NORTH CAROLINA
Department of Transportation

NCDIT
TRANSPORTATION CADD Services

NCDOT

CADD Guidelines and Standards

Version 1.0

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Purpose

This document is prepared and maintained by the North Carolina Department of Information Technology (NCDIT) Engineering and CADD Services (EDCS) team, in coordination with the North Carolina Department of Transportation (NCDOT) Technical Services CADD Integration Team and CADD Coordinators within the NCDOT Engineering Design Units and Divisions. This document provides technical information, guidelines, and business rules on current practices in utilizing CADD software for the purposes of the design and delivery of NCDOT projects from conceptual design through construction.

It is recognized that this document does not capture all areas of interest and that a number of sections within this document may need additional information and updates. This is expected and this document will be treated as an ongoing, dynamic informational resource. As such, the goal is for this document to be updated bi-annually with subsequent versions anticipated to be released at the mid-point and end of each calendar year. That said, the NCDIT EDCS team plans to continuously coordinate throughout the year with all pertinent NCDOT stakeholders to conduct working sessions and incorporate feedback to augment and update the information provided in this document.

For any questions, input, updates, or ideas regarding this document, please contact the NCDIT EDCS Team at: cadd-sup@ncdot.gov.

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Vision and Mission

The **vision** for this CADD Guidelines and Standards document is that it serve as the primary informational resource for the NCDOT project design workflow. With ongoing and consistent updates and maintenance to this document, the vision is that this document will assist NCDOT in a number of ways including:

- Assist in ensuring consistent, high-quality CADD practices.
- Promote efficient project delivery, clear communication, and effective collaboration across all infrastructure and development initiatives.
- Empower state agencies with the CADD tools and knowledge necessary to deliver public projects with transparency, accuracy, and cost-effectiveness.
- Establish a foundation for sustainable infrastructure development through efficient and interoperable CADD practices across all NCDOT Disciplines.
- Serve as the cornerstone for efficient and interoperable CADD practices within NCDOT, ensuring the delivery of high-quality transportation projects on time and within budget.

This vision supports the following NCDOT-specific aspects:

- Efficient and Interoperable: Standardized practices streamline workflows and ensure compatibility between projects.
- High-Quality Transportation Projects: The focus is on delivering high-quality results that benefit the state's transportation infrastructure.
- On Time and Within Budget: The vision emphasizes the importance of efficient project completion.
- Consistency: Projects across NCDOT will utilize the same CADD practices.
- Communication: Consistent CADD practices facilitate clear communication between departments.
- Collaboration: This document fosters effective collaboration on infrastructure and development projects.

The **mission** for the larger NCDOT and NCDIT team is to continue to coordinate and collaborate on an ongoing basis to continually develop these CADD Guidelines and Standards to meet the Vision noted above.

Disclaimer

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TEAM (NCDIT and NCDOT)

The primary responsibility to ensure and maintain the policies, workflows, software, and hardware needed for NCDOT Design engineers to perform their design work is shared by a joint NCDIT and NCDOT team consisting of members from (1) the NCDIT EDCS team, (2) the NCDOT CADD Integration team, and (3) the NCDOT CADD Coordinators. Each group plays an important role in developing these guidelines and being able to help our internal transportation engineering design staff and external partners with technical support as needed. A summary of each of these groups is included below.

NCDIT EDCS Team

The overall focus of the North Carolina Department of Information Technology - Transportation (NCDIT-T) is to provide the full spectrum of information processing services and support for information resource management for the North Carolina Department of Transportation (NCDOT). The EDCS team within NCDIT-T is responsible for providing customer service specifically to all CADD users in NCDOT. These services include highly complex software configuration and custom workspace scripts, department wide and unit specific software standards development, training and software support. The team coordinates with a wide range of stakeholders within both NCDOT and NCDIT to provide CADD/Engineering programming to all of the engineering design units in the Department. EDCS is responsible for assisting the NCDOT Design Units and external partners in implementing several large Technology Initiatives including the Departmental transition to the Bentley OpenX platform and the utilization of ProjectWise.

CADD Integration Team

The CADD Integration Team within NCDOT Technical Services serves as the central hub for coordinating and optimizing CADD workflows across the department's infrastructure projects. The team works closely with project discipline CADD coordinators, who assist in the development and refinement of the CADD workspace to meet the specific needs of various engineering and design disciplines. In collaboration with the project disciplines, the CADD Integration Team identifies opportunities to streamline processes, improve interoperability, and maintain high-quality design outputs. This ensures that workflows remain efficient, accurate, and aligned with NCDOT's broader goals for project delivery and cost management.

The CADD Integration team partners with the EDCS team, to ensure that all CADD tools and technologies function seamlessly, addressing technical issues, managing updates, and ensuring that the necessary

infrastructure is in place for optimal project delivery. Together, the CADD Integration Team, project discipline CADD coordinators, and the EDCS team form a cohesive unit that drives innovation, efficiency, and reliability across all NCDOT CADD operations.

CADD Coordinators

The CADD Coordinators within NCDOT are the Subject Matter Experts (SMEs) for their respective engineering design units and Division offices. They are responsible for understanding the needs and specifics of their unit workspace and standards. The CADD Coordinators assist with the coordination of ProjectWise and SharePoint work areas with a focus on the delivery of CADD files and documentation.

Introduction

The CADD Guidelines and Standards Document includes a number of informational sections covering transportation design, software, hardware, and workflows as denoted in the table of contents of this document. In order to keep this document streamlined and up to date, there are a number of hyperlinks that will direct readers to websites with more detailed information regarding the noted subject.

For an overall understanding of the current NCDOT engineering design workflow and an introduction to a wide range of terminology associated with the CADD Design performed by NCDOT, this document starts with directing the reader to the NCDOT Project Delivery Network (PDN).

Project Delivery Network (PDN)

The NCDOT PDN is a comprehensive framework designed to guide the efficient and consistent delivery of transportation projects. It outlines the stages, activities, tasks, and deliverables involved in project development, providing clear milestones and defining roles and responsibilities for project teams. The PDN aims to enhance transparency, streamline processes, and promote multidisciplinary collaboration throughout the project lifecycle.

The PDN is structured into five key stages:

1. Project Initiation: Establishes the project's initial vision and conceptual layout.

2. Environmental and Right-of-Way (ROW) Plans: Involves necessary surveys, analyses, and design work to develop environmental documents and ROW plans.

3. Final Plans: Completes all design elements and finalizes environmental documentation.

4. Plans, Specifications, & Estimates (PS&E) and Letting: Finalizes all plans, specifications, and estimates in preparation for project advertisement and bidding.

5. Post-Letting/Construction: Addresses activities following the project's letting, including construction oversight and project closeout.

Each stage includes specific activities and tasks, with detailed guidance provided to ensure consistency and quality in project delivery. The PDN is designed to be scalable and flexible, accommodating projects of varying scopes and complexities. For more detailed information, including the latest version of the PDN and associated resources, you can visit NCDOT's Project Management & Delivery page.

The PDN aids CADD integration by establishing standardized workflows and clear stages in the project lifecycle, ensuring that CADD workflow align seamlessly within the project framework:

Structured CADD Deliverables:

Each phase in the PDN, from Project Initiation to Post-Letting, outlines specific deliverables, allowing CADD teams to plan their work in sync with project milestones. This reduces last-minute changes and improves consistency across design outputs.

Defined Standards:

PDN incorporates NCDOT's standards, ensuring CADD work complies with departmental guidelines and meets quality expectations. This includes design standards, file structures, and naming conventions that promote uniformity.

Collaborative Environment:

PDN's multidisciplinary approach encourages collaboration between CADD designers, engineers, environmental teams, and project managers, making it easier to integrate CADD data with other project information seamlessly.

Quality Control and Reviews:

With set review points in PDN's stages, CADD deliverables undergo periodic quality checks, allowing early identification of issues. This results in fewer reworks and a smoother integration into final documentation.

Workflow Efficiency:

The PDN's systematic stages reduce redundancy in CADD work, ensuring that data and design elements developed early can flow smoothly into later stages like Final Plans and PS&E.

ServiceNow and ORD Knowledge Base

The ServiceNow website in general is part of the NCDOT cloud-based service desk software suite that enables to manage and track IT incidents, service requests, and other business processes efficiently. The ORD KnowlegeBase ServiceNow is specifically focused on asking any OpenX CADD related questions, tracking and addressing them by the local CADD community, announcements and guides.

Specifically, this portal allows NCDOT employees and authorized consultant/external users to:

- **Submit and track CADD related service requests**: Users can report CADD issues or request services related to CADD support, application assistance, and more.

- **Access self-service resources**: The platform provides self-help capabilities, enabling users to find solutions to common problems without direct assistance.

- **Monitor the status of requests**: Users can view the progress of their submitted requests and receive updates on their resolution.

Computer Systems

NCDOT gives a minimum recommendation on Computer Hardware and Software based off industry standards and Bentley minimum requirements.

CADD Hardware Specifications

Our PC/Workstation specifications are updated as needed, usually annually and sometimes bi-annually. This could be based off software recommendation changes, specifications from other DOT's or as we move into the 3D, 4D and beyond engineering and data management. Once recommendations are pushed out and approved, we will update the website with this information. The NCDOT replacement cycle for PC's/Workstations is 3 to 4 years.

Here is the most current hardware recommendations by NCDOT: Hardware recommendation

NCDOT does not endorse any specific brand or manufacturer of PC/Workstations. Our recommendations are for our PC's/Workstation that utilize CADD software (mainly Bentley). This does not mean that our general CADD PC/Workstations recommendations are optimal for all users.

NCDOT CADD Software Versions (as of 5.1.24)

Here is our most current list of Software and Versions being used by NCDOT: Software Versions

*ORD projects started before the release of 2023 may still be using ORD 10.12.02.4 or 10.10.20.34 – please double check with your project manager on the version for the project.

Unit specific software and versions are listed below in the Unit Standards and Deliverables Section.

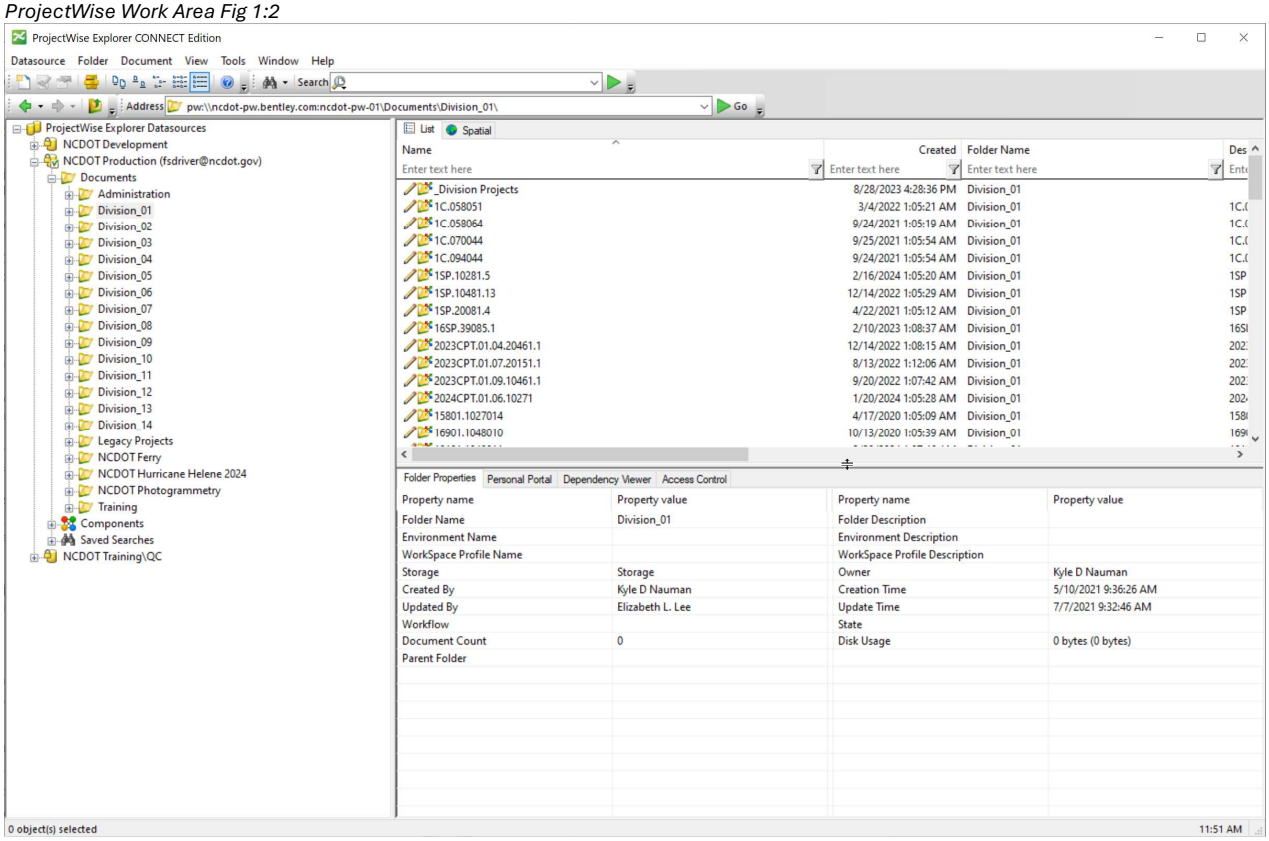
NCDOT ProjectWise

ProjectWise is a software platform developed by Bentley Systems, utilized by the NCDOT for managing, storing, and collaborating on CADD files in real time between NCDOT and Private Engineering Firms (PEFs). It serves as NCDOT's only authorized platform for CADD file maintenance, storage, and project collaboration. All new projects created within NCDOT's SharePoint Preconstruction site will automatically generate a corresponding work area in ProjectWise, using the same name and description.

Folder Structure and Work Area Management

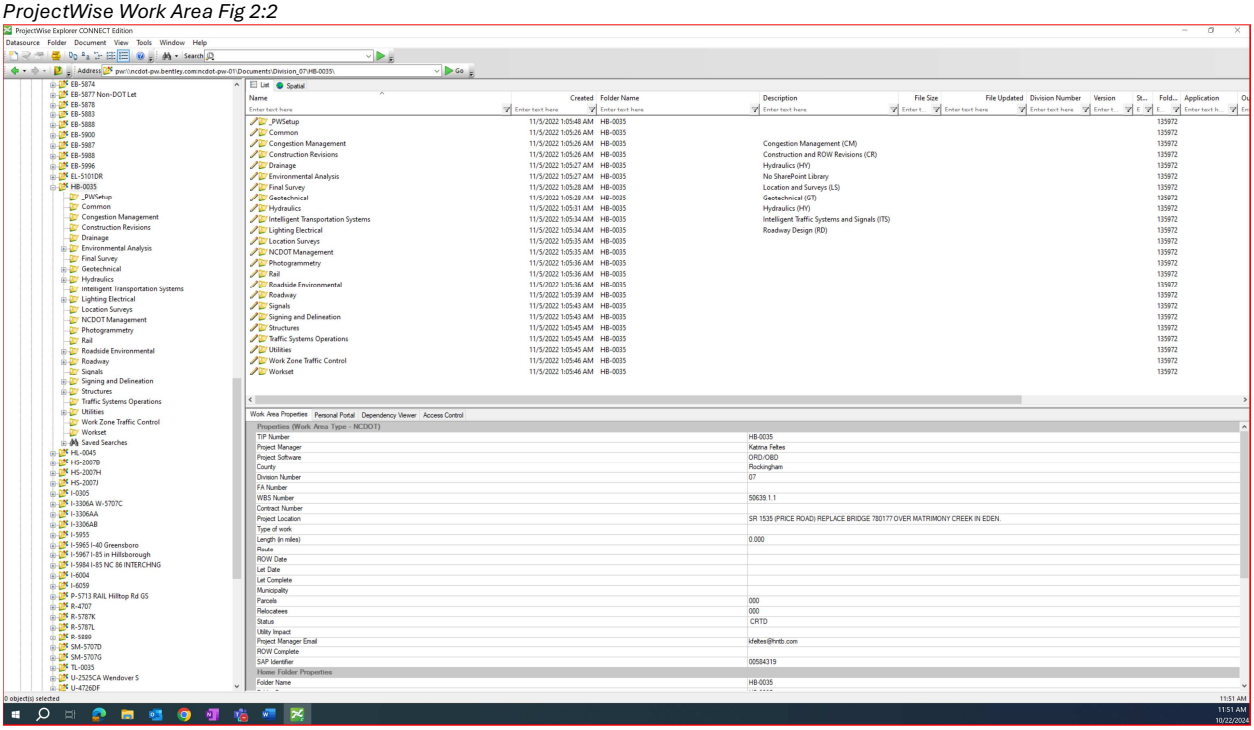
***ProjectWise Work Areas*:** Each new project will have a corresponding work area with the same name and description as the project created on SharePoint Preconstruction. This folder is the central location for all project-related CADD files.

ProjectWise Work Area Fig 1:2



***Standard Folder Templates*:** NCDOT follows a strict folder template structure for new projects, which is revised every few years through group meetings. Any request to alter the template must be documented and submitted by a CADD Coordinator. Minor changes for specific projects can be requested through the project's CADD Coordinator.

ProjectWise Work Area Fig 2:2



Workflow to request unit specific ProjectWise Folder Revision (for all projects):

- Discuss within your unit to establish a standard folder/permission structure for all projects that best aligns with your unit's specific project workflow.

For example, some units would like the flexibility to create subfolders as a standard within their unit folders for all projects to help with their workflow.

- Either you or the group manager contact the PW Admin team and cc the CADD Integration team to make the ProjectWise change.

This will ensure that the CADD integration and PW Administration teams are aware that requested changes are coming from the unit, rather than from individuals working on specific projects.

The goal is to offer flexibility and ease of use in ProjectWise for everyday project tasks while minimizing individual project-based requests to maintain a consistent standard across all projects. If there is an individual project request, it is recommended that designers/PMs coordinate with the CADD Integration Team to ensure visibility and clear communication across the various teams involved.

CADD Integration Team

- Vasim Barodawala – vbbarodawala@ncdot.gov
- Bruce Duane - tbduane@ncdot.gov

ProjectWise Administration Team

- Support request email: dot.pwsupport@ncdot.gov
- PW Admin (NCDIT: Will Chandler - wmchandler@ncdot.gov
- PW Admin (Bentley): Elizabeth Lee - ext-ellee1@ncdot.gov

PEF Access Management and Authorization

***PEF Access*:** PEFs can collaborate with NCDOT on active projects in ProjectWise. External users must authenticate through Bentley's Connection Client and follow the required procedures to gain access.

***Authorization Process*:** Access to a project's work area is controlled by the NCDOT Project Manager, who must submit a formal access request. Access credentials must be authenticated through Bentley's system.

***Forms and User Lists*:** All PEFs must submit a list of authorized users. Forms are available on the NCDOT ProjectWise portal ProjectWise (ncdot.gov).

Workspaces: Managed vs. Unmanaged

Managed Workspace (Used inside ProjectWise): Managed workspaces automatically ensure all project files are up to date with the necessary standards and configurations. This is the preferred method for all projects.

Unmanaged Workspace (Used outside ProjectWise): Unmanaged workspaces rely on locally stored standards and configurations. Projects using this setup must ensure consistency with the NCDOT CADD workspace guidelines.

File Management and Backup Procedures

File Backups: All project files are regularly backed up. File restorations due to corruption or accidental deletion can be requested through the designated CADD Coordinator or ProjectWise administrator.

File Versions and Updates: Regular updates and patches to the ProjectWise platform are rolled out in coordination with NCDIT. Users should always work on the latest approved version of the workspace to avoid compatibility issues.

ProjectWise FAQ and Support

Q: My firm/unit has ProjectWise access but I can't log in.

A: Requests for access to ProjectWise can be made through this request form. To submit a list of users, enter each separately into the single user form or use PEF ProjectWise Access Request and attach it to this form.

Q: How do I get a project/work area created in ProjectWise?

A: Contact your NCDOT Project Manager or the design unit you are working with to have the project site created.

Q: How does a structure (Bridge/Culvert/etc.) get created in ProjectWise?

A: The NCDOT Project Manager must add the structure in the "Project Structures" section on the project's home page in Preconstruction.

Q: How does a consulting firm get access to a ProjectWise work area (Project)?

A: The consulting firm must go through the NCDOT Project Manager who will then submit a "Grant Consulting Firm Access Request" through the project home page in Preconstruction.

Q: Where can I get the workspace ZIP file?

A: The workspace ZIP file can be found at:

NCDOT Connect - CADD Consultants Resources

Look on the right-hand side under CADD Downloads for the most current workspace zip files being used.

Q: Who do I contact if I have more questions?

A: For additional support, contact NCDOT ProjectWise Support at dot.pwsupport@ncdot.gov.

Moving Forward: Digital Delivery and Cloud Transition

NCDOT is committed to transitioning to a fully digital delivery process, where CADD projects are maintained in 3D models instead of 2D drawings. The focus is on evolving design processes and ensuring smooth digital delivery.

1. Digital Delivery at NCDOT aims to integrate Preconstruction, Construction, and Asset Management through a 3D model that facilitates streamlined project workflows from design to maintenance. This model is expected to make data more accessible for construction teams and asset management.

2. **Current Status**: A dedicated initiative has been formed to develop specific goals and an implementation roadmap for digital data exchanges and workflows. This initiative aims to enhance project development, construction delivery, and maintenance operations statewide.

3. **Specific steps include:**
    - Enhancing ORD efficiency.
    - Defining model expectations based on project types.
    - Developing training programs on digital plan usage.
    - Clarifying digital as-built expectations for future asset management.

4. Pilot projects will be key to refining this approach, with the ultimate aim of delivering projects with minimal 2D plans, supported by comprehensive 3D models.

5. Success will be measured by contractors using NCDOT-provided models, improved design efficiency and collaboration, more accurate quantity estimating via ORD, and consistent digital as-builts for asset management needs.

6. Participants are encouraged to embrace changes in project plans, challenge outdated processes, and contribute to a collaborative environment by sharing feedback and challenges with NCDOT teams.

For any updates to this program please visit the NCDOT Digital Delivery website.

ProjectWise Cloud Migration: NCDOT will be migrating to the ProjectWise Cloud in 2024 to enhance collaboration, access, and security for all ongoing projects. This transition will involve improvements like ProjectWise Drive and ProjectWise 365 for easier file management and sharing.

For more information our Pathway to digital delivery:
Digital Transformation (ncdot.gov)

OpenX

OpenRoads

Bentley's OpenRoads Designer (ORD) is a powerful tool for civil engineering design and modeling, combining core MicroStation functionality with specialized tools tailored for civil infrastructure projects.

Disciplines Using this Software in NCDOT:

- Location & Survey
- Photogrammetry
- Environmental Analysis
- Utilities
- Hydraulics
- Geotechnical
- Roadway
- Rail
- Signing
- Signaling
- Traffic Management

OpenRoads versions currently utilized by NCDOT:

- The following version utilizes NCDOT 2018 Standards
    - 2021 R2: Version 10.10.21.04

- The following versions and any new versions after this utilize NCDOT 2024 Standards
    - 2022 R2: Version 10.12.01.59
    - 2023: Version 23.00.00.129

For guidance on selecting the correct OpenRoads version for projects, please refer to the NCDOT ORD Project Version Migration Guideline V1. This document offers detailed recommendations and instructions to ensure the appropriate software version is used for project workflows.

OpenBridge

OpenBridge Designer 2023 (OBD) is a unique application that combines modeling, analysis, and design into one comprehensive bridge product. The application utilizes the modeling capabilities of OpenBridge Modeler and the analysis and design features of LEAP Bridge Concrete, LEAP Bridge Steel and RM Bridge to meet the design and construction needs of all types of bridges. OpenBridge Designer offers direct interoperability for analysis and design, produces detailed reports, clash detection and construction simulation, quantities, geometry reports, and more. The application provides 3D parametric

modeling, analysis, and load-rating software for bridges. Integrates with OpenRoads design applications, ProStructures for concrete rebar detailing and LumenRT for leveraging enhanced visualization.

Disciplines Using this Software in NCDOT:

- Structure Management Unit

OpenRail

OpenRail Designer (ORL) provides tools specifically built for the design of railways. This includes an extensive library of standards for cant, turnouts, geometry, and regression analysis. The Rail group is currently working with a few pilot projects to determine the usefulness of ORL. Once the evaluation is complete, they will make recommendations for the workspace and guidelines.

Disciplines Using this Software in NCDOT:

- Rail Division

OpenGround

NOTE: At the time of release of this document (12/18/2024), OpenGround is currently being tested by NCDIT and the NCDOT Geotechnical Unit for potential incorporation into their design workflow, but it is not currently being used for Production purposes by NCDOT.

OpenGround is a secure, cloud-based geotechnical information management solution for collecting, managing, analyzing, reporting and sharing geotechnical data. OpenGround is made of 2 components. OpenGround Cloud is where data is collected and stored. OpenGround Civil Tools are incorporated withing OpenRoads Designer and will allow the information stored in the OpenGround Cloud to be used in Civil projects.

OpenGround is installed on top of other Bentley Civil products such as OpenRoads or OpenBridge. OpenGround is going to be released in the upcoming 2024 version of OpenRoads Designer.

Disciplines potentially to use this Software in NCDOT:

- Geotechnical Unit

Training Resources

The NCDOT Training Resource document has been created to compile all the training, webinars and Bentley Learn sites into one single location. This makes it easier for the users to navigate to any ORD-related reference material quickly. You will find links to various Bentley and NCDOT specific training manuals, videos, Project conversion guidelines and other helpful resources.

The content in this document is broken down into three categories:

Bentley Learn Center - Contains introductory training videos, documents provided by Bentley for users to understand the basic layout and tools.

NCLUG – This is a Local User Group of designers that provide demonstrations and training videos on various NCDOT CADD topics. This is a good place for users to get familiar with NCDOT project CADD workflow, files and other settings.

NCDOT OpenX specific training – This section provides discipline specific training manuals, videos and datasets for users to understand the OpenX suite and the CADD workflow related to NCDOT projects and file management.

We also have formal training classes available on NCDOT Learning Center (LMS) linked below that can be accessed using the NCID login credentials:

- ORD: Corridor Modeling & Super Elevation (Highlights)
- MicroStation Connect I (ORD)
- ORD 101
- ProjectWise Basics

OpenX Conversion

The document, NCDOT OpenRoads Designer (ORD) SS2 to ORD CADD Conversion Guide, serves as a guideline for the NCDOT to assist in converting project data from the older GEOPAK V8i Select Series 2 (SS2) software to the newer OpenRoads Designer (ORD) platform.

The purpose of this document is to help in making decisions regarding the migration of ongoing or past projects to ORD, offering recommendations based on the project's phase, complexity, and schedule. It outlines the steps involved in the conversion process, the different levels of conversion (minimum, moderate, full), and provides best practices for ensuring the accurate migration of data such as terrain models, alignments, and corridor files. Additionally, it includes recommendations on the use of hybrid approaches when projects are near completion or construction revision is necessary.

The guide serves as a roadmap for NCDOT engineers and CADD technicians to transition to the new software platform while minimizing disruption to ongoing projects and ensuring a smooth migration of critical design data.

OpenX Version Upgrade

The document "NCDOT ORD Project Version Migration Guideline V1," serves as a guide for Project team leads to determine the process of upgrading OpenRoads Designer (ORD) projects to newer software versions. It outlines key stages for project migration, emphasizes when and how to migrate, and provides detailed steps and considerations for the upgrade process. It also highlights the importance of prioritizing project milestones over upgrades, especially with major version changes, and the potential challenges in migrating CADD elements, standards, and specifications from previous versions.

Key sections of the document include:

1. ***Stages of Project and Migration:*** It details specific ORD versions (e.g., 10.08, 10.10) and the actions required at various project stages (from alignment definition to PS&E).
2. ***Version Upgrade Considerations:*** It advises on the appropriate timing of upgrades, the impact of using different NCDOT standards (e.g., 2018 vs. 2024), and the need for manual updates when projects use older versions.
3. ***Plan Production Elements****:* This section discusses potential software deficiencies or changes in features between versions, encouraging collaboration among project managers, discipline leads, and CADD coordinators to ensure a smooth migration process.
4. ***Steps for Migration****:* The document outlines the procedural steps project managers must take, including coordinating with ProjectWise administrators and pausing project work during the transition.
5. ***References to Software Fixes and Resources****:* It provides links to defect logs and fixes for ORD versions and other OpenRoads-related software, such as OpenBridge.

NCDOT New OpenX Version Review/Approval Process:

1. New version of OpenX is released.
2. CADD Services (CS) initiates the DIT security review.
3. CS downloads the new version and installs it on CS, CADD Support Group (CSG), and Unit CADD Coordinators (UCC) PCs for testing.
4. The updated NCDOT Workspace is sent to UCCs for two weeks of testing.
5. Week 1 Coordinator's Meeting:
    a. Discuss any issues found.
    b. Identify development needs and estimated timelines for resolution.
    c. Determine impacts on the NCDOT Workspace and necessary revisions.

6. Week 2 Coordinator's Meeting:
    a. Review test results.
    b. Assess what still needs to be developed and timelines.
    c. Confirm any further workspace revisions.
    d. Set a deployment date for the new version.
    e. Set a removal date for the old version (this should be at least one month after the deployment date).
    f. Deploy the new version to NCDOT PCs.
7. Unmanaged workspace is posted on the CADD Services website.
8. The website is updated to notify PEFs of NCDOT's adoption of the new version.

ORD Knowledge Base

Purpose

The ServiceNow portal provides a single location for ORD/CADD users to ask questions, read articles, find training, and get the support they need to design & model their NCDOT projects. The system maintains FAQ's and is searchable. This builds a knowledge base of ORD information over time.

This will improve the methodologies in which customers investigate, research, and find solutions to questions, challenges, and areas of knowledge necessary in utilizing the CADD software for the development of engineering design plans.

CADD Support and Knowledge Base

Reason

With ongoing customer service, the NCDIT-T Engineering Design and CADD Services team continues to assist NCDOT with the need for an improved process to share all the questions, challenges and issues that have been identified. Currently, when users encounter an issue or problem, they predominately utilize email to pose the issue. Then the resulting technical work and solutions are shared with emails. While this approach has been sufficient in handling these "one off" issues. It presents a challenge around sharing solutions on a broader more effective scale.

Standards

Workspace

To ensure consistency and collaboration, NCDOT provides standardized workspaces that can be accessed both through ProjectWise and local drives.

Setting Up NCDOT OpenX Workspace in ProjectWise:

ProjectWise is NCDOT's authorized platform for CADD file maintenance and storage. When a new project is created in NCDOT's SharePoint Preconstruction site, a corresponding work area is established in ProjectWise. Access to these work areas is configured based on project-specific permissions. For detailed guidance on accessing and utilizing ProjectWise, refer to the NCDOT ProjectWise Explorer User Guide.

Setting Up NCDOT OpenX Workspace on Local Drives:

For projects managed outside of ProjectWise, NCDOT provides a downloadable Connect Workspace for local setup. While local workspaces can be configured, **NCDOT highly recommends using ProjectWise** for optimal collaboration, 3D model consistency and efficiency, especially on projects involving multiple contributors and complex data models. To configure the workspace on your local drive refer to one of the flashcards named "ORD Workspace Setup Flashcard" pdfs on the site related to the utilized OpenX software version.

Updating Local Workspaces:

It's essential to keep your local workspace up to date to align with NCDOT standards. To update your local ORD Workspace refer to the https://connect.ncdot.gov/resources/hydro/ORDFiles/Updating Local ORD WorkSpaces.pdf flashcard pdf document link mentioned above.

By following these procedures, you can ensure that your OpenX workspace is correctly set up and maintained, whether you're working within ProjectWise or on a local drive.

Folder Structure (General)

Below is the purpose of each folder and subfolder in the workspace structure:

The NCDOT OpenX workspace, organized under the configuration_"version name" directory (for example configuration 10_12, configuration 10_10 etc), is structured to facilitate efficient project management and standardization. Below is an overview of the major folders and their purposes:

- **Configuration "version name"**: This is the root directory, containing all necessary configurations and resources.

- **Organization-Civil**: Houses NCDOT organization-wide civil engineering standards, including templates, seed files, and resource files applicable across various projects.
- **WorkSpaces**: Contains individual workspace configurations tailored to specific disciplines or units within NCDOT.

- **DOT-US North Carolina**: Represents the primary workspace for NCDOT projects, encompassing standards and resources specific to North Carolina.
  - **Desk**: Includes desktop icons and shortcuts for launching applications with the appropriate workspace settings.
  - **Roles:** The folder holds configuration files that define user roles that are Discipline specific within the workspace. Each role can have specific permissions and settings suited to various job functions (e.g., Roadway, Hydraulics, Structures etc.).
    - **Content:** This folder contains .cfg files that set up role-based configurations, such as interface settings, tool preferences, and custom views. These configurations help streamline the workspace environment according to the needs of different users.
    - **Usage:** When a user logs in and selects a role, the workspace loads settings defined in the **Roles** folder to customize the experience for that role, optimizing productivity and reducing setup time for each user.
    - **Standards Folder:** This folder contains organization-wide resources that ensure uniformity in design files across all projects. It is the core location for NCDOT's standard design elements and tools.
      - **Content:** This folder includes subfolders with resources such as listed below but not limited to:
        - **Cell Libraries:** Standardized symbols and details used in design.
        - **Line Styles:** Predefined line types to maintain visual consistency in drawings.
        - **Level Libraries:** Organized sets of layers or levels for design elements, ensuring that everyone uses the same structure for visibility and categorization.
        - **Seed Files:** Templates for creating new files, preset with NCDOT standards to ensure every new file starts with the correct settings.
        - **Symbology:** Establishes the settings for colors, weights, and styles associated with various features, ensuring they adhere to NCDOT standards for visual uniformity.

- **Seed Files:** Provides standard template files configured to NCDOT standards, used as starting points for new projects to ensure uniform design settings.

- **Text Styles:** Standardizes text sizes, fonts, and formatting across design files to maintain consistent text appearance in project deliverables.

- **Template Library:** Contains reusable design elements like roadway cross-sections, Drainage ditch components and structural components that align with NCDOT standards, streamlining design workflows.

- **Macro**: Contains scripts and custom commands that automate repetitive tasks, enhancing efficiency in design workflows. These macros streamline processes like batch edits, standard calculations, and model updates, ensuring consistency and saving time across projects.

- **Pref** folder: This folder stores user-specific preference files that customize the workspace environment. These files retain settings such as interface layout, tool preferences, and display configurations, allowing users to have a consistent, personalized setup each time they access the workspace. This folder helps maintain efficiency by preserving individual user settings across sessions.

- **Usage:** The **Standards** folder provides a central resource for all standardized design elements, ensuring that every project adheres to NCDOT guidelines. It promotes consistency and reduces errors by providing access to pre-approved resources.
- **Dgnlib**: This is a critical directory used to store **design libraries** (.dgnlib files), which are essential for standardizing elements across projects. These files provide a centralized location for reusable settings and resources that enhance consistency and efficiency in design files.
  - **Contents such as but not limited to:**

- **Feature Definitions**: Defines characteristics for design elements like roads, drainage, and utilities, determining how they look and behave in the workspace.
- **Element Templates**: Contains templates that apply specific settings to design elements, allowing users to quickly format features with standard NCDOT-approved characteristics.
- **Custom Tools and Task Interfaces**: Provides custom tools, menus, and workflows to streamline project tasks, enhancing productivity by offering a tailored design environment.
- **Sheet Borders and Title Blocks**: Includes standard sheet borders, title blocks, and layout configurations, ensuring all project sheets meet NCDOT formatting requirements.
- **Graphical Filters:** include predefined filters that categorize and manage design elements based on attributes or geometry. These filters enable efficient organization and display of specific data types, streamlining tasks such as terrain modeling, corridor design, and model reviews by isolating relevant elements for focused editing and analysis.

- **WorkSet Folder:** This folder organizes project-specific data, settings, and standards, facilitating efficient management of individual projects within the broader workspace structure.
- **This folder is under discussion by the CADD Integration Team for utilization outside of the workspace folder and part of the project folder structure.**
    - **Content:** Each WorkSet is dedicated to a specific project, containing:
        - **Configuration Files (.cfg):** Defines project-specific variables and settings.
        - **Design Files (.dgn and .dgnws):** Main design files for the project.
        - **Standards Subfolder:** Any custom standards for the project that may override or add to the general standards (e.g., specialized templates or symbols for unique project requirements).
        - **Sheet Borders:** Predefined borders for plan sheets, ensuring consistency in presentation across deliverables.
    - **Usage:** The **WorkSet** folder allows each project to operate independently, with **project-specific configurations while still adhering to organization-wide**

standards. It provides a framework for organizing files and settings unique to each project, improving workflow and file management.

Seed Files

Location and examples:

Name	Description	Who
NCDOT_CONNECT_WORKSPACE\Configuration_2023\Oranization-Civil\NCDOT\Seed		
Seed2D - English Design	Used for 2D design file creation unless stated otherwise	ALL except Structures, Rail, Signing and Delineation, Traffic Safety
Seed3D - English Design	Used for 3D design file creation unless stated otherwise	Roadway, Hydraulics, Location and Surveys, Photogrammetry
NCDOT_CONNECT_WORKSPACE\Configuration_2023\Workspaces\DOT-US North Carolina\Roles\[Discipline]\Standards\Seed		
SMU OBM-seed3d.dgn	Primary seed file for structures design (3D)	Structures Management
SMU OBM-seed2d.dgn	Used for 2D structures design file creation	Structures Management
Seed2D – English Rail Design.dgn	Used for 2D Rail design file creation	Rail
English_2D.dgn	Used for signing and pavement projects	Signing and Delineation
Seed_Hearing Map.dgn	Standard Seed File for Public Hearing Display	Roadway
Recently removed seed files		
Survey – English Design	Not used for new surveys; see Location and Surveys Unit Standards below	Location and Surveys
SMU ModelSeed.dgn	No longer used; contained design, drawing, and sheet models	Structures Management

Plotting Resources

.pltcfg – Printer Driver Configuration file; chooses settings for printer / paper size

.tbl – Pen Table; primary method of evaluating/modifying elements in ORD based on criteria such as:

- Element Type
- Files
- Weight
- Color
- Fill Color
- Level Style
- Class

.pen – Design Script (not commonly used; functional in ORD but primarily used with iPlot which is no longer used with ORD)

100 Roadway Plans

Resource	Description	Location
RD_pdf.pltcfg	See Module 13 - Sheeting pages 130 - 134 for printing instructions	\Configuration_2023\WorkSpaces\DOT-US North Carolina\Roles\NCDOT_Roadway\ Standards\Plot\
Roadway_CONNECT.tbl	Most commonly used for Roadway plans (not for Symbology Sheet - 1B)	
Roadway.pen	Original V8 Design Script for iPlot	
Roadway_CONNECT.pen	Used in limited circumstances if Roadway_CONNECT.tbl not working properly	
RD_Hearing Map_pdf.pltcfg	See Module 14 - Public Hearing Map pages 166 - 172 for printing instructions	

Hydro Redline Plans

Resource	Description	Location
HYD_pdf.pltcfg	Prints to 22 x 34 pdf	\Configuration_2023\WorkSpaces\DOT-US North Carolina\Roles\NCDOT_Hydraulics\ Standards\Plot\
HYD_CONNECT_RedLine.tbl	Pen Table for hydraulic deliverables	

200 Transportation Management Plans

Resource	Description	Location
printer.pltcfg	Prints dgn files straight to printer, not discipline-specific	\Configuration_2023\WorkSpaces\DOT-US North Carolina\Roles\NCDOT_Traffic_Control\Standards\Dgnlib\Printing\
WZTC.tbl	Default Pen Table, grayscales lines and shades survey/existing features	\Configuration_2023\WorkSpaces\DOT-US North Carolina\Roles\NCDOT_Traffic_Control\Standards\Plot\
WZTC_plain.tbl	Does not grayscale things, screens existing pavement markings	
WZTC_Final.tbl	Similar to WZTC, has a few extra options for seals	
pdf.pltcfg	Used to print to pdf, not used often, not discipline-specific	\Configuration_2023\WorkSpaces\DOT-US North Carolina\Roles\NCDOT_Traffic_Control\Standards\Dgnlib\Printing\
jpeg.pltcfg	Used to print images, mainly aerials, not used often, not discipline-specific	
WZ_RDWY.tbl	Screens existing markings, changes priority on drums, signs, barricades, not used often	\Configuration_2023\WorkSpaces\DOT-US North Carolina\Roles\NCDOT_Traffic_Control\Standards\Plot\
TCU.tbl	Only affects drums, not used often	

210 Pavement Marking Plans

Resource	Description	Location
printer.pltcfg	Prints dgn files straight to printer, not discipline-specific	\Configuration_2023\WorkSpaces\DOT-US North Carolina\Roles\NCDOT_Traffic_Signing\Standards\Plot\
pdf.pltcfg	Used to print to pdf, not discipline-specific	
jpeg.pltcfg	Used to print a jpeg, not discipline-specific	
Signing.tbl	Plot existing pavement marking in gray scale	

230 Erosion Control Plans

Resource	Description	Location
EC_PEN_Table_FG.tbl[1]	Final Grade EC phase color (CG phase turned off)	\Configuration_2023\WorkSpaces\ DOT-US North Carolina\Roles\NCDOT_Erosion_Control\Standards\ Dgnlib\Printing\
EC_PEN_Table_CG.tbl[2]	Clearing and Grubbing EC phase color (FG phase turned off)	
EC_PEN_Table.tbl[3]	All EC displayed in color	

1 Final grade and both phases in color; RDY, Hydro, etc. in grayscale/black
2 Clearing and both phases in color; Roadway, Hydro, etc. in grayscale/black
3 Final grade, clearing and grubbing, and both phases in color; Roadway, hydro, etc. in grayscale/black

250 Signing Plans

Resource	Description	Location
printer.pltcfg	Prints dgn files straight to printer, not discipline-specific	\Configuration_2023\WorkSpaces\DOT-US North Carolina\Roles\NCDOT_Traffic_Signing\ Standards\Plot\
pdf.pltcfg	Used to print to pdf, not used often, not discipline-specific	
jpeg.pltcfg	Used to print a jpeg, not discipline-specific	
Signing.tbl	Plot existing pavement marking in gray scale	

260 Signal Plans

Resource	Description	Location
NCDOT_TSMO_PDF.pltcfg	Printer Configuration file for TSMO with paper size selection for Full Size, Half Size, and 8.5x11.	\Configuration_2023\WorkSpaces\DOT-US North Carolina\Roles\NCDOT_TSMO\ Standards\Plot\
NCDOT_TSMO.tbl	TSMO Pen Table for plan sheet creation	
PLOT.PEN	TSMO Design Script to display plan sheet items and fill properly	

300 Cross Section Plans

Resource	Description	Location
RD_pdf.pltcfg	See Module 13 - Sheeting pages 130 - 134 for printing instructions	\Configuration_2023\WorkSpaces\ DOT-US North Carolina\Roles\NCDOT_Roadway\Standards\Plot\
Roadway_CONNECT.tbl	Most commonly used for Roadway plans (not for Symbology Sheet - 1B)	

400 Structure Plans

Resource	Description	Location
SMU_pdf_ANSI_A.pltcfg	Prints to 11x17 pdf (See NCDOT_SMU_OBD_Manual Chapter 4 Section 4.8 for printing)	\Configuration_2023\WorkSpaces\DOT-US North Carolina\Roles\NCDOT_Structures\ Standards\plot\
SMU_pdf.pltcfg	Prints to 8.5x11 pdf (See NCDOT_SMU_OBD_Manual Chapter 4 Section 4.8 for printing)	
smu.tbl	SMU pen table (See NCDOT_SMU_OBD_Manual Chapter 4 Section 4.8 for printing)	\Configuration_2023\WorkSpaces\DOT-US North Carolina\Roles\NCDOT_Structures\ Standards\Pen Tables\

500 Roadway Subsurface Plans / 510 Structure Subsurface Plans (Geotech)

Resource	Description	Location
RD_pdf.pltcfg	See Module 13 - Sheeting pages 130 - 134 for printing instructions	\Configuration_2023\WorkSpaces\DOT-US North Carolina\Roles\NCDOT_Roadway\ Standards\Plot\
Roadway_CONNECT.tbl	Most commonly used for Roadway plans (not for Symbology Sheet - 1B)	
Geotechnical pen table 09192024_testing.tbl	IN PROGRESS	\Configuration_2023\WorkSpaces\DOT-US North Carolina\Roles\NCDOT_Geotechnical\ Standards\Plot
Geotech_pdf_testing.pltcfg	IN PROGRESS	

RW Right of Way Plans (Location and Surveys)

Resource	Description	Location
pdf_Eng.pltcfg	Prints to 11x17 pdf	\Configuration_2023\WorkSpaces\DOT-US North Carolina\Roles\NCDOT_Survey\Standards\Plot\
locationpdf.pltcfg	Prints to 22x34 pdf	
LS_C Series.tbl	Pen table for use with Primary and Secondary Control Sheets	
LS_RW Series.tbl	Pen table for use with RW Series sheets as part of Right of Way Acquisition Surveys	

SINGLE SHEET PRINTING

This method uses the built-in MicroStation Print dialog within OpenRoads, ensuring settings like pen tables and styles are applied based on workspace configurations. See pentable and style list in the appendix for Project Discipline plotting information.

Quick Steps Using the Print Option in OPENX

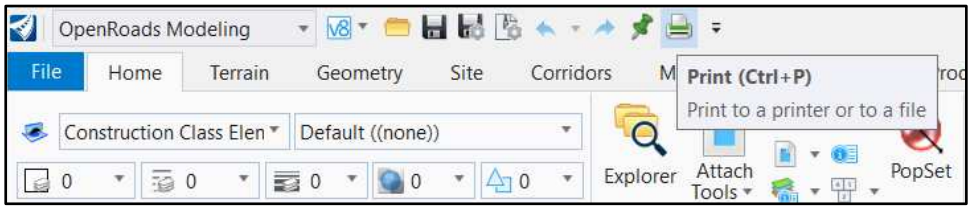
Open the Drawing: Navigate to the desired plan sheet in OpenX.

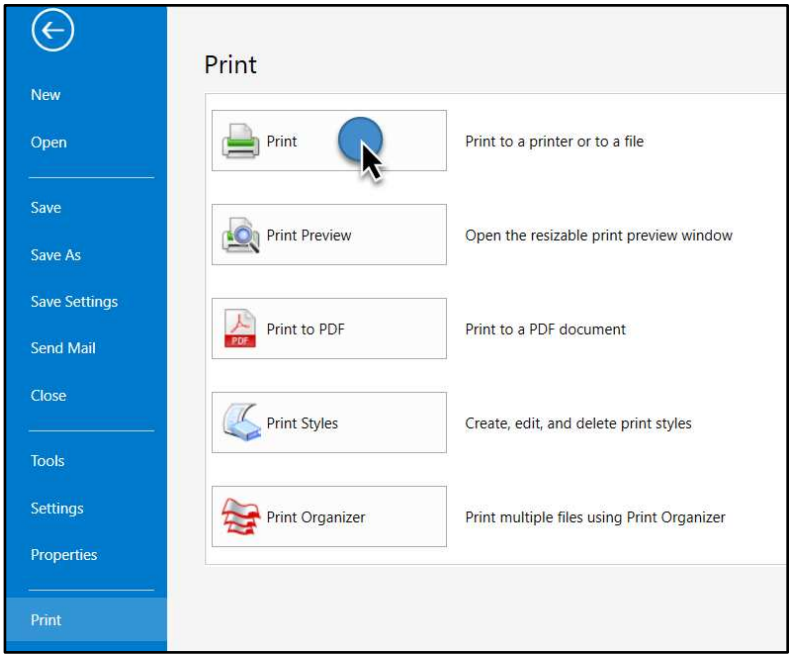
Access the Print Dialog: Click on the "Print" button located on the toolbar or use the shortcut (Ctrl+P).

Select Printer Driver Configuration (PLTCFG): Choose the appropriate PLTCFG file, such as RD_pdf.pltcfg for printing to PDF.

Adjust Print Settings: Modify the print scale, orientation, and sheet size as needed using appropriat pentable and design scripts.

Preview and Print: Use the print preview to confirm settings, then click "Print" to output the file.

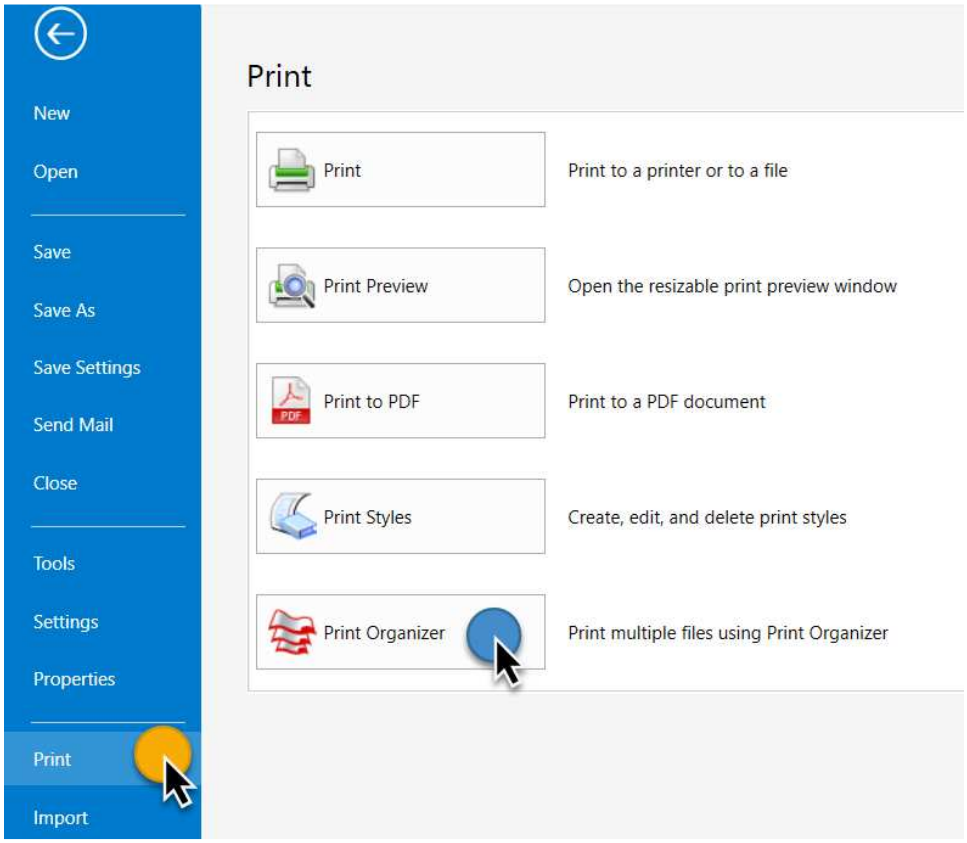




Plan set Printing (Batch Printing) – Print Organizer

This process uses the Print Organizer tool in OpenX to create and manage PDFs for NCDOT projects. The Print Organizer allows for batch printing of plan sheets using pre-configured settings.

Quick Steps Using the Print Organizer Option In OPENX:



Open Print Organizer - Go to *File* > *Print Organizer* from the main menu.

Add Files - In Print Organizer, click *Add Files to Set* and select the plan sheets (DGNs) you want to print.

Choose Print Style - Select the appropriate print style for your project.

Configure Pen Table - Assign a pen table (if required) for line weights and colors.

Set Output Options - Choose printer, paper size, scale, and other settings from the options menu.

Preview and Print - Review the preview of your sheets, then click *Print* to generate the files.

Working Units

There were four design planes for the State of North Carolina in MicroStation V7 DGN files with four different global origins. Since V8 DGN files are 2 million times larger, we only needed one design plane (design cube for 3D) for the entire State and it has a new global origin location (Global Origin is offset -1803984.5480, -659551.9387 from the design plane center). When converting from V7 to V8, the Global Origin (GO) does not match. Referencing files with different global origins can lead to some potential problems if not done correctly. By using reference file attachment method “Coincident-World”, all global origins are re-aligned in the reference files and the active file, so their coordinates appear correct.

MicroStation native unit is a Meter. For English DGN files, (International) Foot or Survey Foot is available. The conversion difference between is small, but rather significant.

1 international foot = 0.3048000 m

1 survey foot = 1200/3937 m = 0.3048006 m

During the V7 to V8 DGN file conversion, MicroStation defaults to (International) Foot for English project files because it is first in the “units.def” file as defined in the NCDOT workspace. Of course, surveys are commonly done in “Survey Foot” instead. Since May of 2010 the (International) Foot unit definition has been removed from our units.def file. All newly converted files will take on the Survey Foot definition.

CADD Standard File Naming and Codes

The documents below provide standardized abbreviations, file naming and file type designations for various units within NCDOT. These abbreviations are integral to the department's file naming conventions, ensuring consistency and clarity across all CADD files. By adhering to these unit codes, NCDOT facilitates efficient file management, retrieval, and collaboration among different departments and external partners. For instance, the abbreviation 'RDY' represents the Roadway Design unit, while 'HYD' denotes the Hydraulics unit. Implementing these standardized codes helps maintain an organized and systematic approach to file naming, which is essential for the effective handling of project documentation. The links below are actively being discussed in the Department for a formal file management guideline document.

- CADD Standards – File Name Unit Codes
- Location Survey file name unit codes
- CADD Services – CADD Standard filenames
- CADD – Roadway Design Standard File Types

CADD Plan Production

Sheeting

In OpenRoads, "sheeting" refers to the process of creating, organizing, and laying out sheets for design plan sets.

Key aspects of the sheeting process in OpenRoads include:

Drawing Models: These are created to represent different views, such as plan, profile, or cross-section views, with all necessary annotations, dimensions, and labels. Each drawing model is set up with specific scales and details appropriate for the sheet.

Sheet Models: Sheet models serve as templates for the final printed output, containing title blocks, project information, and layout settings. Each sheet model represents a single sheet in the plan set and can hold one or more drawing models.

Named Boundaries: OpenRoads uses named boundaries to define the extents of specific areas for sheeting, such as individual cross-sections or alignment segments. These boundaries help automate the sheet creation process by setting predefined areas for each view.

Annotation and Scaling: OpenRoads automates annotation and scaling based on the drawing model and sheet scale, ensuring consistent presentation across the plan set.

Sheet Indexing: Sheets can be organized into a sheet index within OpenRoads, making it easier to manage, reorder, and print multiple sheets as a coherent set.

Within the NCDOT, the sheeting process in OpenRoads Designer (ORD) can vary based on project requirements and specific disciplines. NCDOT Roadway Design Unit has developed comprehensive guideline for the sheeting process in ORD. This guideline covers the creation of drawing and sheet models, the use of named boundaries, annotation practices, and sheet indexing. The "Module 13 OpenRoads Designer Sheeting" document offers detailed instructions on these procedures.

Numbering

NCDOT sheet numbering for project plans is systematically organized to ensure clarity and consistency across various disciplines. Each sheet is assigned a unique identifier that reflects its content and sequence within the plan set.

General Sheet Numbering Structure:

The standard format for sheet numbering typically includes a prefix denoting the sheet type, followed by a numerical sequence. For example:

1A-1: Index of Sheets, General Notes, and List of Standards.

1B-1: Conventional Symbols.

2A-1, 2A-2, 2A-3, etc.: Plan and Profile Sheets.

This structure allows for easy identification and navigation through the plan set.

Discipline-Specific Sheet Numbering:

Different disciplines may have tailored numbering conventions. For instance, the following format for Pavement Marking Plans:

PMP-1: Title Sheet, Key Sheet, Revised Roadway Standard Drawings.

PMP-2: Detail Sheets.

PMP-3: Pavement Marking Plan Sheets.

If certain elements are not required, the subsequent element adopts the preceding number. For example, if Detail Sheets are omitted, Pavement Marking Plan Sheets would begin at PMP-2.

Additional Considerations:

Supplementary Sheets: When additional sheets are necessary, letters are appended to the numerical sequence (e.g., 2A-1A, 2A-1B).

Revisions: Revised sheets are typically denoted with an "R" suffix (e.g., 2A-1R) to indicate modifications.

Discipline Prefixes: Specific disciplines may use unique prefixes to distinguish their sheets (e.g., "SD" for Signing and Delineation).

NCDOT Roadway Design Manual provides a detailed list of sheet numbering conventions

Unit Standards and Deliverables

Photogrammetry

Homepage

Overview

Aerial Surveying with Drones

List of Deliverables:

- SPS
- Sid and SWD image
- Aerial Survey Report
- SPS /DTP ORD design file
- SPS/DTP Transmittal Word document

Construction: Manned flight

- Earthwork quantities
- ORD file (if asked)

Construction: Unmanned flight

- Earthwork quantities
- ORD file (if asked)

Unit Standards

Naming Standards

Photogrammetry File Naming Standards for ORD_20220426.pdf

Shell Plan Sheet Mapping

Mapping manual that resides within the Location survey workspace

Construction Earthwork Quantity Standards

Manned

ORD_Construction_240508.pdf

Unmanned

ORD_Construction_240508.pdf

Unit Software

- Hexagon Intergraph software
- Summit Evolution Dat/Em software
- Global mapper software
- Yellowscan Cloud station
- GeoExpress
- Prism
- MS365 products
- TBC
- UAS master
- Context capture iTwin Capture Modeler
- ORD
- ARCGIS
- Adobe
- Google Earth
- Track Air
- Topoflight
- LP 360
- Snagit
- NVIDIA RTX Desktop Manager 204.84

Knowledgebase

Location and Surveys

Overview

The Location & Surveys department consists of the Central Office at the Century Center complex along with 14 division offices. The Central Office includes the Unit Head, Assistant Unit Head, Private Engineering Firm (PEF) group, Property Survey Department (PSD) and the Geomatics Technical Services department (GTS). The 14 division offices are overseen by three Regional Engineers (Eastern, Central & Western regions). We also have three Assistant Regional Engineers reporting directly to the Regional Engineers providing technical services for their respective regions.

The GTS department is responsible for establishing training & documentation for CAD standards throughout the unit. The Unit Head, Assistant Unit Head, Regional Engineers & Assistant Regional Engineers provide oversight, review and approval of the CAD standards generated by the GTS department.

The Location & Surveys main page under the Connect NCDOT site can be found at this link Location & Surveys Homepage.

Unit Software

The Location & Surveys unit utilizes the following software's to develop deliverables throughout the state:
OpenRoads Designer (ORD) – Current version used to generate all base mapping deliverables.
Trimble Business Center (TBC) – Current version used for GPS processing, Conventional Survey processing, UAS (Drone) processing and Bathymetric (Sonar) processing.

There is additional software's used for specific needs related to LiDAR & Sonar, but this software is only on specific computers and not standard for all CAD users.

Unit Standards

The standards for Location & Survey naming conventions, work flow and deliverables can be found at this link ORD Guidelines, Naming Conventions & Deliverables.

The Project Review Checklists along with additional QA/QC documentation for all stages of project development can be found at this link Project Review Checklist

ProjectWise

The ProjectWise folder structure and work flow are also described in the following link ORD Guidelines, Naming Conventions & Deliverables

Training Documentation

Various training documentation for Location & Surveys procedures can be found on our Teams site and/or YouTube site via the links provided below:

Location & Surveys ORD Training Videos

Location & Surveys ORD Survey Manual

Standard Operating Procedures (SOP's)

There is a knowledgebase forum that allows people to ask questions and provides answers to technical problems for all NCDOT units. The link for our forum is here.

Utilities

Homepage

Overview

It is the responsibility of the Utilities Unit to facilitate and manage the relocation, adjustment, removal, and addition of utilities along NCDOT highways and rights of ways while maintaining the integrity of the highway system and ensuring the safety of its users.

The NCDOT Utilities Unit is comprised of three sections:

Utilities Coordination, Utilities Engineering, and Utilities Encroachments Engineering. Use the menu on the left to navigate to each section. Additional content will be included on our Connect NCDOT site in the future.

List of Final Deliverables (Deliver to both ProjectWise and Connect):

- 100% Sealed Utility Construction Plans
- 100% Utility by Other Plans
- Sealed Utility Construction Project Special Provisions
- Quantity Estimate of Pay Items
- Final CADD/Electronic Files

Unit Standards:

- Utilities Manuals (ncdot.gov)
- Process & Procedure for Utilities Work (ncdot.gov)
- Design Standards for Utilities Work (ncdot.gov)
- 2024 Specifications and Special Provisions (ncdot.gov)
- Division 15 Combined.pdf (ncdot.gov)
- Guidelines for Utilities Designers

Unit Software:

- MicroStation/Geopak SS2, SS4
- ProjectWise Explorer
- Connection Client
- Adobe Acrobat Pro
- Bluebeam
- OpenRoads Designer
- Microsoft Office Suit (Word, Excel, PowerPoint)

Link to Documents:

- NCDOT Project Delivery Network.pdf

Hydraulics

Homepage

Overview

The Hydraulics Unit provides technical expertise, guidance, design and quality assurance to manage stormwater, riverine and coastal impacts in and around roadways for the protection of the public, the environment and NCDOT assets.

List of Deliverables:

- Link

Unit Standards:

- Drainage Studies Guidelines
- Consultant Resources

Unit Software:

- Link

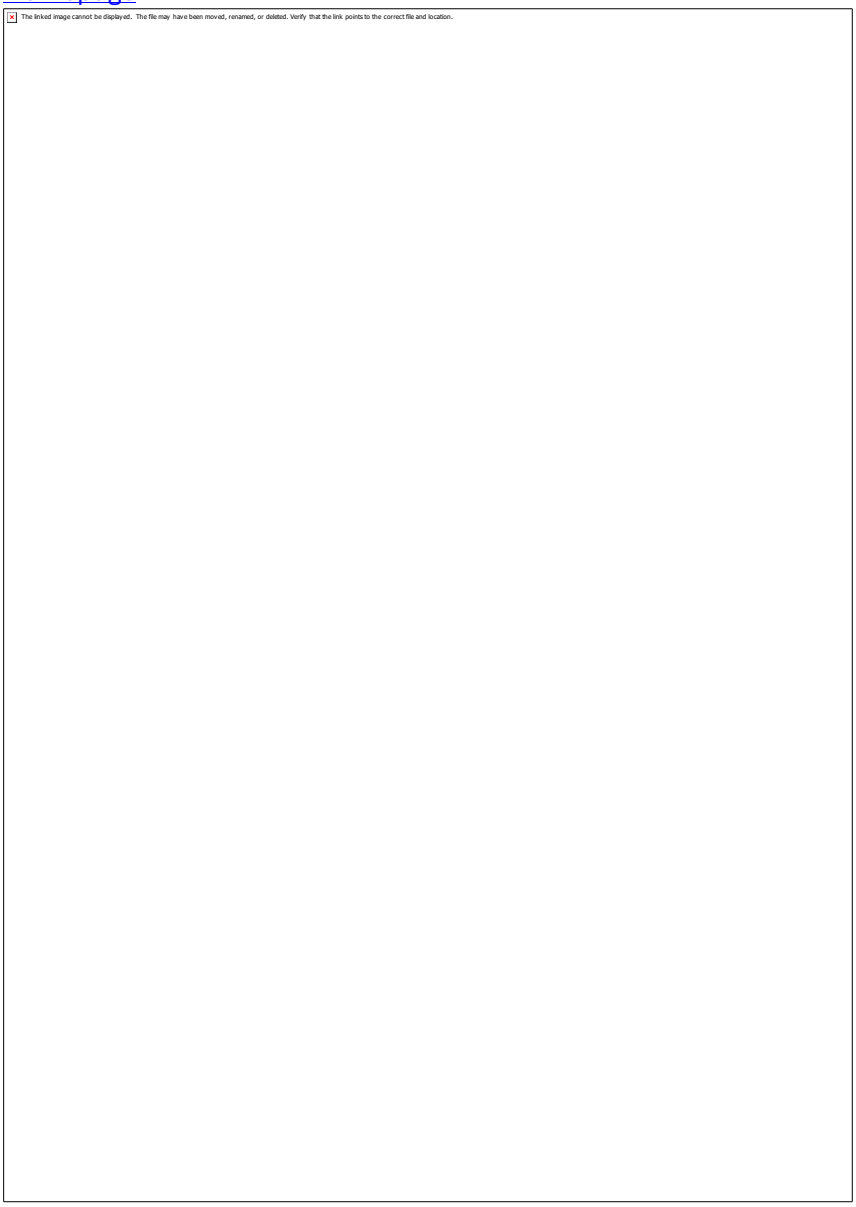
Link to Documents:

- NCDOT Hydraulics ORD
- Drainage and Utilities Manual
- Ditch Manual

Knowledgebase

Structures Management

Homepage



Unit Standards:

- SMU Standard Drawings
- SMU Culvert Standard Drawings
- SMU Standard Design Plans
- File Naming Convention
- SMU Manuals

Knowledgebase

Roadway Design

The Roadway Design Unit's mission is to provide design and technical expertise to NCDOT staff and our consultant partners to ensure the production of quality products throughout the project delivery process. As the Unit implies, our primary focus is on the design of roadway plans. However, we also have a team who are responsible for the development of lighting and electrical plans for NCDOT-owned roadway lighting and other infrastructure. The support provided by the Roadway Design Unit takes many forms including the development and maintenance of design guidance, technical support for CADD design software and associated tools, serving on technical committees, and responding to inquiries from customers internal and external to the agency. To learn more about the different teams in the Unit (Design Development and Support, Support Services, Research Standards and Innovation, and Lighting and Electrical), click on the link for each.

Homepage

List of Deliverables:

- Plan Preparation
- Estimates and Computations
- Roadway Submittal Guidelines
- Design Criteria Submittal
- Meeting/Hearing Maps for Public Involvement Submittal
- Design Recommendation Plan Submittal
- Field Inspection Plan Set
- Right of Way Plan Set Submittal
- Design Complete Review Meeting Plan Set
- Final Plan Set Submittal
- Sealed Contract Roadway Plans Submittal
- PDN Stage - Roadway Design QA/QC Checklists (Featured Tab)
- Final Construction Plans Review List (2018 Specifications)

Unit Standards:

- ORD File Naming Conventions (Module 1 – File Management – Chapter 9)
- ORD Folder Naming Conventions (Module 1 – File Management – Chapter 7)
- ORD File List, File Contents & Referencing Protocols (Module 1 – File Management – Chapter 10)
- Design Manual
- 2024 Roadway Standard Drawings
- Corridor Modeling Abbreviations (SS2)
- Parametric Constraints Chart (SS2)
- Reference File Logical Names (SS2) (Better list is needed. Superficially addressed in Module 1 – File Management on *page 38*)

Unit Software:

- PowerGEOPAK V8i (SS2)
- OpenRoads Designer 2023 (10.10 and 10.12 available)
- ProjectWise Explorer
- Concept Station
- InterPlot Organizer
- UpdateWS
- AutoTURN 11
- Torus
- NEXUS DDI
- AQCESSRAMP
- Agi32
- SAP
- Bluebeam Revu 20
- Adobe Acrobat (Pro)
- 7-Zip (.7z) Zip Utility
- Nearmap
- Google Earth Pro
- Camtasia
- Operating System – Windows 10
- Productivity Suite – Microsoft Office 365
- Microsoft Outlook

- Microsoft Edge
- Microsoft Teams
- Google Chrome
- Webex
- ArcGIS Pro

Link to Documents:

- Design Guidance, Forms, and Memos

ORD Service Portal / Knowledgebase

Geotechnical Engineering

Overview

The Geotechnical Engineering Unit provides scoping, planning, design, technical expertise and management services related to geoenvironmental concerns, pavement and subgrade services, soil and rock assessments/inventories, construction recommendations for slopes, foundations, roadway and structure projects.

Geotechnical Engineering Unit Disciplines:

- GeoEnvironmental
- GeoPavement
- Geotechnical Investigations
- Geotechnical Design
- Operations
- Support Services

Unit Standards:

- Geotechnical Investigation Manual
- GeoEnvironmental Resources
- GeoPavement Resources

Unit Software:

gINT	LPILE
MicroStation V8i	GRLWEAP
Open Roads Designer	MSEW
ProjectWise	SLIDE
Bluebeam	CAPWAP
Adobe Acrobat	APILE
Google Earth	PLAXIS
GPS Pathfinder	DigiPro
ArcGIS Pro	RESSA
ArcGIS Field Maps	Shoring Suite
Survey123	SPW911
Agile Assets	FB MuliPier

Geotechnical Engineering Unit Deliverables:

- **GeoEnvironmental:**
    - Phase I

- Phase II
- Phase III

- **GeoPavement:**
  - Pavement Subsurface Investigation
  - Pavement Subsurface Design Recommendations
  - Full Depth Reclamation
  - Testing Services
  - Subsurface Grouting
- **Geotechnical Investigations:**
  - Roadway Subsurface Inventory
  - Structure Subsurface Inventory (bridge, culvert, sound walls, retaining walls, temporary shoring)
  - Geophysical Surveys
  - Hydraulic Conductivity Testing
  - Rock Slope Investigation, Evaluation and Design
  - Landslide Investigation, Evaluation & Mitigation Design
  - Dam Investigation, Evaluation and Design
- **Geotechnical Design:**
  - Roadway recommendations
  - Structure design and recommendations
  - Temporary shoring design
  - Ground Improvement Design
  - Encroachment review
- **Operations:**
  - Construction review and services (PDA, CSL, etc.)
  - Foundation Testing
  - Vibration & Noise Monitoring
- **Support Services:**
  - Review of geotechnical products for approval
  - Review and creation of geotechnical standards
  - Hammer energy calibration review

Link to Documents:

- Geotechnical Resources and Consultant Information

- Notes and Provisions 2024 and 2018
- OpenRoads Information and Modules
- Boring Webmap
- Knowledgebase
- Geotechnical, Geoenvironmental and GeoPavement Work Request Form

Roadside Environmental Unit

Homepage

Overview

Provide roadside elements for a statewide highway system that are safe, environmentally sound, attractive and responsive to the public's needs.

The NCDOT Roadside Environmental Unit is comprised of several sections: Aesthetic Engineering, Erosion Control Engineering, Litter Management Section, Rest Area Engineering Section, Roadside Vegetation Management, Wetland Vegetation and Precision Mapping section, and Field Operations.

List of Deliverables:

Aesthetics Engineering

Erosion Control Engineering

Initiate E&SC Plans

- Water Quality worksheet
- E&SC Field Inspection Plans
- ROW/Easement request file

Complete E&SC Plans

- 230 Erosion Control plans - PDF on Connect
- 240 Reforestation Plans sheet (if required) - PDF on Connect
- Special Provisions – PDF on Connect
- Quantity estimate report – Excel – Erosion Control folder on Connect
- Trout Variance acceptance letter – if applicable.

Quantities:

- Entered into AWP or PIQ

In house design – files needed from other units:

DGN files

- Roadway design
- Final Survey/existing features
- Hydraulics/drainage design
- Terrain model/contours
- Alignment
- Slope Stakes
- Raster image/aerial photography

Supporting information (EC):

- Structural general drawing
- Permit drawings/conditions
- Environmental commitments
- Earthwork balance sheet
- Disturbed acreage (seeding)
- Cross sections

Reviews – Documents needed from Consultants:

Soil and Water Engineering

- EC Plan Submittal Checklist

Unit Standards

Aesthetics Engineering

- Aesthetics Guidance Manual
- Planting Guidelines for Highway ROW
- Aesthetics Guidance Pattern Book
- Aesthetic Engineering Group Design Policy

Soil and Water Engineering

- Erosion Control Guidelines and Resources
- Erosion and Sediment Control Design and Construction Manual
- BMP Manual for Construction and Maintenance Activities
- Erosion and Sediment Control Field Guide 2015

Unit Software:

Aesthetics Engineering

- ORD 10.12 and ORD 2023
- MicroStation/Geopak V8i

Soil and Water Engineering

- MicroStation/Geopak V8i SS4
- ProjectWise Explorer
- Adobe Acrobat Pro
- Bluebeam
- OpenRoads Designer 10.12, ORD 2023
- Microsoft Office Suit (Word, Excel, PowerPoint)

Link to Documents

- Field Operations
- Field Operations Links

Knowledge Base Link

Environmental Analysis Unit

Environmental Compliance Homepage

Environmental Analysis Unit

Environmental Policy Unit

ATLAS Resources

ATLAS Training

EAU CADD Knowledgebase

EAU CADD Knowledgebase

Overview

The Environmental Analysis Unit and Environmental Policy Unit are responsible for ensuring environmental compliance with all Federal, State and Local laws, rules and regulations. Aside from On-Site Mitigation project plans, these units generally provide reference CADD products that are used in the project development process.

Proposed Template for EAU CADD Guidelines Documentation:

1. *Group*
    a. *Sub-Group (If Applicable)*
        i. *Deliverable*
            1. *Narrative Description*
            2. *Input Dependencies*
            3. *Output Dependencies*

EAU CADD Deliverables

1. Environmental Permitting and Coordination Group (ECAP)

- **Study Areas**
    - **Narrative:** Project Management Unit (PMU) is responsible for creating study areas and transmits study area via ETRACS . There can be various types of study areas, the typical version is created to define limits for stream and wetland delineations. Other types of Study Areas relating to specific environmental aspect of project development may also be produced by PMU. Environmental Policy Unit (EPU) may advise on placement of Study Areas as needed throughout project development to maintain environmental permit compliance. EAU Maintains a level in our workspace for study areas.

- **Input Dependencies:** None - PMU Originates Study Areas in CADD format using either MicroStation or Project ATLAS. Other Study Area types may be produced through the same methods by PMU and EPU.
- **Output Dependencies:** EAU ECAP Group; Study Areas for stream/wetland delineation. PMU and EPU; Study Areas of special concern.

o **Wetland and Stream Delineations**

- **Narrative:**
  - ECAP/PEF places study area on GPS device.
  - ECAP conducts fieldwork, locating wetlands with mapping grade GPS equipment, and places nails at wetland points.
  - ECAP locates streams with mapping grade GPS as a point. If the jurisdiction remains the same through the study area. If the stream's jurisdiction changes (Perennial or Intermittent) in the project area, the point at which the jurisdiction changes is located with mapping grade GPS.
  - Upon return to the office, ECAP/ firm converts the file to MicroStation and transmits the file via a standard distribution email to Locations and Surveys.
  - (Blue=Future process to be worked out) Upon return to the office, ECAP/firm transmits the file in an ESRI GIS format to Location and Surveys Unit (L&S) via a standard distribution email to Location and Surveys.
    - L&S travels back out to Survey the wetland points (nails) and adds those to the Final Survey DGN file.
    - Streams are surveyed via L&S standard practices. However, L&S modifies the streamline to display the jurisdiction. This work is reflected in the Final Survey DGN file.
  - As appropriate, the Jurisdictional Resources are modified based on Agency Verification, project study area changes, or the age of the delineation. When the line changes, the Locations and Surveys process is repeated.
- **Input Dependencies:** PMU staff provide stream and wetland delineation Study Area in GIS or CADD format.
- **Output Dependencies:** L&S receives mapping grade wetland and stream delineation locations in GIS or CADD format.

2. Monitoring & Stewardship Group (M&S)

- **On-Site Mitigation Plans (OSM Plan sheets)**
  - **Narrative:** Stream Restoration/Relocation, Wetland Restoration, and Mitigation Site Remediation plans may be let in conjunction with a Roadway project or separately. Generally, the M&S group employ PEF's to design/draft the OSM plans. Restoration/Relocation/Remediation plan elements should be drafted using the EAU workspace. Development of OSM plans requires the relevant Roadway Design plans as well as (but not limited to) Structure and Hydraulics plans.
  - **Input Dependencies:** Relevant Roadway, Structure, Hydraulics and other discipline's design plans.
  - **Output Dependencies:** PMU/Division Project Development/PEF depending on who is responsible for overall design and letting.
- **Temporary Wetland Impact Reforestation Sheets**
  - **Narrative:** These projects involve recovery of temporary wetland impact areas to jurisdictional Status. Generally, these are related to bridge replacement projects. The M&S Group works with the Roadside Environmental Unit's (REU) Wetland Vegetation and Precision Mapping Group to develop Reforestation plan sheets for these types of projects. Design elements are drafted using the EAU and/or REU workspace.
  - **Input Dependencies:** Relevant Design Plans.
  - **Output Dependencies:** Reforestation sheets (RF) sent to responsible design team to incorporate with let package.
- **Standard Drawings and Specifications**
  - **Narrative:** The M&S group maintains Detail Drawings and Specifications for OSM plans. These are available on the EAU website in PDF format or can be requested in DGN format from the M&S Group.
  - **Input Dependency:** M&S Originates these files and they are approved by the Contract Standards and Development Unit.
  - **Output Dependency:** For those details used in a stream restoration/relocation design they are added to Typical sheets with project specific dimensions as recommended by the design engineer. PEF/Roadway will add these to their plans accordingly. Hydraulics Unit occasionally uses them in their designs.

- **As-Built Plans for both OSM Plans and Temporary Impact Projects**

- **Narrative:** The M&S group develops post-construction As-Built plan sheets to fulfill environmental permit obligations. These are typically drafted in DGN format using original OSM plan sheets as a background and include elements that denote location of post-construction monitoring features. These monitoring features are located with mapping grade GPS and converted to CADD/GIS format for use in monitoring report map figures.
- **Input Dependencies:** Let plans and field data located with mapping grade GPS or better accuracy.
- **Output Dependencies:** Environmental Regulatory Agencies (USACE/NCDWR/NCDCM) receive PDF copies of the As-Built plan sheets to fulfill environmental permit obligations. M&S group includes As-Built plan sheets in post-construction monitoring reports.

3. **Historic Architecture and Archaeology Groups**
    - **Cultural Resources CADD Elements**
        - **Narrative:** Cultural Resources staff regularly attach and reference CADD data within ArcGIS Pro maps. Our staff no longer creates DGN data, having switched to GIS-based mapping, data examination, calculations, and deliverables. When needed, Cultural Resources staff work directly with Roadway Design engineers and Project Management to create DGN level data for specific resource boundaries like NRHP Historic Property or District Boundaries, cemetery limits, avoidance areas, environmentally sensitive areas, or guide placement of construction fencing. After our input and guidance is provided, including associated GIS spatial data, the resulting CADD data is checked for accuracy by Cultural Resources staff before Roadway Design finalizes the DGN files. Roadway Design is responsible for the creation, ownership, and uploading of spatial data to ProjectWise and/or Connect-SharePoint.
        - **Input Dependencies:** Field data or proposed guidance in GIS/CADD format collected by Cultural Resources staff or PEF's.
        - **Output Dependencies:** Roadway Design incorporates into plan sheets.

4. **Traffic Noise and Air Quality Group (TNAQ)**

- **Air Quality Report (AQR)**
    - **CADD Input Dependency**

- **Narrative:** The AQR requires draft Roadway Design plans including but not limited to the proposed alignment.
- **Input Dependencies:** Roadway Design shall provide the draft designs. May be in PDF or DGN format, to be used in development of the Air Quality Report (AQR).

- **Traffic Noise**

- **Envelope Drawings**
    - **Narrative:** Prepared by the noise analyst, in coordination with Roadway Design, for noise walls recommended in the DNR.
    - **Input Dependencies:** Requires the following CADD files, from Roadway Design: final survey, alignment, design, right-of-way, proposed surface. Proposed utilities, existing and proposed drainage design, and slope stakes may also need to be shown, if available.
- **Noise Wall Alignment and Profile**
    - **Narrative:** TNAQ analyzes project designs and advises on horizontal and vertical placement of Noise Walls along project corridors once Noise Wall is approved through a balloting process.
    - **Input Dependencies:** Roadway Design shall provide the following project CADD files: final survey (including existing surface), alignment, design, right-of-way, slope stakes, existing and proposed drainage design, and proposed surface.
    - **Output Dependencies:** Roadway Design maintains levels in their workspace for Noise Wall elements. Proposed alignment and profile are drafted and maintained in Roadway Design Plans.
- **Public Hearing Maps**
    - **Narrative:** Potential Noise Abatement Areas (PNAA) should be shown on public hearing maps, *if available*. The noise analyst will create a CADD or GIS file of the PNAA and provide to Roadway Design for placement on the PHM.
    - **Input Dependencies:** Originates with TNAQ group.
    - **Output Dependencies:** Roadway Design will incorporate the PNAAs in the PHM using the appropriate file format and symbology.

5. Biological Surveys Group (BSG)

- Biological Surveys Group coordinates with various project design disciplines to advise on location of sensitive wildlife populations that require consideration during project development & construction and placement of structures relating to wildlife crossings.
    - **T&E Population Locations**
        - **Narrative:**
        - **Input Dependencies:**
        - **Output Dependencies:**
    - **Roadside Plant Populations**
        - **Narrative:**
        - **Input Dependencies:**
        - **Output Dependencies:**
    - **Wildlife Crossings and Fencing (or Intentional Gaps)**
        - **Narrative:**
        - **Input Dependencies:**
        - **Output Dencies:**
    - **Fish Passage Structures (Fish Ladders)**
        - **Narrative:**
        - **Input Dependencies:**
        - **Output Dependencies:**

6. Public Involvement, Community Studies, and Visualization (PICSVIZ)

- **Community Studies**

- **Mailing Areas**
    - **Narrative:**
    - **Input Dependencies:**
    - **Output Dependencies:**

o **3D Visualization Group**

- **3D Visualization Products**
    - **Narrative:** For Visualization project purposes, we gather specific files (DSN, GPK, ROW, TYP, PLN, STR, etc.) and extract what is needed using MicroStation/ORD. These specific files/data are gathered from the Project Manager, Roadway Design, Photogrammetry, Location Survey, Structure Design, etc. (usually on SharePoint or ProjectWise). Once the desired data is acquired, these files are usually exported from MicroStation/ORD as a ".dwg" file, to be used in other applications like 3D Studio Max. Also, if a CMD model is available we export the finish grade surfaces from the ORD into Autodesk 3ds Max as a DWG file.
    - **Input Dependencies:** Design files from Roadway, Structures, etc.
    - **Output Dependencies:** Model created to be used in animations, photo simulations, static renders, 3D Typical sections, etc.
- **Terrain Models**
    - **Narrative:** When creating our existing terrain/ground, MicroStation/ORD is used to create a boundary/shape file of the area of the proposed project. This boundary/shapefile is then used in ArcMap to acquire the geometric/Lidar information. Once completed, the information is then imported back into MicroStation/ORD, creating a geometric mesh/terrain. The result is an existing terrain that can then be exported out as a (.dwg) file to be used in 3D Studio Max.
    - **Input Dependencies:** Boundary file is created in ORD and imported into ArcMap
    - **Output Dependencies:** Terrain Model created in ORD from the lidar information extracted using ArcMap

- **Google Earth Products**

- **Narrative:** A KMZ file is created from MicroStation/ORD to be used in Google Earth for the purpose of determining potential camera views, impacts, or project information to share with DOT personnel, consultants, etc.
- **Input Dependencies:** DSN, ROW, SS file, etc via SharePoint and Project Wise.
- **Output Dependencies:** A Google Earth (KMZ) file created from ORD

- **Aerial Texture Maps**
  - **Narrative:** NC One Map in ORD is used for acquiring photography via MicroStation/ORD and exporting it as single or multiple "jpg". These files are then used mainly as an aerial texture in the requested visualization product. The images themselves are adjusted in photoshop and then applied to the terrain geometry in Autodesk 3ds Max.
  - **Input Dependencies:** NC ONE Map tools in ORD and raster merge tools
  - **Output Dependencies:** Aerial files generated usually in the form of .jpgs applied to the terrain geometry in Autodesk 3ds Max.

7. **ICI/Mitigation Modeling Group (ICI/MitMod)**
   - **Mitigation Modeling Group (M&M)**
     - **Project ATLAS**
       - **Narrative:**
       - **Input Dependencies:**
       - **Output Dependencies:** ATLAS has ability to output spatial data to CADD .DGN format.
   - **Indirect and Cumulative Impacts Group (ICI)**
     - **Indirect and Cumulative Impacts Products**
       - **Narrative:**
       - **Input Dependencies:**
       - **Output Dependencies:**

Unit Standards:

- EAU Workspace
  - Feature Definitions
  - Element Templates
- Detail Drawings for On-Site Mitigation (OSM)

Unit Software:

- MicroStation V8i SS4
- Open Roads Designer (Various Versions as dictated by PMU)
- ProjectWise
- ArcGIS Pro
- GO!NC (ArcGIS Online)
- ATLAS
- ETRACS
- Autodesk 3ds Max
- Adobe Photoshop
- ArcMap
- Adobe Photoshop
- Adobe Illustrator
- Google Earth

Training Documents:

General CADD Guidance

S:\Engineering\Dave\CTeleworking\ORD\EauCaddTesting\DaveHowTos\CADDUpdateJune2024\ORD Update June 2024.pptx

Mitigation & Modeling

Signing and Delineation

Homepage

Overview

Signs and markings are traffic control devices used to promote highway safety and efficiency by providing for the orderly movement of all road users on streets, highways, bikeways, and private roads open to public travel throughout North Carolina.

List of Deliverables:

Design Guidelines

Unit Standards:

SDU Procedure Manual

Division 9: Signing Standard Roadway Drawings

Unit Software:

How To Use GuideSign

Link to Documents:

Knowledgebase

Work Zone Traffic Control

Homepage

2TM2

Prepare Preliminary Transportation Management Plan (TMP) that includes:

- Preliminary general notes and written construction staging
- Plan details demonstrating how traffic is being safely maintained
- Proposing lane closure and hauling restrictions
- Proposing road closures/detours with need and expected duration (if applicable)
- Proposing temporary alignments/grades (if applicable)
- Location of temporary drainage, temporary shoring/slopes and temporary signals (if applicable)
- Location and type of work zone positive protection (if applicable)
- Location of temporary guide signage for overhead structures (if applicable)
    - Draft preliminary quantity estimate

3TM1

Prepare Final Unsealed Transportation Management Plan (TMP) which includes:

- Drafting quantity estimate, intermediate contract times (ICTs), and project special provisions (SPs)
- Finalizing general notes, phasing language, plan details
- Uploading final unsealed TMP and supporting documents to SharePoint Let Preparation folder
- Prepare Final Sealed Transportation Management Plan (TMP) which includes
- Revised plan based on comments from WZTC/Division (if applicable)
- Address any comments provided by CS&D Unit
- Seal TMP and all supporting documents after receipt of concurrence from the CS&D Unit and upload documents to project SharePoint Let Preparation folder for final processing

Unit Standards:

- Design Standards and Guidelines
- Manuals/Guidelines/Reports
- MUTCD (11th Edition)
- WZ Product Guidelines
- Guidelines for Pedestrian Safety in Work Zones

Link to Documents:

- Traffic Engineering Policies, Practices and Legal Authority
- Knowledgebase
- PDN Stage 2 - 2TM2 QC Checklist
- PDN Stage 3 - 3TM1 QC Checklist
- WASP – WorkZone App for Special Provisions
- PDN Process for Traffic Management
- Contact WZTC

TSMO

Overview

The Transportation Systems Management & Operations (TSMO) Unit is responsible for the design and review of traffic signal PS&E, including geometry, phasing, detection, timing, programming, and communications. The TSMO Unit also provides support for all 14 Divisions from preconstruction to maintenance for over 10,000 traffic signals statewide.

List of Deliverables:

- 100% Sealed Signal Plans and Electrical Details
- 100% Signal Communication Plans (if applicable)
- 100% Sealed ITS Plans (if applicable)
- Utility Make Ready Plans (if Applicable)
- Sealed Project Special Provisions
- Quantity Estimate of Pay Items
- Final CADD/Electronic Files

Unit Standards:

- TSMO Standard Drawings
- NCDOT Roadway Standard Drawings and Standard Specifications
- Traffic Engineering Policies, Practices and Legal Authority (TEPPL)
- Guidelines for the Preparation of Traffic Signal & Signal Communications Plans by PEFs
- Manual on Uniform Traffic Control Devices
- TSMO Unit Design Manual
    - Part 1 – Signal Design
    - Part 2 – Signals Management
    - Part 3 – ITS
    - Part 4 – Definitions

Unit Software:

- OpenRoads Designer
- ProjectWise Explorer
- TEEAS Database
- Q-Free Maxtime and Kinetic Signals
- AutoTurn 11
- Microsoft Office Suite (Word, Excel, PowerPoint)

Link to Documents:

- ORD Quick Reference Manual
- Project Delivery Network (PDN)

TSMO ORD Knowledgebase for Q&A

Feasibility Studies

Overview

The Feasibility Studies Unit investigates candidate Strategic Transportation Improvement Program (STIP) projects recommended by the public, local government, and Board of Transportation Members. The unit evaluates available information, e.g. traffic demand, environmental concerns, local government concerns and long-range transportation plan compatibility, maintenance of construction, available EDTE analysis, to prepare concepts that incorporate RCI, Bike and Pedestrian considerations, and connectivity between communities.

Scoping Site

Historical Feasibility Report Archive

List of Deliverables:

- Express Design Initiation
    - Express Design Assignment Checklist
    - Project Scoping Study Area Shapefile
    - ATLAS Screening Report
    - Environmental Features Map
    - Coordination Log
    - Design Assumptions
    - Express Design Traffic Evaluation (EDTE) (if applicable)
    - Maintenance of Traffic/Constructability Narrative
    - Project Initiation Form
    - Conceptual Design Map(s) pdfs and DGN Files
    - Cost Estimate Request
        - Right of Way Polygon and/or Worksheet
        - Construction Quantities
        - Utilities
        - ITS
- Project Scoping Report (Additional Deliverables not mentioned above)
    - Preliminary Environmental Considerations Checklist
    - Project Scoping Technical Report (PSR and Enhanced PSR)
    - Crash Data
    - Traffic Forecast

Unit Standards:

- Roadway Design Manual
- AASHTO – A Policy on Geometric Design and Streets
- NCDOT Roadway Standard Drawings and Standard Specifications
- MUTCD (11th Edition)

Unit Software:

- MicroStation/PowerGEOPAK V8i (SS2, SS4)
- OpenRoads Designer 2023 (10.10 and 10.12)
- Connection Client
- ATLAS
- TEEAS Database
- ProjectWise Explorer
- Concept Station
- InterPlot Organizer
- UpdateWS
- AutoTURN 11
- SAP
- SYNCHRO 11
- HCS7
- WIGINS
- Bluebeam Revu 21
- Adobe Acrobat (Pro)
- Google Earth Pro
- ArcGIS Pro
- Microsoft Office Suite
- MS Teams

Link to Documents:

- Express Design Project Scoping Report Process
- FSU Help Page
- Knowledgebase

Rail Division

Homepage
Overview
List of Deliverables
Unit Standards
Unit Software
Link to Documents
Knowledgebase

Appendix

ProjectStore

NCDOT is transitioning ProjStore to serve as a read-only repository, where historical project data can be accessed for reference. All active project CADD files will be housed within ProjectWise, which will function as the primary platform for project management, ensuring up-to-date information and streamlined collaboration. This shift aims to centralize document workflows, enhance data security, and provide easier access to current project files within a single platform.

Abbreviations and Acronyms

Building Information Modeling (BIM) Terms

Asset Information Model (AIM) See also: Project Information Model. A model that contains information to support the management and operation of the asset.

BIM Execution Plan (BEP) A plan to manage the use of BIM, especially collaboration and information delivery, to accomplish the project goals.

BIM Manager See also BIM Execution Plan. The individual, normally identified in a BEP, responsible for overseeing the use of BIM on the project.

Building Information Modeling (BIM) See also: Clash Detection Use of 3D Models to coordinate different disciplines (e.g. structural and utilities) and to identify/resolve possible clashes between virtual elements prior to actual construction or fabrication.

Common Data Environment (CDE) A service that collects, stores, manages, and shares information through a managed process.

Computer-Aided Design and Drafting. The use of a digital model of a built asset to facilitate design, construction, and operation processes to form a reliable basis for decisions. BIM may also be used as a noun to describe the digital model.

Clash Detection Use of 3D Models to coordinate different disciplines (e.g. structural and utilities) and to identify/resolve possible clashes between virtual elements prior to actual construction or fabrication.

Common Data Environment (CDE) A service that collects, stores, manages, and shares information through a managed process.

Computer-Aided Design and Drafting (CAD/CADD) See also: Building Information Modeling. A category of computer software that is used to develop designs for a variety of disciplines. CADD software typically

uses an object-oriented approach to apply mathematical rules that automate the process of drafting designs. 3D digital design data is a common output of the application of CADD software.

Discipline Model See also: Federated Model. A model or linked models related to a single discipline.

Engineer of Record (EOR) The professional engineer who signs and seals the project documents and assumes professional responsibility for the design.

Federated Model See also: Discipline Model. A model that is compiled by integrating different discipline models together into one model through either linking and/or importing.

Industry Foundation Classes (IFC) See also: Open Data. A non-proprietary data schema and format to describe, exchange and share the physical and functional information for the assets within a facility. IFC is the International Organization for Standardization standard for BIM and is being extended to roadway and bridge asset classes.

Level of Detail See also: Level of Development. Often confused with Level of Development, Level of Detail describes only the amount of geometric detail in a model element, not the amount of engineering intent. Highly detailed model elements may be placed in a model as placeholders with no engineering intent. Though detail often increases in parallel with development, observing the detail of a model element is not an effective way to determine its development or the appropriate uses.

Level of Development See also: Level of Information, Level of Visualization, Model Progression Specification. A qualitative designation that communicates the degree of engineering intent behind a 3D model element (or group of model elements) and defines the authorized uses for which the model element is sufficiently developed. Normally the LOD will increase through the design development process as defined in the MPS.

Level of Information (LOI) See also: Level of Development. A description of the quality of the non-graphical information attached to the model elements.

Level of Visualization (LOV) See also: Level of Development. A qualitative designation that communicates the degree of visual enhancement given to the 3D model elements, to suit the needs of different target audiences. Generally, non-technical audiences need color-realistic geometry or even photo-realistic materials to be able to understand bridge models.

Model Element See also: Level of Development, Model Element Author, Model Progression Specification. An entity within a model that represents a physical object or an abstract concept (e.g. alignment, north arrow).

Model Breakdown Structure (MBS) See also: Model Progression Specification. A classified list of model elements. A MBS is the basis for a Model Progression Specification.

Model Manager See also BIM Execution Plan, BIM Manager, Model Element. The individual, normally identified in a BEP, responsible for a specific discipline model.

Model Progression Specification (MPS) See also: Model Breakdown Structure. A specification that defines how the LOD for individual model elements increases over the project milestones. The MPS will assign a specific, minimum LOD to each model element for each milestone. The LOD typically increases from milestone to milestone.

Project Execution Plan (PxP) See also BIM Execution Plan. A plan to manage the use of BIM, especially collaboration and information delivery, to accomplish the project goals.

Project Information Model (PIM) See also: Asset Information Model. A model that contains information to support the design and construction of the asset.

Data-related Terms

Attribute Non-graphical data that is part of a model element definition.

Component A physical item or feature within a model.

Constraint See also: Parametric. A relationship between two or more elements in a model, which should be maintained in any modifications made to the base element.

Digital Twin Initially conceived for smart manufacturing, a digital twin is a digital representation of a physical asset that contains a 3D digital model of the physical asset, as well as non-graphical information about the asset such as its properties, functions, evaluative properties, and other analytical context.

Feature See also: Model Element. Anything that can be seen or located and is a physical part of your project.

Graphical Data See also: Non-graphical Data, Spatial Data. Data conveyed using shape and arrangement and/or location in space.

Layer See also: Level. A container within software for model elements or features. Some CADD, GIS, and PDF software products use the term “Layer” to describe the container while other software products use the term “Level.” Common software features include styling elements and controlling the visibility of elements using layer settings.

Level See also: Layer. A container within software for model elements or features. Some CADD, GIS, and PDF software products use the term “Layer” to describe the container while other software products use the term “Level.” Common software features include styling elements and controlling the visibility of elements using level settings.

Links Hyperlinks that can be applied to geometry to allow a user to connect to and access a wide range of external files and formats. These links can be used to link to web addresses, networked folder locations, files and/or folders located in a CDE, or bookmarks within the file.

Metadata Data is used for the description and management of documents and other containers of information. Metadata is usually structured data embedded within the file. However, it could include an external document that describes pertinent information to others on the assumptions and basis for the 3D models, such as the geospatial metadata (grid/ground coordinate system definitions), intended uses of the 3D models, approximations and simplifications (e.g., removing minor curvature from analysis models).

Model A representation of a system that allows for investigation of the properties of the system. (EN ISO 29481-1:2016). "*The roadway and bridge models were delivered in CADD files".*

Naming Convention A set of rules for naming components and features within a model. A naming convention may provide instructions for choosing the character sequence to be identifiers that denote variables, types, functions and other entities in source code and documentation.

Non-graphical Data See also: Attribute, Feature See also: Model Element. Anything that can be seen or located and is a physical part of your project.

Graphical Data, Property. Data that describes attributes and properties of a model element that do not relate to its physical dimensions or location.

Parametric See also: Component A physical item or feature within a model.

Constraint. An approach to creating a model whether the physical dimensions are constrained by mathematical rules such that the model can be manipulated by changing individual property definitions.

Spatial Data See also: Geodatabase, Feature See also: Model Element. Anything that can be seen or located and is a physical part of your project.

Graphical Data. Data that is associated with a spatial reference system, such as State Plane coordinates. Spatial data may be raster (e.g. aerial photography) or vector (e.g. point, line, or polygon).

Data Management Terms

Data Exchange The process of taking data structured under a source schema to transform and restructure into a target schema, so the target data are an accurate representation of the source data within specified requirements and minimal loss of content.

Geodatabase (GDB) analyze, create, connect, and manipulate spatial data. GIS software includes many Geoprocessing Tools that manipulate Geodatabases, as well as Graphical and Non-Graphical datasets in order to perform complex analyses. *NCDOT OneMap is a hosted GIS application.*

Geoprocessing Tool, GIS, Spatial Data. A database that is designed to store, query, and manipulate spatial data. A geodatabase may hold multiple datasets of different types.

Geographic Information System (GIS) Spatial Data. A software application that is designed to display, manage, analyze, create, connect, and manipulate spatial data. GIS software includes many Geoprocessing Tools that manipulate Geodatabases, as well as Graphical and Non-Graphical datasets in order to perform complex analyses. *NCDOT OneMap is a hosted GIS application*.

Geoprocessing Tool A software tool that manipulates spatial data to produce a transformed spatial dataset. *A buffer is a geoprocessing tool that creates a new polygon dataset defined by a specified offset from an existing point, line, or polygon dataset*.

Information Exchange Packages of information passed from one party to another in a BIM process, or the act of passing such information, possibly as a contractual deliverable. Parties involved agree upon and understand what information content and format will be exchanged.

Open Data Data that is publicly available and free to use or reuse without restrictions.

Documents reviewed during the course of development

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Commonwealth of Pennsylvania Department of Transportation Publication 408/2020 Specifications International Organization for Standardization, 2018. *ISO 19650-1:2018.* [Online]

Available at: https://www.iso.org/standard/68078.html [Accessed 14 August 2019].

National Institute of Building Sciences, 2015. *United States National Building Information Modeling Standard Version 3,* Washington, DC: National Institute of Building Sciences.

Utah Department of Transportation, 2020. *Glossary of Terms*. [Online] Available at: https://digitaldelivery.udot.utah.gov/pages/terms [Accessed 9 December 2020].

Revision Summary

NOTE: This is the initial version of the CADD Guidelines and Standards, so there are no revisions of note for this version. This section will be utilized for future versions.