

SENCEIVE

HAREKET İZLEME SİSTEMİ



GENEL BAKIŞ

Farklı boyutlardaki yer altı ve yerüstü yapıların kablosuz olarak profesyonelce izlenmesini sağlar

- Güvenli
 - Düşük/bakım gerektirmez
 - Emniyetli
 - Uzun Kullanım(15 yıla kadar)
 - Kolay kurulum
 - Güç/ Kablosuz iletişim
- Hassas ve stabil data
- Uygun maliyetli.....



- Deformasyon
- Gerilme
- Yük
- Piezometrik basınç
- Su seviyesi
- Eğim
- Toprak basıncı
- Zemin nemi içeriği
- Çökme/Kabarma
- Kayma/Hareket
- Salınım/Ovalleşme
- Ray takibi
- Ray sıcaklığı
- Daralma/Açılma



Farklı alanlarda, farklı yapılarda izleme yapılabilir....

Tüneller



Toprak Kayması



Demiryolları



Köprüler



Yapılar



Barajlar



Destekler



Şehirler



Madenler



Binalar



Pratik ve Kolay Kurulum

- *Birkaç dakika içinde takılıp-sökülebilme*
- *Güvenli ve sağlam*
 - IP67



Kablosuz Elektrik – Güneş Paneli



Kablo karmaşasına SON...

- *Kablolardan kurtulun....*

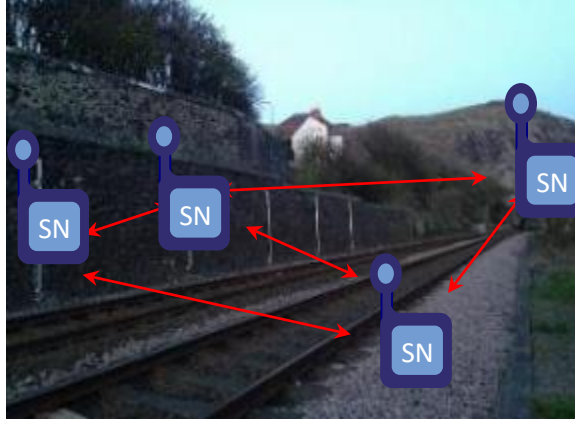
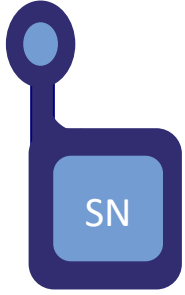


v.b.

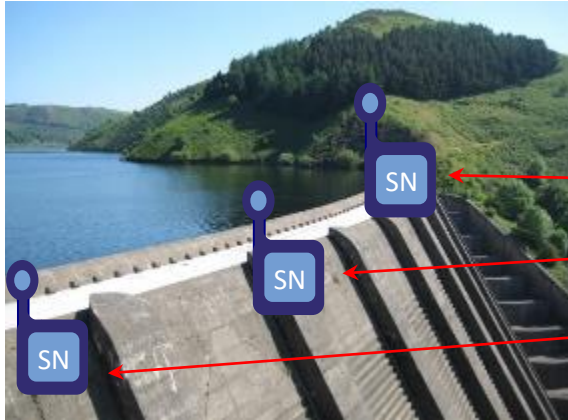


... artı kanıtlanmış, pratik ve olağanüstü uzun ömürlü...

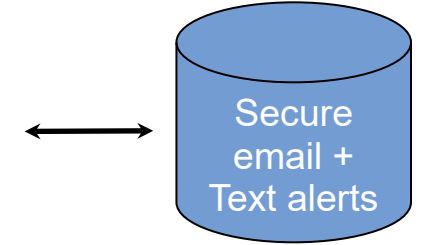
Kablosuz Ağ



Mesh



GeoWan



Uzaktan Web Erişim
(Senceive yada Müşteri Yazılımı)

Kablosuz Sensor Nodes
(uzun mesafe sensör iletişimi-
Dijital/analog
gömülü/harici node)

Gateways
(Solar GSM/USB+)

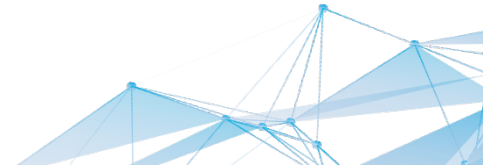
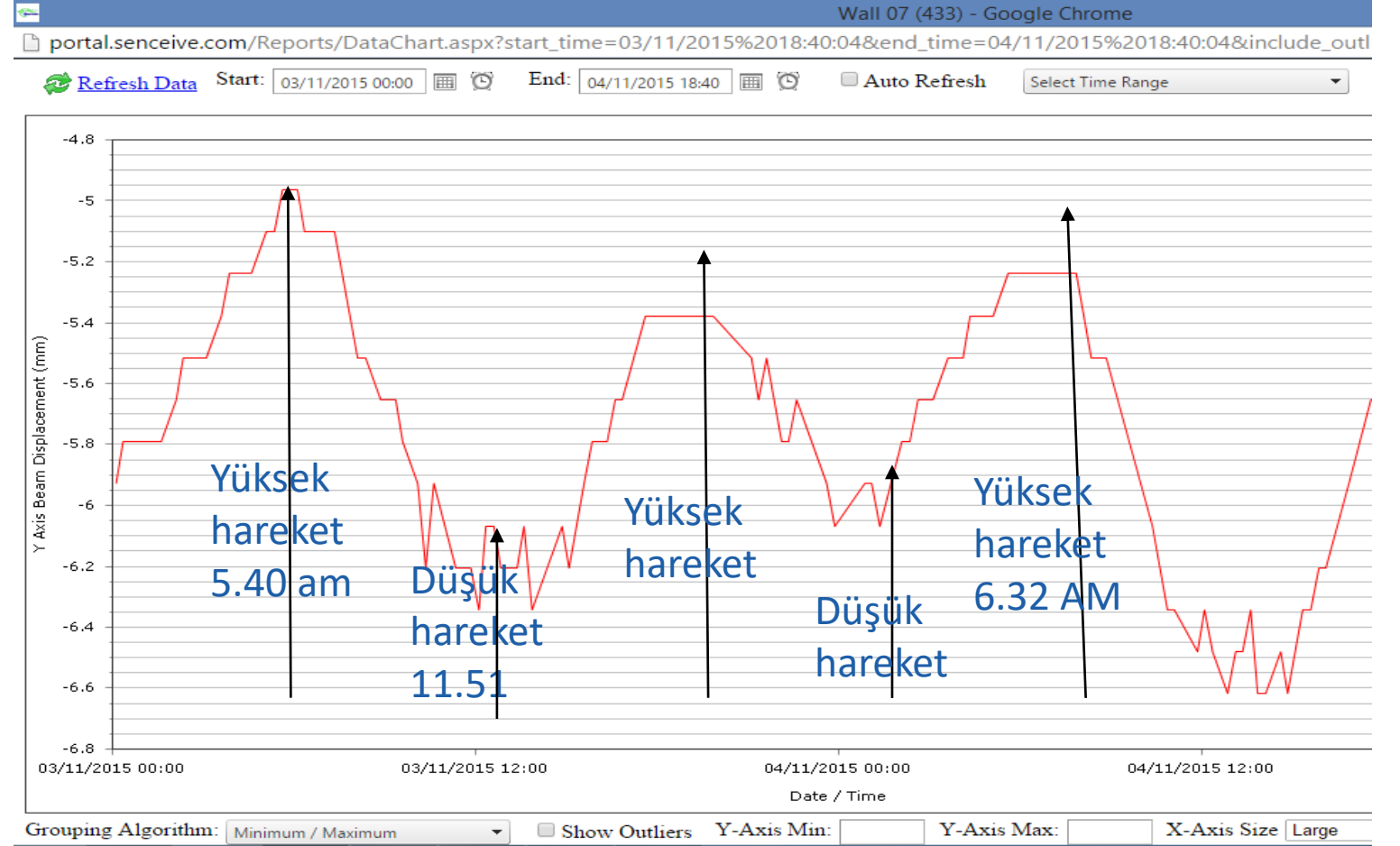


Hassas + Stabil Data

...ama her yapı farklı şekilde
"yaşayacak ve nefes alacak"

.....ortadan kaldırabilir / minimize
edebilir

spikes/false alerts only if requested



Farklı ve üstün çözümler...

GeoWAN



Diğerleri



ODS Optik Mesafe Sensorü



Gömülü kablosuz sensörler



Sensör tetiklemeli özel kamera sistemi



...son teknoloji....

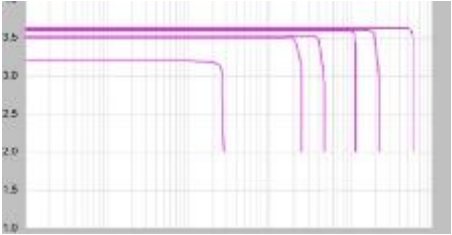


....müşteri odaklı çözüm.....

Akıllı tetikleme sistemi



10-15 yıl batarya
ömürü-hızlı
raporlama



Düşük güç tüketimi-
Nano /Nano +



Otomatik arıza güvenli
yedekleme gateways



Kapsamlı analog ve dijital sensörler

- 1/4/8/12 çoklu kanal



.... ve yeni sensör tipleriyle arayüz oluşturma...



Ürün Ailesi



Optical Displacement Sensor Node



Millivolt Sensor Node



PT100 RTD Sensor Node



Vibrating Wire Sensor Node



Nano Tri-axial Tilt Sensor Node



3G Gateway



FlatMesh Tilt Beam



Triaxial Tilt Sensor Node



Crack Sensor Node



USB Gateway (Monitoring Hub)



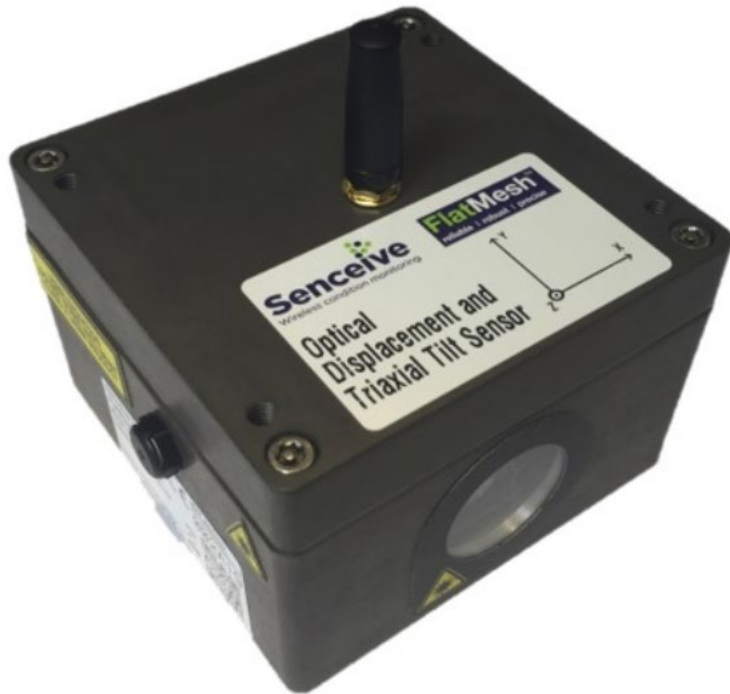
FlatMesh Camera



WebMonitor



Optik Mesafe Sensörü



Optical Sensor Specifications

Parameter	Value
Resolution	0.1mm
Repeatability	±0.15mm
Range	50 metres (natural surface) 100 metres (white target) 150 metres (reflecting target)
Laser Type	Class 2, 655nm (visible red)

Tilt Sensor Specifications (-IX Version)

Parameter	Value
Resolution	0.0001° (0.00175mm/m)
Repeatability	±0.0005° (±0.0087mm/m)
Range	±90°



Milivolt Sensör



Millivolt Sensor Interface

Parameter	Value
Connector	M12 Female 5-pole A-coded Screw-in Type
Range	$\pm 0.625V$ ($\pm 125mV/V$)
Resolution	74.5nV (14.9nV/V)
Repeatability	$\pm 2.5\mu V$ ($\pm 0.5\mu V/V$)
Stimulus	5.0 \pm 0.1V 150mA max

Internal Battery

Parameter	Value
Battery Type	Lithium Thionyl Chloride
Nominal Voltage	3.6V
Nominal Capacity	19000mAh
Typical Battery Life	12-15 years at 20/30 minute reporting intervals, including when acting as a relay node Assumes a resistive bridge load of 350 Ω *



Sıcaklık Sensörü



RTD Interface

Parameter	Value
Connector	M12 Female 5-pole A-coded Screw-in Type
Accuracy	< 0.1°C
Resolution	< 0.01°C
Temperature Range	< -40°C to >85°C
Stimulus Type	Constant Current

Tilt Sensor (-IX Variant Only)

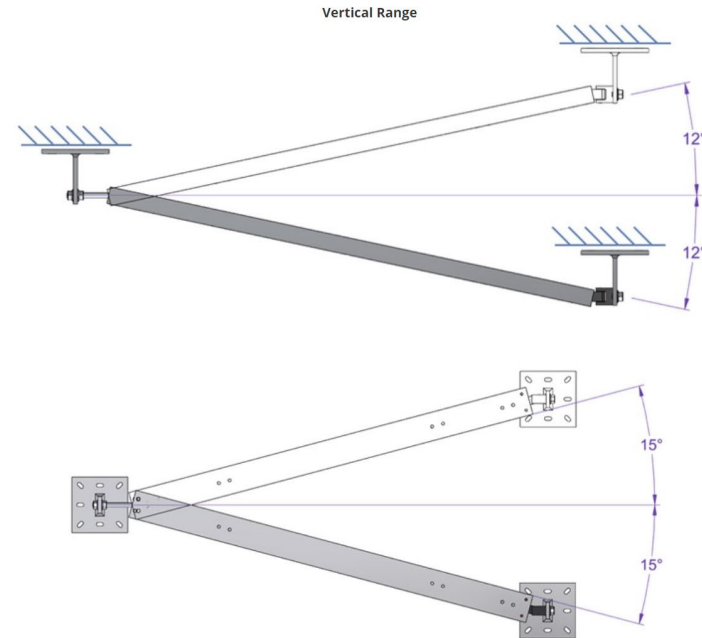
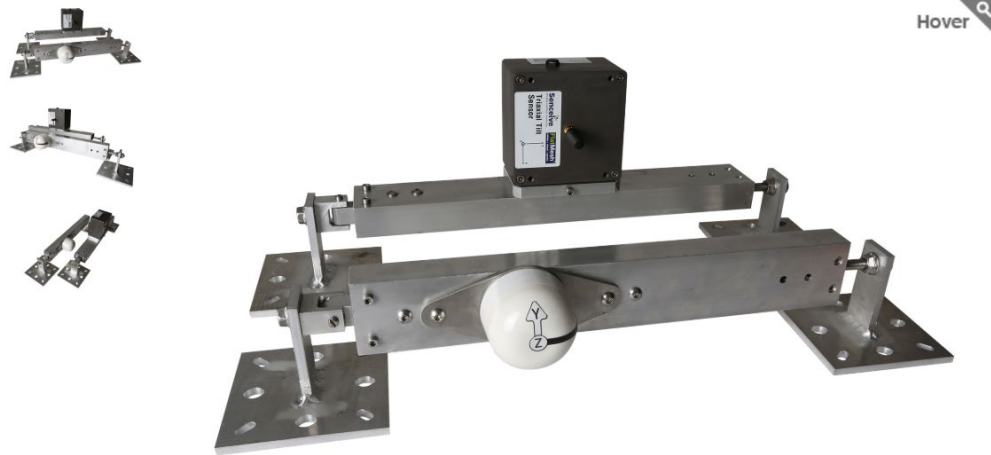
Parameter	Value
Resolution	0.0001° (0.00175mm/m)
Repeatability	±0.0005° (0.0087mm/m)
Range	±90°



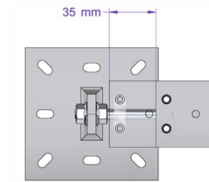
FlatMesh Tilt Beam Sensörü

Physical Specifications

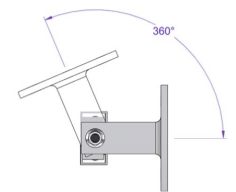
Parameter	Value
Beam Dimensions	500mm, 1000mm, 2000mm, 3000mm (custom lengths available on request)
Support Bracket Dimensions	Base: 100x100mm Height: 75mm
Total Mass (without node)	2kg (approx. for 2m beam)
Material	Aluminium with A2 stainless steel fasteners



Expansion Range



Rotational Range



Ordering

Step 1 - FlatMesh Tilt Beam:

Beam length is specified using the part numbers below. The length refers to the distance between the support bracket centres.

Part No.	Description
FF-BK-500	FlatMesh Tilt Beam 500mm
FF-BK-1000	FlatMesh Tilt Beam 1000mm
FF-BK-2000	FlatMesh Tilt Beam 2000mm
FF-BK-3000	FlatMesh Tilt Beam 3000mm
FF-BK-Cxxxx	Custom Length (xxxxmm) FlatMesh Tilt Beam



3 Eksenli Eğim Sensörü



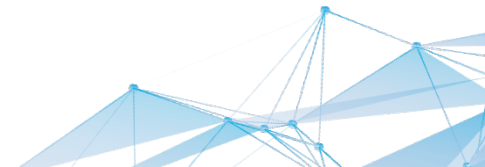
Tilt Sensor Specifications

Parameter	Value
Resolution	0.0001° (0.00175mm/m)
Repeatability	±0.0005° (±0.0087mm/m)

Internal Battery

Parameter	Value
Battery Type	Lithium Thionyl Chloride
Nominal Voltage	3.6V
Nominal Capacity	19000mAh
Typical Battery Life	12-15 years at 20-30 minute reporting intervals, including when acting as a relay node. *

* Consult with Senceive for your application



Çatlakölçer Sensörü



Crack Sensor Interface

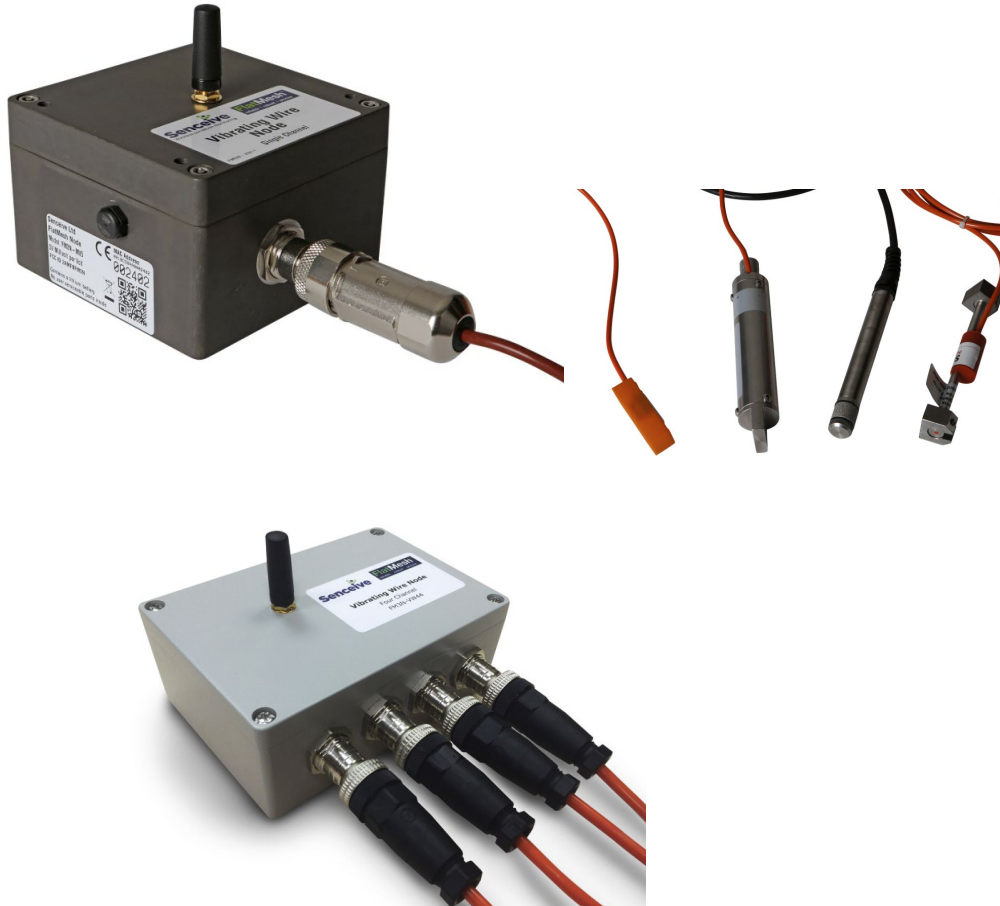
Parameter	Value
Circuit Topology	Voltage divider
Stimulus	2.5V, 100mA max
Resolution	0.0015% of full scale
Noise Level	0.005% of full scale (typical peak to peak)

Internal Battery

Parameter	Value
Battery Type	Lithium Thionyl Chloride
Nominal Voltage	3.6V
Nominal Capacity	19000mAh
Typical Battery Life	12-15 years at 20/30 minute reporting intervals, including when acting as a relay node



Kablolu Titreşim Sensörü



Vibrating Wire Interface

Parameter	FM3N-VW11 / VW17	FM3N-VW41
Connector	M12 Female 5-pole A-coded Screw-in Type	M12 Female 12-pole A-coded Screw-in Type
Frequency Resolution	0.001 Hz	
Frequency Repeatability	±0.02 Hz	
Frequency Range	200-6500Hz	
Stimulus Type	Swept Sine Wave, typ. 6V peak to peak	
Thermistor Type	3kΩ NTC	
Temperature Resolution	0.05	
Temperature Accuracy	±0.1°C	
Temperature Range	-40°C to +85°C	

Internal Battery

Parameter	FM3N-VW11 / VW17	FM3N-VW41
Battery Type	Lithium Thionyl Chloride	
Nominal Voltage	3.6V	
Nominal Capacity	19000mAh	34400mAh
Typical Battery Life	12-15 years at 20/30 minute reporting intervals, including when acting as a relay node*	



Nano 3 Eksenli Eğim Sensörü



Key Benefits

- High performance and sophisticated platform in discrete package
- Tri-axial tilt sensor
- No external aerial and a durable shell (IP68 rated)
- 0.0001° (0.0018mm/m) resolution in 3 axes
- Highly stable and repeatable data ($\pm 0.0005^\circ$ / $\pm 0.009\text{mm/m}$)
- Enhanced noise reduction algorithms
- Explicitly designed for Rail and Construction sectors
- Up to 100 sensors in one network
- Industrial levels of data reliability/throughput – 99.9%
- Wide range of fixings allow for quick installation to any surface
- Easy to use graphical interface
- 1 year battery life for the Nano and 5 years battery life for the Nano+
- Range of up to 100m
- Totally wire and mains power free solar powered GSM data backhaul option
- Robust data backhaul solutions for any under/over ground environment
- Ability to interface with any user/ client monitoring systems
- Event triggering/ Intelligent data processing at node level
- Remotely adjustable sub 1-minute reporting rates
- Custom alerts and triggers
- Remote firmware upgrade capability
- Gateway back-up and auto switchover



3G Gateway



FlatMesh Radio Specifications

Parameter	Value
Communication Type	Proprietary FlatMesh v3 Mesh Networking Protocols IEEE 802.15.4 compliant
Frequency Band	2400 – 2485 MHz ISM Band
Maximum Transmit Power (EN 300 328 v1.8.1)	6.2dBm
Maximum Antenna Gain	4dBi
Range	Up to 300m depending on the environment*
Maximum Network Size	Typically, up to 100 nodes
RF Module	Consult with Senceive to determine the optimal system configuration Senceive FM3Gateway

* Consult with Senceive for your application

Cellular Radio Specifications (Standard)

Parameter	Value
Frequency Bands for GSM/GPRS/EDGE	850 / 900 / 1800 / 1900 MHz
Frequency Bands for UMTS/HSPA+	800 / 850 / 900 / 1900 / 2100 MHz
Output Power	Class 4 (+33dBm) for EGSM850 / EGSM900 Class 1 (+30dBm) for GSM1800 / GSM1900 Class E2 (+27dBm) for GSM 850/900 8-PSK Class E2 (+26dBm) for GSM 1800/1900 8-PSK Class 3 (+24dBm) for UMTS 800/850/900/1900/2100,WCDMA FDD Bdl, BdII, BdVIII, BdV, BdVI
Maximum Antenna Gain	+3.5dBi
Supported Sim Cards	3V and 1.8V
RF Module	Gemalto PH8-P



USB Gateway



USB Interface

Parameter	Value
Standard	USB 2.0
Connector Type	Standard A Plug
Cable Length	1 metre
Type of Device	Virtual COM Port
Power Requirement	5V, 500mA max

Certifications

- Tested to conformity with all the essential requirements of Radio Equipment Directive 2014/53/EU and RoHS Directive 2011/65/EU
- Network Rail Acceptance PA05/04146
- London Underground Approved



FlatMesh Kamera



Physical Specifications

Parameter	Value
Dimensions excluding pole bracket	336 x 174 x 302 mm
Dimensions including pole bracket	356 x 305 x 302 mm
Total Mass	5.6 kg*
Housing Material	Extruded aluminium with plastic end caps
International Protection Marking	IP66
Mounting Options	Wall mounting bracket included with one-screw rotation and tilt adjustment Pole mounting bracket adaptor also available
Operating Temperature Range	-20°C to +50°C

* Approximate values only

Imaging Specifications

Parameter	Value
Maximum Image Resolution	1600 x 1200 pixels
Shutter Type	Rolling shutter
Scanning	Progressive
Lens Focal Length	6mm for standard configuration
Angle of View	Approximately 35° wide, 25° high (6mm lens)
Compression Format	JPEG

Infrared Illuminator Specifications

Parameter	Value
Power	48W
Wavelength	940nm (invisible to the human eye)
Beam Angle	35° wide, 10° high for standard configuration Other configurations are available
Range	Approximately 60m in standard configuration*



İngiltere de sistemi tercih eden bazı inşaat firmaları.....

ATKINS

VMT

SKANSKA

Lorclon
CIVIL ENGINEERING

MORGAN
SINDALL

VolkerStevin

COSTAIN

amey

AMCO

Balfour Beatty

KIER

ferrovial
agroman

GallifordTry

AECOM

LAING O'ROURKE

bam
nuttall

AMBERG
TECHNOLOGIES

Senceive
Wireless condition monitoring

GeoWAN™ FlatMesh™
long-range | reliable | precise | reliable | robust | precise



...Dünya da sistemi kullanan bazı firmalar...



.....partner firmalar



...ve asla bir müşteriye kaybetmedik



Senceive Saha alıřmaları

Structures
Earthworks
Tunnels
Track Bed



Senceive Case Studies

Structures



Case Study- Linton Bridge

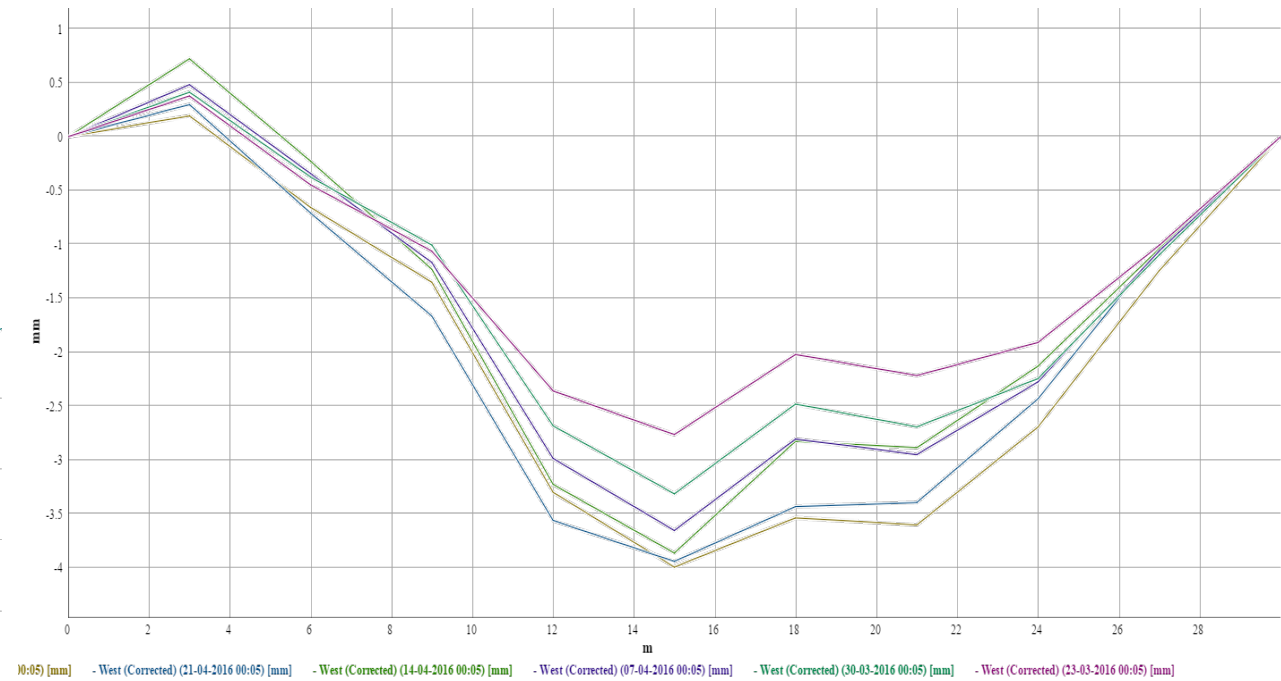
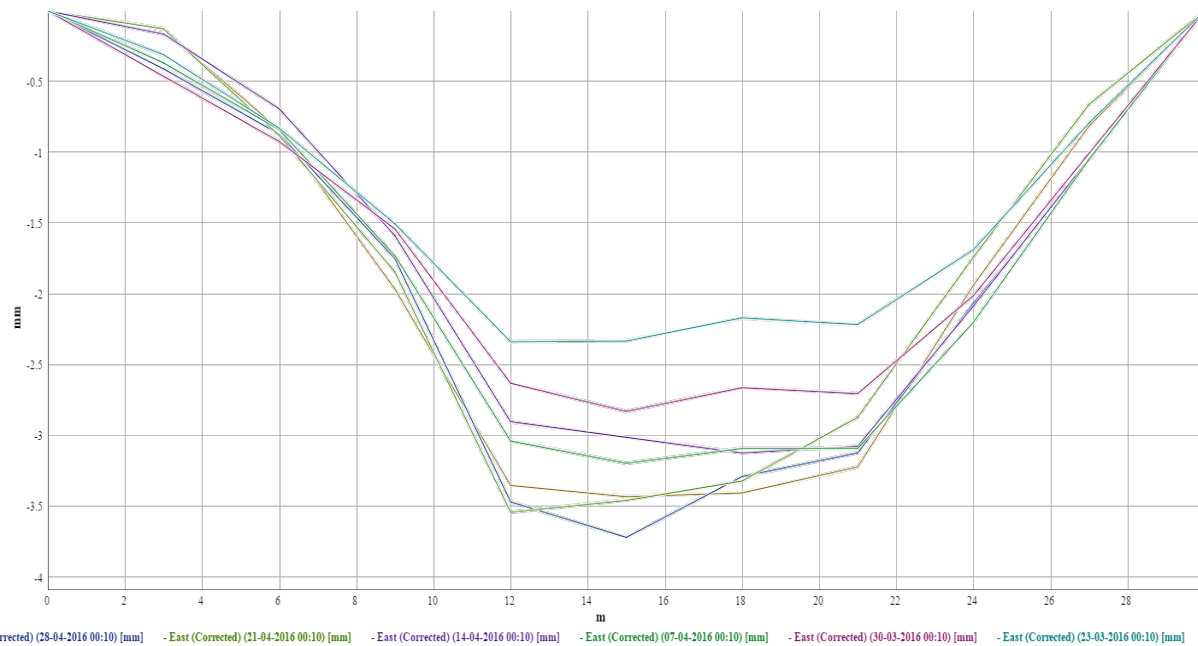
- Bridge closed -200mm of settlement
- River washing away part of arch foundations



Case Study- Linton Bridge

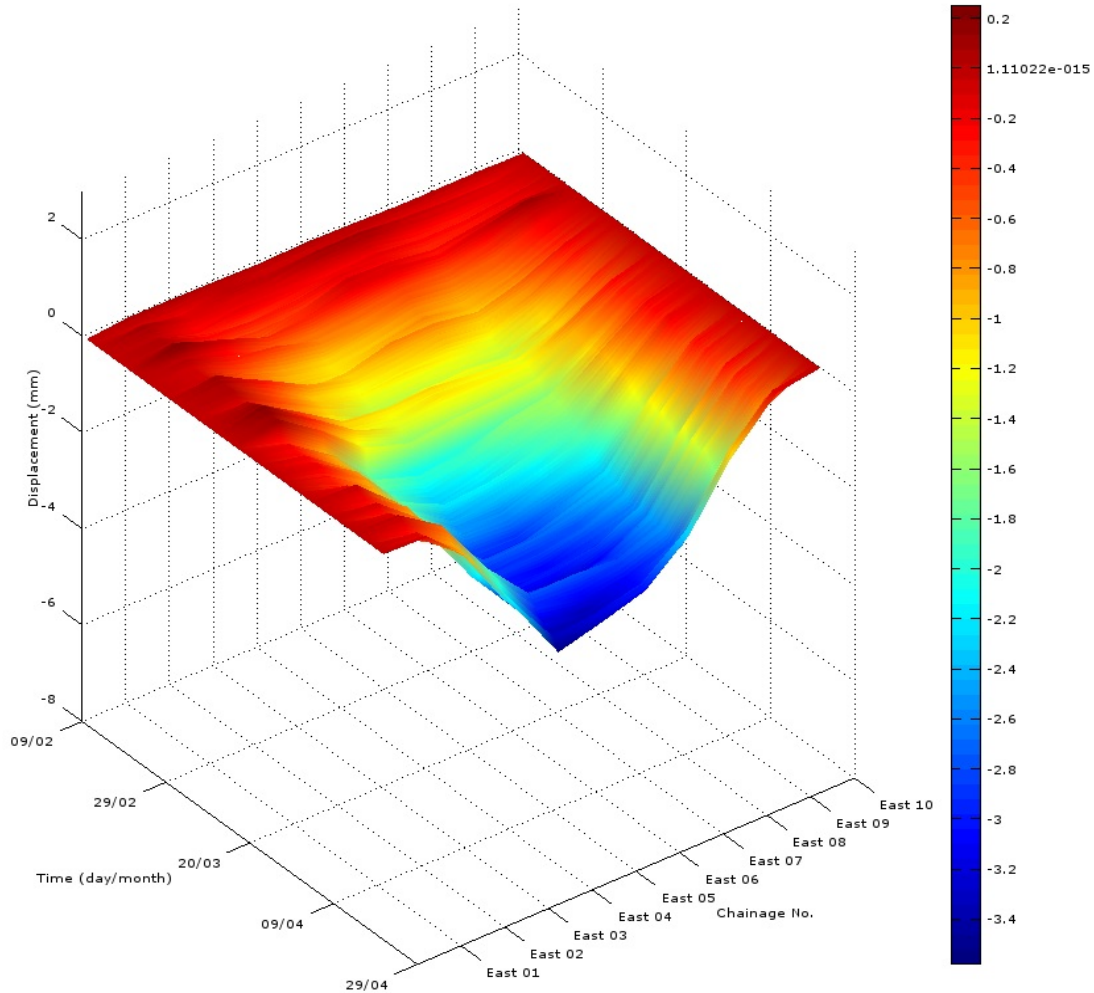


Linton Bridge Settlement

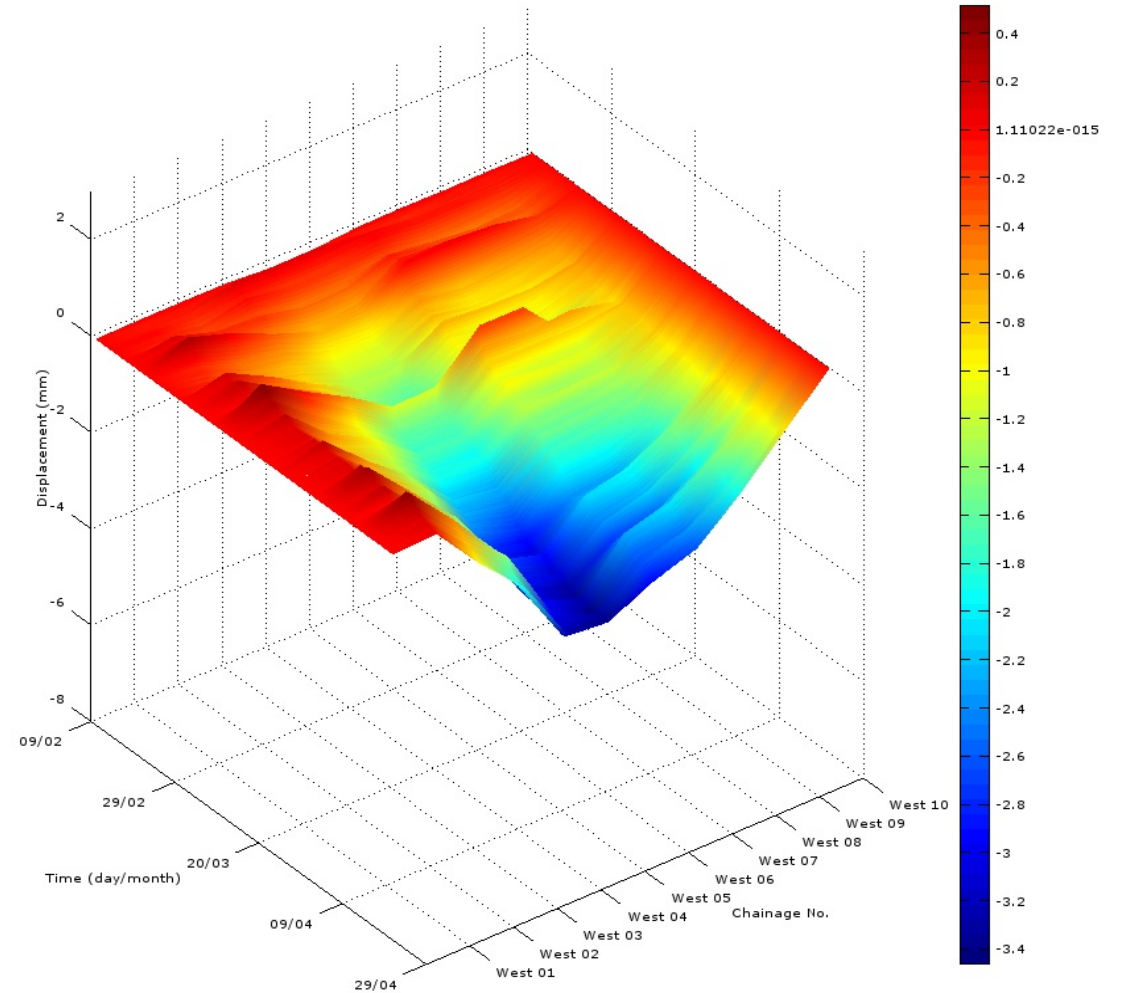


Linton Bridge- Settlement over time

Linton Bridge East (corrected)



Linton Bridge West (corrected)



Case Study – Offshore Turbine

On 1 second reporting to assess if tipping



Case Study – Gantries-West London Line



Case Study – Beams- Bristol Uni



Case Study – Monte Carlo- Piles



Case Study – Oslo - Vibrating Wire

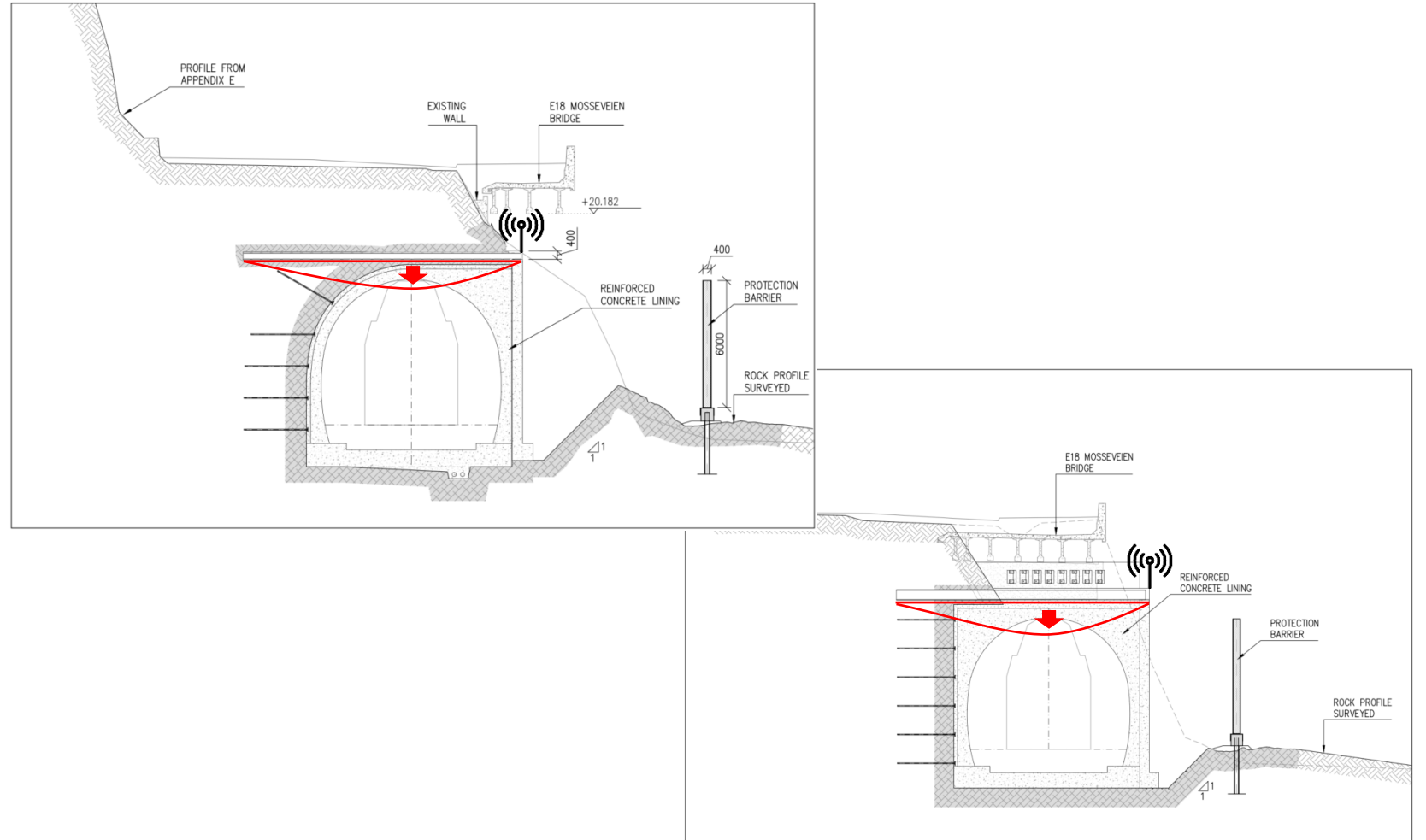


Case Study – Oslo - Vibrating Wire

Oslo – Follo Line

Beam stress monitoring with strain gauges

- Steel Profile Reinforcement (IPE300) and Concrete filling
- Vibrating Wire Strain Gauges installed on the wings of the I-beams
- Magnetic node mounting

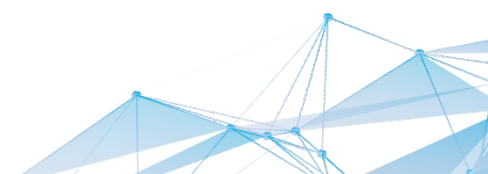
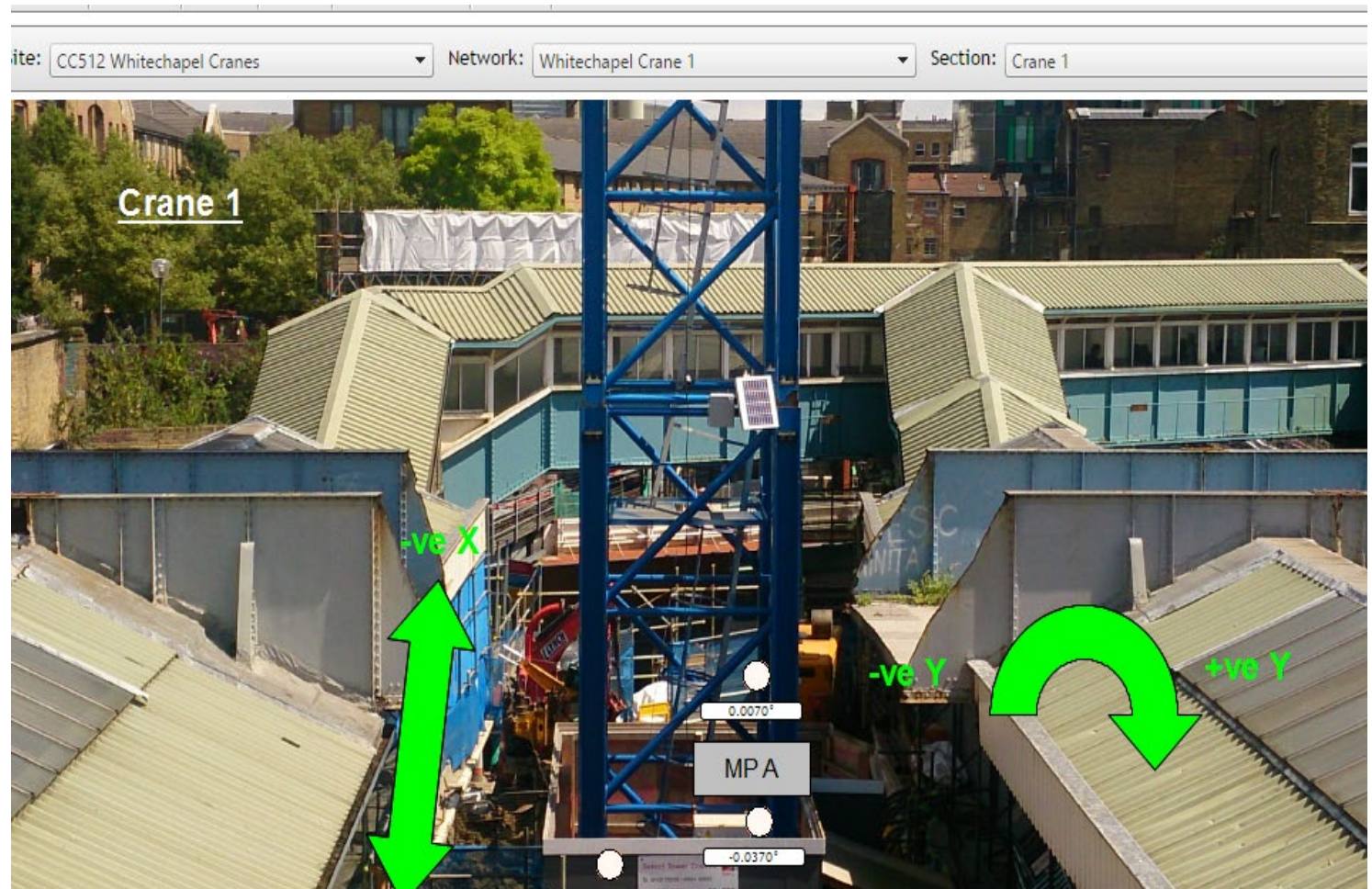


Case Study – BBMV - Whitechapel

Case study: BBMV- Whitechapel

Crane Monitoring

- 4 stable high precision tilt sensors monitoring crane base



Case Study – BBMV - Whitechapel

Case study: BBMV- Whitechapel

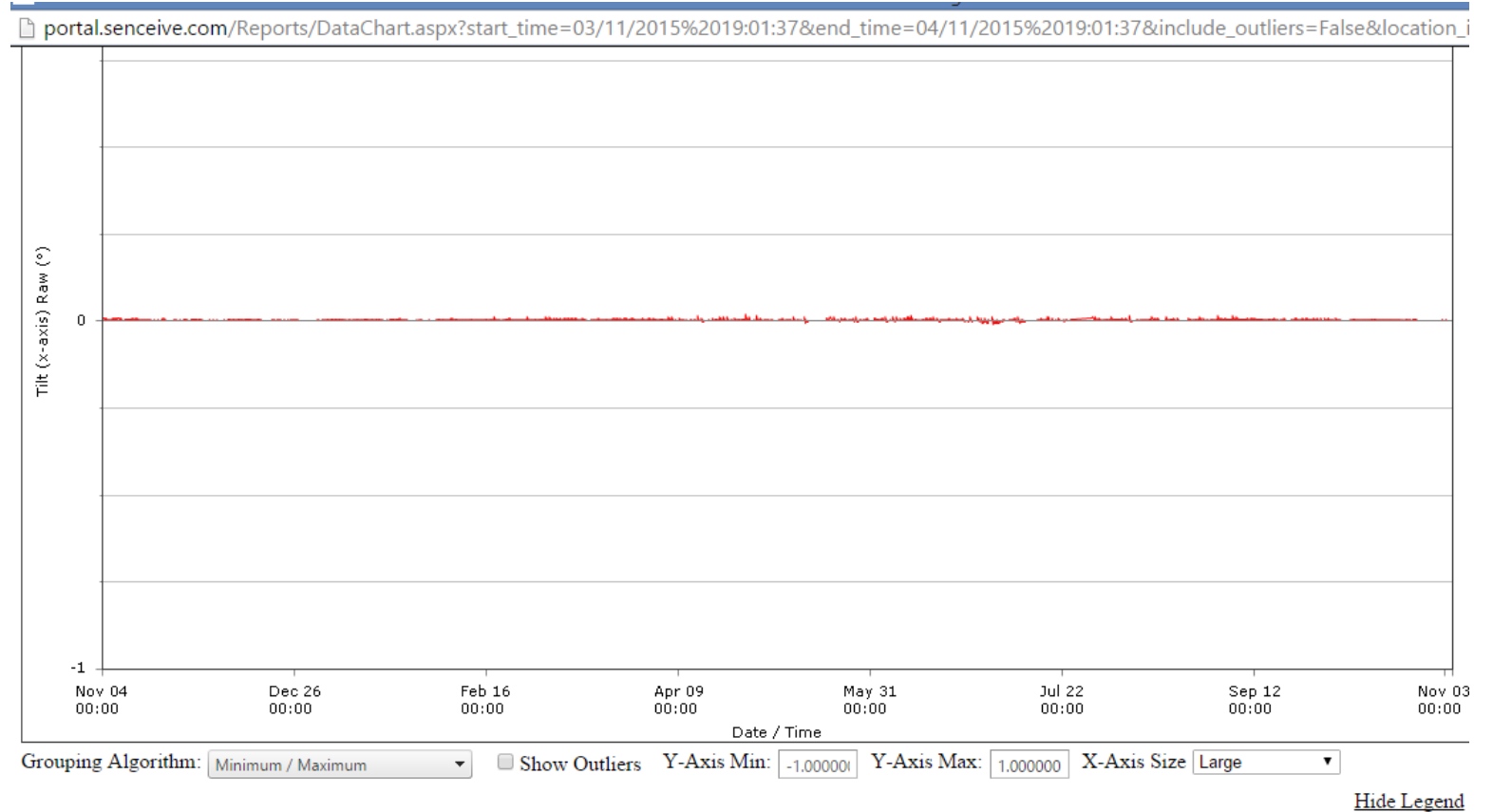
Crane Monitoring

- 4 stable high precision tilt sensors monitoring crane base



Case Study – BBMV - Whitechapel

- Stable data when you expect it to be stable



Legend

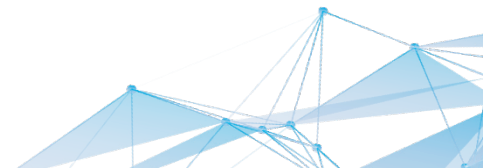
- Crane 2 MP A



Case Study – Bishopsgate-Leica



GNSS with Tilt sensors

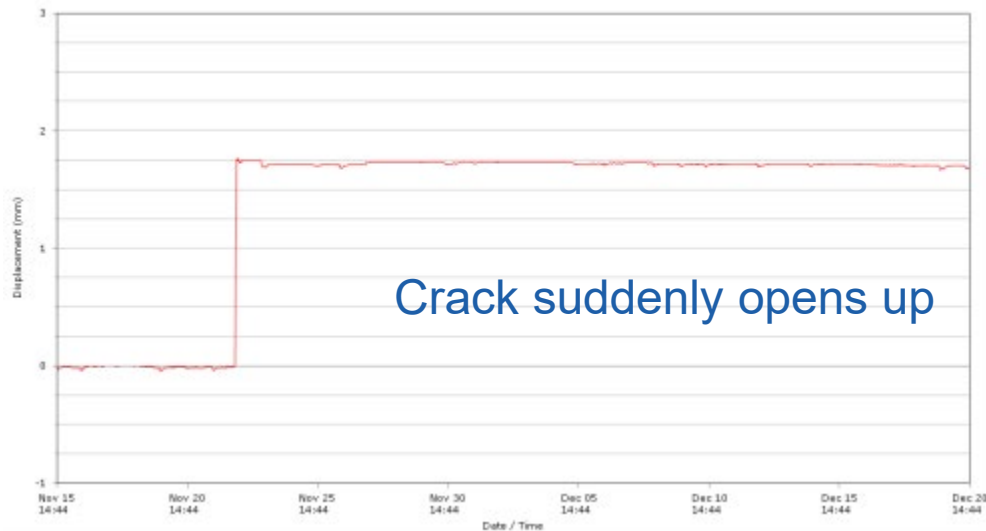


Case Study – Crack sensors and Construction Works

Case study: Construction Works

Viaduct Degradation

- Cracks and tilt on Retaining



Case Study – Network Rail

Case study: Network Rail

Viaduct Degradation



Senceive Case Studies

Earthworks



Case Study – Network Rail

Case study: Network Rail

Railway Embankment Monitoring

- Worried about slippage on embankment with busy rail line above



Case Study – Network Rail

- 40 sensors on stakes and 6 integrated cameras



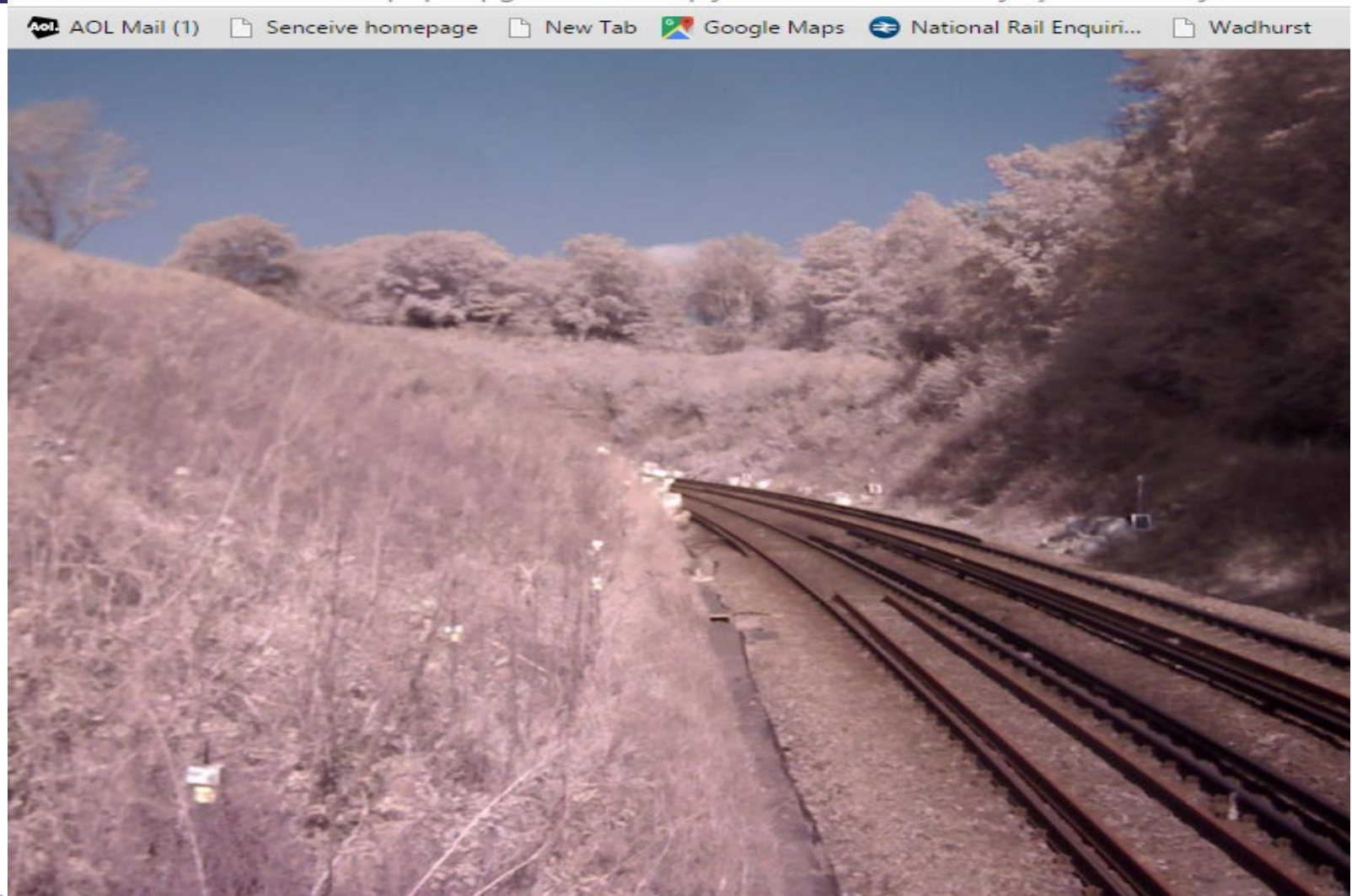
Cameras and solar 3G gateway...no mains power

- Integrated camera and wireless nodes with automatic image triggering



Automatic triggering of cameras...

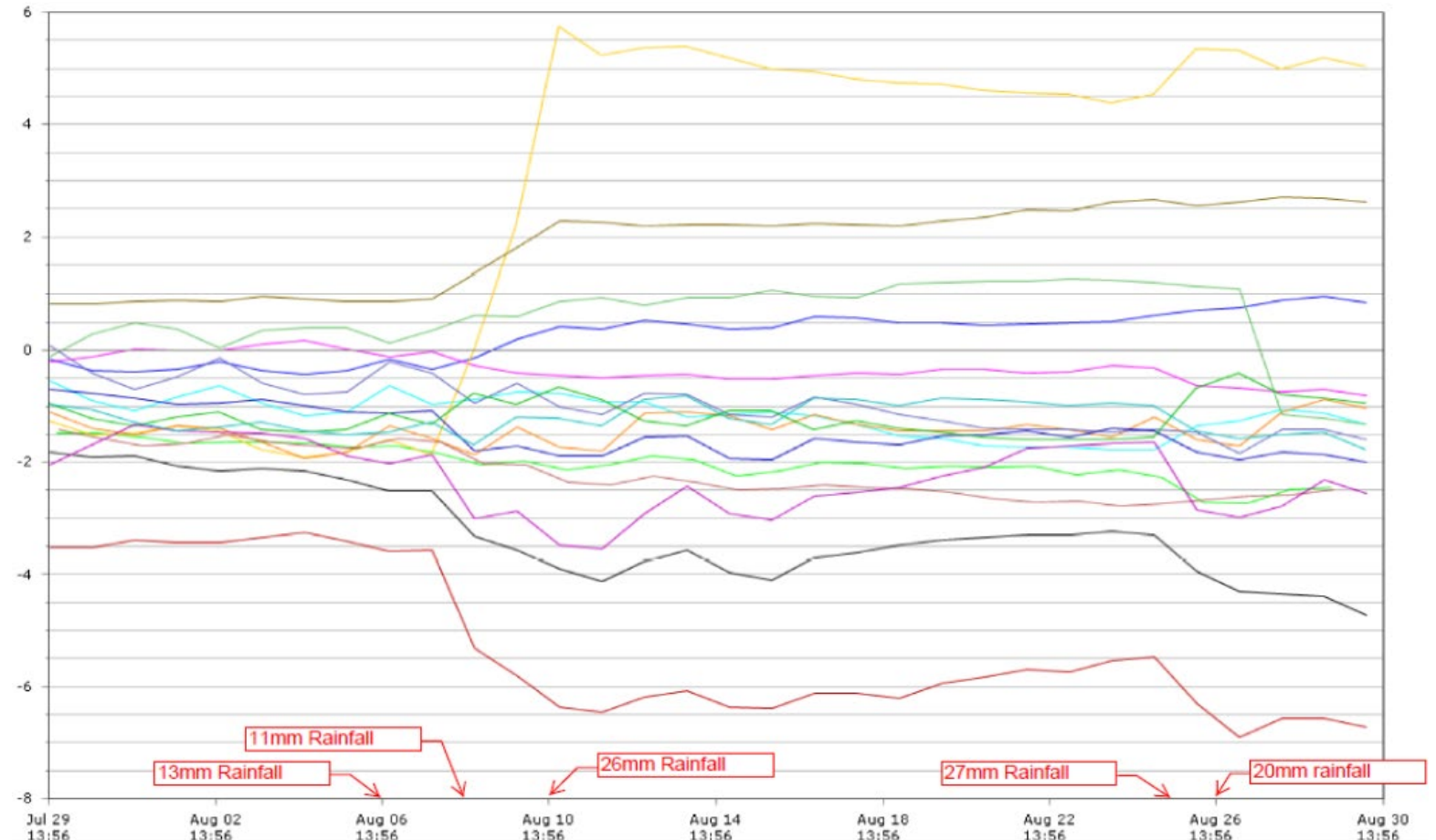
- Multiple camera images and overcame significant challenges with GSM signalonly 1 bar...



Movement unsurprisingly with rainfall....

Case study: Embankment

*Earthworks on
stakes....rain movement*



Case Study – New Zealand Rock fall

Case study: Rockfall protection



Senceive Case Studies

Tunnels



Case Study – Beams- BT Tunnel and Goodmayes



Case Study – Beams- Vauxhall

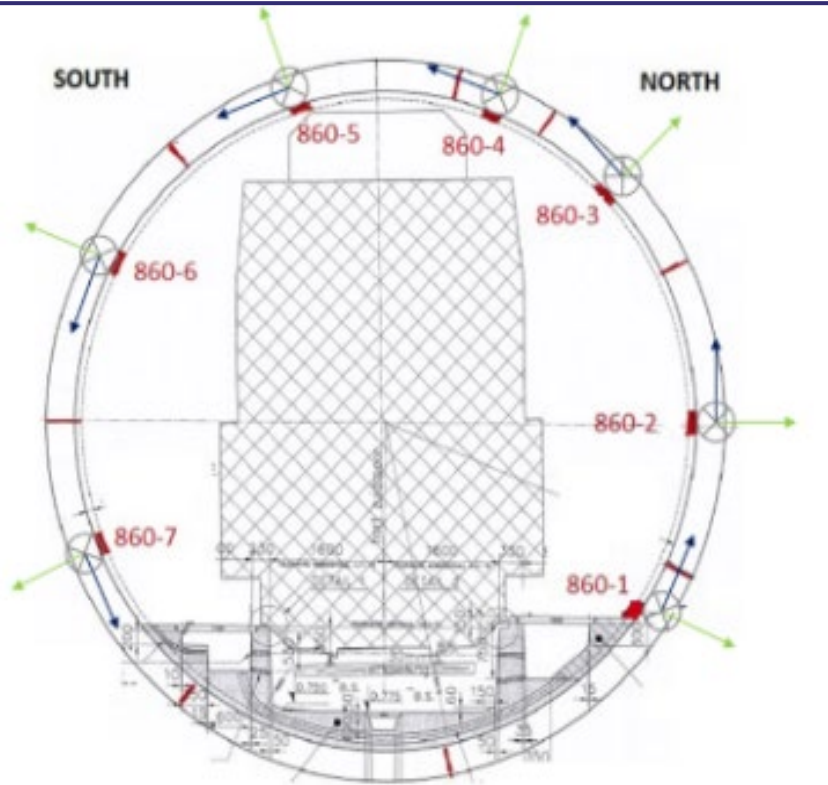


Case Study – Rotterdam –Botlek Tunnel

Case study: 2km tunnel

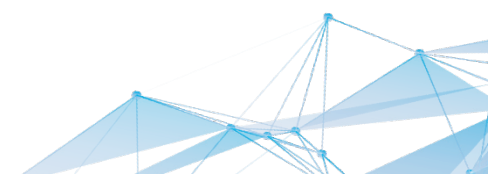
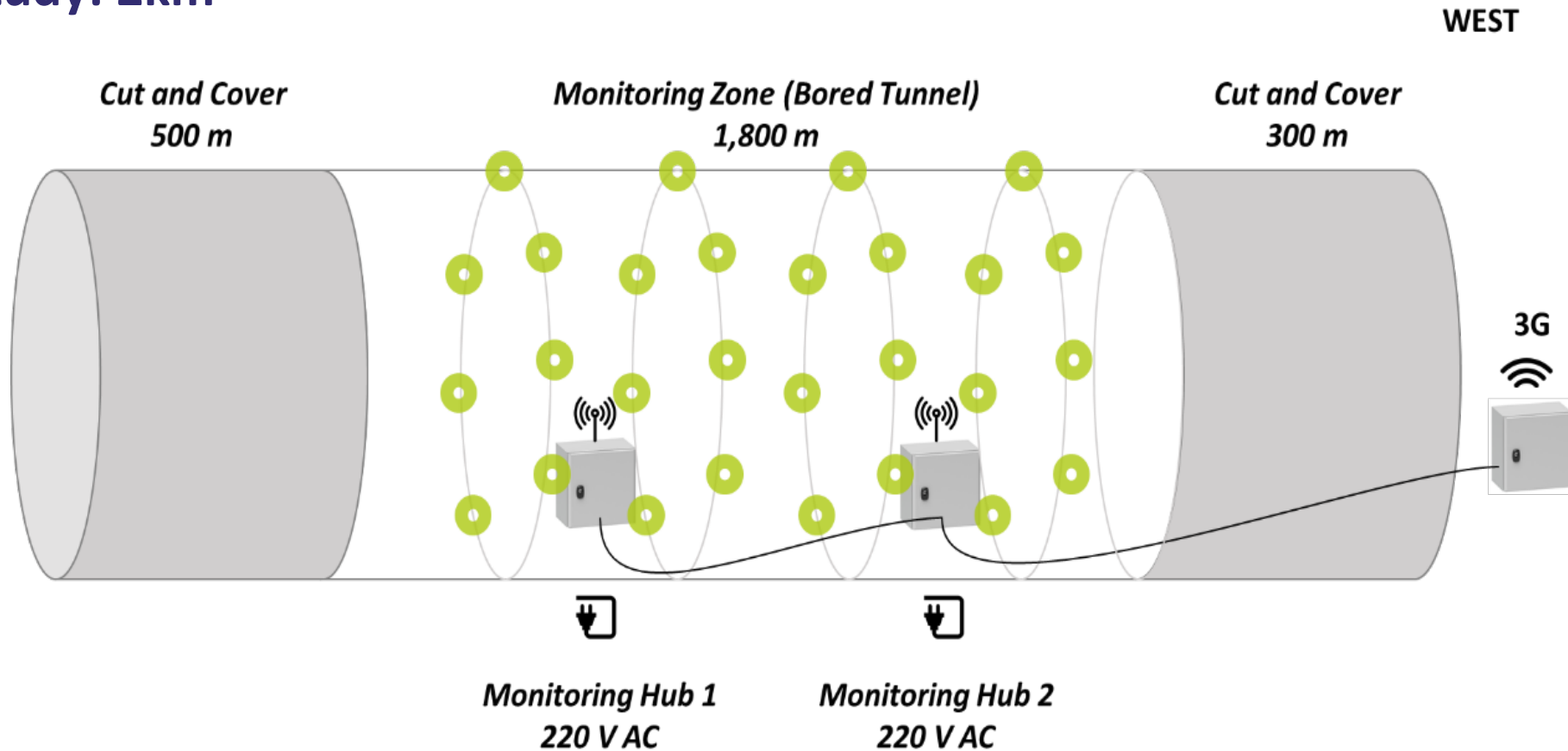
Expected movement 3mm max

c.430 nodes



Case Study – Rotterdam – Botlek Tunnel

Case study: 2km tunnel



Case Study – NLE - Vibrating Wire

London – Northern Line Extension

Prop stress monitoring with strain gauges

- Vibrating Wire Strain Gauges installed on the wings of the I-beams
- Magnetic node mounting
- USB Gateway with manual data upload inside the tunnel



Case Study – NLE – Embedding sensors

London – Northern Line Extension



Case Study – NLE – Embedding sensors



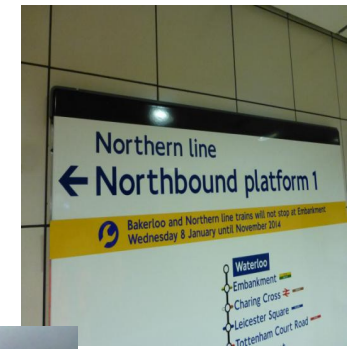
Case study: Shell Centre - London Underground



Site commercial redevelopment – Demolition and rebuild



Senceive system around tunnel and on track

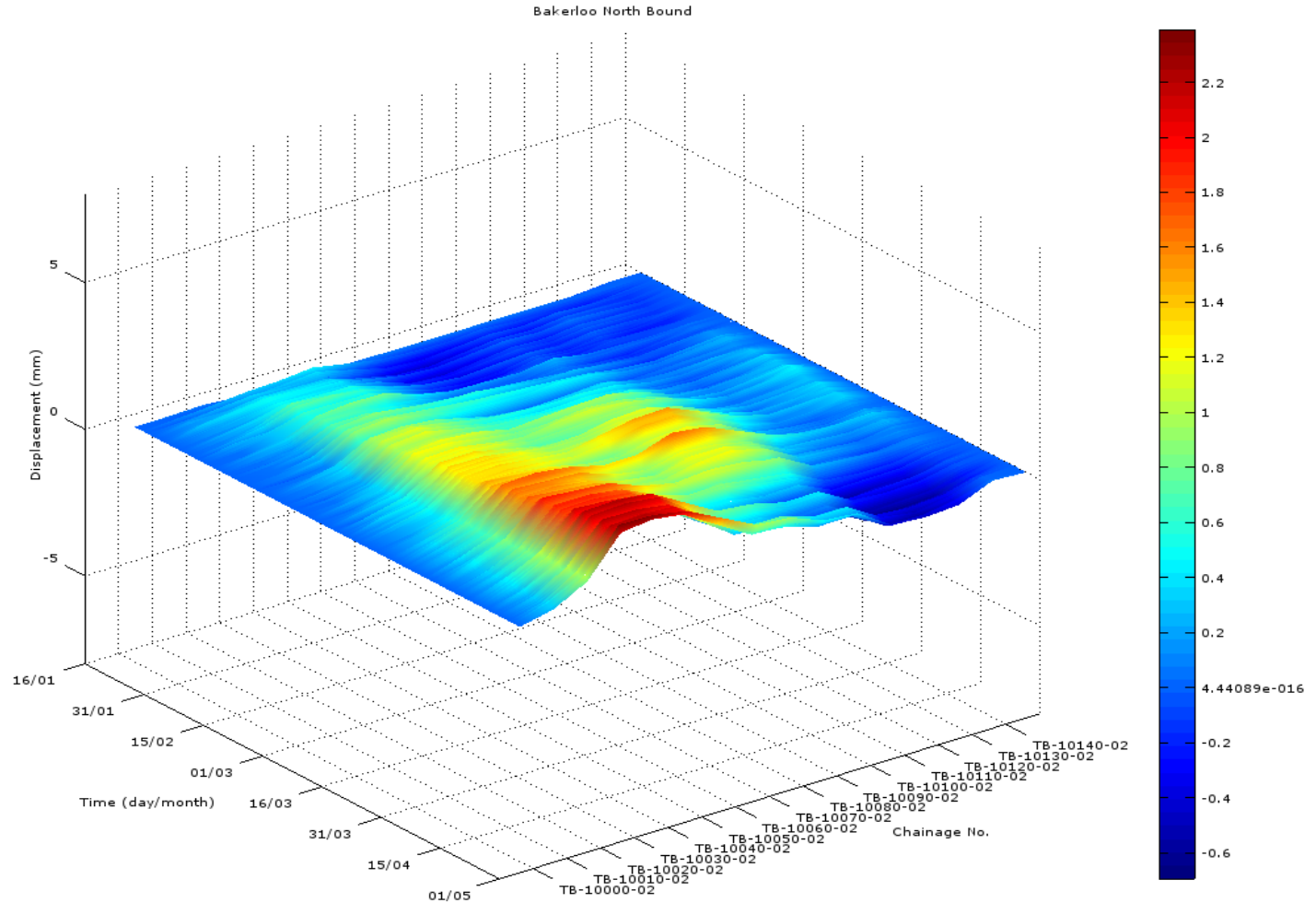


- 400 sensors monitoring deformation, convergence and longitudinal movement on LUL assets
- 4 LU tunnels on lining and on track-bed @ 10m centres



Shell Centre- Longitudinal movement over time

- Able to see 2mm of heave during early phase demolition
- Exact correlation with manual/precision levelling



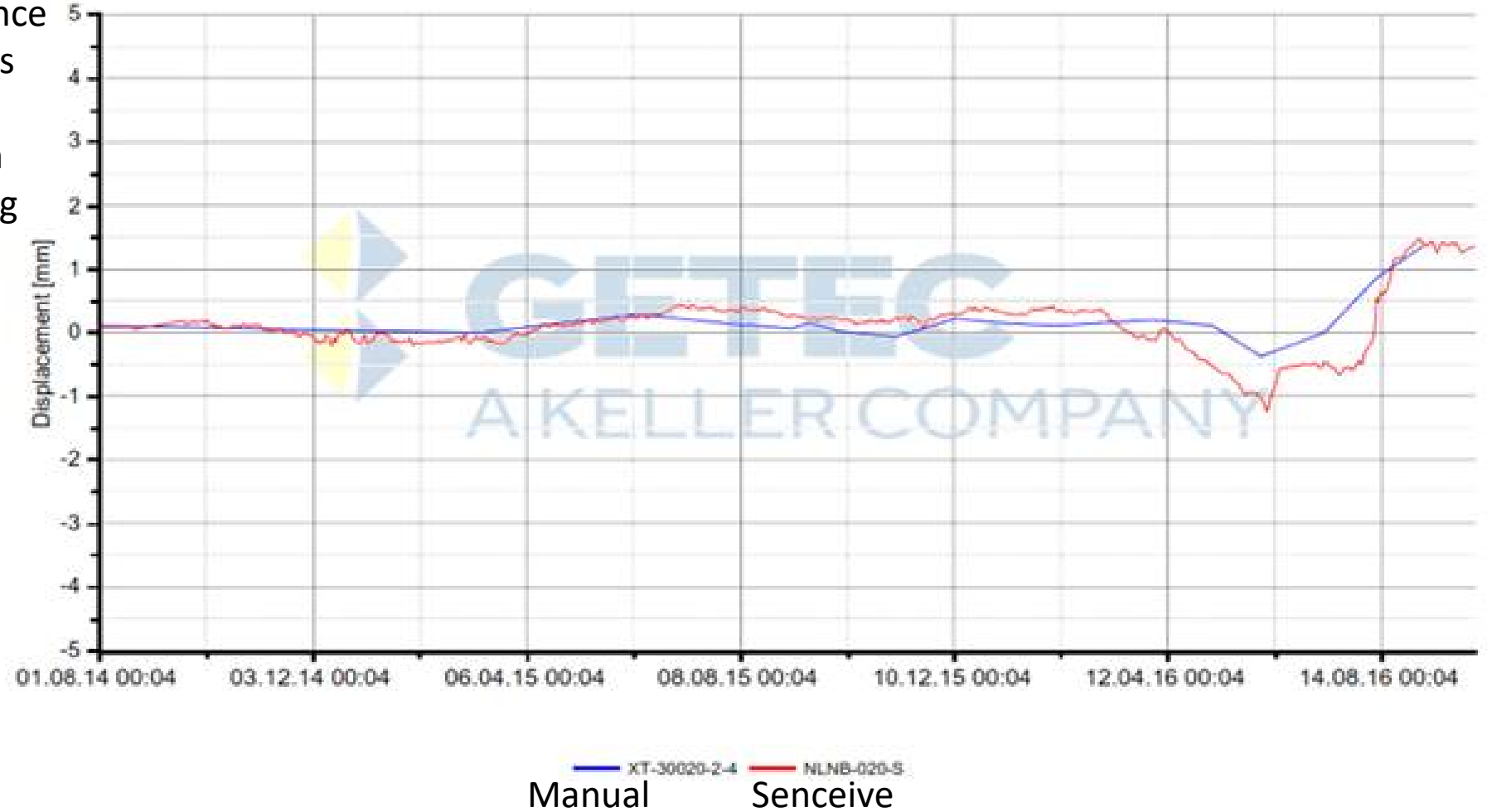
Shell Centre- Longitudinal movement over time

- Able to see 7mm of heave during later demolition
- Excellent correlation with manual/precision levelling

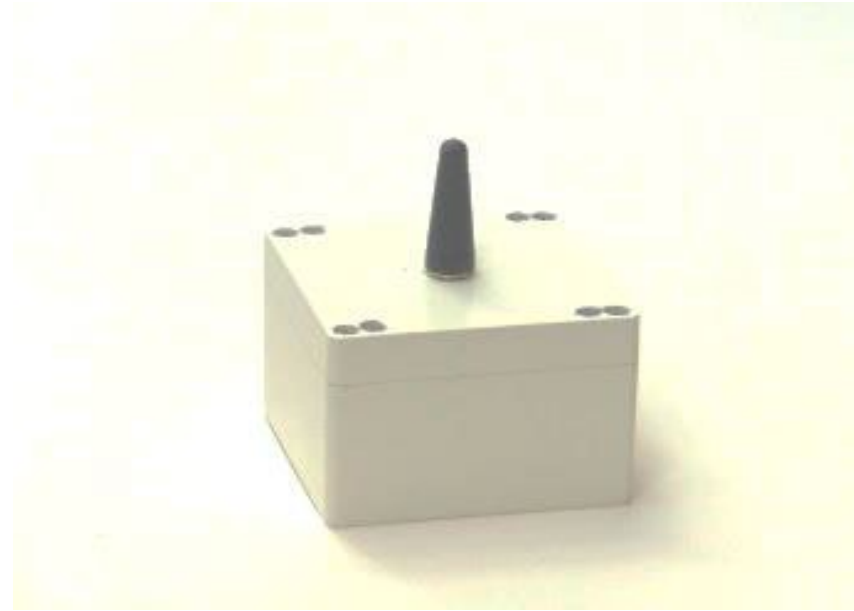


Shell Centre- Convergence movement over time

- Able to see tiny convergence accuracy over long periods
- Excellent correlation with manual/ precision levelling



Senceive system



- High Precision stable tri-axial tilt sensors
 - Steel Beam Mount
 - 15 minute interval measurements/auto triggering faster reporting
 - 3 month period pre, during, post construction
- Senceive System
 - Precision: $\pm 0.001^\circ$ / $\pm 0.018\text{mm}$
 - Accuracy: $\pm 0.003^\circ$ / $\pm 0.053\text{mm}$
 - Supported with visual inspections



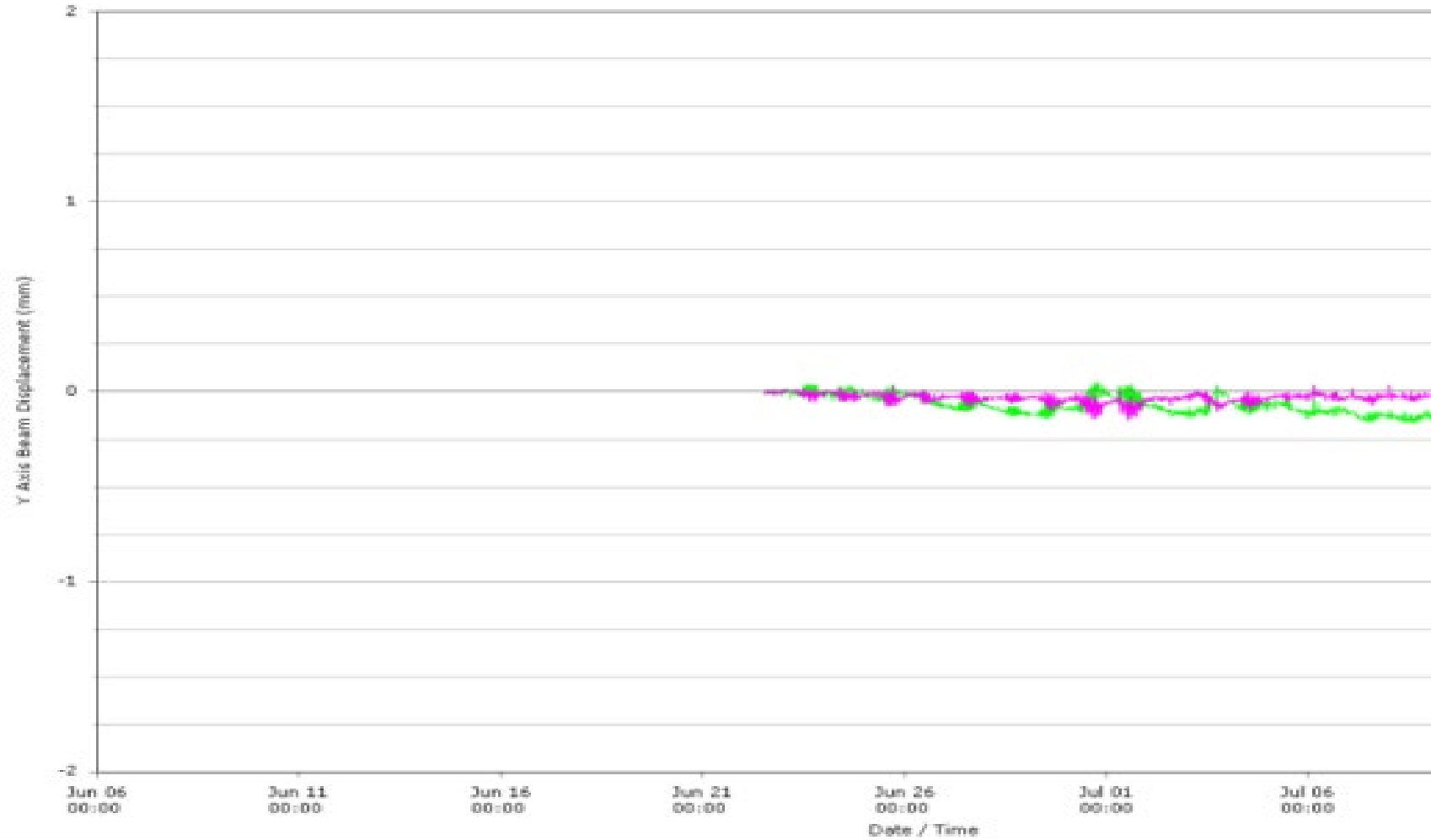
Senceive system

Tunnel Movement Monitoring

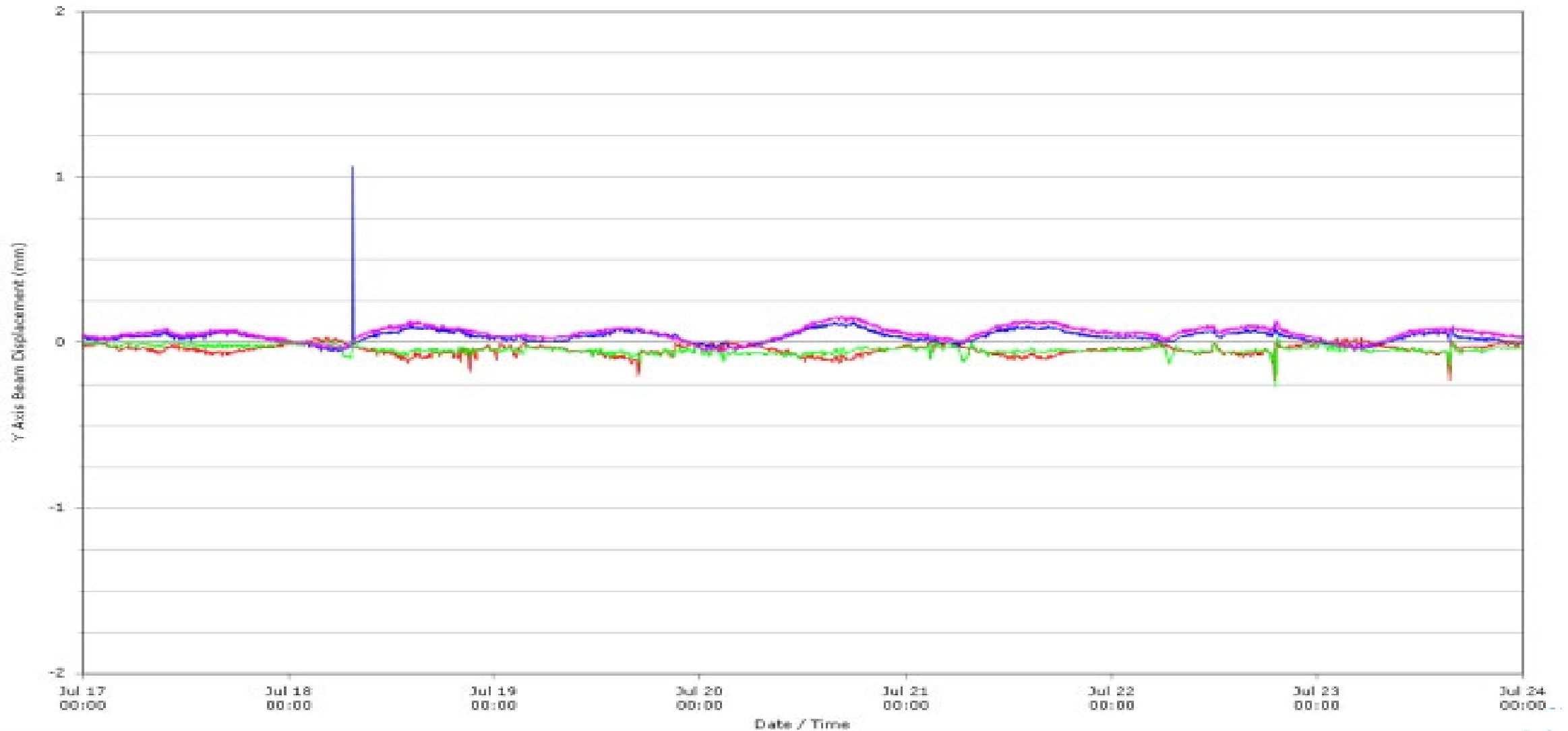
- 250 sensors on short beams
 - 5 battery powered gateways with auto switchover back-ups
-providing wire and mains power free monitoring over 3km



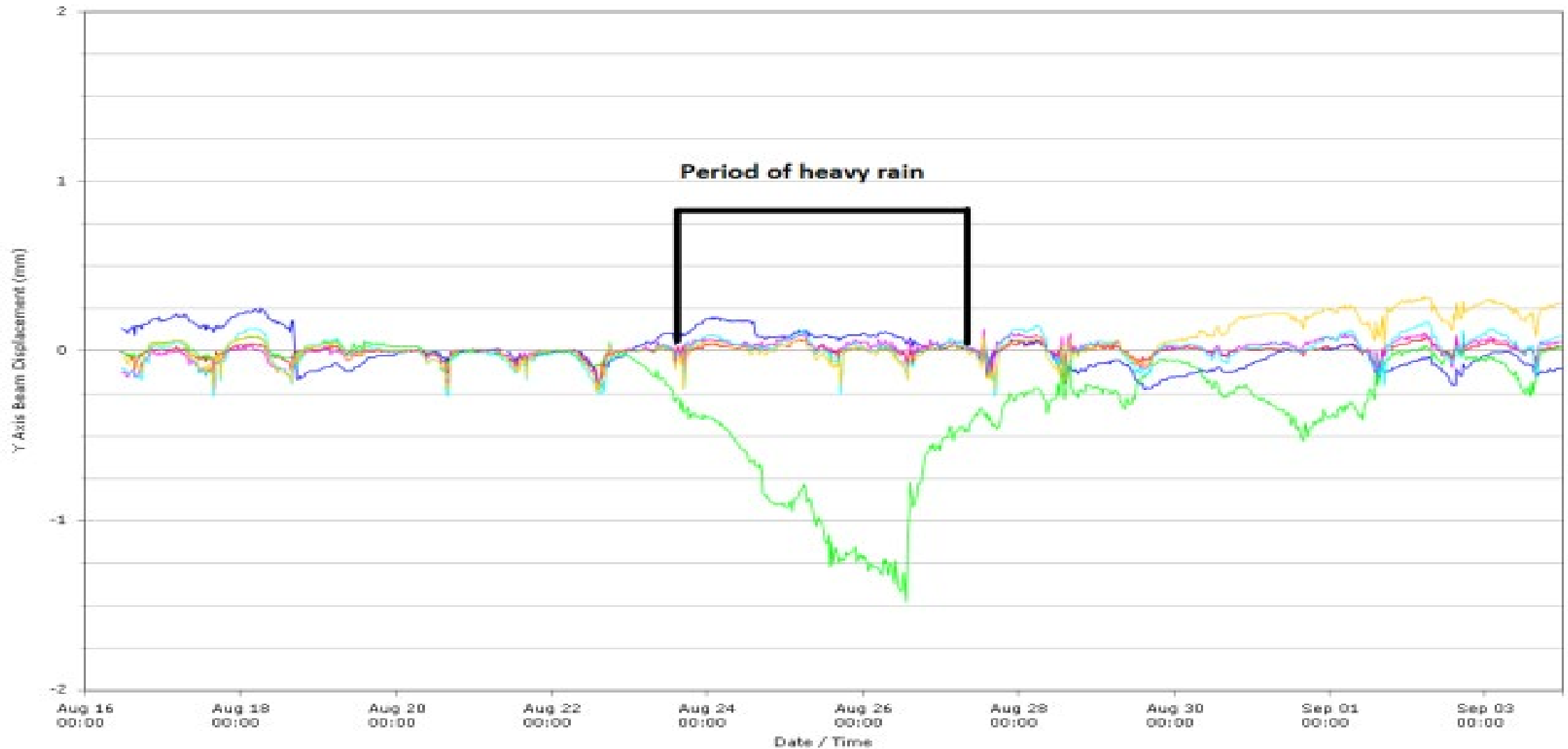
Monitoring Results: Baseline Data



Monitoring Results: During works



Monitoring Results: During works



Senceive Case Studies

Trackbed



Case Study – Crossrail/NR/DLR

Case study: Crossrail/NR/DLR

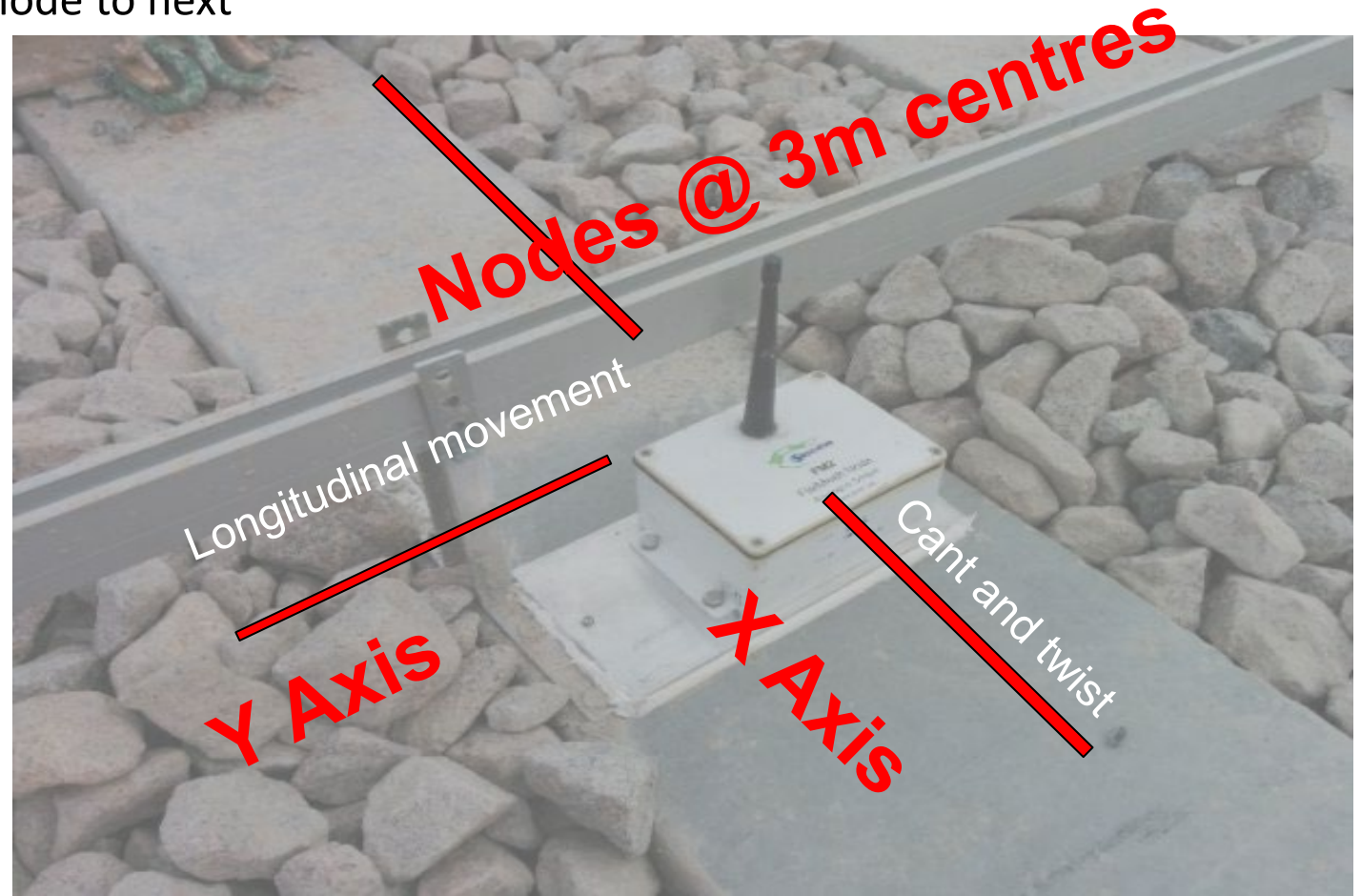
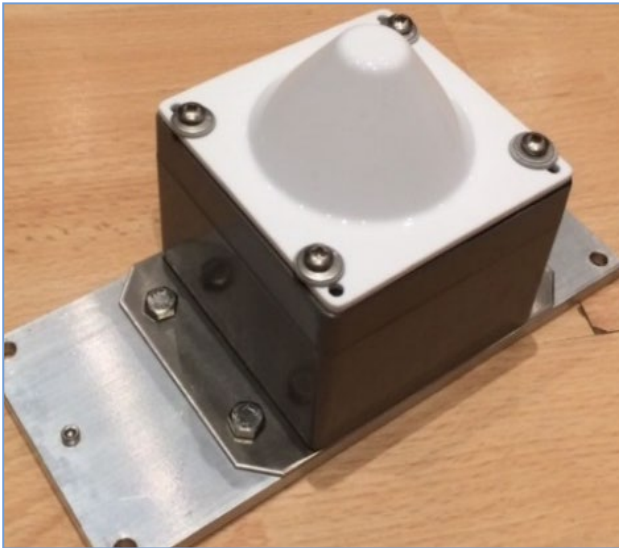
Track Movement Monitoring

- 700 high precision dual axis sensors measuring principally twist and cant on track bed
- Fast installation over 2 shifts



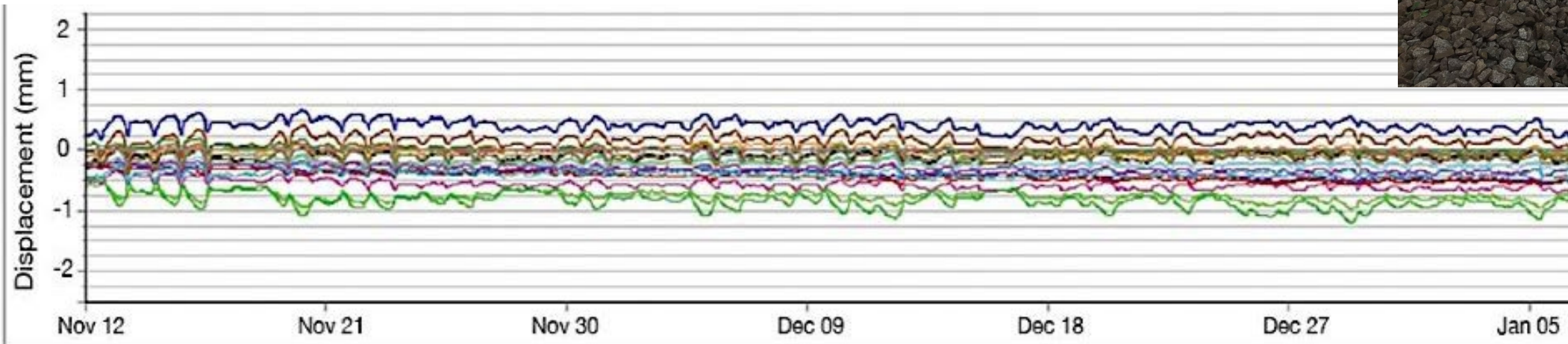
Measuring Cant, Twist and longitudinal

- Measures angle change to calculate cant
- Twist is computation of relationship of one node to next



Stable data in challenging environment

- Stable track bed cant and twist data



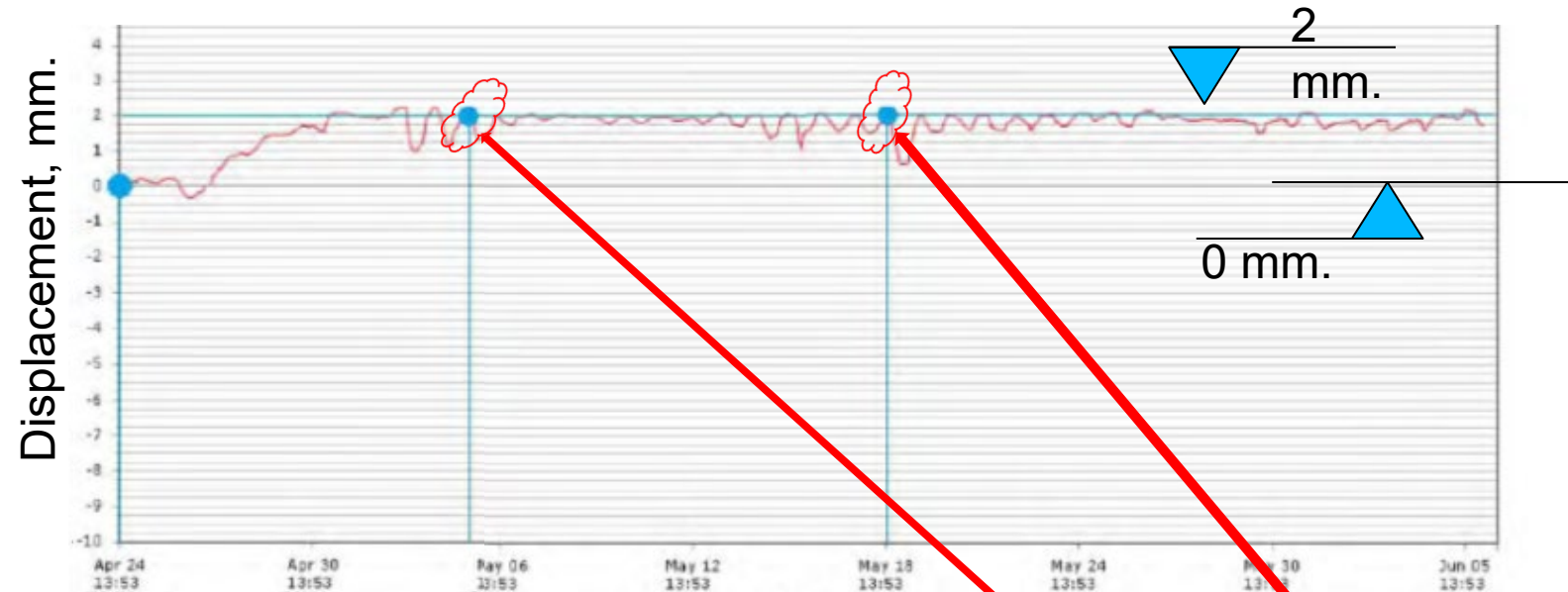
Easy to install

- Flexible install in busy environment



Corroborated by precise levelling

- Accuracy of Senceive data corroborated by manual precise levelling

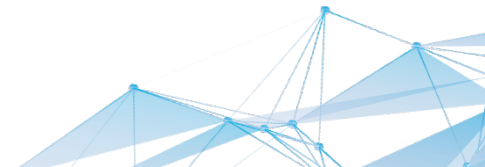


ID for UCIMS	Date / Time.		Manual data			
	Base cant reading [mm] [24/04/2014]	Chainage	Cant reading [mm] [04/05/2014]	Cant reading [mm] [18/05/2014]	Cant Difference [mm] [04/05/2014]	Cant Difference [mm] [18/05/2014]
C350-CA28895-CR094	-52	183.189	-52	-51	0	1
C350-CA28898-CR094	-59	186.008	-59	-59	0	0
C350-CA28901-CR094	-53	189.472	-54	-53	-1	0
C350-CA28904-CR094	-49	192.226	-50	-48	-1	1
C350-CA28907-CR094	-44	195.551	-43	-42	1	2
C350-CA28910-CR094	-43	198.045	-42	-41	1	2
C350-CA28913-CR094	-48	201.357	-46	-46	2	2
C350-CA28916-CR094	-52	204.62	-53	-55	-1	-3



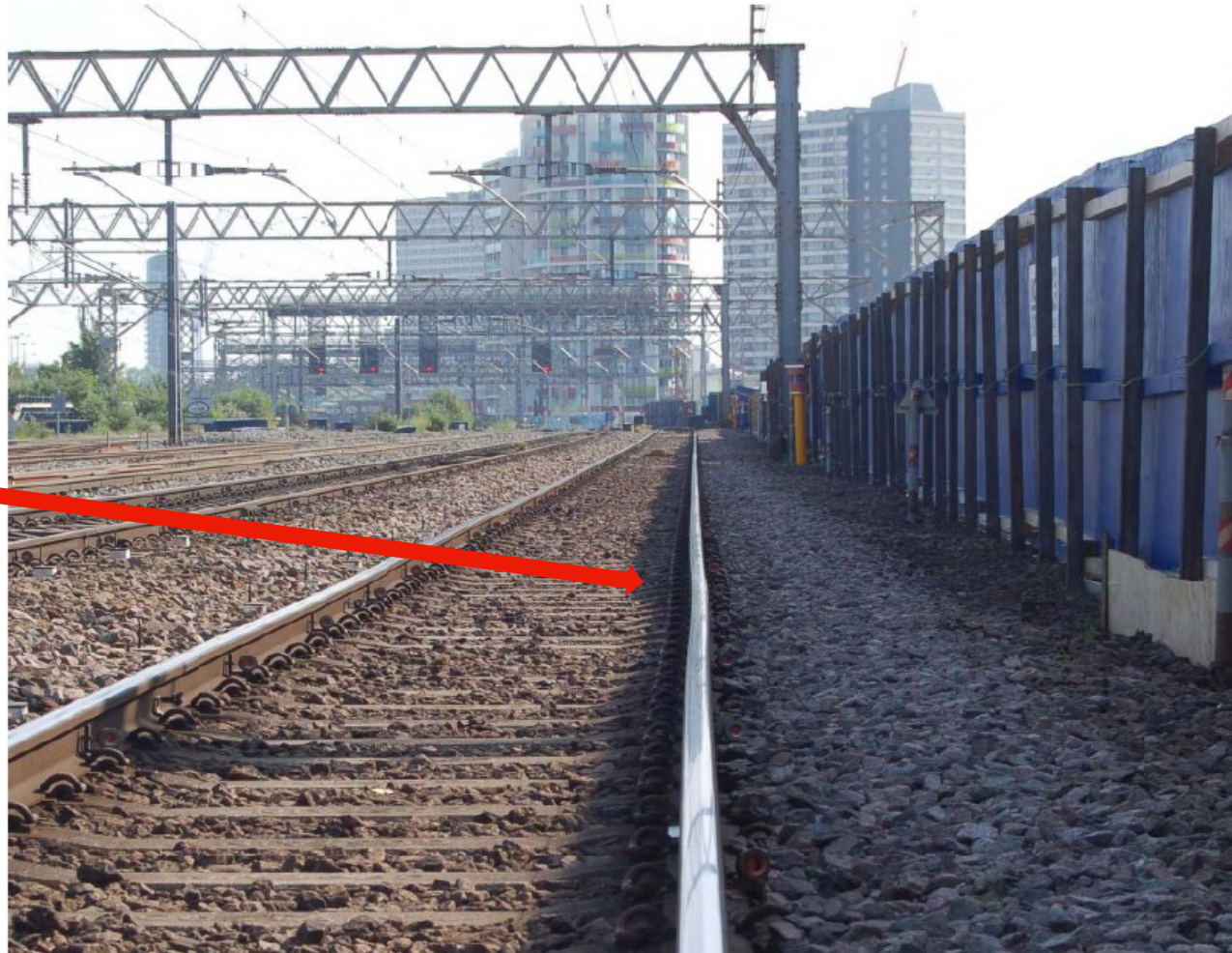
Nearby works....causes movement....

- Adjacent excavation caused loss of ballast under adjacent track



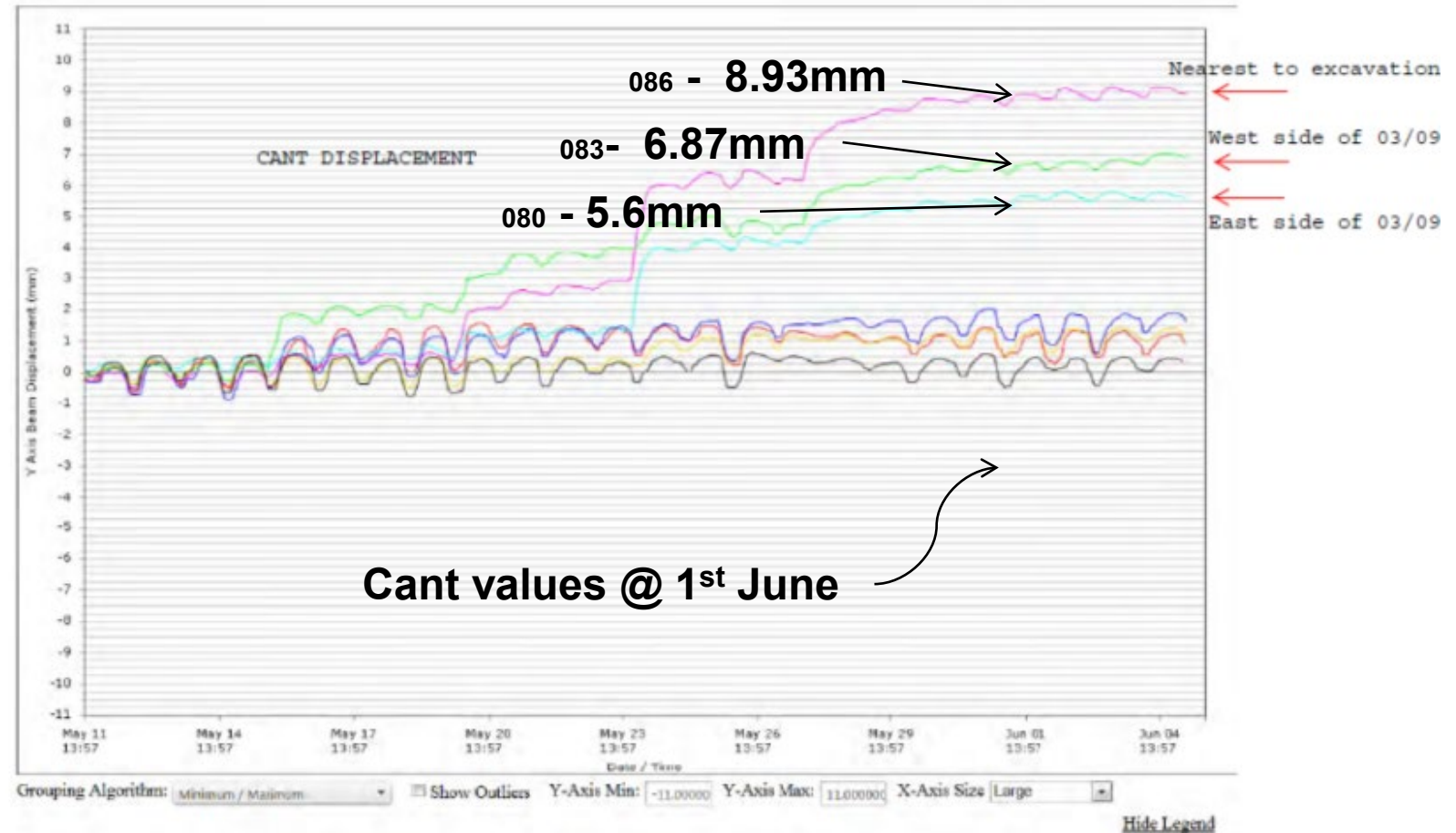
Twist movement...alerts and slow running

- Visual on track misalignment



9mm of Cant

- Senceive cant data precisely sees movement

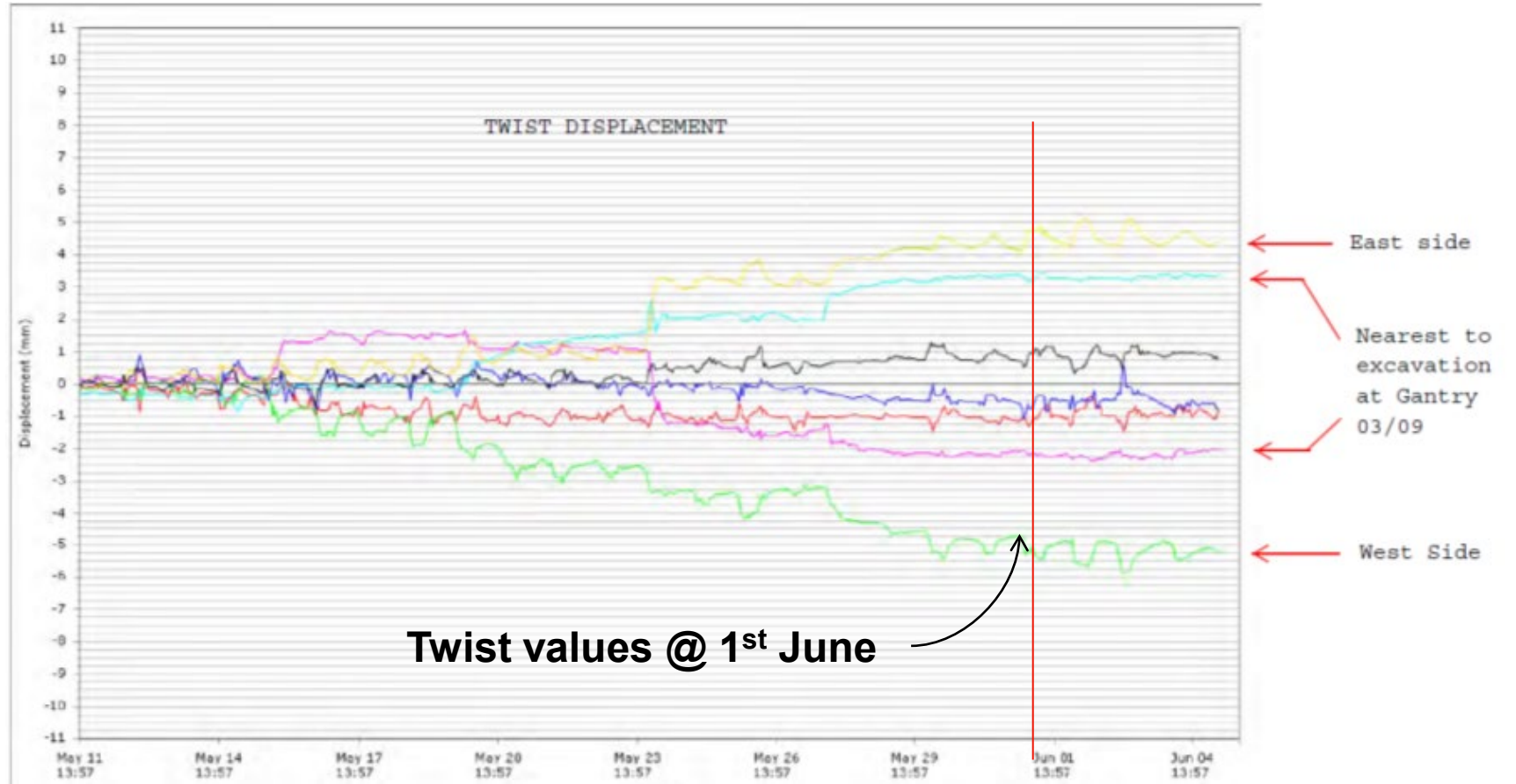


Senceive Webmonitor



5mm of Twist

- Senceive Twist data

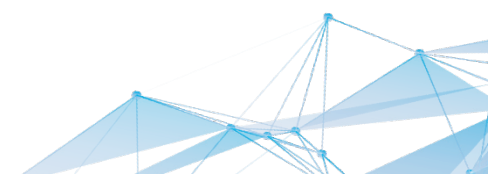
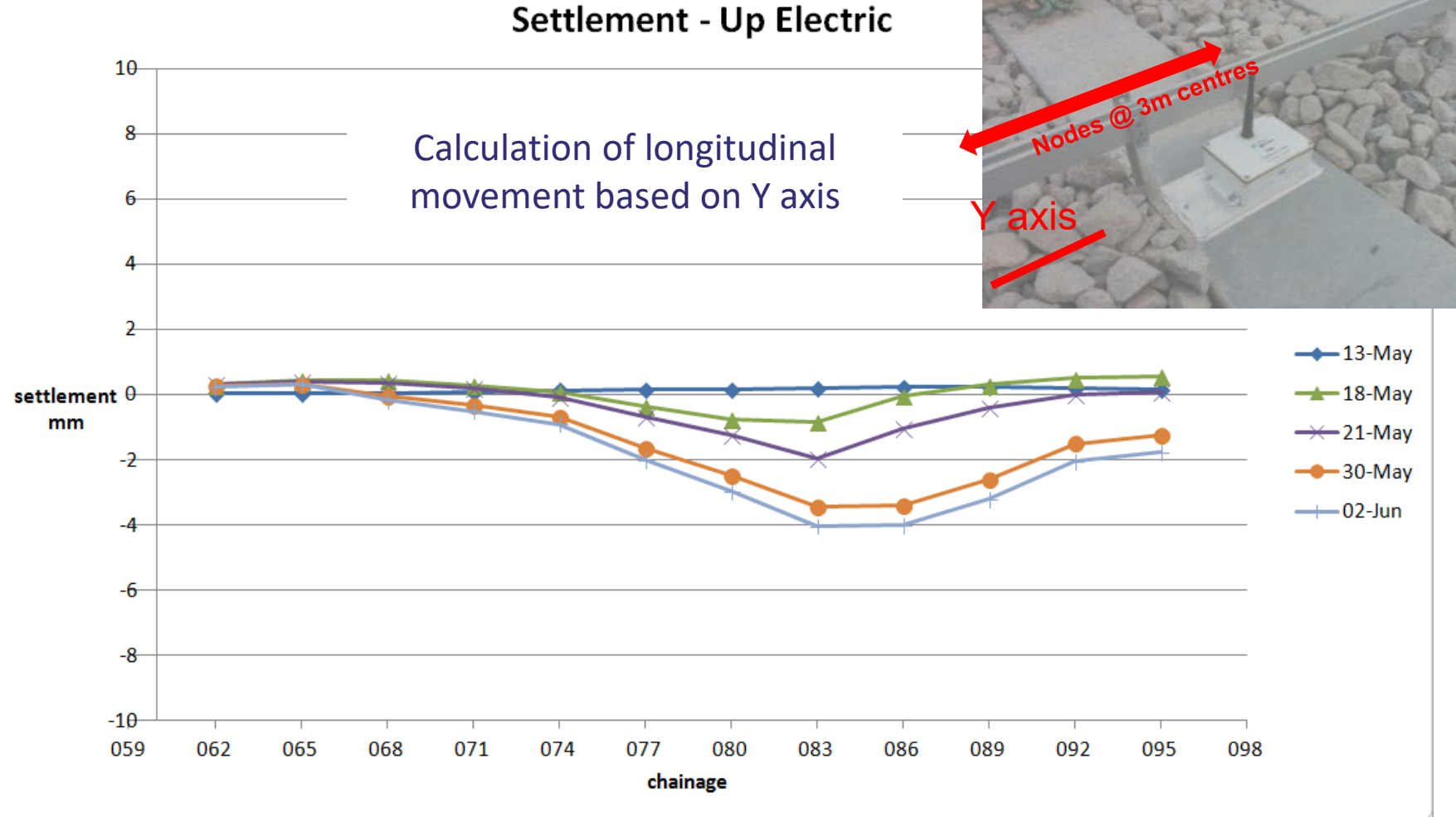


Senceive Webmonitor



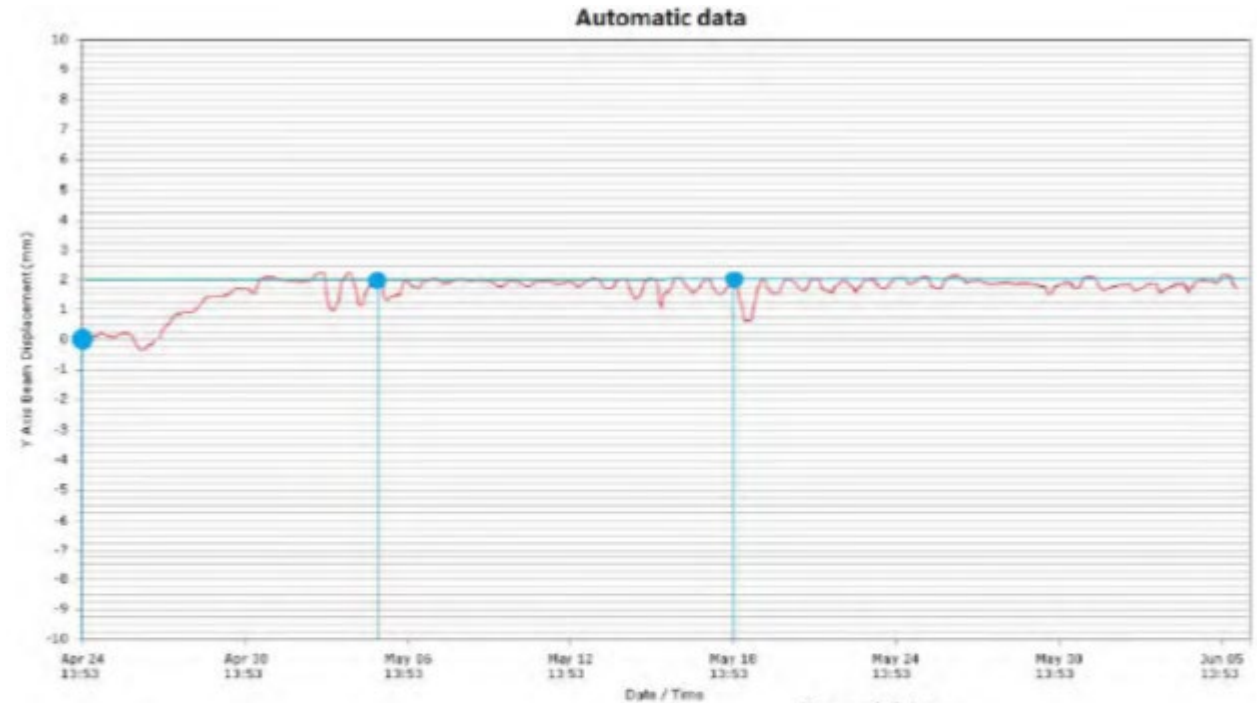
4mm of Settlement

- Longitudinal movement/settlement



Elsewhere -new Ballast settling in

- Accuracy of Senceive data corroborated by manual precise levelling



Legend

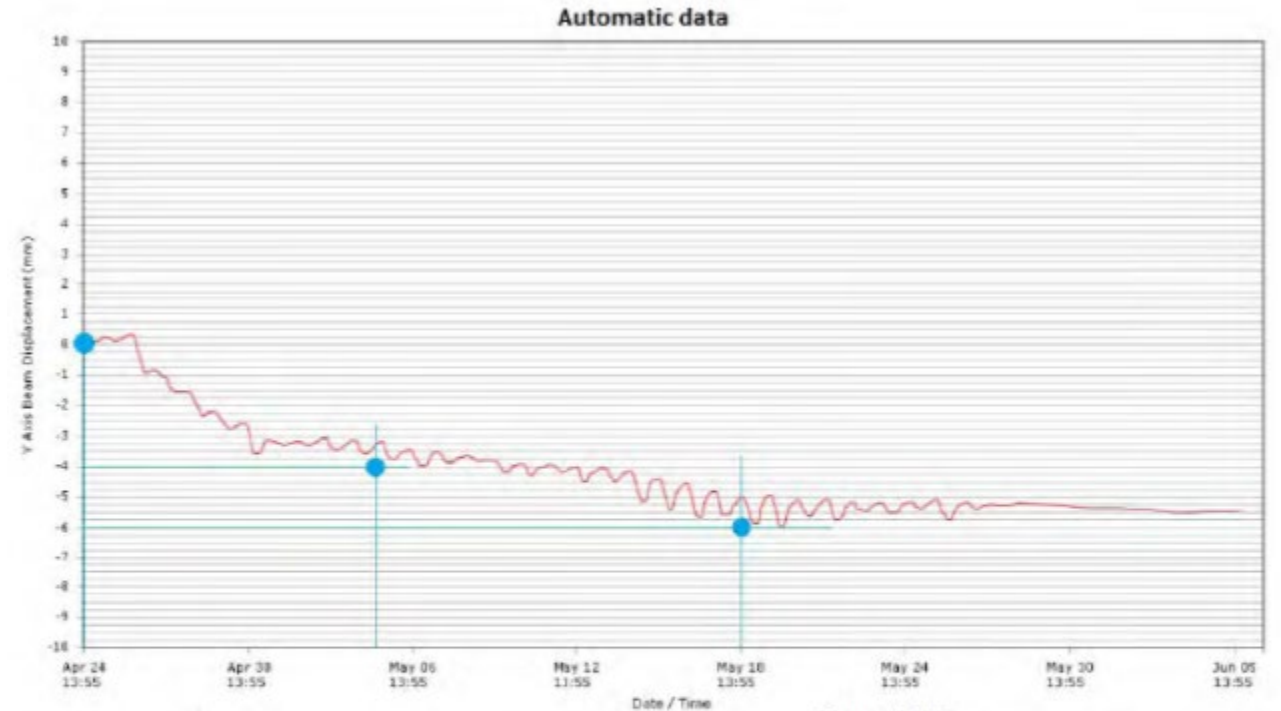
• C350-28913-CR094

Manual data

ID for UCIMS	Base cant reading [mm] (24/04/2014)	Chainage	Cant reading [mm] (04/05/2014)	Cant reading [mm] (18/05/2014)	Cant Difference [mm] (04/05/2014)	Cant Difference [mm] (18/05/2014)
C350-CA28805-CR094	-52	182.189	-52	-51	0	1
C350-CA28898-CR094	-39	186.008	-39	-39	0	0
C350-CA28901-CR094	-53	189.472	-54	-53	-1	0
C350-CA28934-CR094	-49	192.226	-50	-48	-1	1
C350-CA28907-CR094	-44	195.551	-43	-42	1	2
C350-CA28910-CR094	-43	198.045	-42	-41	1	2
C350-CA28913-CR094	-48	201.352	-46	-45	2	2
C350-CA28916-CR094	-52	204.82	-51	-50	-1	-2
C350-CA28919-CR094	-53	207.181	-56	-57	-3	-4
C350-CA28922-CR094	-56	210.416	-59	-59	-3	-3
C350-CA28925-CR094	-55	213.028	-59	-61	-4	-6
C350-CA28928-CR094	-53	216.344	-57	-60	-4	-7

New Ballast settling in

- Accuracy of Senceive data corroborated by manual precise levelling



Legend

● C350-28931-CR094

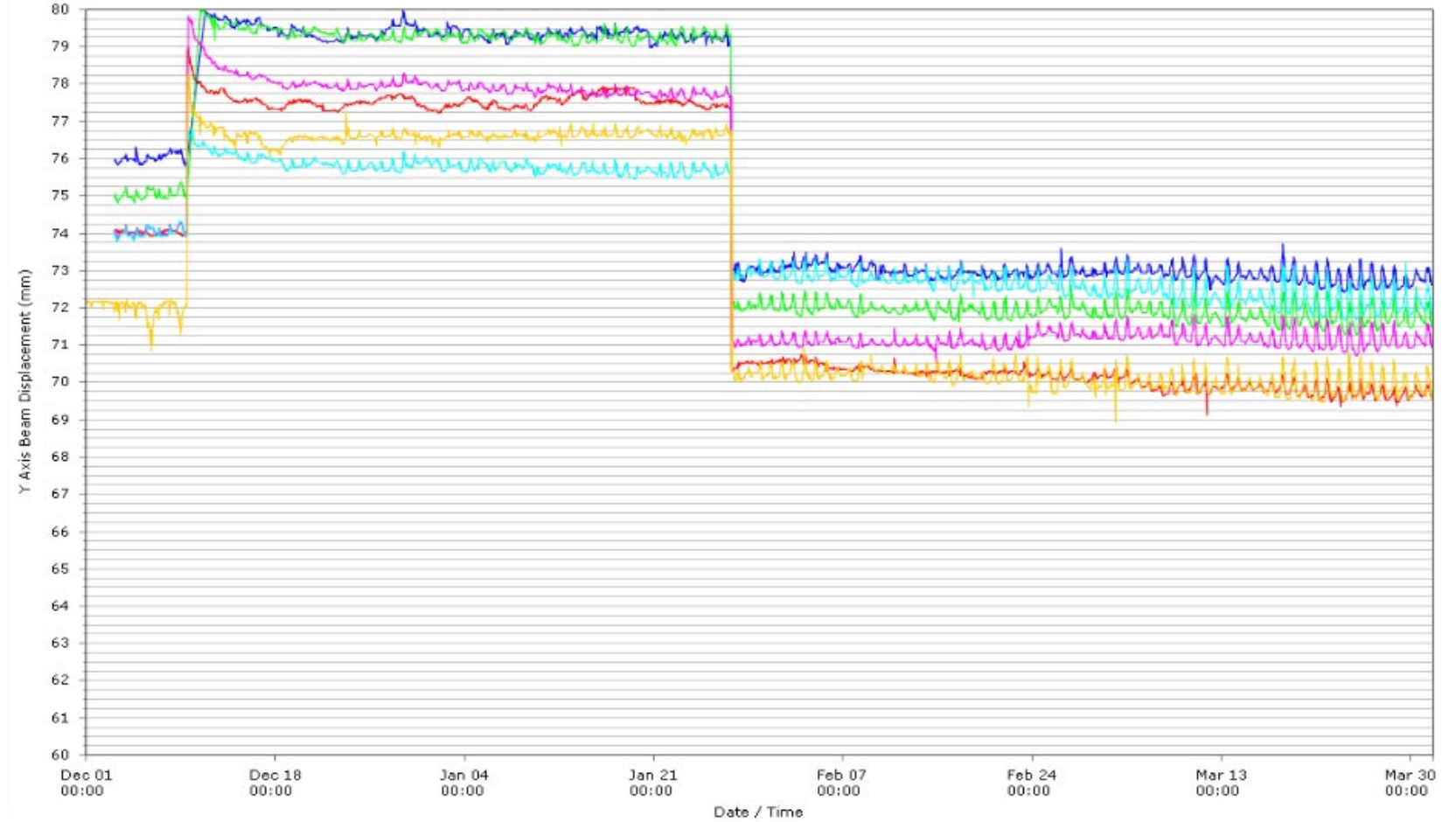
Manual data

ID for UCIMS	Base cant reading [mm] (24/04/2014)	Chainage	Cant reading [mm] (04/05/2014)	Cant reading [mm] (18/05/2014)	Cant Difference [mm] (04/05/2014)	Cant Difference [mm] (18/05/2014)
C350-CA18905-CR094	-52	183.189	-52	-51	0	1
C350-CA18906-CR094	-53	186.008	-53	-53	0	0
C350-CA18903-CR094	-53	189.472	-54	-53	-1	0
C350-CA18904-CR094	-49	192.226	-50	-48	-1	1
C350-CA18907-CR094	-44	193.551	-45	-42	1	2
C350-CA18910-CR094	-43	198.045	-42	-41	1	2
C350-CA18913-CR094	-48	201.357	-46	-46	2	2
C350-CA18916-CR094	-52	204.62	-53	-55	-1	-3
C350-CA18919-CR094	-53	207.183	-56	-57	-3	-4



Tamping

- Cant data - during tamping



Case Study – Track/Retaining wall/Earthworks



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