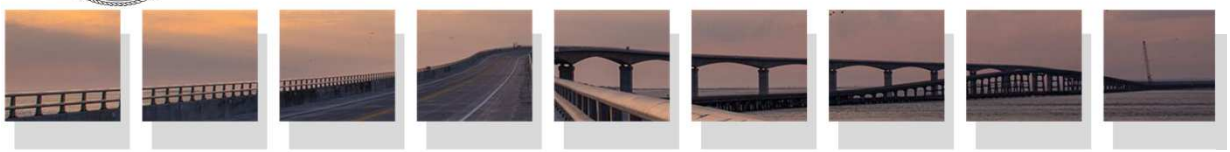
NORTH CAROLINA
Department of Transportation



NCDOT Research & Innovation Summit

Perspectives on Anticipated OpenRoads Designer (ORD) Technological Benefits

Jeffrey M. Garland, PE, PMP
NCDOT ORD Implementation Manager

October 14, 2020

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Overview of Today's Presentation

3:15 to 4:05
- Presentation Overview
- Background
  - On History of CADD
  - On current NCDOT ORD Implementation initiative
- Understanding the Technology of 3D engineered models
- Stakeholders and Anticipated Benefits
  - For Consultants, Design Engineers (PEFs and NCDOT)
  - For Contractors and the Construction Industry
  - For DOTs, Agencies, Decision Makers
  - For Citizens
- Moving Forward
  - Technical Implications
  - ORD Pilot Projects
- Presentation Summary

4:05 to 4:15
- Questions and Input

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Background – History of CADD

CADD means Computer Aided Design and Drafting.

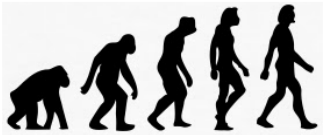
1940s – First digital computer developed

1963 – Ivan Sutherland presents a paper on “Sketchpad” which allows interactive graphics

1980 – Introduction of Personal Computers (PCs)

1990s – NCDOT begins transitioning from hand drawn engineering work to CADD utilizing Bentley Software.

2020s – NCDOT transitioning into 3D CADD utilizing the next ~~version~~ evolution of Bentley’s CADD Software.



V1-5	V95	SE	J	V8	XM	V8i	SS1	SS2	SS3	SS4	OpenRoads Designer CONNECT Edition
1985	1995	1997	1998	2001	2006	2008	2009	2010	2012	2016	

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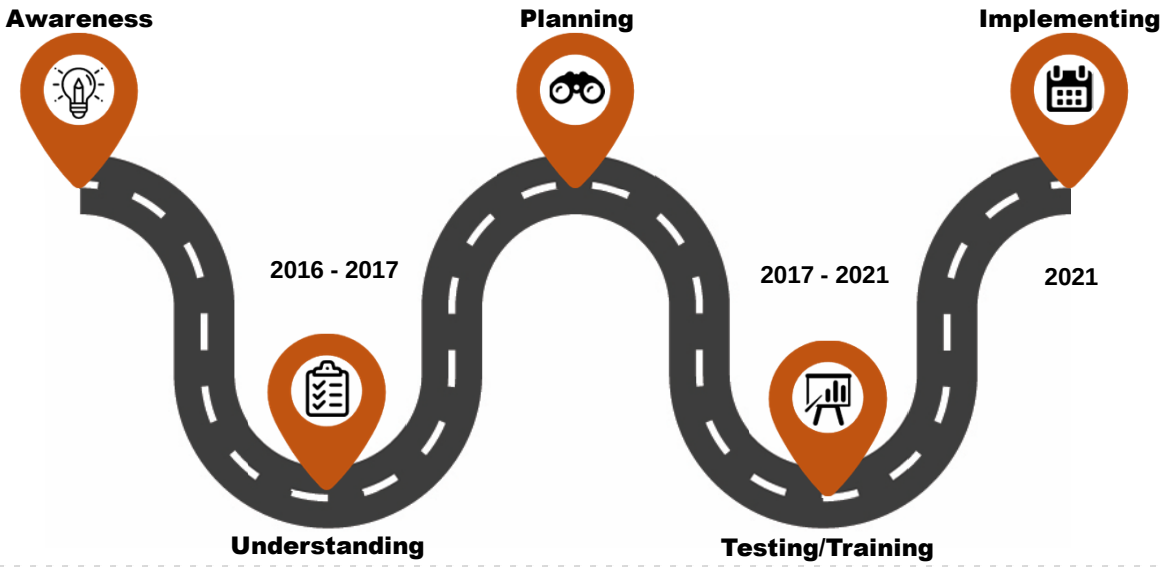
NCDOT ORD Implementation Plan Background



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Bentley OpenRoads Designer (ORD)

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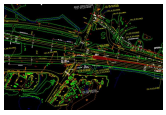
What makes ORD a Paradigm Shift?

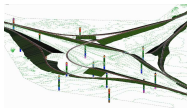
- EVOLUTION = *Just like hand-drafted to CADD*
- 3D Model-Centric

CURRENT



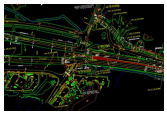
2D Design Workflows

Sheets (PPXS)

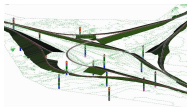


3D Model (Incidental)

ORD



2D/3D Design Workflows



3D Model

Sheets (Incidental)

The design intelligence is stored <u>with</u> the graphical element.

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What makes ORD different?

- Integrate Multiple Disciplines

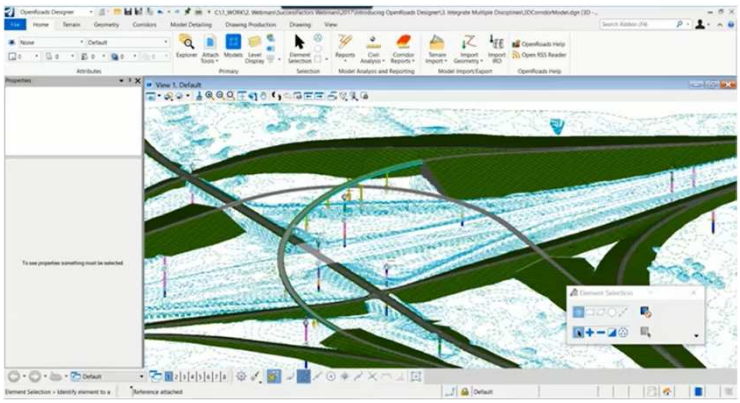
OpenRoads Designer

OpenBridge Modeler

OpenRail Designer

gINT

Drainage & Utilities



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What else makes ORD different?

Civil Cells

Easily place common design layouts.

Street Returns
Driveways
U-Turn Bulbs
Wheel Chair Ramps
Cross Overs

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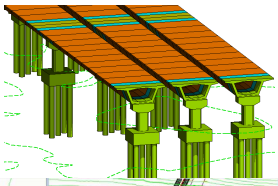
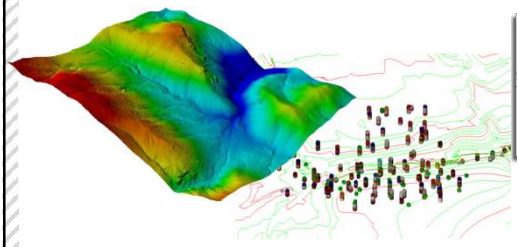
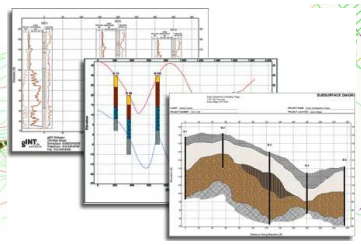
Industry Drivers

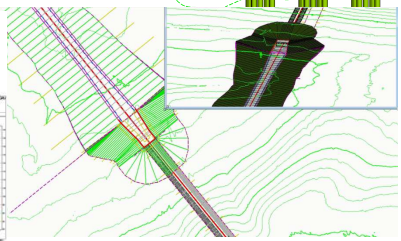
Greater utilization of **intelligent** 3D CAD models to support the lifecycle of transportation projects that provides:

- More economical and efficient project delivery
- Improved public safety
- A focus on benefits to the tax payer









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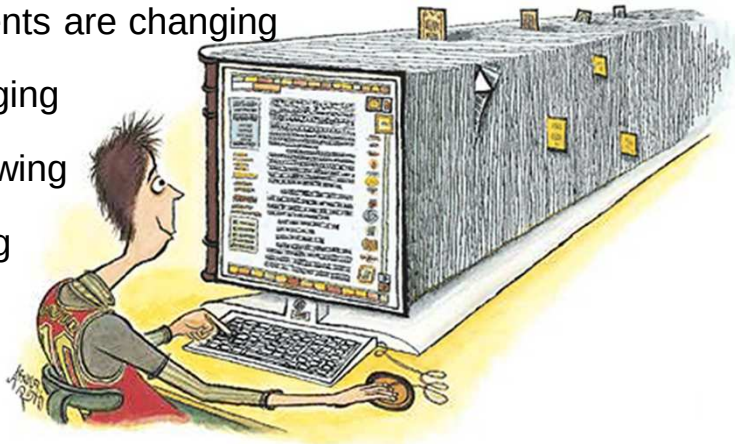
The Industry is Changing

- Deliverable requirements are changing
- Types of data is changing
- Amount of data is growing
- Size of data is growing



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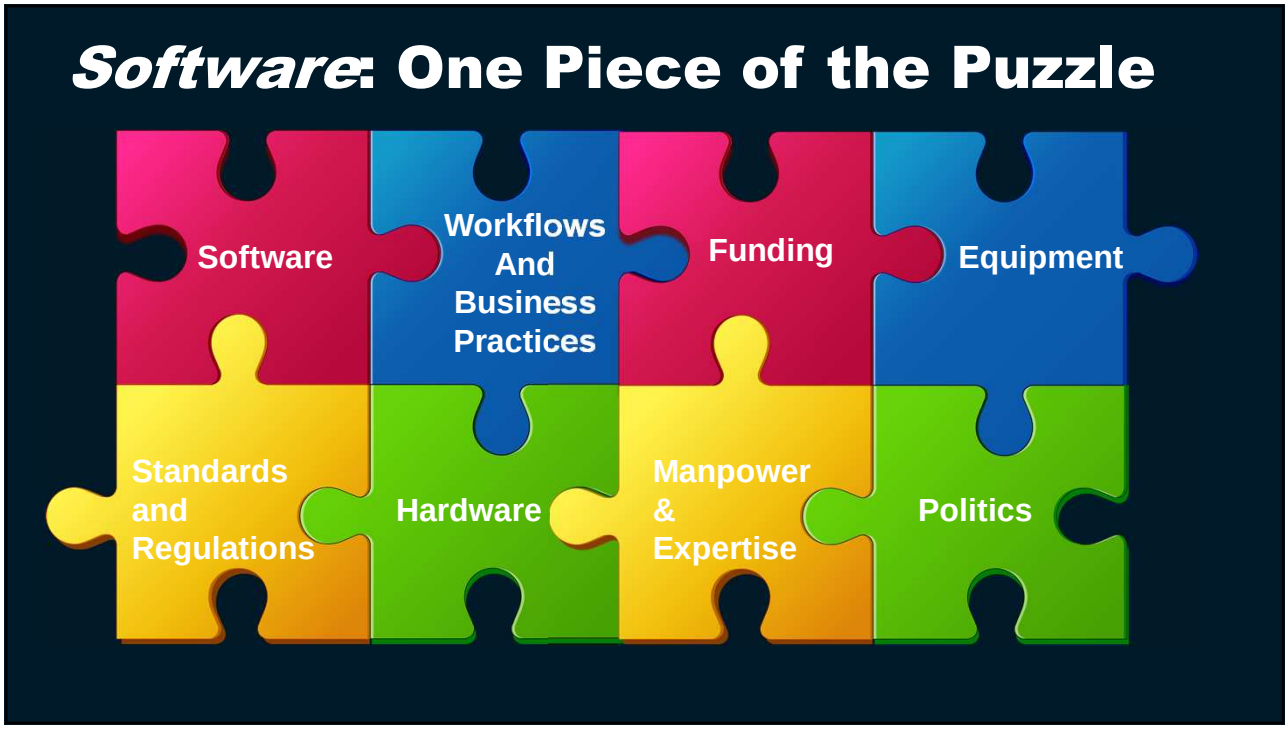
Software: One Piece of the Puzzle
Software
Workflows And Business Practices
Funding
Equipment
Standards and Regulations
Hardware
Manpower & Expertise
Politics

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Technology
Start
Surface
Welcome to PIXEL

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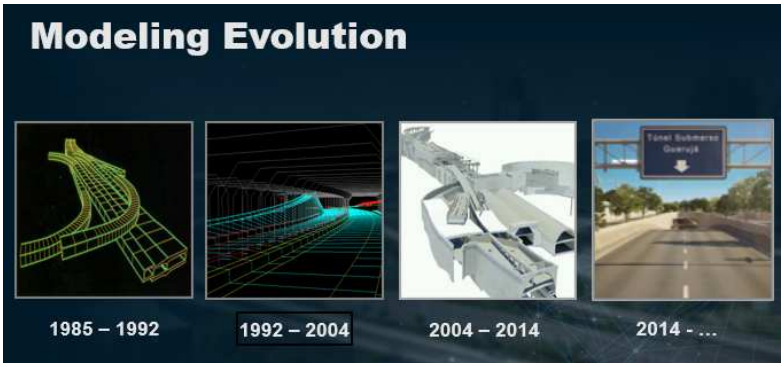
Stakeholders

- Consultants Design Engineers (NCDOT/PEFs
- Contractors and Construction Industry
- DOTs, Agencies and Decision Makers
- Citizens

Benefits

The 3D Technology Modeling Evolution is generating a number of benefits for stakeholders



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Stakeholders

- Consultants Design Engineers (NCDOT/PEFs
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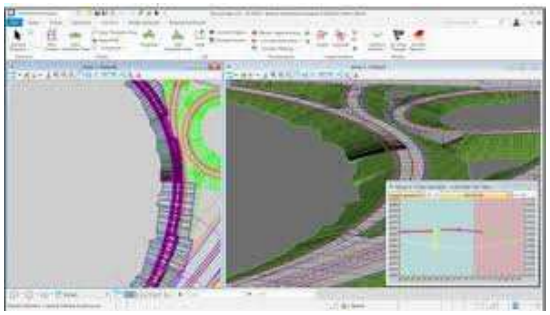
- Citizens

Benefits

- Design and analyze corridors
  - Use immersive corridor modeling capabilities that support complex modeling.
- Design in context
  - Clearly understand existing conditions and accelerate design modeling workflows



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Stakeholders

- Consultants Design Engineers (NCDOT/PEFs
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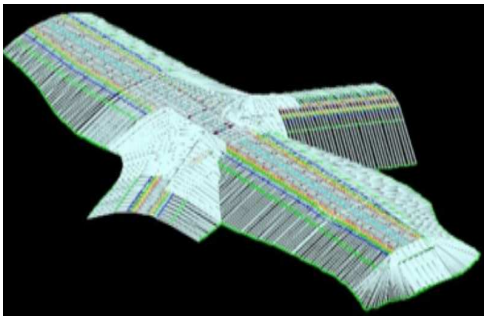
- DOTs, Agencies and Decision Makers
- Citizens

Benefits

- Model and analyze terrain
  - Create intelligent models containing not only terrain data but also roadway or site features. You can use features to visually distinguish structure, appearance, and symbology in the design.



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Stakeholders

- Consultants Design Engineers (NCDOT/PEFs
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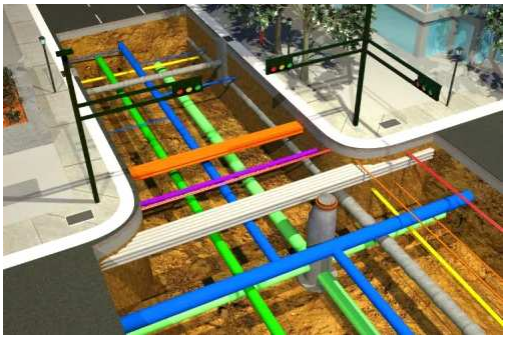
- DOTs, Agencies and Decision Makers
- Citizens

Benefits

- Model, analyze, and design complete stormwater and sanitary sewer networks
  - Create, manipulate, design, and analyze stormwater and sewer networks
  - Conflict Analysis / Clash Detection



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Stakeholders

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Benefits

- Automated Machine Guidance (AMG) is a downstream application that can be applied to highway construction projects to provide construction efficiencies through enhanced location referencing.
- Using a combination of 3D modeling data along with global positioning system (GPS) technology, AMG provides horizontal and vertical guidance in real time to construction equipment operators.

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Stakeholders

- Consultants Design Engineers (NCDOT/PEFs
- Contractors and Construction Industry
- DOTs, Agencies and Decision Makers
- Citizens

Benefits

- AMG involves using construction equipment mounted with onboard computers.

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Stakeholders

- Consultants Design Engineers (NCDOT/PEFs
- Contractors and Construction Industry
- DOTs, Agencies and Decision Makers
- Citizens

Benefits

- AMG assists agencies and contractors in finishing projects in less time and with lower overall cost while providing higher quality and safety.
- The use of AMG improves construction efficiency, quality, and safety while reducing schedule, cost, and the environmental impacts.

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Stakeholders

- Consultants Design Engineers (NCDOT/PEFs
- Contractors and Construction Industry
- DOTs, Agencies and Decision Makers
- Citizens

Benefits

With OpenRoads ConceptStation, you can:

- Assemble context data rapidly from a variety of sources, such as 3D reality meshes, terrain data, images, and geospatial information to bring real-world settings to your project.
- Simplify 3D modeling with easy-to-use engineering sketching capabilities to quickly conceptualize road and bridge infrastructure

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Stakeholders

- Consultants Design Engineers (NCDOT/PEFs
- Contractors and Construction Industry
- DOTs, Agencies and Decision Makers
- Citizens

Benefits

- Rapidly generate 3D layouts with associated project costs and share with project teams and stakeholders to choose the best option.
- Advance the approved 3D model to the detailed design phase to rapidly accelerate project delivery.
- Share realistic visualizations

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Stakeholders

- Consultants Design Engineers (NCDOT/PEFs
- Contractors and Construction Industry
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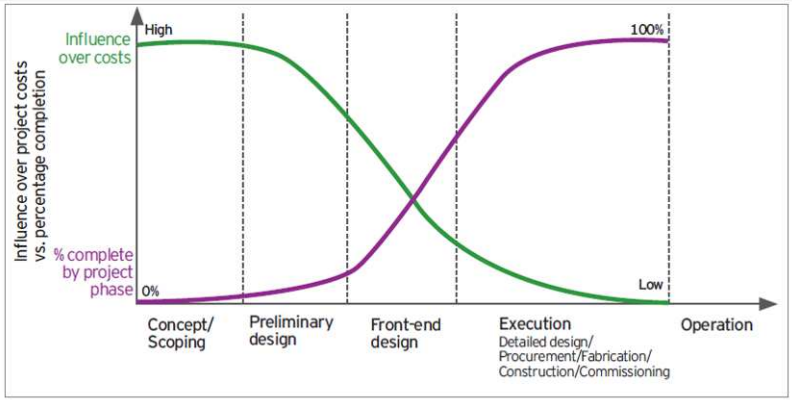
- Citizens

Benefits

More efficient use of Citizen's tax payer dollars.



Source: Ernst & Young analysis

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Stakeholders

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Benefits

Ability to more readily “see” and “understand” projects prior to construction.

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Stakeholders

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Stakeholders

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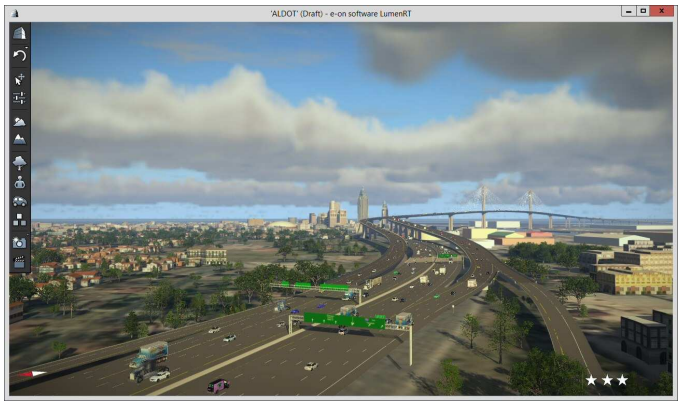

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ORD Testing Process

Pilot Projects

- Approximately 20 ORD Pilot Projects currently underway by NCDOT staff

Testing

- Currently underway on 2020R2
- Next anticipated Bentley ORD 2020R3 update expected this Fall

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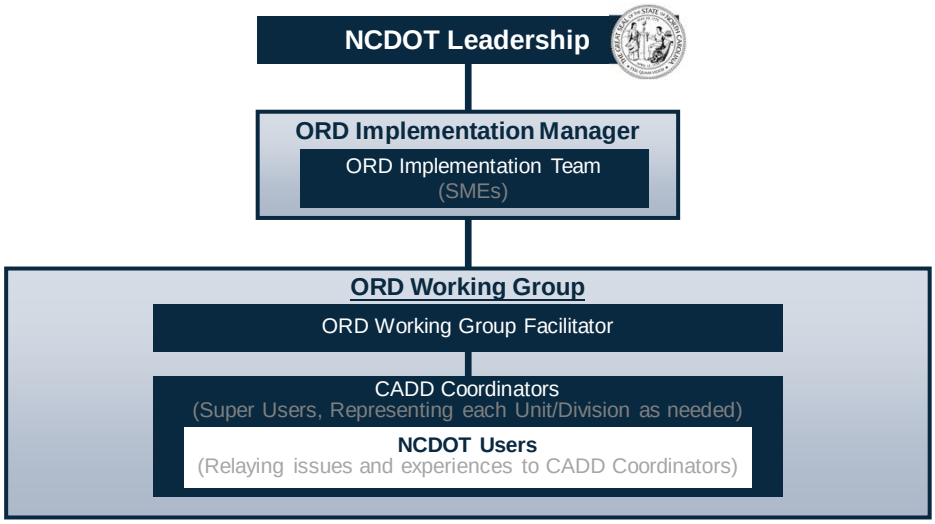
NCDOT ORD Implementation Initiative



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NCDOT ORD Working Group Roles

Coordination and Communication

Disseminate technical information

Discuss challenges and barriers

Collect feedback

Track progress of development updates

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NCDOT Internal ORD Pilot Projects

- Approximately 20 Internal ORD Pilot Projects Underway this Summer/Fall
- Across nearly all 14 Divisions and working with the majority of the Design Units.
- A partial list of current Pilot Projects include:
  - Roadway, Hydraulics, Structures, other Units: B-5156 and U-5816
  - Geotechnical: B-4491
  - Location & Surveys
    - Asheboro Office: U-5758
    - New Bern Office: U-5878
    - Winston Salem Office: 79-0108
    - Sylva Office: R-5799
- Primary focus of Pilot Projects is to:
  - Provide hands on training/practice utilizing ORD
  - Determine how to replicate in ORD work currently performed in MicroStation V8i SS2/SS4
  - Determine what internal Unit / Division Workflows may need modification
  - Determine what feedback to provide to Bentley regarding potential software fixes and or enhancements.

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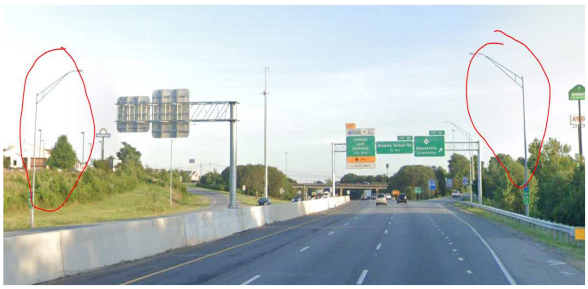
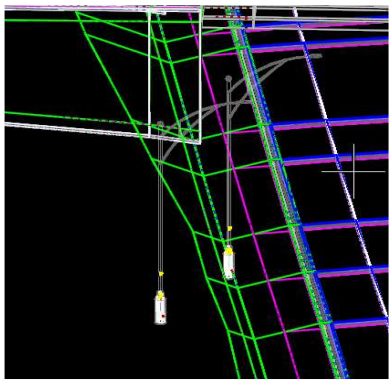
NCDOT Internal ORD Pilot Projects

- On the U-5816 Pilot Project, there will be a new bridge constructed at an intersection and the pavement will be widened. A quick 3D analysis was performed which readily showed that 2 existing Single Arm light poles (circled in red above), will have to be relocated further back. a top-down 3D view, where you can see the original poles are in conflict.





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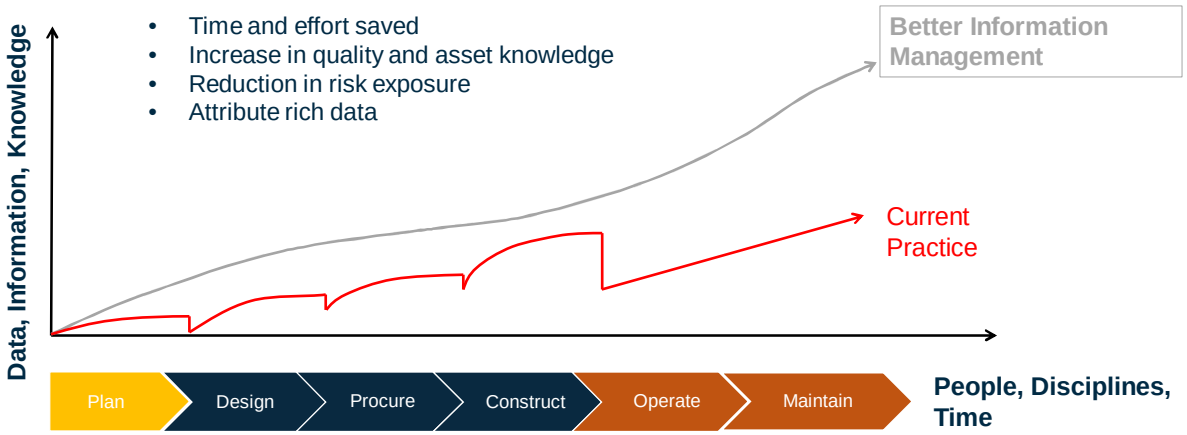
Industry Drivers - Better Information Management (Intelligence Management)

- Time and effort saved
- Increase in quality and asset knowledge
- Reduction in risk exposure
- Attribute rich data



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NCDOT ORD External Coordination

https://connect.ncdot.gov/resources/CADD/Pages/OpenRoadsDesigner.aspx

INTERNAL

NCDOT internal ORD Working Group Members are actively testing, training, and piloting the ORD software now.

EXTERNAL

Working to determine efficient, multi-prong approach to coordinating with our external partners.

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ORD Integration with IPD

N.C. DEPARTMENT OF TRANSPORTATION

PDN PROJECT TRANSITION PLAN

INTEGRATED PROJECT DELIVERY (IPD)

a CULTURE where we PROMISE what we are GOING TO DO and DELIVER what we PROMISE.

— NCDOT's Project Delivery Vision

The use of OpenRoads Designer (ORD) and 3D modeling is a component of the overall Departmental strategy to provide continuous project delivery improvement for our stakeholders through the Integrated Project Delivery (IPD) effort.

Integrated Project Delivery (IPD) is a culture where we promise what we are going to do and deliver what we promise. IPD will help NCDOT and our partners make timely decisions regarding scope, schedule, budget and quality. The utilization of ORD will assist in this effort.

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ORD Implementation Steering Team

Presenter / Facilitator:
Jeffrey M. Garland, PE, PMP
NCDOT ORD Implementation Manager

NCDOT

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Roadway Design Unit Specialty Functions and Support Services Group Lead

Jason Moore, PE
Roadway Design Unit Support Services Section Lead

Oak Thammavong
Roadway Design Unit Engineer III

NCDIT

Ellen Dickson, PMP
Engineering Application Services Manager

Kyle Nauman
CADD Services Manager

Rande Robinson
CADD Services Technology Support Specialist

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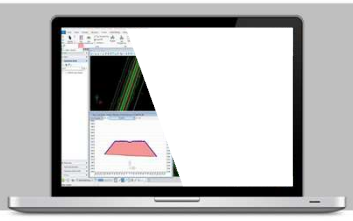
Questions and Input

Additional Questions? Feedback? Input?

Please email NCDOT regarding the current ORD Implementation Initiative to:
NCDOT.ORD.Implementation.initative@ncdot.gov



Presenter / Facilitator:
Jeffrey M. Garland, PE, PMP
NCDOT ORD Implementation Manager

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