A 3D Laser Scanning Study on Slab-on-Grade

How Bruce mentors and guides young professionals

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My favorite ACI mentor

One of my favorite singers

Bruce Suprenant

Jonathan (Chung-shan) Lee

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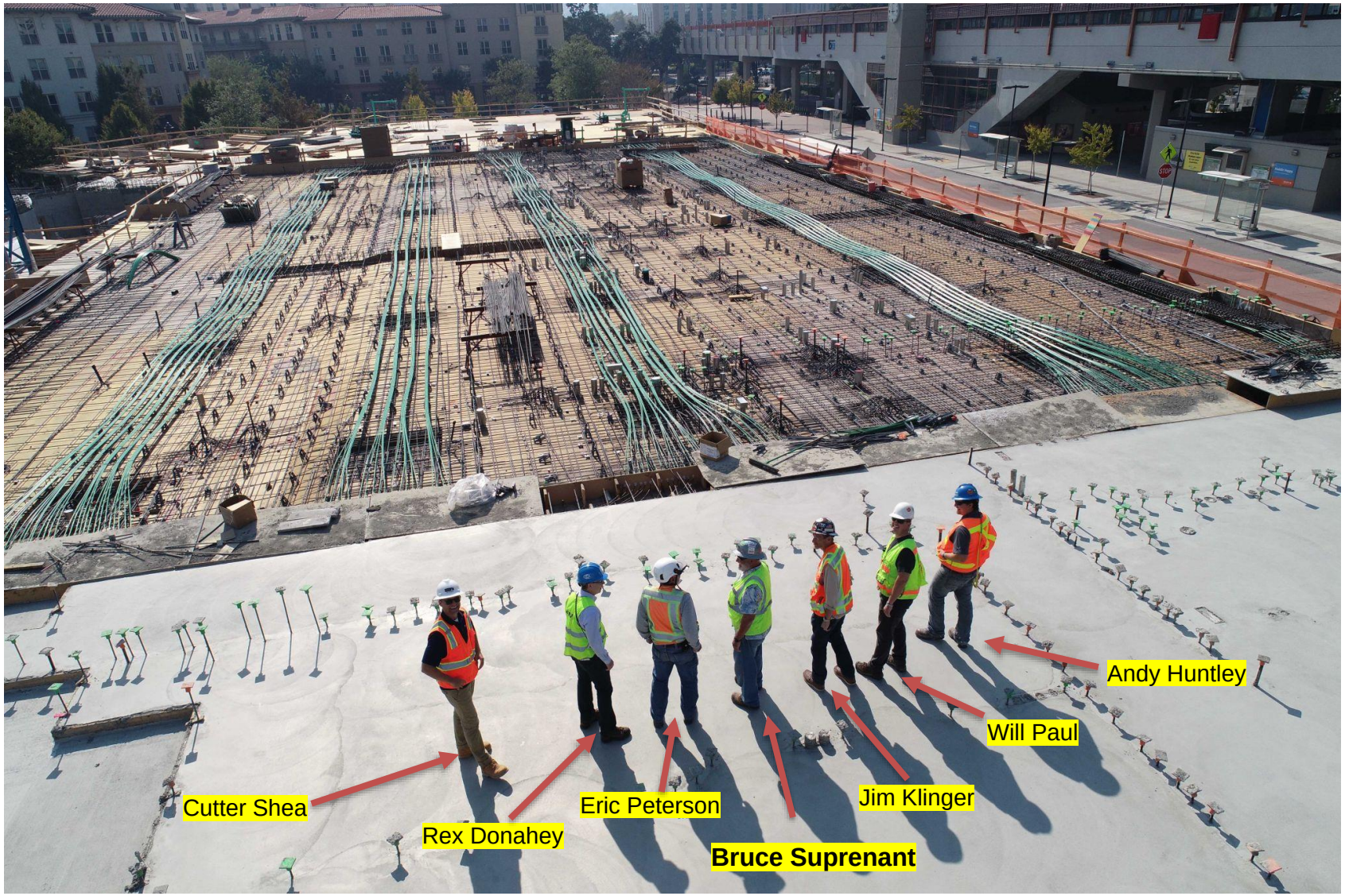

I first met Bruce in Walnut Creek, CA for the ASCC 3D-Laser Scanning Study in October 2018

Magnificent Seven

Photo credit – BKF Engineers

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10/2018 — **ASCC 3D-Laser Scanning Study in Walnut Creek, CA**

Bruce, Magnificent Seven, and I (other participants)

01/2019 — **ASCC Laser Scanning workshop in Las Vegas, NV in January 2019**

Bruce, Three participants including me

12/2021 — **ASCC-ACI Slab-on-Grade laser scan study in Martinez, CA**

Bruce, Jim Klinger, and I

03/2022 — **ACI Spring Convention 117 meeting in Orlando, FL**

Bruce, Jim Klinger, and I

05-09/2022 — **Three Concrete International Articles**

Bruce, Jim Klinger, and I

02/2023 — **U.S. Institute of Building Documentation (USIBD) Scanner Shootout**

USIBD committee members including me

NEXT

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F-numbers and Textured Concrete Surface Finishes

Parking structures and parking lots with swirl and broom finishes

by Lingfeng (Leo) Zhang

Slab-on-Ground Thickness Measurement

A comparison of data collected using laser scanning, ground-penetrating radar, impact-echo, and coring me

by Lingfeng (Leo) Zhang, James Kling

Presenting Laser Scan Results for Slabs-on-Ground

Deliverables tailored to the user's perspective

by Lingfeng (Leo) Zhang, James Klinger, and Bruce A. Suprenant

Joint ACI-ASCC Committee 117, Tolerances, is working on the "Guide to Using Laser Scanning for Concrete Tolerances." Drafts of six chapters were presented and discussed at the second ASCC Workshop on Laser Scanning in Las Vegas, NV, USA, in January 2018. While the six chapters covered the initial part of the document, Chapters 7 and 8 on reporting laser scanning results and deliverables were not addressed. In December 2021, the American Society of Concrete Contractors (ASCC) initiated a study focused on laser scanning results and deliverables for slabs-on-ground. This article presents the recommendations from that study.

Workshops and Studies

ASCC sponsored two laser scanning workshops (January 22, 2018, and January 21, 2019), both in Las Vegas in conjunction with the World of Concrete. More than 30 attendees representing contractors, engineers, laser manufacturers, laser consultants, and laser surveyors participated in each workshop. The first workshop focused on collecting and processing laser data and the application of laser scanning to tolerance compliance. The second workshop presented laser scan results from an ASCC-sponsored study and drafts of six chapters for the new ACI-ASCC 117 guide. ASCC paid for the development of the drafts of the six chapters that have since been turned over to Joint ACI-ASCC Subcommittee 117-L, Laser Scanning.

The first ASCC study was at a construction site in Walnut Creek, CA, USA, on October 6-7, 2018. In the first part of the study, eight teams (each comprising one to three individuals) scanned portions of the project, and their measurements were compared against independently obtained reference data. The second part of the study focused on the use of laser scanning technology to determine F-numbers. The study resulted in two *Concrete International* articles.[1,2]

The second ASCC workshop focused on presenting laser scanning results to be easily understood, readily interpreted, and construction friendly. And while there was preliminary discussion about reporting laser scan data and deliverables, nothing was prepared as recommended practice. ASCC therefore decided to initiate a second study in December 2021 in cooperation with Leo Zhang of The Conco Companies, using a 1600 ft² (150 m²) slab-on-ground test panel constructed as a mockup for broom and swirl finishes.[3]

Issues with Laser Scan Results

ASCC received examples of laser scan results from its contractor members. Three examples illustrate issues with the current deliverables.

Example 1: Reporting measurement precision

A general contractor hired a consultant to use a laser to provide measurements of riser heights and tread depths for a set of concrete stairs. Figure 1 shows measurements reported to the nearest 1/64 in. (0.4 mm). Precision is the level of detail of a measurement, determined by the smallest unit or fraction

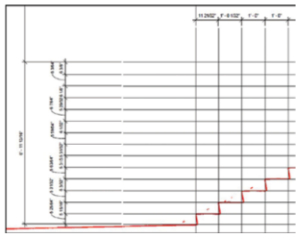

Fig. 1: Laser scanning stair measurements were reported to 1/64 in. (0.4 mm). This "implied" precision is not appropriate. At the best, measurements from laser scanning should be reported at no less than 1/8 in. (3 mm) and, depending on the application, to the nearest 1/4 in. (6 mm) (Note: 1 ft = 0.3 m; 1 in. = 25 mm)

Bruce Suprenant <BSuprenant@ascconline.org>
To Leo Zhang; Jim Klinger

Reply | Reply All | Forward

Sat 7/30/2022 7:38 AM

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131 KB

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383 KB

Accuracy ad Repeatablity of the Laser Scanner and Total Station for Crime and Accident Scene Documentation Dustin & Liscio 2015.pdf

Leo

A starting point for your questions. Most organizations in the US, follow the American National Standards Institute (ANSI) for Standards.
If you follow their procedures and can prove it, then you can become an ANSI approved Standards Development Organization (SDO).
The SDO process is complicated and expensive. ACI and ASTM are SDO's, ASCC is not. Learn all you want to here: https://www.ansi.org/american-national-standards/info-for-standards-developers/accreditation
Some ACI stuff is shown below.

ASTM is an SDO, however, you can have an ASTM standard without a precision and bias statement. There are some ASTM standards that will never have a precision and bias statement.
I was told by an ASTM E1155 member that they approved the inclusion of laser scanning based on Phillip Lorezon's one example. They said they didn't know how to keep it out.
I am not sure why they took this approach, but I was told they did. E1155 has a precision and bias statement that is only for the Dipstick.

ASTM has a standard for preparing precision and bias statement. Shown below and attached. Also attached is the ASTM for "Conducting an Interlaboratory Study to Determine the Precision of a Test Method."
ASTM requires a minimum number of 6 labs, testing two materials (items), at least twice. This should sound familiar. We had 6 laser scanners, testing two floors (the slab on grade and elevated), twice (Saturday and Sunday). This we set up the testing in CA to qualify to make a precision statement about laser scanning. We did this for the vertical and horizontal accuracy (shooting at targets) and then for F-numbers.
The issue with F-numbers is that it appears that the precision varies with the FF. So, we only got one precision for an FF of about 25 in CA. It needs to be done, like the Dipstick, for FF ranges, like 20-25, 25 to 30, 30 to 35, 35 to 40, and so on.

It's unfortunate that the laser industry will not set up and do the work. I don't think they want anyone to know the precision, however, now that more laser scanning is being used in court. I have seen articles stating those issues.

See attached article on "Accuracy and Repeatability of the Laser Scanner and Total Station for Crime and Accident Scene Documentation."

Bruce

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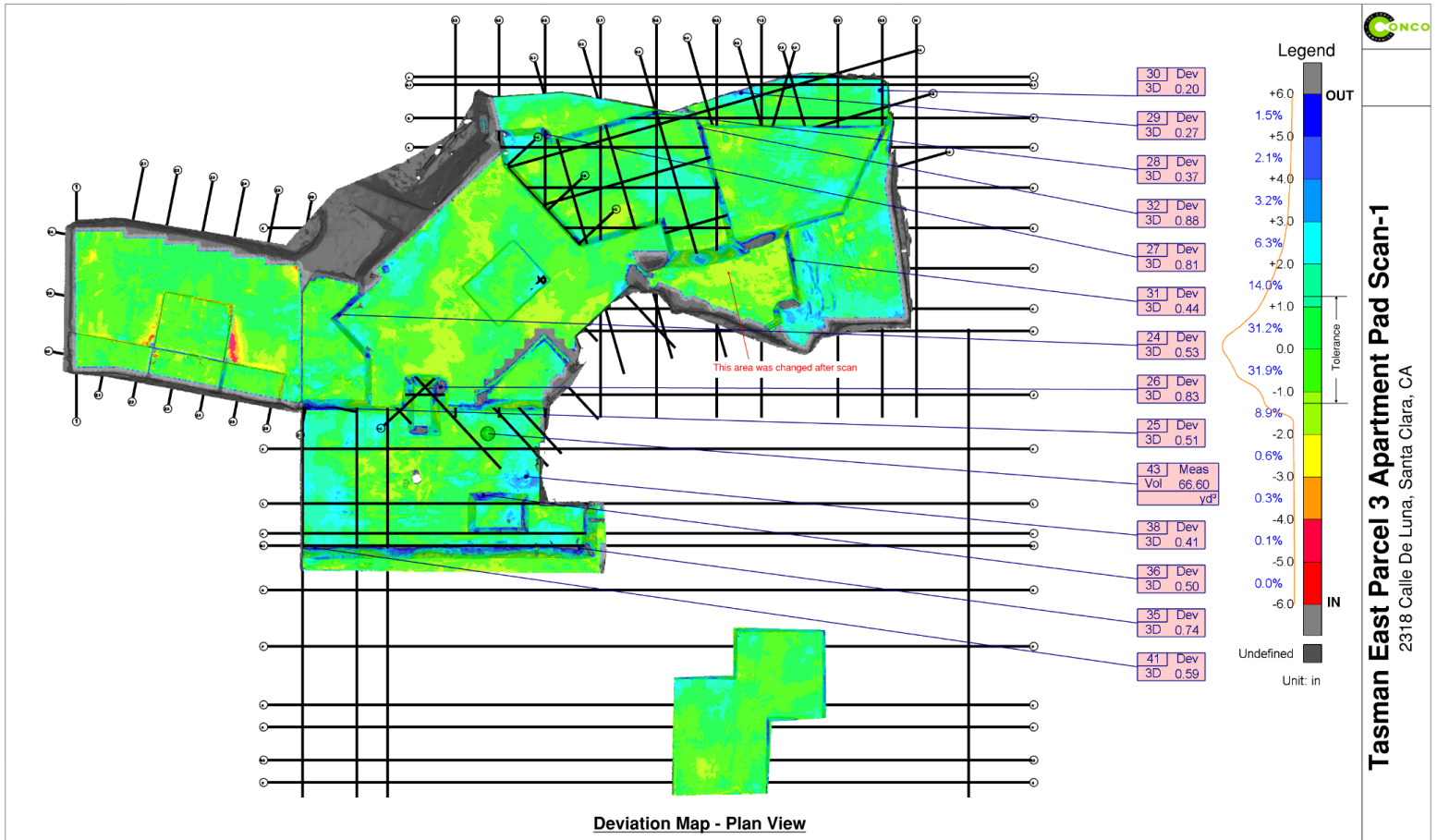

Deviation Map - Plan View

INFORMATION

1. Pad was scanned on the pour day following grading activities;
2. Deviation map was created by comparing bottom of rat slab model and pad scan;
3. Overbreak volume was calculated by comparing bottom of rat slab model and pad scan with a credit of 0.1' layer of volume;
4. Deviation measurements were provided at the worst spots as shown on this exhibit with unit in "feet";
5. Pad was scanned with Leica P40 laser scanner and survey controls were transferred from prisms provided by BKF;
6. "IN" on the legend represents encroachment, and "OUT" represents the opposite way.

DATA ANALYSIS

1. Approximately 63% of the pad areas were within +- 0.1' tolerance;
2. Overbreak volume = 66.60 cy.

"Hill" *by Johnathan Lee (my favorite ACI mentor Bruce S.)*

Lyric at 1:32

We tirelessly climb every hill

I've finally climbed the hill, even though my hair is now grey

Chattering away the worry of missed opportunities

Before I had the chance to see greatness

I lost myself first