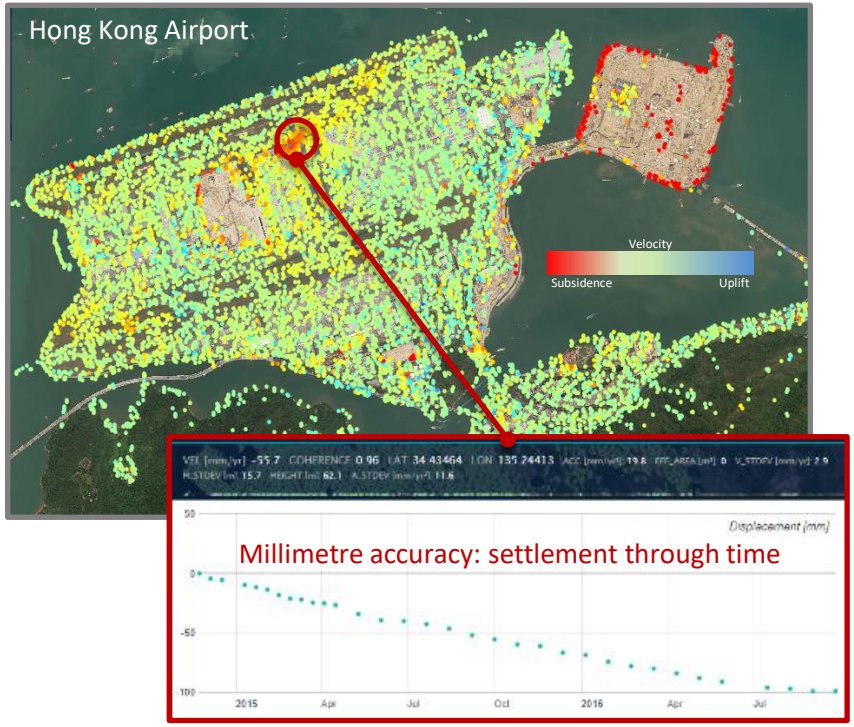
Product Presentation: SqueeSAR®

- **Applicant Name**: TRE Altamira Srl
- **Product Name**: SqueeSAR®
- **Specification**: Latest version of algorithm
- **Reference Video:** YouTube Link



Core Functions

Accurately and remotely monitor ground and infrastructure displacement through time

Technology Used

Advanced InSAR processing algorithm and satellite imagery

Construction Process Involved

All stages: pre-construction, construction, post-completion

Key Improvement in Construction Process

- Productivity
- Safety
- Environmental

Job References

- New Metro Line, France, Adoption, 2015-2030
- Infrastructure, S. Korea, Adoption, 2019
- New Tunnel, Italy, Adoption, 2012-2020
- New LTR, Canada, Adoption, 2012-2017
- Rail Network, Italy, Adoption, 2008-2017

Product Presentation: SqueeSAR®

» **Core Technology**

SqueeSAR® - an advanced Interferometric Synthetic Aperture Radar (InSAR) processing algorithm

» **Patents**

- SqueeSAR® (based on PSInSAR™): Italy No. 1394733, 13th Jul 2012
- PSInSAR™: Italy No. 01312826, 24th May 2002; US No. 6,583,751 B1, 24th Jun 2003; EU No. 1183551, 17th Dec 2003; Australia No. 781580/00, Nov 2000; Japan No. 947881 9th Dec 2011

» **Comparison with current practice and popular models**

- Technology: complimentary technology to traditional surveying techniques
- Specification: provides line-of-site (LOS) displacements measurements from satellite
- Benefits: no man hours required, no installation or maintenance, 100% remote, much wider area coverage than traditional techniques, verification of in-situ results

» **Comparison with similar Pre-approved list products and competitors:**

- No other similar products currently exist in your pre-approved list

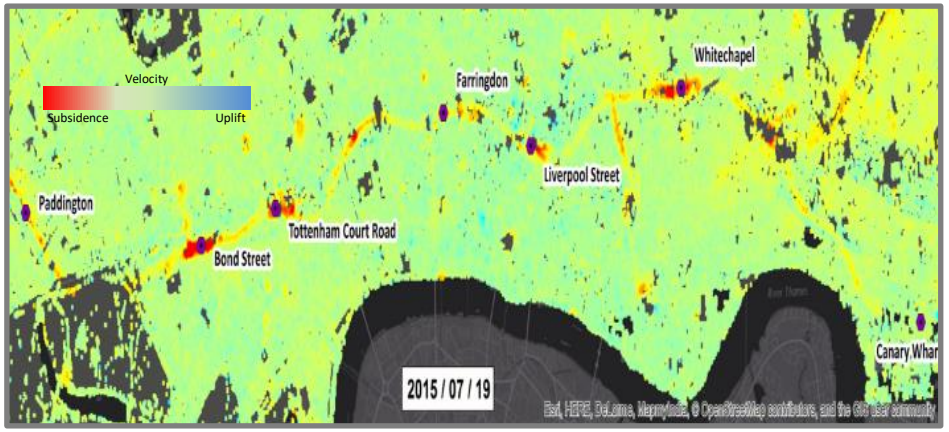
» **First Launch Date:** 01/2000 - continuous updates, last significant update on 01/2021

» **Awards**

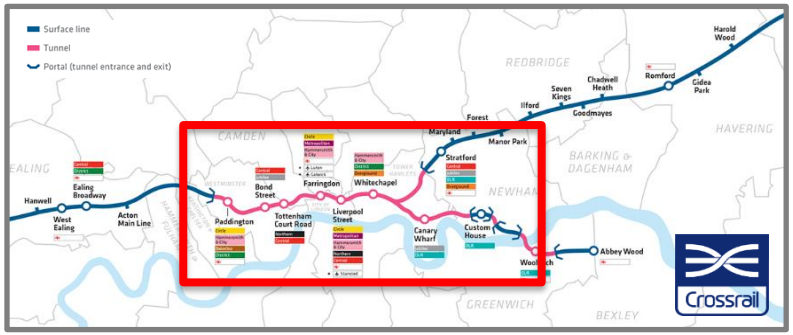
- 2009: Gold Territoria Award: City of Dax (French Minister of Territorial Cohesion)
- 2012: ENI New Frontiers Award - https://www.youtube.com/watch?v=rilHZef5RAo

Adoption Example: SqueeSAR®

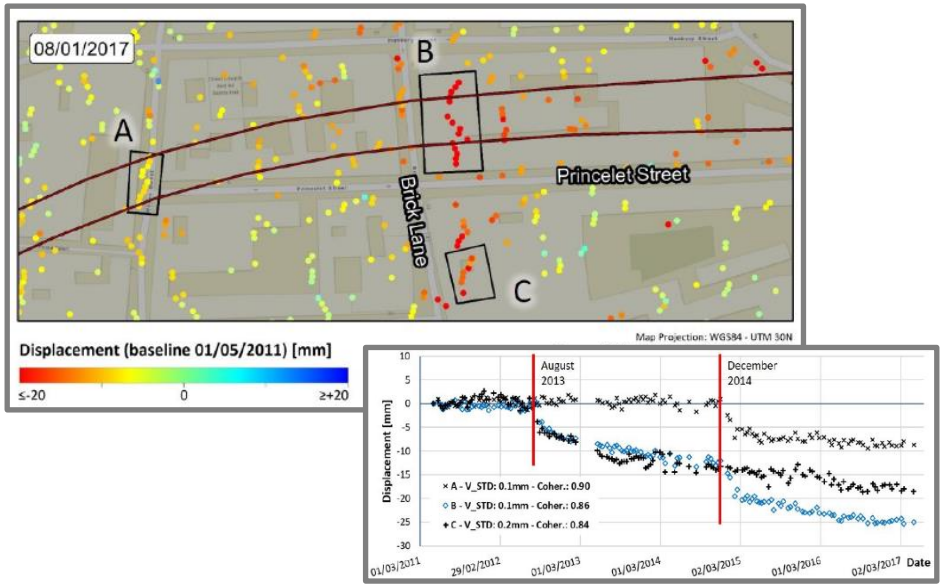
- **Project:** Crossrail New Underground, London
- **Work Process:** 2014 – 2017
- **Function in Project:**
  - Baseline
    - Identify pre-existing instability issues
    - Determine hotspot buildings / areas
  - Monitoring
    - Wide-area & high-density monitoring
    - → “More points for less money” (Client words)
    - Optimise / reduce in-situ instrumentation
    - Validate / compare with in-situ for confidence
  - Post-Construction
    - Long-term settlement / compaction / stability
    - Downsize in-situ monitoring
    - Less personnel on ground



Settlement (red colour) over Crossrail New Underground Line



Crossrail New Underground Line

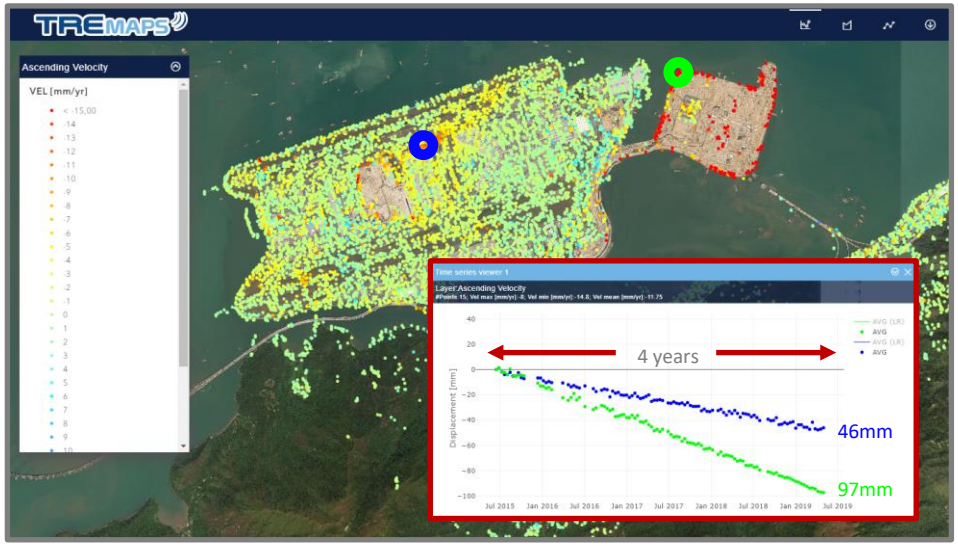


Temporal & spatial onset of ground displacement over underground tunnel

Benefits: SqueeSAR®

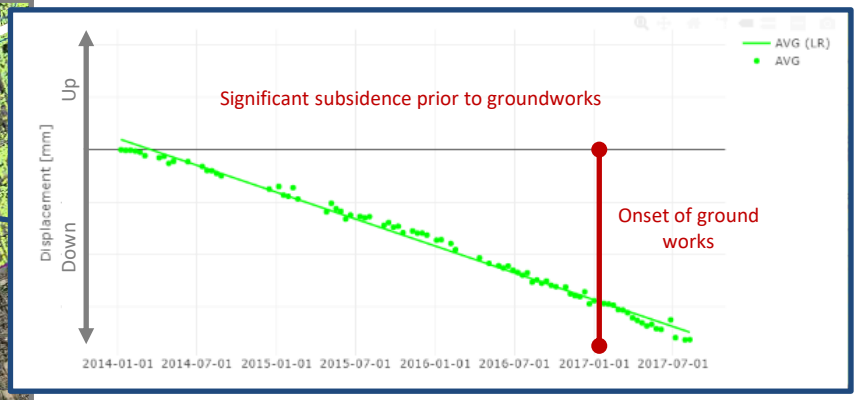
» Boost Productivity

- Accurate detection of spatial and temporal instabilities pre-construction reduces requirement for remedial works
- Reduce in-situ instrumentation (including maintenance, potential human errors and costs) in areas well covered with InSAR data
- Optimise the placement of in-situ instrumentation
- Separate temporal and spatial onset of displacements caused by nearby projects (support for disputes / damage liability)



Settlement over Hong Kong Airport

Historical settlement pre-construction of metro line



Time-series of historical settlement prior to construction

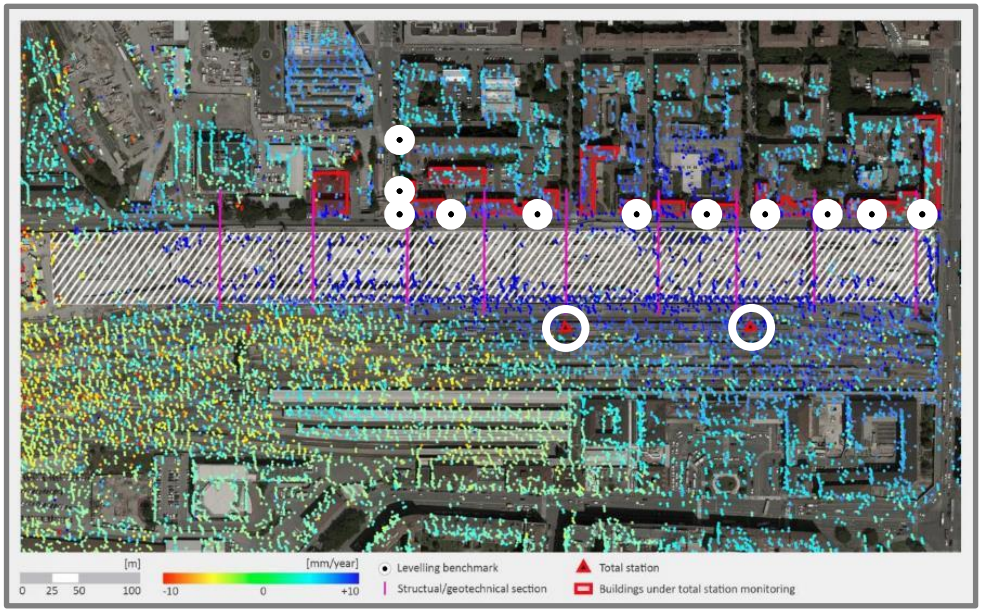
Benefits: SqueeSAR®

» Improve Site Safety

- Complete coverage of groundworks area allows for early detection of out-of-limits displacements and geotechnical zones of influence, minimising risk of unknown (unmonitored) displacements to personnel and damage to buildings and equipment
- Verify data from in-situ instrumentation acquired from different contractors on varying reference planes

» Enhance Environmental Performance

- Early detection of unknown ground and infrastructure displacement through regular and complete site coverage
- Regular monitoring of wide-area impacts of dewatering activities (including impact of changes in aquifer)



Measurement point density comparison: InSAR and levelling benchmarks

InSAR data used to verify in-situ levelling data

Verification of in-situ instrumentation (levelling in this case)