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This series will show you advanced modeling building modeling techniques using Leica's Cyclone.

Hint: You can click on any image to see a larger version.

As objects become more complex, using layers (Shift + L) becomes essential to organizing and controlling the model space.

CHOOSE YOUR MODELING METHOD

As noted, it is best to model features in individual ModelSpaces, re-inserting them into the original ModelSpace upon completion. Often features, such as windows, will repeat on structures or sites. Whether each feature is modeled individually or modeled once and then repeated depends on the discretion of the user and the nature of the subject. New, modern structures (such as office buildings) are well-suited to modeling features once and repeating them as they often utilize standardized materials and building methods. Older and/or deteriorating structures/sites are better-suited to modeling features individually as time, movement, and building methods often result in more organic, unique features. As always, the method of modeling depends on the subject and the user's intentions.

COPY WORKING AREA

1. Copy working area to new *Working ModelSpace* (for example, you may be modeling an entire building but at the current stage, you are inserting a repeating window into a wall; in this case, copy the **wall** to a *Working ModelSpace* and model individual **windows** in a *Feature ModelSpace*. These temporary modeling spaces will be re-inserted into the overall building model later)

2. In *Working ModelSpace*, create base model in which to insert repeating feature (in this example, create the wall) -> Place on its own layer -> Insert Copy of Object's Points

3. Within *Feature ModelSpace* (MS where window is modeled) -> Select all objects making up feature -> Edit -> Group -> Copy -> Close Feature MS (**do not** merge into original!)

ASSIGN GROUP TO ITS OWN LAYER

4. Within *Working ModelSpace* (MS where larger wall has been copied) -> Paste -> Assign Group to its own layer

Note: As long as the coordinate systems have not been altered, the feature will paste into the correct location within the *Working ModelSpace*. This original feature will be the only copy whose location is directly linked to the point cloud data at this point. When the feature is subsequently copied and placed within the working ModelSpace, accuracy to the original data is dependent on how copies are placed by the user and how the points are used/referenced in placement.

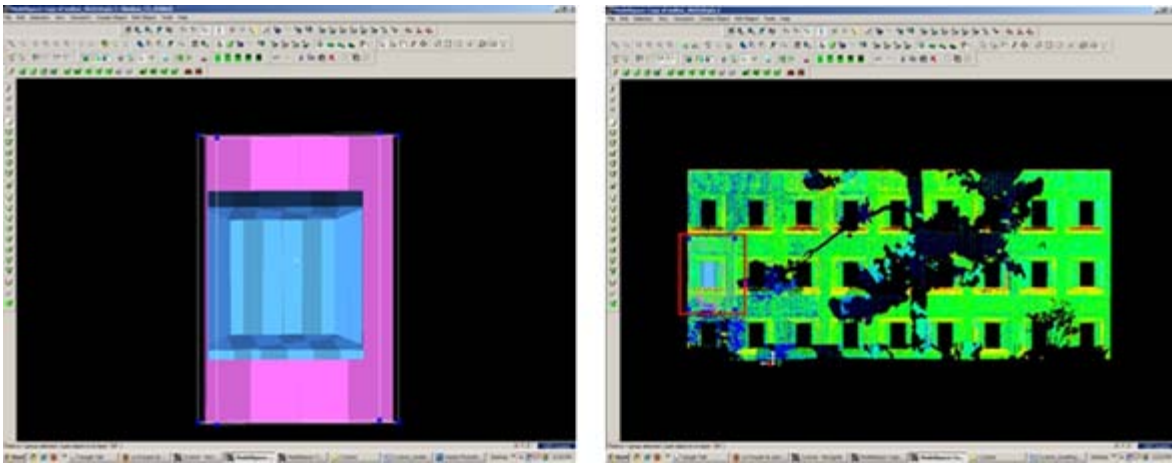


Figure 15 – (Left) Complex feature is grouped and copied (Right) Feature is pasted into the working ModelSpace – note that the feature inserts into the correct position based on the original scan data

DEFINE A “COOKIE CUTTER”

5. If the repeating feature requires a repeating opening, draw a polyline on top of the inserted group to define the opening (this polyline will be used as a “cookie cutter” to make subsequent openings in the wall surface; polyline opening should be **slightly smaller** than the feature to be inserted -> Place cookie cutter polyline on its own layer

6. Use polyline to create opening in primary (wall) patch (follow steps for “*Creating Repeating, Identical Openings*”) -> this opening now reveals the grouped window within the primary wall surface

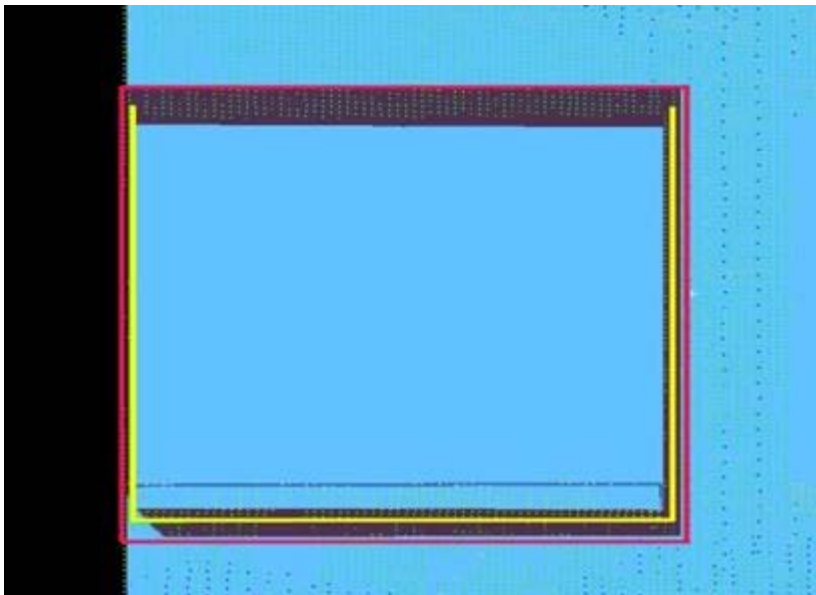


Figure 16 – The large magenta rectangle highlights the entire group; the yellow polyline (representing the “cookie cutter” used to create openings in the primary surface) is slightly smaller than the group

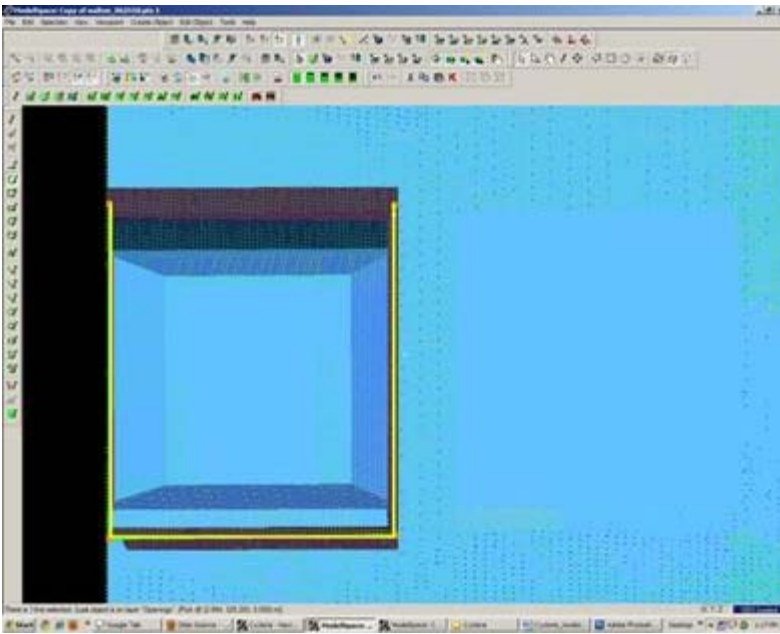


Figure 17 – Opening has been made and the grouped window is revealed – note the yellow polyline “cookie cutter” and the group can be copied and repeated on the primary wall patch

7. Select the Window Group and the “cookie cutter” polyline -> Copy to the next location; there are several methods for placing the repeating feature; two possibilities are outlined below, however different options can be mixed/matched:

7A. Copying and Locating by Pick Points > Multi-select 1st) Group/window 2nd) cookie cutter polyline 3rd) Point representing location where copied object is to be placed -> Create Object -> Copy

7B. Copy dialogue box appears and points that have been chosen are numbered -> Direction of Move, click on blue arrow -> Point to point, define points to use for direction of move and ok -> Distance of move, click on blue arrow -> Point to point, define points to use for distance and ok -> At main dialogue, confirm objects are correctly identified in the “Apply To” pull-down menu -> Copy

Note: If pick points do not show up correctly when copy dialogue box appears, you can re-define pick points while copy command is active; simply multi-select new pick points before defining direction and distance

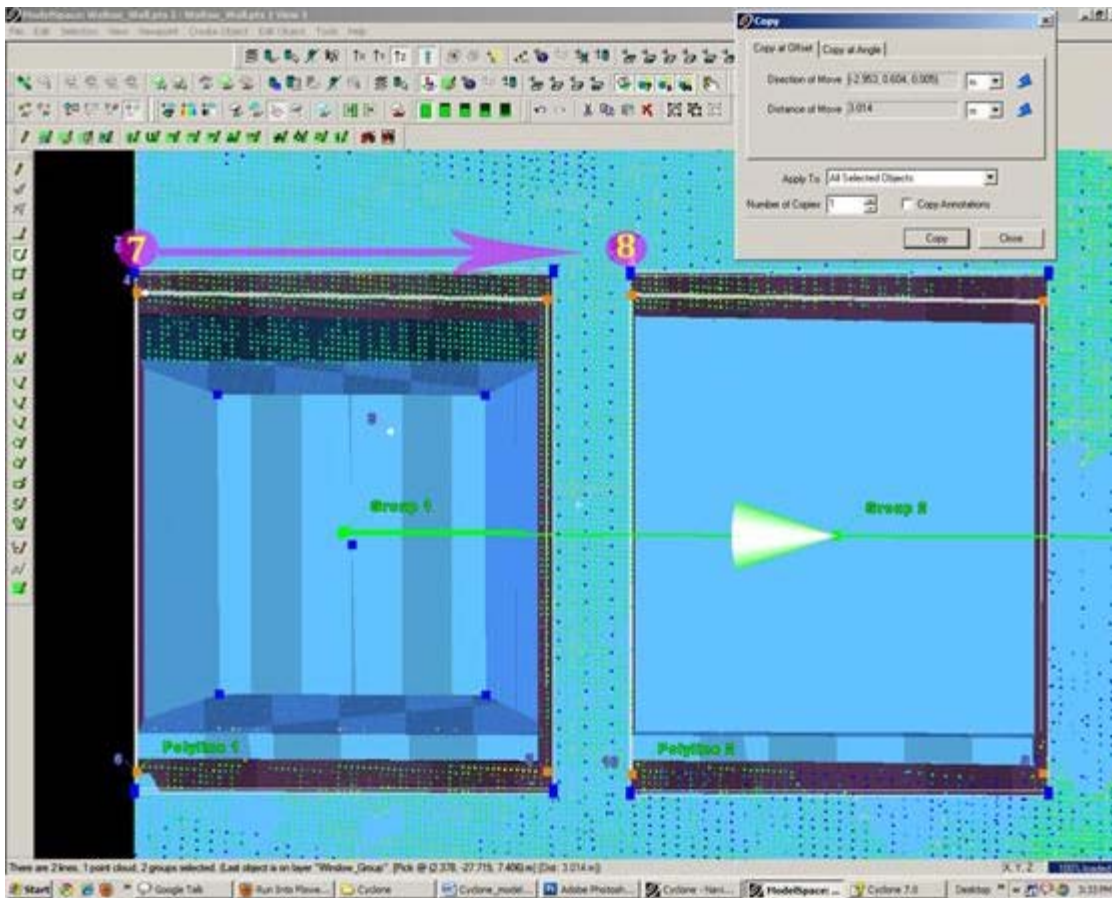


Figure 18 – Window Group and Polyline are copied with Cyclone’s green arrow showing direction of copy – note that in this case, both the direction and the distance of the copy are from Point 7 to Point 8

MULTIPLE COPIES BY DISTANCE AND AXIS

7C. Multiple Copies by Distance and Axis > Multi-select points representing 1st) the starting location of the object to be copied 2nd) the offset distance the object will be copied to -> Tools -> Measure -> Distance -> Point to Point -> Annotation showing distance appears

7D. Continue multi-select command -> Select Object(s) to be copied -> Create Object -> Copy -> Direction of Move -> Choose Axis and ok (arrow appears showing which axis will be used for the copy – note that the direction copy is placed along axis is defined by a positive or negative number in the distance)

7E. Distance of move -> Custom -> Enter amount derived with measure command and ok (a negative or positive possible determines the direction on axis) >Main Copy Dialogue box -> Enter Number of copies – note that copies will be offset from each succeeding copy, NOT from the original start location -> Confirm command applied to objects correctly -> Copy

NOTE: Any error will increase as distance increases; therefore it’s important that you examine each copy for accuracy and manually adjust as needed, especially those copies at the greatest distance from the original

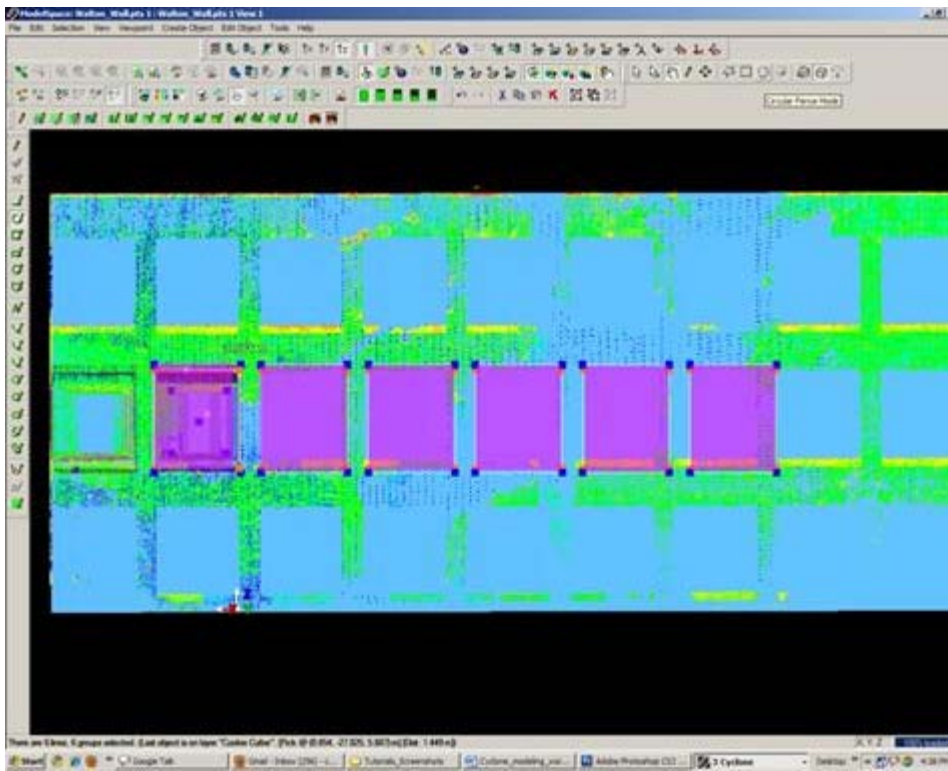


Figure 19 – Multiple copies (highlighted in magenta) are offset from one another; openings can be seen in the green, point cloud data – note that as distance increases from the original left group, the error between the proposed opening/group and the accurate opening in the point data also increases and must be adjusted

REFINING THE PLACEMENT OF REPEATING FEATURES

8. Refining the placement of Repeating Features – as noted, small errors in distance increase with repetition/distance. Using the point cloud and the constraints in Cyclone are essential to accurately placing and locating features. In this example, the primary patch (the wall) is located along the x-axis. As succeeding windows become mis-aligned with the actual point cloud openings, windows are adjusted individually to rectify the model with the point data.

For **distance moved**, specific points are used – in this case the window sill protruded creating a discernible corner to match with the model's sill corner.

Direction moved is restricted to the x-axis – this ensures that (1) the succeeding windows stay horizontally aligned with the original and (2) all windows stay along the same plane (the main wall where original window was placed).

Note: Surfaces are very rarely perfectly orthogonal and flat; rather they usually have fluctuations and they deviate from perfect angles. As such, when comparing a flat surface that has been modeled to the point cloud data, points should appear dispersed on both sides of the plane/patch; all points **should not** be completely located on one side or the other as this indicates the plane is not directly referencing the points.

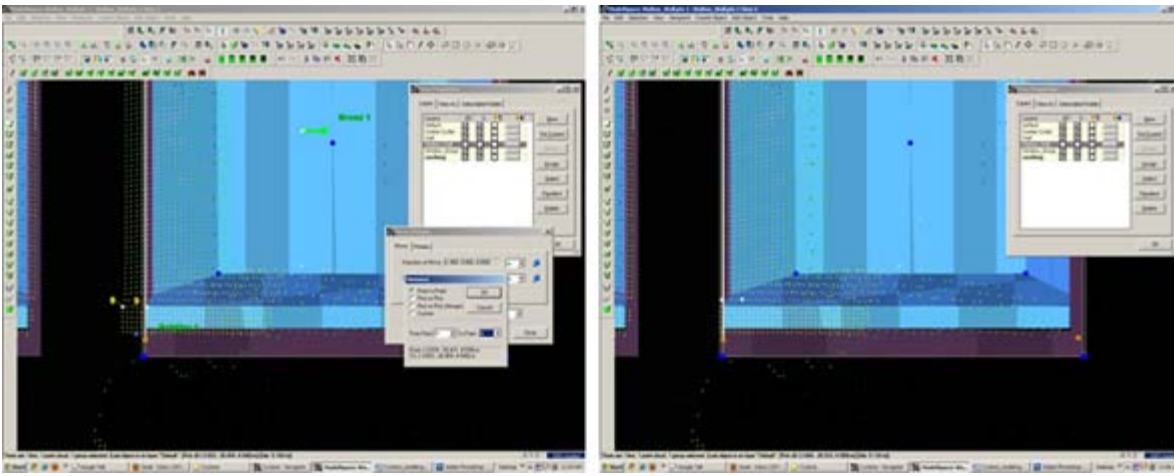


Figure 20 – (Left) A window is misaligned with the point cloud data; zooming in allows the user to use the points very precisely; movement by picking points allows accurate placement of specific features, such as corners, while moving by a standard axis allows orthogonal alignment with other objects, planes, and references (Right) Window is rectified with the x-axis and specific points on the window sill. Note that the visibility of the primary patch (the main wall) has been turned off for clarity of other layers.

MISSING DATA AND COMBINING RESOURCES

9. Missing data and combining resources – While point cloud data and axes help accurately place most features, in some cases data is simply not present. In these cases, utilizing other resources is essential to creating a complete model that is as accurate as possible. In this example, a tree left a large shadow in the wall and placing windows within this shadow becomes difficult with point cloud data alone.

Utilizing measurements – finding the average distance between other windows and placing the windows in shadow at this offset helps place the windows fairly accurately.

Comparing the model with the photographic data collected during scanning further assists in accuracy.

CREATE OPENINGS IN PRIMARY WALL PATCH

10. Once each group has been evaluated and placed accurately -> use the cookie cutter polyline to create openings in the primary wall patch as shown in Step 5 of this section -> Erase or hide the polylines as needed once used (erase if merging back into the original ModelSpace and lines are no longer needed; hidden if copying into original ModelSpace and you want to maintain reference objects in the working ModelSpace).

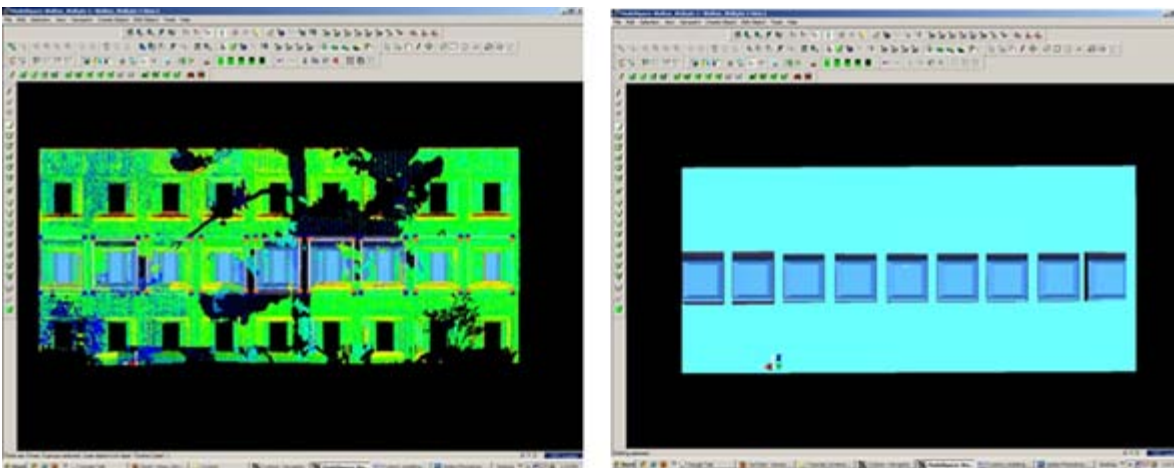


Figure 21 – (Left) Windows, in dark blue, have been individually analyzed and adjusted for accuracy with the point

cloud, in green (Right) Openings have been made in the primary wall patch, in light blue; the dark blue window groups are revealed.

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As objects become more complex, using layers (Shift + L) becomes essential to organizing and controlling the model space.

MODELING AN ANGLED WINDOW OPENING

A. Modeling a Complex Shape – An Angled Window Opening

1. **Copy area to be modeled** into new, working ModelSpace
2. **Familiarize yourself with the object** and the different layers/depths in space that you are working with; when angles are involved it's good to understand where each angle terminates.



Figure 8 (Left) Complex window to be modeled (Right) Familiarize yourself with the layers of space to be modeled – here yellow represents the farthest plane (the glass) and orange represents the closest plane (the wall in which the window is set)

DIVIDE INTO SUB-SELECTIONS IF NESSCEARY

3. It may be useful to divide the point cloud into sub-selections based on their depth in space or on separate areas to model – Rotate the object to view it from the side or top view -> fence the area to be subselected -> RC ->

Point Cloud Subselection -> Add Inside Fence

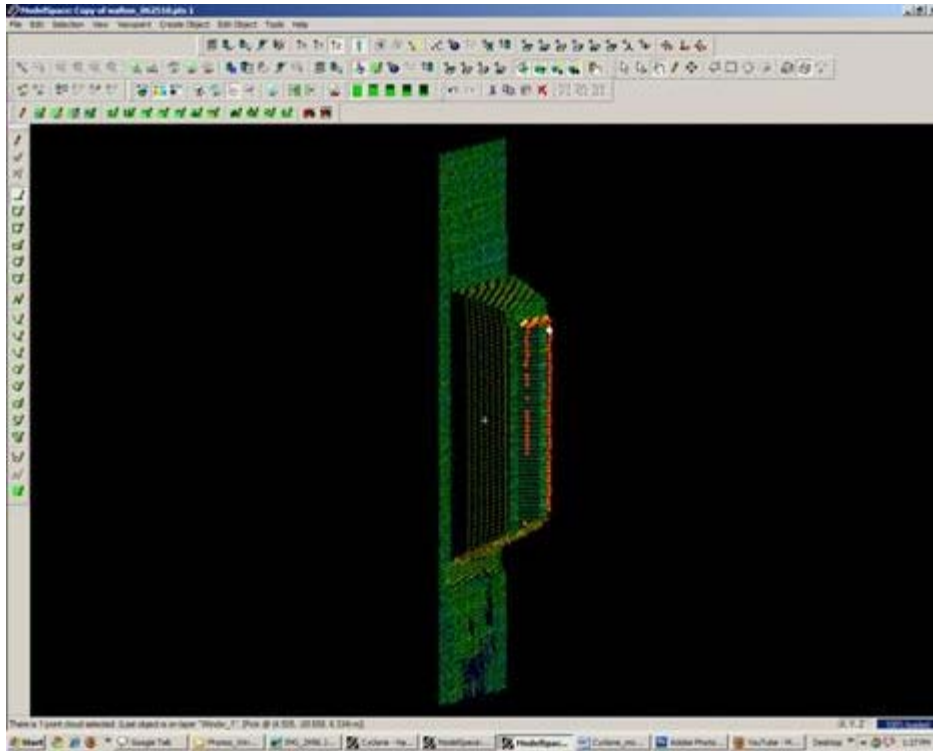


Figure 9 – Point cloud is sub-selected into several clouds based on their depth in space

MODEL THE OBJECT

4. Model the object using patches, extensions and extrusions as previously outlined – when modeling angled or complex surfaces, patches can be created several ways. When fencing an area and fitting a patch, fence the area that best represents the surface – exclude areas where the surface becomes skewed or extreme near boundaries, curves, etc.

5. While snapping adjacent patches together and extending them, extra handles are often created. It's best to clean up the patches as you go of any extra handles/geometries to maintain simple, clean lines where possible:
Select Patch -> ALT + RC on extra handle -> handle removed

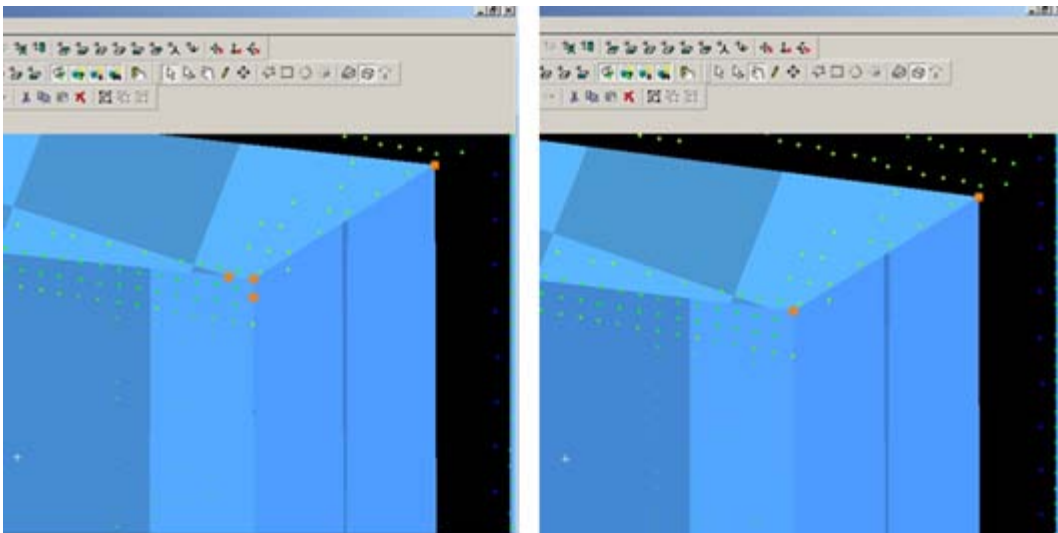


Figure 10 – (Left) Extra handles have been created where the patches intersect (Right) Extra handles deleted, leaving the cleanest, simplest geometry possible

MODELING TIPS

6. As objects become more complex and angles become more complicated, it may be helpful to visually clarify and define the objects. This can be done several ways, including editing object colors and creating lines along the edges of objects that are intersecting. Lines create crisp edges and create wireframe objects for export later.

6A. Change Object Color -> Select Object -> Edit Object -> Appearance -> Choose color

6B. Creating Lines where objects intersect: Once the patches/objects have been extended to one another > Mult-select 2 intersecting patches -> Create Object -> From Intersections -> Curve (Note that in Cyclone, a curve here is a line. Also note that sometimes lines will extend beyond the object. Select the line -> slide the handles so beginning and end of line is within the object -> use handles or extend command to make the lines form corners) **NOTE: It's recommended to place lines/polylines on their own layer to aid in there selection and visibility later.**

MORE MODELING TIPS

7. While modeling complex objects, you will encounter areas where surfaces exist but there is no point cloud data to model directly from. Extruding and extending will often produce these surfaces but sometimes creating polylines and customized patches may be the best way to model these areas. Using the handles of previously modeled objects helps maintain the accuracy of the scan data.

7A. Align view to see the vertices of existing objects to use as guides for the edges of the proposed patch.

7B. Choose handles/points to create the new patch – select the points in the order you wish to draw the polyline that will define the edges for the patch. Do not close the polyline, leaving the last line segment open.

7C. Create Object -> From Pick Points -> Polyline -> Assign Polyline to its own layer

7D. Create Object -> From Curves -> Patch

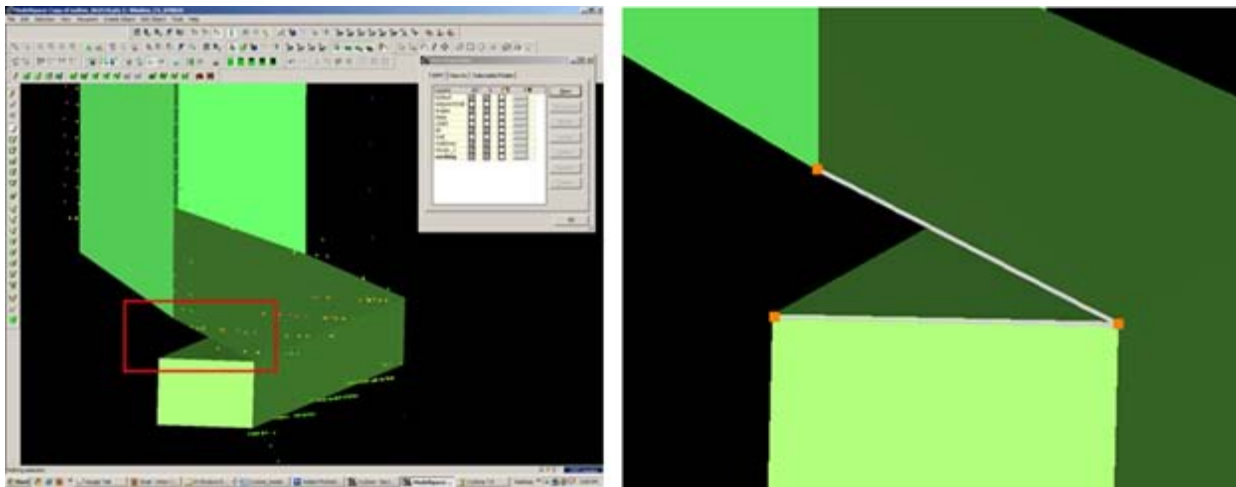


Figure 11 – (Left) Objects have been created from point cloud however no data exists for the area inside the red rectangle (Right) Handles of the previously modeled objects are used as pick points to define the edges of the custom patch – note that the final side of the polygon is left open

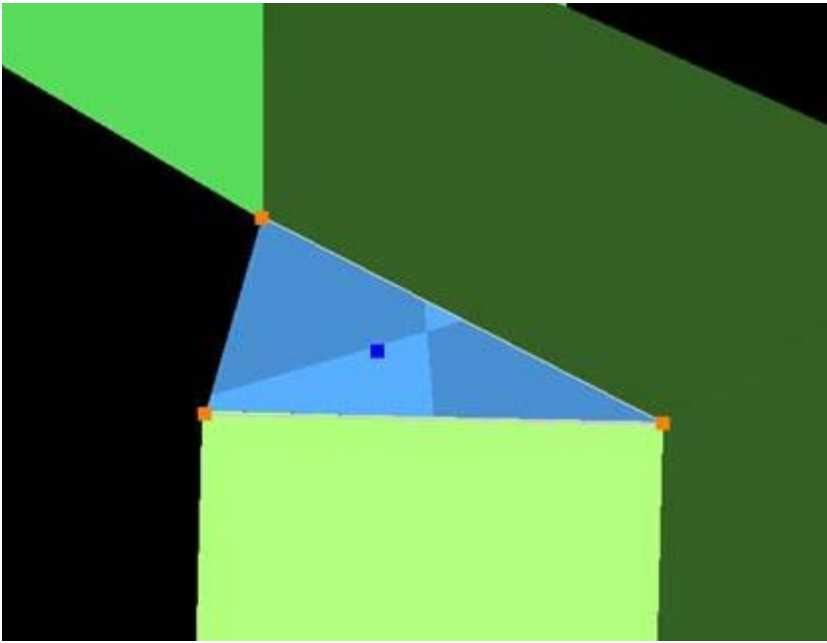


Figure 12 – Polyline that was formed from pick points is used to create new custom patch

GROUPING

Helpful Hints -

Grouping: Whether repeating a complex feature or using it only once, it's a good idea to group the various objects together to maintain the integrity of the individual objects and their intersections. Both small and large ScanWorlds can be best controlled through:

(1) **Copying specific areas to a new ModelSpace** to model individually > Fence > RC > Copy to new MS

(2) **Grouping complex features** after they are modeled > Select All Objects that compose complex feature - > Edit -> Group

NOTE: Select all objects, NOT points in the grouping; Items may be ungrouped and removed from groups through the same command

HINT – VISIBILITY AND SELECTABILITY

Hints

Visibility and Selectability – As complexity increases the use of layers becomes crucial. You can control which layers are visible and selectable in the layers dialogue box during an active command; this becomes very useful as points, objects, and lines become placed on top of one another)

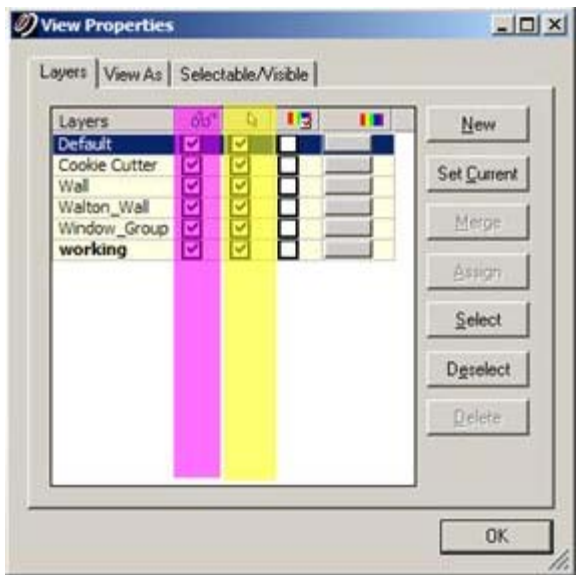


Figure 13 – Magenta highlights the column showing whether layer is visible; yellow highlights the column showing whether layer is selectable – these attributes can be toggled as needed during active commands

HINT – ACTIVE COMMAND

Hints

Active Command Dialogue – The command dialogue at the bottom of the screen is also very useful as models become more complex. It lists everything that is selected (line, point cloud, group, etc), and as each item is selected, the dialogue shows the layer of and the specific coordinates of each

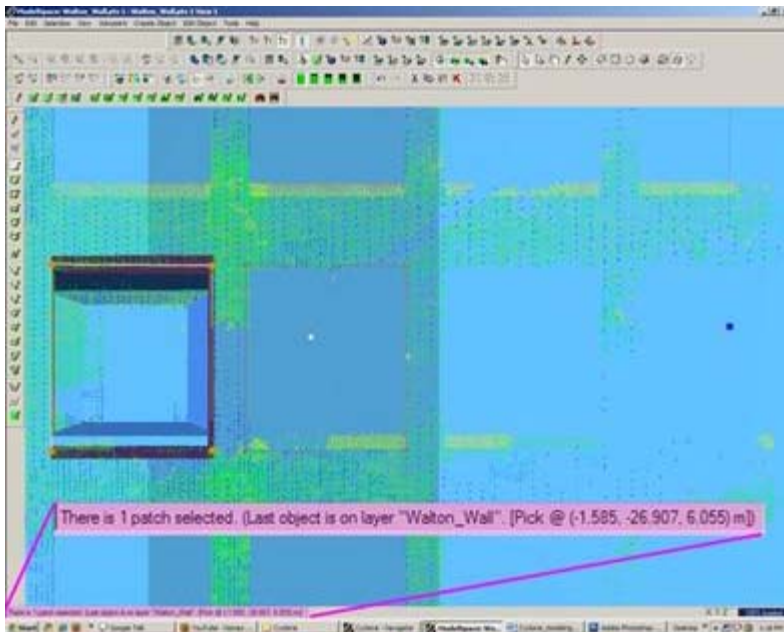


Figure 14 – The dialogue line at the bottom, left of the screen shows information about the items that are actively selected.

HINT – EXPLODE COMMAND

Hints

Explode Command - When a volumetric object is used or when a patch is exploded, it may be necessary to break the volume into individual planes -> Select Object -> Create Object -> Explode

CONTINUE TO...

Continue to [Modeling and Placing Repeating Features](#)

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This series will show you advanced modeling building modeling techniques using Leica's Cyclone.

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SELECT OBJECT

Note that restoring the original points that are removed when an object is created is essential to placing openings or to creating more complex features within an object.

I. Select Object -> Right Click -> Insert Copy of Object's Points. Also note that if/when the working ModelSpace is merged back into the original ModelSpace upon closing, all objects and points are merged so any re-inserted points should be considered (most likely deleted) before merging into the original MS.

II. Once the points have been inserted, Align View so that object being modeled is perpendicular to screen (see GMV Guide 'Model a Non Rectangular Patch'). There are several methods to creating openings, depending on their geometry and whether the opening is repeated:

CREATING A SINGLE OPENING

A. Creating A Single Opening:

1. **Create primary patch/wall** in which hole is to be made
2. **Select Object** -> Right Click -> Insert Copy of Object's Points.
3. **Create Fence** that is completely inside intended opening
4. **Select the primary patch** -> Edit Object -> Patch -> Subtract

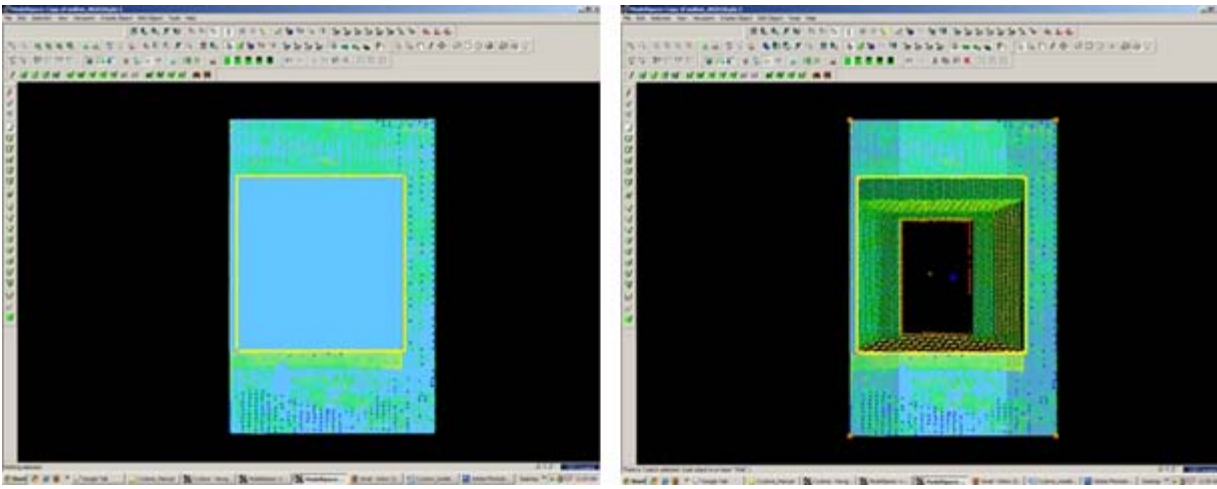


Figure 5 (Left) Primary Patch with copy of points inserted and fence drawn- note the fence for the proposed opening is completely within the patch; (Right) Fenced area subtracted from primary patch

CREATING AND REPEATING IDENTICAL OPENINGS

Â B. Workflow for Creating Repeating, Identical Openings:

1. **Create primary patch/wall** in which opening is to be made
2. **Select Object** -> Right Click -> Insert Copy of Object's Points.
3. **Multi-select points to outline the intended opening** -> Create Objects -> From Pick Points -> Polyline (Recommendation: Assign this polyline to a new layer to make it easier to use later)
4. **RC -> Fence** -> From Selection
5. **Select Primary Patch** -> Edit Object -> Patch -> Subtract
6. **Select Polyline** -> Select handle + CTRL to move to next location -> Repeat Steps 1-6 (Note the polyline can be edited by using the handles if succeeding openings differ)

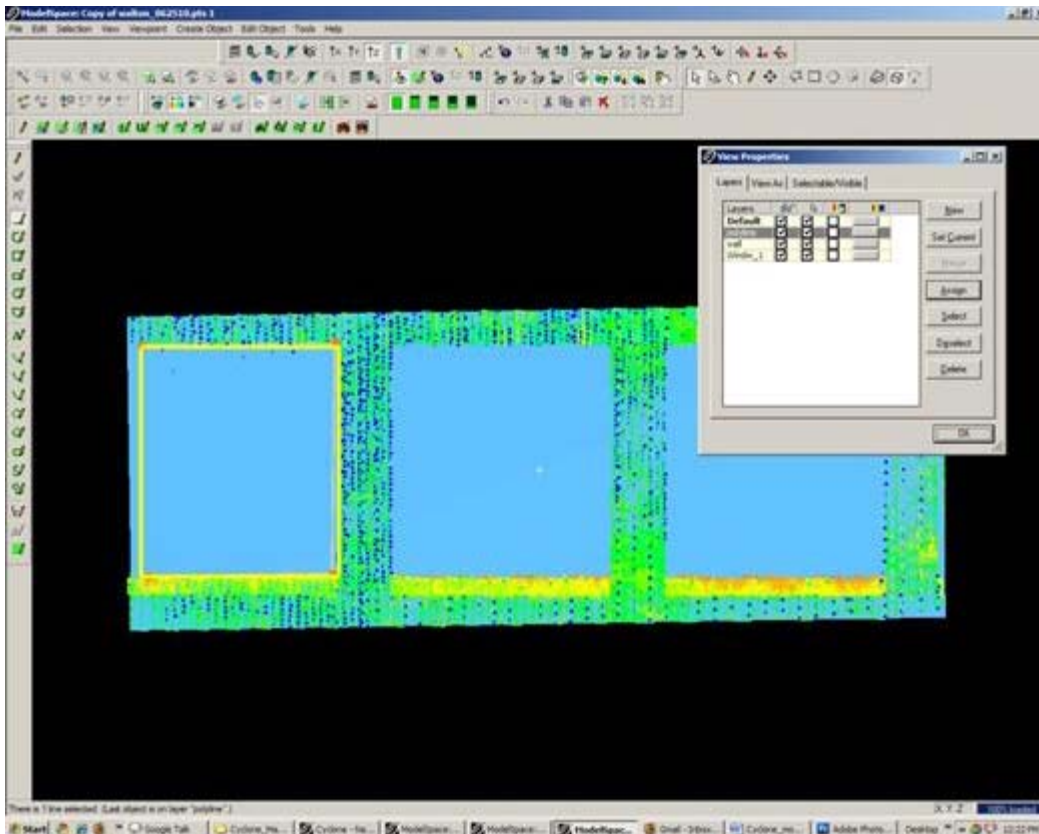


Figure 6 Polyline is created from points and placed on its own layer on the first of a series of identical openings

EXAMPLE

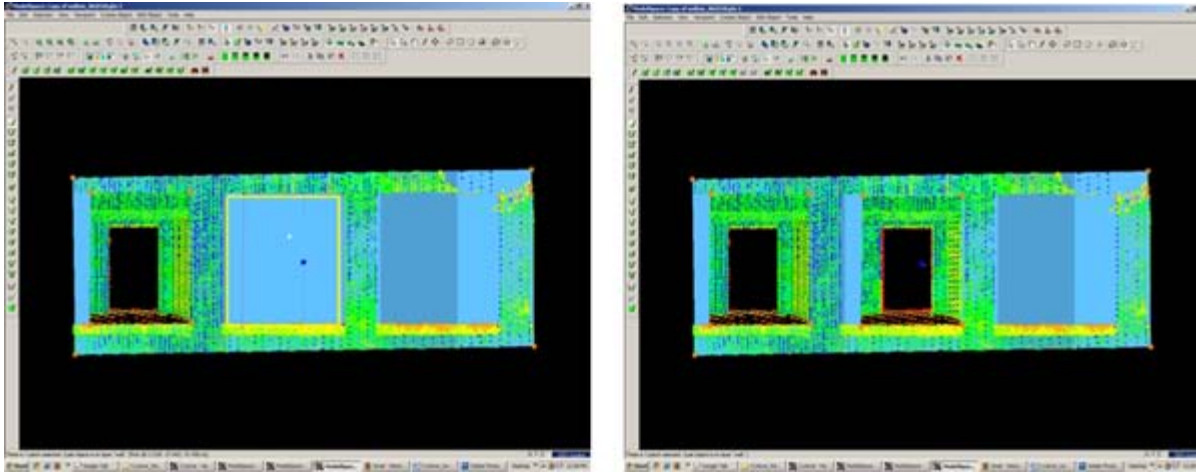


Figure 7 (Left) First opening has been subtracted from the primary patch and the polyline has been moved to the second proposed opening; (Right) Identical second opening has been subtracted

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This series will show you how create a mesh and model surface topography in Leica's Cyclone

Hint: You can click on any image to see a larger version.

SELECT POINTS

9. Select Points (when dealing with large areas, selecting several points results in more surface points being sampled in the surface growing process) -> Create Object -> Region Grow -> Smooth Surface -> Cyclone runs the region grow by default settings to show the initial view and the dialogue box – Adjust Surface Characteristics and click ‘Restart’ to preview results -> Click OK when satisfied with preview:

Hardtop Surface (this is generally chosen for fairly uniform areas with paved or hard surfaces; if dealing with rolling unpaved terrain, uncheck this option). Viewing the point cloud with color from scanner or hue intensity is recommended for this process Per Cyclone 7.0 Glossary: *“This command is used to segment a selected smooth surface in a point cloud. The points representing the smooth surface are merely segmented from the point cloud; no object is inserted. This command is not available for use with a pcE file (pcE cloud).”*

DECIMATE AND SUBDIVIDE

10. Decimate Mesh (per Leica Trainer July 2010 current bug in meshing command) -> Select Mesh -> Tools -> Mesh -> Decimate -> Maintain 100% of original triangles, vertices, and exact boundary edges -> Decimate allows pre-view -> OK to accept

11. Subdivide areas by breaklines -> Select Boundary Breaklines and Mesh -> Tools -> Breaklines -> Extend Polylines to TIN -> (NOTE: This command extends a polyline onto a TIN object, creating edges in the mesh based on the projection of the polyline vertically onto the mesh – although polyline itself does not change. The edges are

stretched vertically to conform to the polyline's shape – If select command through Breaklines submenu, polyline will be converted to breakline on the mesh; if select command through polyline submenu, resulting line will be a geometric object

NOTE: If errors appear 😞 1) Select Mesh -> Tools -> Mesh -> Verify TIN -> If TIN is not valid, the number of invalid faces will be listed and the faces will be selected -> Tools -> Mesh -> Delete Selection -> Repeat this verification and deletion process until TIN successfully verified; (2) If errors regarding polylines overlapping -> Select Polylines -> Tools -> Drawing -> Align vertices to axes

ADDITIONAL STEPS

12. Re-insert break lines (copied in Step V) -> Copy from temporary location -> Paste into working mesh MS

13. Editing Triangles and Spikes -> In layers dialogue box -> View As tab -> Apply to **Mesh** -> **Wireframe** -> **Apply & OK** ->

14. In top view, fence in problematic triangle(s) causing spike -> Fence -> Delete Inside -> Select hole (highlights cyan) -> RC -> Mesh -> Fill selected hole

EXPORTING

15. Exporting 3D Lines, Mesh, Point Cloud -> There are several options for exporting topographic features. The objects created through tracing and meshing can be exported or the point cloud itself can be exported.

A. Export the lines, polylines, arcs -> Use the properties manager (Shift + L) to turn off the visibility/selectability of the point cloud -> Select All -> File -> Export

DXF R12 Format – This retains 3D information (in this case the z-coordinate for the lines); Do not select 2D DXF R12 Format

Objects may also be exported as ASCII or XML file types here

Once exported, the .dxf file can be opened in CAD, imported into Sketchup, or converted for use in multiple software.

B. Export the mesh -> Select mesh -> File -> Export -> Select file type for destination software

C. Export the Point Cloud -> Newer versions of Autodesk products (2009 and beyond) support point clouds. If you do not have Cyclone but you do have CAD, use Cyclone to export the points and then trace/model in CAD software much as we have done in Cyclone. The main issue is file size when importing into CAD; in general, point clouds must be broken into smaller pieces to allow them to be imported. See the CAST workflow, 'Reducing Point Clouds for Autodesk **Applications**' for more details.

NOTE: In general, a .PTS file with a maximum size of 4mb will import into CAD

Create new layers for the breaklines and features (Shift + L) -> Review the area to be modeled identifying where the surface changes and/or where the user wants a clean break or difference between adjacent surfaces. Create layers for primary and secondary features as needed.

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workflows/leica-cyclone-creating-a-mesh-and-modeling-surfacetopography-3/

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This series will show you how create a mesh and model surface topography in Leica's Cyclone

Hint: You can click on any image to see a larger version.

INTRODUCTION AND DEFINITIONS

In this guide, a **mesh** is considered to be a series of triangles that represents a surface. Cyclone generates meshes by using the points in a point cloud, vertices, polylines, or any combination of the three as vertices. For each adjacent trio of points in a cloud, a triangle is created. This has the effect of creating a visually coherent surface from the point cloud, and it is the primary method for modeling topography.

Break lines are lines or polylines that sub-divide the mesh; they represent the edges of a paved surface, a ridge, a channel, or any other topographic feature that the user wants to preserve. While mentioned in 2D topographic tracing, break lines become very important in meshing. Here, they have an accurate z-coordinate and they become the edges that the triangles in the mesh conform to, defining and controlling the smoothness and continuity of the mesh. They allow the user to break-up the mesh into reasonable "chunks" for future texturing and detailing.

Please see 'Leica Cyclone - Creating a Basic CAD Objects From Surface Topography (2D)' as a supplement to this workflow.

OPEN A REGISTERED UNIFIED MODEL SPACE

1. Open a Registered Unified Model Space -> Create fence around ground plane -> Right Click -> Copy Fenced to new Model Space (NOTE: viewing from a standard side, front, or back view in orthographic mode assists in selection) -> Original MS may be closed

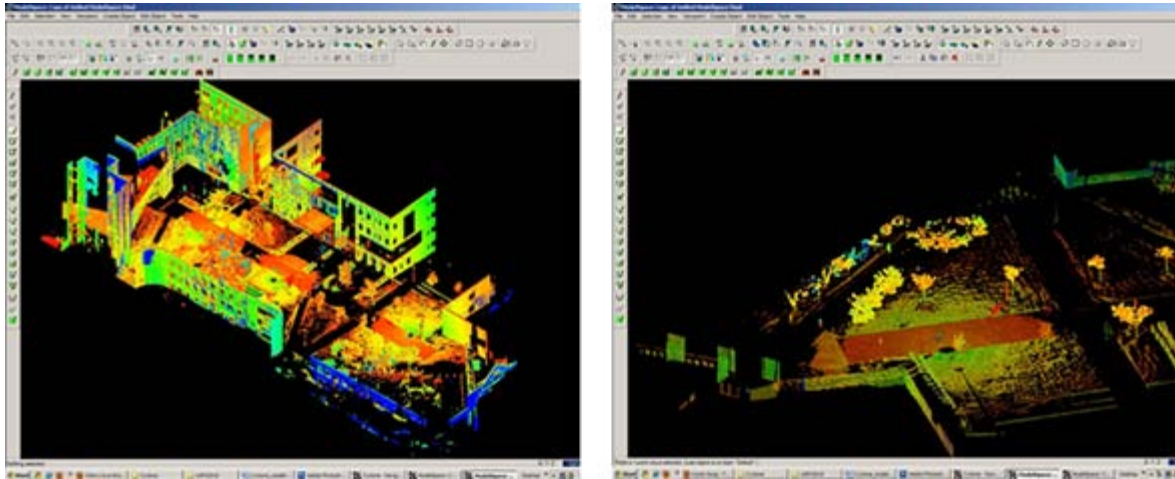


Figure 1 – (Left) Original registered scan world of plaza (Right) Point Cloud Sub-Selection (Select -> Right Click -> Point Cloud Sub-Selection) allows unneeded points, such as trees and vertical surfaces, to be deleted; Sub-selection allows the user to precisely choose and view points before deciding to delete

SELECT AND DELETE UNNEEDED POINTS

2. In the new Working MS -> Select and delete unneeded points (it's best to eliminate as much vertical surface data as possible so that the ground plane to be modeled is isolated; objects in motion, such as trees/vegetation can be especially problematic and cleaning up areas where these are abundant is suggested; eliminating data that may be

present inside buildings or areas that will not be modeled is also suggested)

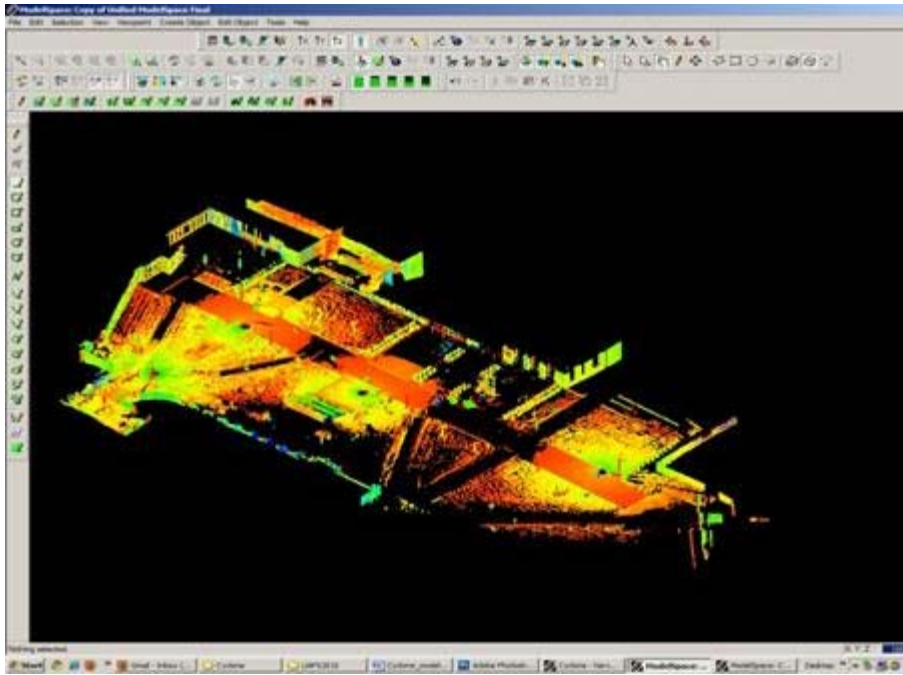


Figure 2 – The same plaza as Figure 1 now copied to a working MS and “cleaned” of unneeded vertical surfaces and vegetation leaving only the ground plane to be modeled.

CREATE NEW LAYERS FOR THE BREAKLINES AND FEATURES

3. Create new layers for the breaklines and features (Shift + L) -> Review the area to be modeled identifying where the surface changes and/or where the user wants a clean break or difference between adjacent surfaces. Create layers for primary and secondary features as needed.

4. Create lines to represent the topography and features, assigning an accurate x, y, and z coordinate -> There are several ways to make lines including (1) using 2D drawing methods (covered in ‘Topography and Site Elements – 2D’ above) (2) with pick points, (3) by extending an existing line (4) by snapping two existing lines together (5) by creating a polyline with Fit Edge command, and (6) by merging polylines together.

See Help -> Contents -> Search -> ‘Make Lines, Polylines, and Breaklines’ for steps for each of these methods. There are additional variations of each. **BEWARE:** Lines created by pick points cannot be used for break lines in meshing; if picking points, be sure to create a polyline rather than a line segment.

TIPS

5. Tips

A.Â If drawn in 2D, use Edit Object -> Move/Rotate to move the object to the correct z-coordinate; there are multiple options moving objects including by a standard axis and pick points.

B.Â Create additional break lines following the feature or edge of the break lines; place these to break up the mesh and around the boundaries, segmenting out areas where a topographic ground plane is not needed (ie: inside buildings)

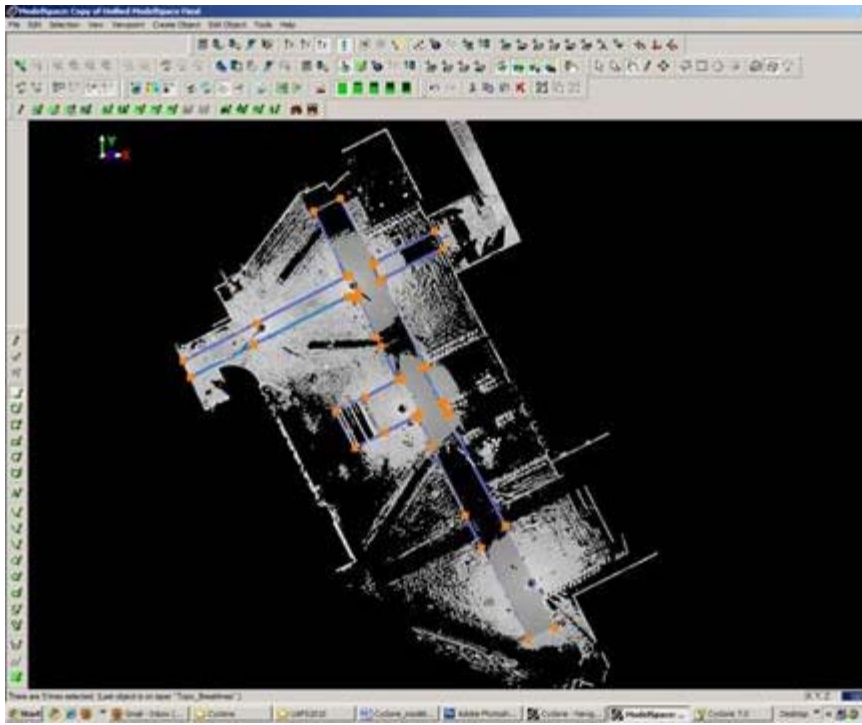


Figure 3 – Top view of plaza; Polylines have been created to outline where the sidewalk and grass meet; orange handles help highlight the polylines

MORE TIPS

More Tips:

C.Ā Use multiple views to confirm line is properly located at all angles and handle constraints (Edit Object -> Handles constrain to -> Various options – NOTE: once placed in top view, constraining handles to z-direction helps placement in 3D)

D. Try different methods to see what works for you. With all, use multiple views to confirm the line is properly located at all angles

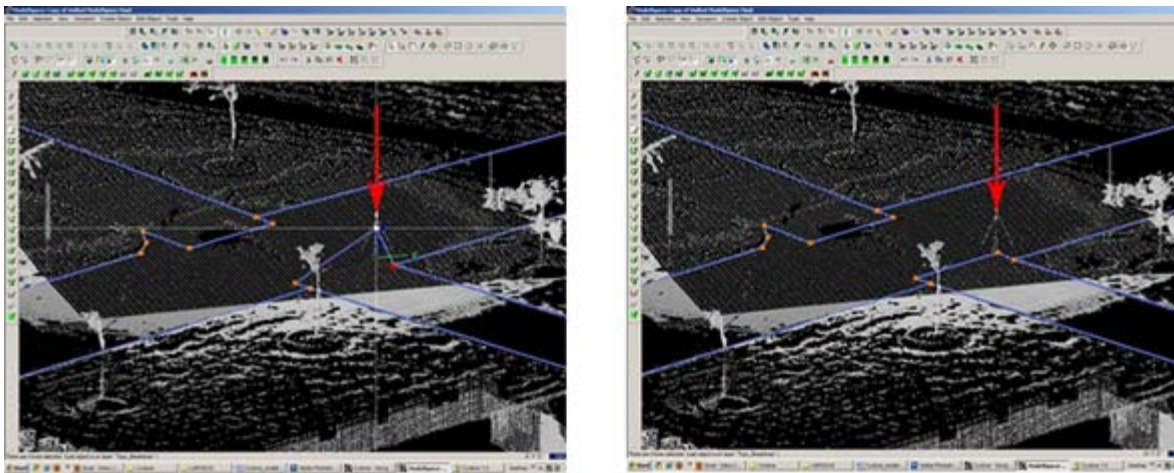


Figure 4 – (Left) Although from Top View, the breakline looks correct, inspection from a different angle reveals that it is not correct (Right) Handles and constraints (Edit Object -> Handles -> Constrain Motion) are used to pull the polyline into the correct position – every section of every breakline should be inspected from multiple views

FINAL STEPS

6. Create handles at places where polylines intersect (Select line -> ALT + Select point on line for new handle to help snap lines together).

7. Delete all points beyond boundary of mesh -> Select polyline representing boundary of mesh -> Right click -> Fence -> From Selection -> Fence -> Delete outside

8. Delete points within other breaklines to remove any remaining points that should not be considered in the creation of the mesh -> Copy final breaklines to original or temporary working space in case altered/needed in future

8. Unify points reducing spacing to 1 foot to start and adjust settings for desired results.

CONTINUE TO...

Continue to [Creating the Topographic Mesh](#)

]]> <http://gm.v.cast.uark.edu/scanning/software/leica-software/leica-cyclone/cyclone-workflows/leica-cyclone-creating-a-mesh-and-modeling-surfacetopography-3/feed/0> <http://gm.v.cast.uark.edu/uncategorized/leica-cyclone-7-1-1-subdividing-large-point-clouds-for-autodesk-applications-final-images-from-example-2/>
<http://gm.v.cast.uark.edu/uncategorized/leica-cyclone-7-1-1-subdividing-large-point-clouds-for-autodesk-applications-final-images-from-example-2/#comments> Mon, 09 Apr 2012 19:11:16 +0000 caitlin 5 meters]]>
<http://gm.v.cast.uark.edu/?p=6015>

This page will show you examples of sub-divided point clouds.

Hint: You can click on any image to see a larger version.

TOP VIEW

VI. Final Images from Example

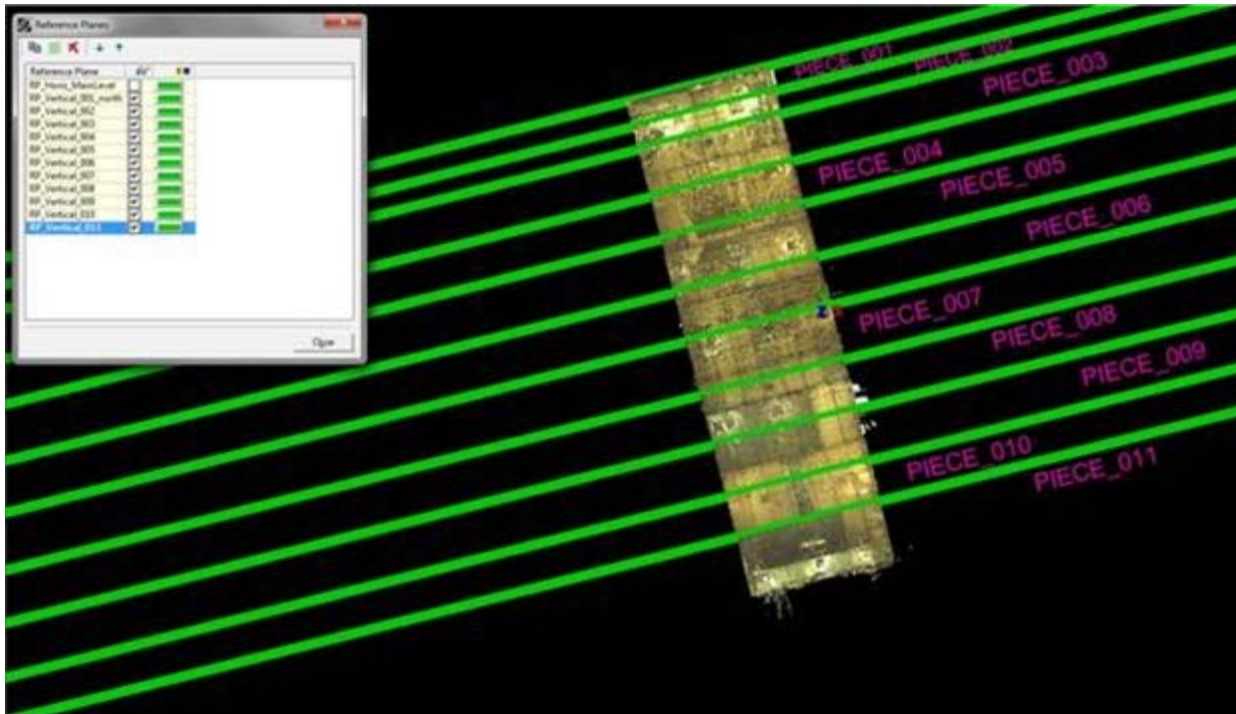


Figure 16 – Top view of the building with all of the vertical RP™s visible; note the top-most RP (above Piece_001) is the original vertical RP that was created from the wall/patch and defined the direction of the grid and the division

SIDE VIEW

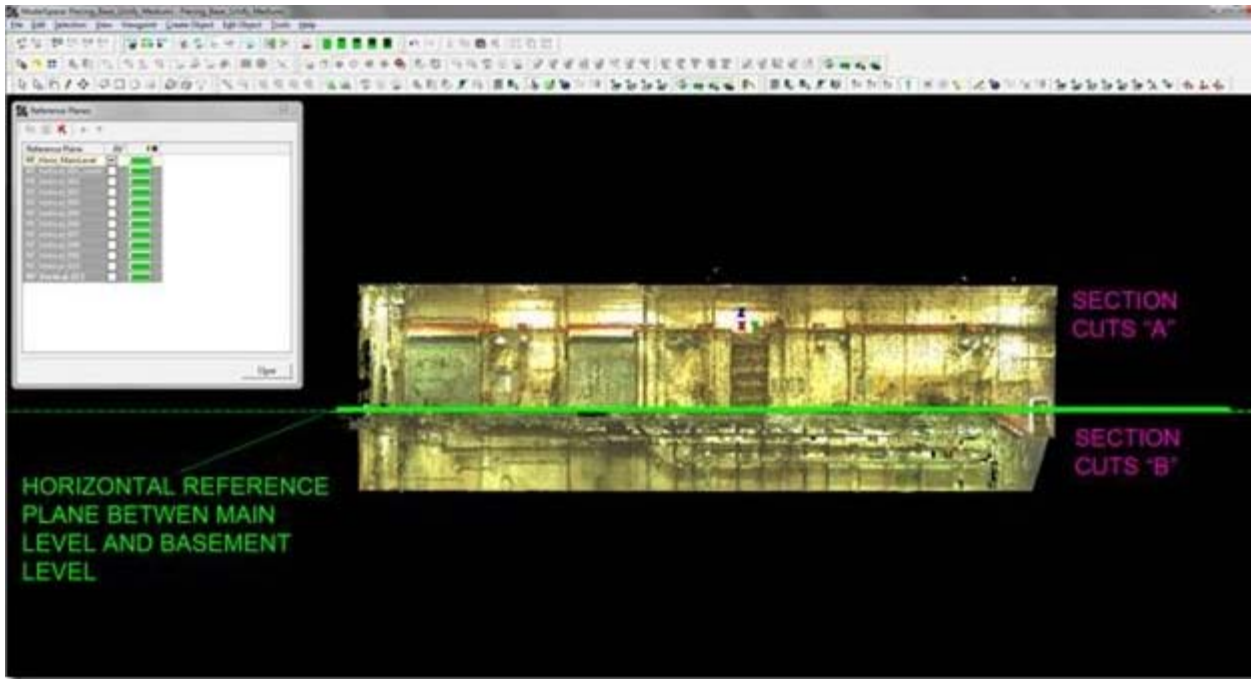


Figure 17 – Side view of the building with the single horizontal RP that was used; note that this was the original, default RP that was moved to a point on the floor of the main level.

SIDE VIEW

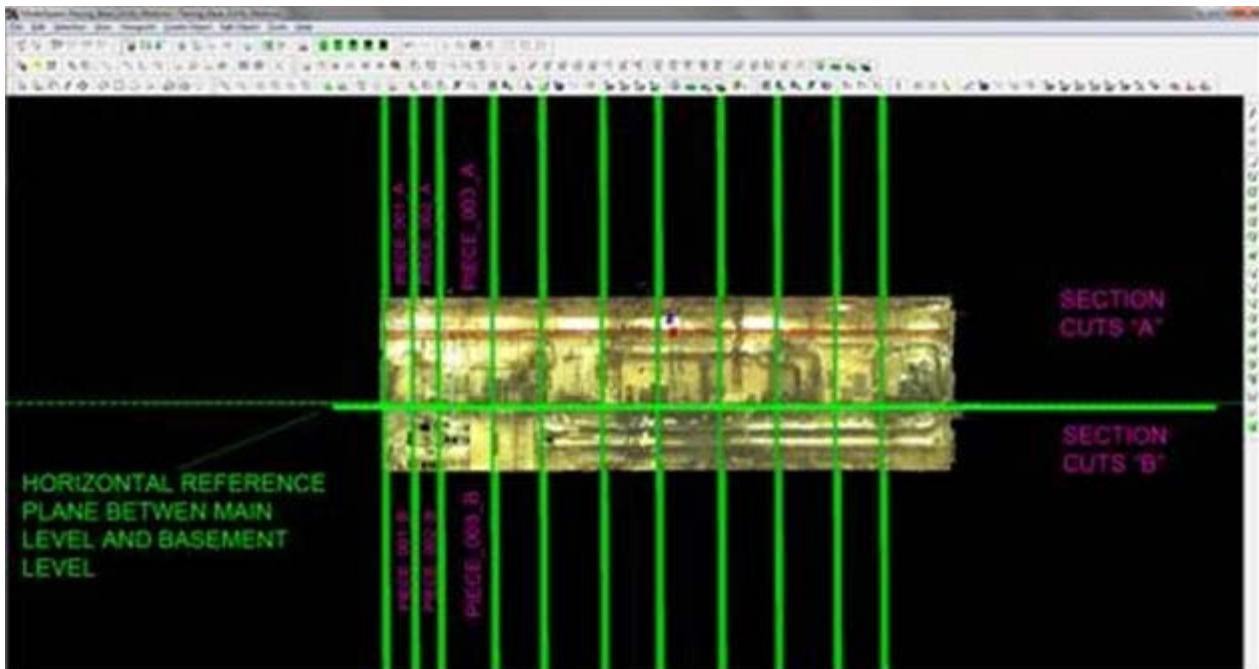


Figure 18 – Side view of the building with all RP™s visible; note that in terms of physical dimensions, the pieces are not identical. The left side of the building is filled with complex layers of pipes – this resulted in more points and density. The RP™s were placed close together making the physical dimensions of Piece_001 smaller than pieces to the right. The right side of the building had larger, less complex equipment resulting in sparser points and density. This meant that the physical dimensions of the pieces were larger although the size of the pieces (# of points) and the size of the exports remained consistent. Finally, note the naming logic, the number indicates it™s from left to right and the letter A or B identifies whether it was the main level or basement level.

FRONT VIEW

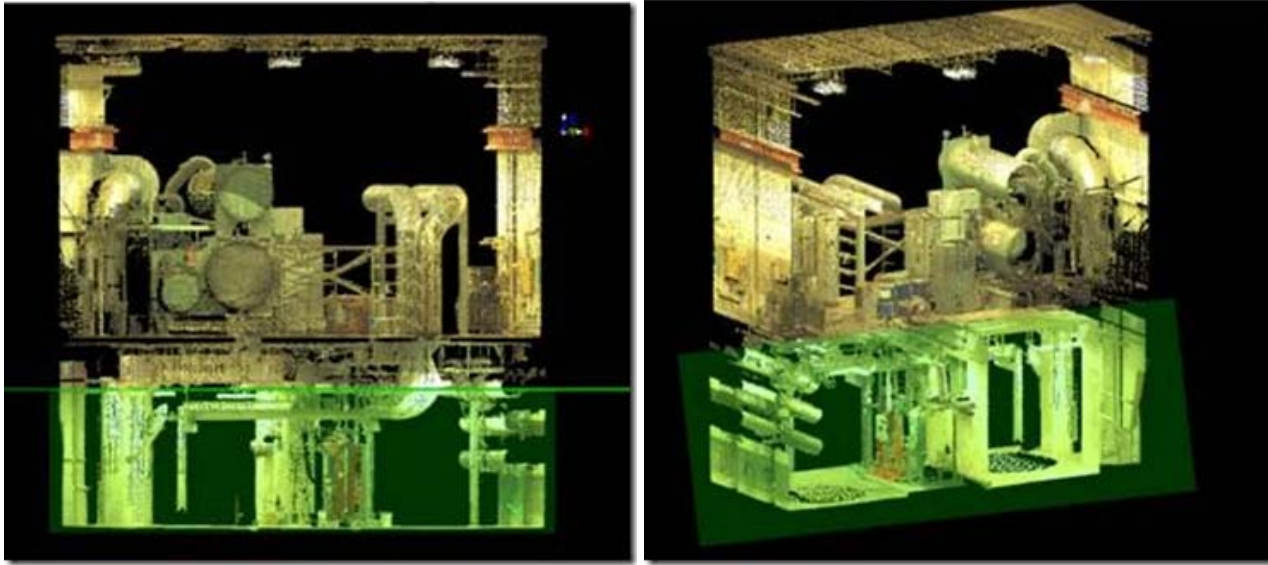


Figure 19 (Left) – Front view of a sectional cut and the horizontal RP used to divide the A & B cuts; Figure 20 (Right) – Perspective view of the same piece; note that initially looking at the data, the lower section has smaller physical dimensions and appears to be less complex/dense. However, the number of points and the size of the export for the top section were approximately equal to the relative sizes of the bottom section. The bottom section was extremely confined with many obstructions and a limited scanning range – resulting in very dense data on objects close to the scanner. The top section was open and the occurrence of very dense data due to proximity to the scanner was much lower. Here the scanning range itself resulted in the need for smaller pieces to achieve the appropriate file sizes.

]]> <http://gmvcast.uark.edu/uncategorized/leica-cyclone-7-1-1-sub-dividing-large-point-clouds-for-autodesk-applications-final-images-from-example-2/feed/> 0 <http://gmvcast.uark.edu/uncategorized/leica-cyclone-7-1-1-sub-dividing-large-point-clouds-for-autodesk-applications-exporting-the-data-2/>
<http://gmvcast.uark.edu/uncategorized/leica-cyclone-7-1-1-sub-dividing-large-point-clouds-for-autodesk-applications-exporting-the-data-2/#comments> Wed, 04 Apr 2012 17:01:00 +0000 caitlin 5 meters]]>
<http://gmvcast.uark.edu/?p=5826>

This workflow will show you how to export your sub-divided point cloud.

Hint: You can click on any image to see a larger version.

CREATING PIECES AND EXPORTING DXF'S

V. Creating Pieces and Exporting DXF's – Once the first two vertical RPs have been placed, the first sectional piece will be copied into its own MS and exported.

A. In Piecing_Base, activate the top view (you may lock the rotation of the view to help create consistent fences > Viewpoint > View Lock > Rotation)

B. Create a fence around the first area marked by RPs Vertical_001 and Vertical_002 > Copy fenced to new MS

1. Leave a slight overlap beyond the RP to allow later re-assembly of the exports
2. Confirm that nothing is selected before creating the fence; otherwise the entire cloud will copy

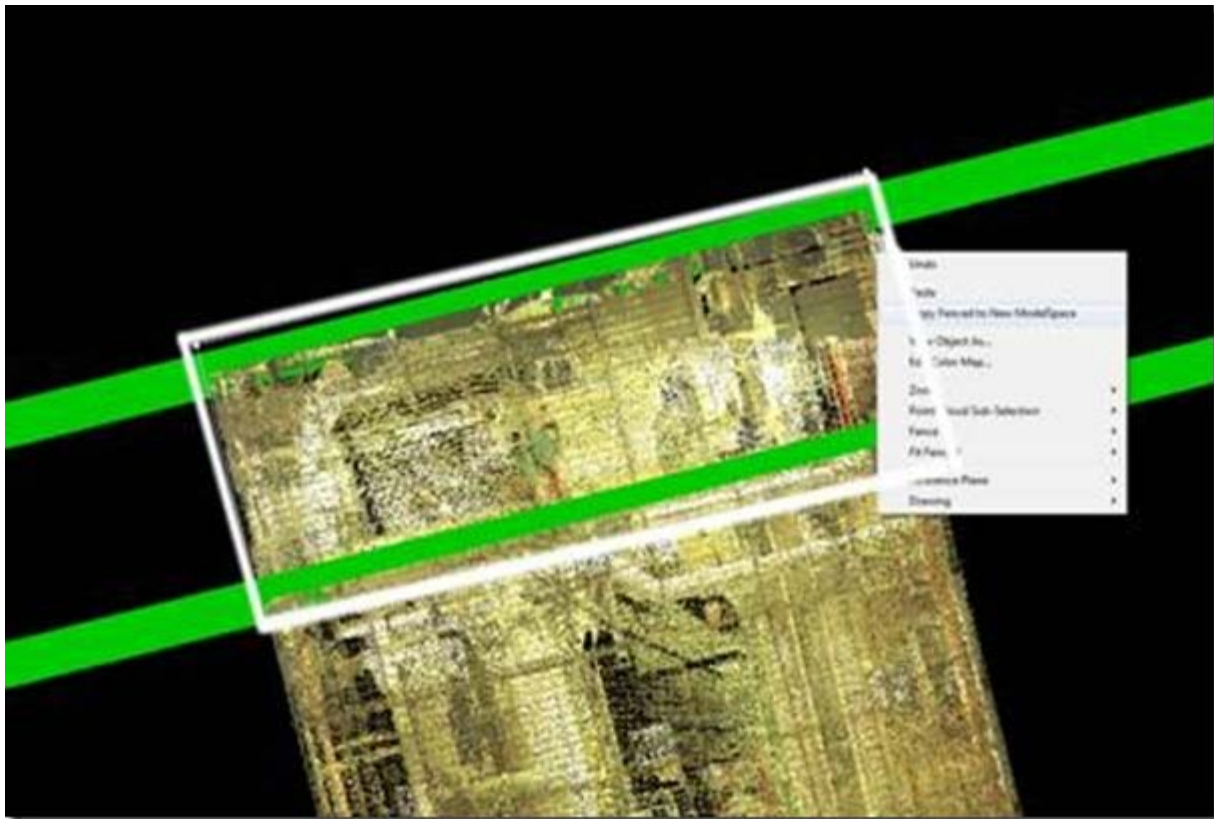


Figure 11

Piece_001 is fenced and copied to a new MS, using the RP™s as guides; note the fence overlaps slightly beyond the RP, capturing redundant points between adjacent pieces for later re-assembly.

ACTIVATE SIDE OR FRONT VIEW

C. In the new MS > Activate a side or front view (you may need to unlock the view lock > Viewpoint > View Lock)

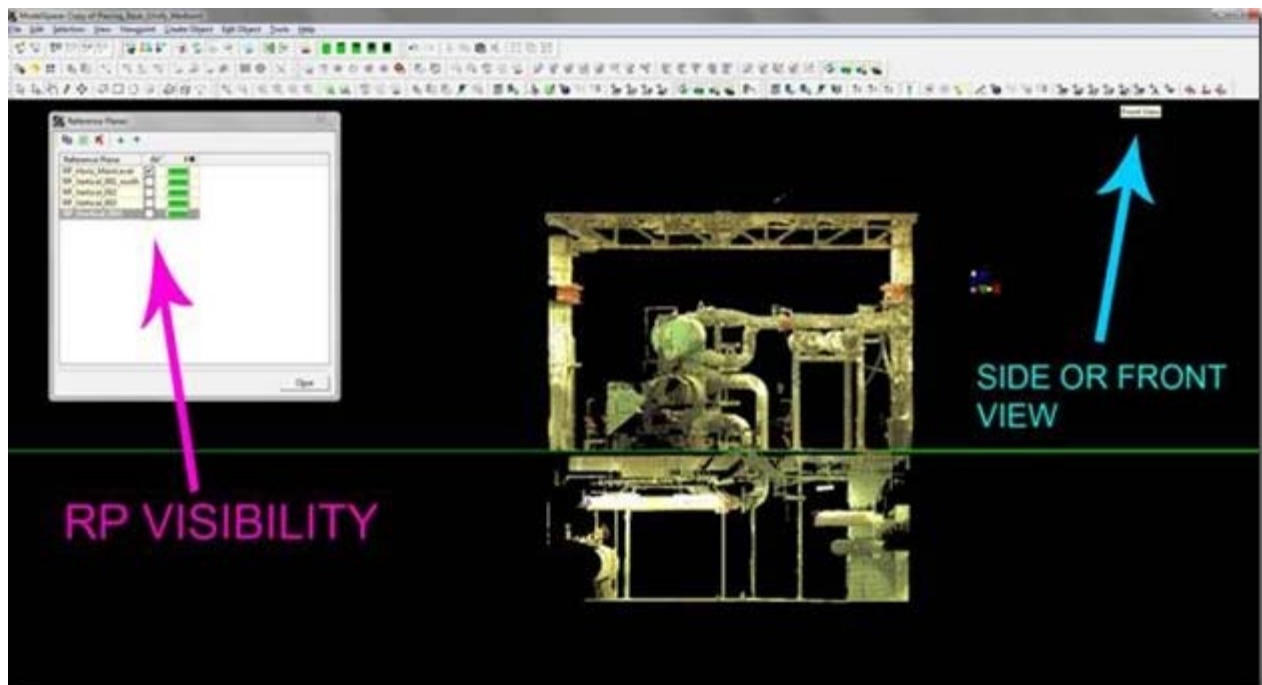


Figure 12 Front view of Piece_001 in a new MS; note all vertical RP™s are invisible, allowing the horizontal division (the green line/RP in the center) to be clearly seen

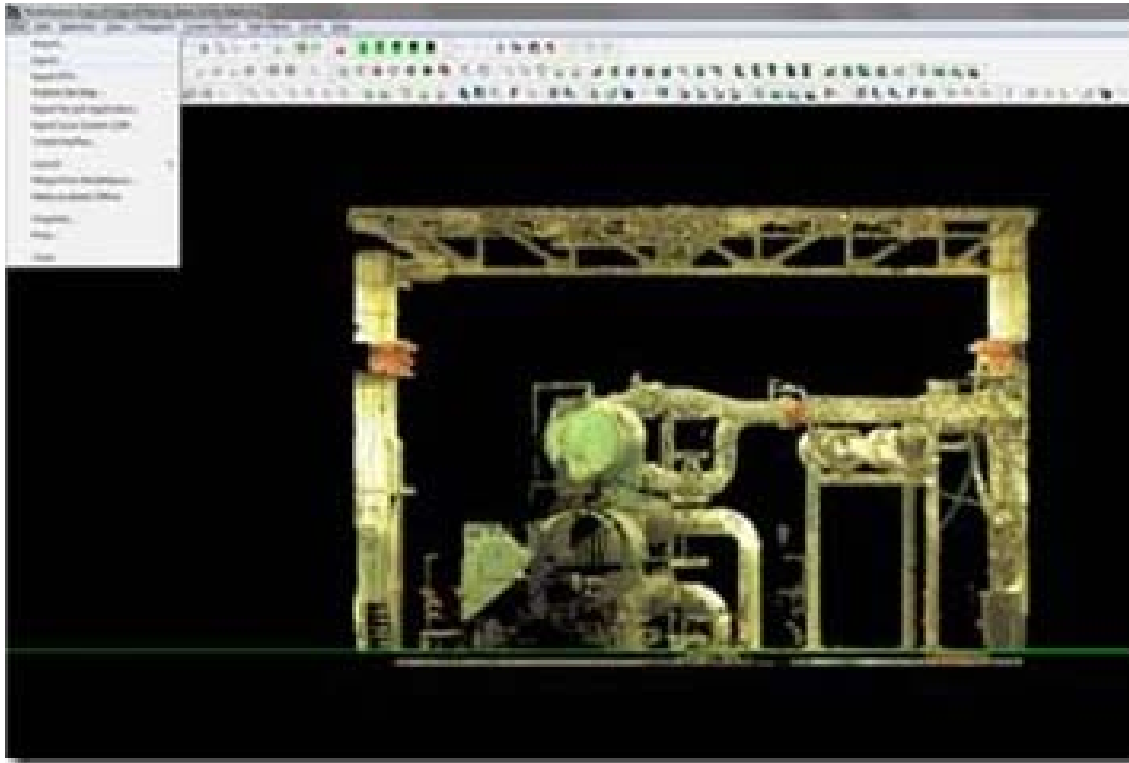


Figure 14 “
Piece_001_A in its own MS, selected and being exported; note the overlap below the RP, creating some redundancy between adjacent scans”

Â

EXPORT

F. In new MS, select piece > Export > Confirm file type is DXF R12 (NOT 2D dxf “ currently DXF R12 is the supported format for direct export from Cyclone) > Selected items > Export (Suggested export name Piece_001_A)

NOTE: If Cyclone immediately states “0 objects exported” either the file type is incorrect or the point cloud was not selected before the export command. Check your settings and selection.

G. **The number of points is displayed as the export begins.** Roughly, when exporting, 1,000,000 points equals a 1 megabyte DXF. Noting this value at the beginning of each export helps you confirm that the resulting imports will be manageable.

1. Even if you have evenly-sized pieces (based on physical measurements) the size of the data in the pieces varies greatly depending on the complexity within each piece. 5 square meters of measured space can have more points than 20 square meters of space depending on what is within that volume (ie: a complicated network of pipes versus an empty room). Taking this into account and watching the exporting figures are essential to figuring out how to divide up your specific project.

2. If the number of points is vastly smaller or larger than the desired file size, delete the MS for the piece > adjust the RP > Copy out the new piece and try again!

CYCLONE BUGS?

3. Cyclone bugs?

- i. When the point cloud piece is copied to its own MS, it may be selected and the object info

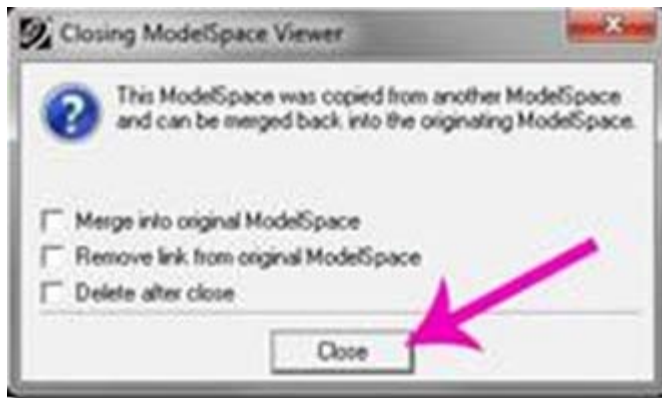
can be displayed. However, this info shows the number of points in the parent point cloud, not the piece. When the export begins, appears to be the first time the accurate number of points in the piece is displayed.



ii. When you name the export file, it always prompts that this file exists and asks if you want to overwrite it; answer yes.

CLOSE EACH MODELSPACE

H. Close each MS > be sure to select **CLOSE** when prompted, **DO NOT** merge into the original MS or merge!!



I. Repeat Steps D through G for each vertical division of Piece_001, naming each export and MS/MS View as you go (Piece_001_A, Piece_001_B, etc)

RENAME YOUR MODELSPACES

J. Before continuing, it is recommended that you go to Cyclone Navigator and rename each MS and each MS view as shown in Figure 15 to avoid confusion. After Piece_001 is completely divided and exported, return to Step IV -Section D and repeat the steps for dividing up the the next piece in the direction you are gridding (Piece_002) reducing it to its sub-divisions (Piece_002_A, Piece_002_B, etc)

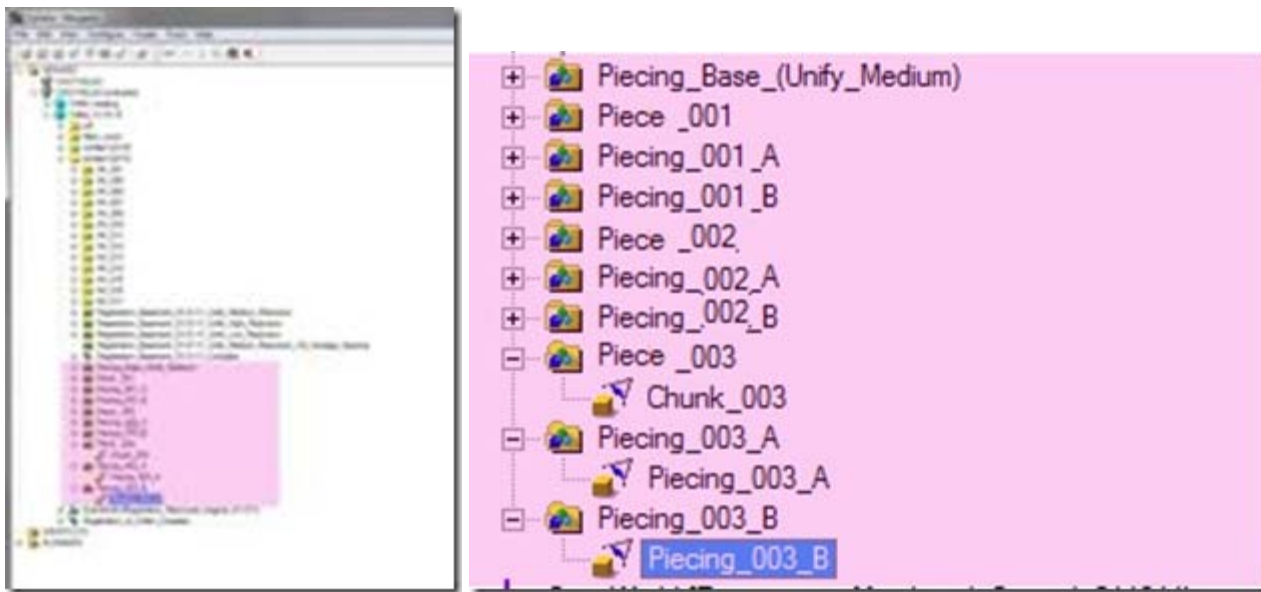


Figure 15 – A closer view of the file structure in Cyclone Navigator; the MS for each vertical sectional slice is named Piece_####. The MS and MS View for each horizontal piece (and the resulting .dxf exports) are named Piecing_####_A , B, etc.

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]]> <http://gmv.cast.uark.edu/uncategorized/leica-cyclone-7-1-1-sub-dividing-large-point-clouds-for-autodesk-applications-exporting-the-data-2/feed/> 0 <http://gmv.cast.uark.edu/scanning/software/leica-software/leica-cyclone/cyclone-workflows/leica-cyclone-7-1-1-sub-dividing-large-point-clouds-for-autodesk-applications-3/> <http://gmv.cast.uark.edu/scanning/software/leica-software/leica-cyclone/cyclone-workflows/leica-cyclone-7-1-1-sub-dividing-large-point-clouds-for-autodesk-applications-3/#comments> Tue, 03 Apr 2012 17:30:41 +0000 caitlin 5 meters]]> <http://gmv.cast.uark.edu/3030/leica-cyclone-7-1-1-sub-dividing-large-point-clouds-for-autodesk-applications/>

This workflow will explain a method of sub-dividing registered, unified point cloud data into more manageably-sized pieces.

Hint: You can click on any image to see a larger version.

INITIAL CLEAN-UP

This workflow may follow “Scanning, and Processing with Targets in Complex Interior Spaces” as a suggested method of sub-dividing registered, unified point cloud data into more manageably-sized pieces. In this example, data is broken up so that it can be imported into AutoCAD and REVIT; as of early 2011, these Autodesk platforms are becoming better at accommodating point clouds, however, currently, only reduced data sets or very small projects can be exported from Cyclone to these software in their entirety due to size limitations. This is a suggested workflow for quickly breaking up data for importation into such Autodesk applications.

I. Initial Clean-Up & Settings – Create MS from registered, unified point cloud > Delete extraneous points and any noise > Save this as Piecing_Base

NOTE: In this example, the original data of a complex interior chilling plant ranged in density from approximately 1cm at the most dense to 10 cm at the least dense. After registration, this data was unified with the medium reduction setting. This resulted in more consistent 2.5 cm spacing in the majority of the data that proved to be manageable in exporting to other formats and software.

II. Set the view to Orthogonal > Viewpoint Tab > Orthogonal

SETTING HORIZONTAL REFERENCE PLANES

III. Setting Horizontal Reference Planes – Once the data is clean a series of reference planes will be created to serve as visual aids to slice the data into smaller pieces. Open the Reference Plane dialog box and leave it open for the workflow.

A. Open RP dialog box > Tools > Reference Plane > Add/Edit Reference Plane > Click the visibility box to activate the original, default reference plane (RP); this is usually a horizontally oriented plane that is aligned to the X-Y plane of your data

1. If your data needs to be divided up vertically and horizontally (ie: multiple levels of dense data), double click the default RP and rename it Horiz_Level_001 > follow Step III-B

2. If your data does not need to be divided up vertically (ie: single level of data), move to Step IV

B. Move RP_Horiz_Level_001 to a significant horizontal point in the data > In this example, a reference plane was set on a point on the floor dividing 2 levels > Zoom into the data so that you can see the floor or significant horizontal feature > use Selection tool to select a point on the feature > Tools > RP > Set Plane Origin at Pick Point

CREATE ADDITIONAL HORIZONTAL RP'S

C. Create additional horizontal RP's to divide up the data in the vertical direction > Within the RP dialog box, left click on RP_Horiz_Level_001 to select it > Use the copy icon at the top of the dialog box to Copy Reference Plane > Name the new RP to identify the level (Horiz_Level_002, _003, etc) > LC the new RP > LC the icon at the top of the dialog box to Set Active Reference Plane > The new RP is now active and can be placed at significant features as outlined in Step III-B (see figures 1 & 2).

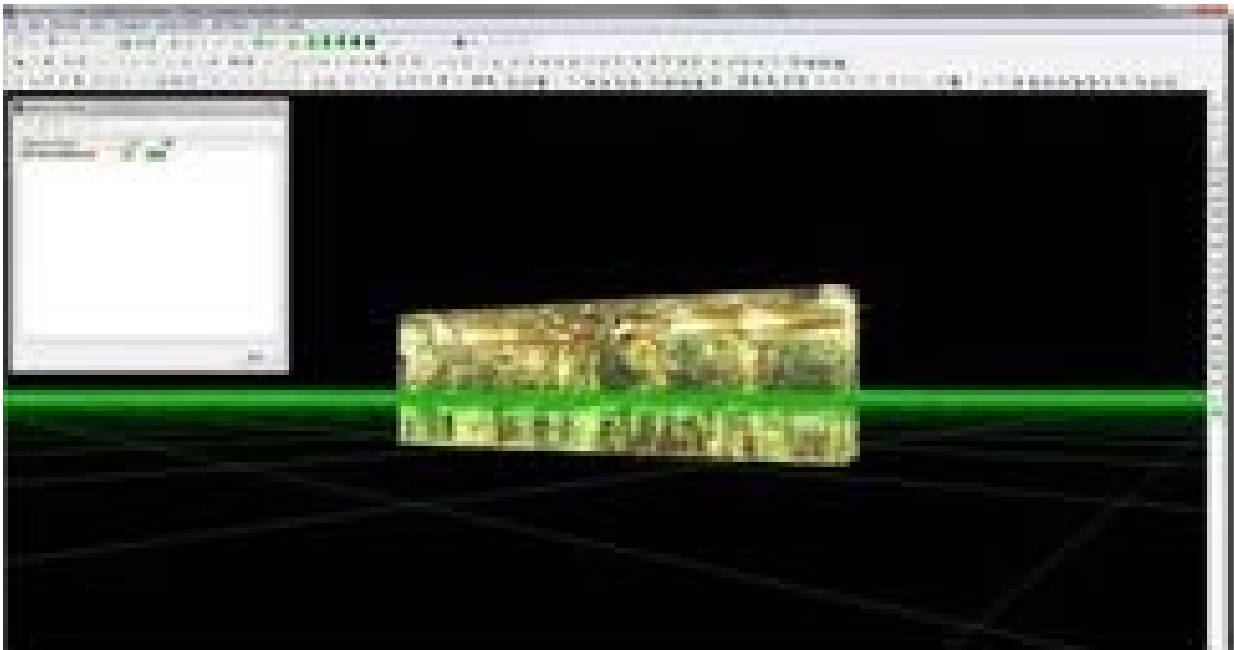


Figure 1 – The Reference Plane dialog box has been opened and the default reference has been named RP_Horiz_001 and placed on the floor dividing the two levels; Note the main level above the RP and the basement below. This building required only one horizontal plant



Figure 2 (Left) – A closer view of the dialogue box and the options for copying/adding RP’s and for activating the RP

ADDITIONAL REFERENCE PLANES & ESTIMATING DATA SIZE

IV. Additional Reference Planes & Estimating Data Size – Ultimately, how the data is divided depends on the original density and complexity of the point cloud data and the needs of the end-user/end-software. The goal is to balance between creating consistently-sized pieces and using sufficient overlap to allow re-assembly with minimal redundancy. Understanding the complexity within the different areas of your project is essential to understanding how/why you place sectional cuts. 5 square meters of measured space can have more points than 20 square meters of space depending on what is within that volume (ie: a complicated network of pipes versus an empty room).

In this example, the unified point cloud (48,000,000 points) needed to be divided into 300-400 MB pieces in a DXF format to import into REVIT.

Note: Users may find it helpful to adjust the RP’s to match the coordinate system or vice versa; this is covered in the *Basic Cyclone Workflow* and is not covered here. In this example, features within the scan data (walls and floors) are used to divide the space instead of defined coordinates. **IMPORTANT TIP: The medium reduction unified cloud creates exports with a clear ratio between the number of points and the size of the resulting DXF file in which 1 million points roughly creates a 1 megabyte DXF file.**

CREATING ADDITIONAL REFERENCE PLANES

V. Creating Additional Reference Planes

A. **Create a copy of an existing RP** (see figure 2) > Make the new plane active and name it RP_Vertical_001

NOTE: turning off the visibility of RP’s that you are not actively using helps to understand what you’re seeing; this is done in the RP dialogue box

B. **Tools > RP > set Vertical_001 to the Y-Z Plane or to the Z-Y Plane** depending on the orientation of your data and the direction that you want to grid it > Visually examine the data to see if this standard view aligns to the grid you desire

1. RC anywhere in the area where the toolbars are located > Enable the Viewing Toolbar > Top view while in Orthographic viewing mode allows you to see if the reference plane is aligned to the feature (an

interior wall for example) that you are using to divide the data > If the plane is aligned to your data, move to Step D.

2. Note that Cyclone toolbars often hide one another and you may need to pull them into the main viewing area to see all of them

CREATING ADDITIONAL REFERENCE PLANES 2

C. If a standard view or coordinate does not align to the feature, leave the vertical RP in place:

1. Create a fence and copy a piece of the data that contain a vertical feature that runs the direction that want to grid/the direction in which you want to divide the data (here the exterior walls running north-south and east-west are used to divide the data so a corner is copied to a new MS)

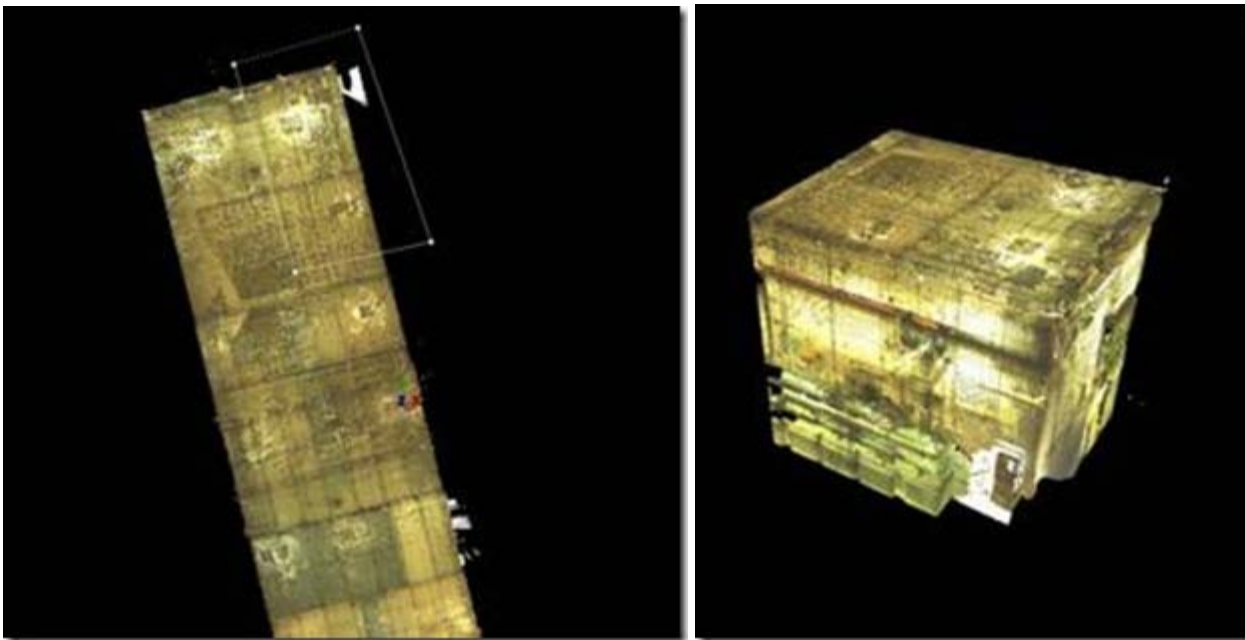


Figure 3 (Left) “ Top View, a corner is fenced; Figure 4 (Right) “ Perspective View, the corner section copied into its own MS

CREATING ADDITIONAL REFERENCE PLANES 3

2. In the new temporary MS, select a point on the wall > Create Object > Region Grow > Patch > View results in MS before accepting results, adjusting settings as needed to create a small vertical patch on each wall/feature being used to grid and divide the data

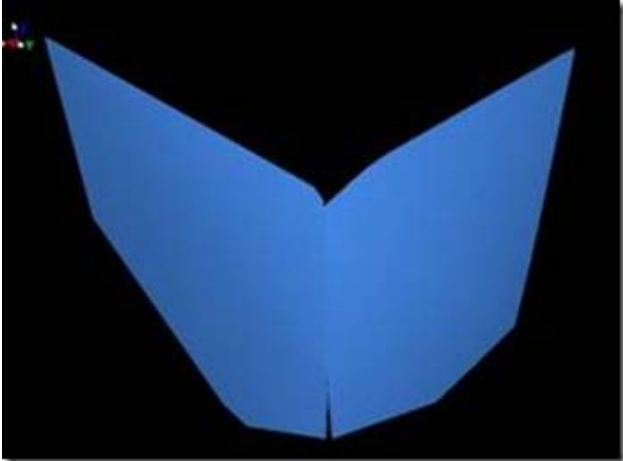
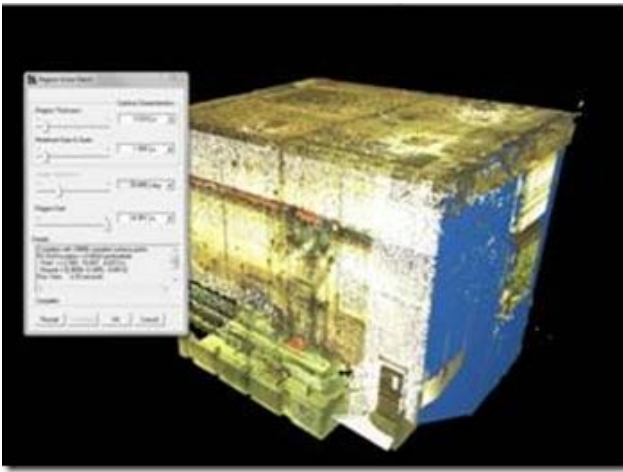


Figure 5 (Left) – A patch is created on each wall/vertical feature; Figure 6 (Right) – The resulting patches with the point cloud hidden

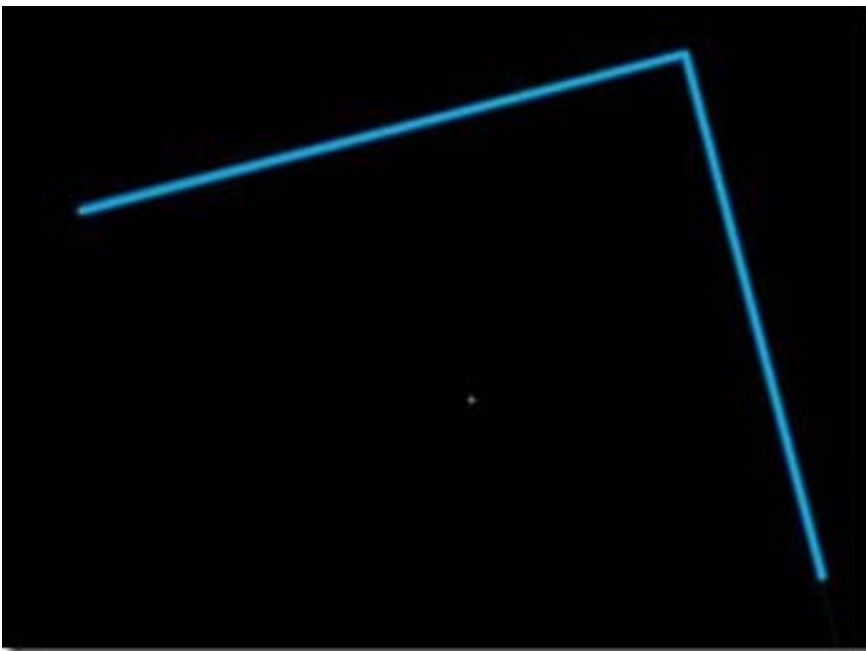


Figure 7 (Left) – Top view in orthographic mode confirms that the planes are perpendicular and have the correct z-direction

3. Select the patches (here there are 2 patches representing the north-south and east-west directions) > Copy > Close/delete the temporary MS

CREATING ADDITIONAL REFERENCE PLANES 4

4. In the original MS (Piecing_Base), open the Layers dialogue box (Shift + L) > Create a layer called Patches > Make the new layer current > Paste the patches into the base MS

Note: The use of a temporary MS to create the patches allows the unified point cloud in the base to remain as a single cloud; when an object such as a patch is created, the points are automatically deleted and if you choose to insert a copy of the deleted points, they are individual sub-set point clouds resulting in undesired multiple clouds in the base.

5. Select a patch > Confirm that RP_Vertical is active and visible > Tools > RP > Set on object > Activate the top view to confirm that the RP is now aligned to the wall/feature

6. Copy/add a vertical RP for each patch/direction > Turn off the visibility of the layer Patches

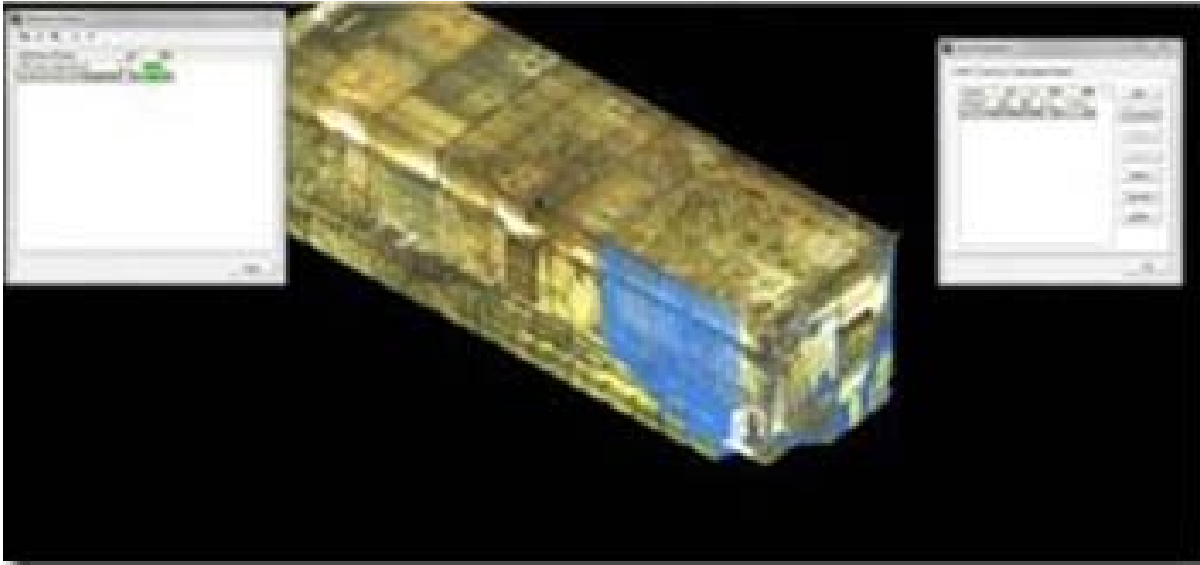


Figure 8 “ Two patches representing the two walls are pasted into the base MS



Figure 9 “ The vertical reference plane is aligned to the wall/patch

CREATING ADDITIONAL REFERENCE PLANES 5

D. Once you have a vertical RP that is aligned to each wall/patch > Create copies of the RPs and move them to significant points/features in the project that will allow consistently sized pieces (You are basically placing guides by which you will cut the data into pieces)

1. Choose the first direction to grid > Select the vertical RP (RP_Vertical_001) > Confirm it is visible and turn off the visibility of the other RPs

2. Copy Vertical_001 > Name the new RP Vertical_002 > Make Vertical_002 active

3. Select a point along the direction you are gridding to define the location for Vertical_002

a. Look for regularly occurring features (such as panels on the roof or interior walls/features) to begin placing the RP guides

Â b. Use the measure tool (Multi-Select 2 points > Tools > Measure > Distance > Point to Point) to further examine the distance between divisions you are considering

CREATING ADDITIONAL REFERENCE PLANES 6

4. Note the information regarding number of points and data size at the beginning of this section

a. The complexity of the data within the section affects the file size of each piece tremendously. It's a matter of testing and evaluating until you become familiar with the density of your data and find what division/grid size will work

b. NOTE: the goal is to have consistently-sized data evaluated by the number of points/resulting megs; this does not always mean pieces have similarly-sized physical dimensions.

5. Once the point is selected > Tools > RP > Set Plane Origin at Pick Point

CREATING ADDITIONAL REFERENCE PLANES 7

Â You have set up the guides for the first sectional piece to be copied out and exported > It is recommended that you place the vertical RP guides one at a time, checking the size of the resulting point cloud and export files until you have a good understanding of how to divide up the data consistently > Going through the export process is the only way to verify the resulting file size and to confirm that your grid dimensions are appropriate to the complexity and density of each area.

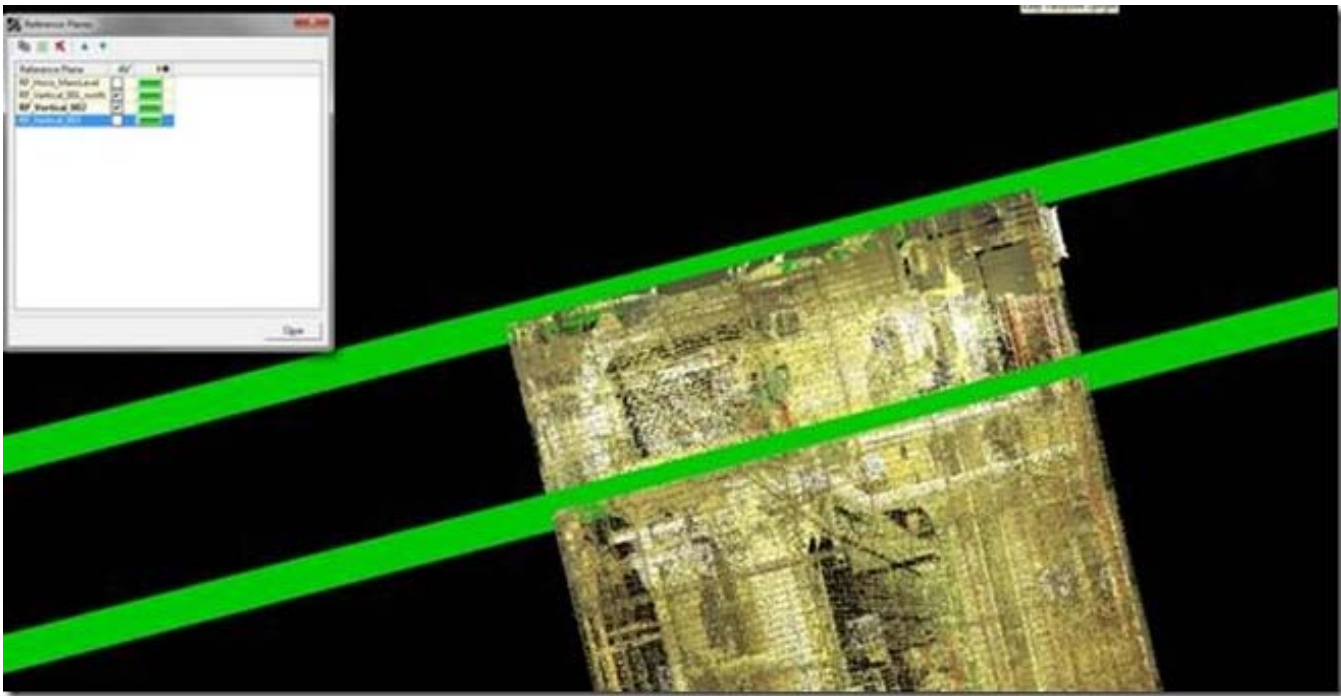


Figure 10 – Top view of the north end of the building; the visibility of the horizontal RP™s has been turned off for clarity. The top green line is the first vertical reference plane (Vertical_001) that was created from the wall/patch. The bottom green line is Vertical_002 that has been moved by selecting a point on the seam between metal panels on the roof. The area between the two RP™s represents Piece_001. This piece/sectional slice will be copied and exported to see if the estimated location for the RP results in an appropriate file size.

CONTINUE TO...

Continue to [Leica Cyclone 7.1.1: Sub-Dividing Large Point Clouds for Autodesk Applications – Exporting the Data](http://gmvc.cast.uark.edu/scanning/software/leica-software/leica-cyclone/cyclone-workflows/leica-cyclone-7-1-1-sub-dividing-large-point-clouds-for-autodesk-applications-3/feed/0)]> <http://gmvc.cast.uark.edu/scanning/software/leica-software/leica-cyclone/cyclone-workflows/instructions-for-using-leicas-truview-2/> <http://gmvc.cast.uark.edu/scanning/software/leica-software/leica-cyclone/cyclone-workflows/instructions-for-using-leicas-truview-2/#comments> Mon, 02 Apr 2012 20:15:59 +0000 caitlin 5 meters]]> <http://gmvc.cast.uark.edu/?p=5703>
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DOWNLOAD

1. Download Leica's FREE TruView Internet Explorer Plug-in [here](#).

NOTE: You are able to use TruView once without the plug-in; The plug-in is for Windows **Internet Explorer** only.

2. Open a TruView Site Map in Internet Explorer. Here is an example Site Map from the [University of Arkansas Chilling and Heating Plants](#). And here is an example Site Map from the [University's Vol Walker Hall](#).

3. The site map opens with each of the scanner locations marked with a yellow triangle and the name of the scan > These icons are hyperlinks into the TruView space where you have a view from the scanner's location. You will see exactly what the scanner saw from that location, and depending on settings, the other scanner locations may be visible; if an error appears, confirm that you are using Internet Explorer



Figure 1 – Hyperlink that allows you to enter viewpoint of the scanner position from the TruView site map. The number represents the scanner station identification.

4. Left Click in the center of the icon to open the TruView Space

USING TRUVIEW

5. Once in the TruView Space, navigate, take measurements, and move between scanner locations as wanted.

Basic Navigation: PAN = Left Mouse + Drag, ZOOM = Roll Middle Mouse.

Also see the information tabs on the left and the tool icons:

Measure Tab – shows the properties of measurements taken and allows the user to set the units; This is also where the user adjusts the visibility of other scan locations (ie: Neighbor TruViews) and the visibility of the point cloud based on range or altitude (when these fields are not checked, the full range and altitude is displayed)

Markup Tab – displays the information about the user's markups and allows markup.xml files to be imported and exported

View Tab – Allows the user to create and save specific views
Toolbar Icons:

TRUVIEW ICONS

	Open Site Map		Draw Oval
	Print		Draw Rectangle
	View Hyperlinks Mode		Write Text
	Markup Mode		Label Coordinate
	Pan/Zoom Mode		Label Distance
	Zoom		Query Coordinate
	Pan		Query Distance
	Draw Arrow		Place Hotlink

6. TruView Icons

]]> <http://gmv.cast.uark.edu/scanning/software/leica-software/leica-cyclone/cyclone-workflows/instructions-for-using-leicas-truview-2/feed/> 0 <http://gmv.cast.uark.edu/scanning/software/leica-software/leica-cyclone/cyclone-workflows/using-leicas-coe-plug-in-with-point-clouds-and-autocad-2010/>
<http://gmv.cast.uark.edu/scanning/software/leica-software/leica-cyclone/cyclone-workflows/using-leicas-coe-plug-in-with-point-clouds-and-autocad-2010/#comments> Mon, 02 Apr 2012 16:08:08 +0000 caitlin 5 meters]]>

This workflow will show you how to use Leica's COE plug-in to import and export objects and points in AutoCAD.

Hint: You can click on any image to see a larger version.

INTRODUCTION

Using COE Plug-In to Import & Export Objects and Points in AutoCAD

Leica's CloudWorx and COE (Cyclone Object Exchange) applications allow the user to view, import, and export files between Cyclone and CAD software while maintaining links and information. This relationship allows the user to take advantage of the accuracy of the point cloud data and the advanced modeling functions in AutoCAD; it also makes comparisons, analysis, and visualizations possible.

The COE import/export tool allows points and modeled objects to be imported/ exported/edited between Cyclone and ACAD (objects can be imported/exported with or without the point cloud data) and must be installed separately. Objects and points can be directly edited in the CAD environment. Importing/exporting points with the COE tool is only recommended for small point sets (less than 1,000,000 points). See the GMV guide 'Leica CloudWorx 4.2 and AutoCAD 2012' for more information about the CloudWorx application.

CONFIRM INSTALLATION AND SET UNITS

I. In ACAD, confirm that the COE tool has been installed (enter COEIN in the command line in ACAD; an import options dialogue box should appear). If it is not installed, download the installation file from the Leica downloads page – check for updates as the plug-in changes as versions update). During installation, the .exe will open AutoCAD, command line (F2) will note the installation and the availability of new commands such as COEIN & COEOUT.

II. UNITS -> To avoid complications, it is highly recommended to work in the same units as the Cyclone Files > **CHECK UNITS IN ALL NEW DRAWINGS BEFORE DRAWING, MODELING, OR IMPORTING** > In new ACAD drawing -> Command Line: UNITS > Adjust options to match Cyclone > Generally, Type: Decimal, Insertion Scale Units: Meters > OK

COE COMMANDS

III. The following COE commands may be accessed through these entries or through the toolbar

COEIN :Import COE files into ACAD

COEOUT: Export contents of drawing to COE file

COEXPLODE: explodes blocks into individual objects

COEANN: toggles annotations from cyclone on/off

IMPORT OBJECTS INTO ACAD

IV. To import objects into ACAD -> command line: COEIN -> dialogue box appears -> Under 'Import File Name' browse for file -> Import Options:

- **Import objects as ACIS Solids** -> imports objects as 3D ACIS solids
- **Import Objects as Blocks** -> Blocks are made up of one or more objects that are combined to create a single object; *using blocks results in the best compression rate when objects are brought to ACAD* (per Cyclone 7.0 Help) and are useful when repeating objects. When editing a block, all similar blocks are simultaneously edited. A block must be exploded or "re-written" to remove or adjust this link between identical blocks. Dynamic blocks are more easily editable and are only available in newer versions of ACAD. See ACAD help -> "Work with blocks" for more information
- **Import Point Sets** -> In general, CloudWorx is recommended for large point clouds (1,000,000+ points), while the COE tool is recommended for objects and smaller point clouds (less than 1,000,000 points) -> If Import Point Sets is selected and you experience problems/crashing, it is recommended that you either decrease the size of the point cloud for import or that you use CloudWorx to view the point cloud versus import it
- **Log files** -> log files are automatically created, adjust path as desired
- **Units Preference** -> UNITS MUST MATCH (see Step II) -> In most cases, scan data is acquired in meters; if imported in a different unit, ACAD should automatically apply a scale factor but using the same units avoids problems (If acquired and imported in the same unit, this scale factor will be 1)

EXPORT OBJECTS FROM AUTOCAD

V. To export objects from AutoCAD -> Toolbar or command line: COEOUT -> Dialogue box appears -> Browse to project folder and name file -> Select Objects to Export -> OK -> Export Options:

- **Export objects USING ORIGINAL COE file as reference:** When selected, the COE file that is created/exported from ACAD references the original Cyclone data set enabling as much original object information/data as possible to be maintained when the object is brought back into Cyclone; select when integrating ACAD data with the original COE file from Cyclone. Export objects WITHOUT original COE reference file: When selected, the COE file is new and maintains no connection or reference to Cyclone data set or original COE file.
- **Export Objects:** choose option All, Visible, or Selected objects
- **Units:** as in importing in Step VI, UNITS MUST MATCH -> In most cases, scan data is acquired in meters; if exported in a different unit, a scale factor should automatically apply but using the same units avoids problems (If acquired and imported in the same unit, this scale factor will be 1)

CONTINUE TO...

Continue to [Using Leica's COE Plug-In in Cyclone.](#)

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