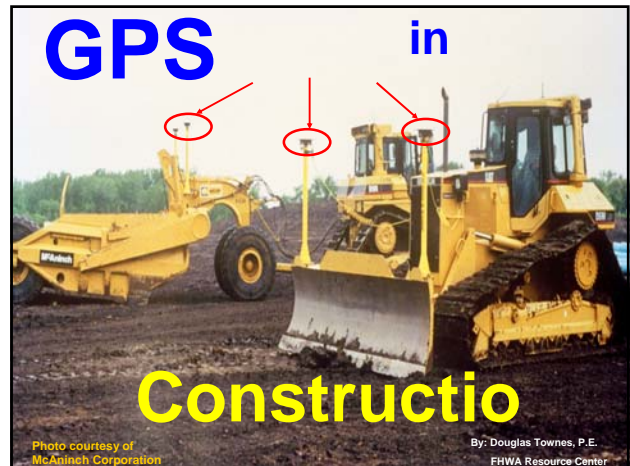
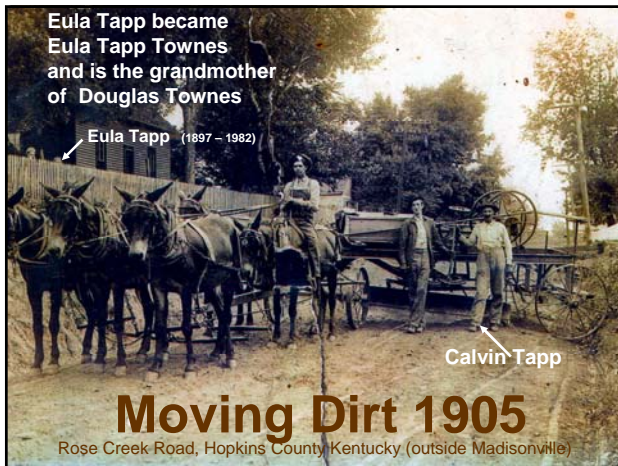


SEAUPG 2005 CONFERENCE - NASHVILLE, TN



During this session

- You will:
 - Hear about the history of GPS in Construction
 - Hear about the advantages of using GPS on a construction project
 - Hear about the impediments that block implementation of GPS technology
 - Here how members of SEAPUG can become a part of the solution

History of GPS in Construction

- 1982 Trimble bought technology and began incorporating into surveying instruments
- 1988 first GPS survey instruments sold
- 1993 first strip mining machines began using GPS for "location"
- 1998 first product to have GPS and cellular on a single board for fleet management

History of GPS in Construction

(Continued)

- 1999 first GPS grade control system for the construction market
- 2000 Contractors begin using "Stakeless" grading
- 2002 GPS machine controls are installed on Caterpillar excavators and motor graders

Show Caterpillar Video

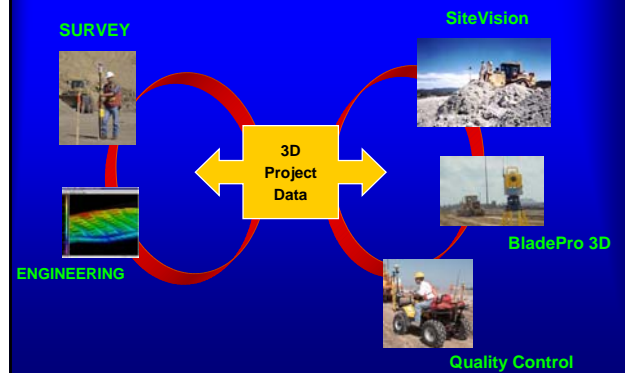
(1 minutes, 30 seconds)

"Stakeless" Grade Control



BladePro 3D-ATS

TOTAL SOLUTION



TOTAL SOLUTION



Projects are being surveyed and designed in 3-D for the DOT's but the Contractors are not allowed to get a copy of those same electronic files when the project is awarded.

Applications of 3D Machine Control and GPS Survey Systems

- BladePro 3D (BP3D)- Total Station Based
 - Finishing Subgrade
 - Knockdown and placing of materials in various zones
 - Finish Grading
 - Phased Construction
 - Erosion Control
 - Bridge Structures
 - Drainage
 - Signs, Guardrail
 - Location of test results

The Global Positioning System (GPS) is used to...

- Accurately position the grading machine **BLADE**, on the 3D digital model of the project
 - Within 1cm in X and Y
 - Within 1-3 cm in Z = 1.18 of an inch
 - Old school one tenth = 1.2 of an inch
- This puts the blade on the design, precisely located in 3D

Four screens available to the operator

The operator interface consists of four screens:

- Top Left:** A 3D wireframe map showing the blade's position on a digital terrain model. Data: Cut Left (FT) ▼ 0.1, Tilt (%) -32.8, Cut Right (FT) 0.0.
- Top Right:** A 2D top-down view of the blade and its path. Data: Cut Left (FT) ▼ 0.1, Tilt (%) -32.8, Fill Right (FT) 0.0.
- Bottom Left:** A data table:

Cut Left (FT)	▼ 0.1
Cut Right (FT)	0.0
Design Elev (FT)	975.0
Tilt (%)	-32.8
Satellites	7
- Bottom Right:** A data table:

Northing (FT)	10381.8
Easting (FT)	9937.8
Elevation (FT)	645.4
GPS Status	High Accuracy
Satellites	9

I-4 Lakeland Florida



I-4 Lakeland Florida



Scaleable Lightbars

Lightbar Scales

Vertical Tolerance: 0.118 FT

00000	10.000	FT
00000	10.000	FT
00000	10.000	FT
00000	10.000	FT
00000	10.000	FT
00000	10.000	FT
00000	10.000	FT
00000	10.000	FT

Vertical Horizontal Tilt Default
Set 0.000 Set 0.200 Set 0.200 Set 0.200



Dozers D3-D11 with GPS Controls



Two Antennas

Gives You:

- Most Accurate Solution!
- Cuts/Fills calculated along the entire blade cutting edge, from the right tip all the way to the left tip (no matter how the blade is tilted or rotated)
- Always know which way the machine is facing and moving. (operator must tell the system which direction with single antenna)
- No need for rotation or tilt sensors that are affected by vibration (especially on dozers)
- No daily/weekly/monthly calibration of sensors



TWO ANTENNA'S

Grading on slopes or flat area



Considerations when using GPS Technology

Advantages

- Places the design in front of the operator.
- Unlimited machines possible on one base
- Line of sight not required
- Dramatically increases production
- Dramatically reduces labor costs-layout, stakes
- Not effected by fog, dust etc.
- Operators love to use it!

Disadvantages

- You need a clear view of the sky
 - Tree canopy
 - Tall buildings
 - Blocking terrain
- Requires a local "champion" to manage-
 - Data and site Cal
 - Radio coverage
 - Proper application requiring attention



GPS Technology

GPS technology	Compared with	Estimated savings
Grade Checking	Manual method	Up to 66%
Reduction or Elimination of Stakes	Using stakes	Up to 85%
Improved material yields/select fills/undercutting	Overruns using manual methods	3% to 6% in volume
Un-interrupted earth moving production under any weather conditions (24/7)	Daytime / fine weather operation only/night work	30% to 50%
RTK, robotics stakeout	Traditional suney stakeout	More than 100% in speed and 66% in staffing

- Other savings from:
 - Improved utilization of equipment/30%
 - Lower skill level required realize over 100%
 - Erosion control as you go
 - Accurate location of testing for QAQC

How to get up and running faster

- Fully committed to the process
- Draw upon experienced resources
- Stay the course and be willing to follow through the learning curve
- Job planning
- Do not panic!



The use of GPS Technology in Construction provides:

- More accuracy in setting grades and control points
- Reduces construction time for the Contractor
- Provides higher quality grading with GPS controlled machinery

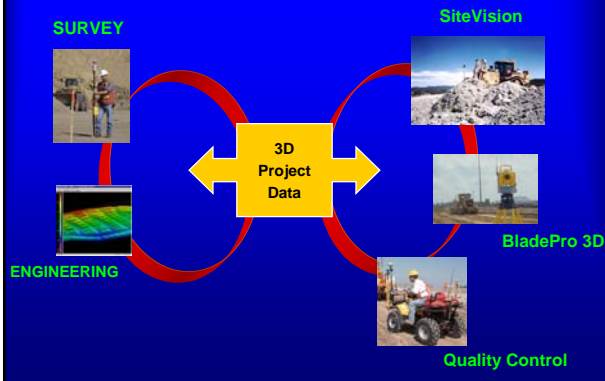
What is happening in DOT Construction Today?

- According to this subcommittee's Technology Implementation Group's (TIG) 2002 survey:
 - Only 9 of 36 States reported contractors were using GPS controlled machinery
- 6 of 17 reported GPS use in Construction in the SOC "Technologies Used in Construction" 2004 survey

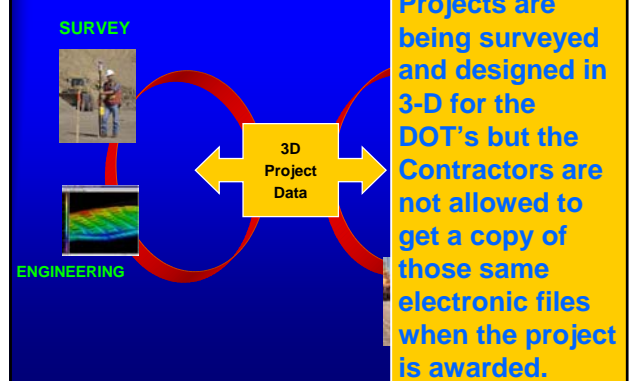
So why isn't GPS Technology being used in more State transportation construction projects?

- State DOTs are reluctant to give electronic survey data with contract documents
 - Fear of misuse or misapplication
 - Procedure for QC does not exist for stakeless grading
 - Current plans are 2 dimensional and leave a paper trail
 - Due to the initial high cost of the equipment, smaller contractors will be at a disadvantage

TOTAL SOLUTION



TOTAL SOLUTION



We are surveying a DOT project in 3 dimensions and Contractors are building projects in 3 dimensions. Designers produce plans for construction in 2 dimensions (on paper) because this has been the standard since roads were first designed.

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What was done in 2005 to help promote GPS technology in Transportation?

- NCHRP project 20-05 Technologies for Construction Delivery has been appointed.
 - Report is due out next year and will highlight some of the impediments to implementing this innovative technology.

Help Needed With GPS Machine Control

- Provide 3-D electronic data along with 2-D paper plans during bid process and at contract award
- Revise standard specifications tolerances to allow stakeless machine grading
- Quality control guidelines for stakeless construction need to be implemented by DOT's
- DOT's need to add Machine control as an option in their Bid packages
- Provide training of the entire Team involved with the project (certification by Level of Training)
- Have Contractor return paper and electronic "asbuilt" files when Project is complete

Many thanks go to the following:

- Jones Brothers Construction (Brett Alsobrooks) for providing slides on the advantages of GPS from the Contractor's perspective
- Caterpillar for providing the video and the brochures in the back of the room

Questions?