LBFoster

Insight Earthworks Monitoring

2022

The Challenge - Earthworks Monitoring

- Responsible for 190,000 earthwork assets – c19,000km of track
- Varying construction types - many over 150 years old & over-steep
- Increasing risk profile
    - Increased periods of wet weather
    - Rapid failures that develop within minutes/hours
    - Increased embankment traffic loading
    - Peat wastage of subsurface soils results in subsidence
    - Effects of vegetation on soil and rock slopes
    - Climate change – extreme weather events can lead to rapid failures in slopes
    - Non Network Rail/3rd Party slopes outside infrastructure

The Challenge - Cause of Failure v's The Impact - Earthworks Monitoring

- Extreme Weather
- Inadequate design
- Degradation of asset
- Surface & Groundwater
- Outside party activities
- Increase in traffic
- Animals
- Vegetation
- Peat waste
- Climates changes

- Fatality
- Injury
- Trauma
- Derailment
- Performance
- Delay
- Financial
- Reputation
- Environment
- Damage to assets
- Damage to other assets

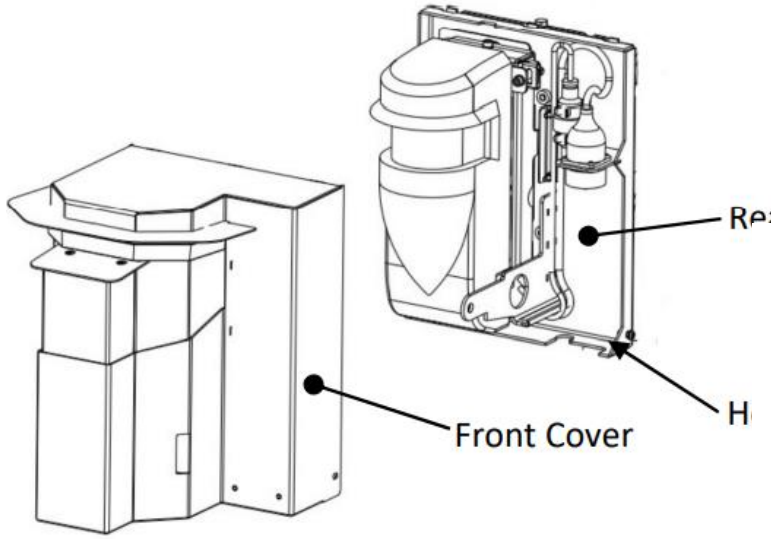
Recognising the general lack of infrastructure resistance to weather events we need to be able to detect asset failures, principally soil cuttings, before they are encountered by train drivers.

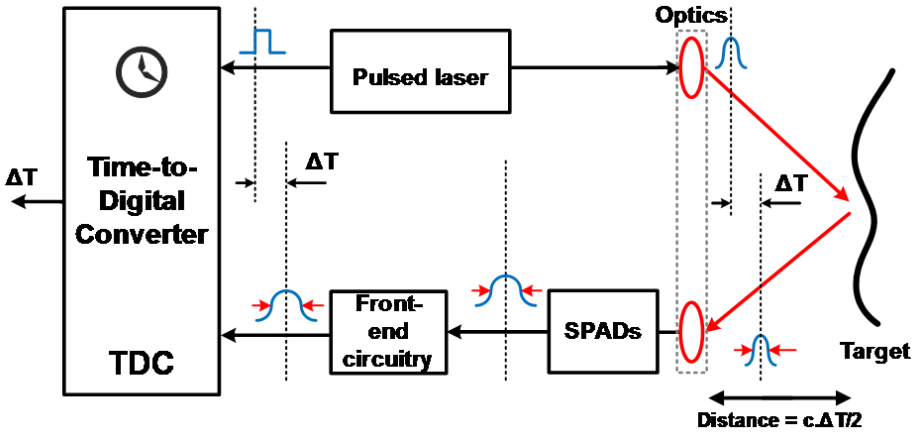
What is – insight Earthworks Monitoring

- Ground displacement monitoring
- 24x7x365 availability
- All weather capability
- Realtime alerting
- Rapid confirmation

LB Foster Approach to - Earthworks Monitoring

- Ground profile monitoring
  - LiDAR
  - Time of flight
- Multiple overlapping units
- Application specific logic
- 3G/4G communications
- CCTV confirmation





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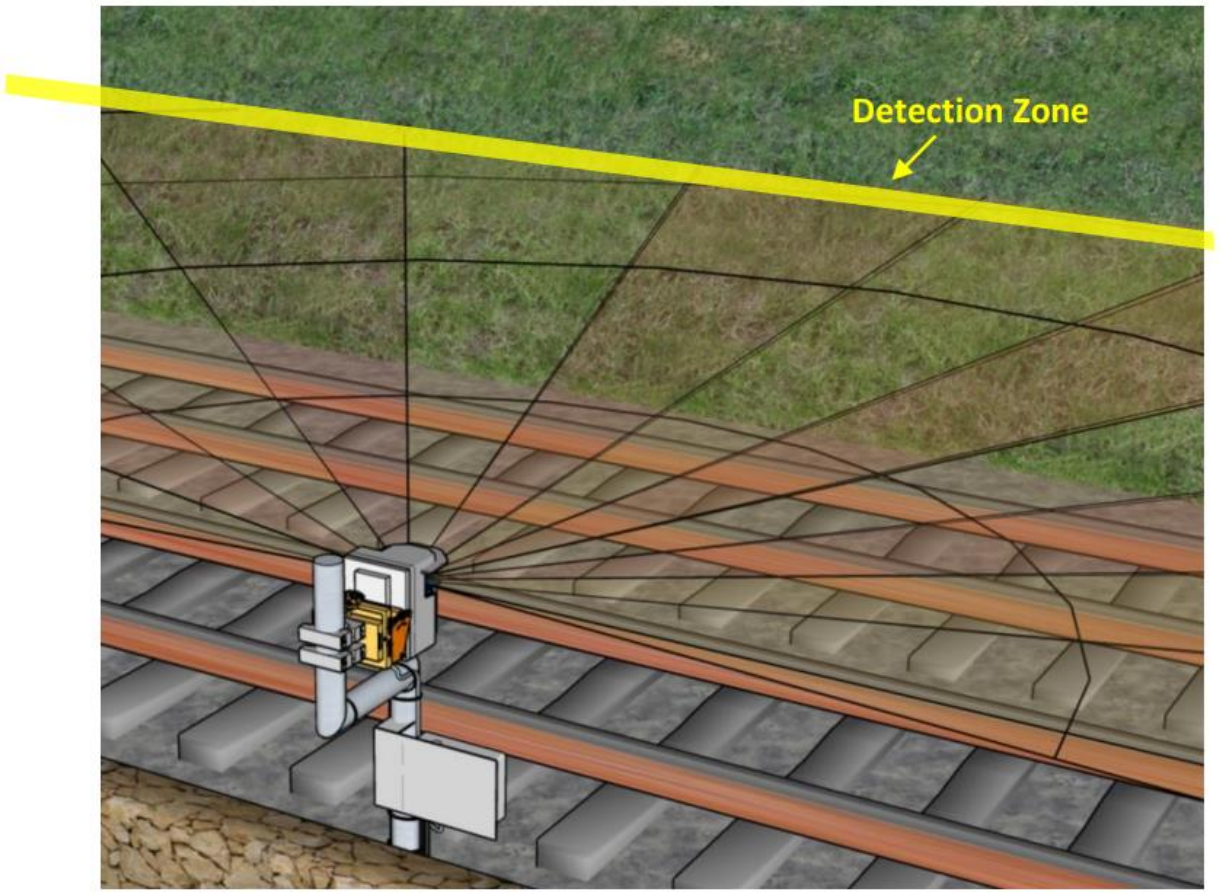

Where is - Earthworks Monitoring

- Little Hagloe (Trial)
    - 15/12/2019
    - 16/02/2020
    - 28/08/2020 (Live)

      Event 07:24
      LiDAR 2 1.6m x 641mm
      At 129m 460yd
      Alert received 07:25
      Trains stopped 07:28
    - 07/02/2021 (Live)
- GE 2021 Award – Equipment Innovation

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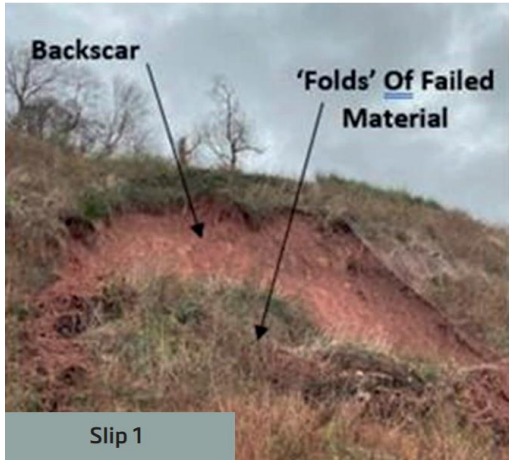
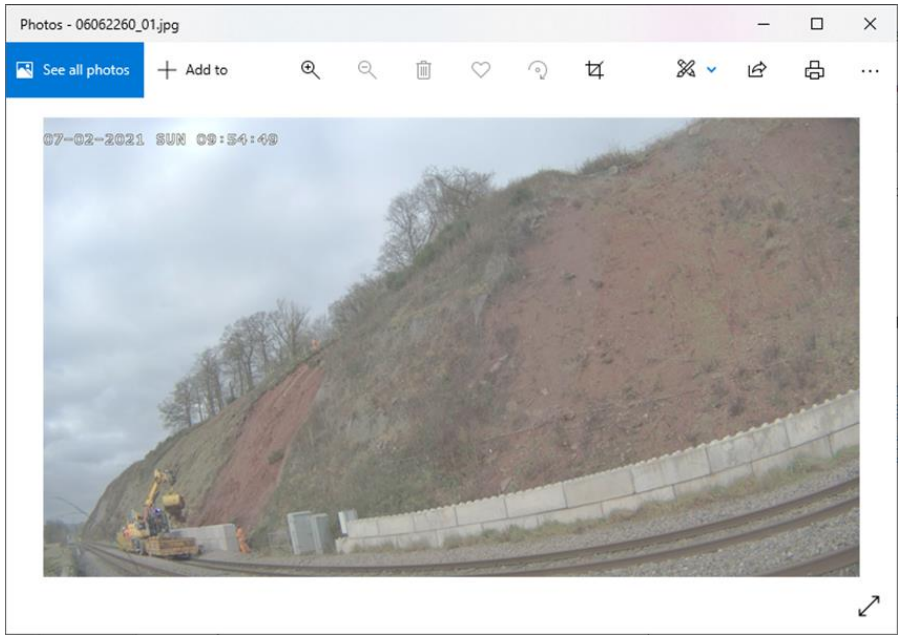
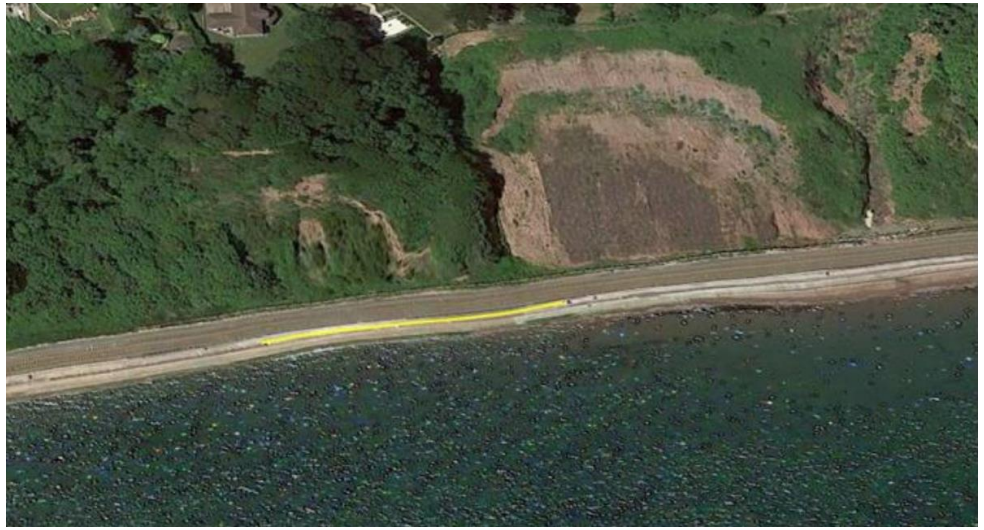


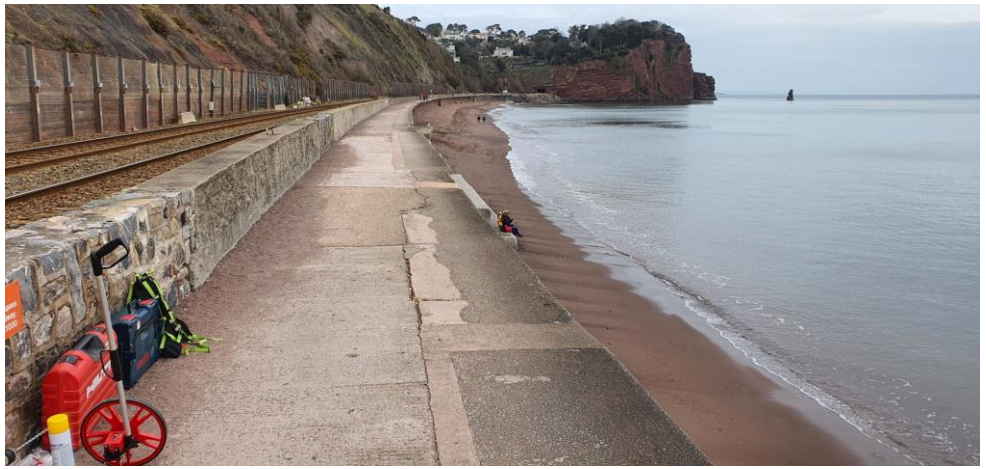


Where is - Earthworks Monitoring

- Teignmouth (Trial)
    - Installed
    - Final Commissioning

      Wed 6th July





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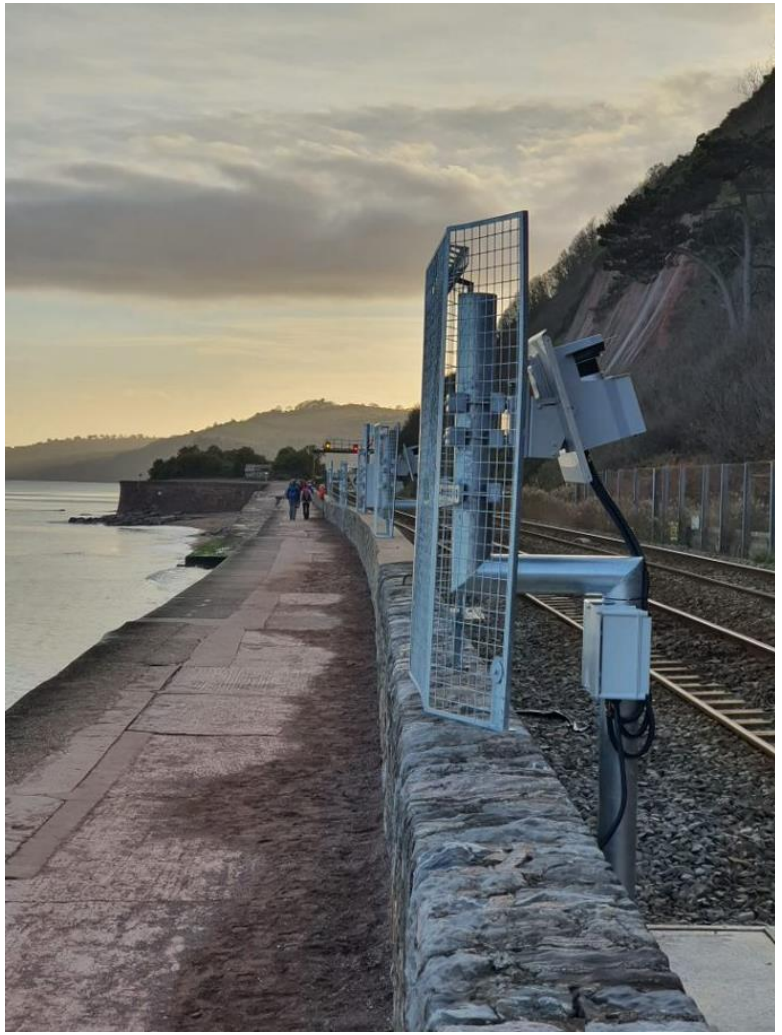
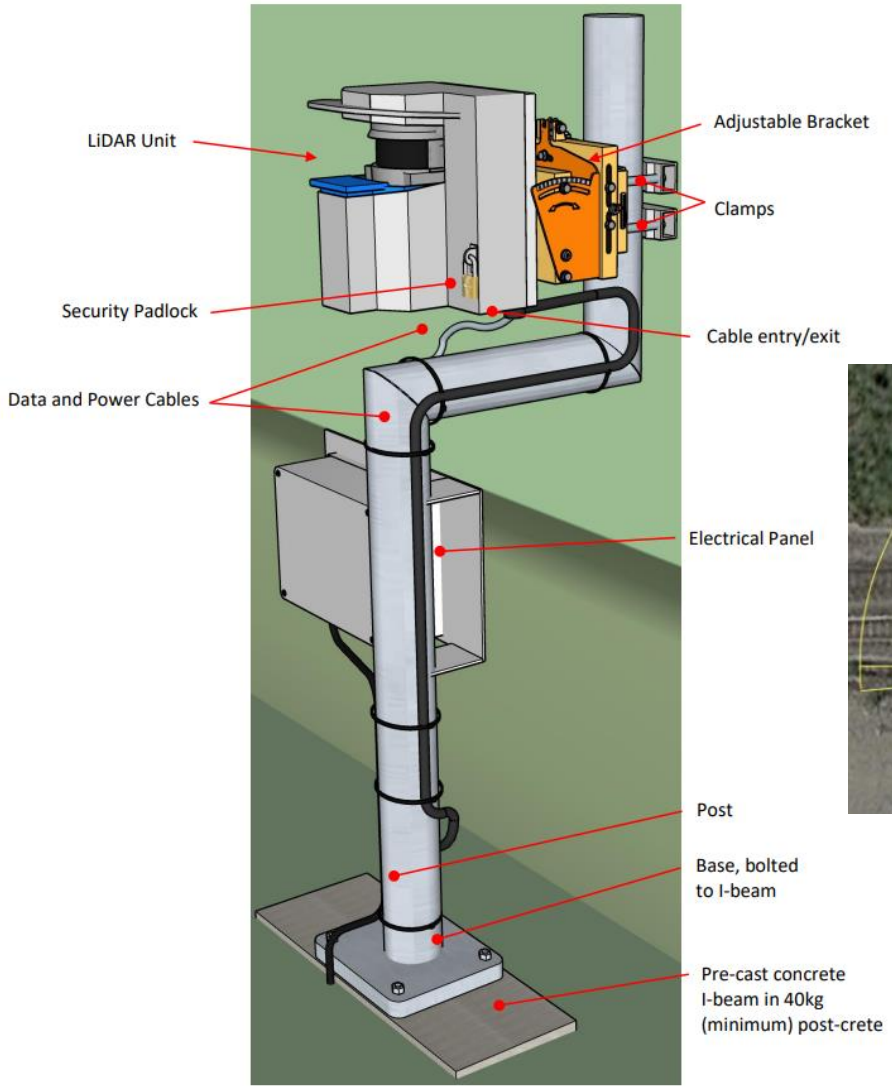
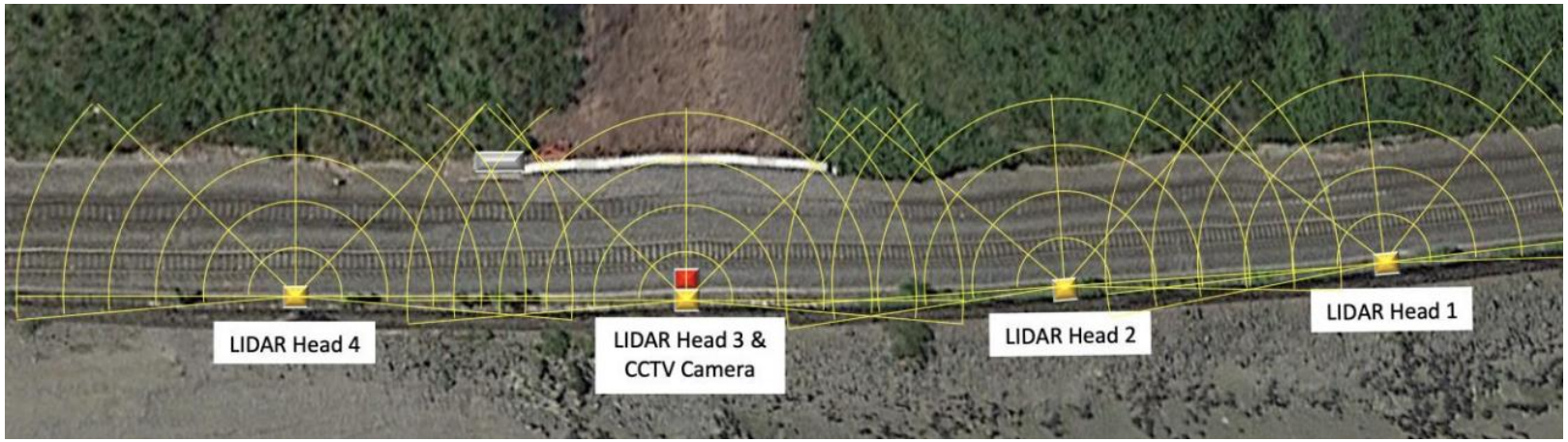
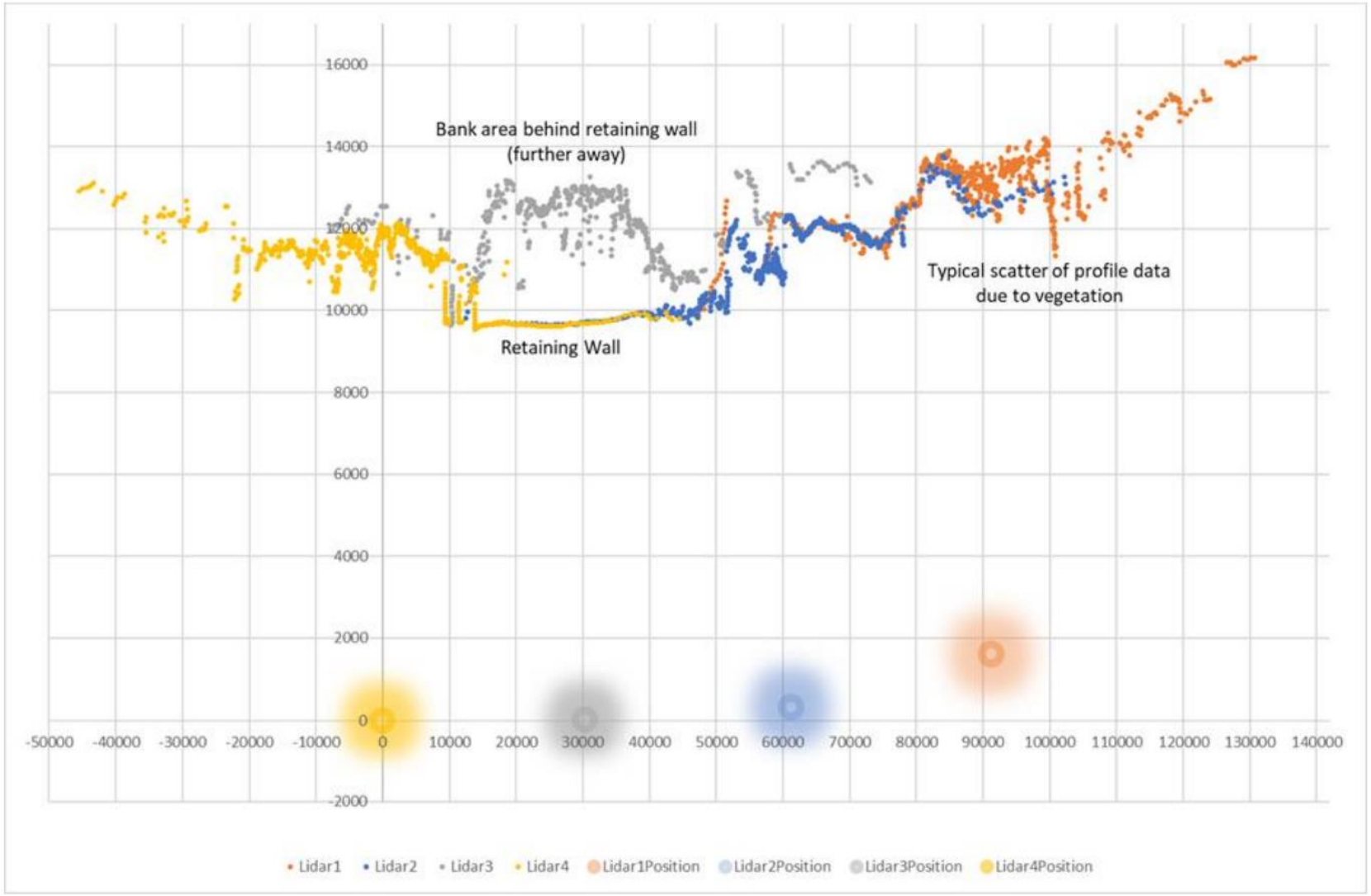


Typical GA - Earthworks Monitoring





The Data - Earthworks Monitoring



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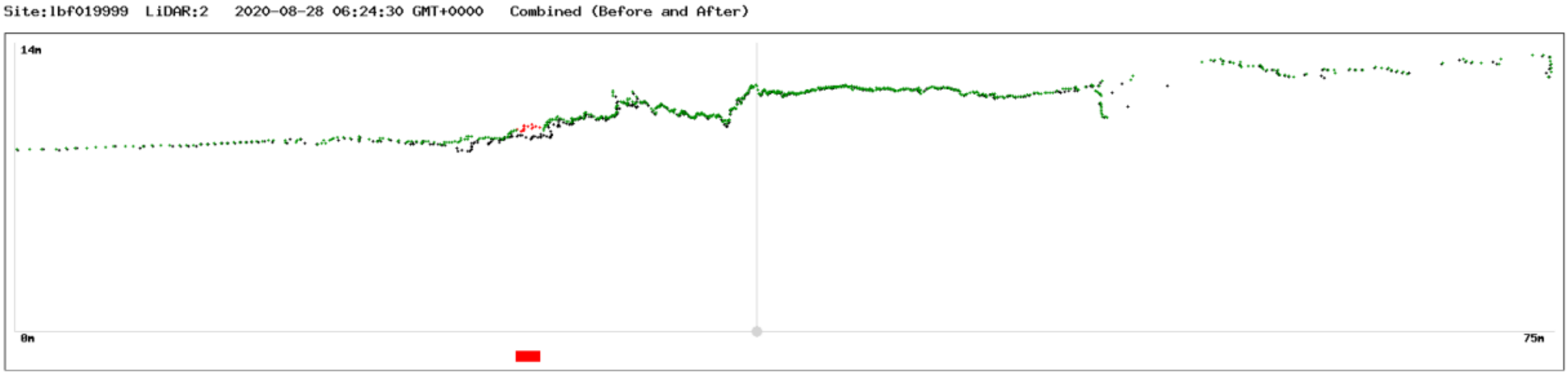


Hidden Features - Earthworks Monitoring

Photographs provided by NWR, © Network Rail

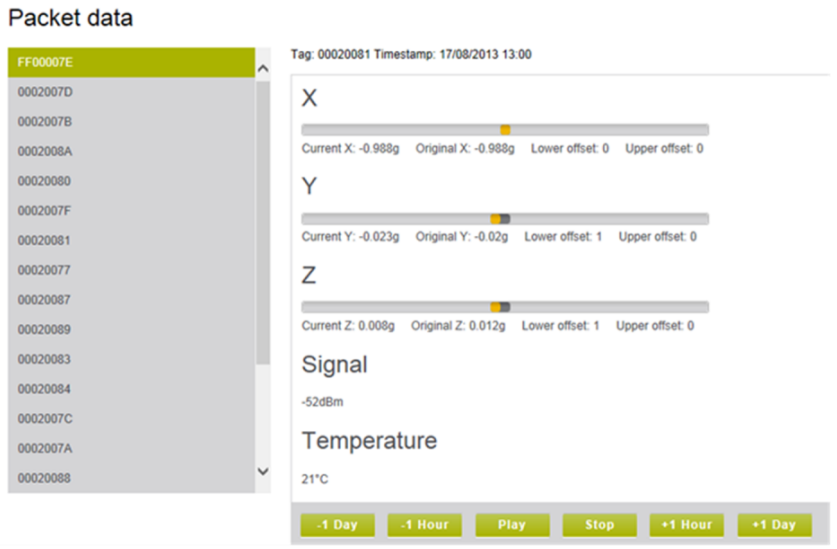
Benefits of - Earthworks Monitoring

- 24x7x365 monitoring
- Realtime detection
- Flexible reporting & alerting
- User portal, including CCTV
- Facilitates rapid response time for maintenance teams
- Reduce risk to traffic & public
- Reduced delay minutes

Tilt Tag - Earthworks Monitoring Test Site

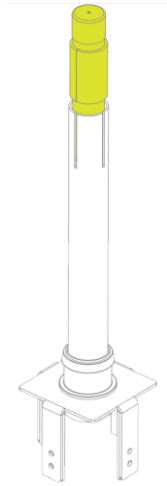
- Clay Cross – Known site, during remedial groundwork
- System deployed and operational in hours
- Movement posts with 3G accelerometers analysing multiple samples per minute transmitting hourly to web server
- Excessive movement detected triggers image updates and alarms
- HD photographs collected midday and midnight
- Custom ‘Invisible’ 980nm infra-red light developed

Tilt Tag - Earthworks Monitoring



Tilt Tag - Avalanche Monitoring (BNSF)

- North American (BNSF) installation
- Operational for over 4 years
- Comprises
  - Tilt Tag/Detectors, 4 minute heartbeat
  - Solar powered Gateway (3/4G)
  - Dedicated HMI, with onward alert messaging
  - Optional solar CCTV for remote verification of event

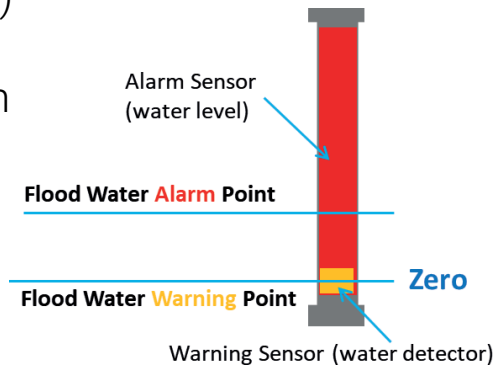


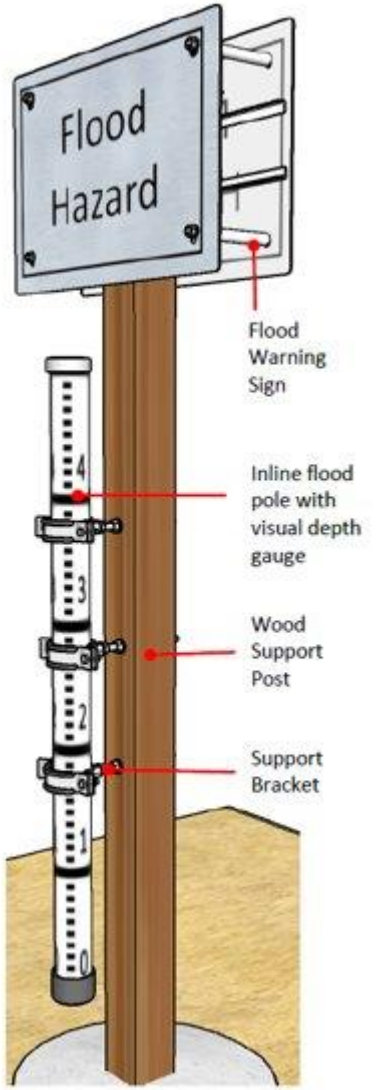
Flood Site Monitoring

- Nationwide flooding problems with over 200 known sites at risk
- Often in remote locations with no available power or land based comms.
- Wireless communication
- Capacitive sensing technology
- Maintenance and cleaning of units reduced significantly

Inline Flood Pole

- Fully submersible design
- All electronics internally sealed in pole
- Variable alarm points
- Visual water level verification printed on pole
- Battery (replaceable) powered poles (~3 yr)
- ½ mile wireless communication range to m





Flood Site Monitoring

- Communicates via intelligent gateway, triggers & alarms to secure server via 3/4G
- Low powered CCTV for visual verification update, snapshots and live video
- Automatically targeted CCTV for snapshots
- Solar powered, battery backed
- Web portal with user friendly software with RAG alarm status
- Customised alarm levels for each location