Course Description - 3D-Dig Single-Step Dragline Simulation Course

This course will introduce you to using 3D-Dig for Dragline Simulation. Firstly, you will make acquaintance with important theoretical concepts, as well as with a few essential structures and tools. Following this you will learn how to set up dragline simulations, create accurate 3D dragline mining plans and export critical planning information. The course will end with a description and hands-on application of the detailed Dragline Productivity Model in 3D-Dig.

Essentials Module

This first module will start with an overview of aims of the Dragline Course. You will learn how to set up the simulated dragline and how to use structures and tools important in dragline simulations. The importance of Prime and Rehandle materials in Dragline Simulation is emphasized. Concepts and methods used to separate these materials during simulation are covered in detail.

Objectives

This lesson introduces you to dragline simulation with 3D-Dig and overviews the Dragline Simulation course and its objectives. You will learn about important aspects of pit and dig design geometry in this lesson and the elements of single-step dragline simulation will be identified and described.

Terminology

In this lesson, terms used to describe the pit to be excavated are introduced and described. You will learn about some important simplifications used to speed up dragline simulation. The lesson finishes by identifying and describing surface features and other structures used in simulation of pit development.

Rehandle

This lesson describes concepts of rehandle which are critical when performing dragline simulation. You will learn about Prime and Rehandle materials and the important difference between them. The lesson finishes by introducing the Prime Surface used to separate Prime and Rehandle and identifies this surface in the list of Terrain Surfaces and on Cross-Sections.

Prime Surface

Here you see how the Prime Surface introduced in the previous lesson is used. This will be done through some simple exercises using excavation and dumping. You will see the important differences between Prime Material and Rehandle Material and how these materials are related to the Prime Surface.

Mark Rehandle

In this lesson you will learn how to mark pre-existing spoil as Rehandle. Examples will show you how to do this and explain the difference between marked and unmarked spoil.

Geology in Spoil

You will see how to remove the rendering of pre-existing geology layers in spoil. The method you learn masks these layers in spoil, where they should not appear.

Block Lines

In this lesson you will use 3D-Dig's Block Line Generator to create the Block Lines used in this course. At the same time this lesson explains how these Block Lines are used simulation.

Material Logs

In this lesson you will create the Material logs used to track Dragline and Dozer materials. These logs will be used throughout the course.

Redundant Data

You will learn the reasons for removing redundant data in this lesson. You will also remove unnecessary or redundant data from all surfaces used in the simulation. This will illustrate the method of removing these data.

Restore Points

This lesson introduces you to the use of Restore Points in simulation and explains the reasons for using Restore Points. You will see which data are saved with a Restore Point. This will be illustrated through application of a Restore Point you have created.

Dragline Operation Module

In this module, you will be provided with essential information on the Dragline Parameters used in simulations. The various dumps used in Dragline simulation will be set up and demonstrated with examples of boom dumps and area dumps. You will learn about the two kinds of area dumps used to form benches. You will also see how to set up the constraints used to form benches in dragline simulation. In addition, you will learn how formation of benches using area dumps simulates the work of a Dragline together with Dozers.

Dragline Parameters

In this lesson, you will learn the initial steps required to set up a dragline simulation. The process of creating draglines in 3D-Dig will be demonstrated, including setting up dimensions and parameters needed to model the actual draglines. Here you see how to set up dragline parameters for simulation of earthworks. In a later module you will learn about the parameters needed for simulation of dragline productivity.

Boom Dumps

The lesson will introduce you to the different modes of dragline dumping, including dumping to form a bench, and dumping to final spoil. You will learn about boom dump settings, including the way boom dump arc location is specified.

Level Constraints

This lesson describes how to set up and work with level constraints during the simulation of dragline dumping. The situation when some excavated material is not dumped is demonstrated. You will see how all extra material is returned to topography, while extra prime material is returned to the prime surface.

Bench Dumps

In this lesson, you learn details of working with bench dumps and the extension of the operating bench in dragline simulation. You will also see how formation of dragline benches using area dumps simulates the work of a Dragline together with Dozers. In addition, you will learn about advancing area dumps and arc area dumps that are used to form benches.

Area Bench

The lesson will demonstrate how to use an advancing area dump to form a bench. At the end of the lesson, you will understand the advantages and disadvantages of using advancing area dumps to form dragline benches.

Arc Bench

In the closing lesson of the module, you will learn about the arc area dump and how it is used to form dragline benches. You will modify the arc area dump to get a feel of how the different settings work. You will also see how the shape of benches formed by an arc area dump can be controlled through bench edge features.

Key Bridge Module

This module begins with a review of the first two modules of this course. Further lessons then concentrate on teaching you the important techniques for dragline simulation. This is done by

executing a Key Bridge operation. Firstly, you will learn how to set up a Dump Limit Polygon to control dumping. You will then set up the Excavation and Dump templates needed for the Key Bridge operation and learn how to create and shape the necessary excavation polygons. Following this, you will simulate formation of the dragline bench using two alternative ways to simulate the dump: an Advancing Area Dump or an Arc Area Dump. Positioning the dragline on the bench, you will use a Boom Dump to cast remaining material to spoil.

Recap

In the first lesson, you will briefly review what you have learned in the first two modules of the course. This lesson also gives you context for the remainder of this module.

Dump Limit Polygon

The lesson will demonstrate how to create a Dump Limit Polygon. This polygon prevents dumping of material in certain areas, such as ramps, dragline access and on top of coal.

Excavation Setup

In this lesson, you will learn how to create and set up an Excavation template from within the Dragline Simulation Settings dialog box. This lesson also shows you how to work with the parameters in this dialog box.

Dumps Setup

In this lesson, you are going to set up some of the dumps needed for the Key Bridge simulation, including bench area dump and boom dump. In this way, you will learn how to work with the parameters in the "Dump Settings" dialog box.

Dig Key Bridge

In this lesson, you will learn how execute the first part in the key bridge operation. The required stages, including work with features, inner polygon, and blocks, and setting up batter angles and the dump area, will be explained.

Cast to Spoil

The lesson concentrates on how to cast the remaining material to spoil, while executing the key bridge operation. Also, you will see how to adjust the size of the inner polygon if it is too narrow.

Remaining Blocks

Having completed the key bridge for the first block of the simulation, you will now execute the same operation with two remaining blocks in this lesson. You will also learn a way to avoid reshaping the inner polygon between key cut and low wall for each block.

Bind Arc Area

The lesson will show you how to set up an arc area dump for the same bench built in previous lessons. In doing this, you will use the option "Bind to Dragline" for both the Excavation polygon and the Arc Area Dump.

Simulate Arc Area

In this lesson you will dig several blocks of the Key Bench operation. You will do this using the simulation you set up in the previous lesson using an arc area dump.

Extended Key Module

In this module you will simulate several blocks of an Extended Key / Low Wall Bench operation. In this way you will reinforce the skills you learned in the previous Key Bridge module. After learning how to build the elevated Low Wall bench by excavating the extended key, you will reposition the dragline on this low wall bench. You will then dig several blocks using the dragline located on the Elevated Bench. In addition, you will see two ways to uncover the coal in this situation.

Overview

In this first lesson you will see an overview of how to dig the Extended Key / Low Wall Bench operation. This lesson will also help you to understand how to design the correct Key Width and Bench Location for a successful operation.

Setup

In this lesson you will set up an Excavation template and an Arc Area Dump template, which are essential for to simulate the Extended Key operation. In addition, you will select the Highwall toe and Low Wall toe needed to position the Arc Area dump.

Dig Extended Key

The lesson will show how to dig several blocks of the Extended key. You will draw an Inner polygon, and see how to reposition dragline correctly. Also, you will learn how to modify the location of the Bench Edge Features.

Setup Elevated Bench

In this lesson, you will see how to excavate several blocks using the dragline, which is excavating from a position on the Elevated Bench. You will learn how to set up and place the Dump Limit Polygon prior to excavation. You will then use the settings in the "Terrain Appearance" Window to switch off the display of this Polygon and various surface features, which are not required in the further simulation.

Dig Elevated Bench

The final lesson of this module will show you how the dragline excavates from the Elevated Bench position to reach the edge of coal. You will then learn about the two ways to use the dragline to uncover the coal in this circumstance, together with the advantages and disadvantages of each option. Finally, you will practice digging from the elevated bench using the first of these options.

Low Wall Pass Module

In this module, you will learn how to quickly change Excavation and Dump templates when you work with multiple templates. You will use various capture settings to set up and capture a series of images as you dig the final pass of a two-pass dragline operation. The simulation will include building an extended bench and casting to final spoil from this bench. This module ends by showing you how to organize and run a slide show using the set of captured images from your simulation.

Bench Extension

This lesson introduces you to the extended bench that you will use to dig the final pass of a two-pass operation. You will see a review of the total operation and understand why an extended bench is needed. This extended bench method with its multiple excavation and dump templates is compared with the previous Key Bridge method. The lesson ends by showing you the Arc Area Dump used to simulate formation of the extended bench.

Change Templates

In this second lesson you will look in more detail at using multiple Excavation and Dump templates in this simulation. You will learn that for efficiency you need a fast way to switch between these templates. You will see that the short cut method used previously to switch between templates is not optimal for this, because it requires all excavation and dumps to be displayed at all times. You will understand the advantage of using hot keys to switch between templates. The lesson finishes by explaining the reasons for using slide shows to present simulation results.

Capture Settings

This lesson will show you how to set up capture settings for the images captured while you simulate several blocks of the Low wall pass. You will learn the initial steps of creating slideshows from the captured images, including the use of the common image file types.

Dig First Block

In this lesson, you will start digging the first block and learn how to quickly change between dump templates by using a hot key. After digging the highwall part of the block, you will quickly change to the Low wall excavation template. To do this you will also use a hot key. During this operation you will use with current capture settings which you set up earlier to capture images during the simulation.

Change Capture

In this lesson you will see the effect of the "Animate Dragline" option and the "Capture Frequency" parameter on the captured images. In the "Dragline Simulation Settings" window, you will change the "Capture Frequency" setting to see the difference in the number of images captured with each setting.

Slide Shows

In this closing lesson, you will learn how to use the images that you captured during the simulations in the previous lessons of this module. You will use these images organize and run a slideshow. You will also see how to import these images into "PowerPoint" to create a presentation.

Dozer Bench Module

The module shows you how to perform the full dozer Bench simulation while working with dragline simulation. You will be using a simplified method to simulate the bench dozing, which involves manual excavation and dumping in "Free" mode. Also, you will learn how to use manual image capture.

Introduction

In the first lesson of this module, you will see an overview of the way the dragline bench is created. You will begin work by creating a Dozer model in Dozer mode. You will see how to create the Dozer, to scale it and to place the new bulldozer on the topography. You will also orient the Dozer's direction to be across the pit.

Setup Dozer Bench

In this lesson, you will start setting up a simplified method to simulate the bench dozing. This method involves manual excavation and dumping in "Free" mode. You will set up an Excavation template and a Dump template for the simulation. You will also learn how to work with manual image capture.

Simulate First Block

You will now perform a simulation of the first block dozing to form a bench. To do this you will use the excavation and dump templates you set up in the previous lesson. You will also learn how to manually capture images of the simulation to create a slide show.

Simulate Full Bench

In the closing lesson of this module, you will complete the dozer simulation of the Bench in "Free" mode. You will also set up a Restore point before proceeding further with the dragline simulation. To assist you, the second part of the lesson demonstrates the full dozer Bench simulation.

Full Pit Module

In this module you will excavate the complete pit using the key bridge method. The module begins with a global overview of important settings and of this method itself. The simulation lessons are divided three segments: Ramp Split, Steady State and Egress. They give you a detailed demonstration of steps necessary to conduct a dragline simulation of the full pit, including each of these three segments. At the end of the module, you will learn how to create a suitable material log and to excavate exposed coal.

Preview

In the introductory lesson of this module, you will be introduced to the concept of excavating the complete pit using the key bridge method. You will also see the three segments (Ramp Split, Steady State and Egress) into which the full pit simulation is divided.

Overview Settings

In this lesson, you will overview the simulation setup and important settings, essential for further operations. You will review the "Capture Frequency" option, used for future image capturing, and then adjust materials logs, excavation and dump templates and set applied constraints. At the end of the lesson, you will set the window appearance for "Terrain View One" so as to display only the active dump template.

Ramp Split Description

This lesson helps you to do the Ramp Split segment. Here you will be advised of the important settings and methods that you will need to follow when splitting the ramp at the start of the pit. You are encouraged to try the ramp split for yourself before referring to the following lesson for guidance.

Ramp Split Example

The purpose of this particular lesson is to assist you with the process of the Ramp Split, described in the previous lesson. The entire procedure will be demonstrated in this lesson.

Steady State Description

In this lesson, you will continue the steady state digging for the bulk of the pit to the point, where you are approaching the end wall. The different elements of the simulation setup are described and illustrated by digging. The lesson also shows you how to use hot keys to work with two excavation templates.

Steady State Completion

The lesson will demonstrate the procedure of the Steady State Completion in order to assist you to accomplish the previously initiated simulations.

Dragline Egress

In this lesson, you will execute the simulation of the final section of the pit and the dragline egress in the conditions of non-steady-state digging. To help you, both a detailed theoretical explanation and demonstration of the exercise's performance will be given.

Excavate Coal

In the closing lesson of this module, you will create a suitable material log and excavate the coal, exposed at the pit floor as a result of the previously executed dragline simulation.

Data Export Module

In this module, you will learn different methods for exporting volumetric and topographic data from 3D-Dig. You will export data directly from 3D-Dig to "Microsoft Excel", including material log information and the dragline report. You will then see how to export your post-simulation topography in DXF format. These data can then be imported into your main mining planning system, or other software, for subsequent demonstration or analysis. At the end of the module, you will look briefly at exporting surfaces using the Earth Technology Interchange format. This ETI format is used to transfer multiple surfaces to and from mine planning systems. You will also learn about the 3D-Dig compressed "BIT" file format which saves the terrain and inner surfaces at full resolution.

Data Overview

In the first lesson of the module, you will see a brief overview of ways to export volumetric and topographic data from 3D-Dig. This overview will include the use of material logs to produce the format and data required.

Log Contents

In this lesson, you will take a closer look at exporting data from material logs. You will learn to export data directly from 3D-Dig to "Microsoft Excel".

Blocks and History

This lesson will show you how to work with and export material log information subdivided by block. You will see the volumetric data for each block, and learn how to use the "To Excel" button for export directly to Excel. In addition, you will look through all the recorded excavation and dumping events in each material log via the "History" button.

Dragline Report

In this lesson, you will learn how to export the dragline report to an "Excel" spreadsheet. You will also see how to select export options. These options allow you to include any of the report data fields in this export.

Cropping Surfaces

In this lesson, you will learn about exporting topological data. This lets you export post-simulation topography for import into your main mining planning system, or other software, for subsequent demonstration or analysis. The way to decrease the "DXF" file size prior to export using the method of cropping surfaces will be explained.

Contours & Grid Points

In this lesson you will concentrate on the detailed procedure of exporting contours and grid points. You will see that you using this type of export, you can achieve a good level of accuracy for a relatively small file size.

Surface & Data Features

The lesson will show how to export surface features and data features. You will revise the difference between data features and surface features. You will then learn how to create new feature types, and to export only selected surface features.

ETI Surface Format

In this lesson, you will look briefly at exporting surface data using the Earth Technology Interchange (ETI) format. This compressed format can be used to quickly transfer multiple surfaces from a mine planning system into 3D-Dig and vice versa.

BIT Grid Format

In the closing lesson of this module, you will learn about the highly compressed 3D-Dig internal "BIT" file format. This format allows you to save the grid for the terrain surface, or for any inner surface. Using this format, you can transfer surfaces between 3D-Dig design files.

Productivity Module

In the closing module of this course, you will see how to accurately predict dragline productivity by using the 3D-Dig dragline productivity model. You will learn about the parameters and setting used to calibrate and apply this model. You will also see the effect of dragline positioning on productivity and an explanation of the observed changes. Later the you will learn the procedure of exporting productivity data from 3D-Dig to a file or directly to Excel. Finally, you will learn a way to export dragline walk positions and visualize them through reimport into 3D-Dig.

Principles

In the introductory lesson of this module, you will learn how to accurately predict dragline productivity by using the 3D-Dig dragline model. You will also see an explanation of the theoretical principles of this model.

Settings

In this lesson, you will look closely at the parameters and settings used in the 3D-Dig dragline productivity calculations.

Positioning

In this lesson you will learn about the effect of dragline positioning on calculated productivity. You will also see an explanation of the observed changes. This will give you a basic understanding of factors that affect dragline productivity.

Export

In the closing lesson of this module, you will learn how to export productivity data from 3D-Dig. directly to an "Excel" spreadsheet. In addition, you will see how to reimport the dragline positions into 3D-Dig to create a visualization of the dragline positions during simulation.