Autodesk University 2012

Urban Infill Subdivisions: Lot Grading on Restricted and Steep Terrain

Justin Ralston – Airey Consultants Limited

CI2922 Urban Infill Subdivisions: Lot Grading on Restricted and Steep Terrain

With the restricted supply of urban land and its increasing cost, developers are using land for subdivisions that was once considered unsuitable, leading to smaller, more complex projects on restricted footprints. In this class, we will look at numerous case studies of grading small lots that involve the use of AutoCAD® Civil 3D® software (since Release 2007) and grading, corridor, and pipe objects. We will review one person's workflow for getting the job done when Civil 3D is pushed to the extreme.

Learning Objectives

At the end of this class, you will be able to:

- Identify key site features and the Civil 3D objects that are required to model those features
- Be able to apply grading and corridor objects to generate complex finished surfaces
- Structure small projects efficiently to limit software issues
- Export grading feature data in a user-friendly format for site

About the Speaker

I started using Autocad in 2003 as a structural engineer developing programs in Autocad to design and pattern the fabric surfaces of tension membrane structures in NZ, the US and Middle East.

Since then I have worked for various consultants, as a Civil Engineer using, LDD and Civil3d and gotten the bug for developing lsp, vba and .net routines to improve the productivity of Civil3d and Autocad out of the box.

Justin Ralston
Senior Civil Engineer
Airey Consultants Limited
Queenstown, New Zealand
justinr@aireys.co.nz

1.1. Contents

1.2. Introduction

1.2.1. Company

Aireys, who are we? Aireys Consultants is a medium sized civil and structural engineering practice of approximately 40 people spread over 6 offices independently directed and collectively owned, with offices in Orewa, Takapuna, Howick, Pukekohe, Christchurch and Queenstown in New Zealand.

We undertake a wide range of projects from small 1 into 2 lot urban infill subdivisions to larger multi-staged waterfront canal developments.

We have traditionally and continue to use Autocad/Autocad LT and Civil Cad to complete some projects but in 2007 we began using Civil 3D and have continued to use it and develop our in house standards through to the current version.

Adopting Civil 3D as the new software package has and continues to be a challenging and evolving process. Rolling out the package is a multi dimensional problem involving training of staff, development of workflows and drawing styles.

1.2.2. Type of work I do

I started using Civil3d and grading in 2007 doing earthwork plans for lots created for urban infill housing, rural lifestyle or bush blocks. These sites typically have steep terrain and numerous site constraints such as existing services, height to boundary limitations, streams/watercourses setbacks and slope stability issues. While working at our Howick office in Auckland between 2007 and 2009, I worked on over 125 jobs with Civil3d along these lines which I would call small in size. Since 2010 I have been located in Queenstown, New Zealand working on a 60 ha master planned development that is pretty much flatter terrain which brings its own challenges

1.2.3. My blog

I have a cyberspace presents in the form of the blog “C3dxtreme” that you can find at **http://c3dxtreme.blogspot.com/** basically I started the blog to post things I learnt on the job to find them faster than search for them in the piles of paper notes I had scratched together over the years.

My blog also contains alot of links to other blogs covering civil3d. If anyone is keen on starting a blog I would recommend using windows live writer and blogger as an easy way to get started.

I have a number of other social media account but I utilitize my blog mostly.

1.2.4. Ideas for this Class

The most popular post on my blog is about grading, so there is obviously a thirst for grading knowledge out there which lead me to submit this class for AU. In this class I will walk you through how I currently use Civil3d for small grading projects and show various real world examples of models that I have created over the past six years and of course give you a bag full of tips and tricks to takeaway.

1.2.5. Warning!

I have only ever been on a couple of Civil3d training courses and cannot remember the last time I read the help files, mainly because they are not that helpful for what I do. So, what you are about to observe does not follow any of the recommended AutoDesk best practice guidelines.

Well, that is enough about me, I know you have come to AU not to learn about me, but to learn what I know.

1.3. Introduction

Infill subdivision is a market niche that requires a lot of detailed design and problem solving for a limited budget. Some would say that Civil3d is not designed for this sort work and I would have to agree that it appears limited resources have been applied to this area of the application to date.

Coupling this with past grading performance and the steep learning curve of Civil3d people are apprehensive in applying Civil3d to these types of projects.

I however, believe the benefits of adopting Civil3d out weigh the negatives and have been able to refine my workflow to achieve some good results with limited issues.

To meet the key learning Objectives I have divided the class into the following four sections with numerous asides which I have added as appendices at the end of this paper.

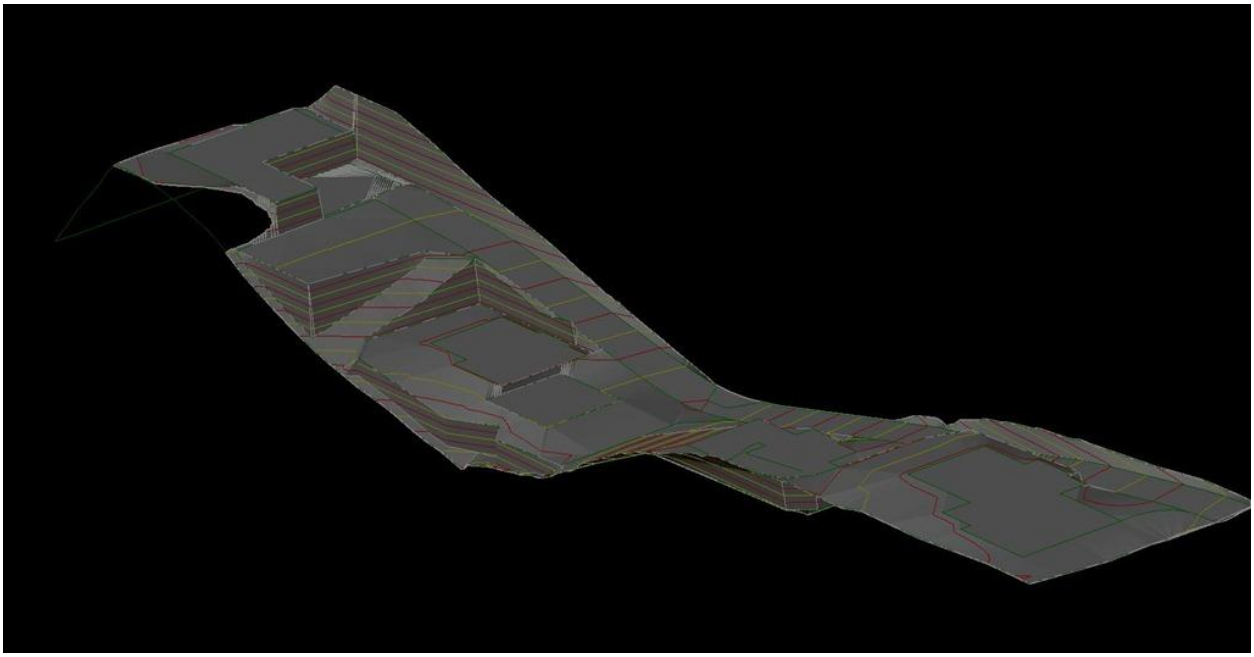
1. Identify key site features and the Civil 3D objects that are required to model those features
2. Be able to apply grading and corridor objects to generate complex finished surfaces
3. Structure small projects efficiently to limit software issues
4. Export grading feature data in a user-friendly format for site

1.4. Identify key site features and the Civil 3D objects that are required to model those features

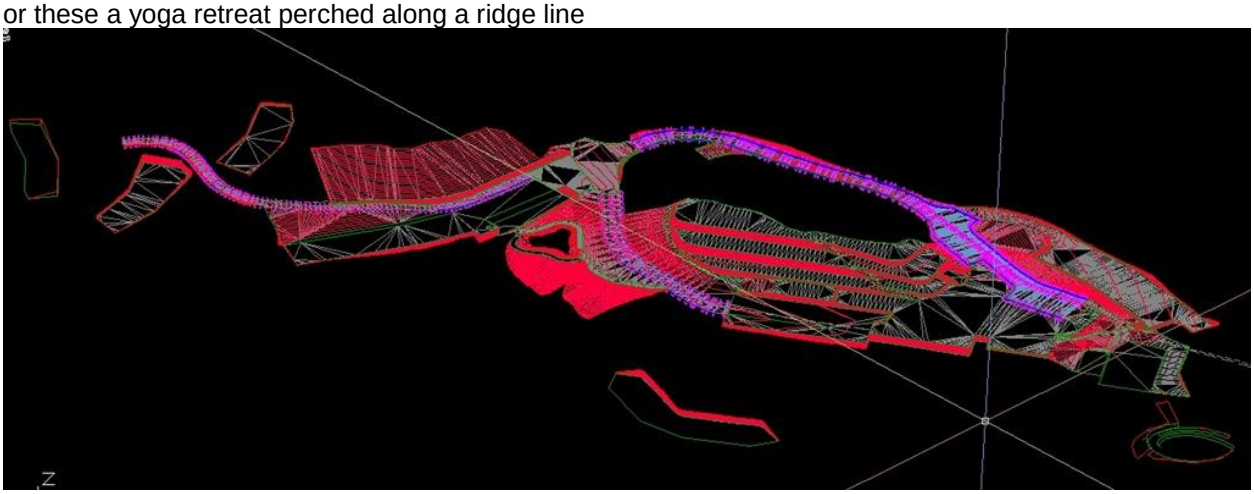
So you have done the shipped tutorials, been on some training, read the help files and know what a feature line is, how to create grading objects, and are able to complete straight forward jobs such as ponds and carparks.

Now you are back in the real world and have to create one of these beauties

A 4 Lot Townhouse Subdivision with shared driveway



or these a yoga retreat perched along a ridge line



So where do you start?

The beauty of grading is there is no right or wrong solution as long as the job deliverables are achieved.

Having the vision and imagination to quickly assess a project and determine the approach of attack is a fundamental skill and something that I have found evolves slowly from past experience and some are just better at it than others.

To determine the grading methodology one just has to work back from the job deliverables. If only base volumes are required then the project maybe achievable with a "simple" featureline only model build. However if right of way longsections and cross sections are required as well as setout data the use of corridors with gradings would indicate a "complex" model build is required.

Other questions you should ask yourself are:-

Do I want a Dynamic model or not?

What sort of site features do I have to model Driveways, Retaining Walls, Building Platforms, Basements, Foundations, Drainage?

Is it going to be a team or individual designer's job?

How big is this job going to get?

Do I need to use grading and corridors to build the finished surface?

Can I encircle the complete site with one Featureline?

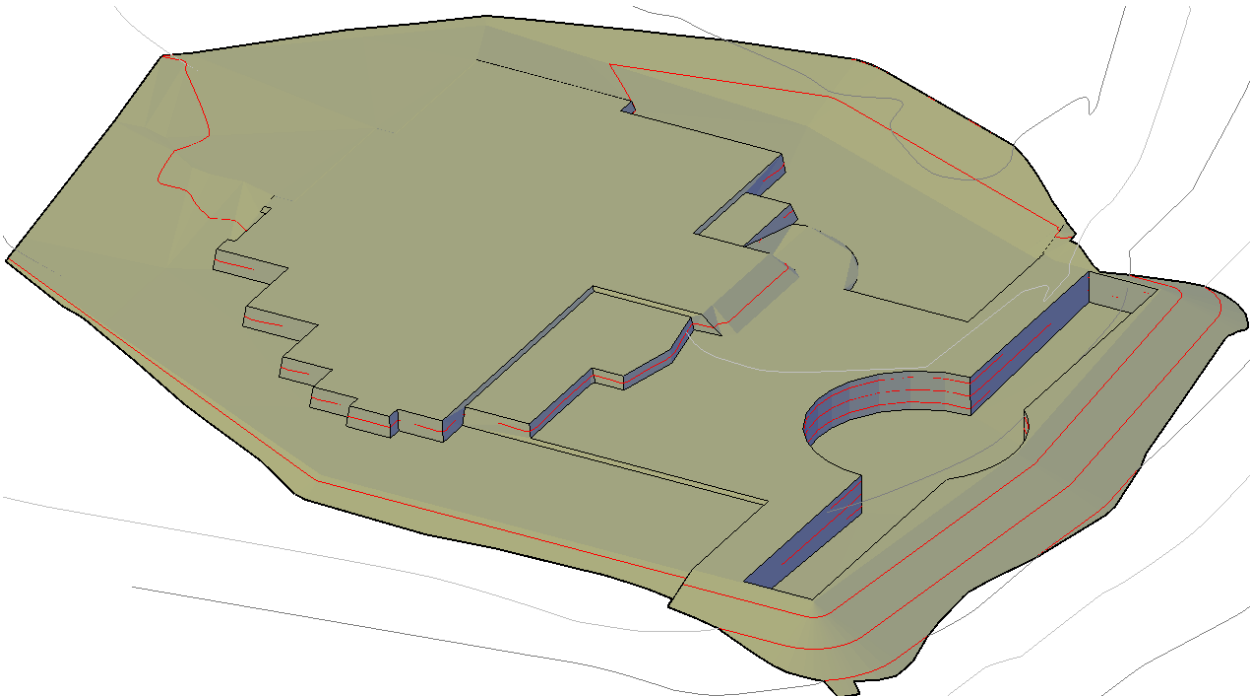
Can I use planar surfaces to get the site levels?

Is it a Single lot?

Is there a basic or shared driveway involved?

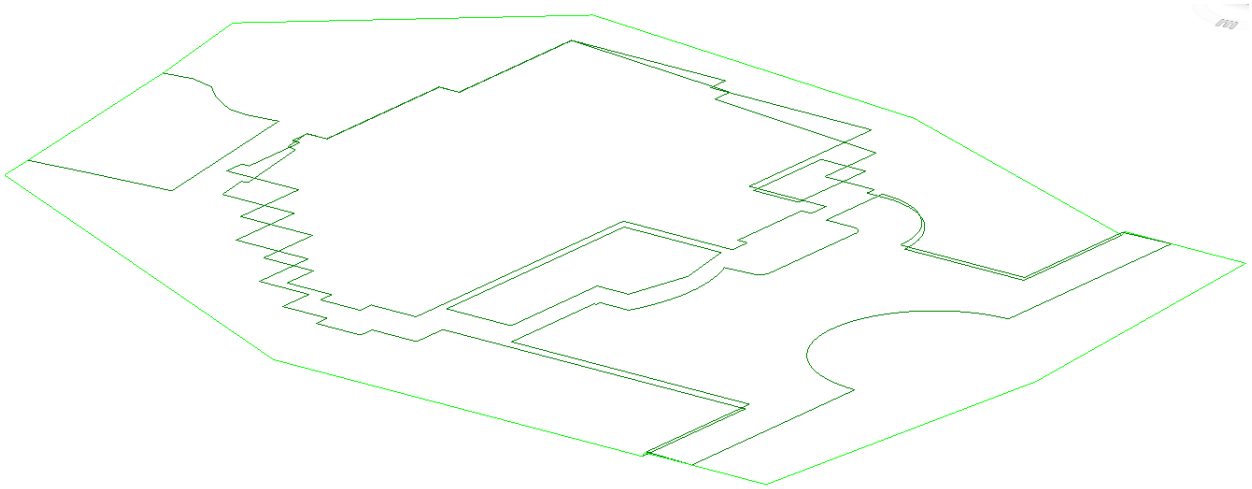
Also to help identify when a "simple" or "complex" model build is required, below are a number of reference examples which graphically depict how various models have been build. For each job I have included a screen capture of the finished surface model achieved and also a capture of the underlaying featurelines and corridor models that was used to create the surface.

1.4.1. EXAMPLES

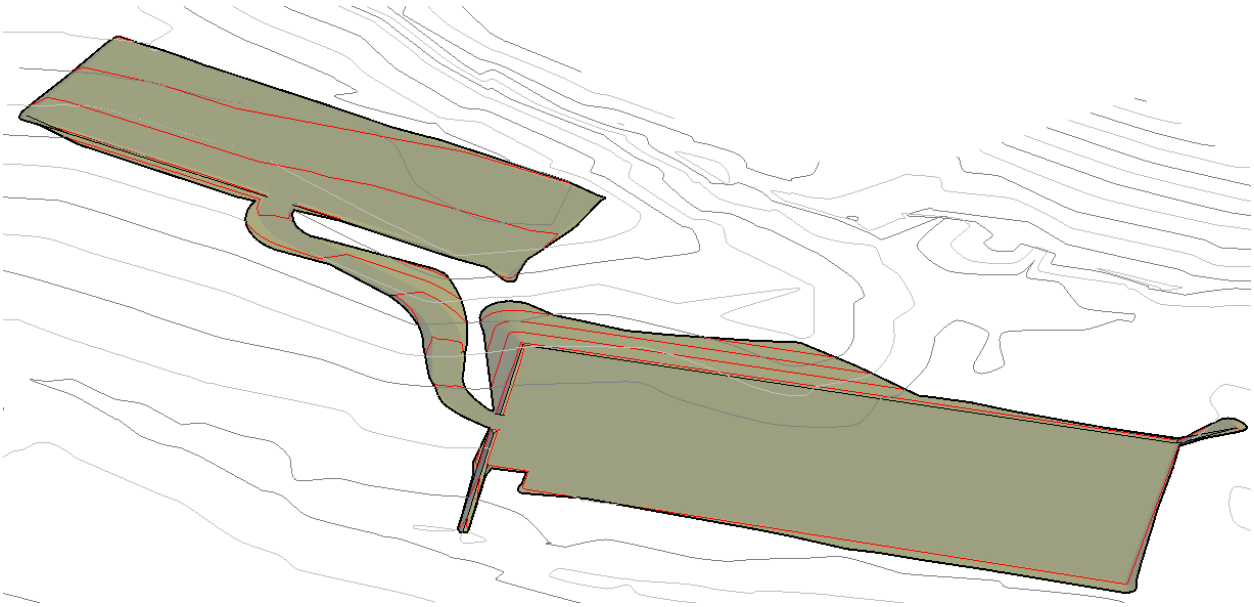


58 Chateau Rise (C3D 2008) New House with Lap Pool

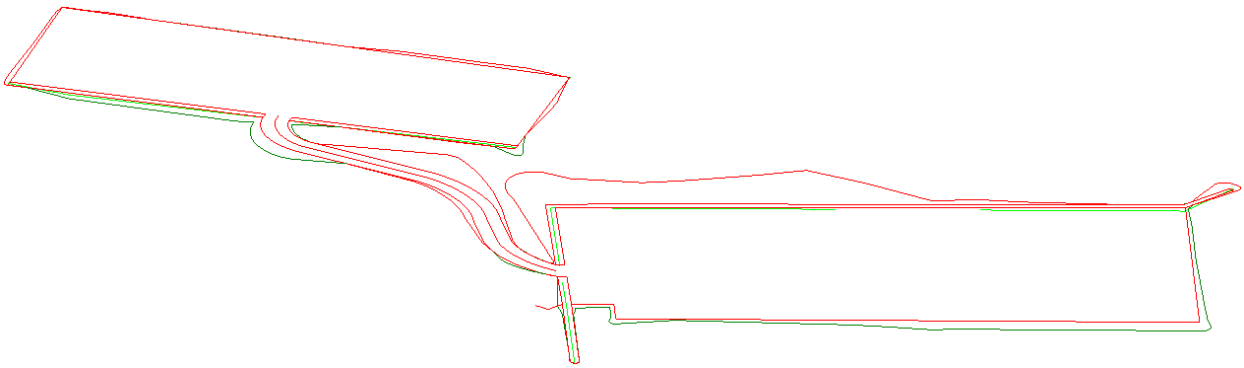
58 Chateau Rise **"Simple"** Featureline Model



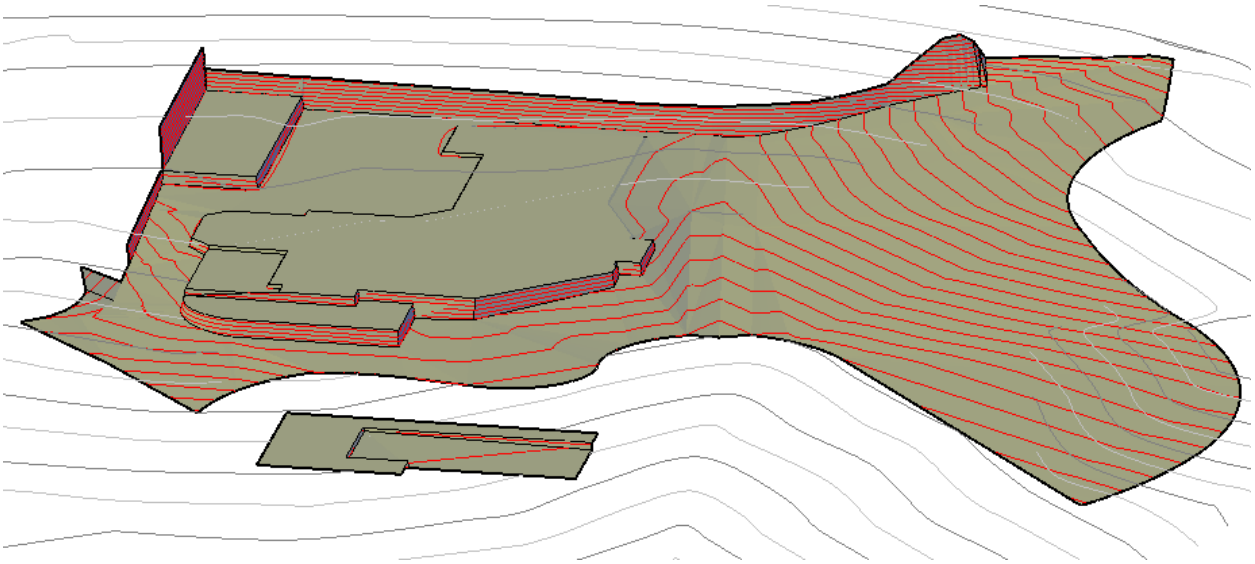
Whitford Park (C3D 2008) - Horse Arena and Carpark



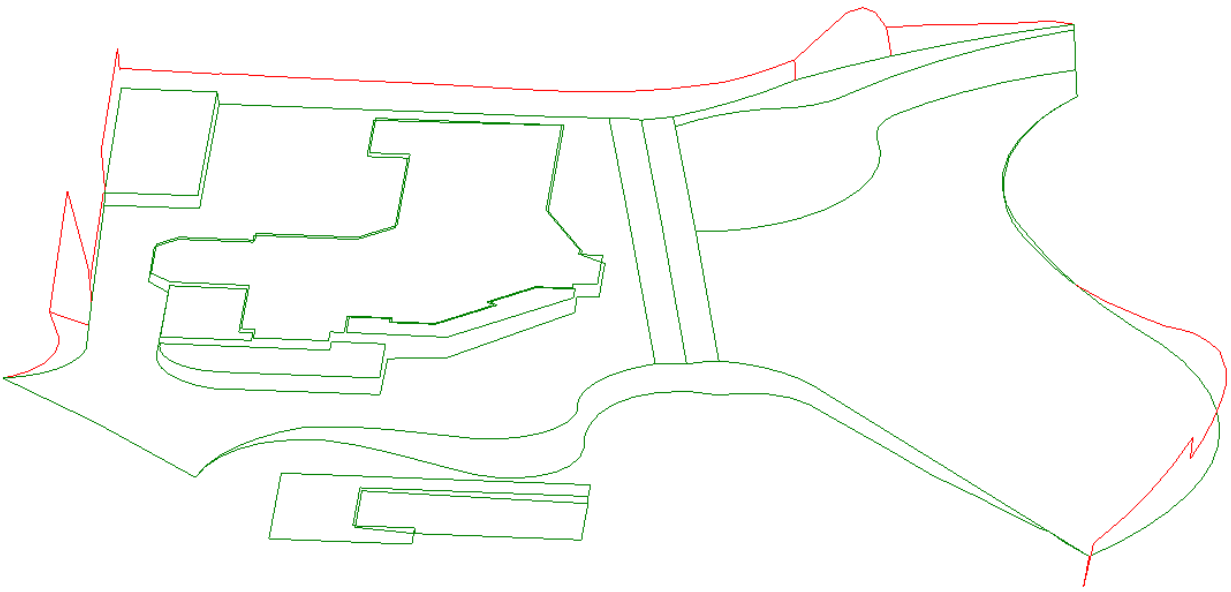
Whitford Park Road **"Simple"** Featureline Model



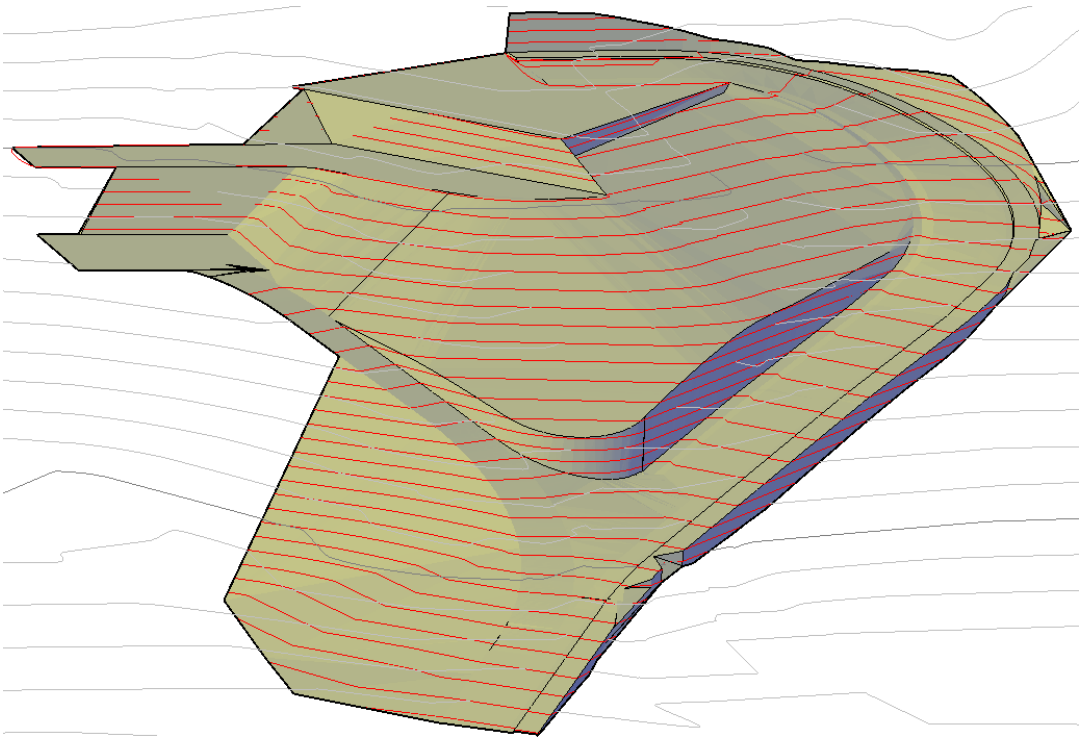
338 PointView Drive (C3D 2009)



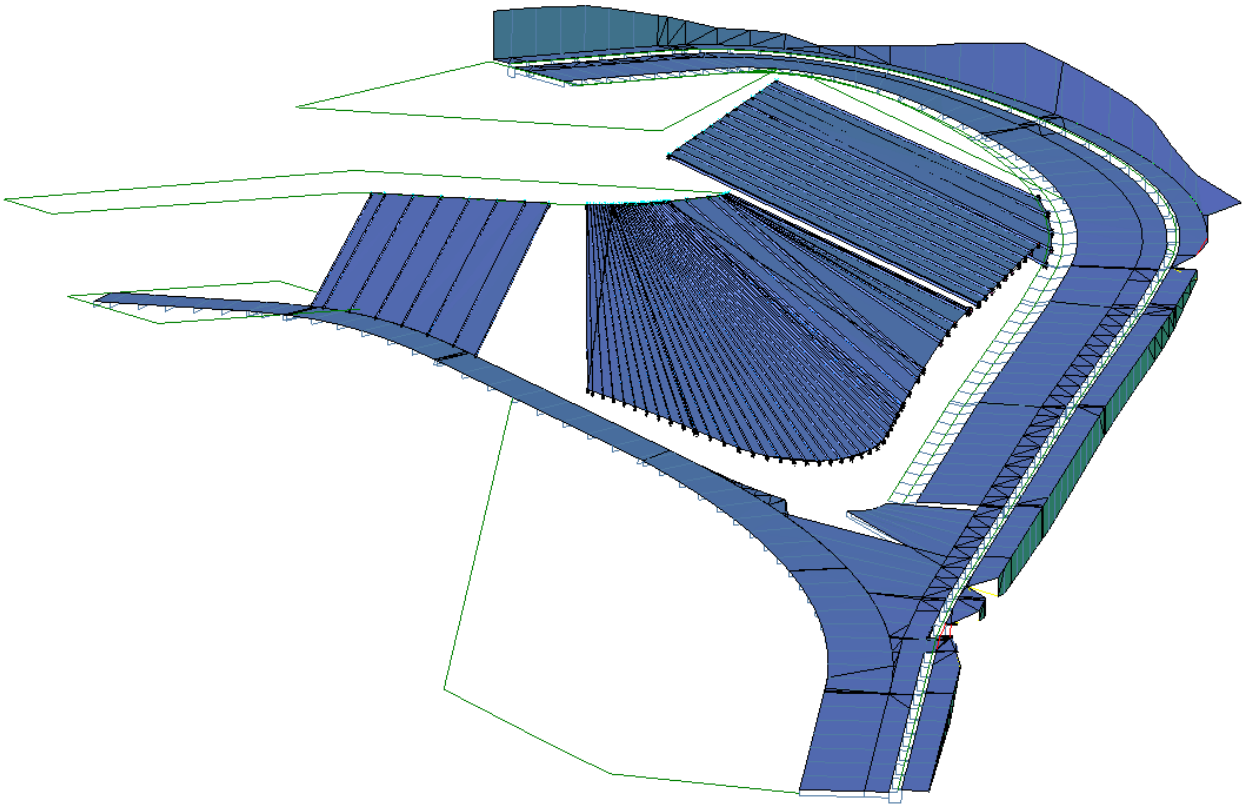
338 Point View Drive **"Moderately - Simple"** Featureline Model



Moeraki (C3D 2010)

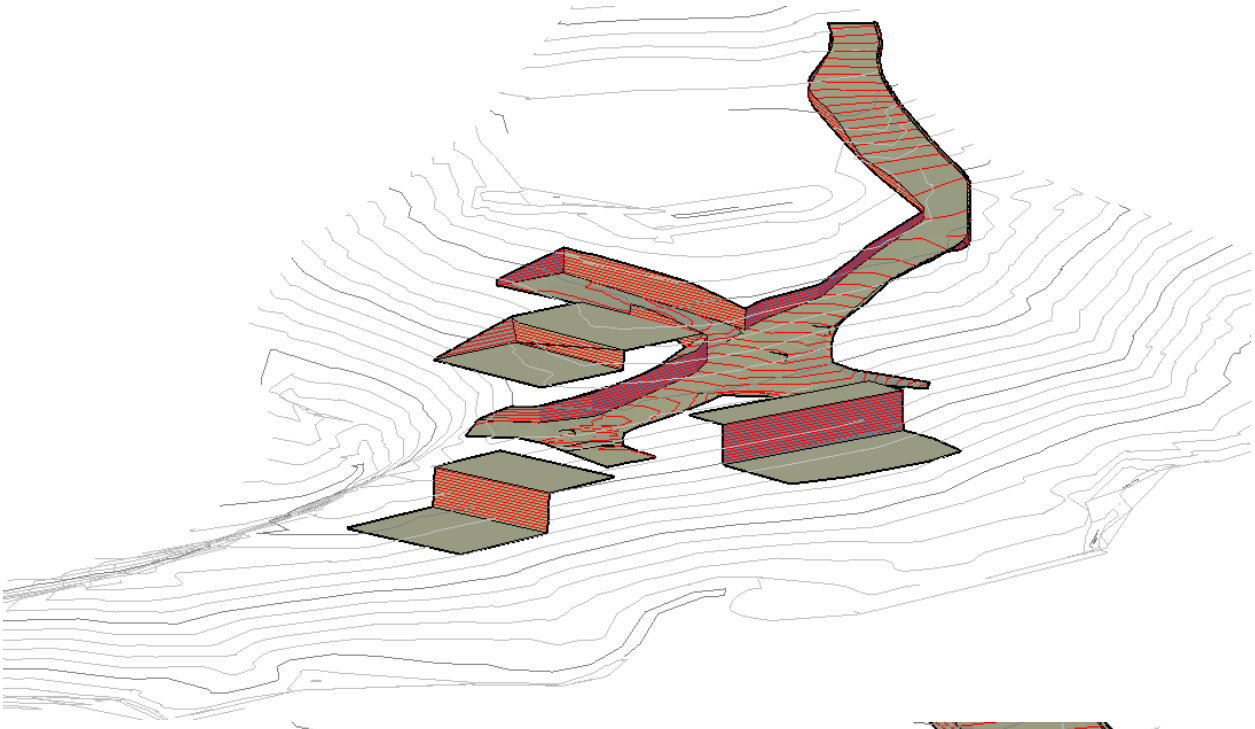


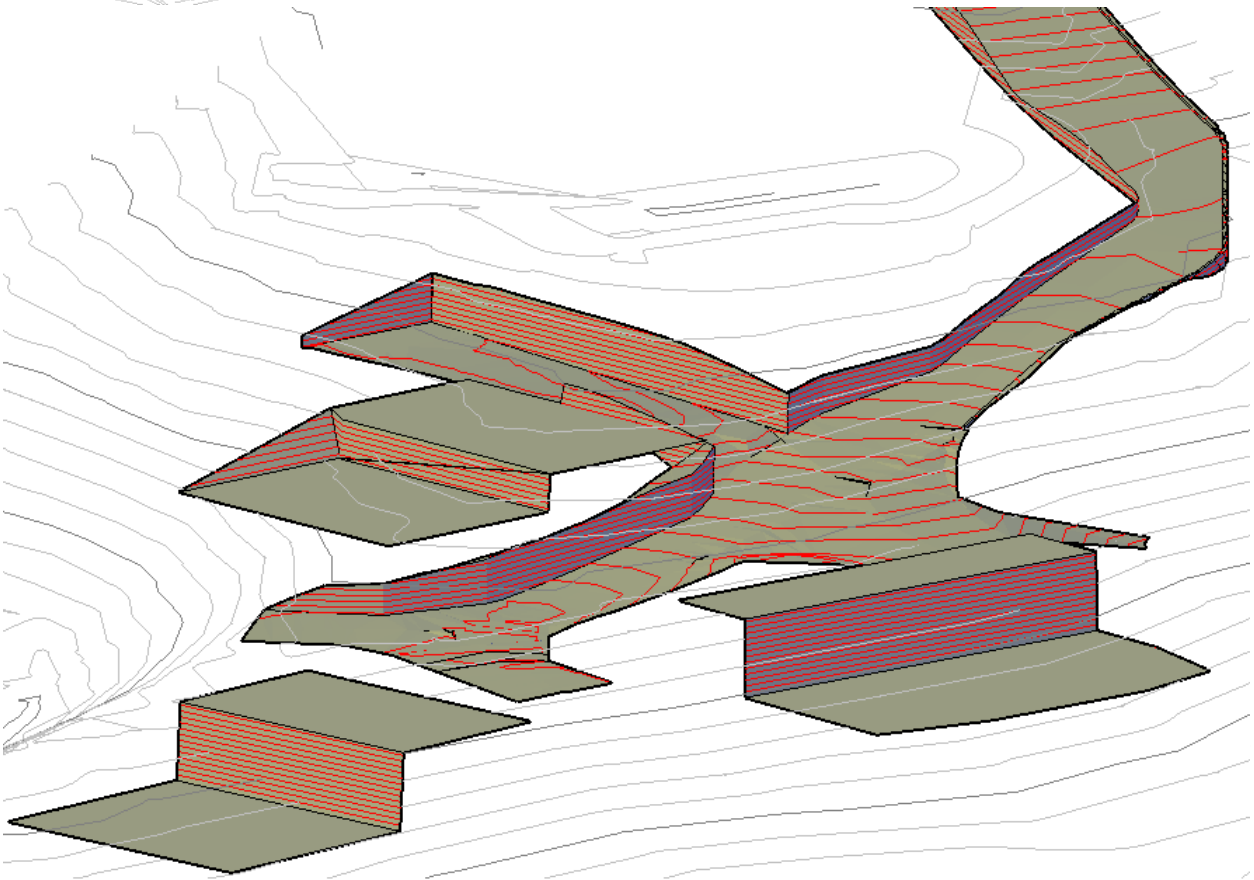
Moeraki **"Complex"** Featureline and Corridors Model

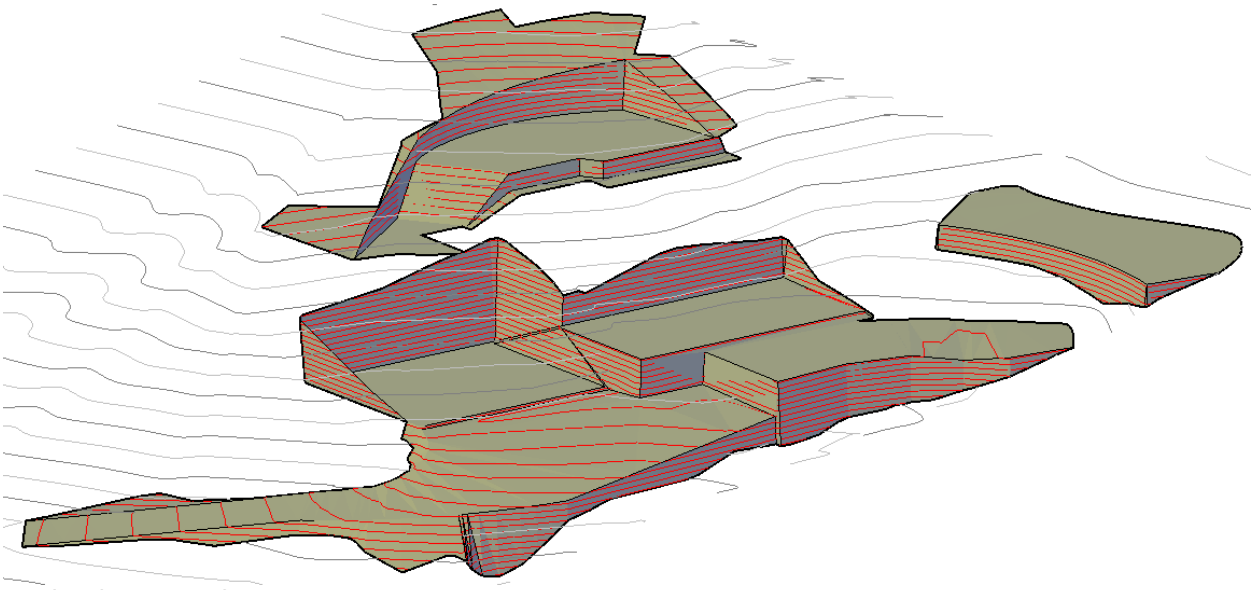


Evelyn Road (C3D2007)

47 Evelyn Road **"Complex"** Featureline and Corridors Model

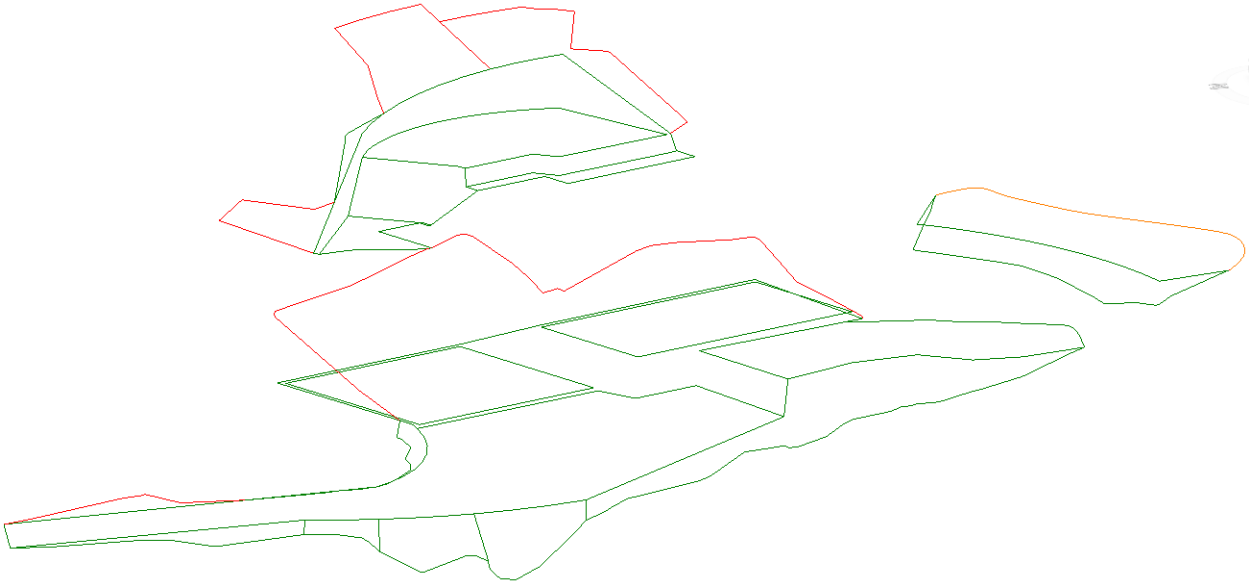






Renlee (C3D 2009)

Renelee **"Complexed"** Featureline Model



Additional Examples
Gowing Drive – Drive way stream buiding Pads
Looped Driveway in Howick
30 Beach Road
One at Buckalnd Veach with all the manholes
Aroha Lot 32, 33 and 34.

1.5. Structure small projects efficiently to limit software issues

So how do we setup our projects to get to the finished models show above with a limited amount of software issues.

We basically break the job into three parts
1. Getting the 2D Base line work.
2. Getting existing 3D Data
3. Building the proposed 3D ground surface.

We roughly build our drawing structure around this arrangement. By trying to keep the grading finished surface and existing surfaces in separate drawings this helps us just encase anything goes wrong and corrupts our drawings.

To split your project affectivity you need to be familiar with Datashortcuts, Sheetsets and Xrefs the bigger your projects become more important these key fundmentals become.

1.5.1. Getting the 2d Base Linework

1. Obtain a copy of the Architects drawings
2. Start a new drawing from your template
3. Paste in the contents from the architects drawing(Issues can come with dwgs saved in other packages)
4. Turn off all the layers except the ones you want to see in your grading drawing.
5.Create LayerState's in the xref of the key feature information you want to refer too (you will see them in your grading drawing)
6.Open or Print out the Architects plan drawing.

1.5.2. Getting the Existing 3d Data

1. Obtain the site surface data from the client or survey team
2. Start a new drawing from your template
3. Pull in the data required to build your existing ground surface
4. Build the E-gl (Existing Ground Level) surface from points, tin or 3dfaces (preferably not contours)
5. Set up Datashortcuts for the E-gl surface ready to be referenced into the grading drawing

1.5.3. Building the proposed ground

1. Start a third drawing for your actual grading
2. In the drawing add a new layer x-"Name of Architects Drawing" make this layer current. (We do this so we can filter and freeze all of the xref's at once or independently)
3. Setup a Xref to the Architects drawing ready to obtain the key site feature 2d linework.

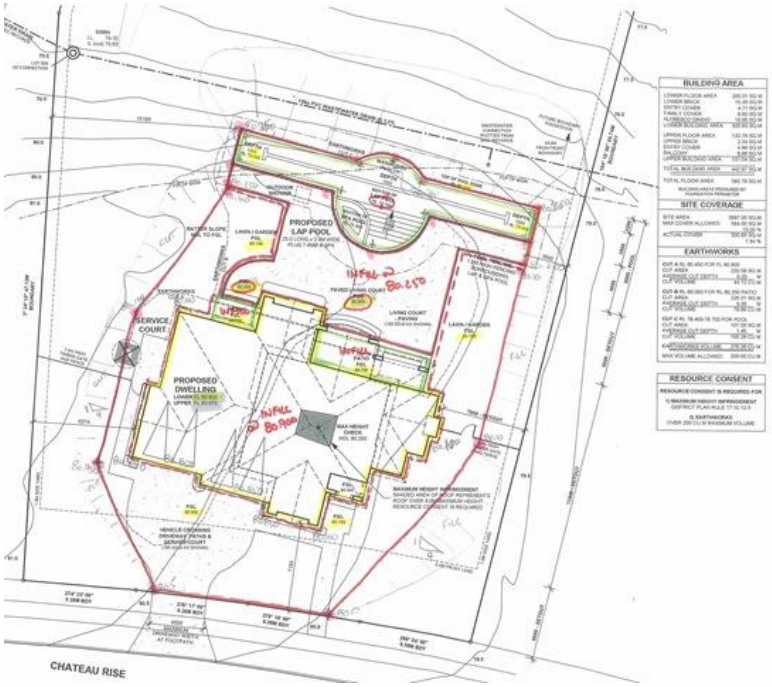
Now we are ready to start grading and go 3D.

For additional formation on setup see Appendix 1 and 2

1.6. Be able to apply grading and corridor objects to generate complex finished surfaces

One benefit of using Civil3d grading is that the tools and user interface has been kept pretty much stable for the last 6 years except of the addition of the ribbon. This means that as a designer once you are up to speed with the grading and corridor tools it is up to your imagination how you apply these tools to a grading project.Our grading method will be determined by the complexity of the site features and topography. To determine if the job is simple or complex build.

1.6.1. Simple Build



1.Open or Print out the Architects plan drawing
2. Look at how you can surround the site (or areas within the site) with one continuous featureline, with under the laying features supplied by the architect. Here for example on the Chateau Rise Job I determined I need featurelines as markup in read

To produce a cut/fill plan like this

3. Set up a perimeter featureline
Now we work either outside from your perimeter featureline back to existing ground or inside from this perimeter featureline to fill in site features

Working Out

This is where I usually start as grading back to existing ground, is typically where the trouble or issues occur and can be the most time consuming part of any job.

You can attach grading to the Full length or part of length of the featureline and use transitioning between sections of grading. Example by adding transitions.

Typically there will be some form of Retaining Walls on a boundary, I find using a batter with 0.1:1 models walls satisfactory, using anything less than 0.1 causes errors in daylight extending to far.

Working In

Add building platforms as enclosed feature lines with infill grading, kerb lines etc do this by pulling in the copies of the line work of key physical features to be used as the base for grading featurelines

You can use a map query or the ”ncopy” command to do this also from labs website the is an xref offset command available.

ncopy does not use a fence or window select so you have to select one item at a time to add it to your selection set. The command is an old lsp that came with express tools can be modify to use a window selection if you are good at lsp.

Join the imported line work of key physical features to form continuous enclosed polyline entity where possible for infill grading

How create Featurelines from your imported linework.

Assign elevations to your featurelines, Using Quick ElevationEdit or the Elevation Editor
Slope, Height, or get the levels from a temporary or existing surface.

Tip *Once you have the correct elevations assigned to your featurelines. Set the osnapz variable to 1 to grip edit the plan position of a individual vertices without having the elevation of the featureline updating.*

Fill any areas enclosed by featurelines with infill grading objects

1.6.2. Complex Build

The main difference between a simple and complex surface build is the introduction of Corridors and/or multiple sites, breaklines and lack off continuous containment of the site making the reduction of an external surface boundary more time consuming.

Seeing shared driveways are usually easier to model with corridors you have to decide how you are going to add your corridors into your model. There are a couple of ways to merge the resulting corridor data into the final surface. You can either

1. Generate a surface from the corridor model and merge it together with other surfaces from grading groups into a composite final surface or.
2. Extract Featurelines of key elements from the corridor and add them to a surface as breaklines.

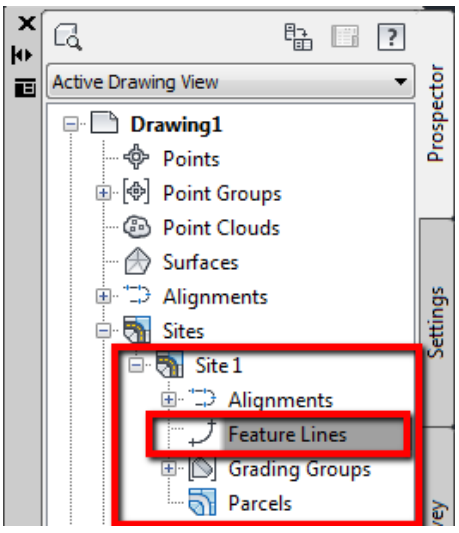
The first choice is really only an option when there is no or limited interaction between the corridor and other site features represented by featurelines.

Seeing that your corridors and featurelines will most like have to interact you need to have a good understanding of Featureline priority to make your life easier.

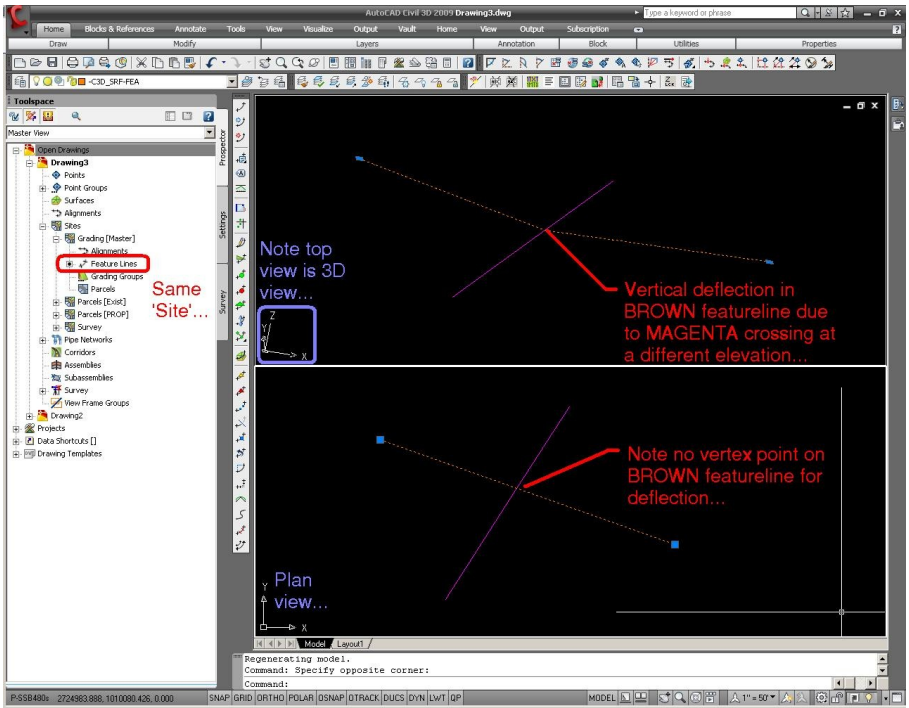
1.6.3. Featureline Proirty (Bridging the gap)

When you have to join corridors and featurelines we can bridge the gap with prioritized featurelines Mark Spatz, P.E wrote an article at http://www.civil4d.com/2010/02/featureline-priority/ that I always find myself referring to0.

Most people are familiar with the “The last drawn wins” featureline functionality in which the most recently drawn featureline in the same site overrides previous elevations and inserts a level point at crossing points of existing featurelines, however most people are unfamiliar with ‘Featureline Priority’.



For example:

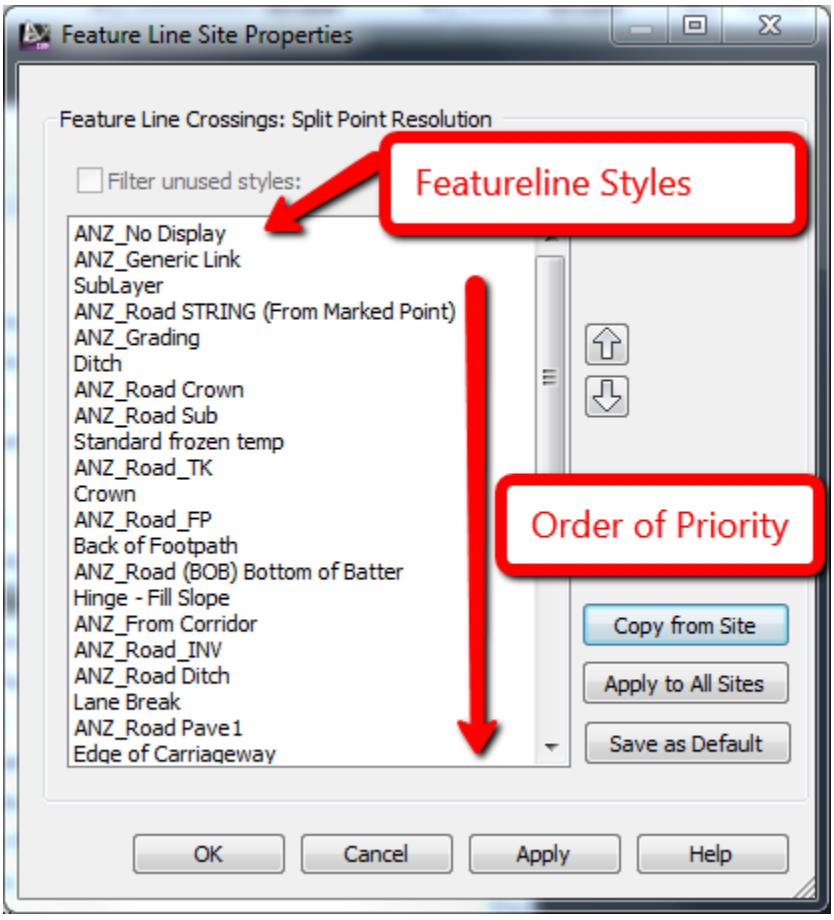


If two Featurelines that cross each other and are in the same ‘Site’, Civil 3D will force them to be at the same elevation where they cross. However with Featureline Priorities you can prioritize the Featurelines by style and use style order to control which one will win/adjust.

To see the featureline priority list, right-click on "Feature Lines" under the ‘site’ that contains your Featurelines and click "Properties…".

Next, proceed to the "Options" tab. There you will see all the Featureline styles that are in the drawing and their order of priority. Adjust them accordingly…

So, if you now assign a featureline style higher up the list to featurelines in your corridor and those representing a building pad and connect them with a third featureline with a lower priority it will always update to the elevations of the corridor and building pad featurelines.



1.6.4. Grading Featurelines from Corridors

Can extract featurelines from your Corridors and add grading to them, I typical use this technique to model the daylighting of the edges of a corridor to avoid bowties and keep the corridors reasonably simple.

Attaching grading to corridors can causes issues as the increased frequency required to model smaller jobs well increases the re calculating time when the corridor is adjusted slows everything down.

You can also use corridors to surround a block of land and create an enclosed featureline to work from.

If you use grading infills between a corridor featureline and other featurelines however I have noticed that the infill grading will disappear, on a corridor code set change.

You can breaking a featurelines dynamic link to a corridor to allow manual editing

You can use the “Opps” command to delete corridor featurelines from a surface without having to hunt for them.

Brians Hailey has a tip on data linking to stop rebuilding.

1.6.5. Extracting Additonal Breaklines.

Sometimes situations arise when you need to extract featurelines from a grading object to perform additional editing actions on it prior to adding it to you final design surface as a breakline. To do this you can

1. Have a site named explode into which you can make a copy of the required grading and explode it to retrieve a copy of the featureline you wish to edit.

2. Use the ExtractPolylineFromFeatureline route in the .net project attached.

3. Use the “MinDistBetweenSurfaces” command to get a 3dpolyline of intersection of two surfaces

1.6.6. Temporary Working Planes

You can use the Grading Work Plane routines developed back in 2008 for the "Caffeinated Grading" paper presented at AU and shipped with Civil3d 2010 and 2011 as a .dvb file. or use the .net version kindly updated here by Jeff Misher.

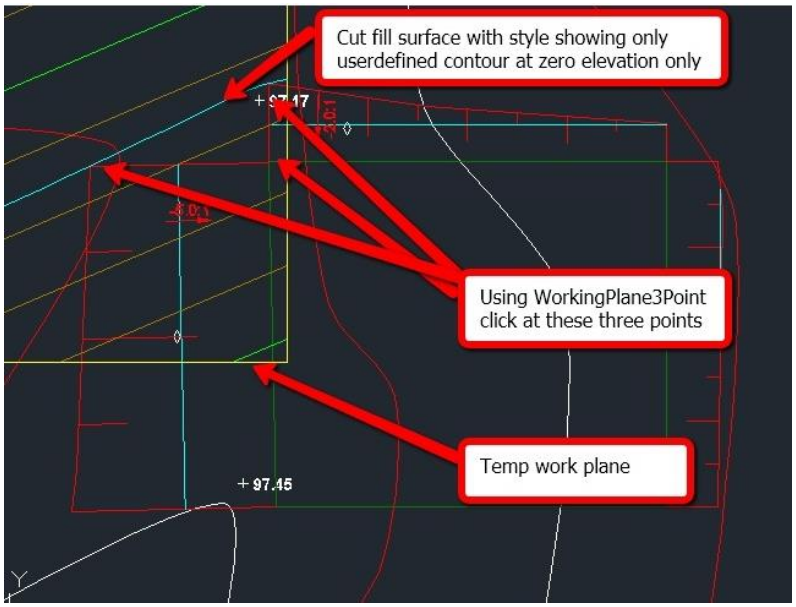
With the C3D Surface Working Plane.dll installed you get a number of additional commands

WorkingPlane2Point, WorkingPlane3Point, WorkPLaneMove, WorkPlaneResize

Creating Mitred Corners in Civil3d is a simple example of how you can use these commands. You can use these commands in combination with a temporary cut fill surface to create feature lines to generate a number of external and internal corners and daylight lines to do this.

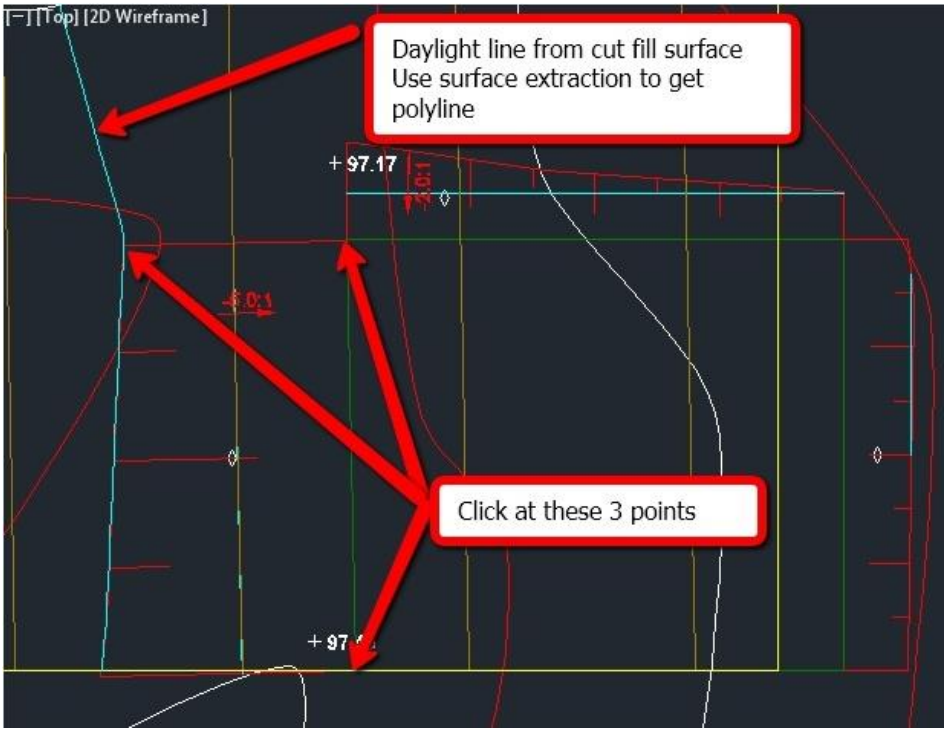
1. Download the .net .dll file for your version of Civil3d
2. Type netload and load the C3D Surface Working Plane.dll

Now you can try one of these methods to build a corner.

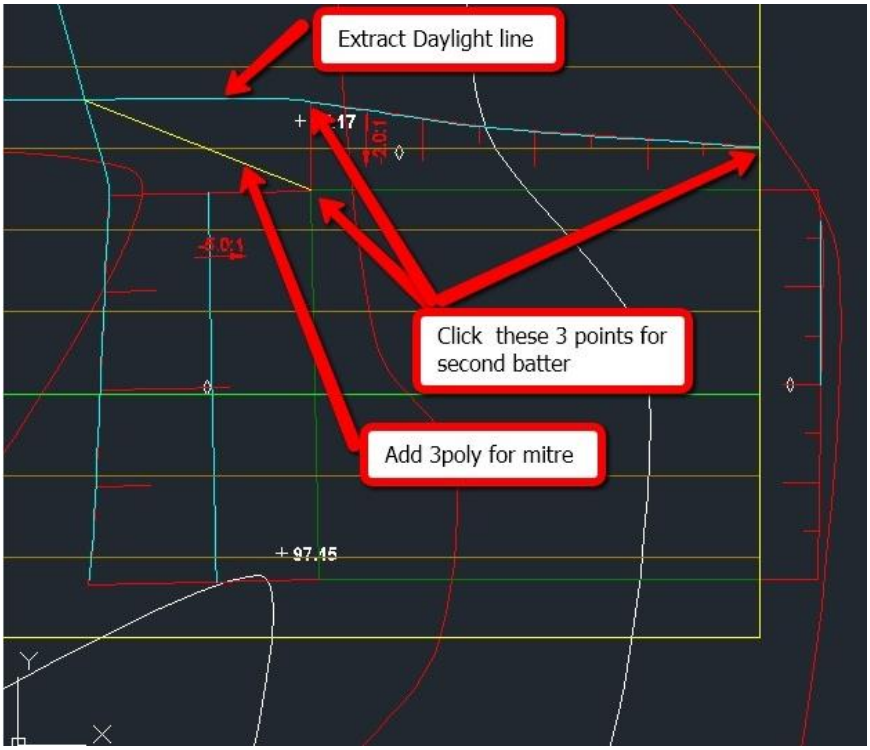


Option One

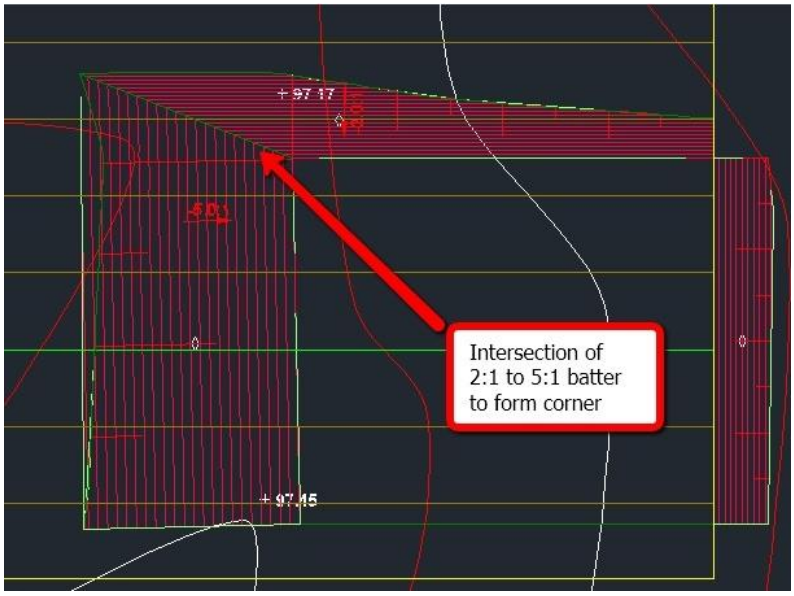
Extract zero cutfill line,trim and assign existing ground levels



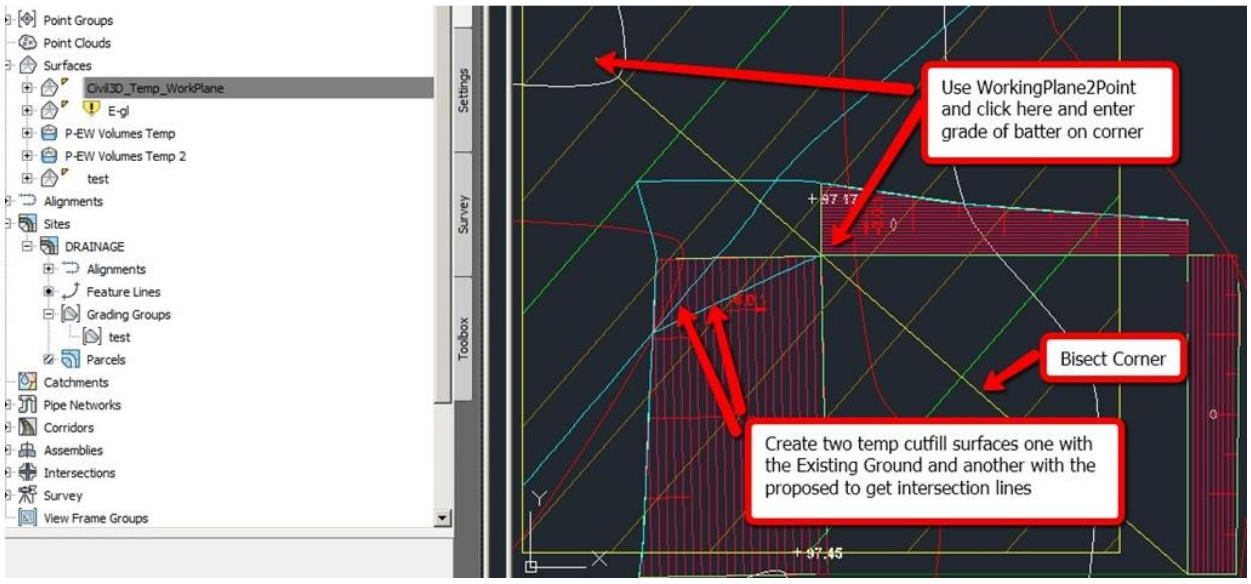
Option Two



Trim up lines, assign surface elevations and add to surface as breaklines , infill grade the corner if you want to avoid having to draw boundary.



Option Three



Trim up and add to surface as per above

1.6.7. Building the boundary

One of the most time consuming parts of any job can be creating an accurate perimeter surface boundary. This can be done in a number of ways.

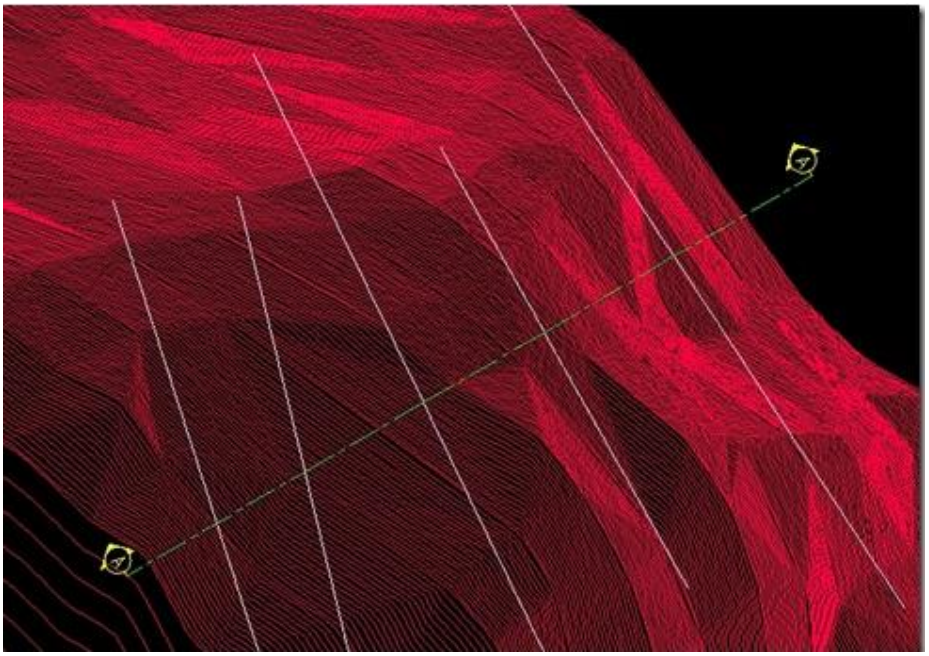
1. You can use the bpoly command and the AEClineworkshrinkwrap with entities to form a boundary.
2. You can use the surface ulitises to extract the boundaries of a surface and then edit it to form a better fit. To speed up the process you can download and use the extract boundaries command by Andrew Puller who posted it here. In civil 3d load the dll by typing "netload" on the command line and then choose the extracted ExtractBounds2012.dll.

Then type "ExtallBdy" and the command will run

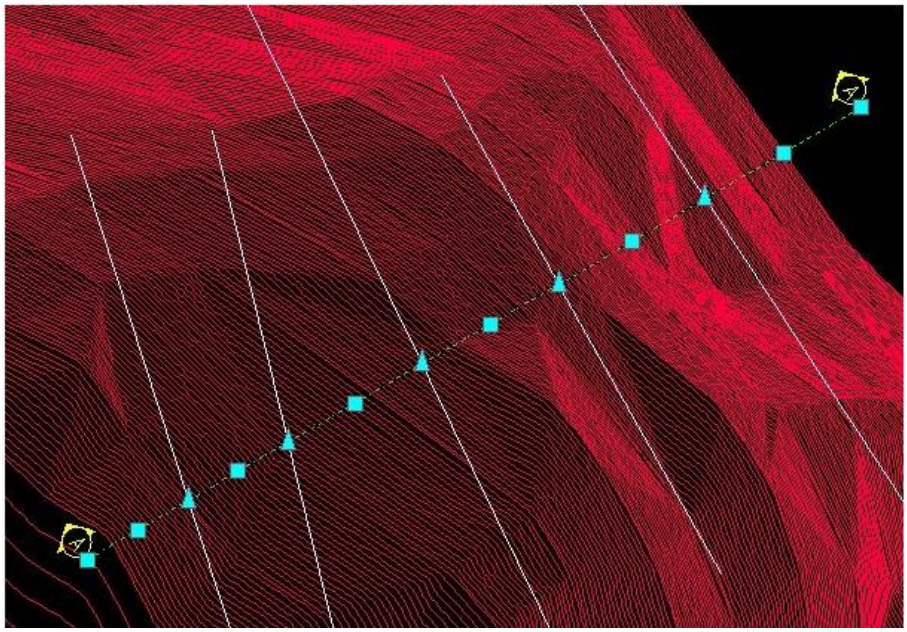
1.7. Presenting and Export grading feature data in a user-friendly format for site

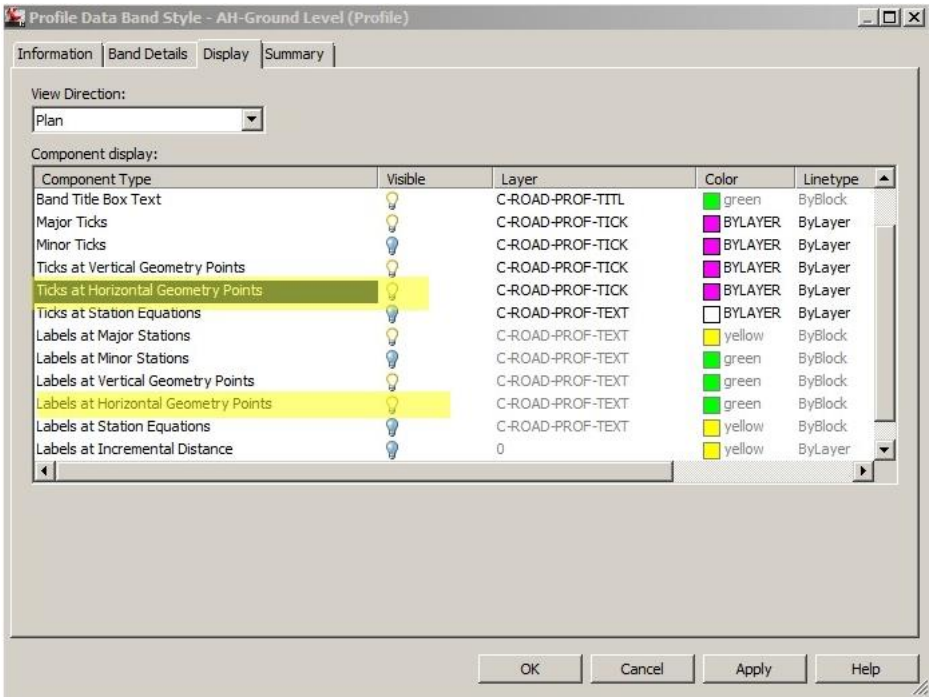
1.7.1. Mimic Sections Using Alignments & Profiles to

For a while now I have been using Alignments and Profiles to mimic individual section lines through sites on small jobs as has having to generate section as for a road way is overkill and overly time consuming.



Until recently I always had an issue with labelling the key crossing points of featurelines or other key lines in the profile then it occurred to me that by adding horizontal geometry points at the intersections and turning on the horizontal geometry point display options in the profile view would give me the data in the bands section that I prefer.





To speed up the process of adding the intersecting vertices to a polyline to then converting to an alignment, you can use this free utility or you can do a two step process using the Map Clean tools to break the lines and then join them.

1.7.2. Adding more Details

Once you have created a Cut/Fill Surface you can add a zero cut/fill line using Userdefined contours in the surface style making sure the style is set to display the UserDefined Contour sub component or use the minimumdistancebetweensurfaces command extract a polyline.

Add Cut Fill surface labels using a spot elevation surface label with Expressions as explained here

You can Mask out Existing surface ground Contours under your new surface by turning on Elevations in the surface style and then using 1 elevation and making its colour pure white 255,255,255. This will mask out the underlying existing ground surface contours leaving just the proposed ground at the front. Note: You can also use this method to display hatches of different colours to represent the staging of a projects earthworks and the benefit over a combined surface is the area of proposed work has can have contours of a different colour.

You can add silt fences Diversion Bunds to the perimeter of your work area by using the surface data extraction to get the surface boundary and offsetting that line as your silt fence or bund

1.7.3. Electronic Data

We deal with a lot of small clients that use numerous software packages other than Autodesk products. Typically ArchiCad, Chief Architect, and Vectorworks to name just a few not to mention surveyors that use 12d, CivilCad and ever one old time surveyor who had written his own DOS based software package to generate contours plans and setout data.

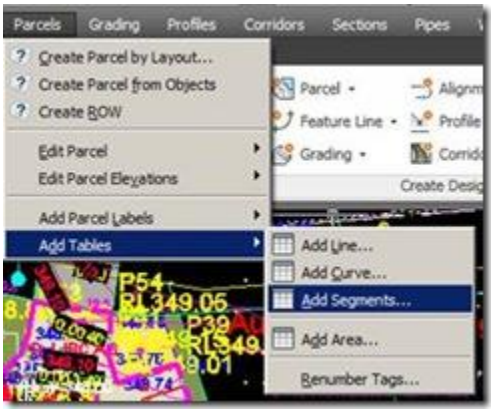
These package are unaware of more modern Civil3d objects, such featurelines so we have to provide our data to them in basic autocad formats such as 3dpolylines.

Civil3d provides Export data functionality to get basic Autocad objects out, however in doing so breaks featurelines into individual line segments. To get featurelines out as one 3dpolyline we have found that you have to explode all the featurelines and copy them out of the drawing.

1.7.4. Point Setout Table

Seeing you can not link points to featureline vertices to dynamically update (without using 3rd party tools)

We add segment labels to featurelines that look like points and then use a Parcels Segment table to generate the Northing and Eastings setout table.



The benefit of this method is the Point levels and co-ordinates are not detached from each other.
The flaws in this method are one that the segment label can not be attached to the end of start of the segment and dragged independently.Two the parcel segment table can not extract the featureline start and end z elevations to add them to the setout table.

If you have to provide point data you can generate a point group of vertices of the featurelines just prior construction hopefully once all changes have been bedded down.

1.7.5. Cut/Fill Surface labels

1.7.6. Setup Plan Views

Use your layer filters to setup your production drawings. Some people may prefer to use a Civil3d No_Display Style, No_plot Style to control the visibility of Civil3d objects during there drawing and plan production process. I found that during plan production you may want to have an object on one viewport and not another. Now a Civil3d object can not have two Civil3d Styles so layers still have to be used to display or hide the objects if on a separate layer.

1.8. What if things go wrong

Recover, Audit, Couple of tools at “Being Civil” blog for checking featurelines

You can daisy chain gradings together to make swales channel,etc

1.9. Reference from over the years

AU 09 CV314-5 AutoCAD® Civil 3D® Design Straight Out of the Box: Going Where the Design Wizards Can't Always Go by Paul Baker

ParkingLotGrading Webcast by Autodesk 13 May 2006

AU 10 CV234-1 AutoCAD® Civil 3D® Caffeinated Tips and Tricks: A Yard Sale by David Garrigues

AU 10 CV228-3 Feature Line Grading for Small Projects by John Mayo

1.10. Wishes

Grading Styles Hatch worked.
QTO attached to grading infill objects of different grading styles i.e Building Platform Style give area, etc
Better boundary tool like for corridors but for selecting featurelines

1.11. Known Issues

Jumping of contours at corners of retaining walls and pools.
Sometimes infill disappear when you move featurelines.
Definitely if you change featureline styles to no display sometimes between corridors a featureline representing the berm the grading goes.
Transitions can struggle
Curves in featurelines and adding elevation points has caused me issues in the past.

1.12. Conclusions

In Summary my recipe to Successful Grading

1. Good Drawing House Keeping (try and keep the drawing as simple as possible while grading)
2. Use Layer Filters, to reduce displayed data
3. Use Layer States, to save your grading layers
4. Use POINTS or a TIN to build your surface. (Contours introduce more vertices and triangles into the surface and therefore more math requiring more memory = Issues)
5. Save before each critical action. (Like a lawyer don't ask the question if you don't know the answer, don't grade without saving unless you know the answer)
6. Use Featurelines and infill grading
7. Always delete grading by using the special "Delete Grading" command that appears on the right click menu when a grading is selected.
8. Avoid attached grading to corridors in large jobs (or be prepared for a slow drawing as there is no way to stop grading from auto calculating so on opening the grading's is re calculated and anytime the corridor is amended also)
9. Do not create surfaces automatically

One day GPS on a digger will be as common as a radio in a car or GPS in a phone, so start making great models now in preparation for the future.

Don't give up and good luck

1.13. Appendix 1:-Prerequisite

Whether you are familiar with the grading tools in Civil3d or not I would recommend you look at the first grading video presented by an Autodesk Civil3d programmer working on grading back on 13 May 2006 here or the latest one (if you can download it from the new Autodesk site, I just tried and failed).

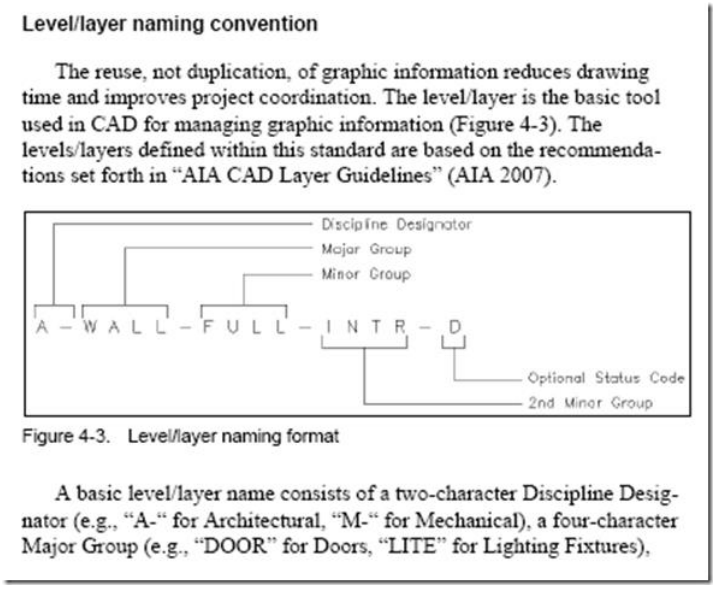
This will give you an insight into how they were thinking about grading when they were programming it into Civil3d and as the grading interface has not changed since then also the basic run down if you are new to grading.

General Autocad Tips to improve your productivity

I need to explain a number of Ribbon Modifications,Layer Filters, Command Alias's and LSP commands I will be using in the example so you can follow me.

Layer Filters

If you use the shipped NCS layer naming convention like us for Civil3d objects, then to boost your productivity you really need to get into layer filters and



Level/layer naming convention

The reuse, not duplication, of graphic information reduces drawing time and improves project coordination. The level/layer is the basic tool used in CAD for managing graphic information (Figure 4-3). The levels/layers defined within this standard are based on the recommendations set forth in "AIA CAD Layer Guidelines" (AIA 2007).

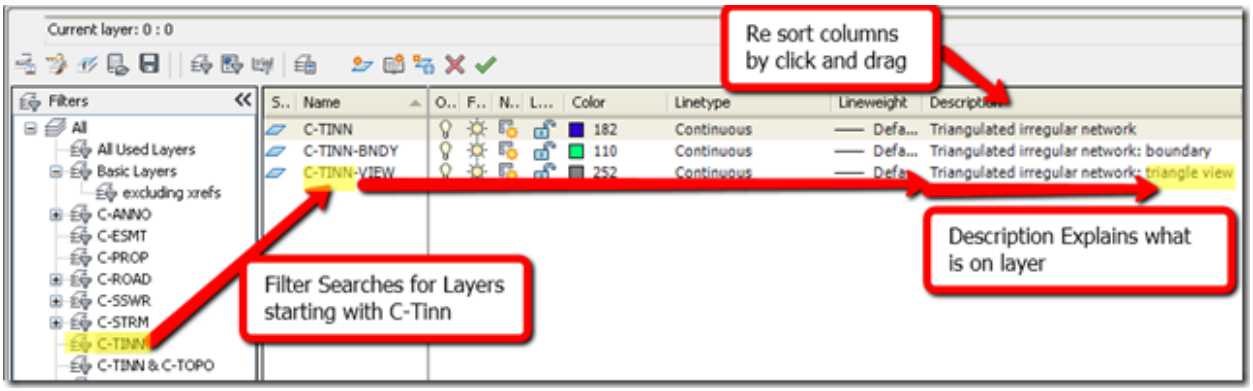
Figure 4-3. Level/layer naming format

A basic level/layer name consists of a two-character Discipline Designator (e.g., "A-" for Architectural, "M-" for Mechanical), a four-character Major Group (e.g., "DOOR" for Doors, "LITE" for Lighting Fixtures),

1. Understand the NCS Layer Naming Convention. The US military standard here gives a good overview

2. Know what Civil3d Objects and Object sub components are on what layer.

Use your filters to become familiar with this by reading the layer description column. Note you can drag the description column.

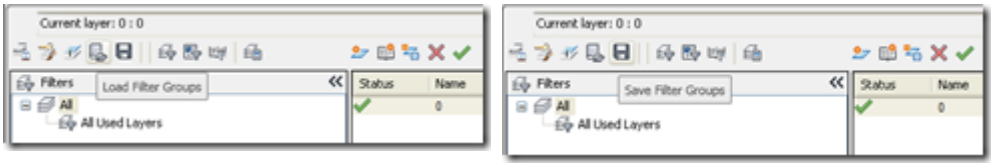


3. Be able to use the power of layer filters to categorize and sort layers quickly into relative groups.

If you have not been using layer filters up to now and to save you typing in your own standard NCS layer filters you can download my from here

Now to get the download filters into your template we have to restore a couple of buttons to the layer manager that we use to have in the 2008 (which should be in the 2012).

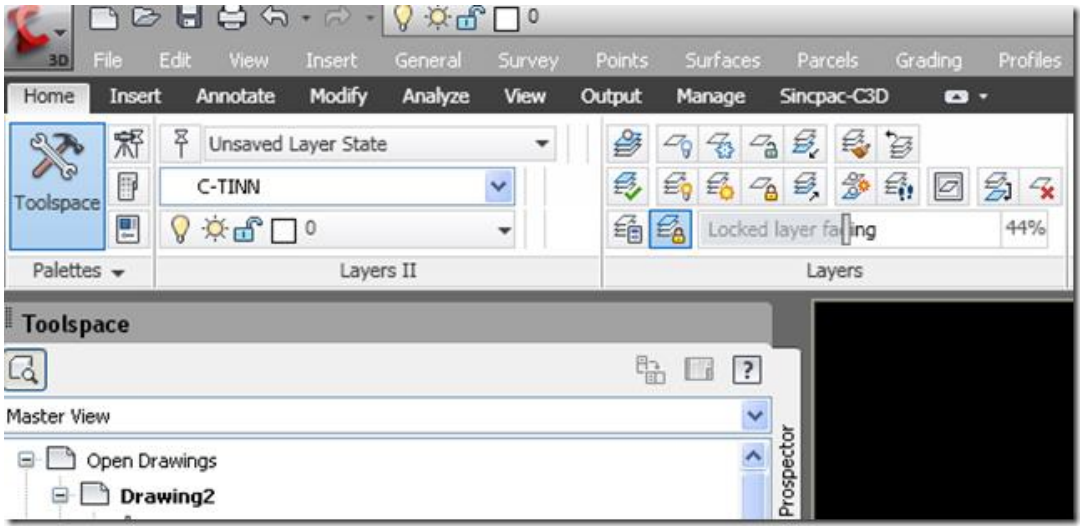
The two buttons were “Load Filter Groups” and “Save Filter Groups” and were along the top of the layer Manager Dialog



To get these buttons back and import the filters you need to add a registry entry to your computer as explained here

Ribbon Modifications

Now if you have limited desktop space or prefer to not have the layer manager open all the time but what



to access your filters quickly you can add a drop down to the ribbon and also a layer drop down to the quick access bar as shown here

Command Alias's
I use the following command alias's in my workflow
LSM = LayerStateManager
IO = Isolate Objects
HOO = Hidden Objects On
OV = Object Viewer

I have explained how to setup command Alias's here

LSP

Before having two monitors and the introduction of the right click "select Similar" command I wrote these lsp commandsmto select grading or featureline entities and jump to the object viewer using OV above quickly to visually check my model.

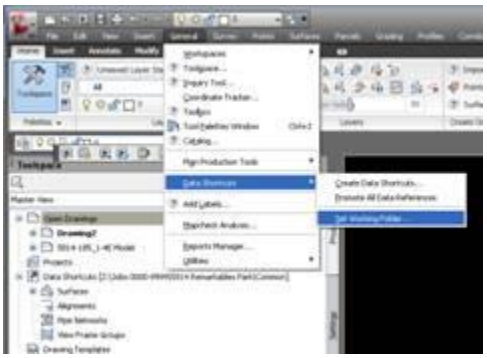
SG = Select Grading
SF = Select Featureline
SFL = Select Featureline Label

I have explained the lsp code and given a link to download the code here

1.14. Appendix 2: Setting up Datashortcuts

Some one in the Civil3d forums asked for help now to setup different project with data shortcuts so I though I would post this guide a wrote for myself a while back. Sorry some of the pictures are blurry that is what happens when I cut and paste from word to live written sometimes.

1.First we to “set the working folder” think of the working folder as the “client folder” for example the

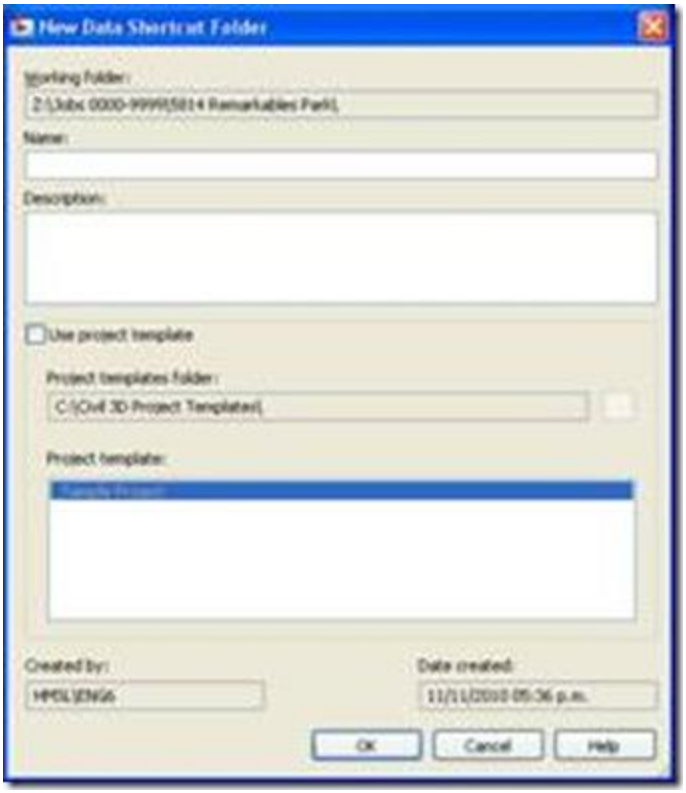


working folder for one client Remakables Park is:- Z:Jobs 0000-9999/5814 Remarkables Park

To set the “working folder” either go thru the general menu or right click on the datashortcuts item in

prospector

2. Next we have to do **<u>one of two things</u>** *either*



i. Set up a new “Data Shortcut Folder” think of this as one of the job folders for that particular client. For the Name type in the job number, If you use the template this sets up all the folder structure in the job as per the Aireys standard or the shipped civil3d standard

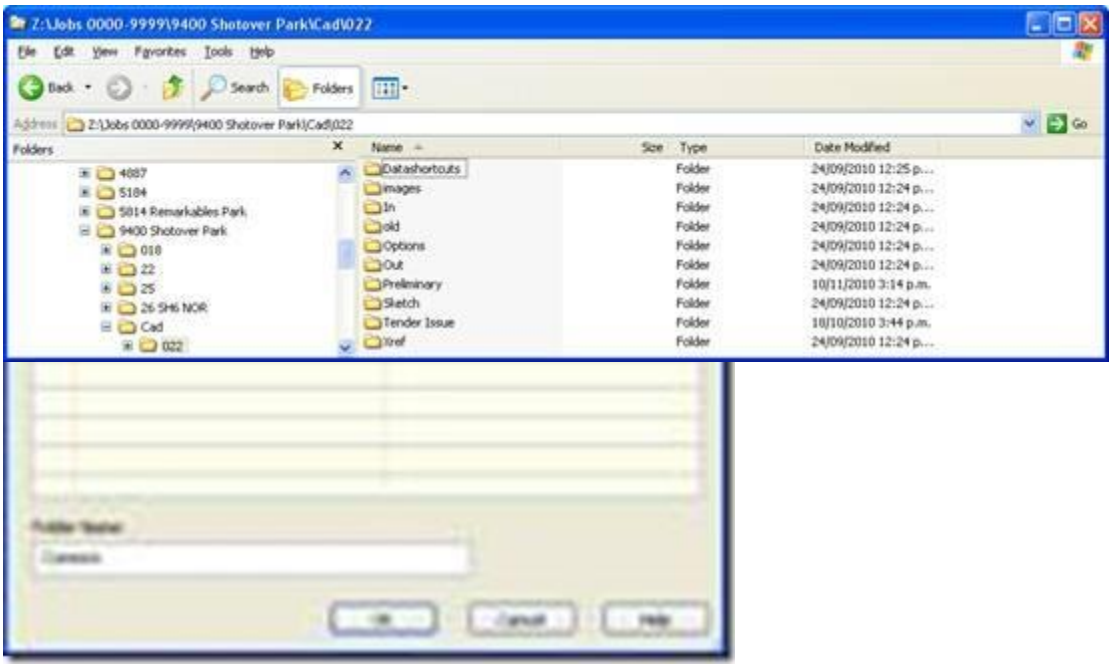
or

ii. “Set the Data Shortcuts Folder” anyone “working Folder” (i.e client folder) can have any number of jobs that have separate datashortcut files or a common datashortcuts file that is referenced regularly by numerous jobs for that client.

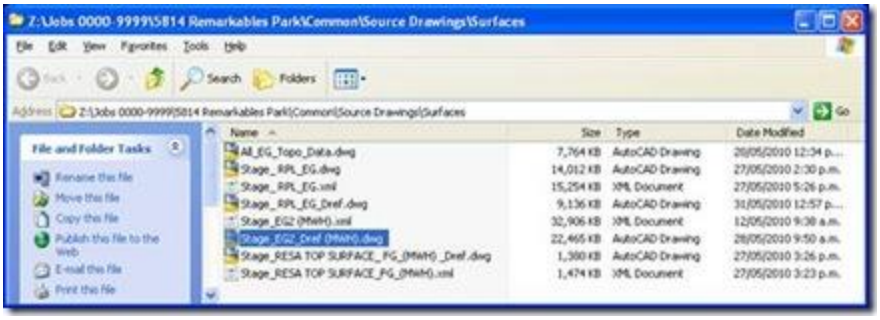
By default as soon as you set the “working folder” (i.e client folder) Civil3d detects all the “datashortcut folders” contained within that “working folder” (i.e client folder). By default Civil3d makes the most recently created “datashortcut folder” inside the “working folder” (i.e client folder) the current one being viewed in prospector. As shown below:- Note the create reference option is greyed out until you save the drawing.

“Working Folder” current “Datashortcuts Folder”

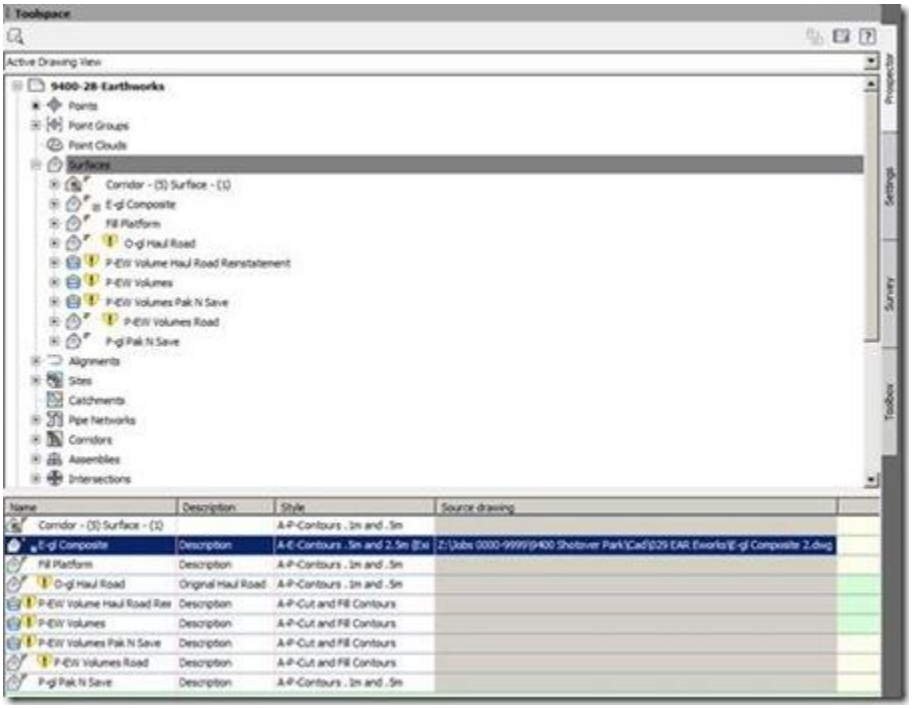
Typically on a bigger project the current “Data shortcut” will not be set automatically to the common “Data shortcut” folder that will have been created way back at the beginning of the project. To change the current “Data shortcut” folder right clicking on the Datashortcuts Row. A menu pops up with a number of other options click the “Set Data Shortcuts Folder” and the following dialog is displayed just choose the name of the folder that you want to is as the current “datashortcuts folder”



When you receive any existing topo of as built data save a copy in this folder and create datashortcuts from those drawings so that they can be used in your design drawings but you original data remains untouched in this folder.

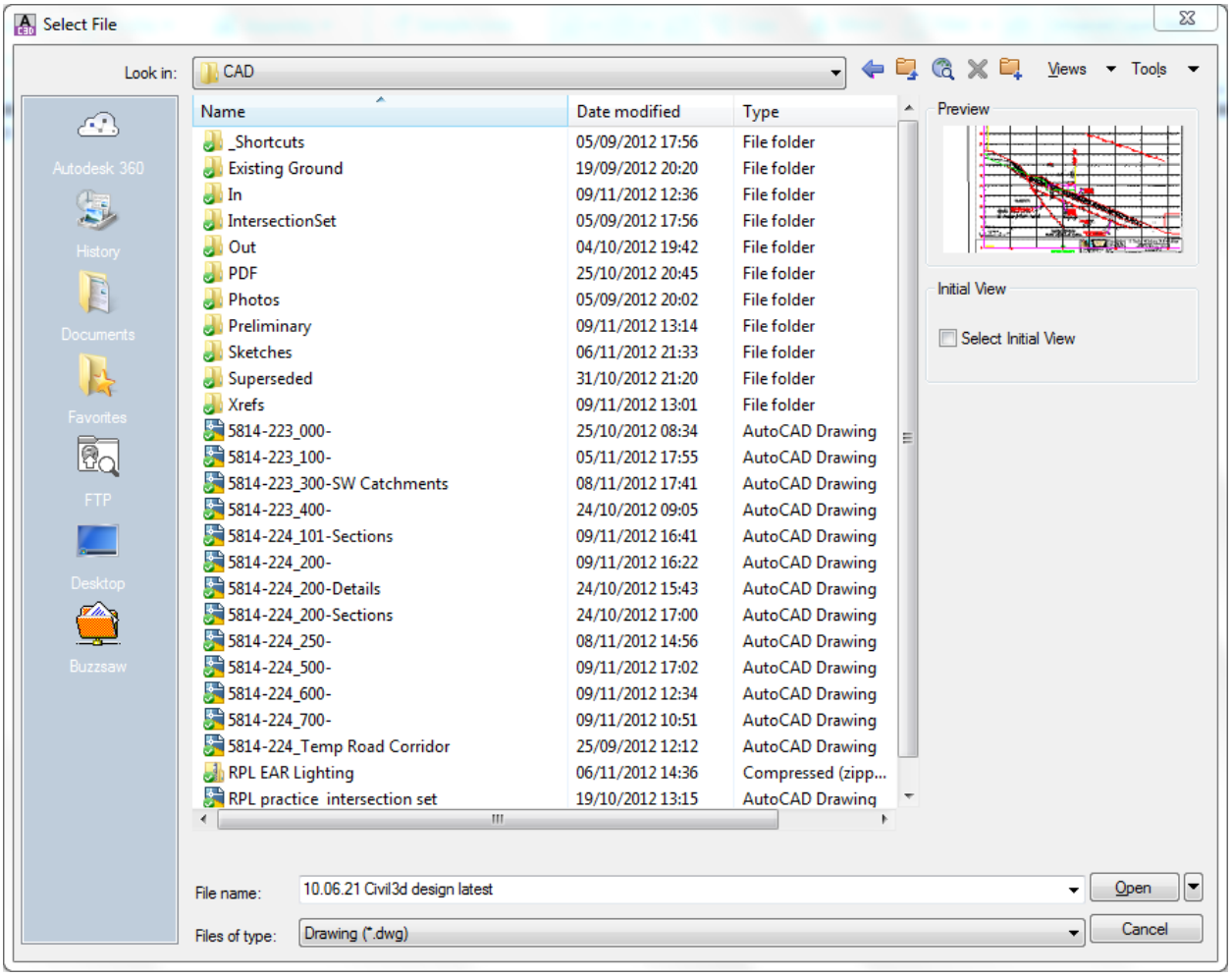


If you are not sure where I surface is sourced from select surfaces and then in panorama you see the path at the end.



1.15. Appendix 3 :Folder Structure How I currently set up my projects?

Like anything Civil3d my project structure seems to be evolving over time but this is how I currently setup my last project.



1.16. Appendix 4 :Learn Acronyms and become a keyboard wirzard

Learn 1 to 3 letter acronym's to use the keyboard to trigger commands

Number of possible combinations

$$N_{combinations} = \frac{n!}{k!(n-k!)}$$ where n = number of letters in the alphetbet

k =length of the acronym

Number 1 Letter combinations

$$N_1 = \frac{26!}{1!(26-1!)} = \frac{26!}{1!25!} = 26$$

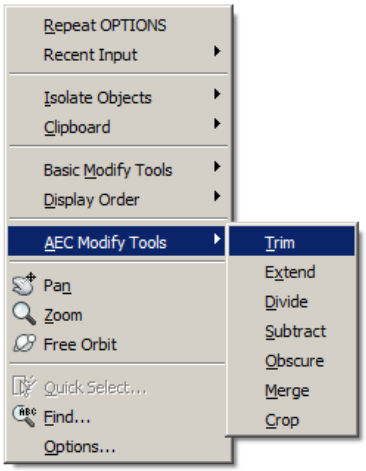
Number 2 Letter combinations

$$N_2 = \frac{26!}{2!(26-2!)} = \frac{26!}{2!24!} = 325$$

Number 3 Letter combinations

$$N_1 = \frac{26!}{3!(26-3!)} = \frac{26!}{3!23!} = 2600$$

Total Number of possible combinations = 2951 say 3000 between friends



Commands fired by these shortcut commands

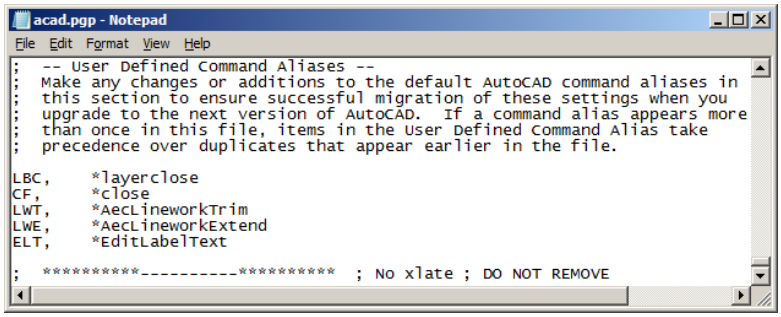
_Aec**L**ine**w**ork**T**rim

_Aec**L**ine**w**ork**E**xtend

To add acronym's command alias for this long commands

Open the acad.pgp file by selecting the following from the menus

Tools->Customize->Edit Program Parameters(acad.pgp)



Save and close the acad.pgp file

Type **reinit** at the commandline and reload the .pgp file.

Autodesk University **2012**