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HOOSIER SURVEYOR

Quarterly publication of the Indiana Society of Professional Land Surveyors, Inc.

IN THIS ISSUE

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INSIDE

COVER PHOTO

A Trimble R8 GNSS receiver from the Marion County Surveyor's Office has a clear track to the north for the time being, but contractors were on the way along the former Nickel Plate railroad line, removing rails and crossties to make way for a greenway trail. Surveyor's Office crews from Hamilton and Marion counties jumped in to record a variety of points while the rails remained in place. The Marion County crew was nearby, checking a culvert's location, when this photo was taken by Ethan Evans. An article and photos are on Pages 9-11.

FROM THE EDITOR

Deadlines for copy for various planned issues of the Hoosier Surveyor are as follows:

- Winter - February 1
- Spring - May 1
- Summer - September 1
- Fall - November 1

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Articles and columns appearing in this publication do not necessarily reflect the viewpoints of ISPLS or the Hoosier Surveyor staff, but are published as a service to its members, the general public and for the betterment of the surveying profession. No responsibility is assumed for errors, misquotes or deletions as to its contents.

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PRESIDENT'S MESSAGE – HAVE WE LOST OUR WAY?

By Todd R. Bauer, PS, ISPLS President

Unlike my previous two President's Messages where I have provided highlights of the activities and actions of ISPLS over the past few months, in this message I question whether we have lost our way in the profession of surveying.

I am currently working with an attorney and his client to provide an opinion of the boundary location in a litigation matter. In addition to our firm, two other surveying firms have been involved in the dispute and have offered their opinion of where the boundary line should be recognized. In review of their approach and potential solutions, I question where we have "progressed" to as a profession. Not only do we have a "pin cushion" effect at most of the boundary corners of the property, several long-standing monuments went unrecovered and evidence of occupation was completely ignored in the potential solutions to the boundary location.

As I have traveled the state these past nine months, meeting with various chapters and members of ISPLS, I understand that this is a common concern and a frequent experience. Like most, I find this particularly troubling and if left unchecked this pattern is extremely detrimental to the profession, the public and our reputation as professionals. As I considered the potential options for the boundary location of the litigation matter, and the need to support the "right" boundary line to satisfy the judge in this case, I revisited Chief Justice Thomas M. Cooley's commentary on the quasi-judicial role of the surveyor. Although I read Cooley's Dictum in college and revisited the document several times over the past 30 years, it never seemed more appropriate and applicable than it does today. It truly is a magnificent document and warns of so many issues that plague our profession today.

In this most recent litigation consultation experience it is apparent that there is a lack of understanding of what our duty as professional surveyors is when performing a boundary retracement survey. There has been an overwhelming application of mathematical solutions that attempt to perfectly recreate record geometric relationships for the perimeter of the property, completely ignoring the evidence of occupation and possession. I find that extremely disappointing and a grave concern for the future of the profession. As Justice Cooley notes:

> *When the witness trees are gone, so that there is no longer record evidence of the monuments, it is remarkable how many there are who mistake altogether the duty that now devolves upon the surveyor. It is by no means uncommon that we find men whose theoretical education is thought to make them experts, who think that when the monuments are gone the only thing to be done is to place new monuments where the old ones should have been, and would have been if placed correctly. This is a serious mistake. The problem is now the same that it was before: to ascertain by the best lights of which the case admits, where the original lines were.*

With the prevalence of equipment and technology that enhances our ability to measure to the closest millimeter, we can certainly analyze and calculate with greater precision than ever before. Measurement is only a portion of our domain as professional surveyors, and certainly not the component that brings value or professionalism to our services. Unfortunately, we are in an environment and time where measurement is easily performed by others and is not an exclusive trait to the surveying professional. As we continue to see intrusion into our field by anyone with a drone, access to GIS or use of an app, the ability to measure well is less of an indication of professionalism than it ever has been before.

As a side note, ISPLS has been actively pursuing the unlicensed practice of surveying by members of the aforementioned groups. However, with a strong economy and with every surveyor being busy with a backlog, there is an ever-increasing number of these alternative providers vying for projects that use to be exclusively within the domain of the surveyor. We all need to be vigilant in this fight and understand the impact that it may have on our profession, but more importantly the impact on the public health, safety and welfare in the future.

Regarding what we can do to enhance our profession, we need to understand our obligations as professionals; remember the importance of the evidence of occupation and possession; and balance these with the geometric relationships noted within the record document. It is time we, as a collective profession, elevate our standards and services to ensure our profession continues for generations to come. Again, quoting Cooley:

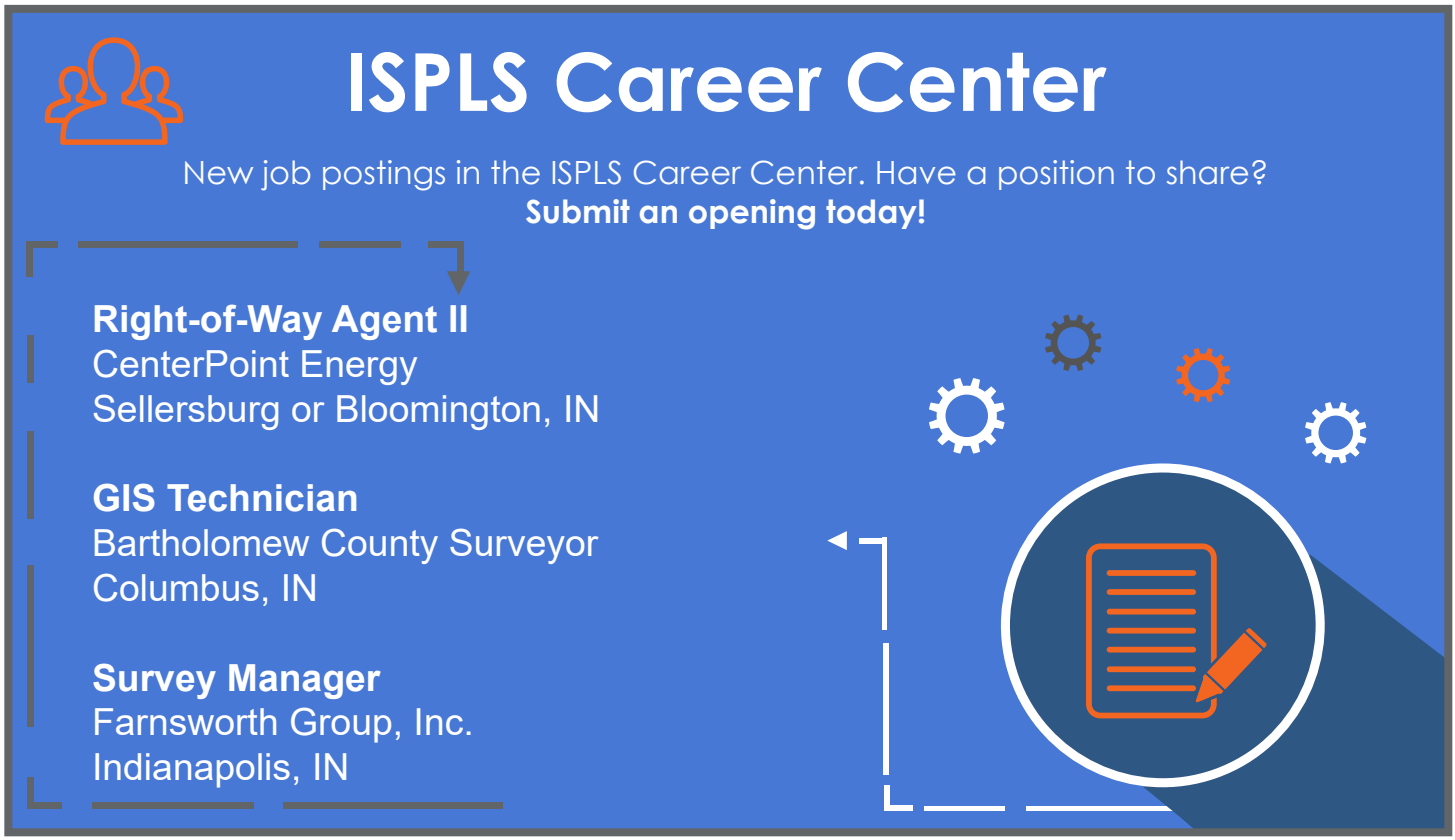
> *Unfortunately, it is known that surveyors sometimes, in supposed obedience to the State statute, disregard all evidences of occupation and claim of title and plunge whole neighborhoods into quarrels and litigation by assuming to "establish" corners at points with which the previous occupation cannot harmonize. It is often the case that, where one or more corners are found to be extinct, all parties concerned have acquiesced in lines which were traced by the guidance of some other corner or landmark, which may or may not have been trustworthy; but to bring these lines into discredit, when the*

people concerned do not question them, not only breeds trouble in the neighborhood, but it must often subject the surveyor himself to annoyance and perhaps discredit, since in a legal controversy the law as well as common sense must declare that a supposed boundary line long acquiesced in is better evidence of where the real line should be than any survey made after the original monuments have disappeared.

The mischiefs of overlooking the facts of possession most often appear in cities and villages. In towns the block and lot stakes soon disappear; there are no witness trees, and no monuments to govern except such as have been put in their places, or where their places were supposed to be. The streets are likely to be soon marked off by fences, and the lots in a block will be measured off from these, without looking farther. Now it may perhaps be known in a particular case that a certain monument still remaining was the starting point in the original survey of the town plat; or a surveyor settling in the town may take some central point as the point of departure in his surveys and, assuming the original plat to be accurate, he will then undertake to find all streets and all lots by course and distance according to the plat, measuring and estimating from his point of departure. This procedure might unsettle every line and every monument existing by acquiescence in the town; it would be very likely to change the lines of streets and raise controversies everywhere. Yet this is what is sometimes done; the surveyor himself being the first person to raise the disturbing questions.

As they often say….."everything was fine until the surveyor showed up."

Todd R. Bauer, PS
President ISPLS



LEGAL SURVEYS

By Bryan F. Catlin, PS, ISPLS Past President

The goal of this column is to provide brief summaries of recent Indiana Court of Appeals and Supreme Court cases involving topics related to surveying practice, certainly not to provide legal advice. Information is gathered from the courts website at www.in.gov/judiciary. Comments or suggestions for future columns are welcome by email to: Bryan.Catlin@indy.gov.

Gregory T. Hardin and Kelly T. Hardin v. Ruth McClintic, Indiana Court of Appeals Case No. 53A01-1712-PL-2964, May 23, 2019

Here the parties owned adjacent parcels on Lake Lemon with a gravel driveway along the western border of the McClintic property and the eastern border of the Hardin property. The driveway has been in this location since before Virginia Chitwood divided her larger parcel into smaller tracts, including the tracts along the driveway, around 1965. Until 2007, the owners of both tracts had used the driveway and contributed to its upkeep. In 2007, the Hardins purchased the property and had a survey performed after the transfer. Upon learning that McClintic might have some rights to the driveway, the Hardins sent two letters in late 2007 seeking to determine if McClintic had permission or an easement to use the driveway and in which they told her use of the driveway would constitute trespass. McClintic did not respond to the letters. At the beginning of 2008, the Hardins sent McClintic two more letters stating they wished to avoid confrontation and granting McClintic permission to continue using the driveway.

In 2016, the Hardins put their tract on the market, had another survey done, and hired a contractor to put up a fence around their property. The contractor set stakes to mark the area where the fence would be installed, apparently including part of the driveway. McClintic objected, and her tenant blocked the contractor from putting up the fence. The Hardins filed a complaint against McClintic seeking a permanent restraining order based on trespass to enjoin McClintic from entering the Hardins property, including the driveway, damages from when McClintic trespassed on their property and blocked installation of the fence, and damages from interference with the Hardins fencing contract. McClintic filed a counterclaim asking for adverse possession of a strip of ground encompassing the driveway, a prescriptive easement for use of the driveway to access her property, and an implied easement from prior use.

The Monroe Circuit Court held a bench trial on these claims and counterclaims. Kelly Hardin testified that when she purchased the property, she saw McClintic using the driveway, had no concerns about that use, and that she allowed McClintic to continue using it. But now Hardin testified she was revoking her permission for McClintic to use the driveway and McClintic could put a driveway on her own property.

There was fairly extensive testimony, including from children of prior owners of the Hardin tract, concerning their belief that the right wheel track of the driveway, when driving north towards Lake Lemon, was the boundary. Other evidence of payment of taxes and payments for upkeep of the driveway was presented. The Hardins presented testimony of a friend and a deposition from another family member of a prior owner of their tract. The trial court granted an amended order quieting title up to the right wheel track in fee simple in favor of Ruth McClintic as well as quieting title to the remainder of the gravel driveway in favor of Ruth McClintic to use the driveway for ingress and egress to her property.

On appeal, the Hardins argued that the use of the driveway was permissive, an argument the trial court had specifically rejected. The Court of Appeals rejected this request to reweigh this evidence or the trial court's credibility determinations. There were additional arguments about tax payments and evidently confusion over the extent of the fee simple ownership and the use of the rest of the driveway based on the Hardins' contentions. The judgment of the trial court was affirmed.

Town of Brownsburg, Indiana, et al. v. Fight Against Brownsburg Annexation, et al., Indiana Supreme Court Case No. 19S-PL-342, June 5, 2019

As a reminder, my earlier summary of the Appeals Court opinion on a part of this case follows in italics.

Town of Brownsburg, Indiana, Town Council of Brownsburg, Indiana, and Jeanette M. Brickler v. Fight Against Brownsburg Annexation, et al., Indiana Court of Appeals Case No. 32A01-1702-PL-215, April 5, 2018

This case was decided on whether 60% of the annexation area had been subdivided as well as whether the area was needed and can be used in the reasonably near future as required by Indiana Code. Brownsburg presented six scenarios from one of their planners to the Hendricks Superior Court arguing that the Indiana Code did not specify that only actual acreage be considered in the required percentage. Each of the six scenarios considered the percentage of tracts subdivided as well as the percentage of acreage they included in the 4,462 acres Brownsburg sought to annex. Briefly, the first method considered only recorded traditional subdivision plats and found that 66.74% of the tracts, but only 17.5% of the acreage was subdivided. The Hendricks County cartographer also calculated that only 17.54% was subdivided. The other methods used included

agricultural land to arrive at different percentages (including any "subdivision" of the original patented land into smaller aliquot parts). The court also looked at the definition of subdivided in both the Brownsburg and Hendricks County Subdivision Control Ordinances and found Brownsburg was short of the needed percentage.

When it came to the needed and can be used in the reasonably near future question, Brownsburg argued that since the expansion of the Ronald Reagan Parkway was going to create a new interstate crossing in the proposed annexation and extend beyond Brownsburg's current limits, Brownsburg needed to be able to manage future growth in the area. But there is no firm timetable for much of this development, and Brownsburg currently has enough undeveloped land that the argument that the annexation area was needed was questioned. The trial court found that Brownsburg had not met its burden under Indiana Code, and the annexation could not proceed.

On appeal, the trial court's findings were not found to be clearly erroneous and were therefore affirmed.

Brownsburg sought transfer to the Indiana Supreme Court which was granted, thus vacating the appellate decision. The Supreme Court again affirmed the trial court judgment after review of some of the requirements for annexation. They first noted that all land has been subdivided in the broadest sense of the term, but for annexation purposes, subdivided refers only to formally recorded residential subdivisions and that even minor residential subdivisions might not qualify as subdivided. Second, the only permissible unit of measurement is acreage, not the number of parcels. Finally, all acreage in the proposed annexation must be included in the ratio's denominator; none should be exempted or excluded.

James Curtis Todd v. State of Indiana, Indiana Court of Appeals Case No. 18A-CR-3017, May 6, 2019

MEMORANDUM DECISION

As you might guess from the State of Indiana being a party, this case is about someone seeking relief from a criminal conviction, in this case criminal mischief. Here two cousins lived on side by side parcels. Jacob Todd to the north was in possession of a survey that showed a fence and gate, which had been in place for years between the two properties, was seven or eight inches north of his southern boundary. In 2018 Jacob trimmed tree limbs along the fencerow which resulted in a heated argument between James and Jacob. Jacob explained a survey had been conducted, he knew where the boundary was and offered to give James a copy of the survey. James disagreed and claimed the northern boundary of his land was eighteen feet north of the fencerow. Police arrived and broke up the fight. Prior to this dispute the gate had been left open to allow travel between the two tracts. Now Jacob decided to permanently close the gate by setting a pole to hold it shut and fastening it with a lock and chain. A day or two later, Jacob found the pole, chain, and lock lying in his driveway by his mailbox. Video footage from a trail camera showed that at about 1:45 a.m., James and his girlfriend had removed the gate and portions of the fencerow.

The State charged James with misdemeanor criminal trespass and misdemeanor criminal mischief. After a bench trial in the Sullivan Superior Court, James was found guilty of criminal mischief.

The judgment of the trial court was affirmed on appeal. The survey only played a small part in this case, but again we have a case that shows how strongly people feel about that they consider "their property."

Bryan F. Catlin, PS has been registered as a Land Surveyor in Indiana since 1991. He holds B.S. Land Surveying Engineering and M.S. Engineering (Geodesy) degrees from Purdue University.



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SURVEYORS' RESPONSES PRESERVE NICKEL PLATE'S TRACES

By Mike Davis

The rails and crossties became expendable this summer when the Hoosier Heritage Port Authority, which owns former Nickel Plate Railroad trackage in Tipton, Hamilton and Marion counties, decided to convert the southernmost 22-mile section to a greenway trail.

What wasn't discussed, though, was that railroad right-of-way boundaries are based on evidence including the centerline between the rails. That's a location which becomes challenging to find when the rails are gone — maybe even next to impossible —and it could affect future boundary retracement surveys.

Central Indiana Chapter member Gary Kent, PS, said he talked with Hamilton County Surveyor Kent Ward in June about documenting the centerline positions. At the end of July, the Indianapolis Business Journal reported that Utah-based A&K Railroad Materials had submitted the winning bid for track removal. Bryan Catlin, PS, technical supervisor for the Marion County Surveyor's Office, began receiving email messages about the issue on Aug. 1, the same day an article appeared on the Indianapolis Star website, and also decided to gather data to preserve the location of the railway centerline.

Hamilton County Surveyor Kent Ward (right) and Surveyor's Office crew members (from left) survey manager Brian Rayl, section corner technician Bob King and survey technician Steve Fesmire stand at what's left of the Plum Street crossing in Noblesville, several days after rails and crossties were removed along the former Nickel Plate Railroad line. Ward's crews got ahead of track-removal teams when work began Aug. 16, collecting 600 points to document the centerline between the rails from Noblesville south to the Hamilton-Marion County boundary. (Photo submitted by Todd Whisman)

A&K began pulling rails from the crossties on Aug. 16.

Brian Rayl, PS, survey manager in the Hamilton County Surveyor's Office, said crews got ahead of track-removal workers moving south from Noblesville and finished that same day at the Hamilton-Marion County boundary at 96th Street. Rayl said work to be done the following week by section corner technician Bob King would focus on the Allisonville Road-146th Street area, and a crew also would work north in Noblesville to the former Indiana Transportation Museum rail yard in Forest Park.

Ward said two-man crews worked a total of 10 days in August and the first week in September between 96th Street and Noblesville's Division Street, as time allowed. "We knew when and where (A&K crews) were going to work, and we went to the tail end and started there," he said. Rayl led the Hamilton County team, which included survey technician Steve Fesmire and section corner technician Bob King.

Ward's figures showed a total of 600 points collected on rails, switches, sidings, mile posts and whistle signs, as well as other features such as a Department of Natural Resources monument, magnetic nails or rebars in the centerline, county drains and bridges. Extra points were collected at railroad crossings where rails were left in the roadway for future removal. Also, crews will go back this fall when vegetation is down to locate fences and other points of interest that were missed because of overgrowth.

Catlin said the three-man Marion County crews recorded 152 centerline, switch, frog and guard rail locations between 96th and 22nd streets, where the tracks end. Culverts with stationing were among the targets. Most points were observed twice, for five minutes. He said pdf-format documents and an Excel file would be available on the Marion County Surveyor's Office website in October. In addition to Catlin, the Marion County crew included crew chief Robert Pangelinan and surveying technicians James Wilburn, Kevin Herrin and Joshua Lindo.

Ward said he wasn't sure at this point how the Hamilton County data would be presented, but drawings would eventually be placed on the surveyor's office web page. He also said sixteenth-section corner points would be marked for reference purposes once the asphalt trail was in place.

While pleased with what was accomplished, Ward said he would have liked to also have done this along two other rails-to-trails corridors in Hamilton County, where the Monon Railroad line became the Monon Trail, and the Central Indiana Railway line became the Midland Trace Trail between Westfield and Noblesville. "But at that time, we didn't have the manpower," he said.

IN CASE YOU MISSED IT:

Top Articles Featured in the ISPLS Newsletter | July 2019 - September 2019

- What Gen X means for the future of surveying
  July 8 Newsletter | GPS World
- Interior to move most of Bureau of Land Management's DC staff out West
  July 15 Newsletter | Washington Post
- Who will win in Apple-Google map race?
  July 23 Newsletter | Geospatial World
- Using the new 'GPS on Bench Marks' interactive map
  August 5 Newsletter | GPS World
- 8 emerging technologies that could impact geospatial industry
  September 4 Newsletter | Geospatial World
- UESI Surveying & Geomatics Conference coming to the Midwest in 2020
  September 17 Newsletter | ISPLS

Have an article you want to see in the ISPLS Newsletter? Email Evan Hoffmeyer.

A crew from the Marion County Surveyor's Office measures a distance to a tie along the former Nickel Plate Railroad tracks between 86th and 96th streets. From left are crew chief Robert Pangelinan and surveying technicians Joshua Lindo and Kevin Herrin. The rails and crossties, which have since been removed, will be replaced by a paved pedestrian trail. (Photos submitted by Ethan Evans)

Crew chief Robert Pangelinan sets a MAG nail at the intersection of the centerline of a culvert and the centerline of the former Nickel Plate Railroad tracks. Marion County Surveyor's Office crews recorded 152 locations between 96th and 22nd streets. Photographer Ethan Evans' shadow is at right.

Joshua Lindo, foreground, follows Kevin Herrin and Robert Pangelinan as the Marion County crew heads south along the former Nickel Plate tracks between 96th and 86th streets.

I SURVIVED CAREER DAY AND THE CST EXAM ALL IN 1 YEAR

By Glen E. Boren, PS, CST I

The Northwest Chapter of the Indiana Society of Professional Land Surveyors held a joint meeting last year with the Chicago/Northeast Chapter of the Illinois Professional Land Surveyors Association with the theme of an almost worn-out topic of "workforce development." The goal of the meeting was not just to talk about the lack of the next generation of surveyors, but to come away with some action items for the individual surveyor that may actually help the profession.

There were several great presentations about a number of topics, but there were two areas that really caught my attention and seemed attainable. The first is participating in career days at local schools; the second is implementing a Certified Surveying Technician program in my workplace.

For most introverted surveyors, participating in a career day can be a bit of an uncomfortable task. I really had never participated or much less put on a presentation about surveying outside of helping with Trig-Star exams at the high school level. So when my daughter's elementary school sent out a flyer at the end of the school year asking for people to participate in a career day, I was delighted (even after I figured out they were just filling time to make up for lost instructional time from snow days). It was the opportunity I'd been looking for.

The key to any speech or presentation is to know your audience. In this case, I needed to bring down my lofty goals of creating a legion of surveyors from the approximately 500 students I was going to talk to — and just be happy if they knew what a surveyor was by the time I left.

I found out that I would be given a table in the gym next to other occupations for approximately two hours where students in different grades were cycled in every half an hour. The school encouraged giving away promotional material like stickers and pencils in addition to having some informational material presented on a tri-fold board.

I created the tri-fold board with some basic information breaking down everything we do into the two M's of mapping and measuring, or M&M, if you will. I briefly saw a brilliant connection between my material and the glorious people at the Mars Wrigley Confectionery for my promotional giveaway item, but was soon reminded (and rightfully so) of the danger of distributing peanut-laden sugar bombs on the unsuspecting teachers who were welcoming me into their school. So, I turned to some promotional pencils that I ordered online featuring a stock picture of Mount Rushmore with the (hopefully uncopyrighted) "Three surveyors and another guy" phrase.

The wonderful people of NSPS graciously provided me with little blue globe stress balls with the NSPS logo. Their supplies also included Get Kids Into Survey posters, stickers and coloring pages, though I had to take out the Crime Scene Yeti coloring page. While a dead yeti with a knife in its back may play well with kids in the U.K., more sensitive U.S. kids (and parents) would be left remembering the word "surveyor," but not in a good way.

Stress balls were a big hit among older elementary school students on Career Day. Glen Boren had none left at the end of the day, but wished he had one more. (Photo submitted by Glen Boren)

I arrived at the school a little early to set up a small automatic level, the posters mounted on display boards and everything else I could carry, not really knowing what to expect. It turns out they put me between a beekeeper and a nurse.

The bell rang and it was pretty much mass chaos as the kindergarteners and first graders trampled all they saw before them. They loved the pencils and stickers, but they saw the posters and asked how they could get one. I told them they had to answer a question from the tri-fold board, which they immediately scurried over to and began frantically reading. When the first ones came back, I asked them the simple question, "What do surveyors do?" which prompted a series of blank looks and running back to the tri-fold. Finally, a student ran up and said, "mapping and measuring," to which I handed him a poster. He held it to the sky as the other children formed a circle around him gasping at the prize he had achieved.

Glen Boren prepared an informative tri-fold display for an elementary school Career Day event. It helped students answer questions about surveying — and receive rewards. (Photo submitted by Glen Boren)

For the next half hour, random children came up to me and screamed in my face, “mapping and measuring,” before I could even ask the question.

As the event progressed to the older students, they became weary of the stickers and posters, so I reached below the table and pulled out the blue globe stress balls. I lost sight of my automatic level as the students formed a very large crowd around the table to the point where I thought the ones in front were going to be crushed. The sheer mass of the group began to overtake my beekeeping and nursing neighbors.

I tried to change up the questions to limit the number of balls that I would give out as I knew I didn’t have enough to go around. After I ran out of questions, I turned it into “ask-a-surveyor.” It seemed to slow the chaos down and became very interactive and informative.

When the last of the students left the gym, I packed everything up except for the globe stress balls, which were completely gone. I had made my way to the school office to check out when a frantic teacher came in and asked the office staff if they knew who was giving out the globe stress balls. She explained that she needed one more because one of her students was having a complete meltdown because he didn’t get one.

There was maybe some heated discussion with the front office staff about who in their right mind would not bring enough promotional items. I quietly mentioned that it was probably the beekeeper and left.

I followed up with a thank-you email to the teacher who organized the event in hopes of getting invited back next year as I assessed whether I made an impact or at least achieved my goal. I eagerly awaited the arrival of the weekly school newsletter which summarized the event for the parents. The article also contained pictures of the beekeeper and the nurse and some other occupations, but sadly not the surveyor. The article went on to mention the various occupations that were represented including a beekeeper, an engineer, a Realtor, a baker, a fireman and others. As I scanned the remaining list of occupations for the payoff that I so desperately wanted, I came to the end of the list without once finding the word “surveyor.”

Then it dawned on me: there were no engineers at the event.

So, while we continue to try and change the adult perception of who we are and what we do, the kids seem to get it. I know that the kids can at least read the giant letters of the word “surveyor” on a tri-fold board that was displayed during the entire event, something that was missed in the weekly newsletter.

I also know that I gave out more than 50 Get Kids Into Survey posters, and a good percentage of them might be hanging in bedrooms right now. I also know that I gave out more than 100 pencils that had the word “surveyor” on them, many of which went home or stayed in the classrooms.

The other reason I am encouraged is that I volunteered for the school Field Day about a week later where I ran a pizza box relay race. About mid-morning, a student came up to me and said he recognized me and added, “You’re that surveyor guy.” (Not “engineer” guy, so I consider that a win.)

Then he asked me for a globe stress ball, but the point had already been made.

(To be continued in the next issue of the Hoosier Surveyor, with Glen Boren writing about his experience implementing a CST program where he works.)

Glen E. Boren, PS, CST 1, is Director of Surveying at DVG Team, Inc., in Crown Point, Indiana.

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COMMON PITFALLS OF POINT CLOUDS IN DRONE SURVEYING - AND HOW TO AVOID THEM

By Logan Campbell, Aerotas

Ever since the introduction of LiDAR, point clouds have been a hot topic of discussion and debate among surveyors. They provide a rich and highly accurate source of data, but their complexity and size cause many firms to struggle when integrating point clouds into their data processing workflow.

Because of the rise in popularity of drone-based photogrammetry, the point cloud discussion has gained momentum. Point clouds are one of the core outputs of photogrammetry; some firms are very familiar with laser scanning technologies and successfully use point cloud data, but many do struggle and decide not to use point clouds at all, while others wind up using point clouds in a way that takes way too much time, costs too much money, and actually leads to a lower quality deliverable. We want to help you avoid the latter.

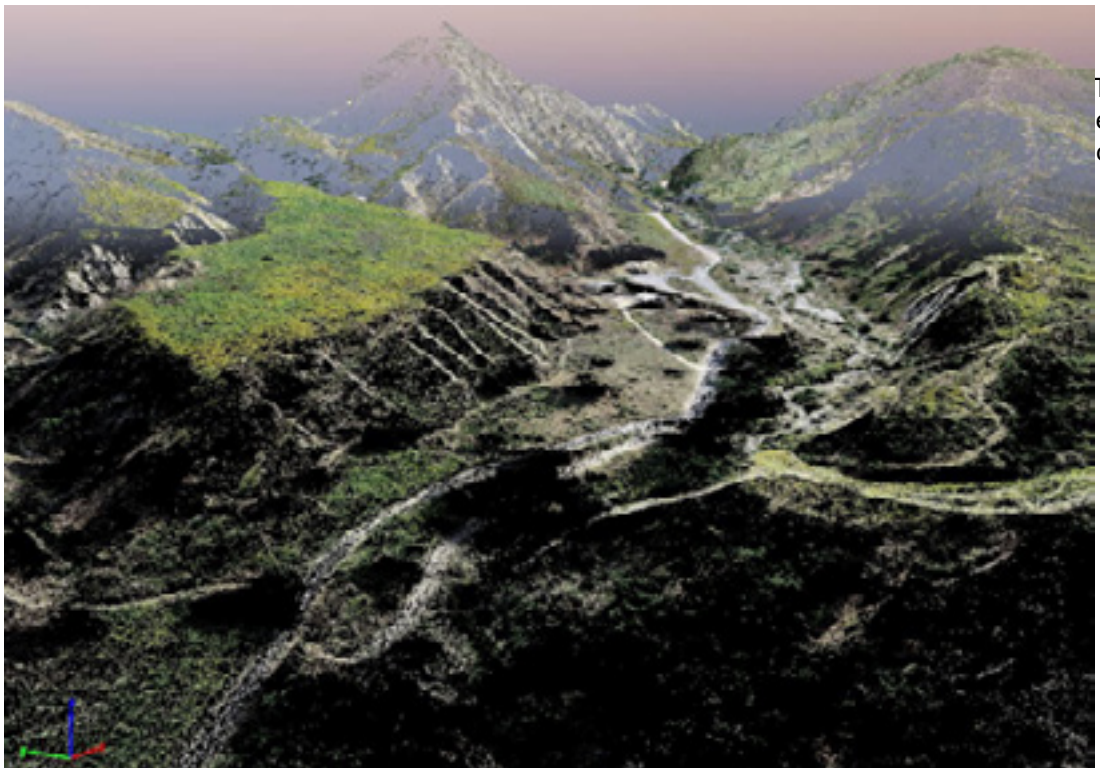
Although point clouds from drones are an incredibly rich and valuable source of data, they are often misused. When used properly, point clouds can serve an important role in a well-developed drone surveying system. In this article, we will examine some common pitfalls of point clouds, and discuss how to avoid them.

Working in point clouds is difficult for three main reasons. This article will help you avoid these common pitfalls and provide a few tips for successfully integrating point clouds into your drone surveying workflow.

The Benefits and Challenges of Point Clouds

Point clouds are the richest, most complete, and most accurate source of data that comes out of drone photogrammetry. If the photogrammetry step has been processed well, then any bit of information contained in the photos will be represented as accurately as possible in the point cloud. So, if the data is so good, then why not use point clouds all the time and for every project?

The problem is that working in point clouds takes a lot of time, and if your drone program isn't saving time and money, then it isn't working. So, if it is taking too long, then it probably makes sense to default to alternative methods rather than spending a week parsing through a massive point cloud file.



Sparse point cloud of valley (image provided by Aerotas)

The Challenges

There are three key challenges that make working in point clouds difficult:

- Too much data: The benefit of point clouds is that they capture absolutely everything about a project site. But that is also their downfall. When surveying a project site, surveyors almost never need to know the location of every leaf and every branch on every tree. They don't need to know how many bumps there are on a manhole cover. They don't need to know the exact dimensions of the roof rack strapped to the car parked on the edge of the property. And yet all that data is there. In order

to get a clean deliverable, all of that data would have to be properly cleaned out, which can be very time-consuming.

- Unclassified points: Part of what makes working in point clouds so time-consuming is that, by default, drone point clouds typically aren't classified in any meaningful way. With the advancement of machine learning and artificial intelligence, automated programs are getting better at automatically classifying points as surface, vegetation, objects, buildings, etc., but from first-hand experience, these algorithms still have quite a ways to go before they can become useful. So, for now, it is up to the surveyor to determine what is what in a point cloud and classify the data in the way they need it, whether that be curb lines, topographic features, buildings, or vegetation.

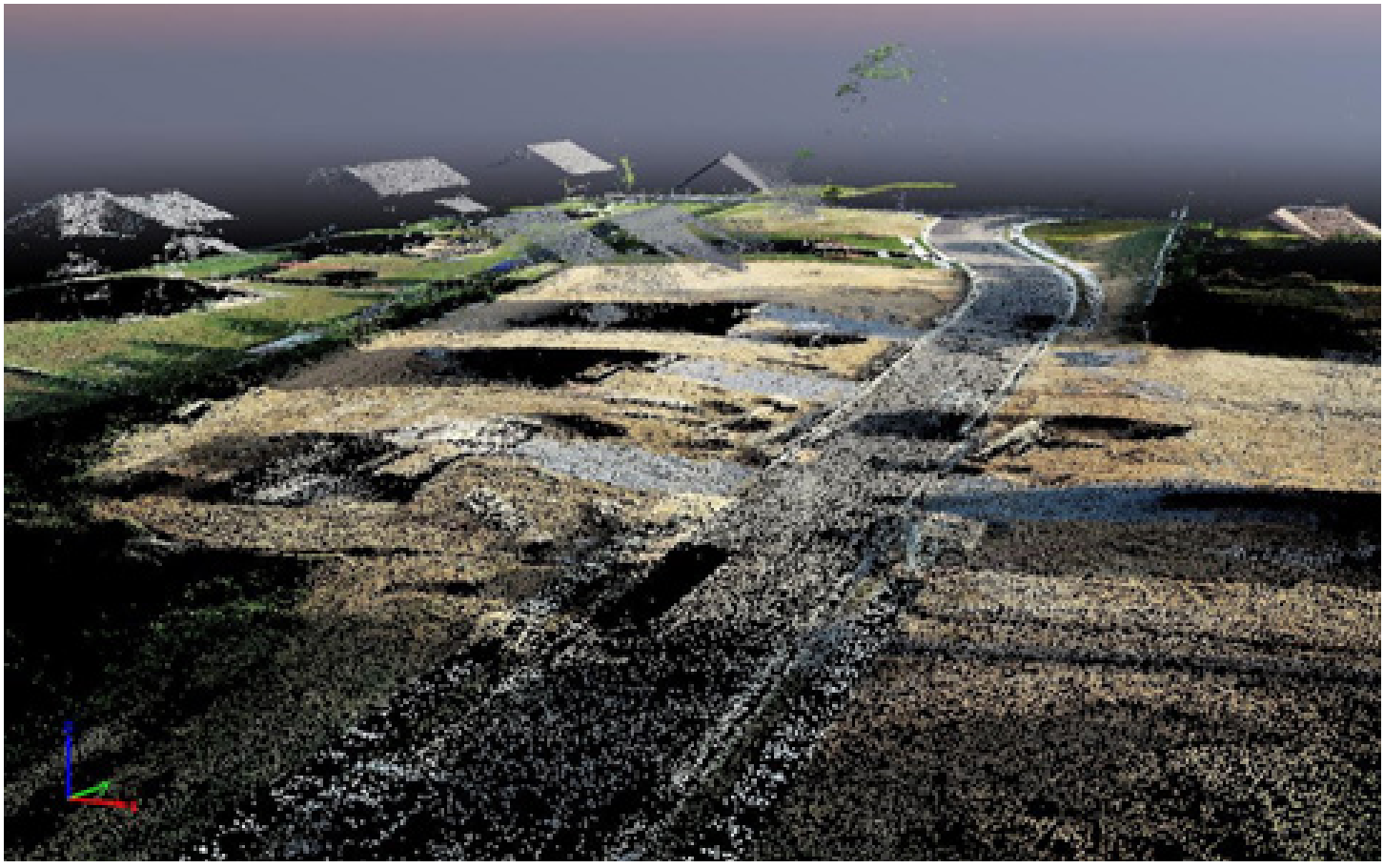
- Difficult to Manage: Lastly, point clouds are very difficult to manage. The large file size, often over 10GB, can be difficult to transfer and will usually crash familiar programs like Civil 3D without extensive modification. So instead, specialized point cloud software is used to extract data from the point cloud. This software can be extremely expensive and can still be difficult to use for all but the most experienced engineers and design technicians. Put simply, working in a point cloud takes a lot of the right types of hardware, software, and experience.

Tips for Working in Point Clouds

Working in a point cloud is not only possible, but if done correctly, can be a valuable addition to an aerial surveying program. Here are a few tips we have found over the years that help when you want to work in point clouds.

- Extract selected data: When working in a point cloud, you should go in knowing what data you need to extract, and then extract only that. A common mistake is to try and get everything, and it winds up being a time killer. Being brutally selective about what data you are trying to extract will help to save a huge amount of time.

- Don't force a square peg into a round hole: Or rather, don't try to work with a point cloud in a program that isn't designed for it. A common mistake that we see is when people delete 90% or more of points to make the point cloud smaller so it will work in familiar applications like Civil 3D. This is a process we call "Dumb Decimation", and it results in losing 90% of the accuracy! Important features, like utilities, fire hydrants, signage, and curbs often disappear entirely in this method, and what is left is of lower quality than it was before. When working in point clouds, use a program designed to work with point clouds, and only ever use the full resolution file.



Sparse point cloud of subdivision under construction (image provided by Aerotas)

- Know the limitations of photogrammetry-based point clouds: Photogrammetry-based point clouds may be the richest source of data from photogrammetry, but that doesn't make it perfect. While LiDAR often can penetrate at least some vegetation, the point clouds that come out of photogrammetry still only map the tops of vegetation. This means the top of tall grass, and the tops of trees when present. No amount of point cloud editing will create points where they don't exist. As long as you are aware of these limitations going in, you should be fine.

- If it isn't working, use something else: Point clouds are not the solution to every problem. If you find yourself spending too much time working in a point cloud, and you just aren't getting the data you need, don't be afraid to collect more data in the field or on the ground, and use that to supplement your drone data. Or, don't be afraid to abandon point clouds entirely and use an alternative method of extracting data from drone photogrammetry.

Alternatives to Point Clouds

If point clouds aren't working for you, don't give up hope! There is a huge amount of value to be had from drone photogrammetry, and not all of it comes from the point cloud. Here are a few other methods that can be successful in certain instances.

- Orthophoto drafting: One of the simplest ways to get accurate data out of drone photogrammetry outputs is drafting data directly onto the orthophoto. This has the benefit of being extremely easy, very intuitive, and very accurate for XY coordinates at least. The obvious, massive downside to this is that the resulting data is not going to have any elevation data associated with it, so the applications are clearly limited.

- 2.5D modeling: This is the result of combining a raster DSM file with the orthophoto, both of which are typically standard outputs of any decent photogrammetry software. By combining these into a 2.5D surface model, it is a lot easier to extract individual points and polylines from a surface than it is to work in a point cloud. The downside is that, because the model is only 2.5D, it is impossible to "look under" any eaves, trees, overhangs, or equipment to the surface below. But while the point cloud typically has richer data than the 2.5D model, often the time savings more than makes up for the slight loss in data quality.

- Hire an outside expert: Many people make a career out of working in 3D data. That, combined with specialized computer hardware and software, means that specialists are often able to extract data from a point cloud faster, cheaper, and more accurately than others. Companies like Aerotas specialize in this type of work and can help you get the best data in the most efficient manner possible.

Using Point Clouds for Drone Surveying

Point clouds are a mixed blessing for many people. Their richness and accuracy have enabled surveyors to collect and analyze data that was never before possible. But they have also turned into a massive time sink, costing hundreds of hours that could have been spent better on other projects. The best way to use point clouds in drone surveying is to make sure that you use them selectively. Point clouds are not a magic bullet that solves all problems, so only use them when you know they can provide value. Also, be sure to use point clouds as part of a mixed workflow. Combining point cloud data with orthophoto data, 2.5D data, and good old-fashioned field surveying typically leads to the best end result.

About the Author

Logan Campbell is the founder and CEO of Aerotas. He began his career as a statistician and went on in 2014 to found Aerotas, which provides drone data processing services for surveyors. He holds an MBA from Harvard Business School and is a Certified Mapping Scientist - UAS by the American Society for Photogrammetry and Remote Sensing (ASPRS). As a recognized industry expert, he regularly speaks at survey and drone conferences and also writes for various land surveying publications.

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Dennis R. "Woody" Woods

Dennis R. “Woody” Woods, 72, a resident of Wayne Township in Indianapolis, passed away Aug. 29, 2019.

He retired in 2009 as a land surveyor and crew chief for A&H Surveying, Avon. He previously worked for the State Highway Commission, as a draftsman; MW, Inc., in the bridge department and surveying staff; and USI. He also was a U.S. Navy veteran, working in construction as a Seabee in Vietnam, and he was remembered as being active in Scouting and an avid hunter and fisherman.

“He was a good and thorough surveyor,” said Rick Alexander, of Alexander Surveying, formerly A&H Surveying. “He taught me a lot of different skills, and he also had a great sense of humor. I will miss him.”

Surviving are his wife, Lana Sherfick Woods; and son, Eric Woods.

A military service was held Sep. 12 at Conkle Funeral Home - Speedway. Online condolences may be shared in his online guest book.

(Photo courtesy of Conkle Funeral Home)

William F. "Frank" Switzer

Frank Switzer, 85, of Crawfordsville died Aug. 10, 2019, at Life’s Journey of Avon. He was a long-time resident of Crawfordsville.

He was born in Alamo as the son of Raymond and Vina (Mullen) Switzer. He graduated from Crawfordsville High School and Purdue University. Following graduation he served in the United States Army Corps of Engineers as a second lieutenant and was promoted to first lieutenant in the Army Reserve.

Switzer was a registered land surveyor and a registered civil engineer, working for the Indiana State Highway Commission for 38 years. He held positions as project engineer, traffic engineer, construction engineer, field engineer and district director. Upon retirement, he was awarded the title of Sagamore of the Wabash by then Gov. Evan Bayh for his services to the State of Indiana.

He later worked part-time in a custom cabinetry shop in Lafayette and pursued his interest in woodworking by building projects for family and friends. In tribute to his farm upbringing, he acquired and refurbished a 1947 Farmall M tractor which he enjoyed displaying at the annual Strawberry Festival and 4-H Fair. He was a member of the Montgomery County Pioneer Club.

Switzer attended and was a member of Woodlands Height Christian Church. He held membership in the Montgomery County Shrine Club, Montgomery County No. 50 Masonic Lodge, Scottish Rite Valley of Indianapolis, and The Murat Shrine in Indianapolis. He also was a member of the American Legion. He had previously belonged to the Crawfordsville Country Club, Elks, Eagles and the Moose Lodge.

During recent years, he enjoyed reading and having morning coffee and playing cards at the American Legion Post.

Switzer married Maudanna Mills on Dec. 26, 1954. At the time of her death, they had been married for 58 years.

He was preceded in death by his wife; his parents; his brother/best friend, Ed Switzer; his older sister, Elsie Jernagan; and his youngest sister, Mary Cox.

He is survived by two daughters, Yvonne Ratcliffe (Larry) of Indianapolis and Paula Schroeder of Biltmore Lake, North Carolina; and three grandchildren, Dana Ratcliffe, David Ratcliffe and Holly Schroeder. Also surviving are his sister, Georgia (Bill) Redden as well as seven nieces, a nephew and their respective families.

In lieu of flowers, the family asks that memorial contributions be made to Midland Meals, Crawfordsville Senior Nutrition Site, 3313 Concord Road, Lafayette, IN 47909; or the Shriners Hospital for Crippled Children, Development Office, 2211 N. Oak Park Avenue, Chicago, IL 60707-3392.

(Originally published in the Journal Review, Aug. 14, 2019.)

ISPLS PUBLICATIONS DONATED TO STATE LIBRARY

By Mike Davis

Over the years, Life Member Roger Woodfill saved — and rigorously filed — an impressive collection of Indiana Society of Professional Land Surveyors publications. That's probably no surprise to those who know of his long interest and participation in the Surveyors Historical Society at the national and state level.

Those documents have now been donated to the Indiana State Library, where they are a permanent part of the Indiana Collection. While the ISPLS has preserved its own 35-volume set of Hoosier Surveyor issues, no other library is known to have a collection of the publications, and Librarian Monique Howell said they are "exactly the type of thing we collect."

They are referenced in an online catalog (www.in.gov/library/catalog.htm) — and though the issues or publications themselves are not posted online, they are available for use in the library at 315 W. Ohio St. in downtown Indianapolis.

The items include printed copies of the Hoosier Surveyor magazine from September 1974 (Vol. 1, No. 1), to the Spring 2008 publication (Vol. 34, No. 4), as well as photocopies of issues from Summer 2008 to Summer 2015.

The collection also features a December 1967 copy (Vol. 12, No. 1) of Surveying and Mapping News, a four-page newsletter. It was edited by the late Ken S. Curtis, a Purdue University civil engineering professor, and jointly published by the ISPLS and the School of Civil Engineering and the Division of Conferences and Continuation Services at Purdue.

Curtis was named executive secretary when the ISPLS was formed in 1953, helped launch Surveying and Mapping News in 1956 and stayed on for more than 50 years as editor of what eventually became the Hoosier Surveyor magazine. He retired from Purdue in 1992.

Other early publications in this grouping are six issues of Surveying & Mapping Newsletter from 1969-72 and three issues of the Hoosier Surveyor Newsletter from 1972 and 1973.

Items in the collection also include:

- A variety of brochures on such topics as Surveyor-Client Relations, ISPLS Standards of Practice, Development Planning, and Land Descriptions, as well as program brochures from the 1971 and 1973 Annual Land Surveyors Conferences, both held at Purdue.
- The Compass, an ISPLS Board of Directors publication (four issues from 1981 and 1982).
- A September 1988 ISPLS Newsletter that mentions contact by the Collegiate Liaison Committee with Dr. Henry T. Yang, Purdue's Dean of Engineering, to discuss searches for new heads of the Civil Engineering and Surveying and Mapping programs, as well as student recruitment efforts and establishing an advisory committee for the Surveying and Mapping program.

Roger Woodfill stands beside the Thoreau family headstone in Sleepy Hollow Cemetery, Concord, Mass., on September 24, 2017, during a Surveyors Historical Society dedication of a Final Point marker at the nearby gravesite of author and surveyor Henry David Thoreau. The recognition honored Thoreau's contributions to land surveying. Woodfill, an ISPLS Greenville Treaty Chapter member from Lawrenceburg, served as the historical society's administrator.

Woodfill, who lives in Lawrenceburg, served as ISPLS president in 1978 and 1990. He also was administrator of the Surveyors Historical Society for many years and is a member of the Greenville Treaty Chapter.

What's next?

While the State Library's collection of Hoosier Surveyor issues is large, there are some gaps. There are no copies of the 1981 combined Hoosier Surveyor Magazine issues 8-3 and 8-4, the 1986-87 issue 13-1, or the 2004-05 issue 31-3. Also missing are Surveying and Mapping News publications from 1956 through 1966, as well as an issue or issues from 1968.

Assistance from anyone who can help fill these gaps is welcome. Contact Mike Davis at mijdavis@iupui.edu or (317) 777-2954.

Also, though the ISPLS has scanned issues of the Hoosier Surveyor magazine dating back to 2010 and posted them online, it hopes to find a volunteer or volunteers who could scan copies from 1974 to 2010 so that the entire series would be available. For more information, contact Executive Director Brian Lewis at execdir@ispls.org or (800) 362-2546.

Early ISPLS Publications Inventory

Year	Volume	Issue	Issue	Issue	Issue
Surveying and Mapping News					
1967	12	12-1			
Surveying & Mapping Newsletter					
1969	14	14-1			
1970-71	15	15-1	15-2	15-3	
1971-72	16	16-1	16-2		
The Hoosier Surveyor Newsletter					
1972	1	1-1	No. 42		
1973		No. 43	No. 44		

Hoosier Surveyor Magazine Inventory

Year	Volume	Issue	Issue	Issue	Issue
1974	1	1-1	1-2		
1975	2	2-1	2-2	2-3	
1976	3	3-1	3-2	3-3	
1977	4	4-1	4-2	4-3	4-4
1978	5	5-1	5-2	5-3	5-4
1979	6	6-1	6-2	6-3	6-4
1980	7	7-1	7-2	7-3	7-4
1981	8	8-1	8-2		
1982-83	9	9-1	9-2	9-3	9-4
1983-84	10	10-1	10-2	10-3	10-4
1984-85	11	11-1	11-2	11-3	11-4
1985-86	12	12-1	12-2	12-3	
1986-87	13		13-2	13-3	13-4
1987-88	14	14-1	14-2	14-3	14-4
1988-89	15	15-1	15-2	15-3	15-4
1989-90	16	16-1	16-2	16-3	16-4
1990-91	17	17-1	17-2	17-3	17-4
1991-92	18	18-1	18-2	18-3	18-4
1992-93	19	19-1	19-2	19-3	19-4
1993-94	20	20-1	20-2	20-3	20-4
1994-95	21	21-1	21-2	21-3	21-4
1995-96	22	22-1	22-2	22-3	22-4
1996-97	23	23-1	23-2	23-3	23-4
1997-98	24	24-1	24-2	24-3	24-4
1998-99	25	25-1	25-2	25-3	25-4
1999-00	26	26-1	26-2	26-3	26-4
2000-01	27	27-1	27-2	27-3	27-4
2001-02	28	28-1	28-2	28-3	28-4
2002-03	29	29-1	29-2	29-3	29-4
2003-04	30	30-1	30-2	30-3	30-4
2004-05	31	31-1	31-2		31-4
2005-06	32	32-1	32-2	32-3	32-4
2006-07	33	33-1	33-2	33-3	33-4
2007-08	34	34-1	34-2	34-3	34-4
Photocopies only of the following issues					
2008-09	35	35-1	35-2	35-3	35-4
2009-10	36	36-1	36-2	36-3	36-4
2010-11	37	37-1	37-2	37-3	37-4
2011-12	38	38-1	38-2	38-3	38-4
2012-13	39	39-1	39-2	39-3	39-4
2013-14	40	40-1	40-2	40-3	40-4
2014-15	41	41-1	41-2	41-3	41-4
2015	42	42-1			
Note: Copies of Issues 36-3 (Winter 2010) to current at ispls.org					

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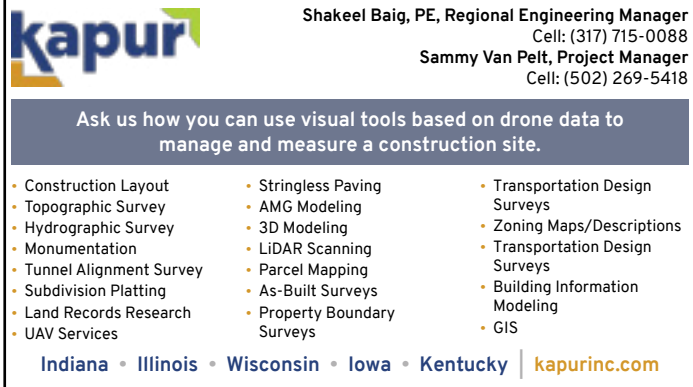

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