

Carlson Software -

the Complete Toolkit for Today's Land Surveyor

*A case study of developing
an ALTA/NSPS Land Title Survey
using Carlson's Survey solutions.*



The Dilemma of Deadlines

No surveyor is a stranger to a tight deadline. At times, clients can be completely unrealistic when it comes to expressing their needs as far as a timeline goes. The truth of the matter is many don't really know what goes into a survey so have no inclination of how much time it takes to complete a survey.

Intuitively, most people assume that the larger the project (in terms of area) the longer it will take and the more expensive the survey will be. Surveyors, however, know that the amount of detail on the site is often the greater cost and time variable than the size of the property itself. Not to mention the complexity of the boundary, which is probably the most difficult variant to explain to a client.

The positive aspect to a tight time frame for a project is that, in many cases, the surveyor's ability to meet a client's accelerated schedule will often outweigh the cost of the survey. The surveyor's challenge then is to produce a final product as quickly as possible without sacrificing quality and accuracy. If a firm can get confident in a work flow that lends itself to both speed and accuracy, the words "I don't care about the cost; I just need this done" can be music to their ears.

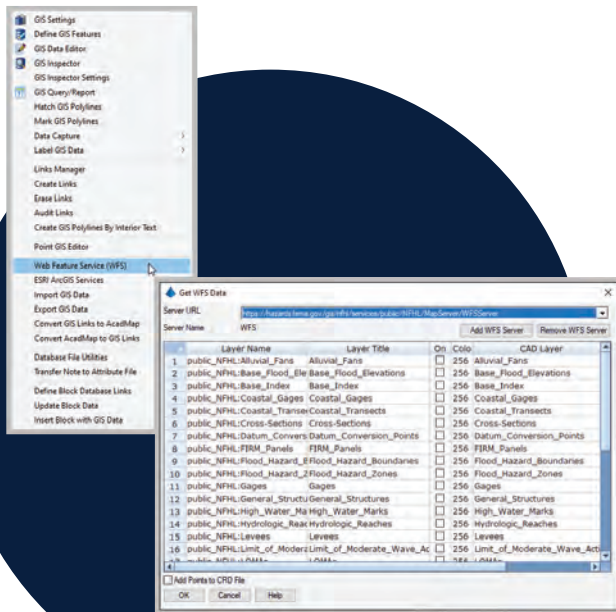
This case study follows such a firm, Merrill Engineers, that was tasked with performing an ALTA/NSPS Land Title Survey for a project almost 90 acres in size that contained a fully developed commercial business site. While Merrill was already scheduled to capacity for the foreseeable future, the deadline for this survey was three weeks.

Douglas L. Aaberg, PLS, Director of Land Surveying at Merrill Engineers and Carlson Product Advocate.



Douglas L. Aaberg, PLS

Planning the Survey and Developing a Base Map



Most residential surveys don't really take a great amount of planning. Research the property for record information, perhaps perform some initial calculations, review the scope with a field crew, and you're off. Larger surveys require more forethought. For this survey, I decided to make use of several of the tools available to me. I took full advantage of drone technology, GPS efficiency,

and the plethora of publicly available data and information. I like to begin each job using Carlson's GIS module that imports shape files, Google Earth images, flood zone information, and just about anything else you can get from a public URL. With Carlson GIS, we created a base map with parcel lines, owners, deed references, flood zones, and other resource areas.

Product Spotlight



Carlson BRx7 GNSS Base/Rover

The Carlson **BRx7 GNSS** Base/Rover represents the highest performing, most reasonably price, best supported GNSS solution available today.

For more information, visit:
carlsonsw.com/brx7





Jumpstarting a Job with GNSS

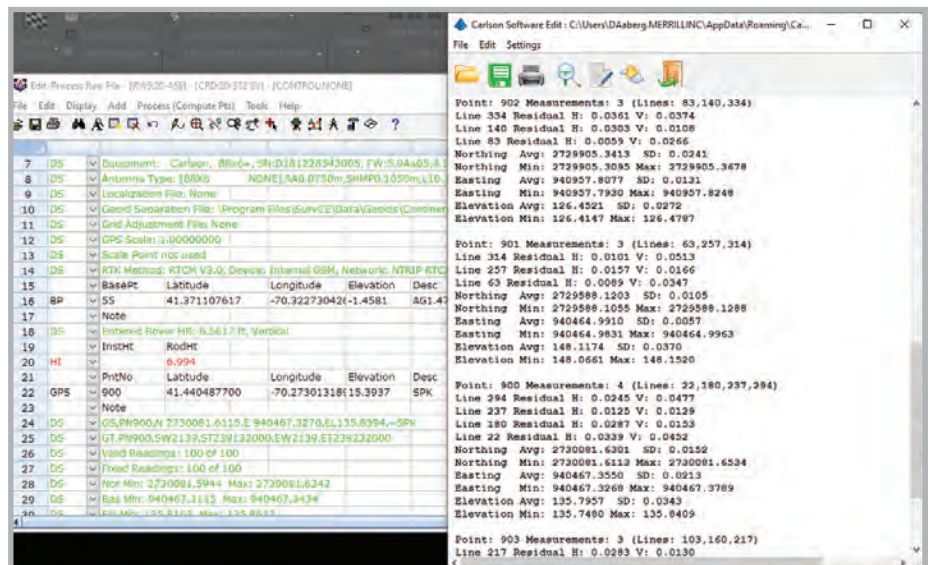
Most surveyors are using – or are at least aware of – GPS technology and how a GNSS receiver can greatly reduce the amount of time it takes to complete a field survey. The confusion and hesitancy in the steady use of GNSS receivers is the lack of confidence many surveyors have in the results. Any surveyor who has used a network solution for an RTK survey is well aware of some of the inherent inconsistencies that come with it. Whether it be a public or “pay for” system, accuracy can vary depending on things like the density of the network, atmospheric conditions, available constellations, and the number of satellites in view. The reality though is that with a better understanding of the limits of RTK and the implementation of a field workflow that includes checks, balances, and minimum post processing adjustments, GNSS receivers can be used in everyday surveys that meet high standards; in this case, those set out by ALTA/NSPS. You don’t have to

sacrifice the expediency of GPS to achieve great results.

For this survey, we ran an initial control network using our Carlson GNSS receivers tied to the state of Massachusetts public network. Panels were set at each point for the drone portion of the survey that would ultimately be used for the lion’s share of drafting.

A healthy series of “Check Points” were gathered as well. (paint stripes, utilities, etc.)

To increase the precision of the initial control points, longer occupations were made at each, 100 epochs minimum, with redundant occupations that were then averaged using Carlson’s Raw Data editor.



Drafting From a Drone Survey

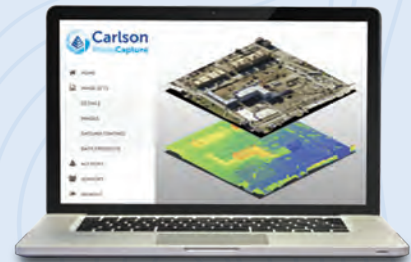


The use of drones in surveying is another technology that is becoming more popular. As a matter of fact, it is one of the most rapidly growing elements of the industry. There are a lot of misconceptions about drones with regard to the accuracy, reliability, and cost. Many surveyors and engineers are under the impression that a monumental investment must be made to get any kind of reliable data when it

comes to photogrammetry. The truth is, you can get very good results using what I would consider somewhat of an entry level drone with a moderately priced camera. For this survey, we used a 24MP camera flown at an altitude of 150' above ground.

Zoomed up, you are able to make out everything from cracks in the pavement to light poles and drainage structures.

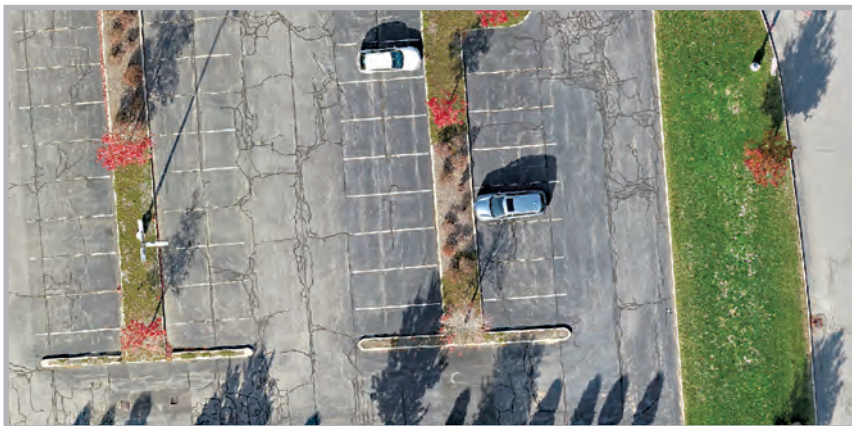
Product Spotlight



Carlson for Photogrammetry

Carlson PhotoCapture bridges the gap between drones and CAD by using powerful technology to quickly generate highly accurate 3D site maps, orthoimages, surfaces, point clouds, and more.

For more information, visit:
carlsonsw.com/photogrammetry



Creating an Orthoimage and Point Cloud

Regardless of how crisp the images are, they are not georeferenced well enough to ever be considered “survey accurate.” The trick is to tie the images to the ground, hence the use of the panels.



I used Carlson’s PhotoCapture to produce both a composite ortho-image and point cloud of the area captured by the drone. The individual JPG files produced by the drone were uploaded into Carlson PhotoCapture, which has an extremely easy-to-use “drag and drop” interface.

Since PhotoCapture is an online processing program, I only had to upload the photos and reconcile them with the ground control points. After that, I could get back to work on other parts of the project while Carlson PhotoCapture did the rest. After processing, the georeferenced TIF composite image file was inserted and initial drafting of the plan began.

Product Spotlight



Carlson CR+ Series

The **Carlson CR+ Series** of Robotic Total Stations, available in 1”, 2”, and 5” angular resolutions, provide field-proven, fast, and efficient workflows to surveyors.

For more information, visit:
carlsonsw.com/cr-series



Carlson SurvCE and Carlson SurvPC

Whether with the BRx7 and CR+ Series or with one of the hundreds of other models from numerous manufacturers, **SurvCE** and **SurvPC** are the industry-leading surveyor’s choice for mobile software.

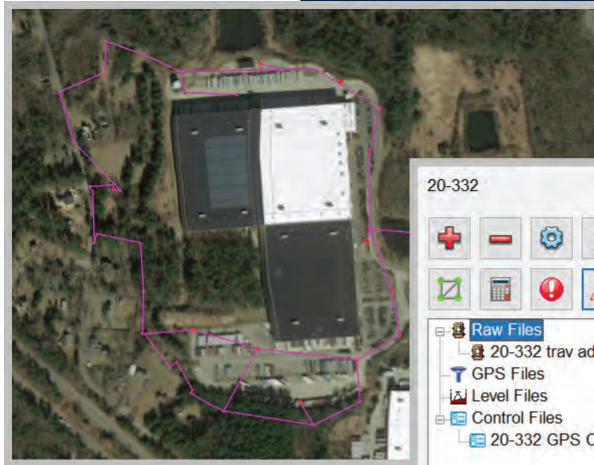
For more information, visit:
carlsonsw.com/survce

Combining with a Ground Survey

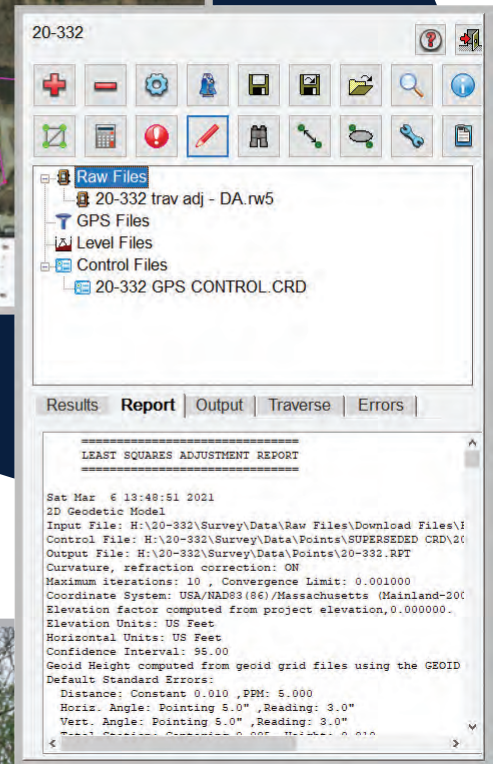
for Tighter Control

Even though the orthoimage had been fixed to ground control points, it was not to be used for the perimeter survey itself. A ground survey still needed to be performed to locate all monuments and any detail or any improvements that were within 10' of the boundary lines (my comfort level). I doubt there is any surveyor that would show an encroachment over a property line without first field verifying it. Areas obscured by trees or buildings in the drone survey also needed to be investigated. The details that could be gathered from the imagery were paint stripes, pavement, islands, utilities, etc., which saved a tremendous amount of field time.

A field traverse was performed collecting all of the needed information



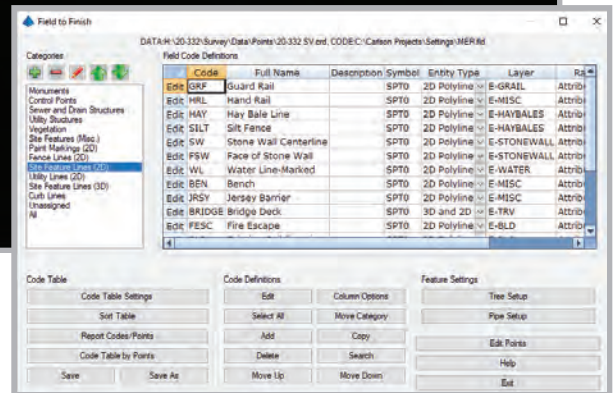
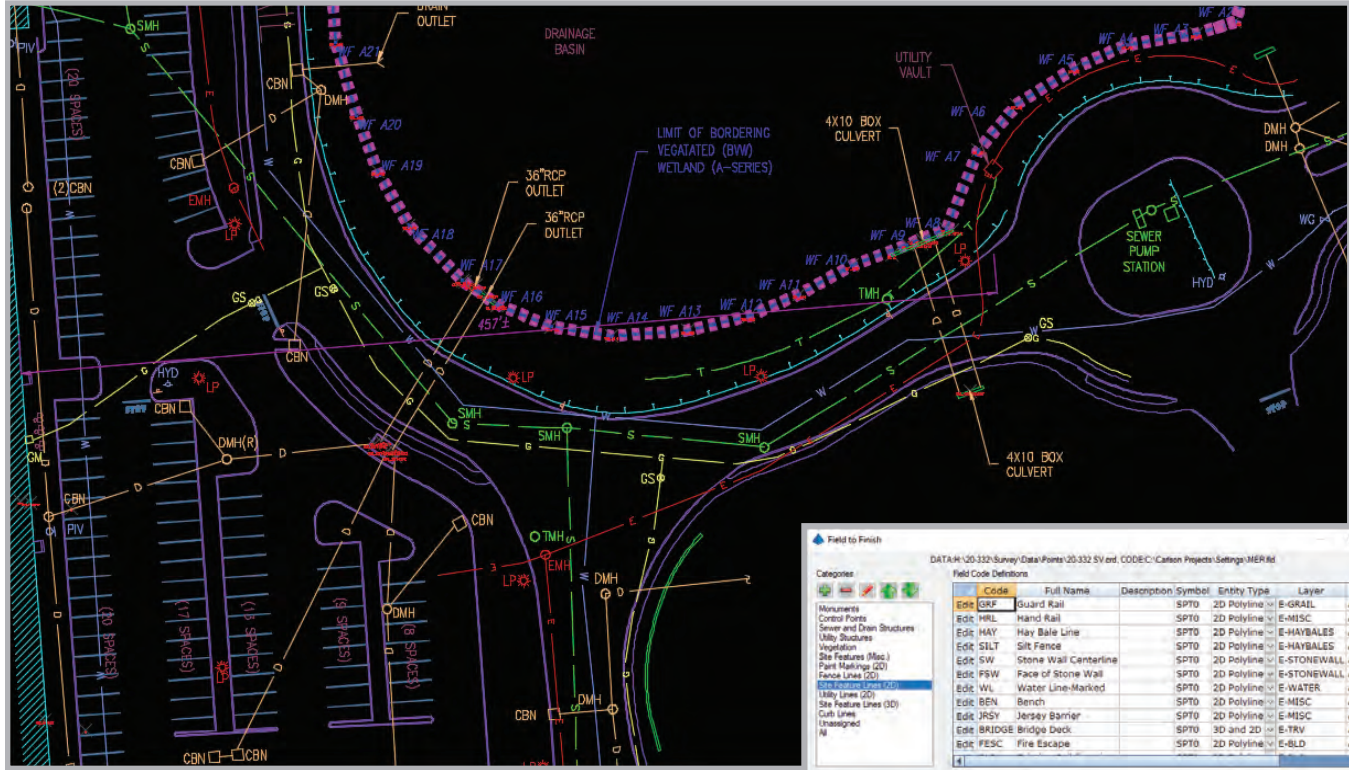
as well as tying into the initial GPS control points. Using **Carlson SurvNET**, a least squares adjustment was then made that included the entire network of ground and GPS control.



We use **Carlson SurvCE** data collection software not only because they work seamlessly with our Carlson office software, but because they also support many other hardware manufacturers in the industry. We have some existing equipment that the crews are familiar with, and SurvCE communicates with that equipment without issue.

SurvNET also produces an ALTA report that checks all user-identified connections as to compliance with the specified ALTA/NSPS standards.

Going From Field to Finish



Carlson Software has an extremely versatile **Field to Finish** program included in the **Carlson Survey** module that essentially drafts lines, symbols and annotations directly from raw field data.

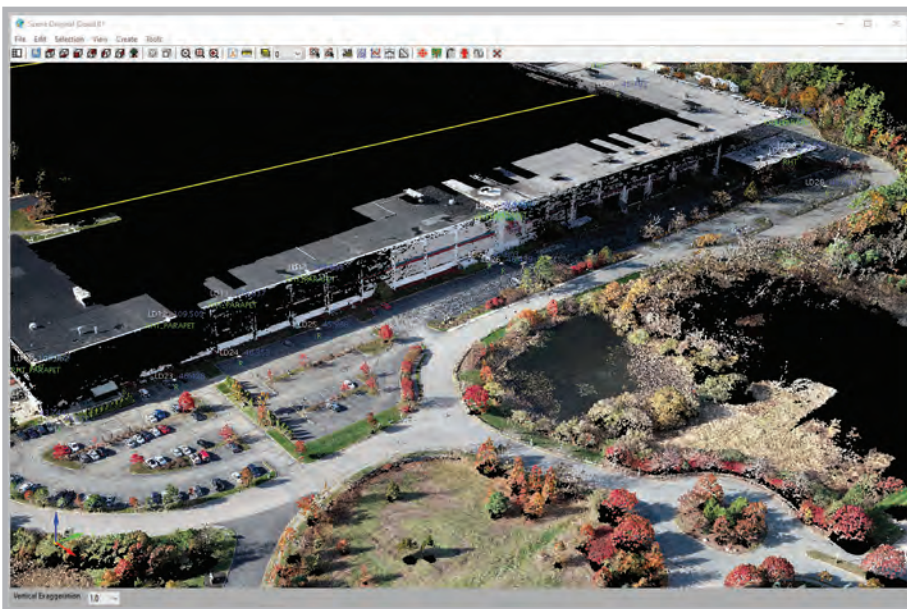
It is tied to the codes used during the field survey. We use this system extensively and have honed it over the years to create a very effective and efficient method of

getting a plan drafted and out the door. Any detail collected in the field was drafted immediately upon download and overlaid precisely with that drafted from the imagery.

Productive Use of the Point Cloud data

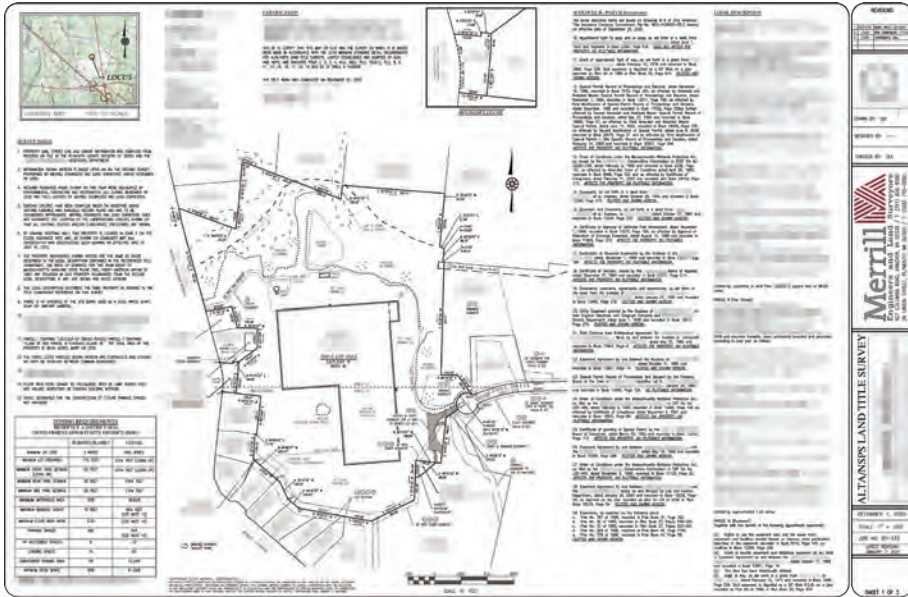
Although topography was not a requirement for this particular ALTA/NPS survey, some elevation data was needed. In addition to a georeferenced TIF, a three-dimensional point cloud was created from **Carlson PhotoCapture** which I could view and extract data from using the **Carlson Point Cloud** module.

Using Carlson Point Cloud, I was able to set points, draw 3D polylines and add additional information to the plan. If, in fact, topography would have been required, I could create one-foot contours directly from the cloud.



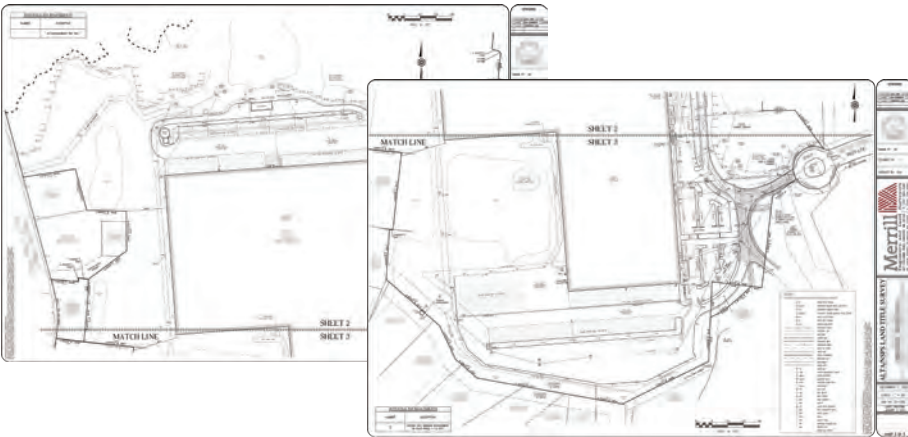
Successful Conclusion

Product Spotlight



When producing an ALTA/NSPS Land Title Survey, the complexity of the title commitment and the requirements of the survey are not something that can be shortcutted. We still needed to read the commitment and all respective

documents and note them on the plan. However, the gathering of the field data and the drafting of the plan was greatly enhanced through the hardware and software technology used throughout. The plan was submitted on time.



Carlson Select Suite

The Carlson Select Suite provides the opportunity to choose from 2 to 6 Carlson office software programs at discounted rates. In this case study, Survey (which includes SurvNET and Field-to-Finish), Point Cloud Basic, and GIS were used. Additional modules available in the Select Suite are Hydrology, CADnet, and Civil.

For more information, visit:
carlsonsw.com/select

Learn More

Put the Carlson Toolkit to Work for You

We can answer any questions about the Carlson survey workflow and how it can help your business!

From training options to asking the author of this study a question, we're here to support surveyors.

For more information, visit:
info.carlsonsw.com/survey or
call Carlson at 606-564-5028

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