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Advanced Curb and Gutter Concrete Construction Using Stringless Technology

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Construction stakeout is a major cost item in concrete construction. If we rely on subcontractors to do the stakeout that often adds scheduling issues. By the time we add the potential for error in the stakeout, the stress level can be enormous.

This economy demands that we reduce our cost, but produce as much, or more than we did in the past. None of us have any choice in the matter.

Take Control with Advanced Technology

This is going to describe:

1. How to take complete control of your production schedule
2. How to eliminate stakeout for curb and gutter
3. How to eliminate string lines entirely
4. How to save \$1 per foot of curb and gutter placement

Stringless Curb and Gutter is a Machine Control technology that is no harder to run than your GPS bull dozers and graders. It uses the same principals to control the curb and gutter machine. The best way is with Robotic Total Stations because they are more accurate.

With a stringline setup, the curb and gutter machine has a horizontal and vertical sensor on the front and on the back of the machine. The robots take the place of the string controlled sensors.

The robots are placed with very few limitations in convenient places on the project. The next step is to establish a position for the robots. This is accomplished by turning angles and measuring distances to the project control points.

Once this is done, the robots are pointed to the prisms on the machine and the production starts as soon as the concrete truck is ready to load the machine.

Your foreman or machine operator can be easily trained to use this system. If you have in house stakeout personnel you might prefer for them to set the machine up. It doesn't matter because anyone who has done stakeout will pick it up right away. There is no need for a great deal of experience with using total stations because the robot automatically sights the prisms and tracks the machine during the curb run.

Stringless curb and gutter will save you the cost of the stakeout. If you are using subcontractors this breaks out as 1,500 LF/day of stringline stakeout at about \$1,200.00/day. Or about \$5,000 of savings per production mile!



GOMACO GT3600 Curb and Gutter Machine

The Construction Model

The official name for the construction model is a Digital Terrain Model. Most contractors that use stringless technology will also use models and GPS to do the site grading.

How the model is created is very important. Remember, the model is the reason you can save \$5,000 per production day. A very big caveat here is don't scrimp on the model.

A proper model is created as a single entity. In other words, the sub-base, base, pavement, curb, sidewalks, embankments are all part of the same model, not 5 or 6 different pieces. If you have 5 or 6 different pieces, then whoever built the model better check one against the other or you will have a mess and the cost benefit will be lost. The term we will use for unchecked modeling data is disconnected data. So, if the 5 or 6 parts don't work together, they are disconnected.

A DTM is generally thought of as a single entity, but it can have thousands of sub elements. It is created with the data provided by your designer. There will be DTM points for all of your surface elements (asphalt, concrete, curb and gutter, (etc.)). These points are defined with just the position and elevation. When you look at a DTM point list the data doesn't indicate what the point represents.

In order for your stakeout to be performed, you need an additional file where the points have been described. In other words the point list needs to define if the point is a joint elevation or an edge of asphalt. If you don't have this data the best case scenario is that your stakeout will take longer, the worst case is that you will have errors in the stakeout.

The impact of disconnected data can be made with a question; can the trimmer on your curb machine trim 0.3' and lay concrete at the same time?

This is not a question any of us want to answer with the concrete ordered, the trucks coming and the finishing crew waiting for concrete to finish. If your model isn't right, you will find out the answer to this one the hard way.

One last word of advice, use a surface model for everything and have your operators 'dial down' to the sub-base and the base. It's the best way almost all of the time.

Using the Technology

I've been real lucky to be around machine operators that would open up and talk about what they do. The biggest complaint from seasoned operators is that the technology just doesn't work or that it's too slow.

The answer to "the technology doesn't work" is that there are probably model disconnect issues, calibrations issues or the construction control was not done properly. We won't get into any of these, but will address them in another discussion.

That the technology is too slow is a real issue for a seasoned operator. But this is really a learning curve issue that needs to be addressed. I will add that we should listen to our operators because they are the front line troops that use this technology. If we take the time to talk to them about the actual increased accuracies and production they will catch on pretty quick. It's just a better way and the ways to make it better need to be learned.

The biggest difference for an operator is that there are no stringlines, so there is no physical view of what is about to happen. If we look ahead on the ground we don't see that a curve is coming up or the tangent is another 200' or so. This information is on the machine controller screen and the operator needs to learn to use it. It's just matter of practice, but it doesn't take a lot of practice for an operator that wants to learn.

Once the operator has run for a day and the concrete trucks or the finishing crew didn't run over the string and stop the job, you will have a convert on your hands. Curves are a breeze by the way.

The Leica PaveSmart 3D System

The only manufacturer that has a successful stringless application today is Leica. The real advantage to the PaveSmart 3D system is that it not only controls curb and gutter machines, but can be applied to slip form pavers, milling machines, trimmers and asphalt pavers as well.

There are 3 controlling configurations which includes robotic total stations front and rear, GPS on the front and a robot on the back or a single robot for tangent sections. The system can be run with up to 3 robots for continuous uninterrupted runs. This process has 2 robots controlling the machine at any time and a 3rd that is in place up station and ready for the machine when it comes into range. When the system transitions from the back pair of robots to the front pair, the back robot is moved into a convenient position up station, is positioned and waiting to go.

I've used robots for over 5 years in one man applications; in fact, you might say I'm a pioneer of robotic processes. I've never had a robot complain about wanting a raise or that it was too hot or tired to keep going. This might impress the foremen, superintendants and owners amongst us.

Adapt and Conquer

The way we used to do business is changing whether we like it or not. I've been at this for over 33 years now and in the surveying world we've gone from transits and chains with 3 man crews to GPS and robotics and 1 man crews.

Not only do we have the opportunity to significantly increase our production levels and quality, but if we are competing with firms that use Machine Control we're going to struggle if we don't use it ourselves.

Investments in technology in these days might be a hard pill to swallow, but if we take the leap, we'll be here in 10 years to talk about how bad things were. What about the guys that didn't take the leap?