The Antonine Wall's distance-slabs: LiDAR as metric survey

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The "Hidden Landscape of a Roman Frontier" is a collaborative research project run and jointly funded by Canterbury Christ Church University (CCCU) and Historic Environment Scotland (HES). Intended to run for a 3-year period, it began in October 2015. The project focuses on the landscape archaeology, history, and heritage management of the Roman frontier in Scotland, part of the "Frontiers of the Roman Empire" transnational UNESCO World Heritage Site since 2008.[1] The project's primary data-set is comprised of aerial LiDAR at 0.5-m resolution covering the World Heritage Site, combined with terrestrial laser-scanning coverage for the forts at Bar Hill and Rough Castle and the fortlet at Kinneil. All data was commissioned under the auspices of the Scottish Ten Project;[2] the aerial data was captured in spring 2010, the terrestrial data in July 2013 and April 2016. The project also draws upon a number of supplemental data sources, including the National Monuments Record of Scotland (https://canmore.org.uk/), geophysical survey data, archive aerial images, colour infra-red imagery, and additional LiDAR data from the UK Environment Agency.

This paper will offer a fresh perspective on the use of LiDAR in archaeology, but our emphasis will not be the technology itself. LiDAR-based landscape archaeology projects have become commonplace as regular reports display a plethora of new features identified through a range of visualization techniques, but less time is spent considering the archaeological questions that the surveys could be tasked to answer, primacy often being given to visualization and site prospection over analysis.[3] Our aim here is to use the project's LiDAR dataset to investigate a number of long-standing archaeological questions for which LiDAR's potential may not initially be obvious to archaeologists more familiar with the limited applications of this technology. This will be done by using the LiDAR data as a high-resolution metric survey, concentrating on the captured measurements, rather than on the more typical identification of features within LiDAR-derived topographic visualizations. We will focus on how measurements and features from the LiDAR data can be integrated with the evidence of the sculpted and inscribed distance-slabs to answer several

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1 *UNESCO 2009. Decisions adopted at the 32nd session of the World Heritage Committee (Quebec City, 2008)* (Paris) 182-83; R. H. Jones and P. McKeague, "Mapping the Antonine Wall," *Scottish Geog. J.* 127 (2011) 146.

2 L. Wilson *et al.*, "The Scottish Ten Project: collaborative heritage documentation," *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, vol. XL-5/W2, *XXIV Int. CIPA Symposium* (Strasbourg 2013) 685-90.

3 E.g., R. H. Bewley, S. P. Crutchley and C. A. Shell, "New light on an ancient landscape: LiDAR survey in the Stonehenge World Heritage Site," *Antiquity* 79 (2001) 636-47; S. Bödecker, "Roman camps in the Rhineland: a half century of aerial reconnaissance, excavations and airborne LiDAR," in D. J. Breeze, R. H. Jones and I. A. Oltean (edd.), *Understanding Roman frontiers: a celebration for Professor Bill Hanson* (Edinburgh 2015) 346-53; A. F. Chase *et al.*, "Airborne LiDAR, archaeology, and the ancient Maya landscape at Caracol, Belize," *JArchSci* 38 (2011) 387-98; S. Crutchley, F. Small and M. Bowden, *Savernake Forest: a report for the National Mapping Project* (Swindon 2009); R. Hesse, "LiDAR-derived local relief models — a new tool for archaeological prospection," *Archaeological Prospection* 17 (2010) 67-72.