





Survey Aspects of Automated Machine Control

The Changing Role of the Construction Surveyor / Inspector/Grader





The Changing Role of the Construction Surveyor / Inspector



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The Changing Role of the Construction Surveyor / Inspector



The Way Things Were When They Were That Way





The Changing Role of the Construction Surveyor / Inspector



The Way Things Were When They Were That Way



The Location Surveyor:

His job was to provide the initial survey of project for design

- Staked an alignment
- Cross sections
- Maybe Photogrammetry (in the deep grass and through the trees?)
- Set points that may not last



The Changing Role of the Construction Surveyor / Inspector



The Way Things Were When They Were That Way



The Construction Surveyor:

His job was to interpret the design, and to provide the controls, set the stakes, and provide field information for the Contractor's crew.

The survey crew consisted of:

Party Chief
Inst Operator
Stake Driver

Asst Party Chief
Rodman
Stake Writer/Carrier



The Changing Role of the Construction Surveyor / Inspector



The Way Things Were When They Were That Way



The Construction Surveyor:

- Check or set up initial control
- Staking...and re-staking...and...
- “Hurry Up” or “Wait”
- Nothing to do but nap in the carry-all



The Changing Role of the Construction Surveyor / Inspector



The Way Things Were When They Were That Way



The Construction Inspector:

His job was to interpret survey marks and plans

- Check the Contractor
- Verify Specs
- Sometimes stand around while Contractor did or re-did.
- Keep records! Document Everything



The Changing Role of the Construction Surveyor / Inspector



The Way Things Were When They Were That Way



The Construction Inspector:
Sometimes he measured, or called
in the surveyor to measure





The Changing Role of the Construction Surveyor / Inspector



The Way Things Were When They Were That Way



The Grader Operator:

His job was to interpret survey marks and plans and build the project

- Follow the Stakes
- Try to read those little stakes from the cab of the Grader
- What happens between the 50' intervals?



The Grader Operator: His View of the World

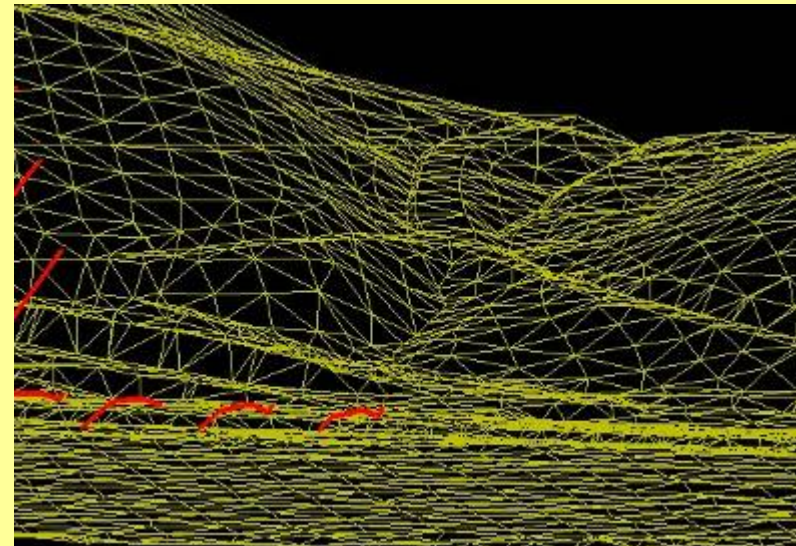


The Changing Role of the Construction Surveyor / Inspector



Then Came Technology:

- GPS
- Digital Terrain Models
- Robotic Total Stations
- Digital Levels
- Blue Tooth Technology
- Real Time GPS
- Computer-driven Hydraulics
- GPS- Guided Navigation
- 3D Design (OK – still working on that one)





The Changing Role of the Construction Surveyor / Inspector



Put It All Together and We Get:

Automated Machine Control:

The applications of various technologies resulting in the assisted guidance of heavy equipment, using GPS and robotic total stations to accurately locate the equipment cutting surface with relation to a proposed 3 dimensional model, and using GPS- or remotely guided hydraulics (with human intervention) to correctly and accurately maneuver that cutting edge in the placement or removal of earth, asphalt, concrete, etc.



The Changing Role of the Construction Surveyor / Inspector



Put It All Together and We Get:

Automated Machine Control:





The Changing Role of the Construction Surveyor / Inspector



Now Things Are the Way They Are: Who's Minding the Store?



The Grader Operator:
His job is still to interpret survey marks and plans and build the project. Only now those plans and marks are electronic.



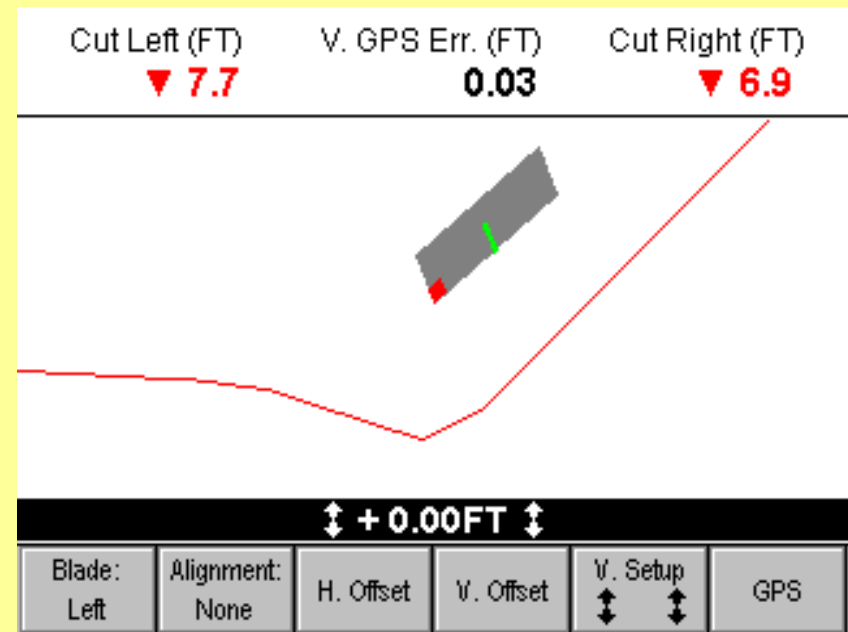
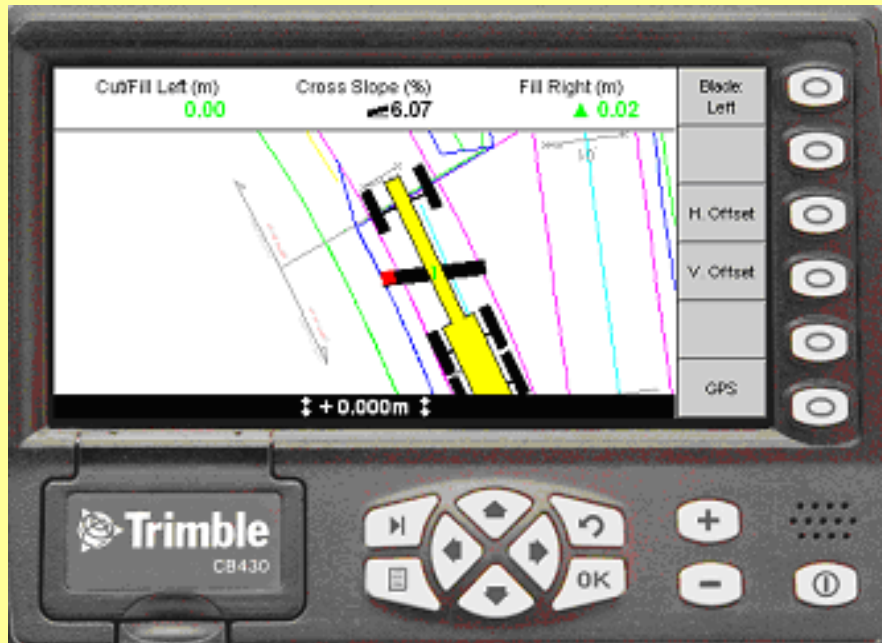
The Grader Operator: His View of the New World



The Changing Role of the Construction Surveyor / Inspector



Now Things Are the Way They Are: Who's Minding the Store?



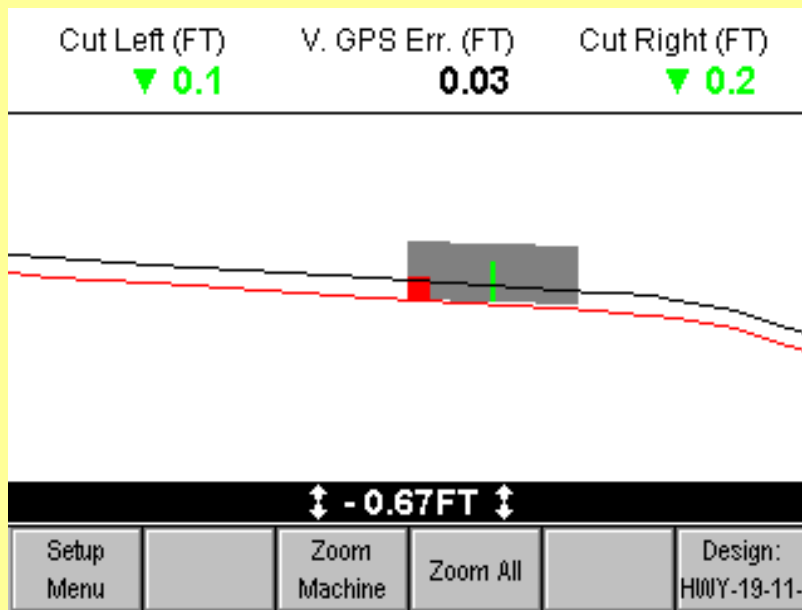
- Computer images tell him where to go or how deep to cut
- In Real Time
- Everywhere on the project (not just at 50" sections)



The Changing Role of the Construction Surveyor / Inspector



Now Things Are the Way They Are: Who's Minding the Store?



The Grader Operator:
He's making decisions
“on the fly” about grade
and slope

But didn't he always do
that?



The Changing Role of the Construction Surveyor / Inspector



Are the Way They Are: Minding the Store?

The Construction Inspector:

His job is still to interpret survey marks and plans, and all the other things he used to do

But now using his own surface models and other software, he can do it electronically





The Changing Role of the Construction Surveyor / Inspector



Are the Way They Are: Finding the Store?

The Construction Inspector:
He checks and verifies
He even measures





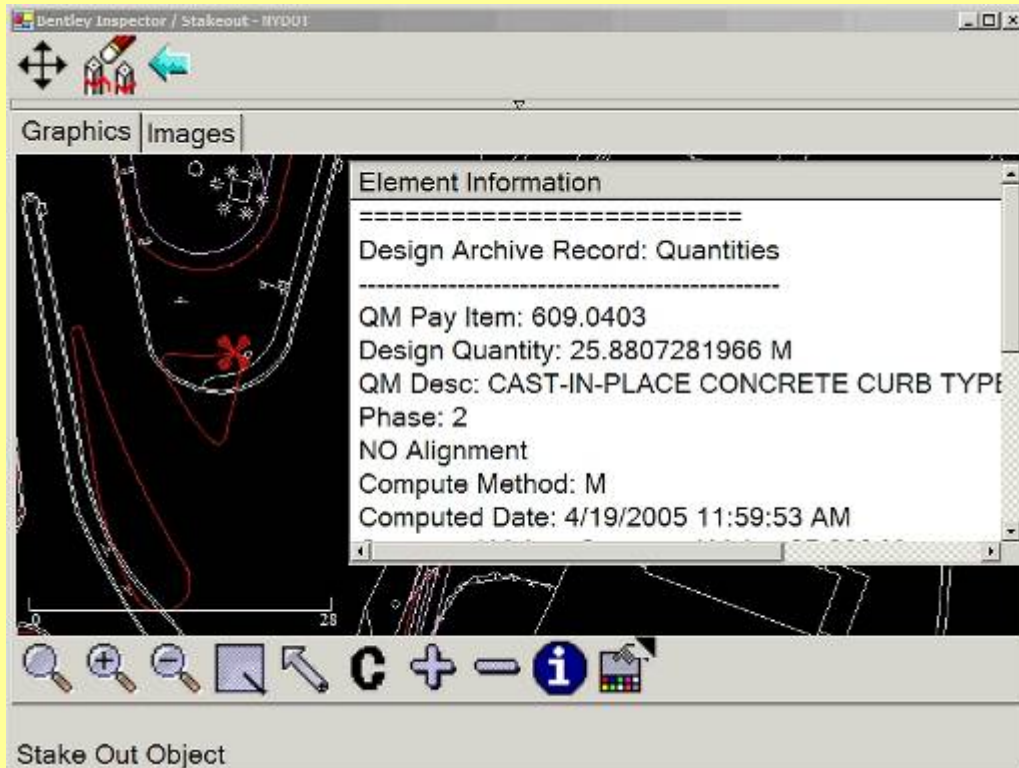
The Changing Role of the Construction Surveyor / Inspector



Now Things Are the Way They Are: Who's Minding the Store?

The Construction Inspector:

And his records can
be automatically
stored





Changing Role of the Surveyor / Inspector

AMERICAN ASSOCIATION OF
STATE HIGHWAY AND
TRANSPORTATION OFFICIALS
AASHTO
THE VOICE OF TRANSPORTATION



Are the Way They Are: Finding the Store?

The Construction Surveyor:

His job is still to interpret the design, and to provide the controls, set the stakes, and provide field information for the Contractor's crew.



The Changing Role of the Construction Surveyor / Inspector



Now Things Are the Way They Are: Who's Minding the Store?



The Construction Surveyor:

He's interpreting the plans and building a DTM – in his office

This might be for the DOT, or for the Contractor

This DTM goes to the Inspector and the Grader Operator



The Changing Role of the Construction Surveyor / Inspector



Now Things Are the Way They Are: Who's Minding the Store?

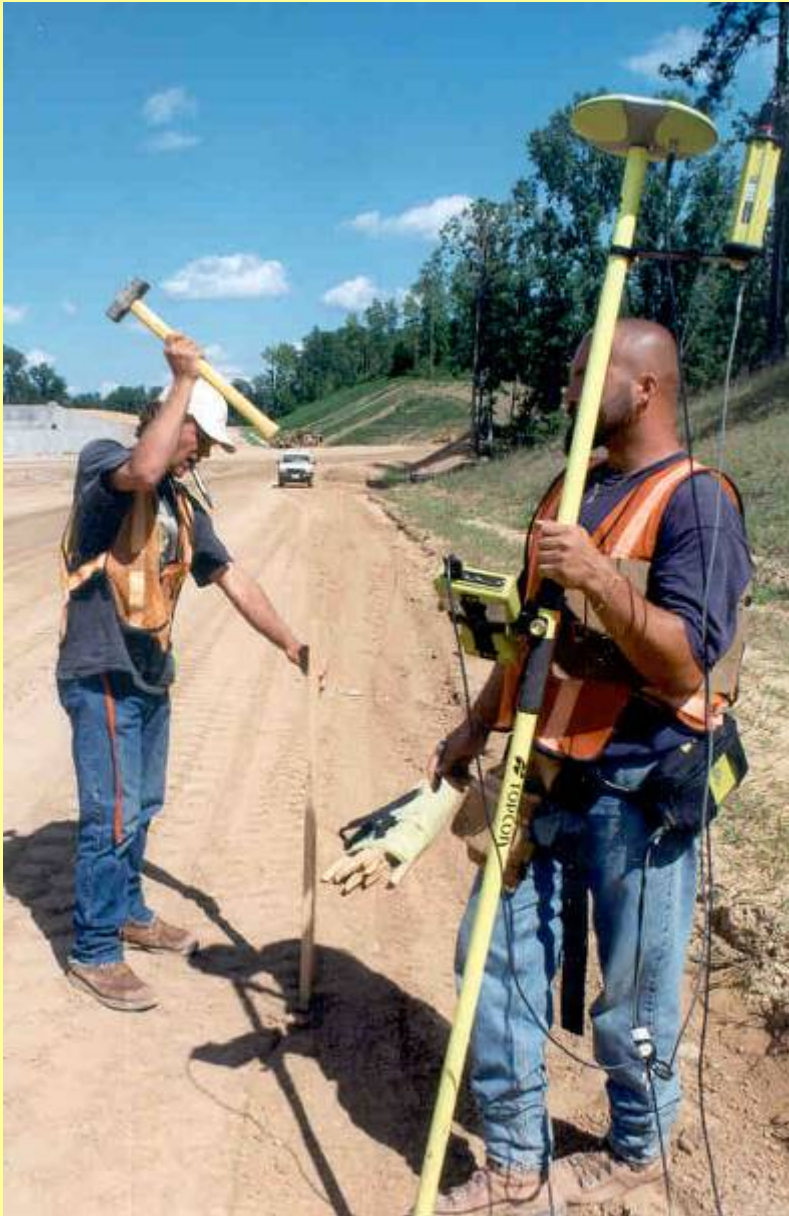


The Construction Surveyor:

- He's verifying the accuracy of the plans
- Surveying bare earth for better tie-ins
- Verifying the accuracy of construction equipment (equipment calibration)



The Changing Role of the Construction Surveyor / Inspector



Are the Way They Are: Ending the Store?

The Construction Surveyor:

He's still setting stakes for all of us reluctant DOT people

But at 1000' intervals rather than 50' intervals



The Changing Role of the Construction Surveyor / Inspector



Now Things Are the Way They Are: Who's Minding the Store?



The Construction Surveyor:

- 4 Mile Project with 4 Grade Stakes at every 50' Section = ~ 1700 stakes
- 4 Mile Project with 4 Grade Stakes at every 1000' Section = ~ 90 stakes
- Where's the greater chance of error?



The Changing Role of the Construction Surveyor / Inspector



Now Things Are the Way They Are: Who's Minding the Store?



The Construction Surveyor:

- And he's tying everything back to original project control
- Establishing network control
- Setting up/monitoring base station or verifying RTK network
- Calibrating the project data
- Checking the datum



The Changing Role of the Construction Surveyor / Inspector



Now Things Are the Way They Are: Who's Minding the Store?

The Construction Surveyor: Ensuring there's no bust





The Changing Role of the Construction Surveyor / Inspector



Conclusion (Finally)

Roles have expanded, but we're all still doing a lot of what we did – only with bigger and better and more accurate tools. We're sharing data, and that leads to better communication, and that leads to a better product.



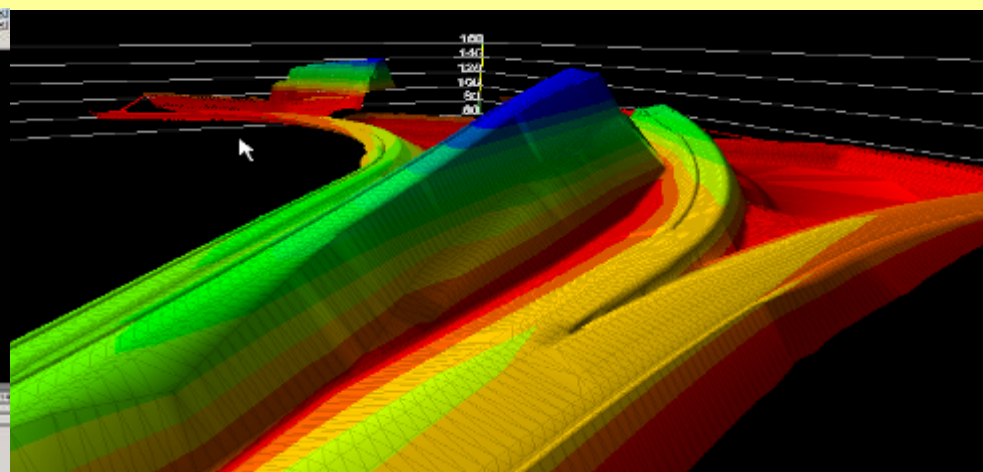
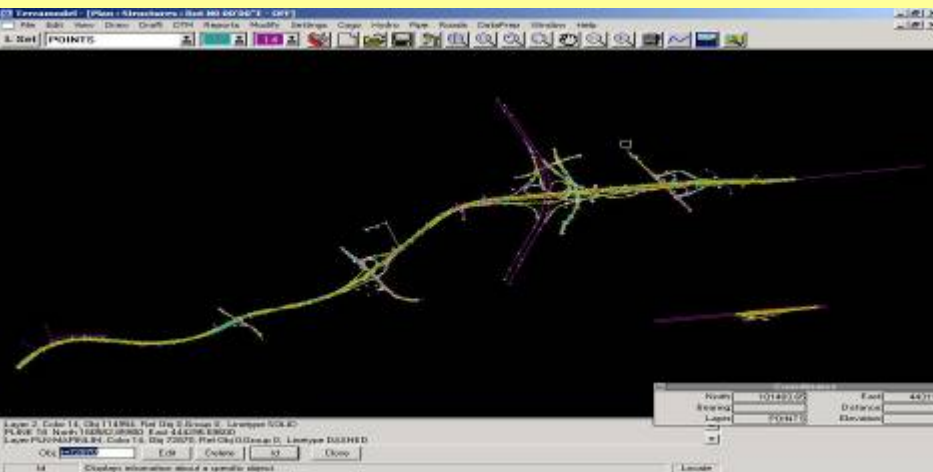


The Changing Role of the Construction Surveyor / Inspector



And that As-Built?

It's there – electronically – in CADD
Built by the Surveyor
Adjusted by the Contractor
Updated by the Inspector





The Changing Role of the Construction Surveyor / Inspector



Questions?



The Changing Role of the Construction Surveyor / Inspector



Thank You!