



Certainty 3D's TopoLIFT increases scanning productivity, data quality and operator safety.

# TopoLift—Reinventing the Tripod for Laser Scanning

**A**s the old saying goes, “Necessity is the mother of invention.” “Necessity” is the only way to describe the motivation behind Certainty 3D’s development of TopoLIFT. With scanning technology becoming dramatically faster, the last remaining productivity killer in the field is standard tripod operation. Just ask any scanner operator who drags equipment from setup to setup, constantly seeking a higher vantage point to maximize point

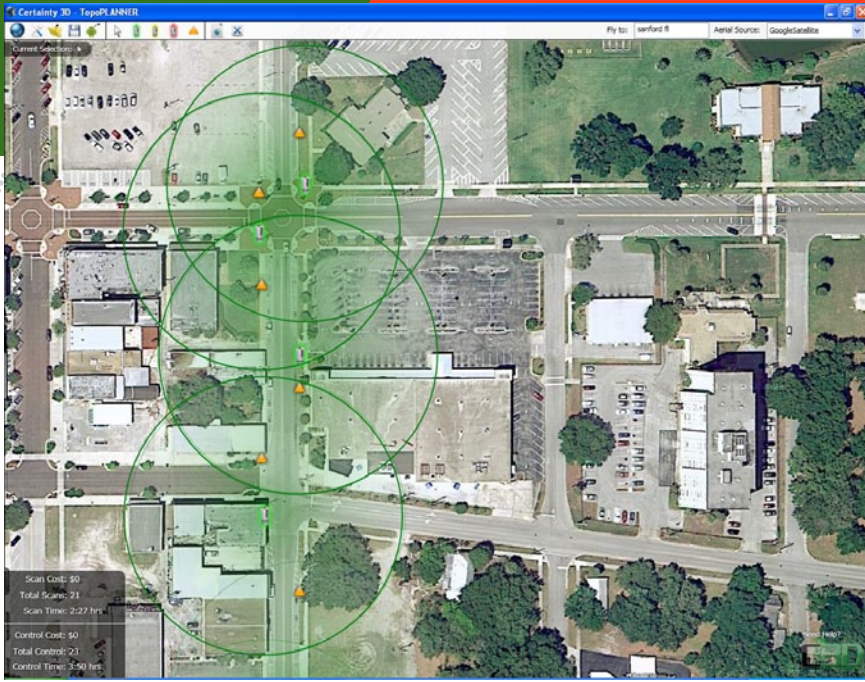
cloud coverage and stares at a small LCD screen or works on a laptop in sunlight. The standard tripod is the last remaining obstacle to dramatic increases in field productivity long promised by laser scanning technology.

Certainty 3D’s patent pending TopoLIFT is elegantly simple, user-friendly, easily installed and increases scanning operational productivity by typically 400% or more. [Watch TopoLIFT operation](#) in the field and it

becomes immediately evident that this innovative alternative to the tripod will become a standard tool for the application of static scanner technology to the 3D survey of roads, bridges, campuses, and general infrastructure projects.

[TopoLIFT is easily installed](#) into any standard pick-up truck bed in minutes. Two primary components, the bridge and lift, comprise the TopoLIFT system. The bridge is a stable structure which exceeds the span of a full size pick-up truck by a few inches. Engineered for stability, three legs support the bridge and provide a 12 foot high platform for

BY TED KNAAK



Certainty 3D's TopoPLANNER freeware demonstrates clearly the schedule/cost advantage gained by TopoLIFT over standard tripod operation.

laser scanner operation. Operated by remote control the lift employs a simple 12VDC screw gear motor to pick up the entire bridge assembly for quick transport to the setup position. Upon reaching the setup position, the operator simply lowers the lift until the bridge is totally supported by its three legs. At this point, [the bridge is completely isolated from any truck movement.](#)

TopoLIFT's increased height improves the scanner field of view, coverage and moves the line of sight over vehicles, thereby reducing the number of required setups by at least 50% over standard tripod operation. Each individual setup times is reduced from 20 minutes to 1 or 2 minutes. Data quality is significantly improved as the operator works in a safe, climate controlled vehicle cab. There the operator can focus on running scanner operations, assessing data coverage and

quality, selecting the next setup position, and moving the entire system with the push of a remote control button. Increased operator safety, a comfortable environment for on-the-spot data quality assessment, decreased operator fatigue and increased productivity all contribute to vastly superior data quality and overall project performance.

### TopoLIFT versus Tripod: Project Estimator Comparison

TopoLIFT's direct contribution to the bottom line can be demonstrated using Certainty 3D's [free TopoPLANNER application](#) (TopoPLANNER facilitates project cost and schedule estimation of static scanning projects.) The operator may select scan project areas from any public domain aerial images such as Google Earth, Bing, Yahoo, etc. Operational parameters such as average time per scan position, scanner

height, hourly scanner operation cost are input to TopoPLANNER along with similar parameters for setting up the control network.

TopoPLANNER was used to develop scanning plans for a project undertaken by Southeastern Surveying and Mapping of Orlando, FL. This downtown Sanford, FL project was only about 3000 feet in length. TopoPLANNER employed the very high performance operating parameters associated with the Riegl VZ400/Nikon D700 system for a comparison between standard tripod and TopoLIFT operation.

TopoLIFT's fast setup time reduces scan position time to an average of 7 minutes versus an average of 17 minutes using the standard tripod. In addition to significantly faster setup times, TopoLIFT's 12 foot scanner height almost triples the radius of coverage per scan from about 70 feet to over 170 feet. This increased coverage results from an improved incident angle of the laser beam to the road surface; the higher the scanner is the further down the road it can acquire useable data. Thus, using TopoLIFT typically reduces the required number of setups by a factor of 30-50% depending on the complexity of the scene.

The TopoPLANNER output above provides a project time comparison between a standard tripod mounted Riegl VZ400/Nikon D700 system and the same system mounted on TopoLIFT. The increased coverage of the TopoLIFT system is denoted by the larger circles (green shaded area) around each scan position. This increased coverage reduces the amount of setups. A significant reduction in setups combined with a 60% decrease for each scan position time yields dramatic productivity gains. In this specific case the result are given in the **Table 1**.

	Scanning Operation	Control Setup
<b>Tripod Operation</b>	30 scans / 8.13 hours	23 points / 4 hours
<b>TopoLIFT Operation</b>	22 scans / 2.34 hours	23 points / 4 hours

Table 1



Resection from fixed cooperative targets over surveyed control points provide scanner location and orientation. Scanner and target height facilitate a clear line of sight over most traffic.



Certainty 3D's TopoDOT was employed to generate a detailed topography model. Here TopoDOT displays the extracted linework over a calibrated image.

Thus TopoLIFT operation using the same scanning equipment is estimated to yield a 25% reduction in setups and a 75% reduction in field time. For actual results, see the following project summary.

### TopoLIFT Field Project Results: Sanford, FL

Southeastern Surveying and Mapping of Orlando, FL recently applied TopoLIFT and a Riegl VZ400/Nikon D700 system to a project in downtown Sanford, FL. The required deliverables were a complete surface topography of approximately 3000' of a road surface designated for repaving existing asphalt with decorative brick. In addition a standard utility survey along the roadway was required.

The projected time estimates provided by TopoPLANNER were within 30 minutes of the actual scanning time for the Sanford project. More impressive, is the comparison of these operational parameters with estimated

time using conventional survey technology and processes.

Julio Rivera, GPS operations manager for Southeastern Surveying & Mapping, estimated the Sanford project would have required about 8-10 working days to complete using traditional survey methods. Using TopoLIFT and the Riegl VZ400/Nikon D700 system, that time was significantly reduced. **Table 2** shows a summary of the actual project time using TopoLIFT compared to the Mr. Rivera's estimate using traditional methods.

Saving more than five days on a ten day project represents a 50% reduction in time. Office processing time is typically longer for scanning operations than those in support of traditional

survey data. However, new products such as Certainty 3D's TopoDOT ([www.certainty3d.com](http://www.certainty3d.com)) point cloud processing application have reduced processing time and increased deliverable quality dramatically. Thus the time savings provided by TopoLIFT operation can be applied to back office processing requirements. The result is significant decreases in **field to finish** project time, lower costs and higher quality output.

*Field Process Details* Southeastern Survey & Mapping established a control network along each side of the road with markers placed at intervals of approximately 200 feet. Approximately eight reflective targets were placed on fixed height rods over each control point

	TopoLIFT	Traditional Survey
<b>Control Survey</b>	1 day	1 day
<b>Utility Survey</b>	1.5 days	1.5 days
<b>Data Acquisition</b>	0.5 day (3 hours)	6 days
<b>Office Processing</b>	4 days	3 days

**Table 2**

within the vicinity of the TopoLIFT and scanning system. After each one or two scan positions, scanning team members typically “leapfrog” the last two or three targets forward to new positions in preparation for the next scan.

The scanner position is determined based on resection using the control targets. The TopoLIFT height and 8 foot target rod height facilitate location of targets over traffic—another advantage over traditional tripod operation. Workflows with Riegl’s RiScan Pro software include “on the spot” verification of scanner located targets to the establish control network typically using least squares methods. Additional on location QA/QC might involve examining point cloud overlapping areas to common fixed surfaces to assure alignment. Finally an on the spot assessment is made with respect to data coverage and the appropriate next scan position is

determined. These QA/QC procedures are best performed using a laptop in the environmentally controlled vehicle cab. *In this way TopoLIFT contributes to overall data quality in addition to operational productivity.*

Certainty 3D’s [TopoDOT software](#) was employed to extract the surface topography model from the Riegl VZ400/Nikon D700 data. This required about two to three man-days of processing operation. The extracted topography digital terrain model far exceeded project requirements.

### **TopoLIFT Fills the Technology/ Cost Gap between Terrestrial Tripod and Mobile Scanning Operations**

The emergence of improved scanner performance along with high density mobile airborne and terrestrial scanning technology promises to revolutionize

survey and mapping operations. These systems also opened up a huge price/performance gap in the market place. Tripod operations are still rather slow and relatively dangerous in the areas of heavy traffic. Mobile scanning operations are extremely fast, however the systems are very expensive with rather complex operational and processing requirements.

Thus TopoLIFT fills that performance/price gap between static tripod and mobile scanning. It is an integral part of a [field-to-finish system](#) that is easily learned, is relatively low cost, increases operator safety, provides high quality data, and for those applications where parking a vehicle is an option, will typically prove the quickest and most cost effective solution to corridor and large area surveying and mapping operations. ■

---

**Ted Knaak** is the founder and CEO of Certainty 3D. He has extensive experience in the 3D laser scanning industry.