ACCUGRADE

Rogier Tonies

PRODUCTION STUDY

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Introduction

- In November 2006, Caterpillar conducted a **production study** comparing a conventional road construction project guided by grade stakes, string lines and grade checkers with the use of AccuGrade, Caterpillar machine control & guidance.
- The road design simulated a highway intersection, roundabout or other complex road design.
- During the construction process measurements were taken to define overall productivity, machine utilization, fuel consumption, number of people on site and finished design quality.

The Job: Construction of two Roads

- One team of professional operators
- Two identical road design
  - Identical Alignment and Profiles including Curves, Elevation Changes and Super Elevations
  - Identical Cut and Fill Areas, Same Material
- Same equipment
  - D6N Track-type Tractor
  - 330D Excavator
  - 140H Motor Grader
- Comparing Conventional vs. AccuGrade Way

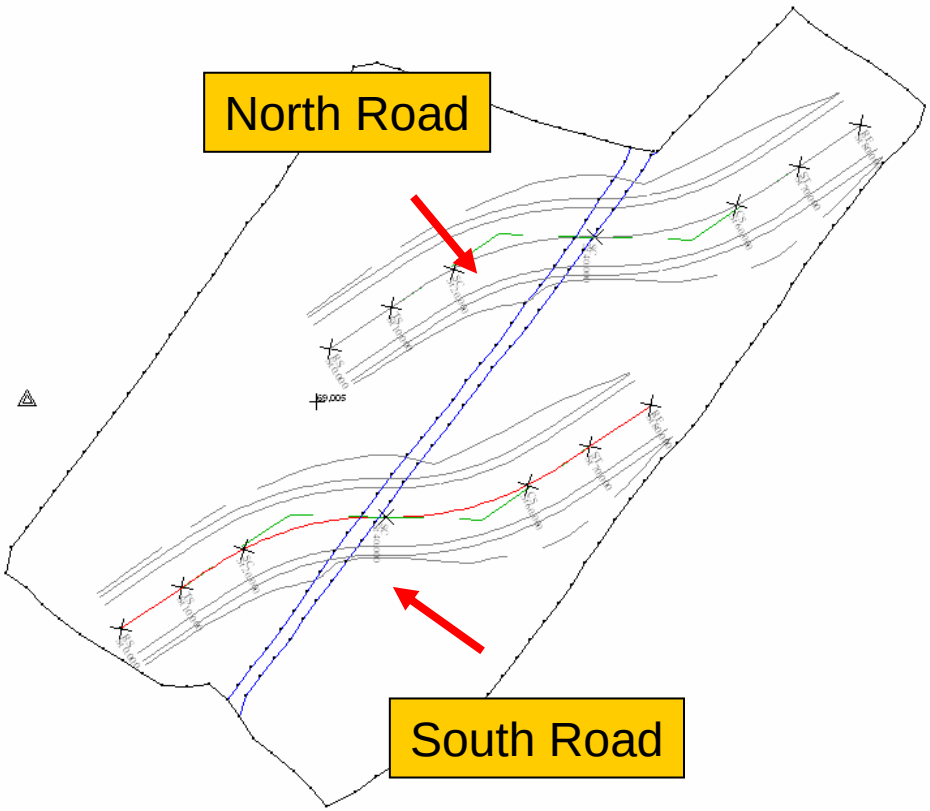
The Team

- Gary (Foreman)
- Siggy (Dozer and Motor Grader Operator)
- Andy (Excavator Operator)
- Ron / Kelly (Articulated Dump Truck Operators)
- Kjeld (Compactor Operator)
- Eric (Site Surveyor)
- Rogier (Grade Checker)
- Amr / Marilyn (Time Keepers)

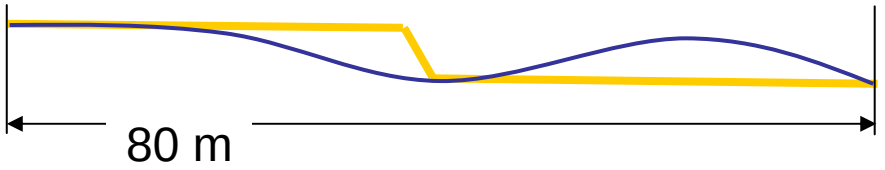
The Road Construction Job Site

The Road Design

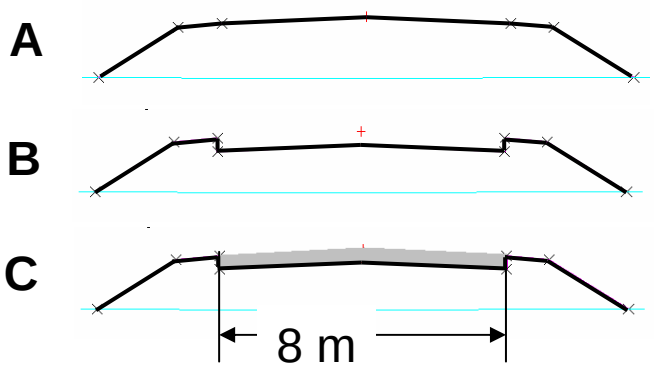
Top View



Profile View



Cross Section View



The Conventional Equipment

D6N

330D

140H

Other Equipment:

- Compactor CS563
- ATD 730
- ATD 735
- ATD 740 Ejector

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The Equipment with AccuGrade

D6N AccuGrade GPS

330D AccuGrade GPS

Other Equipment:

- Compactor CS563
- ATD 730
- ATD 735
- ATD 740 Ejector

140H AccuGrade ATS

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The Measurements Taken

- Surveying & Staking vs Data Prep & ATS Setup
  - Time / Number of Persons
- Machine Operation
  - Operating Times
  - Number of Passes / Buckets
  - Fuel Consumption
- Finished Design Tolerances
  - Subgrade
  - Base

The Construction Process in Steps

- **Step 1.** Site Layout: Data Preparation / Staking

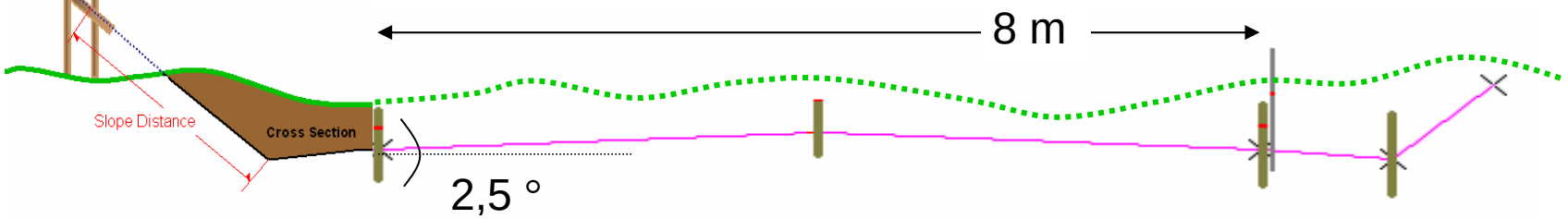
- **Step 2.** Bulk Earthworks
- **Step 3.** Subgrade Fine Grading
- Grade Checking

- **Step 4.** Base Course Construction
- **Step 5.** Base Course Fine Grading
- Grade Checking

Step 1. Site Layout - Conventional Staking

1. Staking Slope Rails
   & Digging Slope Pilots
2. Staking Road Profile

Cross Section View



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Step 1. Site Layout - AccuGrade Data Preparation

- Data Conversion using AccuGrade Office
- GPS Base Station was already on site
  - Same Base Station used for GPS rover and AccuGrade
- Installation of ATS Total Station to grade road base

Total Station

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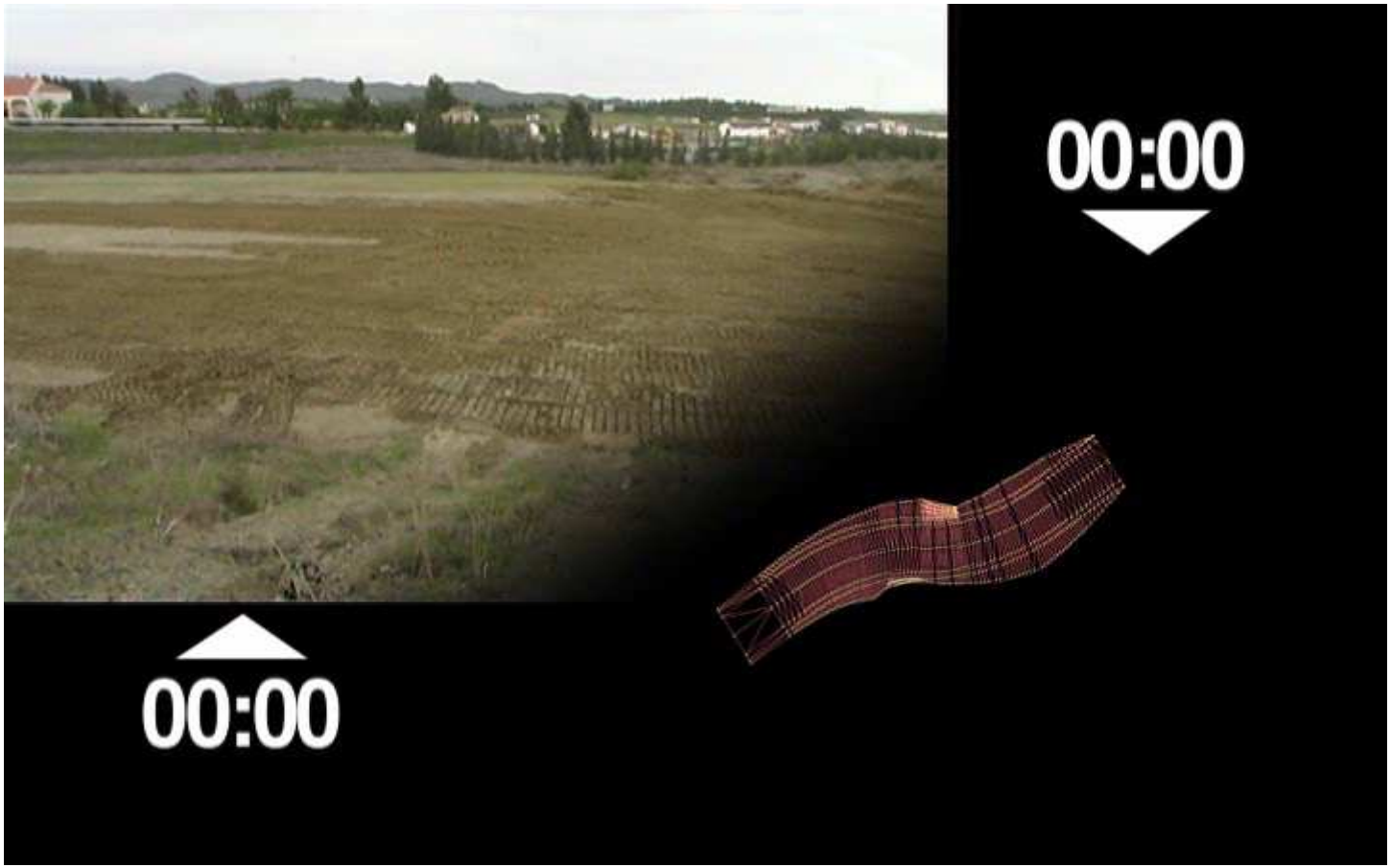
Step 1. Site Layout



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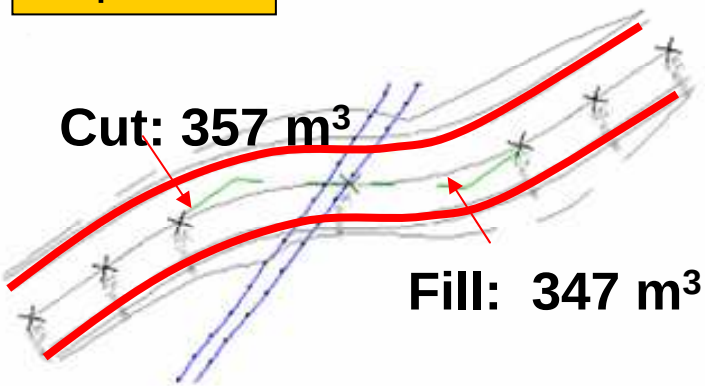
Step 2. Bulk Earthmoving

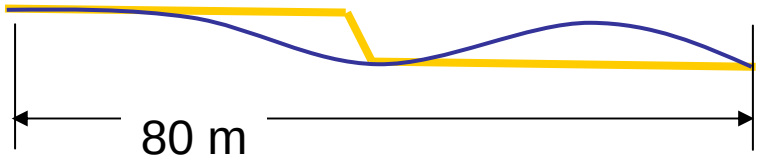
Construction of the subgrade of the road:

- 330D starts in the Cut area to dig the side slopes
- ATD's transport and dump material in the Fill area
- D6N pushed the material into the rough road shape

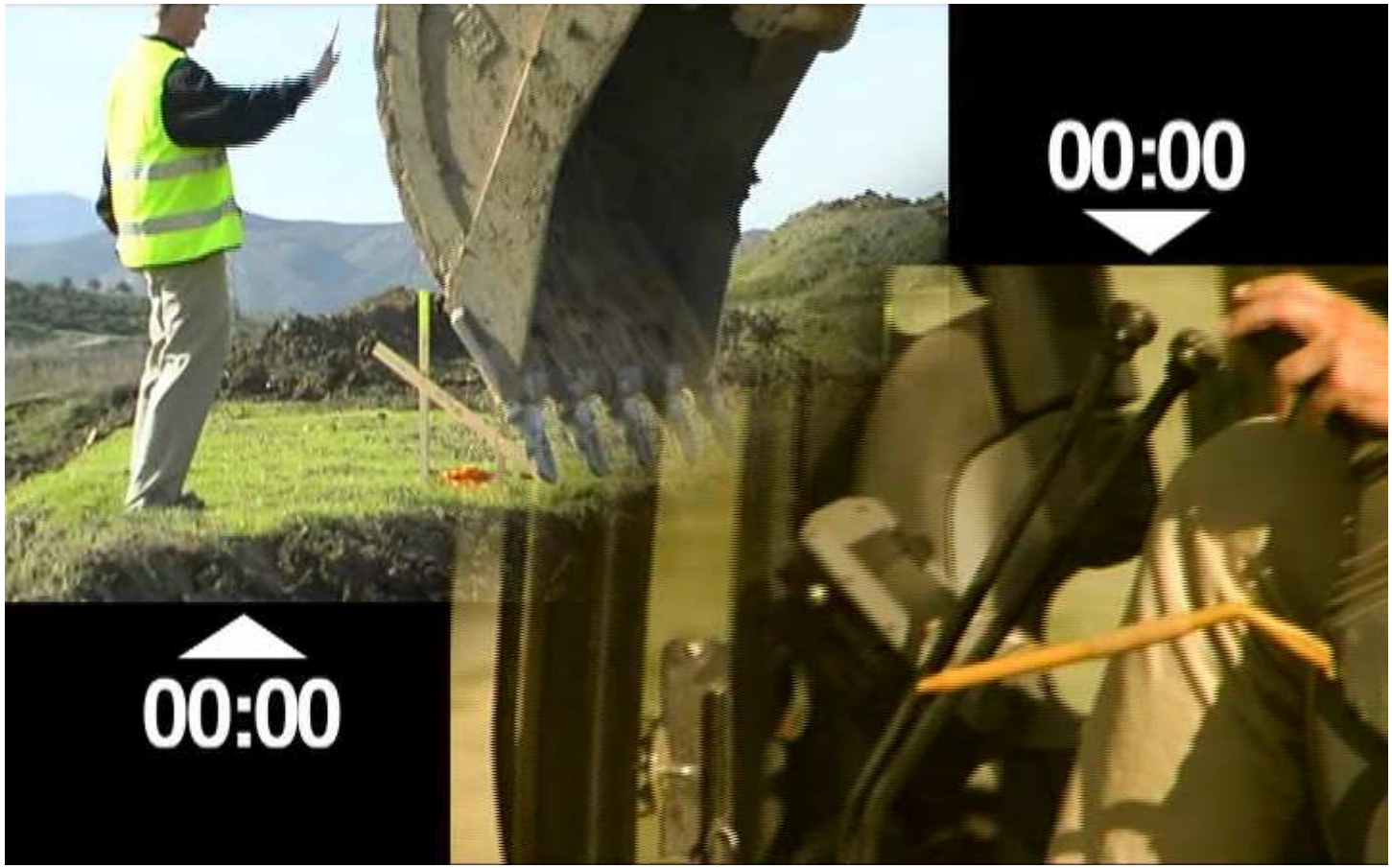
Top View



Profile



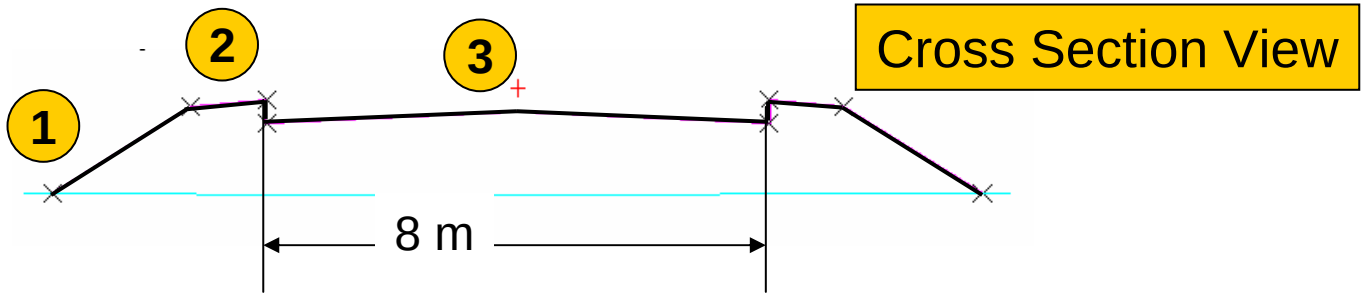
Step 2. Bulk Earthmoving



Step 3. Subgrade Fine Grading

The Subgrade supports the road base

- Fine grading of the Subgrade included:
  1. The side slopes
  2. The shoulders
  3. The road box (profile with crown)



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Step 3. Subgrade Fine Grading

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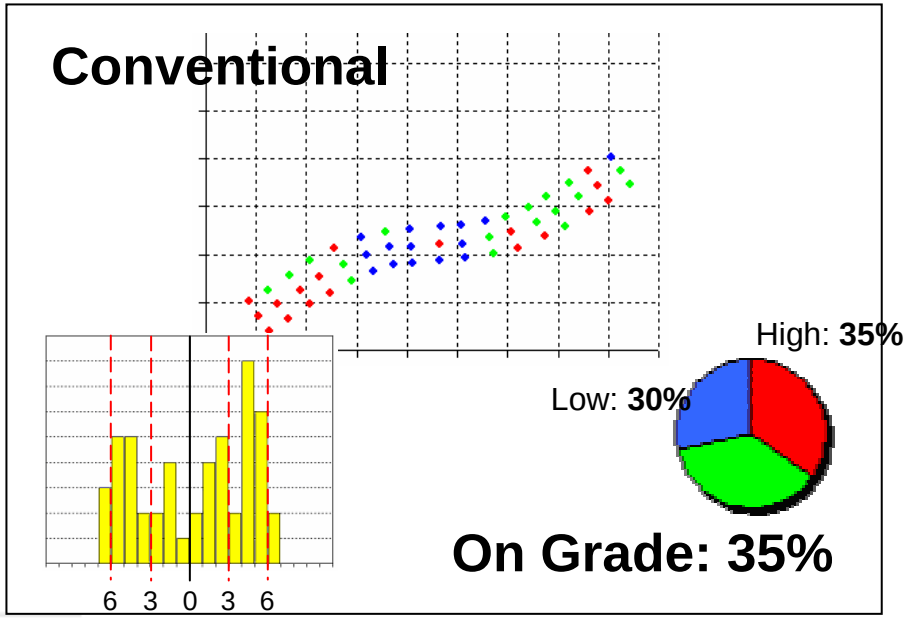
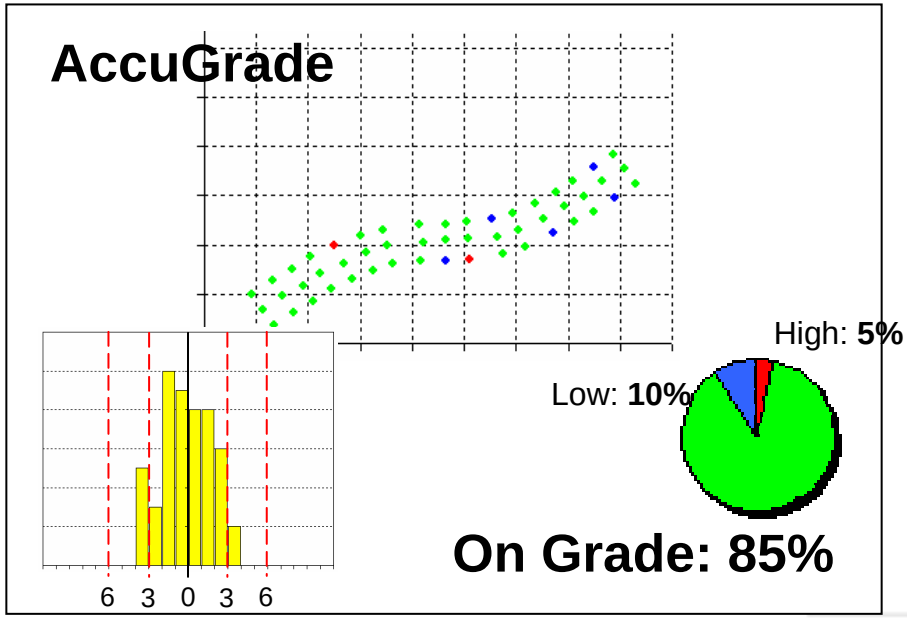
Grade Checking of Subgrade

- Three points every 5m were surveyed on the road
- A tolerance of ± 3cm was applied

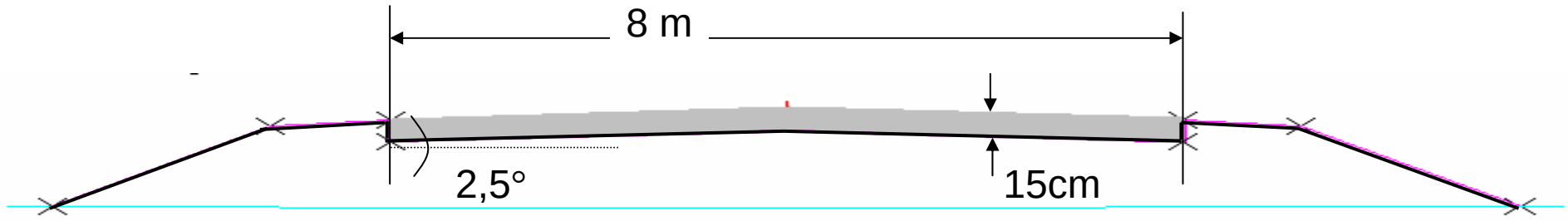




Step 4. Base Course Construction

- 15 cm of highly compacted crushed aggregate
- Often referred to Referred to as the “road base”
- ATD dumps the aggregate and the D6N spreads

Cross Section View



Step 4. Base Course Construction

Step 5. Base Course Fine Grading

- After the Soil Compactor CS563 compacted the aggregate, the 140H motor grader cut the base to the finished grade.

Step 5. Base Course Fine Grading

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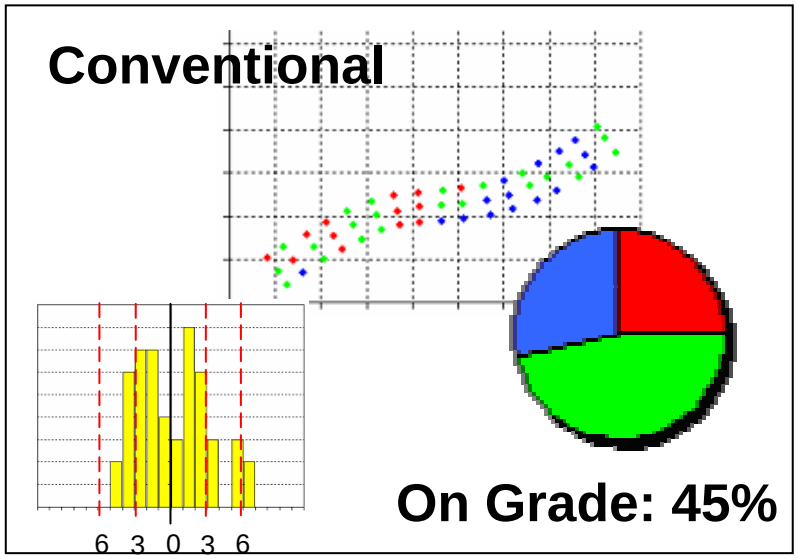
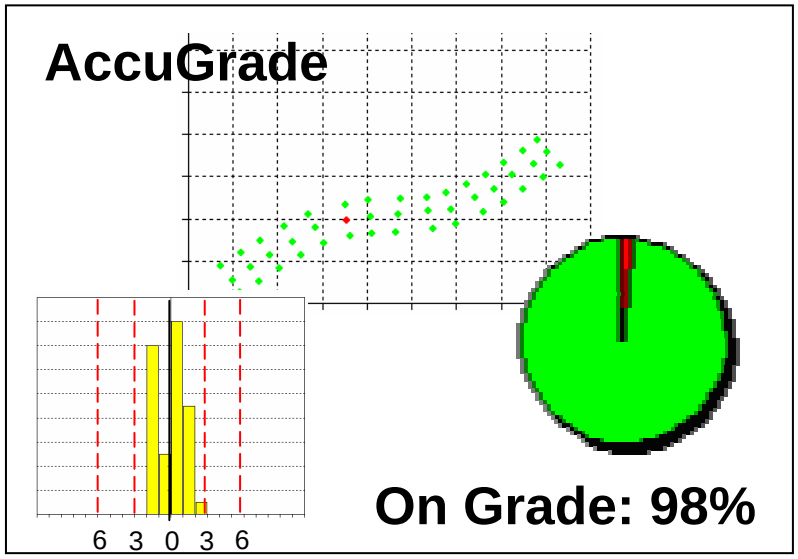
Summary of Results

- A tolerance of ± 2cm was applied
- Improved quality resulting in 11 % material savings
- Slopes and shoulders matched the design much better





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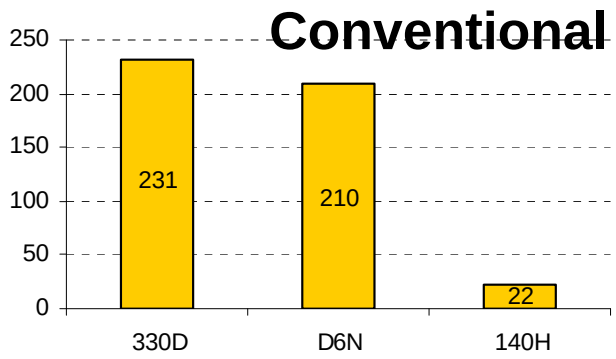
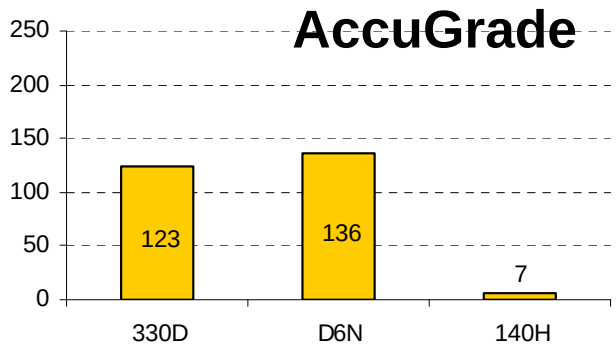
Summary of Results

- 100% Increase in Productivity
  - 3,0 days versus 1,5 days
- Increased Machine Utilization
  - Less waiting time
  - Longer passes
- Savings in Operating Cost
  - 43% less Fuel consumption
  - Less wear on U/C and GET

43% fuel saving





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Summary of Results

- Surveying
  - Cost reduction in setting out grade stakes and checking the grade.
- Job Site Safety
  - No grade checkers or labour crew on site with the AccuGrade.
- Operator Satisfaction
  - Even excellent operators become more productive and less stressed

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On behalf of the whole team: Thank You!!

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TODAY'S WORK. TOMORROW'S WORLD.™