12d® Model
Civil and Surveying Software

12d Model Training - WA

Training Courses

March 2020

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1.0 12D MODEL TRAINING OVERVIEW

We have been training users for over 25 years, and have been refining our courses not only as the product develops, but also from the feedback that we receive after every course, from both trainers and users.

All our trainers have vast industry experience and are experts in the use of 12d Model. All training is conducted hands-on, with the trainer projecting onto a screen while each attendee operates 12d Model on a laptop.

Our courses are intensive with a steep learning curve, which means that you can become a productive user within a matter of days. Some courses have prerequisites to ensure that all attendees are at the right learning stage to absorb advanced course information.

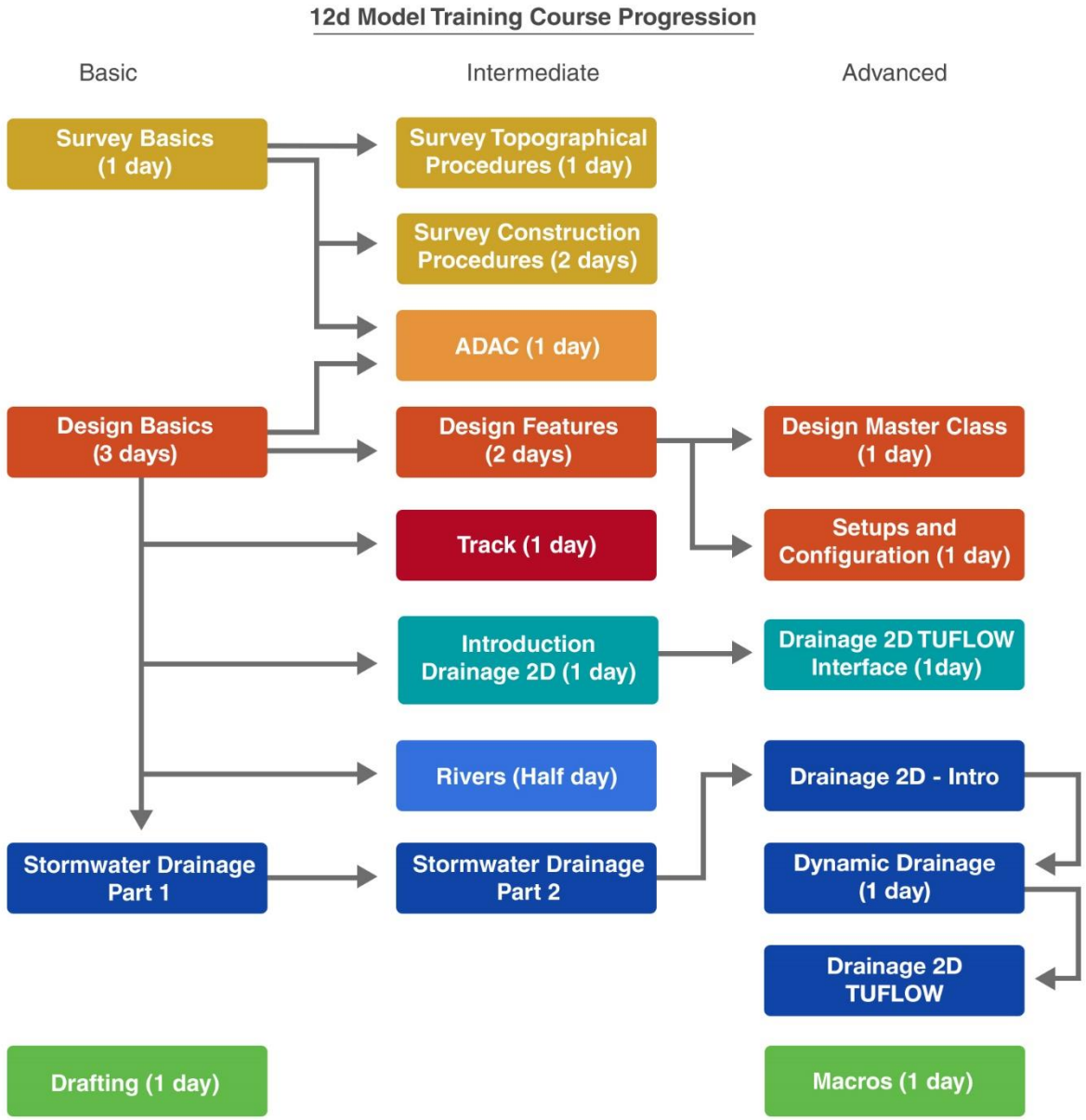
All 12d Training course attendees are issued with comprehensive course notes, ensuring they get the most out of the experience on the day, and afterwards have useful reference material.

If you have any questions about any of our training courses, or about in-house training, please contact us at wa.training@iscdt.com.au

2.0 AVAILABLE TRAINING COURSES

The diagram below provides a handy summary of the training courses offered with the full courses outlines included in further detail throughout the rest of the document. The complexity of courses increases from left to right, and arrows indicate courses that are prerequisites to attend a course.

These courses have been made modular, so for clients requesting in-house we are able to customise a course to suit your needs.



3.0 DESIGN BASICS

Three Days **Course ID:** 3DCDB

Summary:

This course introduces people to the use of 12d Model and its concepts for civil work.

Prerequisites:

No experience in 12d Model is necessary but **basic computer skills** are required along with the ability to understand and write in the English language.

Course Content:

B01 B02 & B03: Introduction

- 12d Model Interface
- String Picking Concepts
- Creating and Editing Strings
- Display Settings
- 12d Principles and Folder Structure
- CAD Snaps, Construction, Text & Symbols
- Measures & Global Edits

T01 & T02: Tins and Volumes

- Create Project with Configuration
- Importing Data – Mapfiles
- Triangulation – Edit a TIN
- TIN Information and Inquiry
- Contouring and Labelling
- Platform Design and Volumes
- Super TIN
- Importing a Raster

B05: Sharing

- Share Models and TINs
- Add Shared Models and TINs

B06: Chains

- Create Basic Chain

A01: Super Alignment, IP Method

- Create Super Alignment
- Create and edit horizontal alignment using IPs
- Create and edit vertical alignment using IPs

D01: Design Basics

- Template Creation and Edit
- MTF File – Inserting design templates
- Apply MTF
- Modifying the design

D03: APPLY MANY MANAGER

- Creating MTFs via the Manager
- Intermediate Modifiers & use of the MTF with Smart Chainages & Alias's

P01: Plan Plot and Label

- Plan plotting

P02: Sections and Plotting

- Plotting long sections
- Plotting Cross sections

Important Note:

This course is for showing how to use 12d Model when doing civil design work. It **does not** teach civil design principles.

4.0 DESIGN FEATURES

Two Days **Course ID:** 2DCDF

Summary:

This course follows on from the **Design Basics** course. Understanding of basic road design is essential.

Prerequisites:

Experience in 12d Model with **completion** of the **Design Basics Course** is required.

Course Content:

B05: Sharing

- Making Models and TINs shared
- Sharing in Models and TINs

A02: Super Alignment, Element Design

- Design Toolbars
- Create Super Alignment
- Horizontal element geometry
- Vertical element geometry
- Named parts
- Named positions

A04: Super Alignment, Computators

- Using computator elements
- Computator kerb return tool
- Widening function
- Modifiers with computators

D03: Design, Advanced Modifiers

- Import templates
- Apply MTF defaults
- Apply MTF Manager
- Modifiers using smart chainages
- Modifiers using layers
- MTF features, Alias, Regions and copy and paste

D02: Design, MTF Snippets

- What are Snippets
- Basic Snippet edits
- Applying Snippets
- Design TIN and SuperTIN

D07: Design, Tri-mesh Boxing

- Boxing with Snippets
- Named grades
- Asphalt surface, Kerb shapes and Subgrade layers

B06: Chains

- Design Chain

P04: Plot Sheets

- CAD dimensions, leaders and tables
- Plot sheet

Important Note:

This course is for showing how to use 12d Model when performing **intermediate and some advanced road design work**. It does not teach civil design principles.

5.0 STORMWATER DRAINAGE – PART 1

One Day **Course ID:** 1DSWP1

Prerequisites:

Experience in 12d Model with **completion** of either the **Design Basics Course** or the **One Day Introduction to Survey Course**. In some cases, working through the **'Getting Started for Design'** Manual is sufficient – enquire upon booking.

Course Content:

Part 1 of the Stormwater Drainage Course includes the skills required to complete a minor stormwater drainage design including the following:

W01: Network Design

- Trainees will start from creating a super tin to use with the drainage design
- Create (using templates) and edit a 12d drainage string and import designs from CAD
- Use the powerful network editor for pipe invert alignment including detecting and avoiding service clashes
- Link structures to the roadway design for structure alignment and construction levels/setout
- Additional techniques to calculate structure coordinates with grate and cover elevations

W03: Rational Hydrology

- Review default hydrology methods for determining C and tc
- Set multiple catchment areas per inlet structure via direct input and catchment polygons
- Determine time of concentrations from length – slope strings

W02: Hydraulic Grade Line Check

- Parameters for determining energy losses in pipes
- Pit pressure loss Coefficients (K) in 12d Storm analysis
- Culvert design with inlet control calcs
- Size pipes and box culverts

W04: Reporting

- Produce detailed hydrology, hydraulic and construction setout reports
- Produce drainage plan and long section drawings with user defined data, pipes as linestyles and manholes as symbols

Important Note:

This course is for showing how to **use 12d Model** when doing stormwater work. It **does not** teach stormwater and drainage principles.

6.0 STORMWATER DRAINAGE – PART 2

One Day **Course ID:** 1DSWP2

Prerequisites:

Experience in 12d Model with completion of the **Stormwater Drainage - Part 1** is required.

Course Content:

Part 2 of the stormwater drainage course continues on with the rational based hydrology of part 1. It includes the additional skills for analysing major flood events and customising the user defined database for the drainage module.

W05: Approach, Bypass Flow and Inlet Capacity Calculations

- Flooded width, section capacity and velocity*depth calculations for roadway and channels
- Bypass nodes for combining flow paths
- Alter n values, max flooded width and proportion catchment flows along bypass flow paths
- Analyse flooded areas resulting from ponding at SAG pits
- Bypass flow with detailed inlet capacity for SAG and on grade inlets
- Surcharging flows during major flow event analysis

W06: Network Quantities and Reporting

- Customise pipe and pit quantity reports by type and depths
- Use 12d templates to calculate trench volumes
- Import/export to spreadsheets
- Customise pit schedule reports through spreadsheet interfaces
- Customised drainage long sections with hatching under roads and adding of user defined data
- Customised plan drawings with user defined pit symbols and data
- Bring your own inlet capacity curves, pit symbols, reports, long sections or plan drawings that you want to customise in 12d (otherwise we will use our examples at this training session)

Important Note:

This course is for showing how to **use 12d Model** when doing stormwater work. It **does not** teach stormwater and drainage principles.

7.0 DYNAMIC DRAINAGE

One Day **Course ID:** 1DDD

Prerequisites:

For experienced 12d Users only. You must be fully **familiar** with the **Drainage Network Editor (DNE)** and know how to design drainage networks in 12d Model.

This “Dynamic Drainage for Modelling Storage” course is a logical extension for 12d drainage users who have already attended the **Stormwater Drainage (Parts 1 and 2)** and wish to further extend their Drainage design skills.

The course continues on from the **rational hydrology** method to rainfall runoff models and dynamic flow in pipes (St Venant unsteady flow equations).

Course Content:

W07: Dynamic Drainage

Hydrology

- Rainfall runoff methods discussed will vary with regions (SCS, ILSAX or EPA SWMM)
- Moving from rational "C" to Soil types
- Additions to the 12d rainfall file including Rainfall fixed time and variable temporal patterns.
- Reviewing graphical outputs
- ARR 2016

Hydraulics

- Modelling diverging flow conditions
- Bypass flow using surface flows with section shapes cut from the design tin.
- Time series for tail water conditions.
- Modelling natural channels using section shapes cut from the design tin.

Detention Basin Design

- Estimating storage to meet the pre-development discharges,
- Creating detention basins and extracting elevation area curves from the tin,
- Multiple outlets design (combining spillway, control pipe, orifice)

Storage Tank Design

- Estimating storage to meet the pre-development discharges via discharge control pipes and orifice plates.
-

Infiltration Tank and Swale Design

- Using discharge rating curves to model infiltration in swales and tanks.

8.0 DRAINAGE 2D – INTRODUCTION

One Day **Course ID:** 1DID2D

Prerequisites:

A working knowledge of the 12d interface is required. View control, model management, basic CAD drawing skills.

Course Content:

W10: Creating a rainfall on grid 2d model

- Create and run a TUFLOW model using the Roadflow quick start panel.
- Add ridges, gullies to enhance the 2D grid.
- Add roughness polygons for a second roughness.
- Link a 12d drainage model to the 2d grid.

Review check files and results

- Review the grid z pts, ridges/gully, 1d-2d link and boundary control check files.
- Create and display tin varying grid tin results for water depths, velocity and hazard. This is done in plan, section and 3d perspective views.
- Create results legends and customise result colour bands.

Time Results

- Create time plots of results of velocity, depth, water level and hazard.
- Create flow measurement lines to total the flow over the line.

Visualisation and Fly Overs

- Create time lines viewing flooding from a stationary perspective
- Create flight and target paths for project flyovers of flood results.

9.0 DRAINAGE 2D – TUFLOW INTERFACE

One Day **Course ID:** 1D2D

Prerequisites:

Working through Chapters 1-7 of the **'Getting Started for Design'** Manual.

A basic understanding of TUFLOW modelling using the TUFLOW control file commands, and completion of **Stormwater Drainage – Part 1** Training, are strongly recommended.

Completion of **Drainage 2D – Introduction** and **Dynamic Drainage** Training would be an asset but are not required. The **Drainage 2D – Introduction** course includes the skills to use the road flow quick start panel and view 2D results and check models. The **Dynamic Drainage** course includes the dynamic drainage 1D hydrology and pipe hydraulics. These skills are required to understand the coupled 1D pipe system to the 2D surface modelling.

Course Content:

W11: TUFLOW control file (TCF) editor

- Use the 12d model (tcf) editor to review and update the tcf, tbc and tgc files created by the Roadflow quick start panel.
- Modify active area polygons and boundary conditions.
- Use the String attribute editor for advance attribute manipulation and the attribute to spreadsheet tool for bulk changes.

TUFLOW string editor (TSE)

- Use the TSE to create and update string attributes and csv database files.

Hydrology Options

- Create strings for inflow hydrographs (SA & QT),
- Rainfall hyetograph regions (RF)

Boundary Conditions

- Tidal boundaries.
- Head discharge (HQ)
- Initial water levels

Soil Types

- Soils file.
- Infiltration methods.

Structures

- Storage Reduction factors.
- Form Loss Coefficients
- Variable Form Loss Coeff.

Variable Z Options (Dam break)

- Adding a culvert connecting to multiple 2D cells.
- Distributing 1D hydrology results onto a 2D grid.

Important Note:

This course is designed to for TUFLOW modellers who want to use the 12d Model interface. Although 2d modelling theory and concepts are discussed, it is only the start of TUFLOW 2d classic modelling

10.0 RIVERS

Half Day

Course ID: HDRV

Prerequisites:

Experience in 12d Model with completion of the **Design Basics** Course or working through the ‘Getting Started for Design’ Manual is required.

12d Model provides an interface with HEC-RAS which allows the creation of a HEC-RAS project from a digital terrain model, and provides powerful tools for presenting the results of the HEC-RAS analysis.

Course Content:

- Identify the river strings required for the HEC-RAS project
- Create and locate cross sections along the river
- Export the data from 12d Model to HEC-RAS
- Open the HEC-RAS Project, and analyse the river for a design discharge
- Use HEC-RAS to interpolate cross sections
- Export the river water levels and channel shape data from HEC-RAS
- Import the data from HEC-RAS into 12d Model
- Create an inundation map using the water levels from HEC-RAS
- Create plans and cross sections from the HEC-RAS data suitable for use in reports. This includes multiple water level results and depth
- Contours
- Create a ‘fly down the river’ .avi movie file of a rendered 3d perspective view.

Important Note:

This course is for showing how to **use 12d Model** with HEC-RAS. It **does not** teach rivers work principles or how to use HEC-RAS.

11.0 ADAC

One Day **Course ID:** 1DADAC

Summary:

This course covers the use of 12d Model for production of an ADAC XML file ('ADAC' refers to 'Asset Design and As Constructed'). The creation of assets and their validation are in accordance with IPWEA (Institute of Public Works Engineering Australasia.

Prerequisites:

Experience in 12d Model with completion of either the **Two Day Design Basics Course** or the **One Day Survey Basics Course**. In some cases, working through the 'Getting Started for Design' or 'Getting Started for Surveying' Manual is sufficient – enquire upon booking.

Course Content:

C01: ADAC

- Examining the ADAC 4.1 XML schema as provided by the IPWEA
- Looking at what is an ADAC Asset in **12d Model**
- Assigning ADAC Assets to points, lines and polygons
- Explaining and running the 12d-ADAC chains
- Validating the ADAC Assets
- Creating an ADAC Header
- Generating an ADAC Report
- Generating an ADAC.XML file
- Reading in an ADAC.XML file
- Creating and using an ADAC Map file
- Creating and using an 12duaf file
- Use of more advanced features of map files (Attributes)
- UAF (12 and User defined)
- Label map files
- ADAC tools for data preparation
- User_lib and local defined systems.

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12.0 SURVEY BASICS

One Day **Course ID:** 1DIS

Summary:

This course introduces people to the use of 12d Model and its concepts for surveying work.

Prerequisites:

No experience in 12d Model is necessary but **basic computer skills** are required along with the ability to understand and write in the English language.

Course Content:

- Overview of 12d concepts: File structure, On Line Help, Mouse configuration
- Screen Layout: Pull down menus, Icons, Views Models (Layers), Strings, CAD Concepts
- Importing / Exporting data
- Triangulation and analysis
- The completion of this course or the 'Getting Started for Surveying' manual is required before attending other survey courses

Important Note:

This course is for showing how to use 12d Model when doing surveying work. It does not teach surveying principles.

13.0 SURVEY TOPOGRAPHICAL PROCEDURES

One Day

Course ID: 1DDS

Prerequisites:

Experience in 12d Model with completion of the **One Day Survey Basics** course or working through the **'Getting Started for Surveying'** Manual is required.

Course Content:

- Traversing: Manual entry and adjustment, least squares network adjustment
- Field techniques: Feature coding, control coding for enhancements including pipes, image attachments and attributes
- Downloading: Trimble Link, Sokkia Link, Leica 1200 GSI and Topcon GTS700 formats
- Field file and manual editing: Dynamic editing of data with full auditing
- Errors in coding, target heights and stringing
- Manual edits: Joining strings, point edits, tinability
- Triangulation: Creation, analysis, Section views, Perspective views, Raster draping
- Plotting: Contours, Text labelling, Grids, Plotter mapping files, ACAD map files,
- Quick plots, Plot frames, Plot to PDF file and AutoCAD.

Important Note:

This course is for showing how to use 12d Model when doing surveying work. It does not teach surveying principles.

14.0 SURVEY CONSTRUCTION PROCEDURES

Two Days

Course ID: 2DSCP

Prerequisites:

Experience in 12d Model with completion of the **One Day Survey Basics** course or working through the **'Getting Started for Surveying'** Manual is required.

Course Content:

This course is only for **experienced** 12d Model surveyors.

- Importing Road design
  - 12d Archive
  - Genio
  - DWG
- Analysis and checking
- String conversions and filtering
- Cross section creation
- Boxing creation
- Point cloud
  - Import
  - Thinning
  - Tinning
- Volumes
  - Stockpile volumes
  - Progressive volumes
  - Isopachs and shading
- Setout
  - Road
  - Structure cad entry
  - Uploading points / string
  - Road upload
  - Machine control upload
- Plotting
  - House setout
  - Road Construction
    - Index & layout plans
    - Long & Cross sections
    - Volume reports
    - Plot book

Important Note:

This course is for showing how to use 12d Model when doing surveying work. It does not teach surveying principles.

15.0 CONVERSIONS AND ADJUSTMENTS

Two Days **Course ID:** 2DCA

Prerequisites:

Experience in 12d Model with completion of the **One Day Survey Basics** course or working through the **'Getting Started for Surveying'** Manual is required.

Course Content:

This course is only for **experienced** 12d Model surveyors.

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- Helmert Transformations
  - 2d
  - 3d
  - 2.5d (12d Field Localisation)
- Traverse adjustments
  - Bowditch
  - Height adjustment
- Least Squares Adjustment
  - GNSS Network
  - Total Station network
- Level Network
- Height Adjustments
- Geodetic Conversions
  - Australian Conversions
  - Cartographic
  - Different Datums
  - Geodetic Reporting

Geoid conversions

Important Note:

This course is for showing how to use 12d Model when doing surveying work. It does not teach surveying principles.

16.0 12D FIELD SETOUT AND PICKUP

Two Days **Course ID:** 2DTDF

Prerequisites:

Experience in 12d Model with completion of the **One Day Survey Basics** course or working through the **'Getting Started for Surveying'** Manual is required.

Course Content:

This course is only for **experienced** 12d Model surveyors. It covers:

- Tablet setup
- Coding and mapfiles
- Instrument connection
    - Total Station
    - GNSS
- User Settings and Menus
- Total Station Control Bar
- Total Station Options
    - Station setup
    - Checks
    - Setout
        - String
        - Segment
        - Batter
        - Tin
        - Crossfall
        - Point
        - Tunnel
        - Crown
        - Drainage
        - Grid
        - Pile
- Total Station Pickup Menus
    - SDR
        - SDR Function
        - Reading and Coding
        - Favourites and Template
    - Basic
    - Face / Scan
    - Tunnel
    - Section
    - Measure Rounds
- Total Station TPS Menus
- GNSS Control Bar
- GNSS Options
    - Localisation
    - Utilities
    - Checks
    - Setout
    - Pickup

Important Note:

This course is for showing how to use 12d Model with 12d Field when doing surveying work. It does not teach surveying principles.

17.0 MACRO

One Day **Course ID:** 1DMAC

Summary:

This course starts people writing, compiling and running 12d Model Macros.

Prerequisites:

Attendees should be familiar with basic 12d Model terms and concepts such as models, tins, strings, panels, picking strings.

No previous programming experience required but a capacity for logical thinking is essential.

Course Content:

- The 12d Programming Language (12dPL) is a powerful programming language designed to run from within 12d Model.
- Its main purpose is to allow users to enhance the existing 12d Model by writing their own programs (macros).
- 12dPL is based on a subset of the C++ language with special extensions to allow easy manipulation of 12d Model data. A large number of intrinsic functions are supplied which cover most aspects of civil modelling.
- 12dPL has been designed to fit in with the ability of 12d Model to "stack" an incomplete operation.
- This training course does not try to teach programming techniques but takes attendees through the basics steps to start writing and running 12dPL programs (macros).
- This course covers
  1. Using the 12d Model Programming Language manual.
  2. 12sPL syntax and flow control.
  3. The basic 12sPL variable types and "handles" to 12d elements (strings etc.).
  4. How to create, compile and run 12dPL code.
  5. How to retrieve and change basic element properties.
  6. Reading and writing files (creating reports).
  7. Creating 12d Model panels.
  8. Including your 12dPL programs in the User Defined menus, function keys and toolbars.

18.0 TRACK

One Day **Course ID:** 1DT

Summary:

This course introduces users to 12d's Track Design Tools for rail design.

Prerequisites:

For reasonably experienced 12d Model Users!

Completion of the Design Basics Course and some experience/use after the course is essential plus a reasonable knowledge of Element Based Super Alignments.

Experience in Rail Design & Rail Terminology is strongly recommended.

Course Content:

R01: Rail / Track

- Calculate the Track Centreline (3D) from the Surveyed Rails
- Use of Linear & Arc Regression (Though not actually part of the Track Tools, Regression is essential for developing a CL off Surveyed Data when no Design Data is available).
- Track Slew. Creating Reports, Spreadsheets & Diagrams & Plotting the Slew.
- Rail Profiles. Producing &/or Extracting a Rail Profile.
- Turnouts. Creating & Editing Turnouts & then Placing Turnouts.
- Chainage Equalities. Equality Types & Definitions. Their use + Inquiring on Equality Chainages
- Rail Cant. Cant design, Virtual Cant, Altering Speeds to Adjust Cant, Spreadsheets & Graphs & applying the Cant to the Rails.
- Plotting the Rails, Ballast & Sleepers. A quick look at producing a Circular (Bored) Tunnel.
- Setting and running structure gauge
- Some Long Section Plot Settings/Tweaks.

Important Note:

This course shows the use of 12D's Track Tools; *it does not teach* Track Design or cover any of the Basis of Design Rules for Rail work.

19.0 DRAFTING

One Day **Course ID:** 1DDC

Summary:

This course introduces Users to the tools required for producing drawings.

Prerequisites:

No experience in 12d Model is necessary but **basic computer skills** are required along with the ability to understand and write in the English language.

Course Content:

B02: CAD

- Creating a Project
- Drawing and CAD snaps
- Modification tools including:
  - Move, Rotate and Copy
  - Clip
  - Parallel
  - Trim, Extend and extend by length
- Properties
- Symbols
- Text

B03: CAD Tools

- Sharing
- Toolbars
- String Properties
  - Changing and Editing
  - View Settings
- Super String Tools
  - Tinability
  - String Symbols
  - Pipe / Culvert properties
- Measuring
- Raster
  - Importing
  - Cad Holes
- Creating a TIN
- Contouring and Labelling

P01: Plan Plot and Label

- Labelling data
- Plan plotting

P04: Plot Sheets

- CAD dimensions, leaders and tables
- Plot sheet

P02: Sections and Plotting

- Plotting long sections
- Plotting Cross sections

20.0 BIM

One Day

Course ID: 1DBIM

Summary:

For a surveyor, engineer or information manager who wants to utilise the functionality inside 12d Model to collaborate and coordinate models from different project disciplines. Being able to import and share BIM (*i.e.* Building Information Modelling) model data, access and coordinate attribute/metadata information and trimesh models.

Prerequisites:

Some experience in 12d Model is necessary along with **basic computer skills** and the ability to understand and write in the English language.

Course Content:

Content:

- Import and manage BIM data including open BIM IFC files
- 3D Helmert transformation of models
- 12d Model Data Management
- Mapping data with attributes
- Recreate MTF files from design strings
- Pavement Manager and Snippets for trimesh BIM creation
- Trimesh creation and editing tools
- Trimesh reporting and volumes
- Creating trimesh objects from 12d objects
- Create and edit an attribute manipulator file
- Create and apply attribute label map files
- Export open BIM IFC files
- Investigate 3D clash detection rules; apply and report on 3D object clashes.

NOTES: