hollow bearer S & C Systems currently in use on Network Rail

HPSS

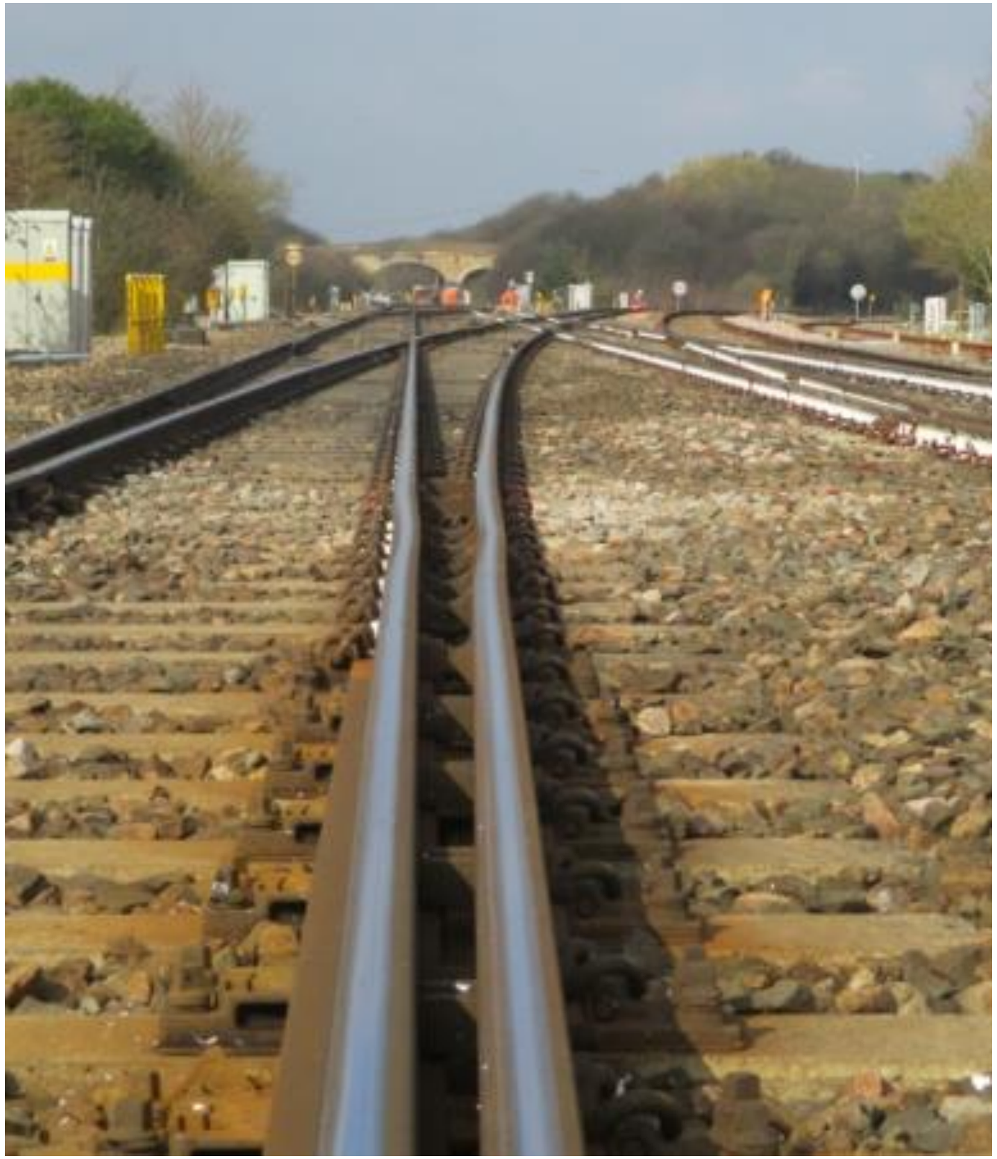
HOLLOW BEARER S & C SYSTEMS

Hy-Drive System

HOLLOW BEARER S & C SYSTEMS

In Bearer Clamplocks (IBCL)

STRESS TRANSFER / HEEL BLOCK MISALIGNMENTS



THIS FAULT CANNOT BE TAMPED OUT

FOAM PACKING INITIALLY USED TO SUPPORT BOLTS PRIOR TO TORQUE BEING APPLIED

REPLACED BY EPOXY RESIN

BRITTLE AND RESTRICTS THERMAL MOVEMENT

25mm BOLT IN 30mm

RAILS OF DIFFERENT LENGTHS REQUIRE THERMAL MOVEMENT

RESULTS IN CHRONIC STRESS TRANSFER / HEEL
BLOCK MISALIGNMENT

TRACK BUCKLE RISK

STRESS TRANSFER / HEEL BLOCK MISALIGNMENTS

PROCEDURE

UNDO / CRACK STRESS TRANSFER BOLTS TO APPROX 6mm (1/4”) THREAD

TAP EACH BLOCK BOTH WAYS WITH KEYING HAMMER

ENSURE EXPOXY RESIN IS BROKEN UP AND BLOCKS CAN MOVE

LIFT / LINE WITH OTM OR SLUEING JACK TO DESIRED / DESIGN POSITION

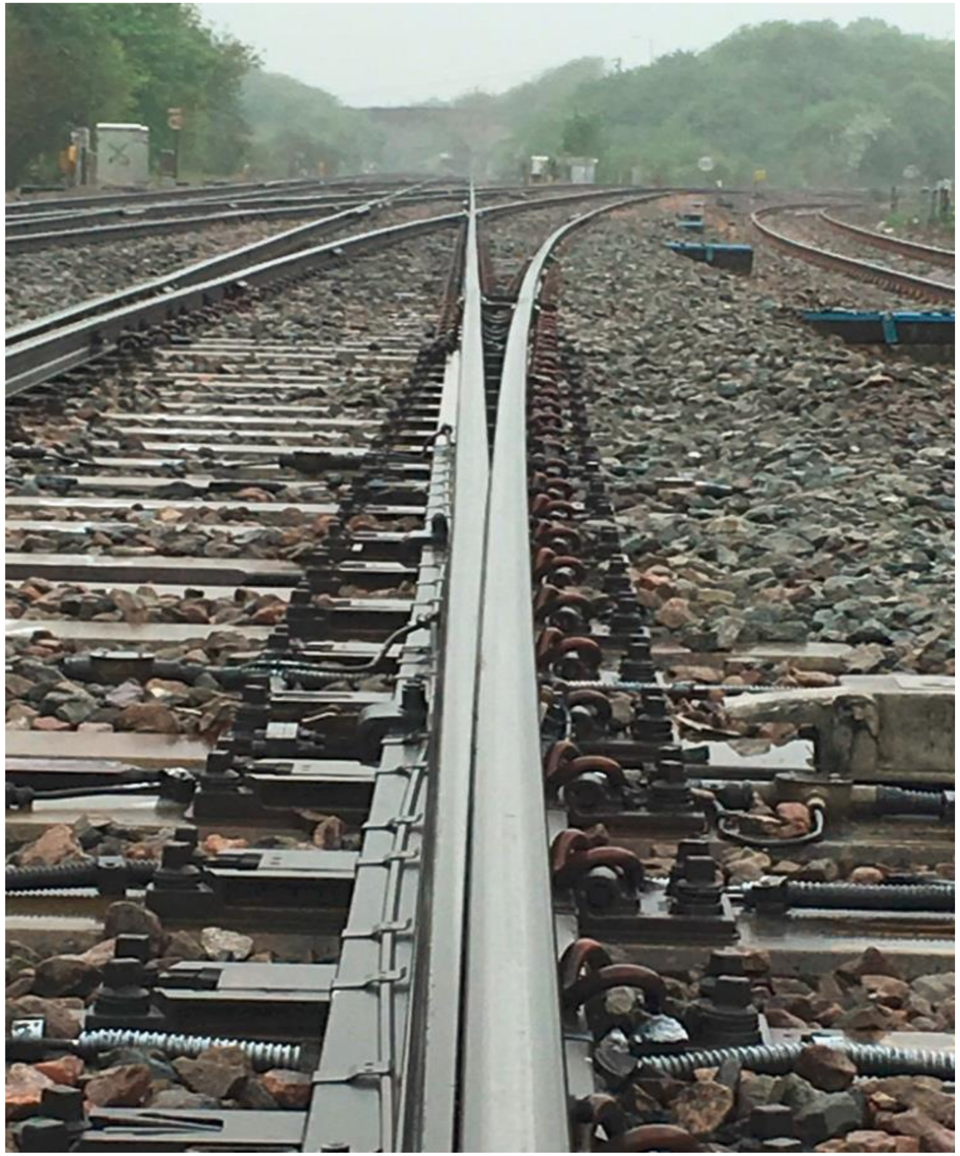
TORQUE BOLTS TO 650ft/lb

GOOD PRACTICE

ENSURE BOLTS ARE SET TO CORRECT TORQUE PRIOR HOT AND COLD WEATHER SEASON

REPLACE PREVIOUSLY TORGUED BOLTS IF NECESSARY

STRESS TRANSFER BLOCK MISALIGNMENTS

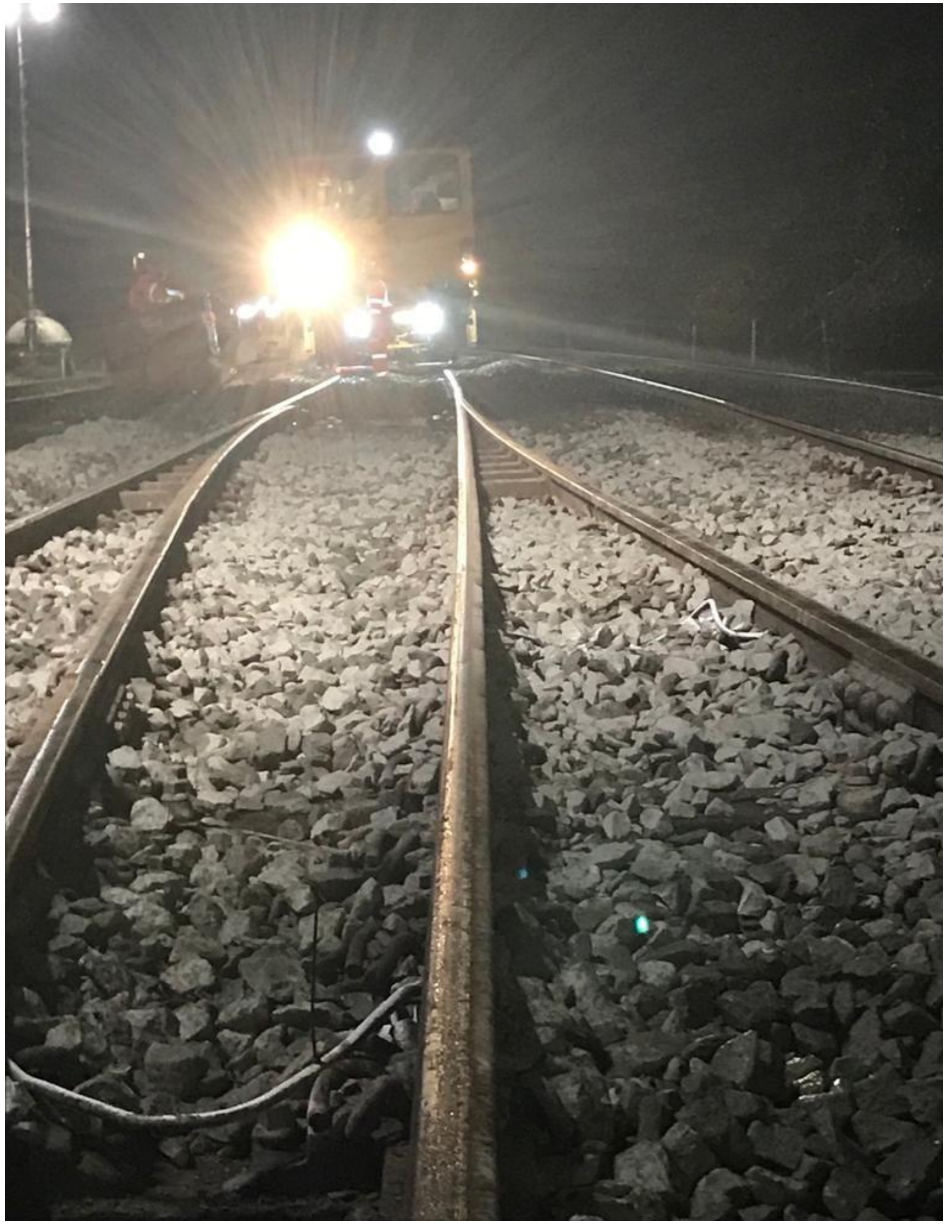


STRESS TRANSFER / HEEL BLOCK MISALIGNMENTS

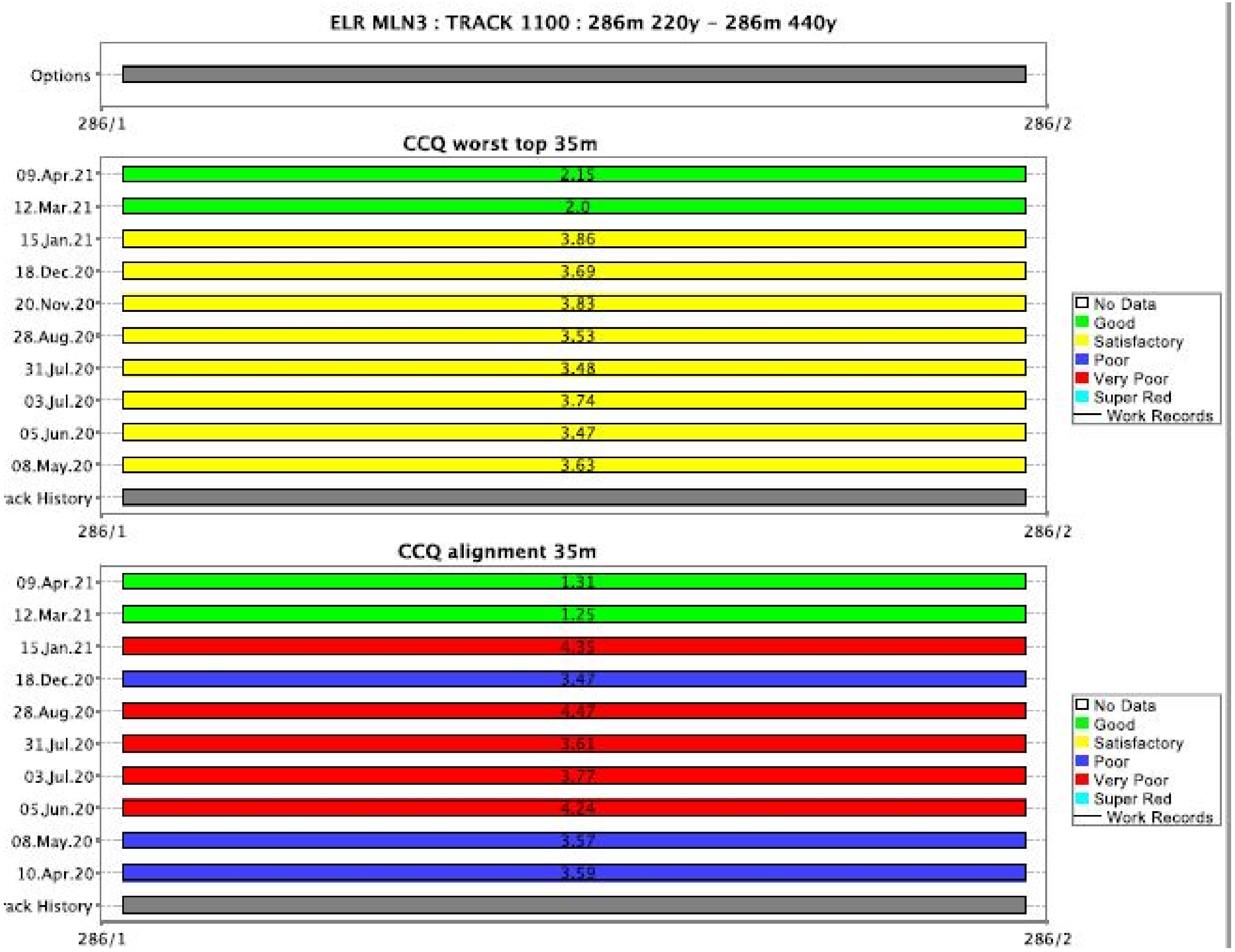
STRESS TRANSFER BLOCK MISALIGNMENTS

P

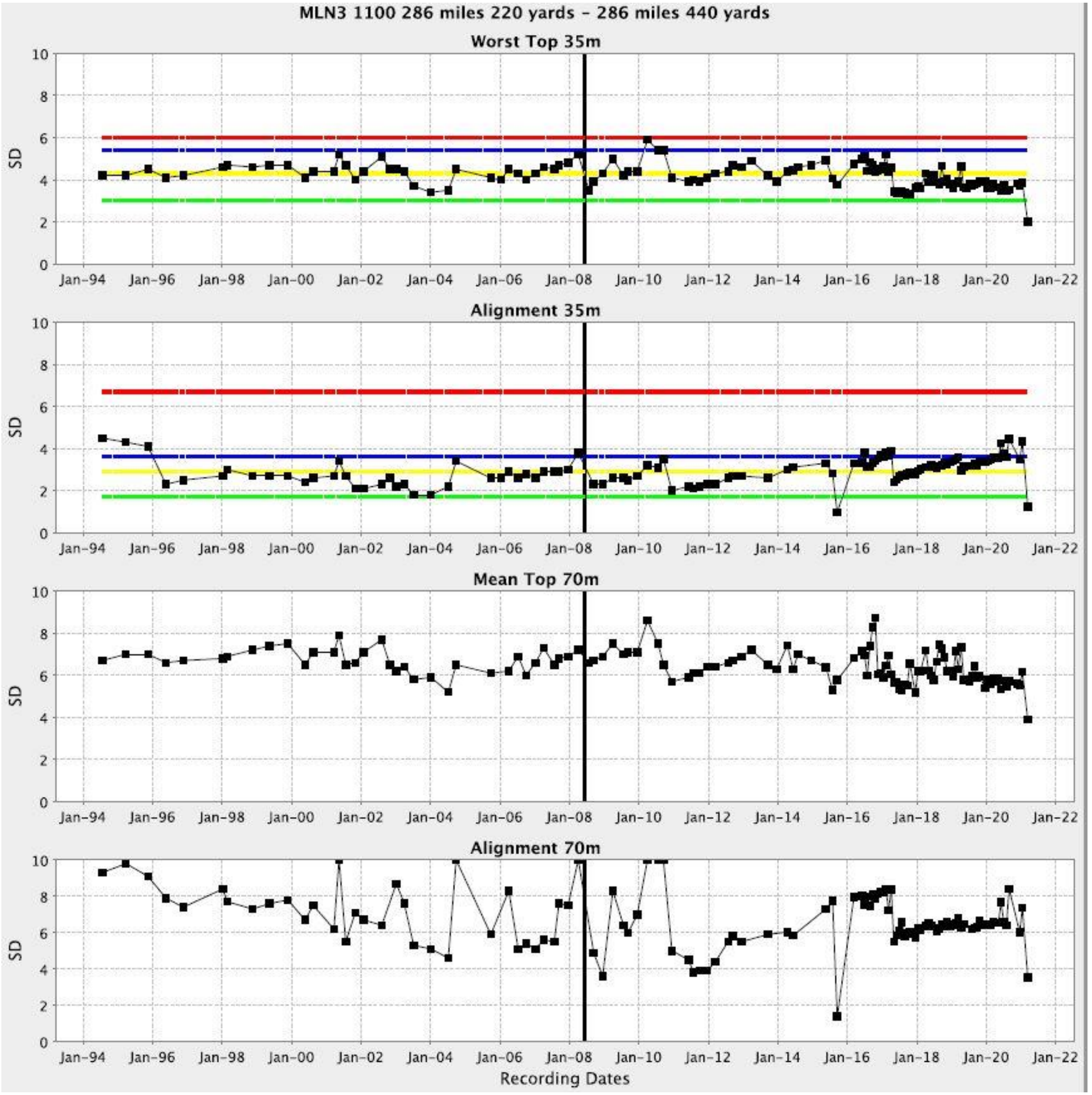
HEEL BLOCK MISALIGNMENTS



HEEL BLOCK MISALIGNMENTS



HEEL BLOCK MISALIGNMENTS



P

09 4 x 4 / 4S DYNAMIC

EVERYONE STILL WITH ME??

CURVE ASSISTED LASER (CAL)

WHAT IS CAL?

- KHR straight laser trolley mounted on moveable frame which automatically adjusts to the track curvature to stay in line with receiver

- Receiver situated on tamper which again automatically adjusts to the curvature of the track to stay in line with the laser

HOW IT WORKS

- **Direct Mode –** simultaneous measurement and tamp / line

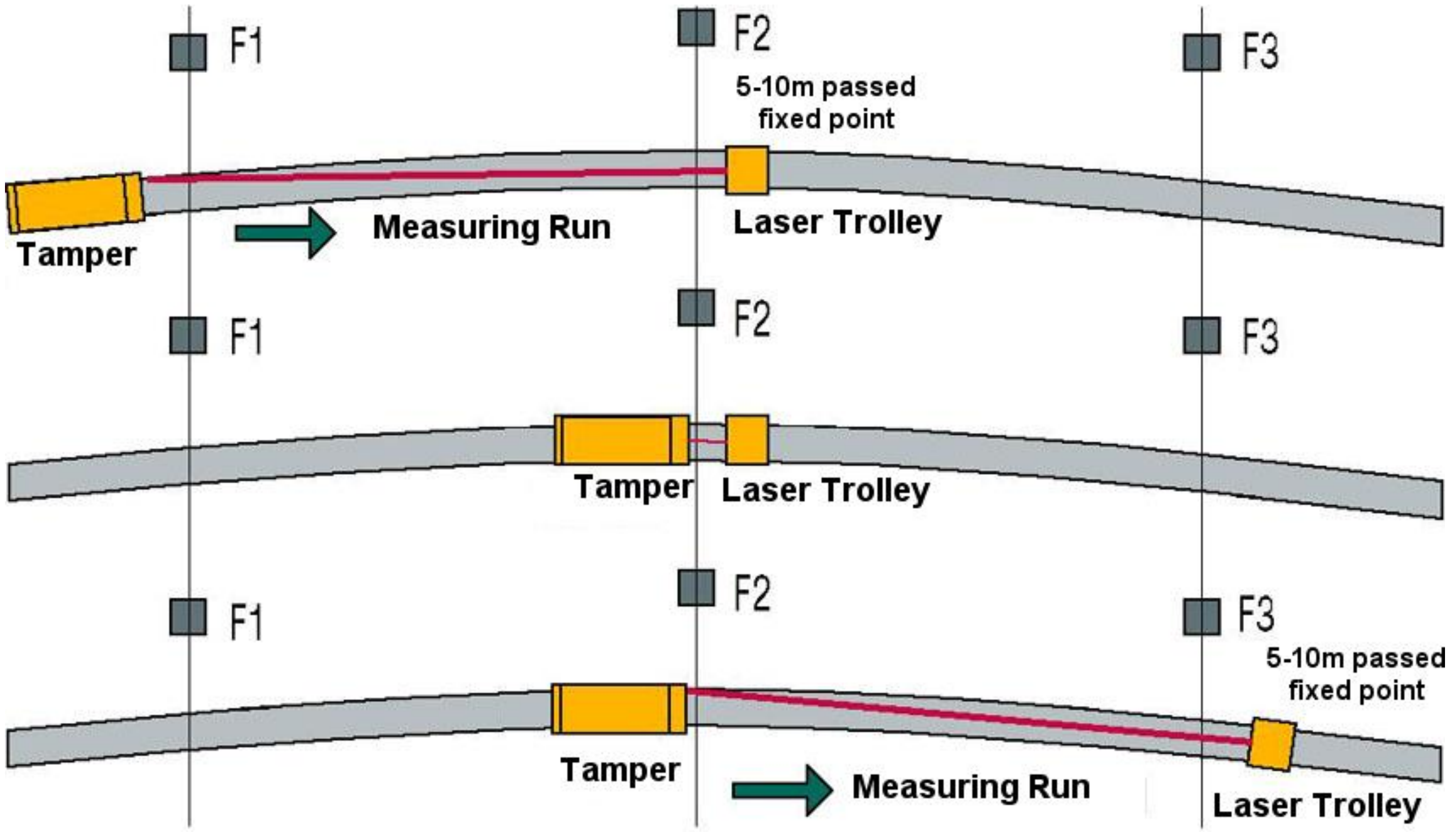
- **Indirect Mode - ** measurement, evaluation, confirmation and tamp / line

WHAT'S REQUIRED:

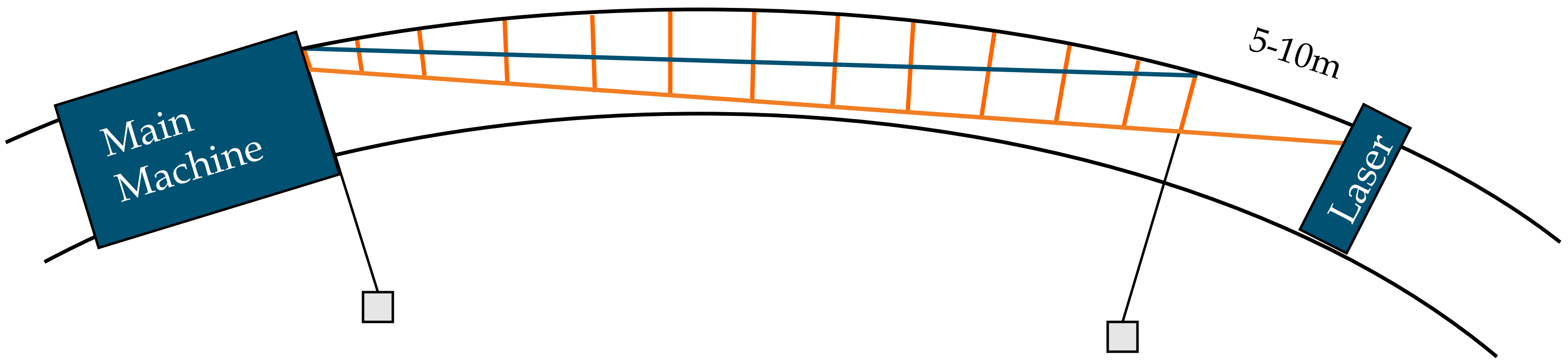
- Vertical & Horizontal Geometry

- Fixed Point / Monument Data

INDIRECT MODE

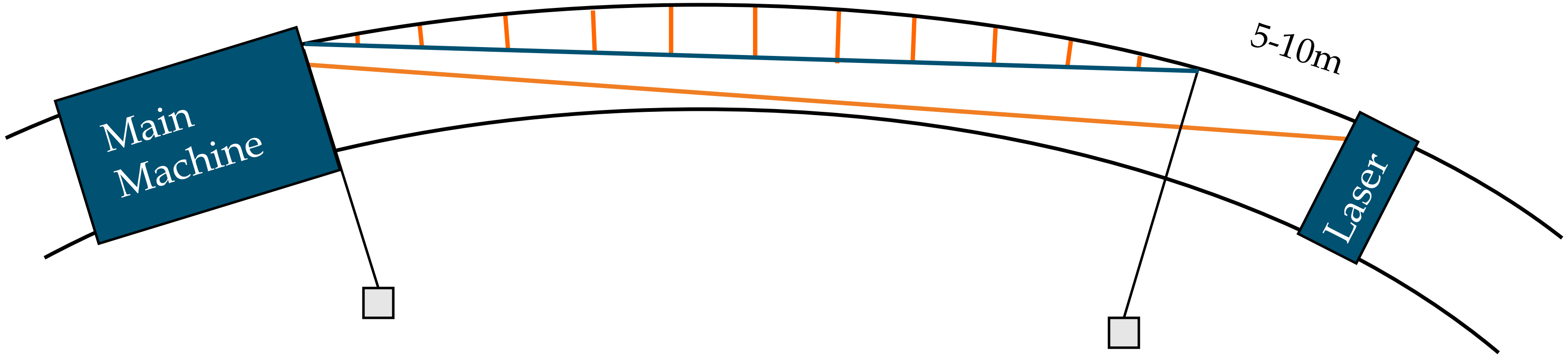


INDIRECT MODE



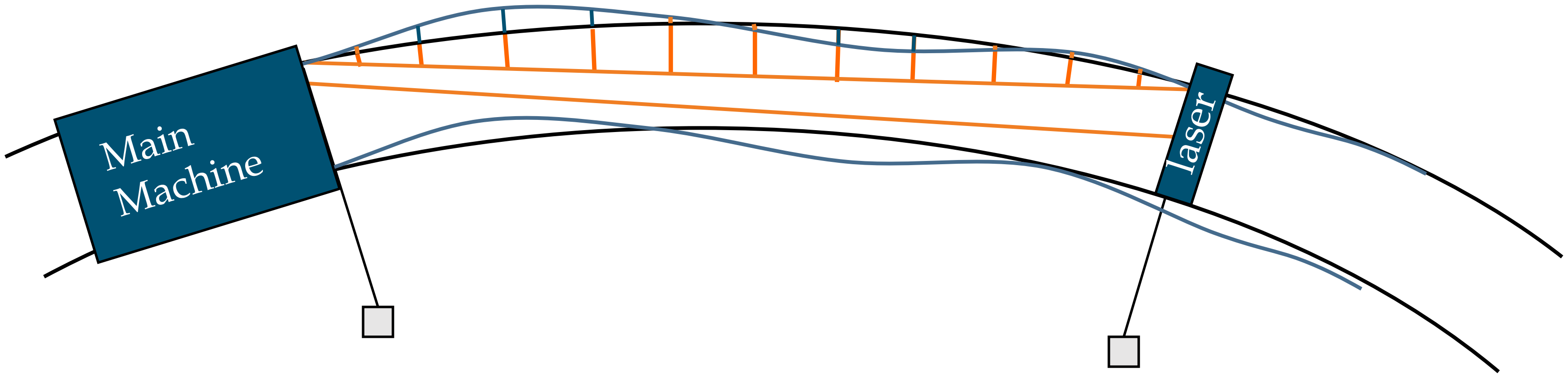
Machine uses long chord for measuring created by Laser to Receiver from Start to Fixed Point, then Fixed Point to Fixed Point and finally to the end of the site

INDIRECT MODE



Long Chord then displaced to Datum Rail from Start to Fixed to Fixed Point

INDIRECT MODE

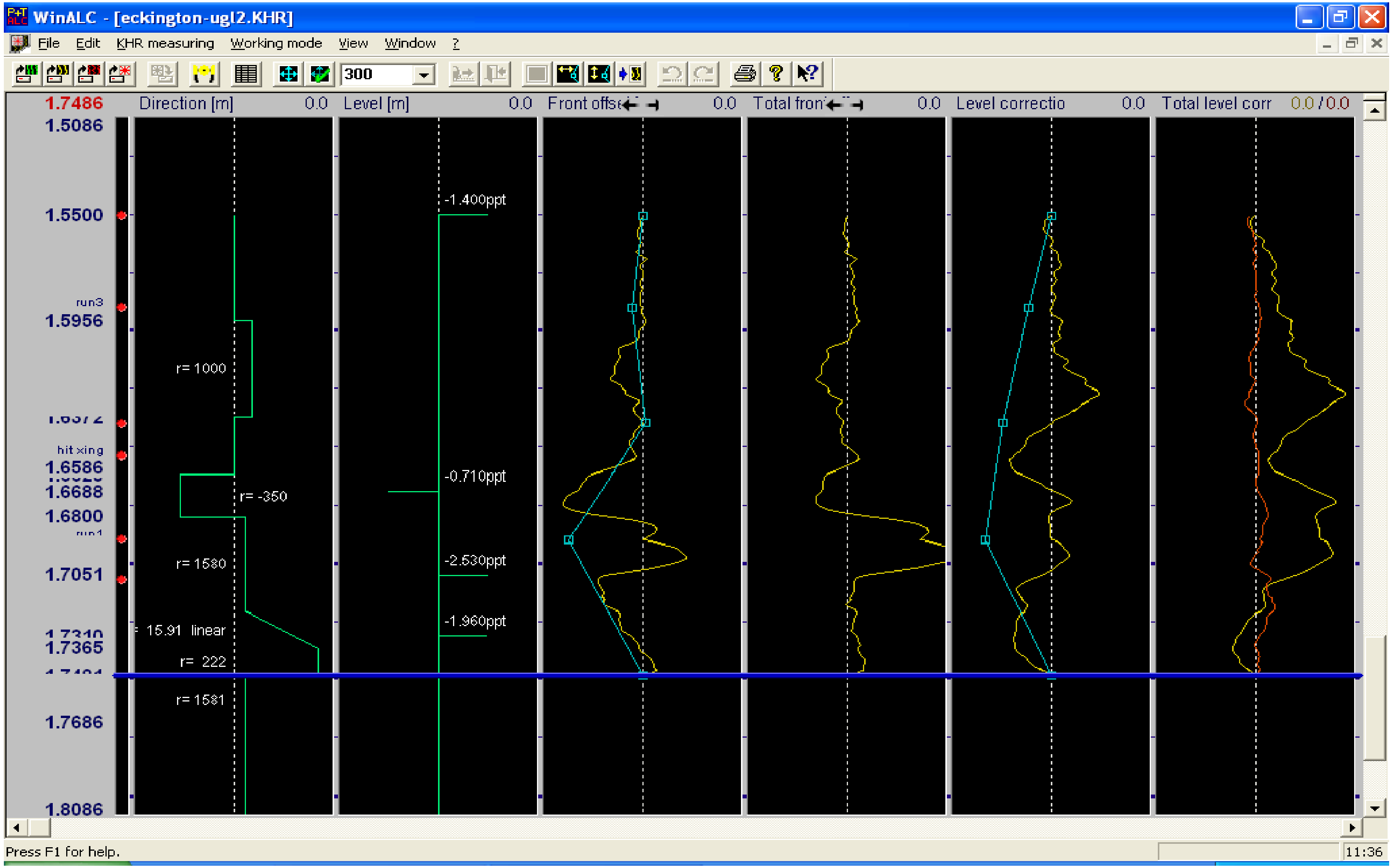


Adjustments calculated to attain Horizontal and Vertical Geometry
- already loaded onto machine from the Design

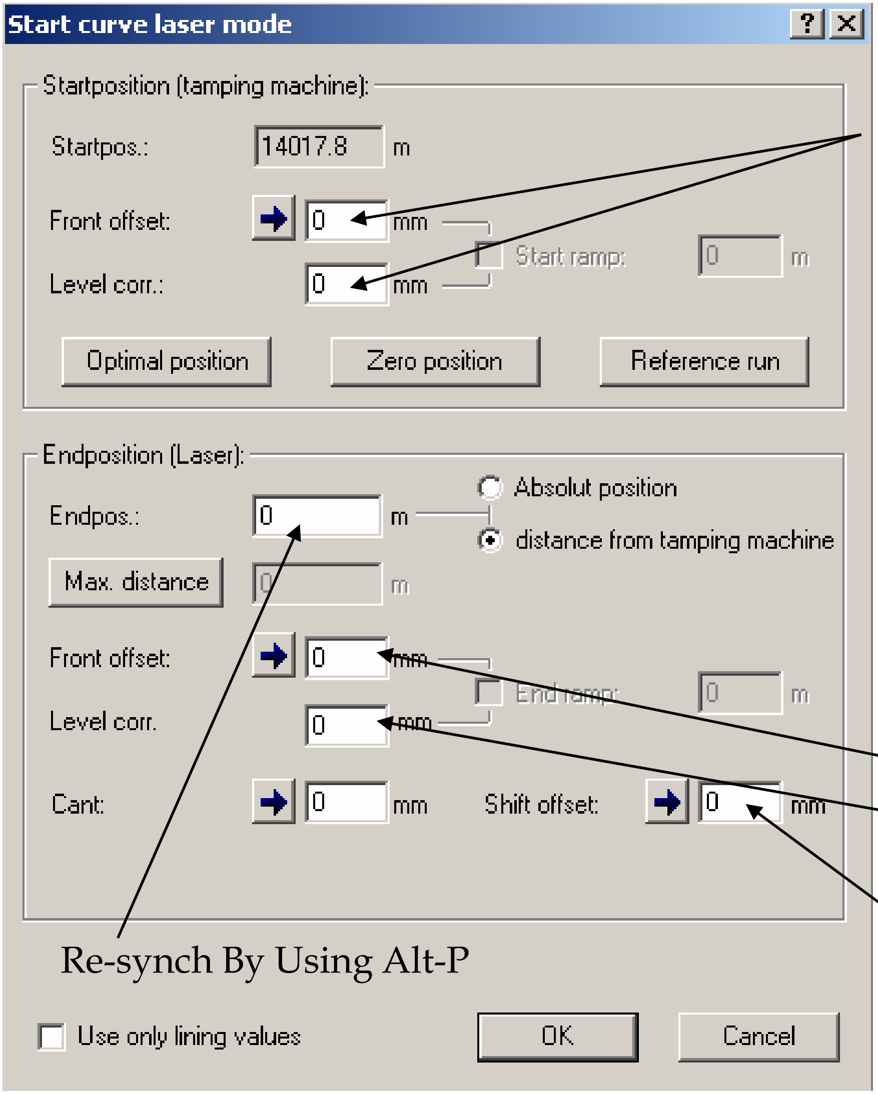
INDIRECT MODE

- Fixed Point Data – design position is then added at Fixed Points in form of **Polygon Points**
- Front Offset / Level Correction modified to now reflect Geometry and **Track Position**
- Adjustments can now be **Assessed** and **Validated**
- High Density Verche File - Front Offset / Level Correction every metre
- Geometry and Verche File now loaded into Work Mode and tamping can commence

INDIRECT MODE



Direct Mode information



Last FP Information

Re-synch By Using Alt-P

Fixed Point Offset Data

Fixed Point Level Data

Laser Offset On Trolley

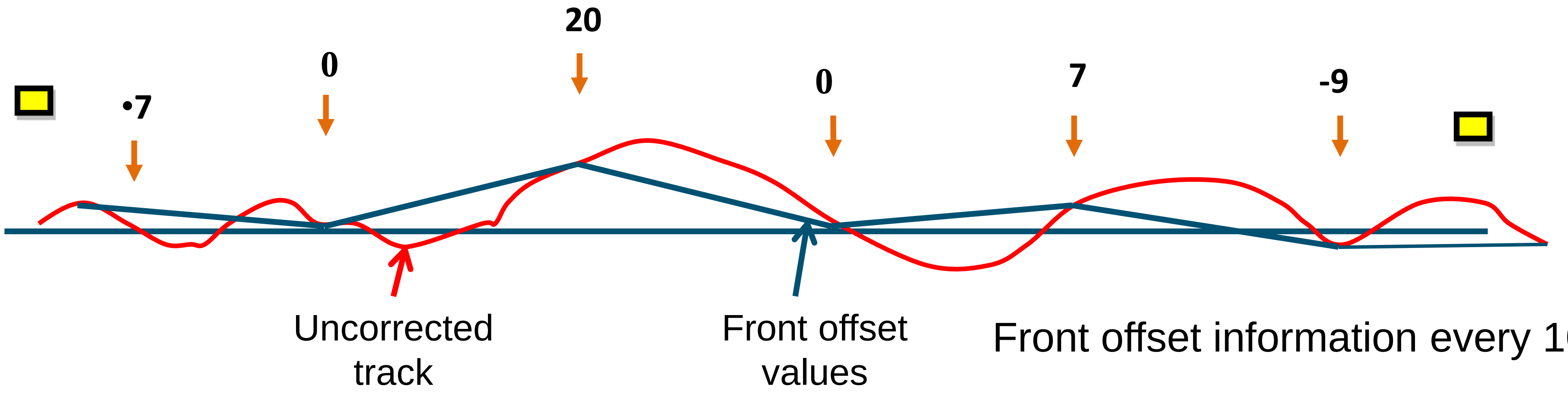
CAL V DESIGN

Design - Survey & Design – repeated for each intervention is costly, labour intensive and time consuming

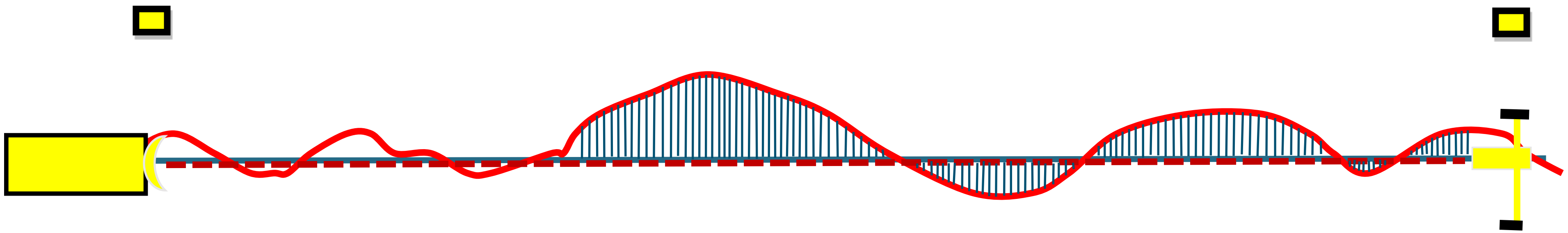
Curve Assisted Laser -

- Geometry is permanent
- Only survey Fixed Points info required (Offset & Level)
- **Long Chord measured every 200mm picks up all short and long wave defects**
- **Computer Generated Chord – no human error**
- **Dynamic measuring**
- Exceptional Track Quality
- Available on 09 series machines and some 08 machines (ROTME to clarify)

CAL LONG CHORD V DESIGN



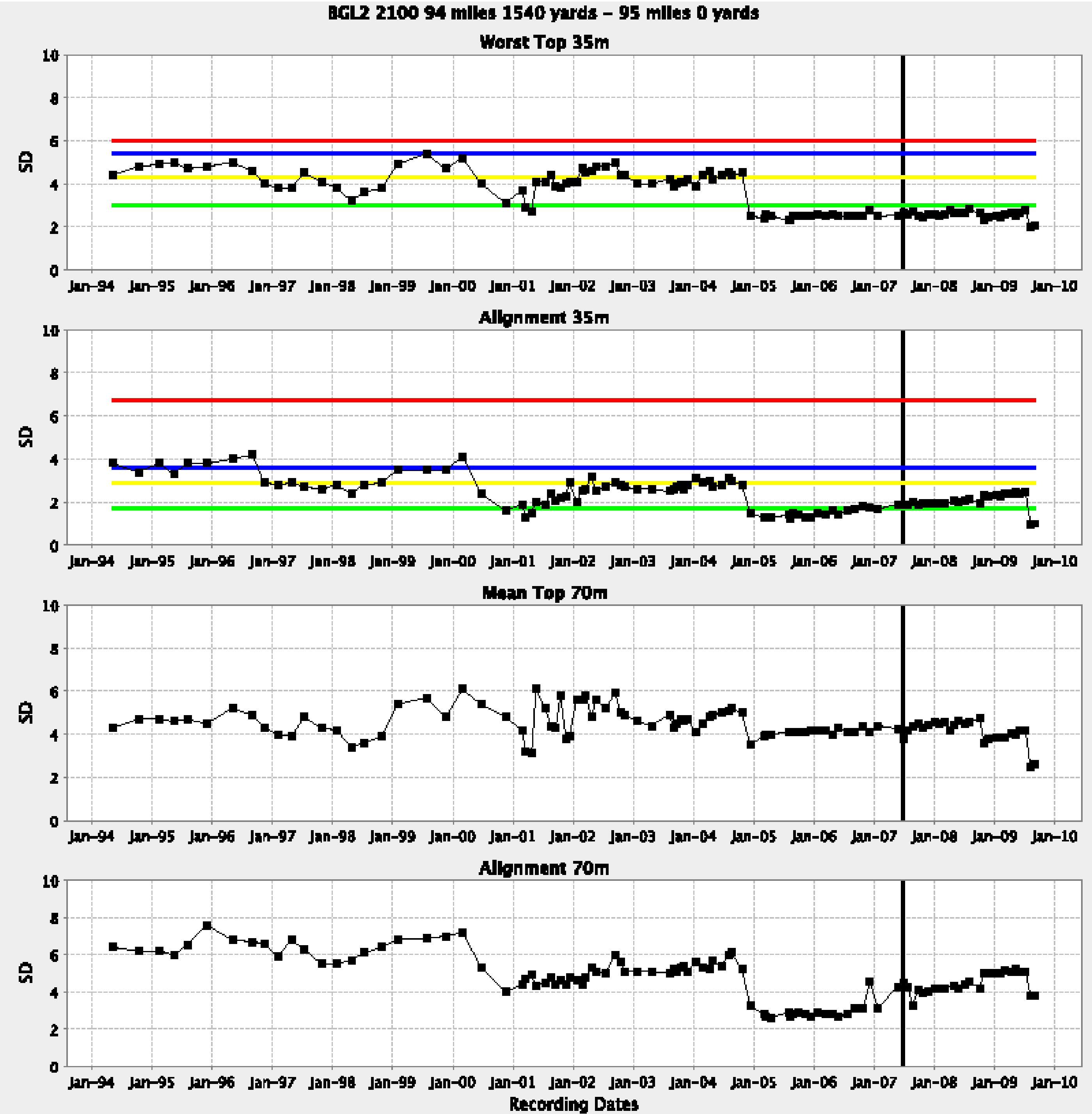
Front offset information every 10m



<u>Curve Laser</u>

Chord Up to a maximum of 250m pending curvature

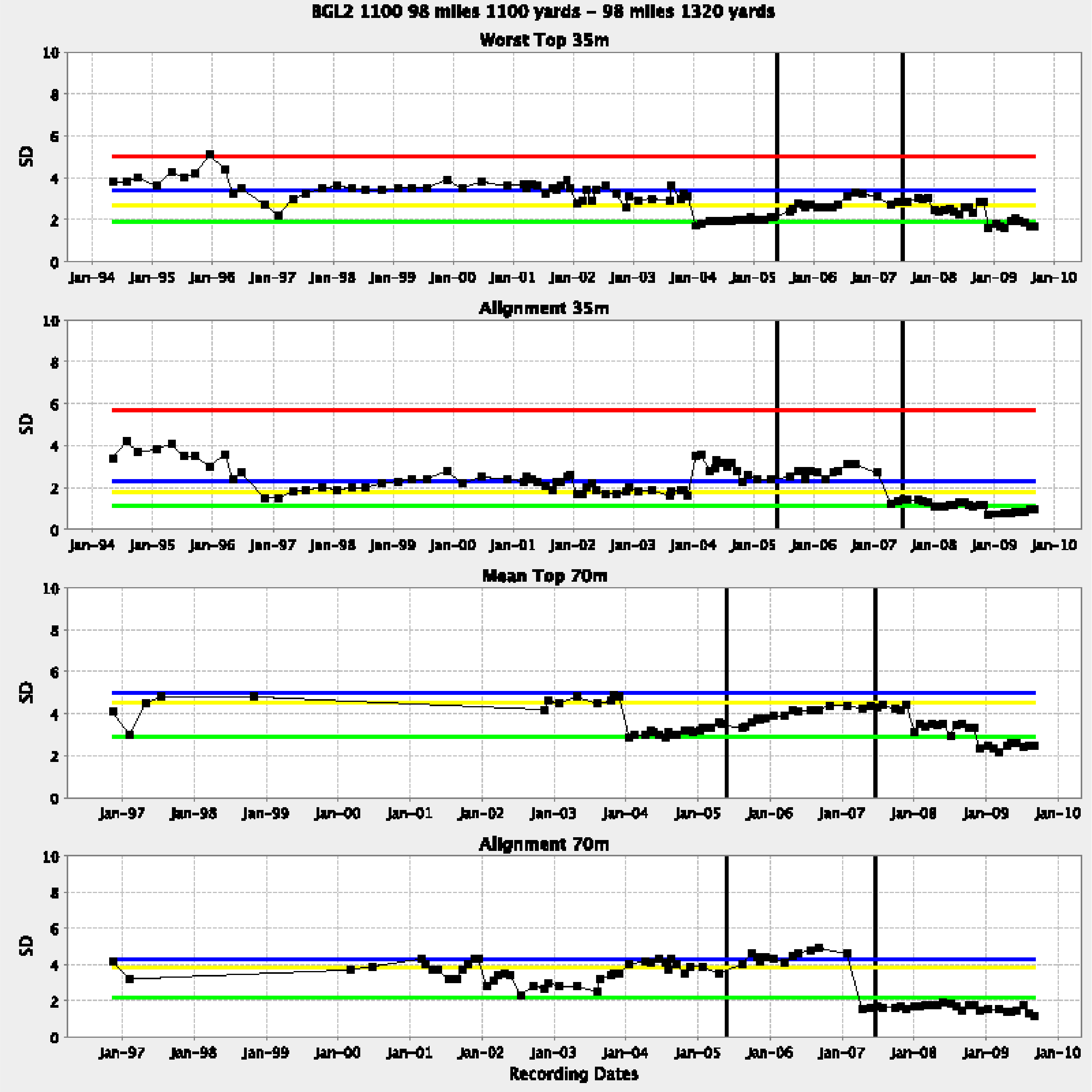
Front offset information every 0.2 m



Track Quality – CCQ Graphs

Relay Jan 2004

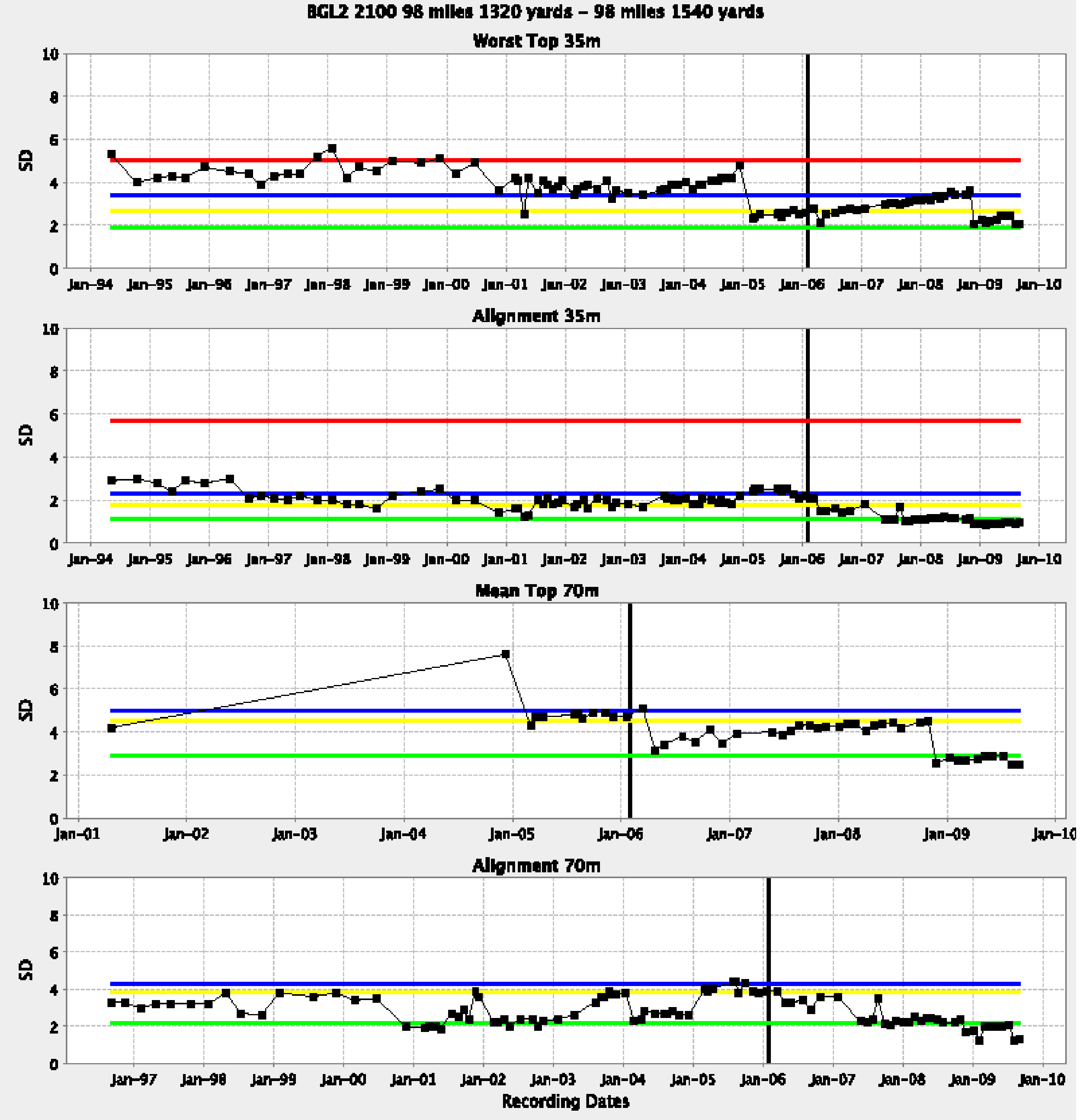
CAL Sept 2009



Track Quality – CCQ Graphs

Relay Jan 2004

CAL Oct 2008

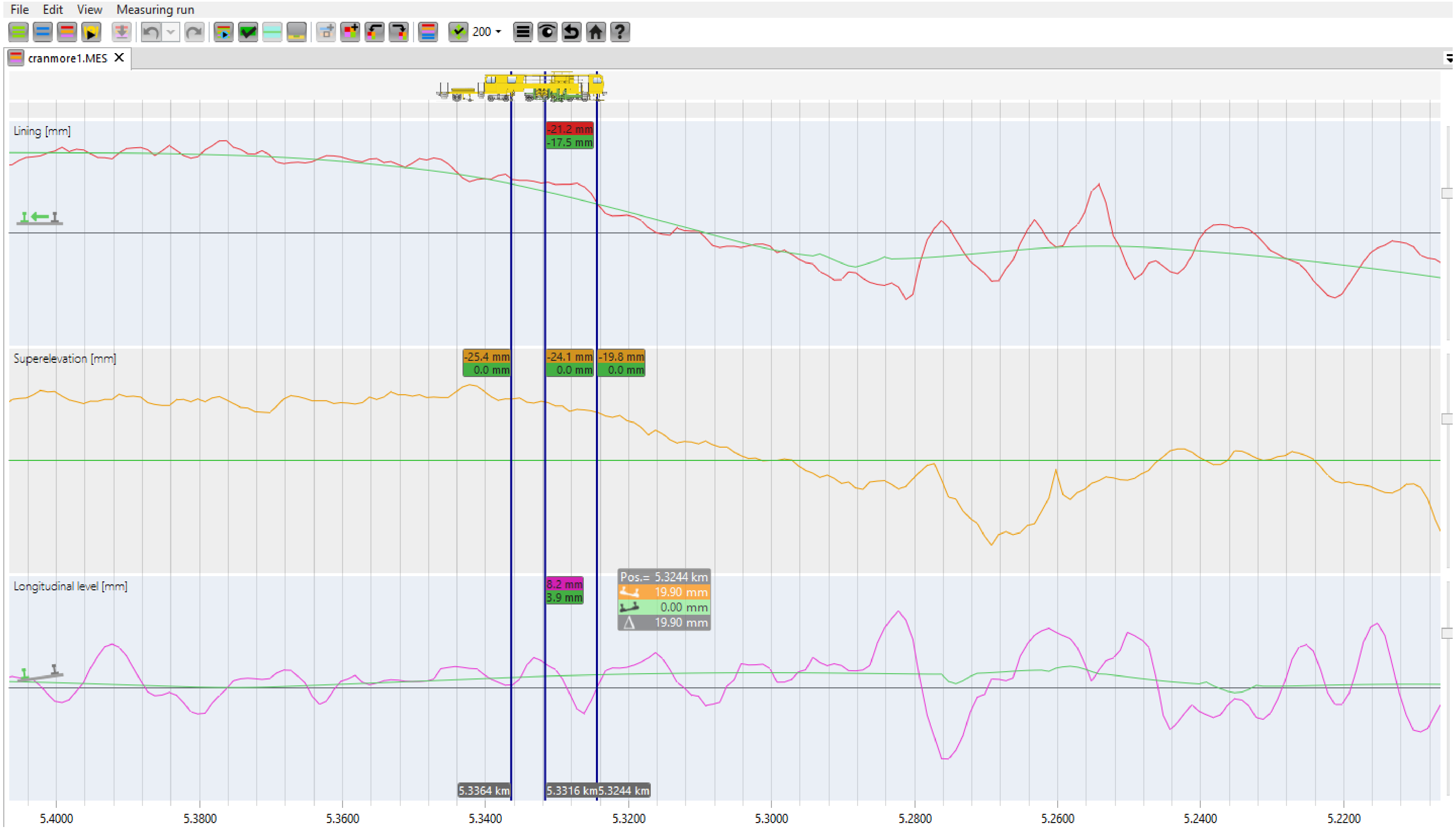


Track Quality – CCQ Graphs

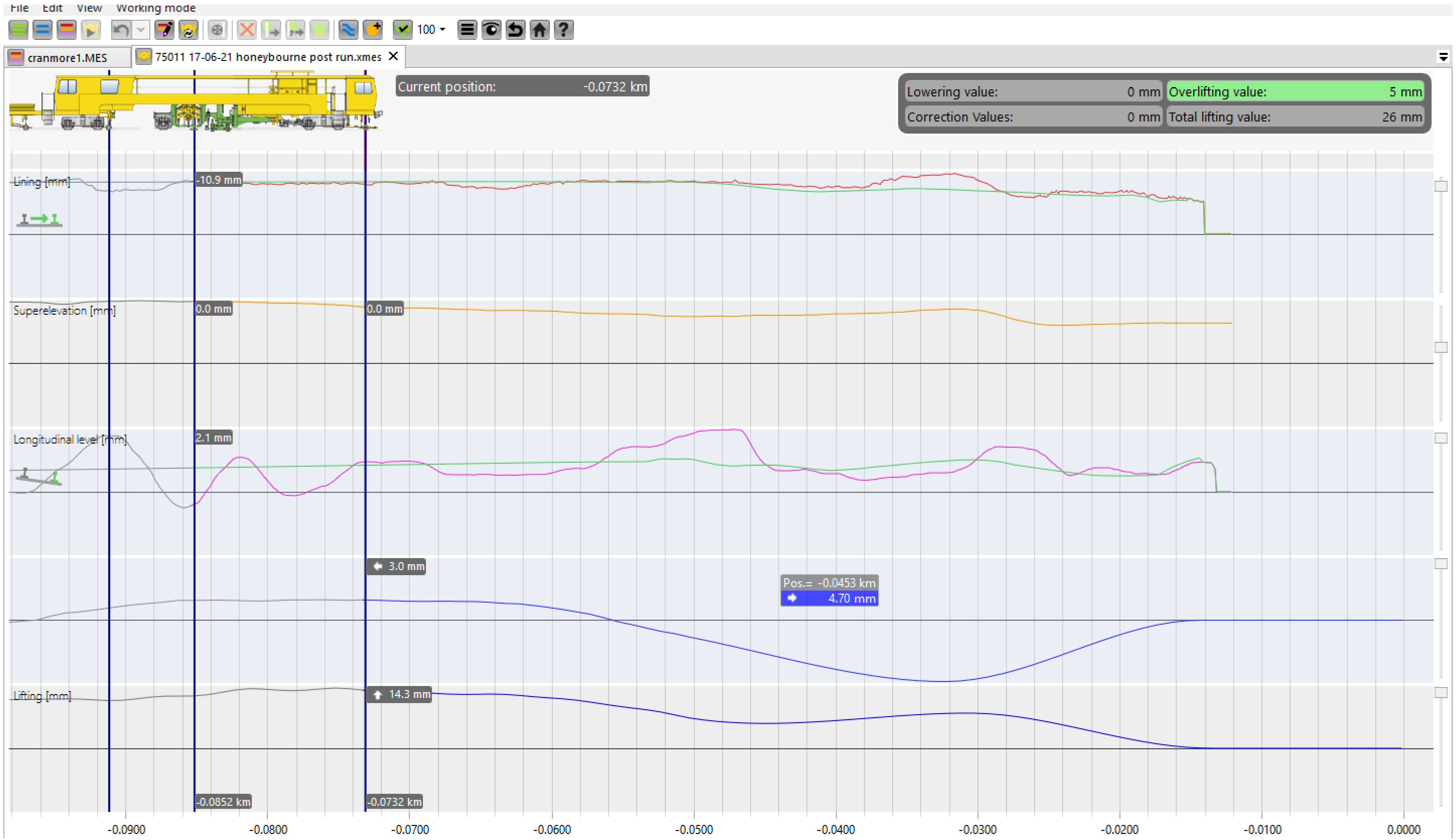
Relay Jan 2004

CAL Feb 2009

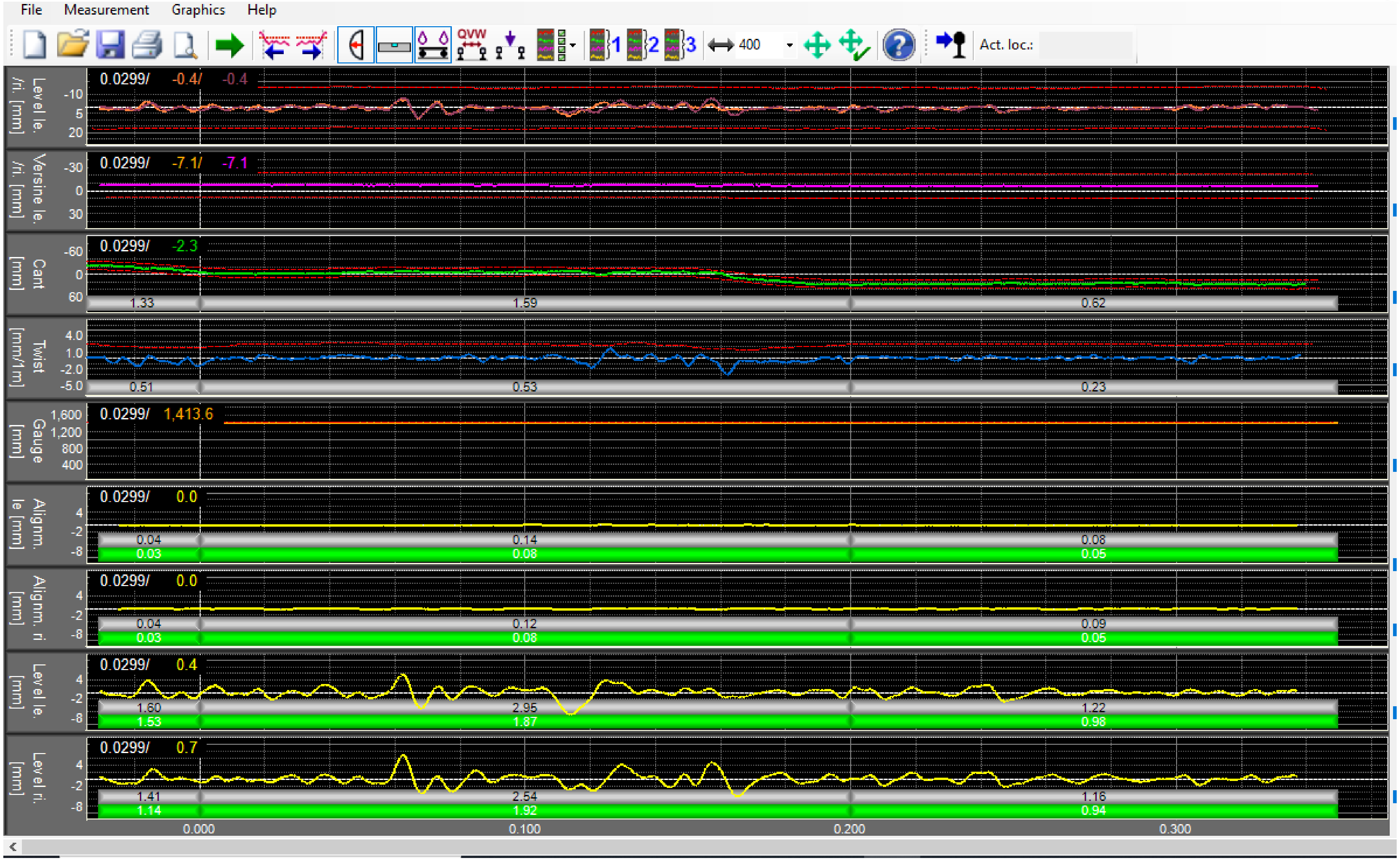
SMART ALC


File
Edit
View
Measuring run
200
cranmore1.MES
Lining [mm]
-21.2 mm
-17.5 mm
Superelevation [mm]
-25.4 mm
0.0 mm
-24.1 mm
0.0 mm
-19.8 mm
0.0 mm
Longitudinal level [mm]
8.2 mm
3.9 mm
Pos.= 5.3244 km
19.90 mm
0.00 mm
19.90 mm
5.3364 km
5.3316 km
5.3244 km
5.4000
5.3800
5.3600
5.3400
5.3200
5.3000
5.2800
5.2600
5.2400
5.2200

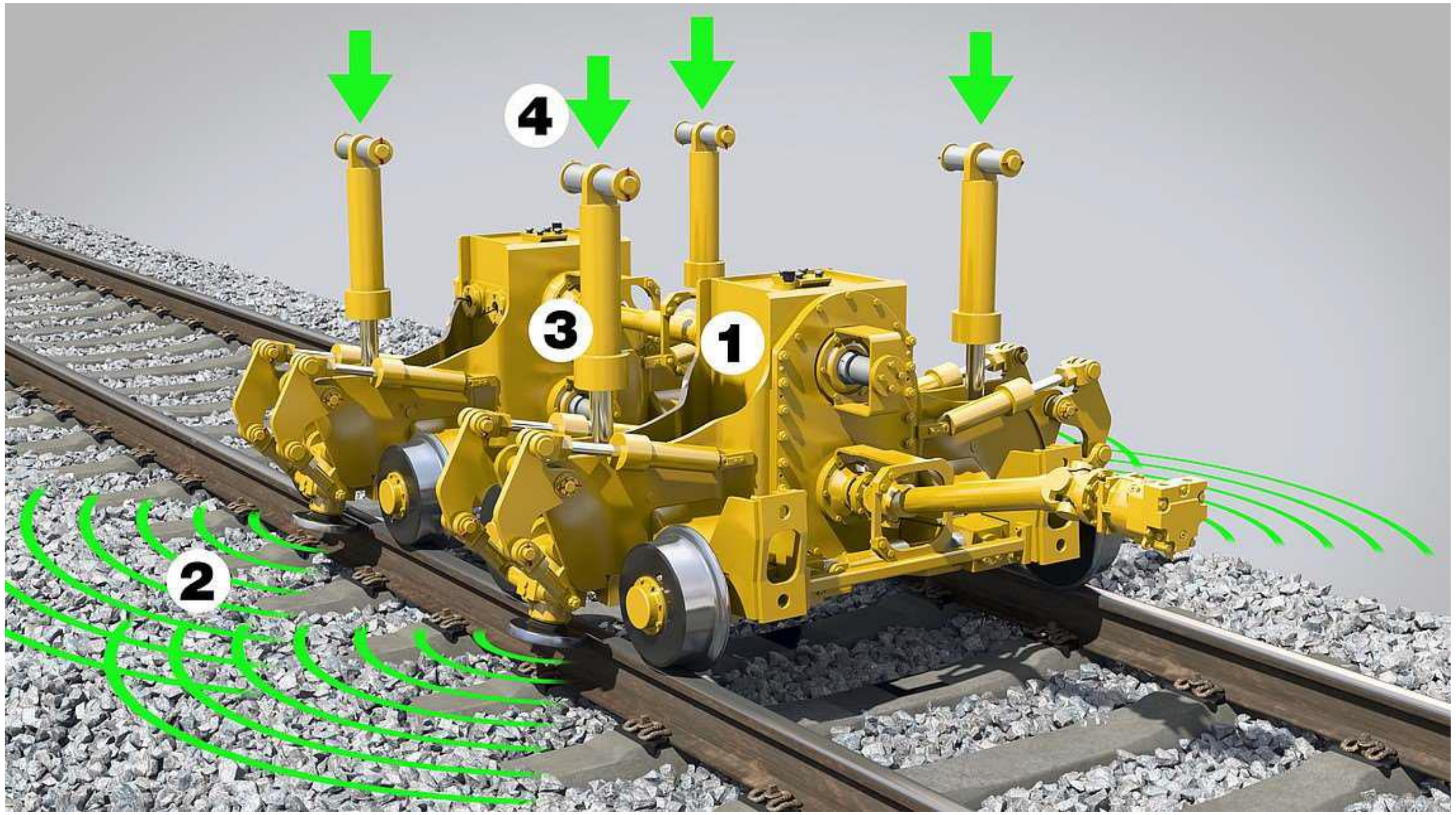
SMART ALC


File Edit View Working mode
100
cranmore1.MES
75011 17-06-21 honeybourne post run.xmes
Current position: -0.0732 km
Lowering value: 0 mm
Overlifting value: 5 mm
Correction Values: 0 mm
Total lifting value: 26 mm
Lining [mm]
-10.9 mm
Superelevation [mm]
0.0 mm
0.0 mm
Longitudinal level [mm]
2.1 mm
3.0 mm
Pos.= -0.0453 km
4.70 mm
Lifting [mm]
14.3 mm
-0.0852 km
-0.0732 km
-0.0900
-0.0800
-0.0700
-0.0600
-0.0500
-0.0400
-0.0300
-0.0200
-0.0100
0.0000

DRP – DATA RECORDING PROCESSOR



DYNAMIC TRACK STABILISATION



- Artificially induced Track Settlement via Horizontal Vibration

- Fully Flexible – Vibration Force and Vertical load can be precisely controlled

DYNAMIC TRACK STABILISATION

- Homogenic settlement of ballast layers
- Higher Resistance to Track Buckling
- Higher CRTs – 5 Deg Celsius (NR/L2/TRK/001 Mod 14)
- Controlled, rapid settlement significantly reducing damage to ballast
- Increased longevity of Track Quality
- Reduced maintenance intervals (up to 30%)
- Lower exposure of staff to unplanned work when reacting to faults
- Higher Handback speeds; reduced need for speed restrictions
- Great control over Track Position / As Builts