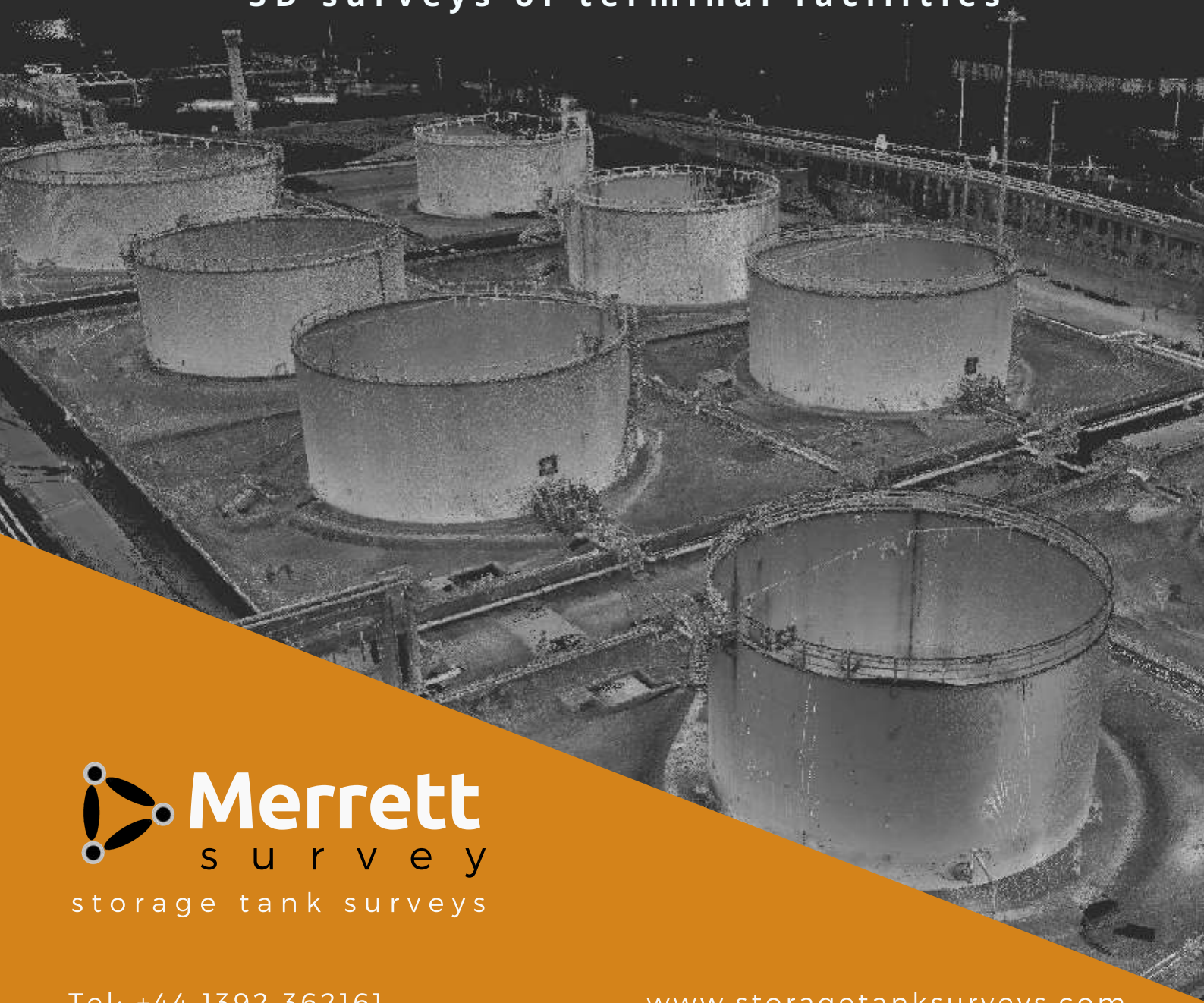
STORAGE TANK SURVEYS

Working to API, ASME & ISO standards
Tank wall deformation
Tank tilt/verticality
Out of roundness (ovality)
Tank calibration tables
Bund containment volumes
Peaking and banding
3D surveys of terminal facilities



Merrett survey
storage tank surveys

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MERRETT
SURVEY LIMITED

Storage Tank Solutions

About us

Merrett Survey put forward innovative ideas and use the latest technology to measure and calibrate tanks of all shapes, materials and sizes, above and below ground. We survey tanks that hold crude oil, refined petroleum products, LPG, LNG and other wet or dry bulk products.

Specialised analysis

We specialise in analysing storage tanks and provide highly accurate strapping tables, shell deformation analysis, surveys for tank bottom and foundation settlement, shell roundness, structural column verticality, and more.

By providing a geometric evaluation of the tank in its current state, we can provide 3D models and layout drawings of the floor, shell, roof structure, and attached infrastructure. This data can assist with assessment of tank integrity, risk analysis, design of floating roofs to ensure they fit, and much more.

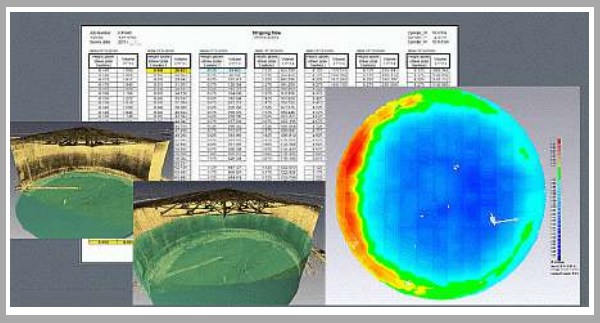
Using the latest technology

Laser scanning is fast and safe. Our scanners can record up to a million points per second and does not require temporary scaffold to be erected.

We can also capture imagery on site, this visual information provides a record of areas surveyed and could be used for monitoring or for Q/A of work carried out.

Laser scanning allows us to survey the entire tank shell for deformation rather than by surveying a limited number of discrete points. Our methodology meets and exceeds current API and ISO standards.

Comparisons of millions of points between 2 scans over an extended period can monitor movement and highlight areas where change has occurred. Closer inspection or repairs could then be undertaken on the specific areas of concern to avoid costly failures and potential loss of assets.



Strapping tables, tank floor assessment & more...

We use the latest surveying technology

Comprehensive 3D modelling for accurate volumes

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Calibration Tables

High Standards

Our storage tank calibration services are designed to meet (or exceed) the standards published by the American Petroleum Institute (API) or by the International Standards Organisation (ISO).

Volumetric tables can be customised according to your requirements and we can analyse tanks of all shapes, sizes and materials.

We can create the strapping tables using conventional survey equipment, or we can create them using the latest laser scanning instruments.

Accurate and Complete

Laser scanning can provide a more complete survey for creating highly accurate strapping tables. Volumes are derived from comprehensive data across the whole tank wall and floor, and all internal deadwood is taken into account. Gain a clear understanding of the precise capacity and volume of your tanks with accurate calibration.

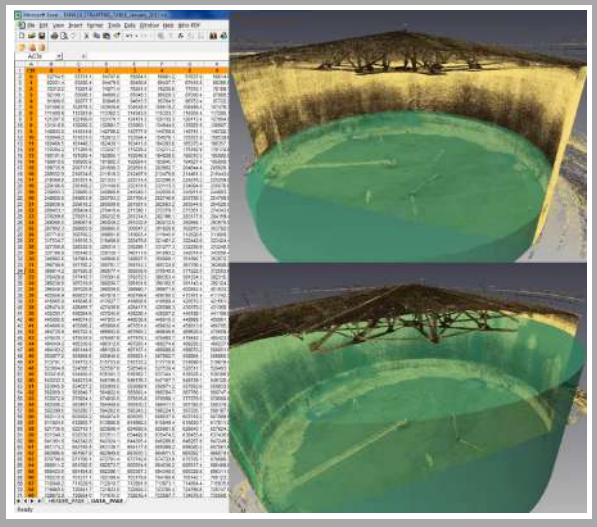
Once the tank has been scanned, the data can be used to report on the tank floor settlement, assess tank verticality, and can be used to measure deformation of the tank shell.

Worldwide Survey Service

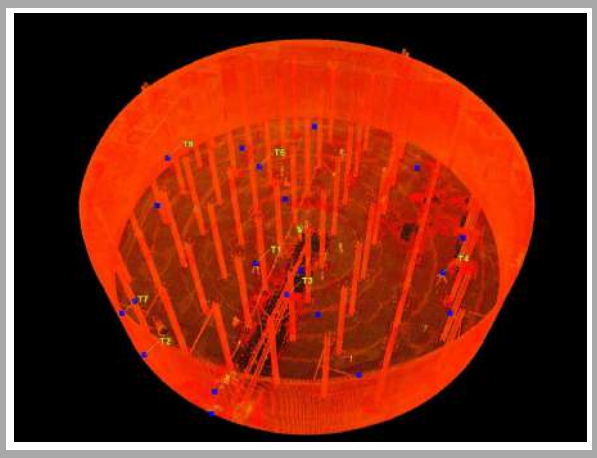
Merrett Survey work worldwide and have worked in over 50 countries. Our tank strapping services are available on a global basis for:

- Bulk storage tanks
- Barge and ship's cargo and bunkering tanks
- Survey above and below ground tanks
- Survey of new and existing terminals

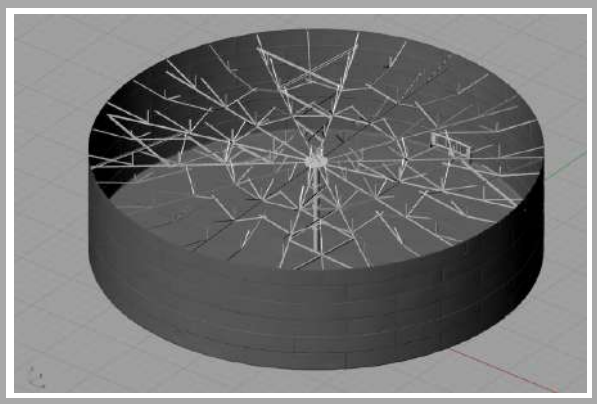
Our bespoke software, developed specifically for creating tank volume tables facilitates the creation highly accurate strapping tables. For high value products, it pays to have accurate volumes.



Accurate strapping tables



Laser scan data coloured by intensity of an underground storage tank. The yellow targets are used to join the scan positions together



Comprehensive 3D modelling for accurate volumes

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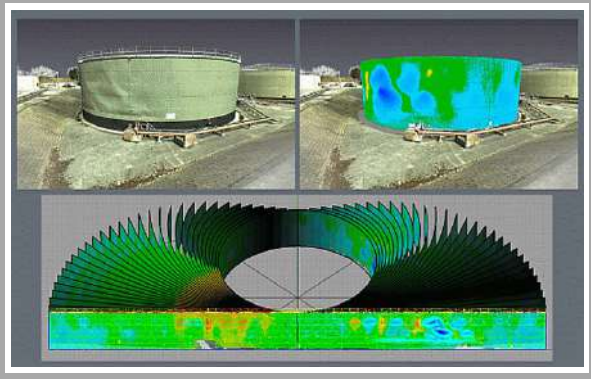
Out of roundness & shell deformation

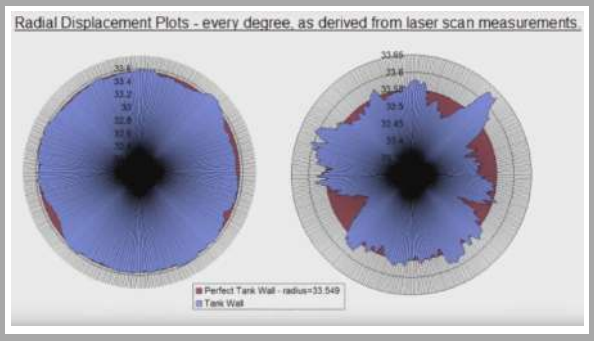
Storage tanks require periodic surveys to monitor long and short-term movements, settlements of the foundation and other deformations such as tank shell deformation due to hydrostatic pressure. In the case of a floating roof tank, the roof rim tends to go out of shape which can hinder movement of the floating roof due to uneven foam seal gap.

With one survey, we can report on the out of roundness, tank tilt, peaking and banding, plus tank floor settlement.

We can also report on tank verticality, and can measure deformation of the tank shell from either the outside or the inside of the storage tank. This data can also be used to analyse peaking and banding across the whole tank surface and not just the locations an operator can reach.



Deformation maps show variation within the tank shell



Exaggerated radial displacement plots show the out of roundness of the tank shell

Tilt and subsidence

We can monitor for subsidence in crude oil storage tanks by the method of precise levelling and laser scanning. With comprehensive laser data across the entire tank wall we can see if the tilt on the tank is uniform or is creating stress in different areas of the tank base or tank wall.

Tank floor edge & bottom settlement

The weight of liquid pressure exerted on the tank bottom can cause the tank bottom to subside which can cause edge settlement and make the tank tilt. We can produce contour maps and deformation plots of the tank floor.

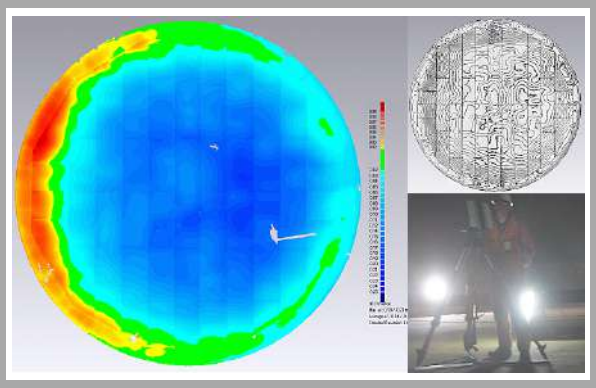


Image showing tank floor edge settlement

Bund capacity

The Control of Pollution Regulations 2001 (Oil Storage, England) require that secondary containment bunds have the capacity to contain a spill or leak in the event of a failure. Our surveys confirm that the bund is able to hold the required 110% of the maximum capacity of the largest tank or drum. We can compute the bund capacity and our data can be used to model spill scenarios.

If the survey is extended beyond the bund, we can examine the route pollutants may take to a watercourse in the event of a failure.

Visualisation of jetting failure for oil spill analysis

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Modelling complex plant

New terminals

We can apply a variety of surveying technologies to provide topographical survey of green field sites prior to development of a new terminal. This includes aerial lidar, aerial photogrammetry (including low cost UAV technology), & conventional ground based survey.

For shore based terminals we can add seabed survey using bathymetric & hydrographic methods, plus detailed surveys of existing berths & jetties using laser scanning methods.

Existing terminals

For expansion of existing terminals we can add laser scanning and 3D modelling for pipeline tie-ins to existing plant.

Maintenance of existing plant is enhanced by accessing asset management data via a 3D model of the site. We can generate P&IDs, produce as-built CAD drawings where records or plans have been lost & provide BIM modelling.

During development of the UK's latest container terminal (London Gateway), we surveyed the river Thames inter-tidal zone for DP World. Aerial Lidar and satellite imagery, ensured that they could comply with their Environmental obligations to ensure there were no detrimental affects during the deep channel dredging.

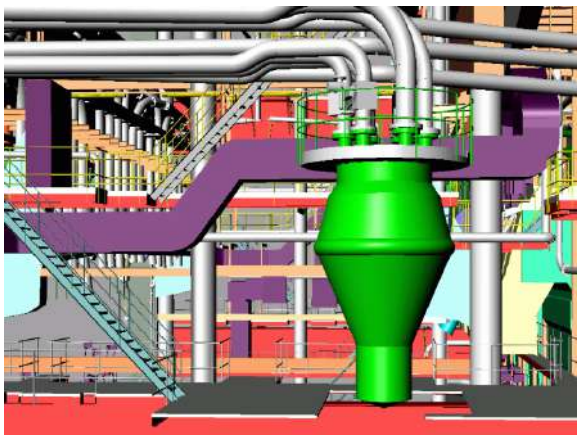
BIM, P&ID's, isometrics & GIS

We can generate 3D models of the entire tank, including complex roof structures, floor, shell and apertures. These models can aid in designing floating roofs or replacement floors or any other engineering modification.

Complex plant modelling of terminals and associated infrastructure can be carried out. Maintenance of existing plant is enhanced by accessing asset management data via a 3D model of the site. We can generate P&IDs and re-engineer as-built CAD drawings where records of design plans have been lost.

Laser scan of storage tank terminal coloured by panoramic HDR imagery taken on site

3D BIM visualisation of storage tank installation



Modelling complex plant and pipework

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Retrofitting

Our surveys provide complete and accurate as-built models of tanks and plant features. This data allows for engineers to create better retrofit designs, improve off site fabrication and reduce costly on site modification.

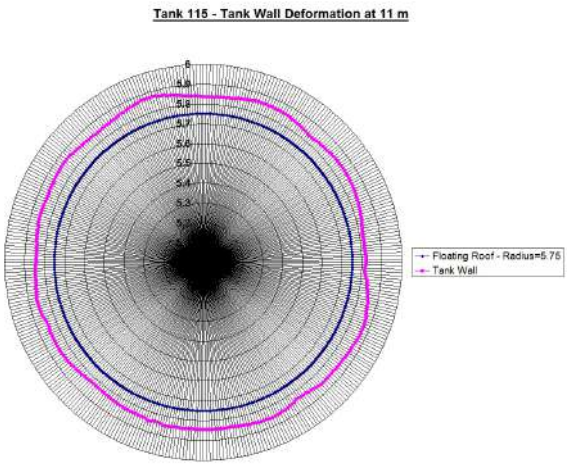
Internal Floating Roof (IFR) case study

Our client required us to determine if an Internal Floating Roof (IFR) design would fit inside the storage tank.

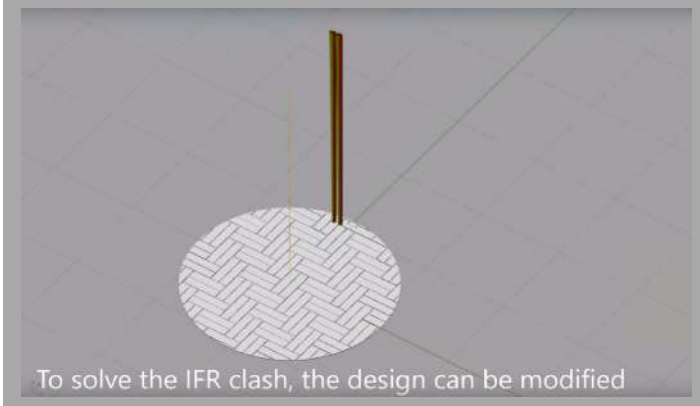
An accurate 3D mesh model of the storage tank was created from the survey data. A tank roof model was created and inserted at the centre of the tank. The result showed that the floating roof model clashed with the meshed tank wall.

For this tank - the precise measurements from our survey showed that it was still possible to install the IFR, but with some precision engineering adjustments. The stilling wells would have to be raked to ensure smooth IFR travel.

The tank floor was also scanned and meshed, the location of the stilling tubes and anti-rotation kits could be plotted, thus allowing the engineer to see the slope of the floor in the location at which the components were to be installed.

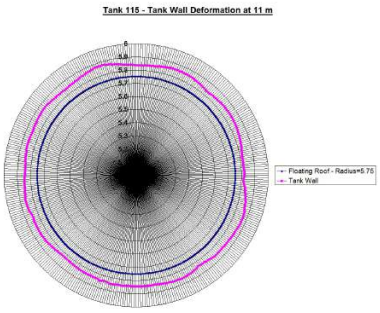


A comprehensive analysis of the proximity of the IFR to the tank wall was provided and engineering drawings were updated to show floor flatness.



Deformation maps

Deformation maps can be produced that show the radial displacement in the shell of a storage tank. The advantage of the deformation map is that the entire tank shell can be analysed and the maximum areas of deflection can be easily identified.



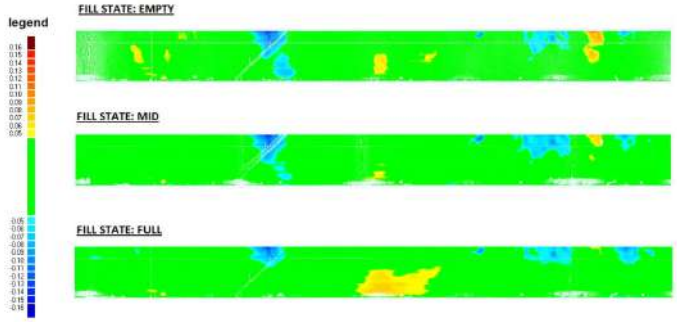
The data can also be presented as a radial displacement plot.

Out of roundness case study

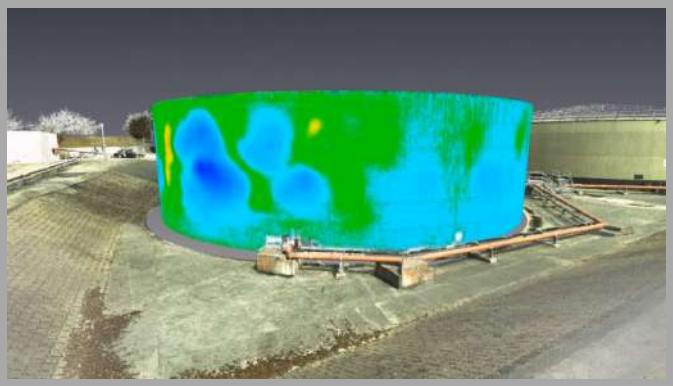
Our client required us to survey a number of storage tanks in Nigeria at different stages of fill to analyse the effect that oil pressure was having on the tank shells.

In the image below, the position and extent of deformation, and also its numerical expression of shift or bulge of the steel casing can be seen. Localization of the extent of deformation as well as identifying errors of welded joints is relatively easy. The colourisation in the image below show inward deformation in blue and outward deformation in red. Green represents a nominal range where no deformation has occurred.

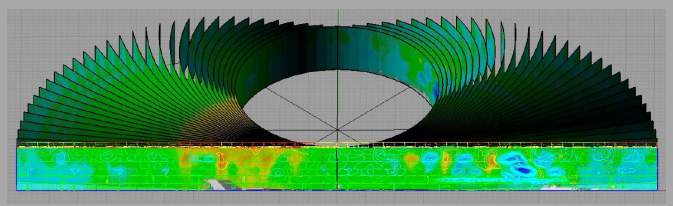
In the full state, outward deformation has increased and inward deformation is reduced. Tilt, subsidence & verticality analysis were also carried out at the different fill states.



Dents visible in the tank shell needed to be quantified



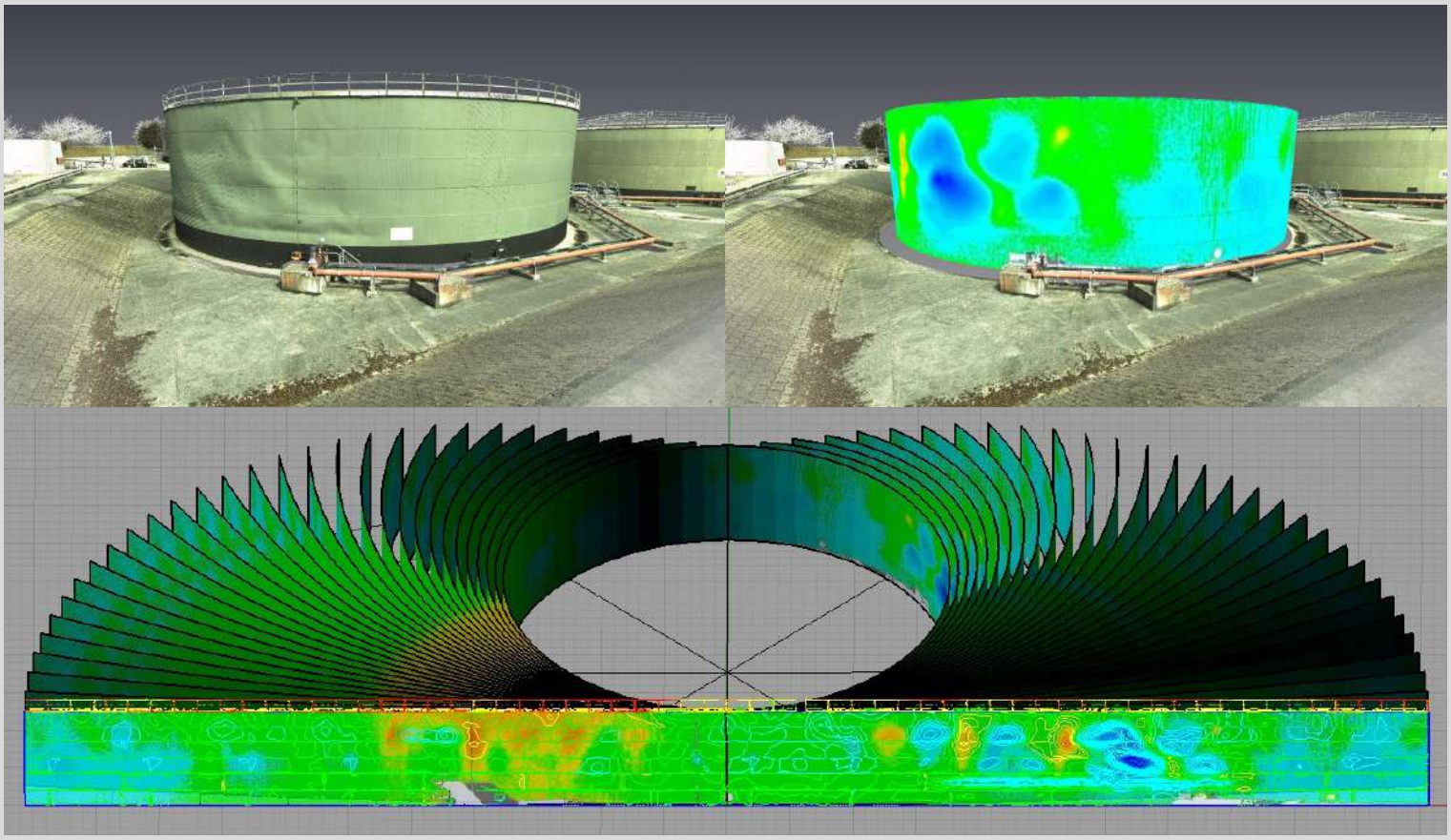
Further to the survey, the tank was decommissioned due to the extent of the radial displacement in the tank shell



In order to determine the deformation of the wall of a tank, we compare the radial displacement of the surveyed points to the tanks 'design radius'. Each surveyed point is assigned a value using it's distance from the centre of the tank, which we compute by best-fitting a cylinder to the point cloud.

Each surveyed point's 'radial distance' is compared to the theoretically correct 'radial distance'. For the purposes of presentation we 'unfurl' the data so we can present it as 2D - see images above.

The colourisation in the above images show inward deformation in blue and outward deformation in red.



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