



Pavement Assessment using Mobile Laser Scanning and high-resolution imagery on Flinders Ports, South Australia

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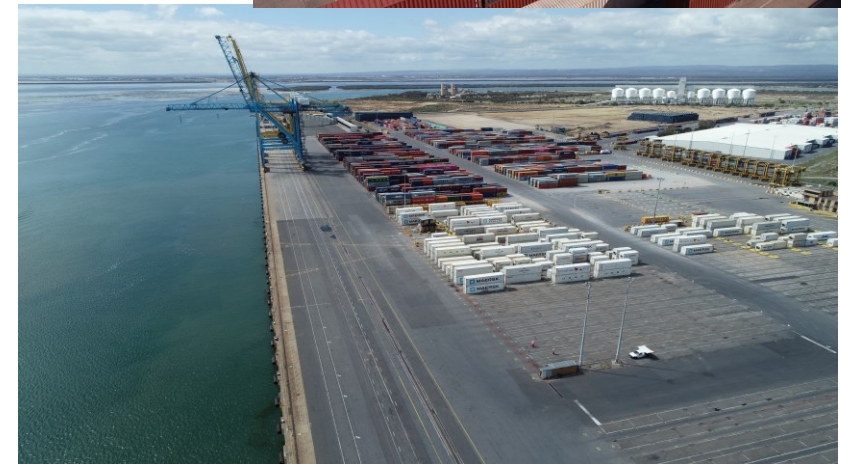
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Flinders Adelaide Container Terminal (FACT) is South Australia's only container terminal. The site has seven direct services that sail every week and one fortnightly direct service; 350,000 – 400,000 containers move through the terminal each year

The terminal operates numerous heavy mobile plant that shifts and manages containerised freight between ships, vehicles and trains.

Critical to the ongoing and efficient operation of the FACT is a reliable pavement suitable for the traffic of heavy vehicles, straddle carriers, mobile plant and storage/stacking of containers.

Heavy investment driving toward a 6 fold increase in volumes over the next 40 years



Aim

- Reduce operational disruption and exposure of personnel to the dangers of a terminal environment
- Provide a comprehensive assessment of current pavement condition and maintenance priorities
- Provide a rich dataset to assist with future planning and projects
- Deliver in a format readily accessible to a range of stakeholders



CLIENT BUY IN

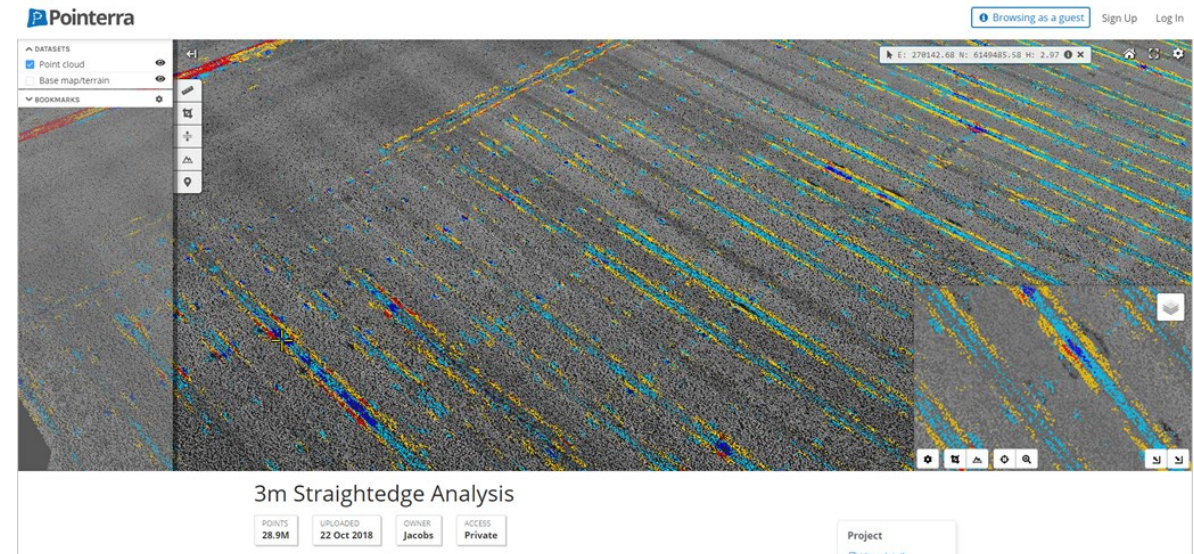


Large amount of work went into clearing vast areas to expose pavements. The client and the FACTS operation team were instrumental in making this a successful project



Challenges

- Operational Logistics – working port with requested minimal disruption
- Critical Timeframes
- Safety – Site works
 - Survey
 - Services
 - Geotech
- Innovation
 - Development of new condition assessment/rating for pavement.
 - The application & use of new technology – MLS/RPA
 - Automated pavement analysis



Legend



Port Extents



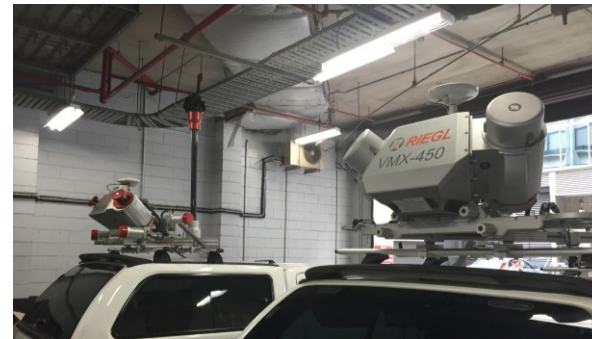
JACOBS® – Who are we?

Global Multi-disciplined Engineering Consultancy (US Based). Business growth through Mergers & Acquisitions.

2014 Jacobs acquires Australian based Engineering Consultancy Sinclair Knight Merz (SKM)

Australia –strong Survey/Spatial capability delivering services across a diverse range of industry sectors for over two decades.

Early adopters of Scanning Technology TLS 2004 – MLS - 2009

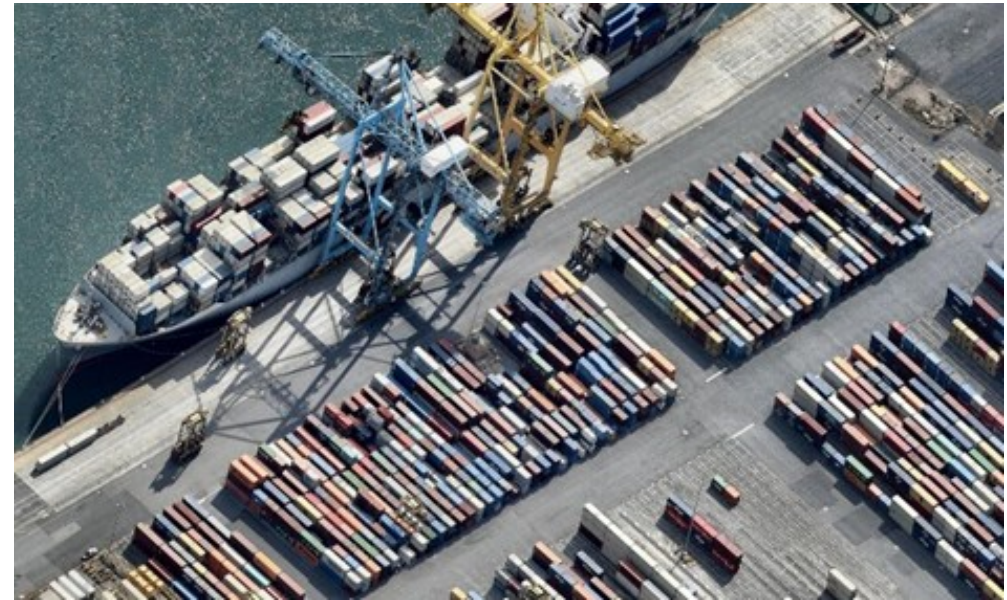


Approach

Applied experience from similar projects to combine cutting edge mobile laser scanning technology and orthorectified imagery (to produce a detailed 3d model of the container terminal).

A virtual site inspection was conducted on the resultant, rich data set. Defects were heat mapped using a digital straight edge, pavement slope, and semi-automated photogrammetric crack detection.

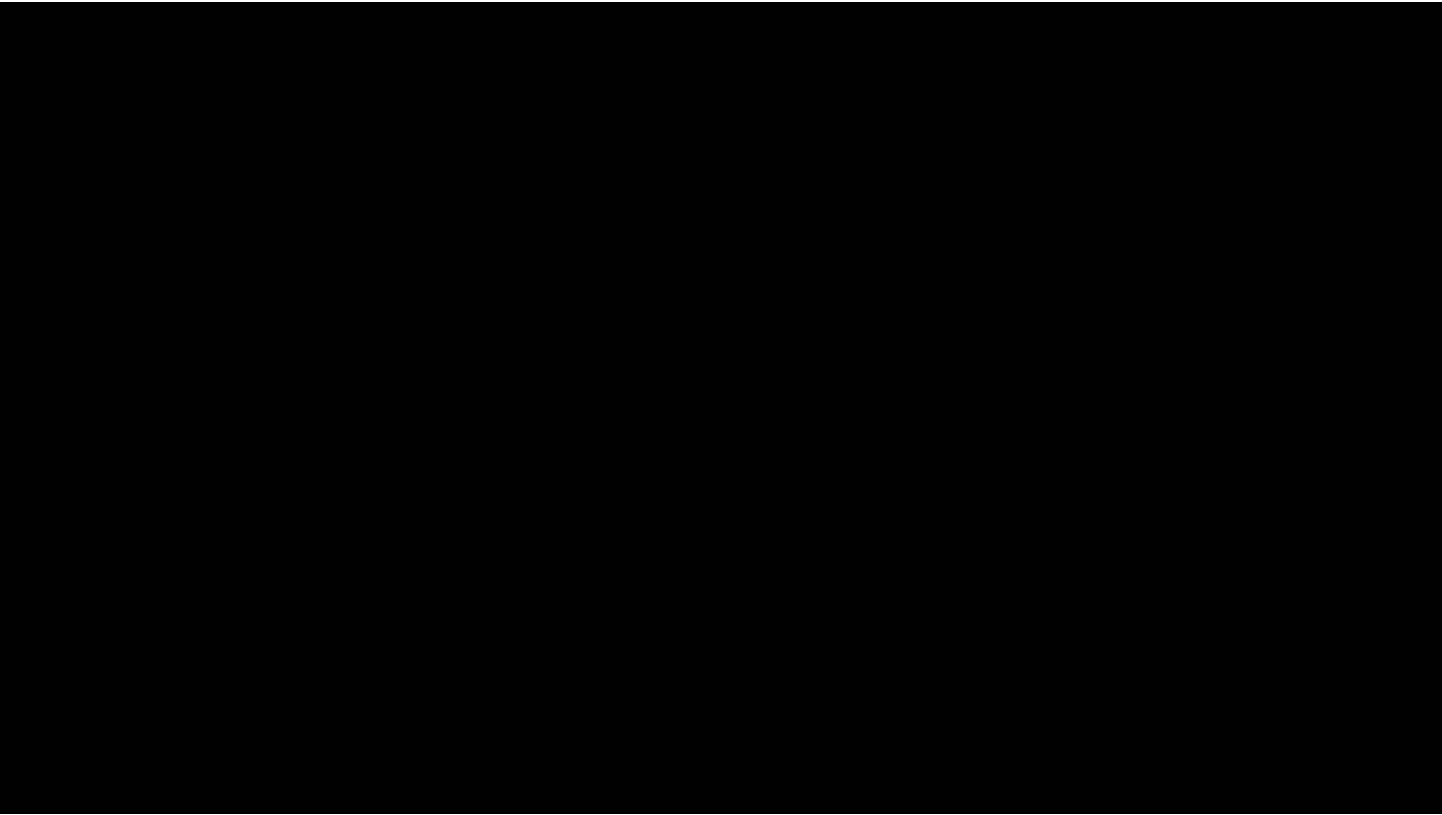
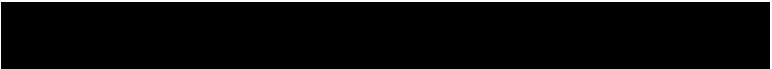
Major defect classes present in the pavement were identified, classified and prioritised for rectification.



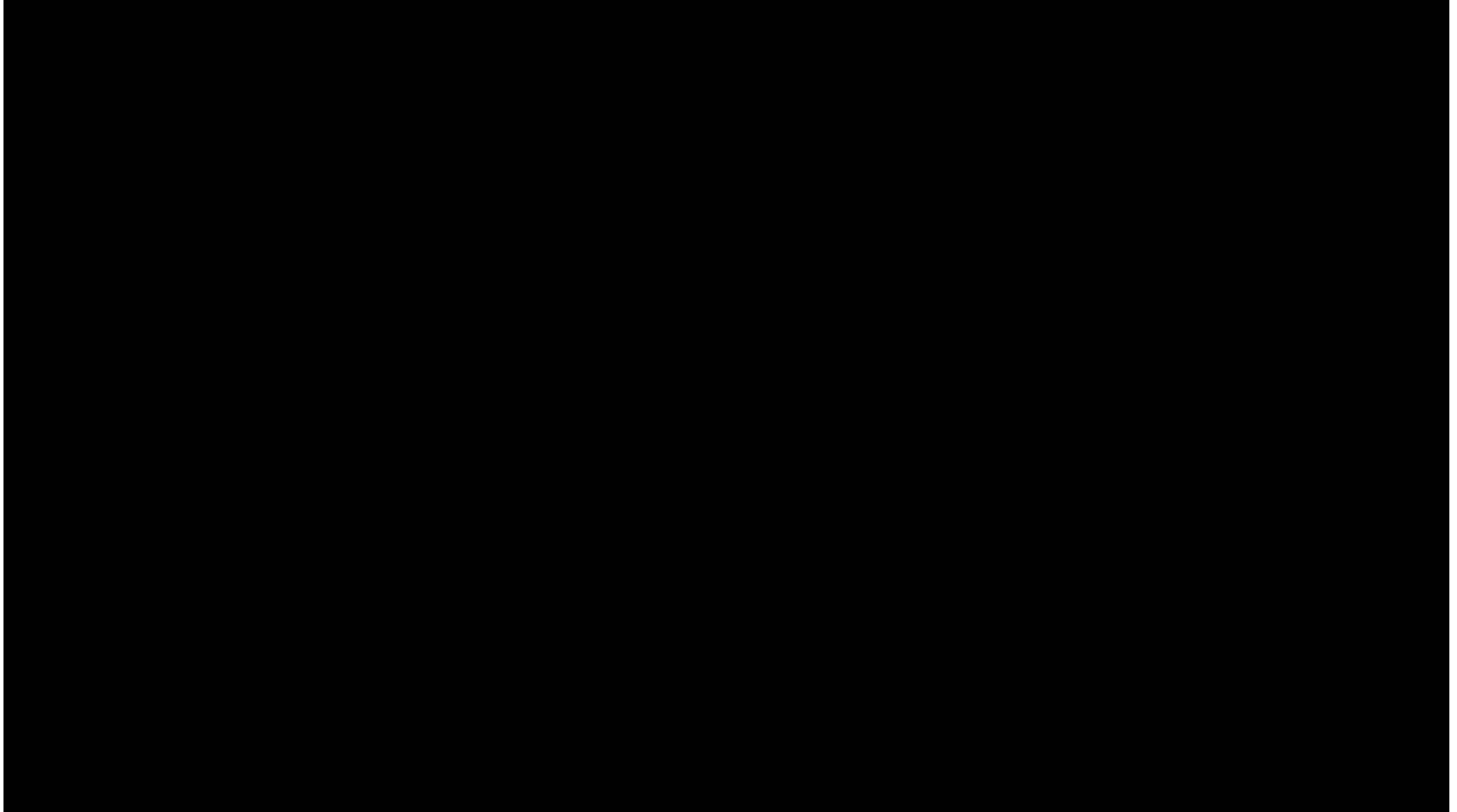
Detailed Methodology

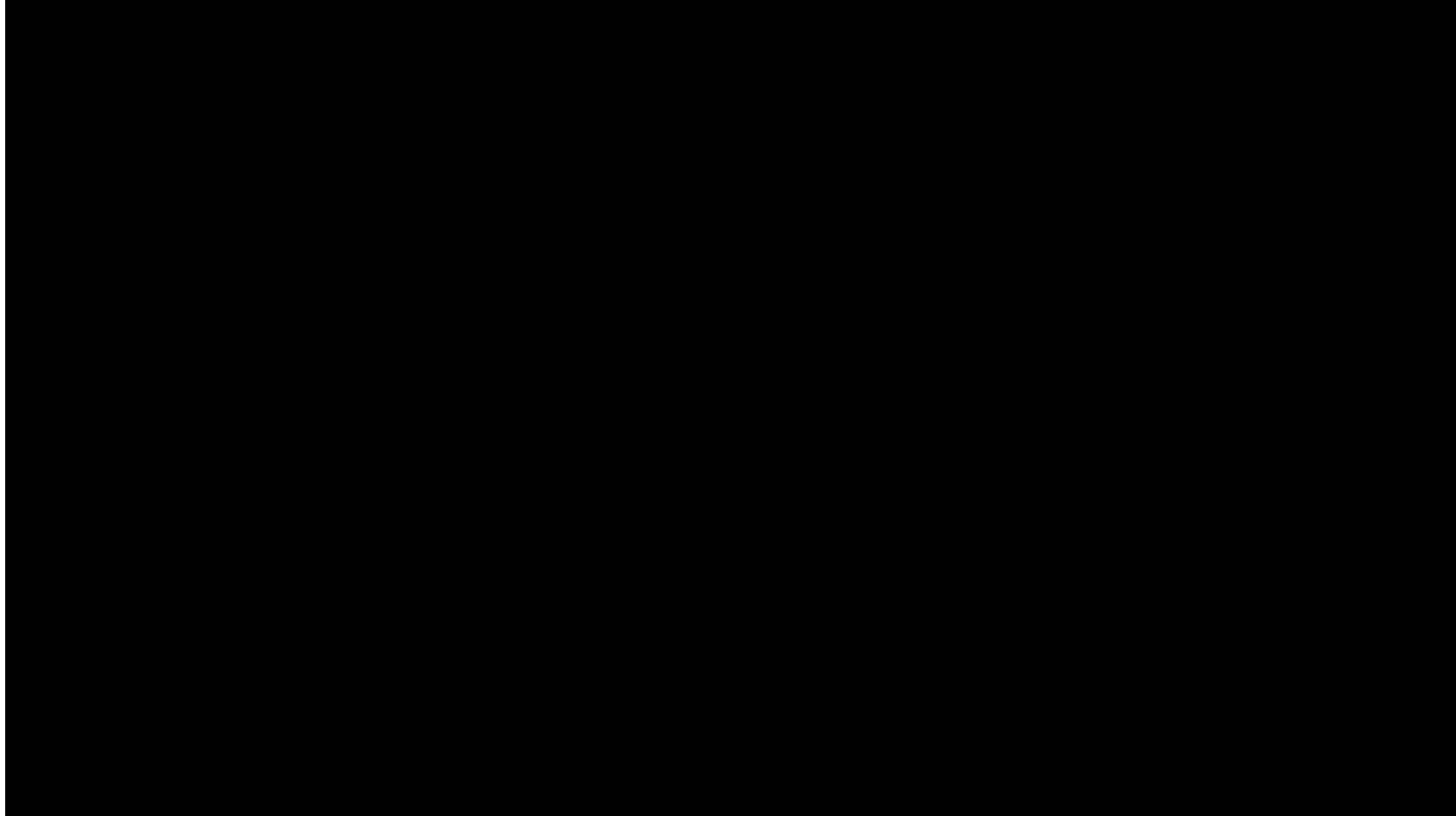
1. Primary Control Survey
2. Data capture
 - Utilise Mobile Laser Scanning
 - Use Remotely Pilot Aircraft (RPA) for image capture
3. Process data captured
4. Analyse the data
5. Deliver the data (internal/external)
 - web ready



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- Establishment of control framework to support and underpin data capture and analysis
 - Undertaken during operations to minimise disruption to operations
 - Utilising the light road which provides access to the majority of the port
 - Critical part of the task to ensure successful analysis is possible









- High Density cloud required (horizontal & vertical) – Single pass
- Data capture over multiple weekends challenges timeframes
- Massive amounts of data – LAStools to classify (ReShaper doesn't like big clouds)
- Validate and check (manual)



- Different RPA used during capture
- Data capture over multiple weekends – cant process until the end
- Small overlap in areas between weekends (containers shifted) often only roads available to match
- Lots of image cropping and editing to get the output



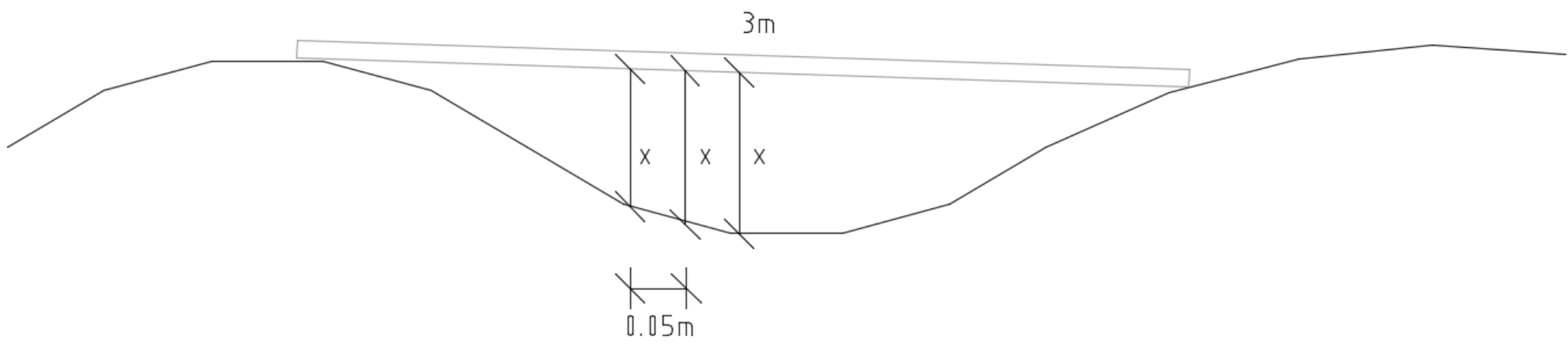


FIGURE 1

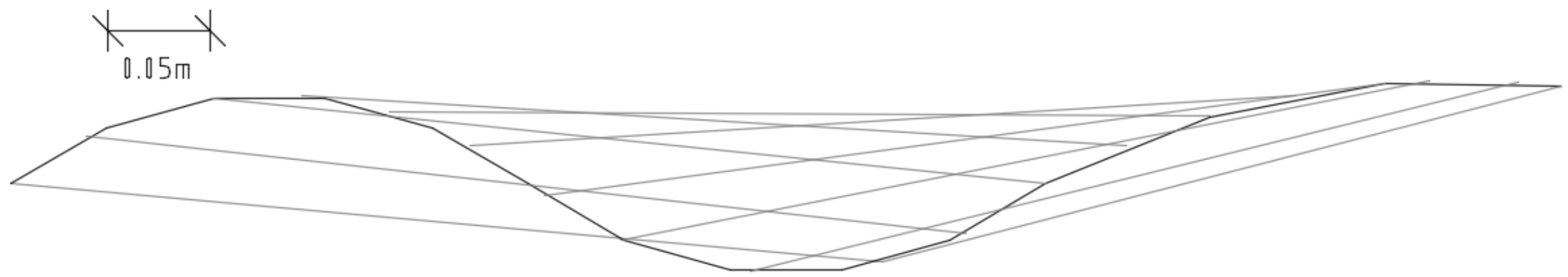


FIGURE 2



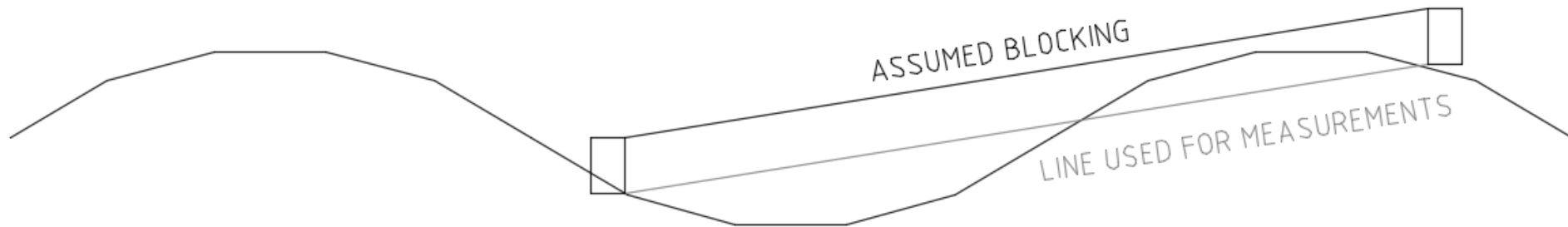


FIGURE 3

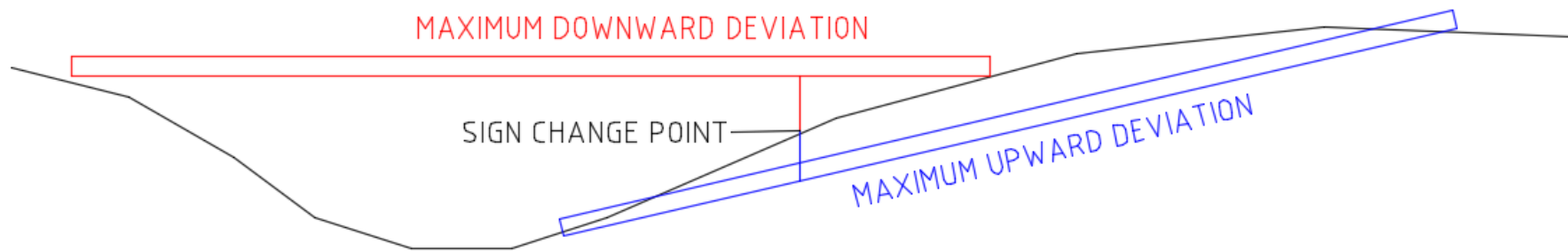
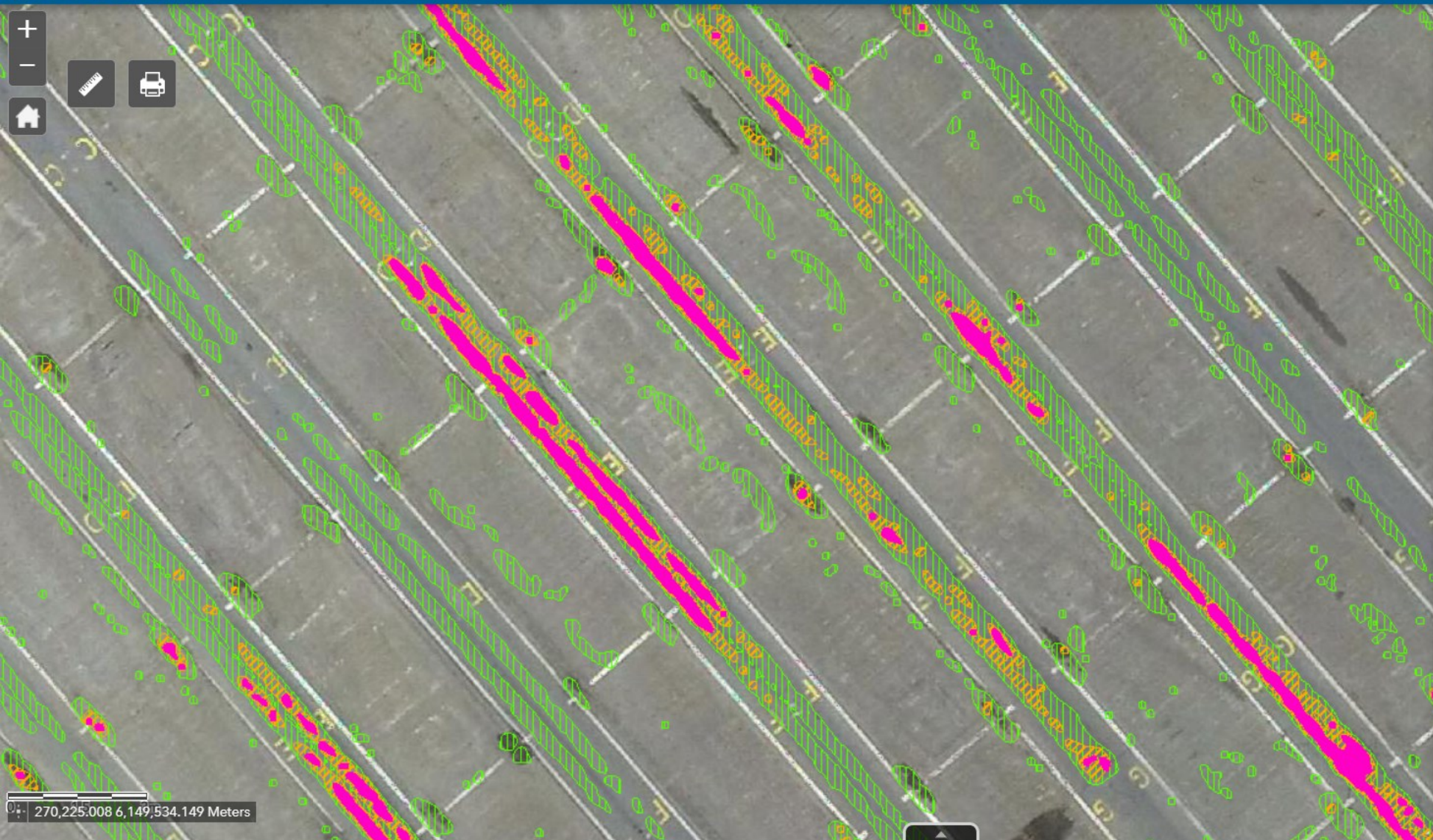


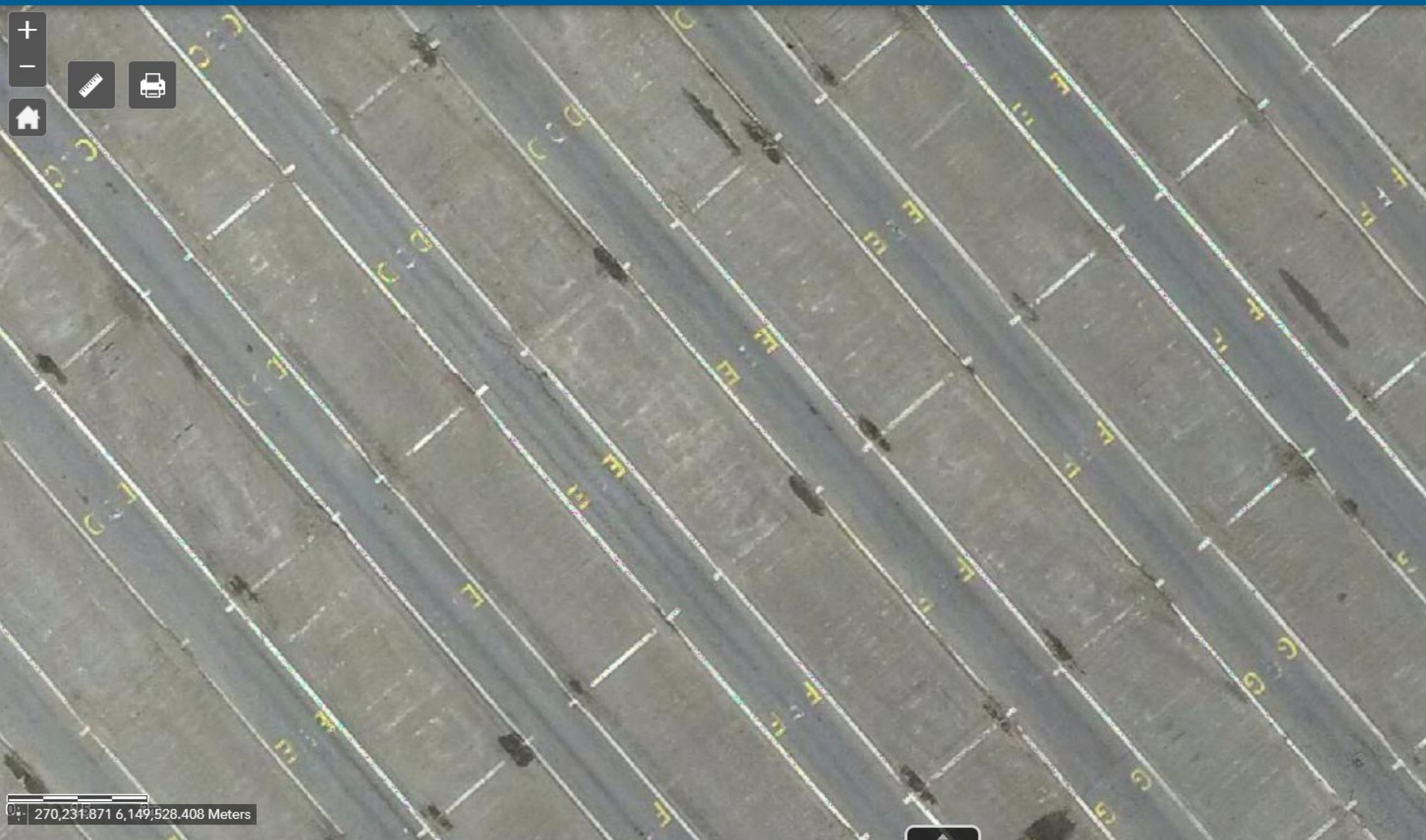
FIGURE -4





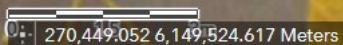
Layer List ⌵ ✕

- ☐ Geotechnical Survey Locations ...
 - Geotechnical Survey Locations
- ☐ Condition Rating Boundaries - bays ...
 - ☐ Condition Rating Boundaries -bays
- ☐ Condition Rating Boundaries - other ...
 - ☐ Condition Rating Boundaries - other
- ☐ Pavement Condition Rating (Detail) - bays ...
- ☐ Pavement Condition Rating (Detail) - other ...
- ☐ Pavement Condition Rating (general) - bays ...
- ☑ Heatmap ...
 - ☑ Negative 25mm ...
 - Negative 25mm
 - ☑ Negative 20mm ...
 - ▨ Negative 20mm
 - ☑ Negative 10mm ...
 - ▤ Negative 10mm
- ☐ Coarse Deformation ...
- ☐ Elevation [m] ...



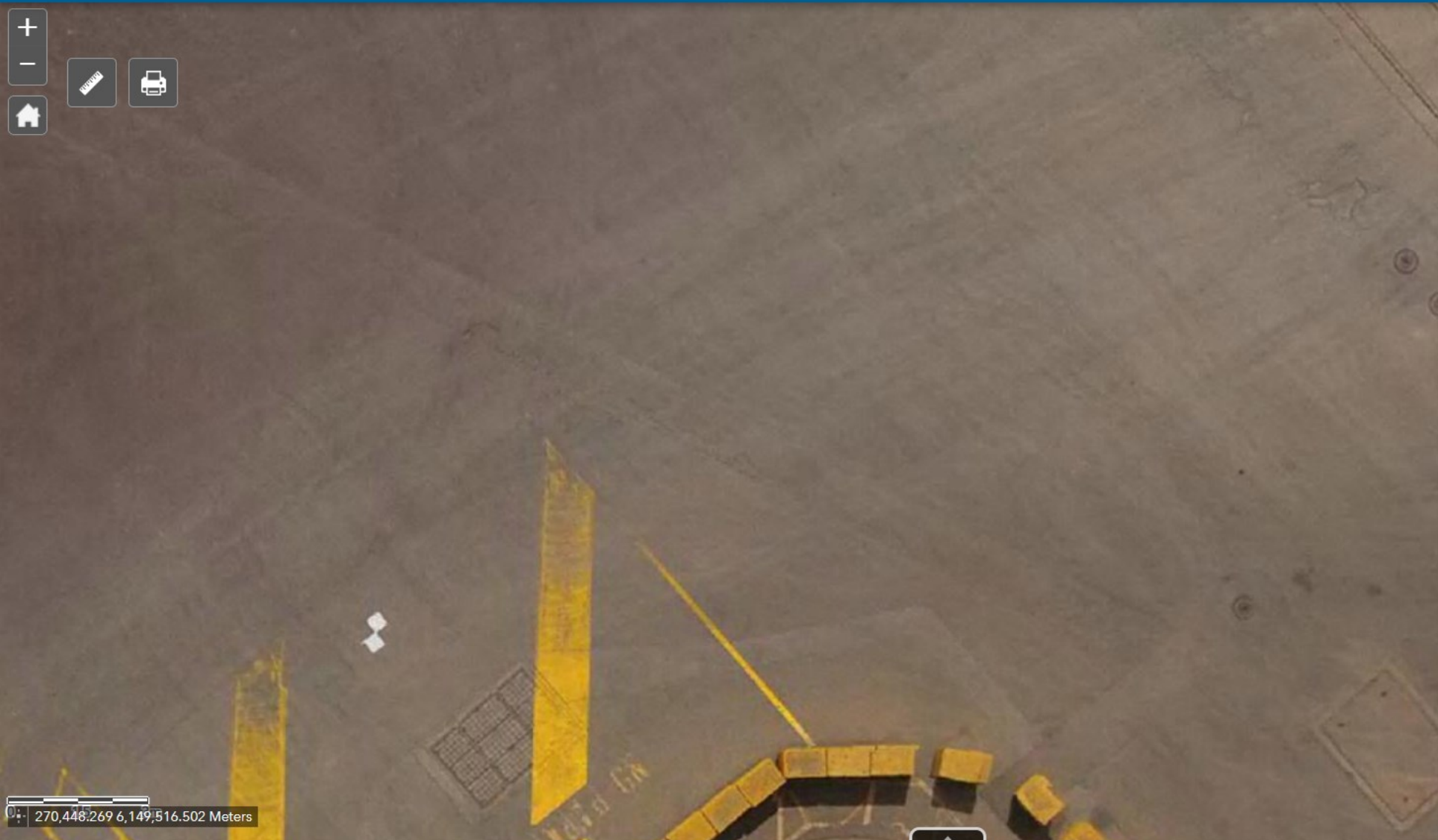
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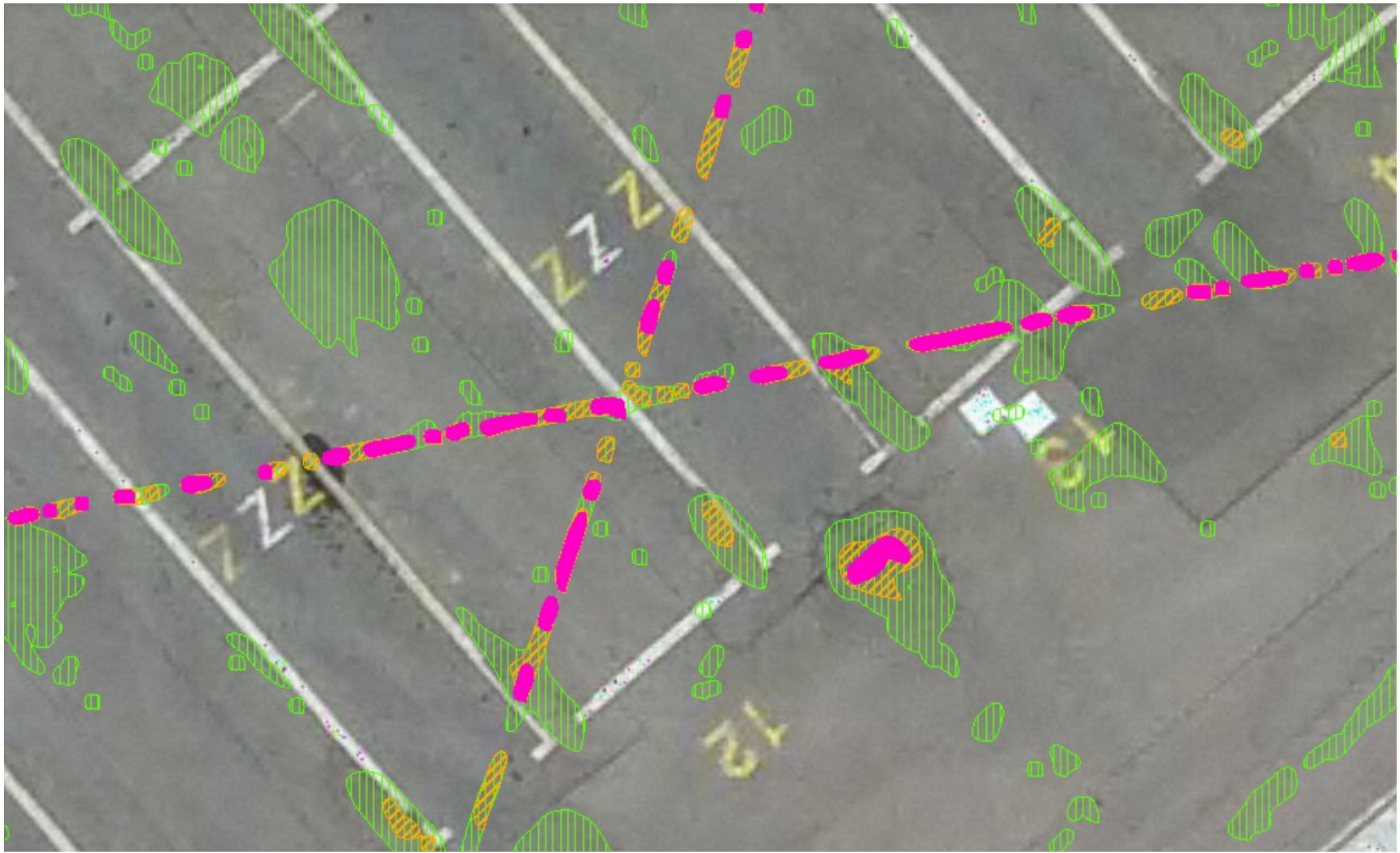
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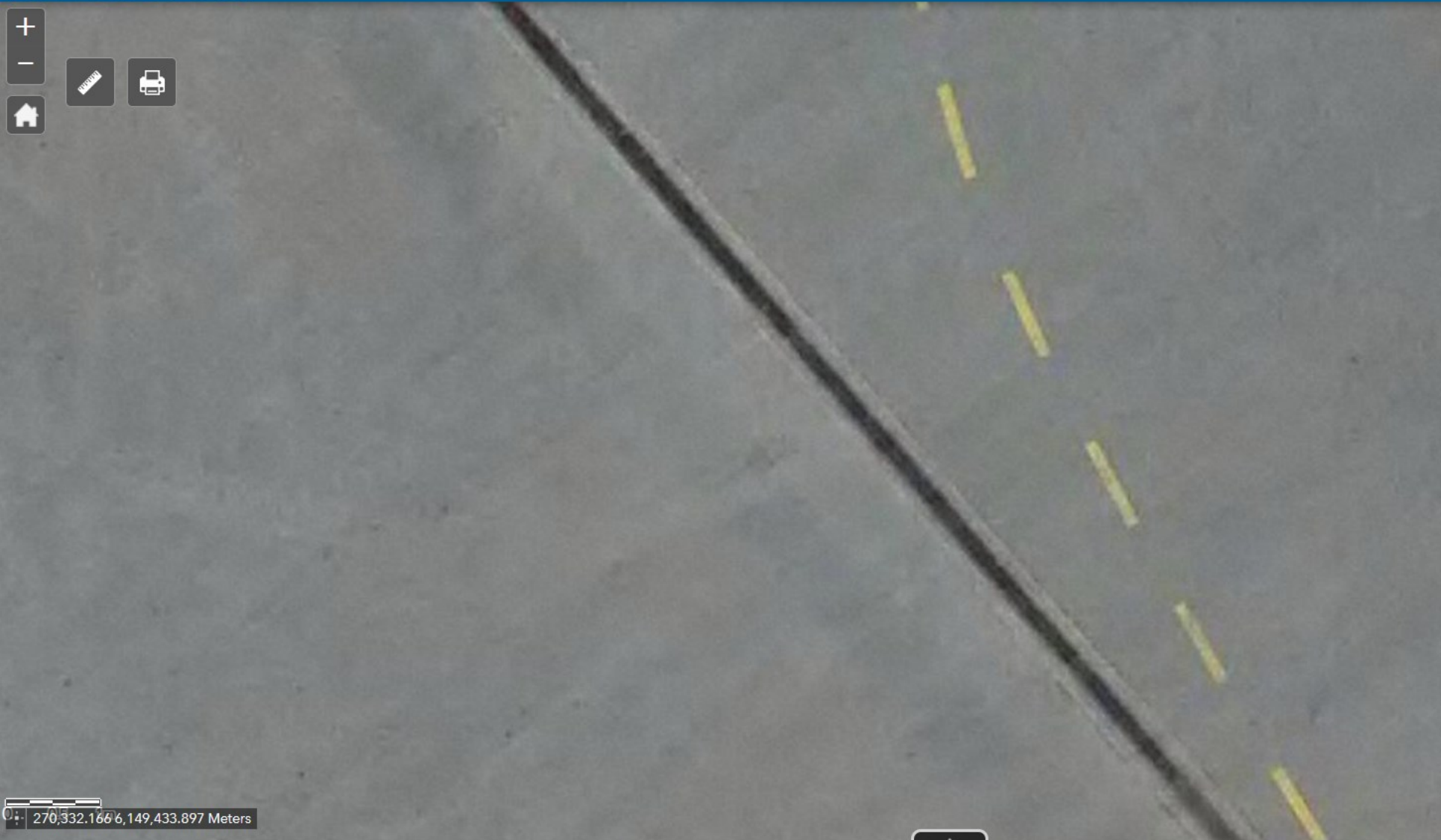
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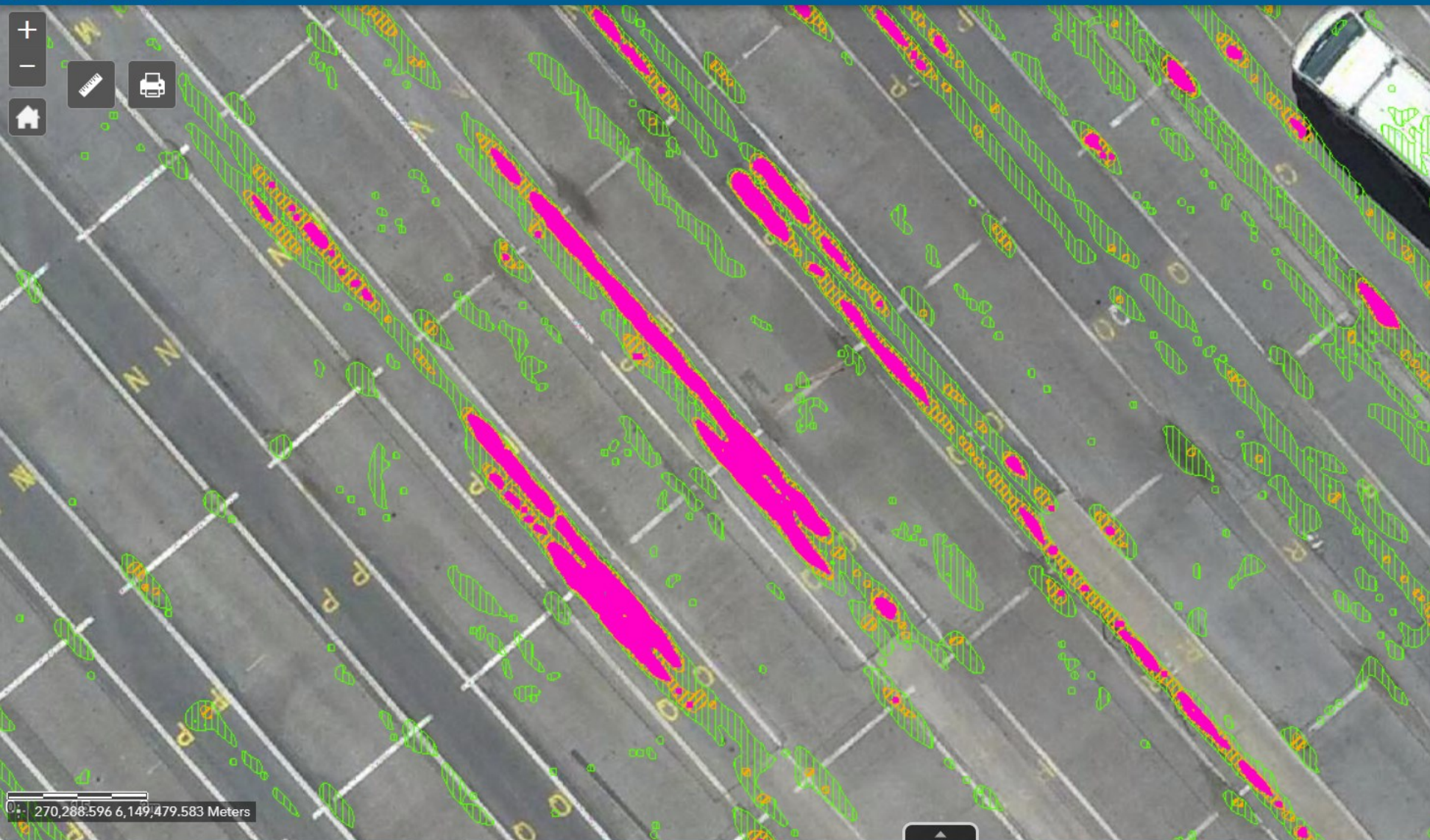
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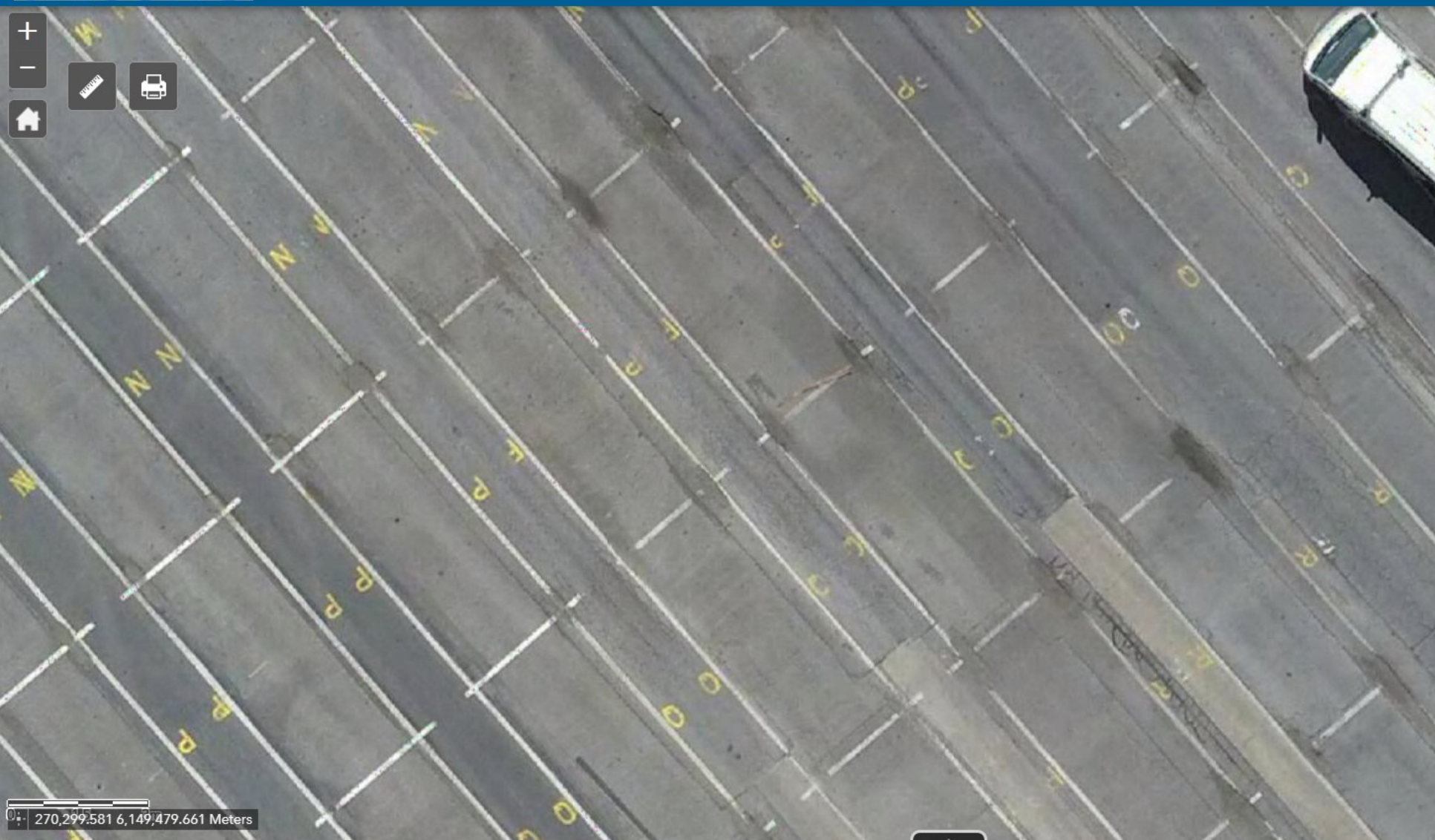
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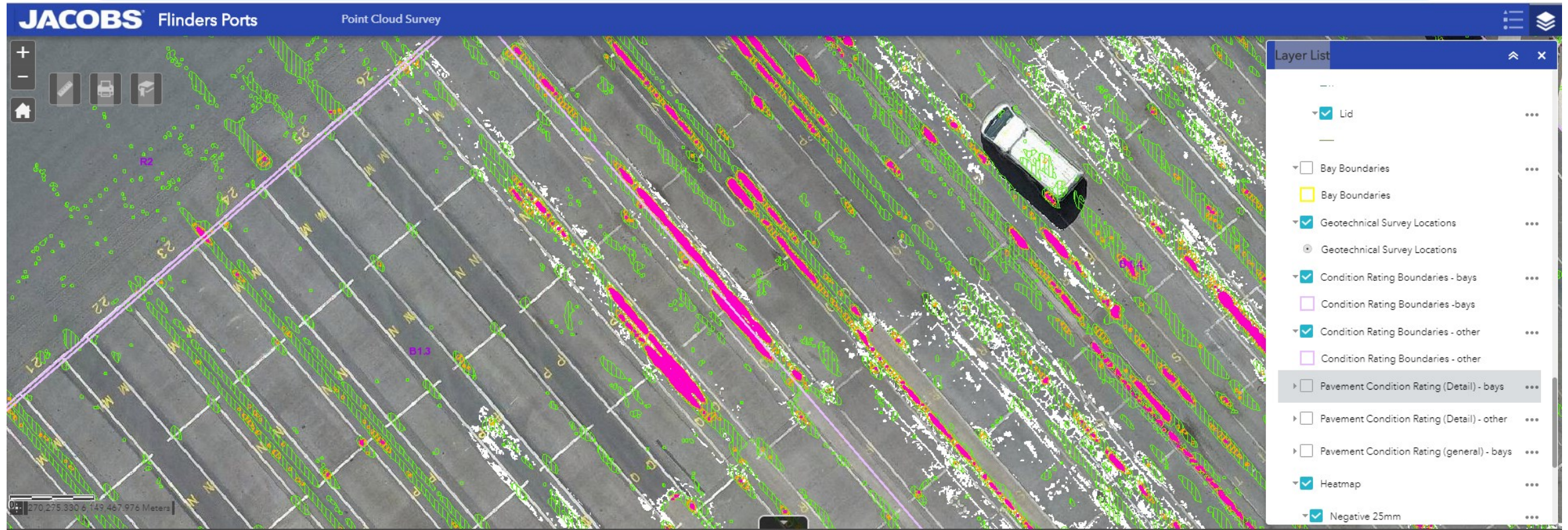
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- Internally (within JACOBS) the data was extremely useful, it help Geotech engineers target locations. Gave the pavement engineer lots of data to analyse
 - The client was able to make informed actionable decisions from a holistic analysis
 - Has large amount of additional uses – entire feature survey can be extracted at later timeframe. A single dataset to refer to at a point in time

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- Crack Analysis using photogrammetry and AI – Further refinement

