Bridge Essentials Using InRoads XM

Course Curriculum

Revised: January 2010

Duration:

Two days

Prerequisites:

Prerequisite courses are:

- ***MicroStation Essentials*** or work experience with MicroStation drafting tools
- ***InRoads Geometry Fundamentals*** or work experience with InRoads geometry tools
- work experience with roadway or bridge alignments (preferable)

Other prerequisites include:

- Prior experience with and a basic understanding of the design and detailing process of bridges and structures
- Involved in an active design project, preferably one that is using InRoads XM

Course Objectives:

This class is designed to illustrate specific InRoads tools that can be used to facilitate bridge design and detailing processes. The class will use specific bridge design scenarios that currently take a substantial amount of time or that are prone to error and show how InRoads tools save time and/or reduce errors.

In addition to covering key features and functionality of InRoads XM and the CDOT configuration, other course objectives include:

- Evaluation of alignment and surface data obtained from other specialty groups, such as topography from ROW/Survey or geometry from Design
- Developing standard and custom cross sections and profiles for the evaluation of existing conditions or for design and detailing of bridges and structures
- Enhanced knowledge of how InRoads can be used as part of the workflow for designing and detailing walls
- Perform a variety of calculations including the calculation of quantities, generate volumes for excavation and backfill, and finding minimum clearance of crossing features
- Identify and apply the appropriate InRoads tool to enhance productivity and accuracy by following the step-by-step instructions presented in the bridge design scenarios taught in class
- Be able to apply the concepts taught in class to CDOT projects

Refer to the day-to-day schedule for additional objectives for the course.

Rather than a button-to-button approach, this course uses specific Bridge workflows to teach key design and detailing concepts and how to apply available InRoads tools to those standard processes.

Students will get more from the class if they are currently working on a design project, but will still find the course useful by using the data set provided in class.

What to Bring:

Although the following items are not required, students may bring the following data from their active design project. These items will be used only if time permits.

- Bridge model and/or roadway model
- Existing surface data files for a design project (*.dtm)
- Project alignment data file (*.alg)

Students should bring the data to class either on a ***CD*** or ***Flash drive***.

Resources:

Students will find electronic copies of the reference material and labs associated with this course online under the ***Manuals and Training*** page of the CADD and Engineering Innovation web page located at www.dot.state.co.us/DesignSupport/CADD and Engineering Innovation/

Instructional Media:

This is an instructor-led hands-on course. Each student will have a computer for the duration of the course. The instructor will utilize a whiteboard and projection system for demonstrating key topics and techniques of the software. Students will access the reference material for this course electronically, either locally or online as noted under the section ***Resources***.

The instructor will provide each student a hard copy of the lab material. Course data files will be pre-loaded on the computer used in class. As with the reference material, course data files will also be available online for students to download and work through at their convenience.

Material Requirements:

A printed copy of the course labs will be provided in the class. The lab material will be used in conjunction with an electronic copy of the resource manual ***A Practical Guide for Using InRoads XM***. Students may be asked to refer to ***A Practical Guide for Using InRoads XM*** during the lecture portion of the class for detailed explanations of how to use specific InRoads commands and to gain an understanding of the command options.

CDOT Standards:

This course uses all CDOT standard configuration files, including the new standard CDOT_Civil.xin and template library files.

Class Schedule and Objectives

DAY 1

Objective:

Demonstrate proper setup of project and usage of project resources. Introduce students to the Bridge toolbar. Evaluate topography and design alignments. Generate cross sections and profiles from existing data. Find excavation and backfill quantities for a structure design.

1. Introduction 0.5 hour

A brief discussion of the class format will be given. Other topics to be covered in this section are:

- Where to get help

- How to access the course materials online
- Discuss file types used in InRoads XM

2. Getting Started – 1 hour

Proper setup of the project will decrease the amount of time looking for files or trying to get the correct symbology for a feature to appear. Key topics covered in the introduction include:

- Project directory structure (show what files will be used by Bridge and where they are located) and introduce file sharing
- Resources and design files (illustrate how to verify that all the correct files have been loaded)
- Introduction to the Bridge Toolbar
- Show how to use the Project Creation Utility (This is usually done by the Design Engineer but is a good foundation for why things are done the way they are.)

3. Reviewing Roadway Design Data - 2 hours

In this section the student will gain an understanding of how to evaluate and use project data provided by the roadway design group. Topics covered in this section include:

- Introduction to the tools used to display and evaluate alignments such as the Review Horizontal and Tracking tools
- Introduction to the tools used to display and evaluate surfaces such as the Creating Cross Sections and Profiles tools

4. Working With Alignments - 2 hours

Students will learn how to create and modify horizontal and vertical alignments by developing a new flowline for a drainage channel. Topics covered in this section include:

- Import horizontal alignments from a graphic element
- Add a horizontal curve to the alignment
- Create a profile
- Define a vertical alignment

5. Templates and Corridors - 2.5 hours

Students will learn how to utilize templates and corridors to create a surface model (dtm) that can be used to calculate earthwork and other quantities. This will be accomplished by developing a template for a cast-in-place concrete channel, running the template along an alignment to develop a dtm, then extracting quantities for excavation and backfill to complete the construction.

- Build a template showing the excavation, channel liner, and slope paving
- Create a corridor that follows an alignment
- Review design data in Roadway Designer
- Generate design surfaces from the template and corridor

DAY 2

Objective:

Verify clearances and find conflicts of intersecting design elements. Learn how to create and modify cross sections and profiles, how to create sloped surfaces used to model the slopes from one feature to another, and how to use various tools to compute and check volumes.

6. Evaluating Clearances and Conflicts - 1.5 hours

This section covers the evaluation of design data for minimum clearances and finding potential conflicts in design features. In this section the student will learn how to:

- Find the minimum clearance between crossing vertical alignments
- Evaluate areas for potential clearance issues
- Use a combination of MicroStation and feature graphics to check clearances

7. Working with Surfaces - 1.5 hours

This section covers how to review surface data using additional cross section and profile tools. Topics in this section include:

- Cutting sections on a skew to the alignment
- Cutting sections at specific locations based on graphic elements
- Manage the display of specific levels or groups of levels using level filters
- Update components, features, or surfaces on cross sections
- Annotate points or features on cross sections
- Use feature filters to find specific features for displaying or annotating
- Cut profiles along graphic elements

8. Feature Based Modeling – 3.5 hours

This topic covers how to modify design templates to create the final design concept. There are several methods that will be covered including Standard Point Controls, Secondary Alignments, Parametric Constraints, Template to Template Transitions, End Condition Overrides, Modifying Single Template Drops, and Target Aliasing. These methods will be covered in groups as follows:

- Create excavation and backfill surfaces for footers (piers, walls, etc.)
- Create proposed surfaces by intercepting existing or design surfaces using the Generate Sloped Surface command
- Create a profile of excavation and backfill surfaces
- Import graphics into a surface
- Create pier features and a pier surface for volume computations

9. Evaluating Bridge Design Surfaces – 1.5 hours

Students will evaluate the excavation and backfill surfaces from the previous lab by computing volumes using the different InRoads volume tools.

- Compute Triangle volumes

- Control the format of InRoads reports by setting the default XSL style sheet
- Compute Grid volumes as a check for the triangle volumes
- Compute End Area Volumes from cross section graphics