# Historic railway gets back on track

A Modern survey technology has been applied to assess the safety of derelict railway tunnels and collect data for rehabilitation planning.

Wingfield Scale & Measure is applying cutting-edge 3D spatial data collection methods and modelling software to assess the safety of derelict railway tunnels in Pennsylvania, USA.

The East Broad Top Railroad (EBT) National Historic Landmark is the oldest surviving narrow-gauge railroad east of the Rocky Mountains. The EBT non-profit foundation is dedicated to restoring and preserving 27 miles of rail lines, six steam locomotives, a roundhouse, rail and engine manufacturing shops, as well as passenger and freight cars.

Since 1937, Wingfield Scale & Measure has been a leader across the USA in the industrial scale and weighing systems industry. The Tennessee-based business expanded into bulk inventory measurements in 2013 using terrestrial laser scanning.

EBT approached Wingfield to assess rehabilitation possibilities for tunnels that had been bored in 1874. The Sideling Hill and Wrays Hill tunnels had not been used since 1956 when the rail line closed. Structural conditions were a significant safety concern, preventing access for traditional inspection methods.

Autonomous data collection was determined as the ideal approach to safely and effectively map the tunnels before initiating rehabilitation efforts.

Wingfield used multiple data collection methods over one field day to capture 106 GB of raw data. Efficient data capture and post processing techniques delivered high quality verified 3D models of more than 2000 ft of inaccessible tunnels to EBT.

Aerial LiDAR, Maptek™ SR3, FARO S350, Emesent Hovermap, DJI M300 drone and Spectra Precision GPS were all used. The collected data was combined into a single dataset in Maptek™ PointStudio™ where the final deliverables were produced.

Wingfield Senior Engineer James Kenney said that autonomous UAVs made it possible to collect high calibre data, and PointStudio brought the best out of that data.

'The robust filtering, enhanced visualisation and modelling options allow the mapping team to check data quality and coverage to ensure accuracy and note areas of interest,' Kenney said.

Proprietary workflows combine lidar and photogrammetry platforms to optimise field data capture and enhance the overall deliverables.

> Autonomous mapping systems delivered new data for several locations that had not been accessible or lacked 21st century documentation.

The data captured aids in the rehabilitation and planning for future work. Remote mapping provides a higher level of safety by removing personnel from potential risk.

'Safety should always be at the forefront. The tunnel mapping data provides clients and contractors with real information to support decisions on how to best approach the rehab phase of the project,' Kenney said.
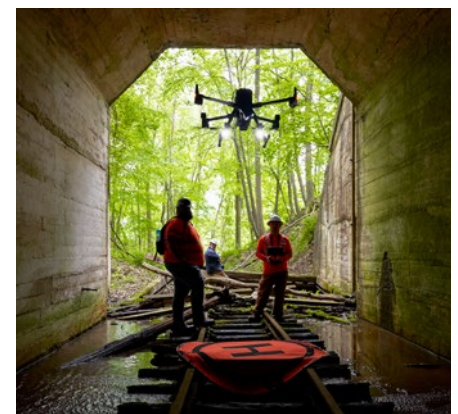
'I hope one day to ride on the restored EBT railroad with my family and see more of the rail line. Preserving history is very important – connecting with the past helps us work towards a positive future.'



*UAV in flight returning from mapping Sideling Hill tunnel*
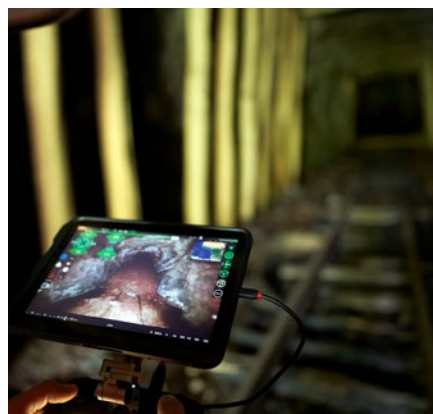


*Emesent Hovermap flight controls showing the collapsed back about 1000 ft into Wrays Hill tunnel*



*Austin Brooks (L) and James Kenney (R) piloting the Emesent Hovermap in Sideling Hill tunnel*

Kenney is enthusiastic about the technology advances in the 65-plus years since the last steam locomotive rolled through the tunnels.

'How great is it that in 2022 the next 'engine' to enter the tunnels is an autonomous UAV with a laser lidar scanner. It is fantastic to see the old and the new combine, and for historical landmarks to be shared with global communities.'

EBT Director of Engineering James Roslund is excited at the use of new technology to refurbish the 150-year-old railroad.

'It is amazing seeing the past come alive through the data gathered,' Roslund says.

'The lidar mapping is incredible, and we had no idea how detailed it would be. This helps us document and better plan refurbishment while minimising safety risk.'

The knowledge gained through this project will allow the focus to turn to the actual rehabilitation work. The project owners already anticipate a post-rehabilitation role for lidar, specifically to record a precise map for future comparisons.

*Thanks to*
*Wingfield Scale & Measure*
    *James Kenney, Senior Engineer*
    *Austin Brooks, Field Technician III*
*East Broad Top Railroad*
    *James Roslund, Director of Engineering*
    *Brad Esposito, General Manager*
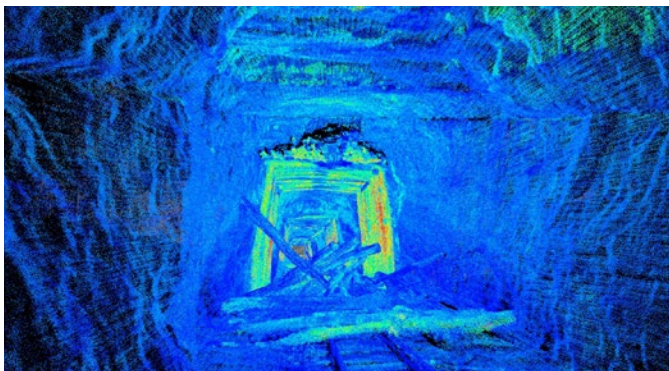


*Emesent Hovermap data displaying collapsed support timbers inside Wrays Hill tunnel*
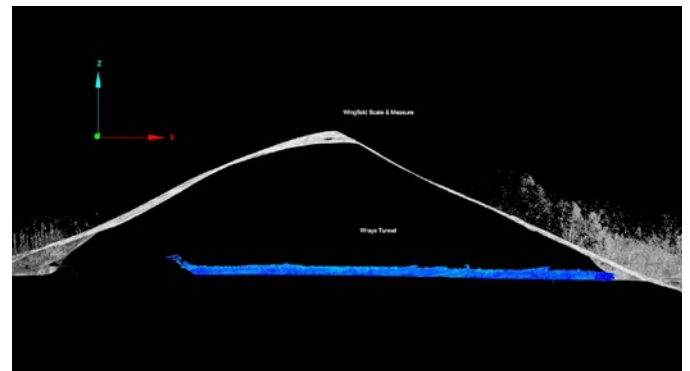


*Cross section side view of Wrays Hill tunnel showing data from aerial LiDAR (white surface), Maptek SR3 (tunnel entrance, right), FARO S350 (collapsed tunnel exit, left) and Emesent Hovermap (blue tunnel)*



*FARO S350 data of collapsed Wrays Hill tunnel exit*



*FARO S350 scanner in front of Wrays Hill tunnel exit – note the surrounding vegetation and condition of the outside rail lines*

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