3D Paving:

What do we Mean????

3D Paving

OR

Paving while following 3D Coordinates as reference

??????

PAIKY Winter Training – 3D Paving:

Why 3D???

– Positioning for All Equipment, No Physical Reference Required
PAIKY Winter Training – 3D Paving:

Why 3D???
No Physical Reference Required for automatic Grade Control
Don’t Need to Erect Expensive string for Grade control or steering
No steering guide / reference Needed
If Auto steering is not available
- Operator follow directional data

Most Important:
- Accurate Coordinates
- Trained Operator
- Frequent Verification of Grade

Advantages of Using 3D Reference:

Expensive String lines used for Reference for Grade Control:
- New construction
- Base material

3D – No Physical Reference
String – Physical Reference
Advantages of Using 3D Reference:

Paving without setting up String lines for Grade Control & Steering:
- New construction
- Base material

Advantages of Using 3D Reference:

Paving Projects with Complicated Transitions:
- Race Tracks
- New roads

Paint Line used for Steering Reference
Advantages of Using 3D Reference:

Paving without setting up String lines for Grade Control & Steering:
  - New construction
  - Base material

Advantages of Using 3D Reference:

FHWA Sponsorship of ASP:

ASP: Asphalt Stingless Paving (3D)
  - Online Training for Qualification
    Draft Program Completed

Who Should Consider??
  - Tractor & Screed Operators
  - Superintendents
  - Foreman
  - Bidders
  - State Inspectors
3 Dimensions According to Physics:

Objects are defined by 3 Dimensions

1. X axis
2. Y axis
3. Z axis

A slab of Concrete or an Asphalt Roadway is defined by 3 Dimensions

3 Dimensional Shapes | Reference.com Answers
www.reference.com/motif/science/3-dimensional-shapes

3 dimensional shapes are shapes with three sides. The three sides are length, width and depth. A cube for example is a 3 dimensional shape.

3D Image of a Pavement:
3D Image of a Pavement:

Each side is controlled individually (Manually or Automatically)
- Individual Reference and Machine control required per side
Traditional Control of Depth on both sides

Manual:

Operator Manually follow Physical Reference to control depth & Slope
- Using Depth screw or Tow point Jog Switch

Traditional Control of Depth

Automation and Physical Reference:

Physical Reference:
- String line, Existing Joint, Subgrade, Curb, mechanical Ski, etc.
- Machine controls guided by Grade and Slope sensors
Traditional Control of Depth
Automation and Physical Reference:

Physical Reference:
- Machine Control Guided by a grade sensor following a string

Machine Controllers:
- Niveltronic, Topcon & MOBA and Others
Traditional Control of Depth

Automation and Physical Reference:

1 D Paving: Controlling Depth LH & RH using Physical Reference

Non Traditionally Control of Depth

Automation and 3D Coordinates as Reference:

What is Required??

1. 3D Reference and Positioning System
2. Machine Control
**3D Reference & Machine control systems**

1. **3D Reference & Positioning Systems:**
   - 3D Job Coordinates – Design Files or Road Scanner
     - Reference Monitor: Prism / Laser Scanner, Digital Level
       - a. Topcon – MM GPS System
       - b. Leica – PaveSmart Robotic Stations
       - c. Trimble – PCS900 Total Station

2. **Machine Control Systems:**
   - a. Topcon (1D)……….Topcon + Vogele Navitronic (1, 2 & 3D)
   - b. Leica (1D)………Leica + Vogele Navitronic (1, 2, & 3D)
   - c. Trimble 1D
   - d. Vogele Niveltronic 1D

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**Comparisons of different 3DSystems**

*This chart should be filled out by Contractors to ensure Suitability to their Project*

<table>
<thead>
<tr>
<th>Technology</th>
<th>Total Station</th>
<th>GPS-only</th>
<th>mmGPS (= &quot;laser + GPS&quot;)</th>
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</thead>
<tbody>
<tr>
<td>Supplier</td>
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<td>Working (Paving) Range</td>
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<td>Typical Accuracy (Position)</td>
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<td>Typical Accuracy (Height)</td>
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<td>“Availability” for Operation</td>
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<td>Use at Night?</td>
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<td>Use in Forested Areas?</td>
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<td>Use in “Urban Canyons”?</td>
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<td>Use in Dense Fog?</td>
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<td>Tracks multiple Targets</td>
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<td>Use for all Survey Tasks?</td>
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<tr>
<td>Setup Sensor anywhere?</td>
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<td>Pre-conditions for use on Jobsite</td>
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</table>
3D Reference, 1D Paving
Controlling Depth on Left

- Reference: 3D Job coordinates & 3D Positioning system
  1 Grade Reference, Robotic Total Station
- Machine Control

3D Reference, 1D Paving
Controlling Depth on L & R

- Reference: 3D Job coordinates & 3D Positioning system
  2 Grade Reference, one per side
- Machine Control
3D Reference, 1D Paving:
Controlling Depth on L & Slope on R

- Reference: 3D Job coordinates & 3D Positioning system
  1 Grade Reference & Cross Slope Sensor
- Machine Control: Must be capable of communicate with Slope Sensor
  Could also use Traditionally Slope control with 3D Grade

3D Reference, 1D Paving – Topcon System:
Controlling Depth on Left

Topcon 3D Position Control & Machine Control
- Control Mat Depth on the LH side
3D Reference, 1D Paving – Topcon System:
Controlling Depth on Both Sides

Topcon 3D Positioning Control & Machine Control:

- GX60 Control Box
- MCR 3 GPS Receiver
- PZsMC Receivers
- GR5 Rover
- Bay Station
- PZL1a Transmitter

3D Reference, 1D Paving – Trimble System:
Controlling Depth

Trimble 3D Positioning Control & Machine Control
- Control Mat Depth on the RH & LH side
3D Reference, 1D Paving – Trimble System

Components:

Trimble 3D Positioning Control & Machine Control:

- Mast Tilt Sensor
- Machine Target
- Machine radio
- 3D Control Box
- Standard Control L & R Box
- Total Station for guidance, 2nd Station for checking

3D Reference, 1D Paving – Leica System

Controlling Depth on Right

Leica 3D Positioning Control & Machine Control
- Control Mat Depth on the RH side
3D Reference: 1D Paving – Vogele Niveltronic

Components:

Topcon or Leica 3D Positioning Systems
- Vogele Machine Control (Same as the Screed Control)

3D Reference, 1D Paving on any Model Paver

Controlling Depth (Z)

Any 3D Positioning & Machine Controls will work on any Model Paver
- The paver must be setup for Automatic Grade and Slope
- Some 3D Positioning and Machine Control Systems:
3D Reference, 2 & 3D Paving:
Controlling Pavement Depth, Width & Direction

Machine Control & 3D Reference Required

1. Machine Control
   Vogele Navitronic Plus

2. Reference – Positioning Control
   Topcon, Leica, Trimble

3D Reference, 2D Paving:
Controlling Depth (Z) and Pavement Width (X)

- Reference: 3D Job coordinates & 3D Positioning system
  2 Grade Reference and Screed Width Sensor

- Machine Control: Vogele Niveltronic
Industry Confusion: 2D paving refer to Automatic Grade Control following Traditionally Physical Reference

Actual 2D paving: Controlling 2 Dimension of the Pavement

Traditional 1D Paving - Depth

2D Paving - Depth & Width

3D Reference, 3D Paving:
Controlling Depth (Z), Width (X) and Direction (Y)

Reference: 3D Job coordinates and a 3D Positioning system

2 Grade Reference, Screed Width Sensor & Steering control

Machine Control: Vogele Niveltronic

3D – No Operator
Navitronic Plus Control Screens:

3D Machine Control Option - Pavement Width & Steering control Screens

3D Reference, 3D Paving:
Controlling Depth (Z), Width (X) and Direction (Y)

Vogele Navitronic & Topcon 3D Positioning System
- Controlling Pavement Depth, Width and Steering with S2100-3
3D Reference, 3D Paving:
Controlling Depth (Z), Width (X) and Direction (Y)

Vögele Navitronic & Leica 3D Positioning System
- Controlling Pavement Depth, Width and Steering with S2100-3

3D Reference & Machine control systems

3D Paving - What do we Mean????

3D Paving: Generally refer to Automatic Control of Mat Depth:
- Following 3D Coordinates instead of a Physical Reference

3D Paving: Truly means Controlling Depth, Width & Direction
- Following 3D Coordinates for reference

2D Paving: Automatic Control of Mat Depth and Width
- Following 3D Coordinates for reference
- Not Following Physical Reference such as Joint, curb etc.
3D Reference & Machine control systems

Questions?