TachyGIS – An Idea to Survey Archaeological Excavations with Total Station and GIS

Reiner GOELDNER, Archaeological Heritage Office Saxony, Germany

Keywords: *Excavation — Survey — Total station — GIS*

CHNT Reference: Goeldner, Reiner. TachyGIS – An Idea to survey Archaeological Excavations with Total Station and GIS. Börner, Wolfgang; Kral-Börner, Christina; Rohland, Hendrik. Proceedings of the 24th International Conference on Cultural Heritage and New Technologies, held in Vienna, Austria, November 2019. DOI: https://doi.org/10.11588/propylaeum.747

TachyGIS is an idea to survey archaeological excavations with total station and GIS. Former CAD based approach (with field book and 3D visualization) are transferred to GIS. The idea meets current challenges of total station survey like increased license costs, deficient attribute integration and insufficient sustainability (suitability to be archived).

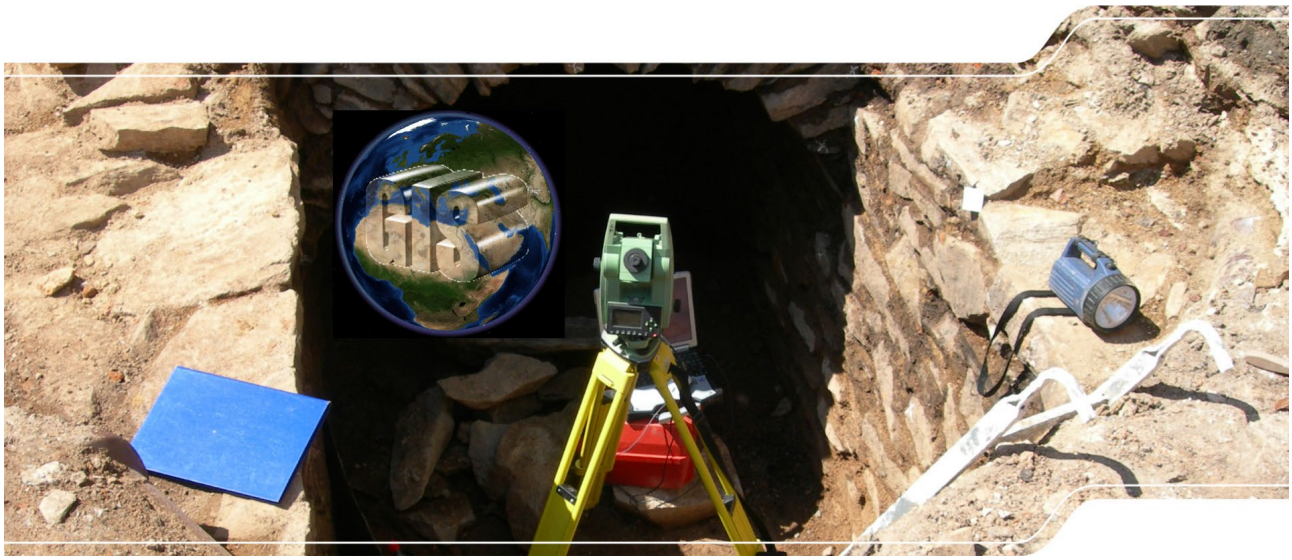

Fig. 1. TachyGIS Teaser.

The presented project idea “TachyGIS” is to transfer features of existing CAD based approach (especially coordinate transfer from total station and 3D visualization) into GIS to meet the above-mentioned challenges. Therefore, cost reduction is possible with cooperative FOSS (Free and Open Source Software) development, attribution is realized by GIS respectively geodata and sustainability can be achieved by using geodatabases with standard data formats. Valuable assistance comes from the “survey2gis” project (Survey-Tools 2019).

FOSS has high potential to limit costs, not only by (cost) free use of existing software, but also by free development of user specific software components. There are only costs for new, additional software components. This positive effect can be multiplied by controlled cooperation! Using modularity and standardization lead to successful IT processes because they ensure flexibility and sustainability. Interacting with suitable cooperation they build a “Triangle of Success in FOSS” (Fig. 2),

which is able to permanently reduce costs. Some more information on FOSS in German state archaeology can be find at VLA2 (2018).

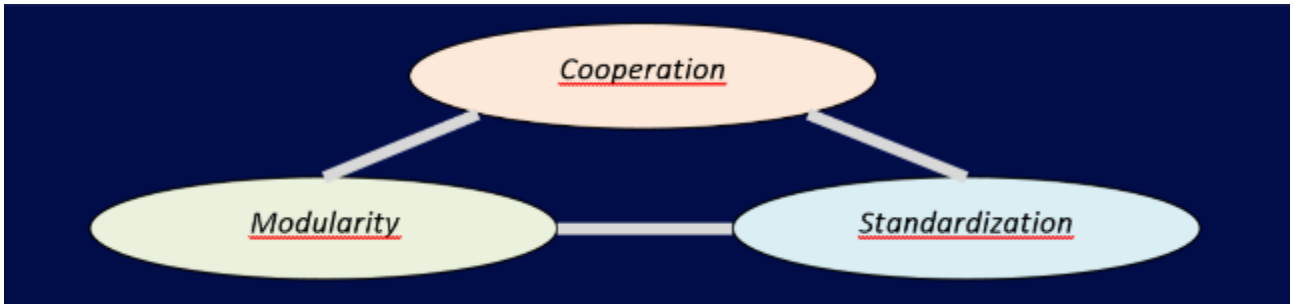

Fig. 2. Triangle of Success in FOSS.

The presented basic concept contains a system overview, a functional model and a data model (Göldner 2018). A TachyGIS system contains of total station and field book / notebook with data connection. TachyGIS software modules import 3D surveying coordinates via total station interface and interact with appropriate GIS components to record and visualize them. Surveying data is recorded in a geodatabase in standardized and sustainable geodata format, so it is easily accessible from GIS and can be analyzed using GIS methods.

TachyGIS consists of three necessary functional components: total station interface, recording/attribution and visualization. Total station interface directly imports measurement data from total station to TachyGIS modules. Recording/attribution performs editing of geo objects (points, lines, polygons) from measured coordinates and assigns attributes like object ID or object type from controlled vocabulary. 3D visualization supports survey and recording. Besides that, many more functions to support daily excavation life are desired and an appropriate user interface is needed. But there are already many useful functions available in GIS that can be instantly used.

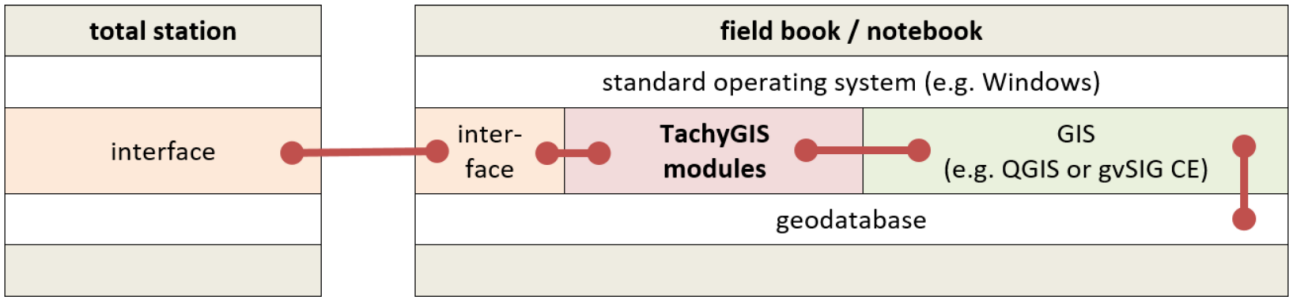

Fig. 3. Basic TachyGIS structure.

The Geodata model considers 3D recording of points, lines and polygons (areas). OGC standard “Simple Features Access” with WKT characteristic is recommended. Important attributes are: activity (excavation) code, basic object type, object ID (e.g. find no.), kind of object, annotation and remark. Further attributes and relationships are usually recorded in a specific excavation database and they may be linked by the object ID.

Sustainability of excavation geodata depends on realistic preservation strategies (that differentiate “archiving” from only “storing” the data). As showed in VLA (2017) and discussed in Göldner and Bibby (2018), excavation geodata doesn’t match the usual but simple format-based preservation

approach, because they contain functionality. But it contains highly systematic information that can be handled with a customized database preservation strategy as mentioned in VLA1 (2018). If all geodata structures (of the database) are clearly standardized and documented and if there are alternative visual representations of maps and tables in PDF/A or TIFF format, an optimistic prognosis about a permanent preservation is possible.

Realization of TachyGIS is on the way. There is a prototype available that shows basic function of TachyGIS. The Hamburg Archaeological Museum maintained the development of all basic components of the so called Tachy2GIS software (Tachy2GIS 2019). The first prototype worked fine, so it was interesting to test it over several months on excavations at the opencast mines near Weißwasser (Saxony). During these tests, the team improved the excavation specific geodata structure and developed a specific user interface for an optimized support of excavation workflows. The focus was on easy data acquisition in the field without extensive knowledge of QGIS-functions.

There are also further development activities, provided and coordinated by at least two institutions and foremost targeting appropriate 3D visualization followed by an excavation specific user interface and a more sophisticated interaction with the total station (e.g. to read and set prism height and to generate a more detailed measurement log file which then should contain stationing parameters as well as r$\vartheta\phi$ polar coordinates and prism height for every single measured point to enable effective debugging). And there is an expanding group of interested people in discussion about more detailed requirements.

References

Göldner, R. (2018). TachyGIS – Eine Idee zur archäologischen Grabungsvermessung mit Tachymeter und GIS. Available at: https://landesarchaeologen.de/fileadmin/mediamanager/004-Kommissionen/Archaeologie-und-Informationssysteme/Grabungsdoku/V_Goeldner1_TachyGIS_Artikel.pdf (Accessed: 07 December 2020)

Göldner, R., Bibby, D. (2018). Digital Excavation Documentation – Objective and Sustainable (A Workshop Summary). Available at: https://landesarchaeologen.de/fileadmin/mediamanager/004-Kommissionen/Archaeologie-und-Informationssysteme/Grabungsdoku/DGD-Workshop_Summary.pdf (Accessed: 07 December 2020)

Survey-Tools (2019). Open-Source GIS-Tools für GIS, Vermessung und Datenakquise. Available at: https://www.survey-tools.org (Accessed: 07 December 2020)

'Tachy2GIS' (2019). GitHub, Archaeological-Museum-Hamburg. Available at: https://github.com/Archaeological-Museum-Hamburg/Tachy2GIS (Accessed: 07 December 2020)

VLA (2017). ‚Themenblätter zur Archivierung digitaler Daten – Erhaltungsstrategien 1 – Grundlagen', in Website Verband der Landesarchäologen. https://landesarchaeologen.de/fileadmin/mediamanager/004-Kommissionen/Archaeologie-und-Informationssysteme/Archivierung/TB_Erhaltungsstrategie1_Grundlagen.pdf (Accessed: 07 December 2020)

VLA1 (2018). ‚Themenblätter zur Archivierung digitaler Daten – Erhaltungsstrategien 4 – Geodaten und CAD', in Website Verband der Landesarchäologen. https://landesarchaeologen.de/fileadmin/mediamanager/004-Kommissionen/Archaeologie-und-Informationssysteme/Archivierung/TB_Erhaltungsstrategie4_Geodaten.pdf (Accessed: 07 December 2020)

VLA2 (2018). 'Kommission Archäologie und Informationssysteme - AG FOSS', in Website Verband der Landesarchäologen. Available at: https://landesarchaeologen.de/kommissionen/archaeologie-und-informationssysteme/projekte-2 (Accessed: 07 December 2020)