Development of Survey Control and Problem Based Learning in Heritage Tunnels, North Derbyshire, Uk

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SUMMARY

Over several years, students have undertaken a Post Graduate (PG) Field course in North Derbyshire, with the aim of creating 3D models of the tunnels on a former Railway Line. In recent years the cohort has increasingly become more Internationally diverse. The most recent cohorts have had less experience in using LiDAR technology and therefore have struggled to complete the survey within one day.

The objectives of the research:

• To create a robust survey control system within a difficult environment

• Allow for different rates of progress in the field

• Develop Problem based learning practice

Usually pins or stations could be established to tie into the following day. The tunnels however have heritage status and there are restrictions on establishing stations or leaving equipment over night, as they are unlit at night and not secure. An alternative solution was sought. The lining of the tunnels are heavily sooted and have limited returned reflective signals, longer reference points suffer from acute angles and refraction along the tunnel walls, which are uneven and deformed.

Working with students' attempts were made to establish control over a short range, but due to restrictions on the scanner positions, one wall was always within 2 metres preventing a measurable return signal using the standard targets.

After some investigation, small tiltable prisms were found that could be attached to the wall in four

positions in close proximity to the scanner. These formed strong 3D control, with a good array and were been positioned in the central sections of the tunnel (the tunnel in question being curved and over 400m long), with the adoption of mini prisms work can be performed with a variety of instruments and has allowed GPS locations to be transferred into the tunnel, for more control fixing.

Due to the heritage and to prevent vandalism (as the controls are permanent to avoid extended damage) the prisms have been fitted with covers and sprayed black. As a teaching aid the students are posed with Problem Based Learning (PBL) and asked to consider how they can leave control to return the later. They can plan solutions with a series of options that were presented to them to try and establish a working control. They were then shown the working solution and asked to identify the benefits and limitation of such a system.

The work has been supported by a detail literature review, field observations and interviews with selected members of the cohort

The outcome of the research has produced a number of benefits for the students, staff and the Trustee of the tunnels. They are:

1. Improving problem solving skills

2. Establishing GPS control points in a tunnel

3. Allowing students to work at different rates

4. Providing improved spatial awareness of survey control

5. Extending critical reflection on field practice

6. Developing unintrusive control points

7. Significant Time savings and more potential for Project work by PG Students