

# A Toolset for Automating 1mm Measurement Accuracy in Photogrammetry Surveys

Kenneth Varner (Germany)

**Key words:** Bridge surveying; Engineering survey; Low cost technology; Photogrammetry; Professional practice; Remote sensing

## SUMMARY

The implementation of calibrated photogrammetry tags produced with optimal surface materials enables very precise engineering surveys (down to 1mm relative measurement accuracy) of water management infrastructure. Such photogrammetry tags create automatically detected control points within the model space that also provide the basis for very precise measurement control.

Each unique tag is coded within the photogrammetry software completely automating the typical manual work of adding control points, merging projects, and merging different datasets of the same project. The nuance presented here is using the coded tags around the surveyed object as the measurement system. Producing the tags with an optimized surface material enables the surveyor to mimic measurement standard conditions (lab conditions) in the field to systematically achieve sub-cm measurement accuracy.

The recipe for success for implementing this coded tag based measurement system as well as case studies of 3D surveys with 1mm measurement accuracy of dams using UAVs and handheld cameras are presented here. The key elements to take into account for successful implementation of such surveys are the following:

- 1: Know your camera
- 2: Trust your measurement
- 3: Control your space
- 4: Understand your photogrammetry

---

A Toolset for Automating 1mm Measurement Accuracy in Photogrammetry Surveys (10623)  
Kenneth Varner (Germany)

FIG Working Week 2020  
Smart surveyors for land and water management  
Amsterdam, the Netherlands, 10–14 May 2020

software

The correct implementation of photogrammetry tags with consumer grade measurement devices and consumer grade UAVs and cameras enables very precise and very fast photogrammetry based 3D models at a much lower cost compared to laser scanners and total stations.

---

A Toolset for Automating 1mm Measurement Accuracy in Photogrammetry Surveys (10623)  
Kenneth Varner (Germany)

FIG Working Week 2020  
Smart surveyors for land and water management  
Amsterdam, the Netherlands, 10–14 May 2020