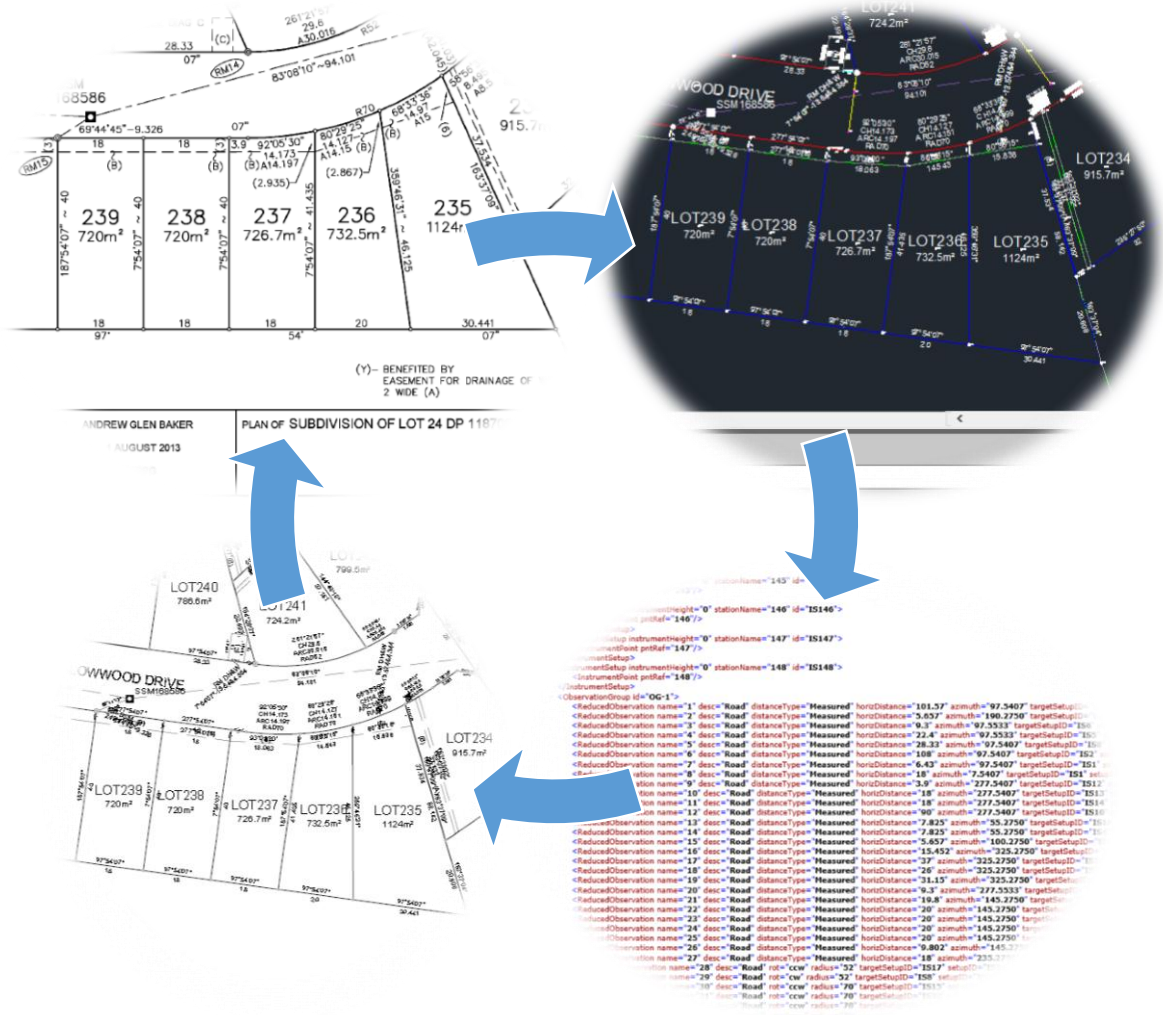
Land XML for AutoCAD

Version 1.15



Contents

Introduction

LandXML for AutoCAD (LXML4AC) is a tool used to export NSW recipe LandXML files from AutoCAD. It was designed a link between the existing tiff or paper style drawings which are familiar to surveyors and the new XML format which the LPI has adopted. It is written in the AutoCAD Visual Lisp language, and is supplied as fully functioning source code. This means that if you don't like how it works, you are welcome to change it to suit your needs. It also means if you are doing something boundary related that is not standard, or parts of the xml recipe are edited, the code can be changed by people other than the author.

This document outlines the tools in the LXML4AC program, how they work, and hopefully provide some guidance to those who are new to LandXML for NSW

In this document I refer to LXML – a Land XML file following the NSW Recipe, and LXML4AC – this program. Please don't confuse the two.

If you find a bug, have issues with the program or would like to request a feature please email LandXML4autocad@gmail.com

There is also an crash course tutorial in the program showing its main features on Youtube here

http://youtu.be/3WScoKnIHts

there is also a number of written tutorial at the end of this document

Background

In late 2014, the author of the code was exposed to LandXML on a limited basis. The company that he worked for was quoting for the input of all existing plans into LandXML format, and after looking at how it was being proposed to be done, thought using an existing CAD program that is widely used around the world might be a more suitable method. The contract was eventually given to a company outside Australia.

His vision (which was not the vision of his company of course) was that perhaps if it was easy enough and enough plans could be entered per day for a reasonable price, then the input of the plans could be done by NSW's own surveyors, who are the experts in reading and producing them. This would also give the inputted plans some responsibly, rather than being entered by a nameless data entry person, who may not care as much about the finer points on the plans. A by-product of this vision would be that many of the NSW surveyors would become familiar with the LandXML format.

After examining the LandXML recipe, he started to realise that the transition between the existing way of doing plans and the new format was going to be a big step for many surveyors, so he saw that the solution was to try to create something that looked like an existing plan format, but could also be exported to XML and then re-imported and presented the same way. This was a key mission goal of the program.

The way LandXML works is very unsuitable for rendered plan production, as it does not take into account many drafting properties, such as drawings scale, text size, text rotation, line thickness, callouts and diagrams. To get the program to print something close to an existing plan, many rules, exceptions, if/else statements and checking/aligning routines had to be employed. In the author's opinion, it is very doubtful that a survey draftsperson was consulted during the entire compilation of the NSW LandXML recipe (or LXML in general), but the benefits a digital version of the plan (of sorts)

being stored are untold in terms of cost savings to surveyor; provided they are input correctly and care has been taken to ensure the completeness. The author has no survey drafting qualifications, is not a registered surveyor (yet), but is engineering surveyor, who performs survey drafting for his company, has a reasonable understanding of deposited plan drafting, and has an advanced understanding of the AutoCAD Visual Lisp programming language.

Goals of LandXML for AutoCAD

1. Create a viable LandXML format from:
   -Data entered using the program
   -Data from other programs which could be imported into AutoCAD using a number of methods
2. Print an existing tiff style plan from the same data with minimal effort
3. Be able to read existing LXML files and create a plan that was familiar to surveyors, so that it could be printed and used in the field.

Installation instructions

The program has been tested in AutoCAD 2012 and 2014. There is not an automatic installer, and users may not want to use the tool all the time.

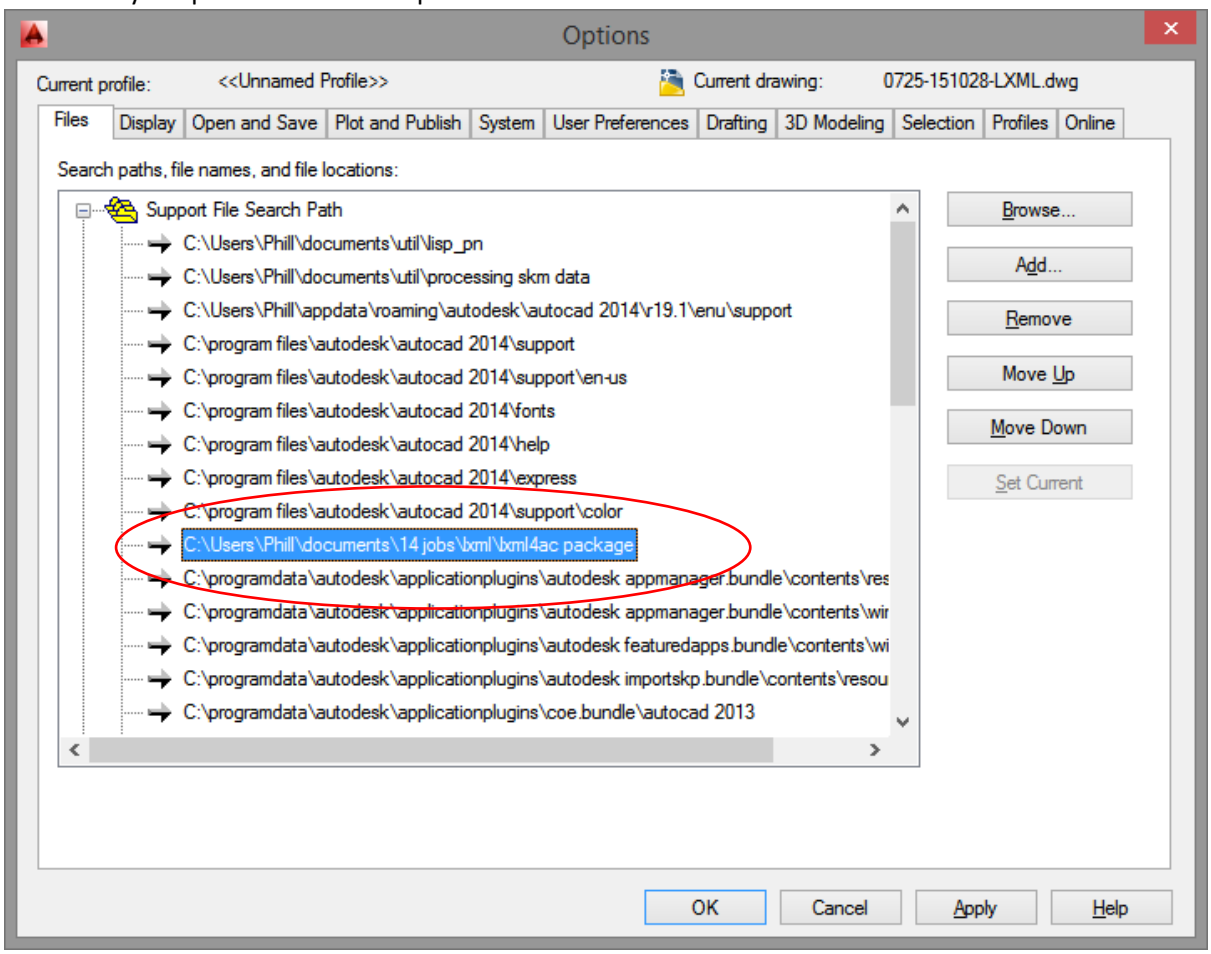
First time installation instructions

1. Download the Zip file and extract the contents to a folder.

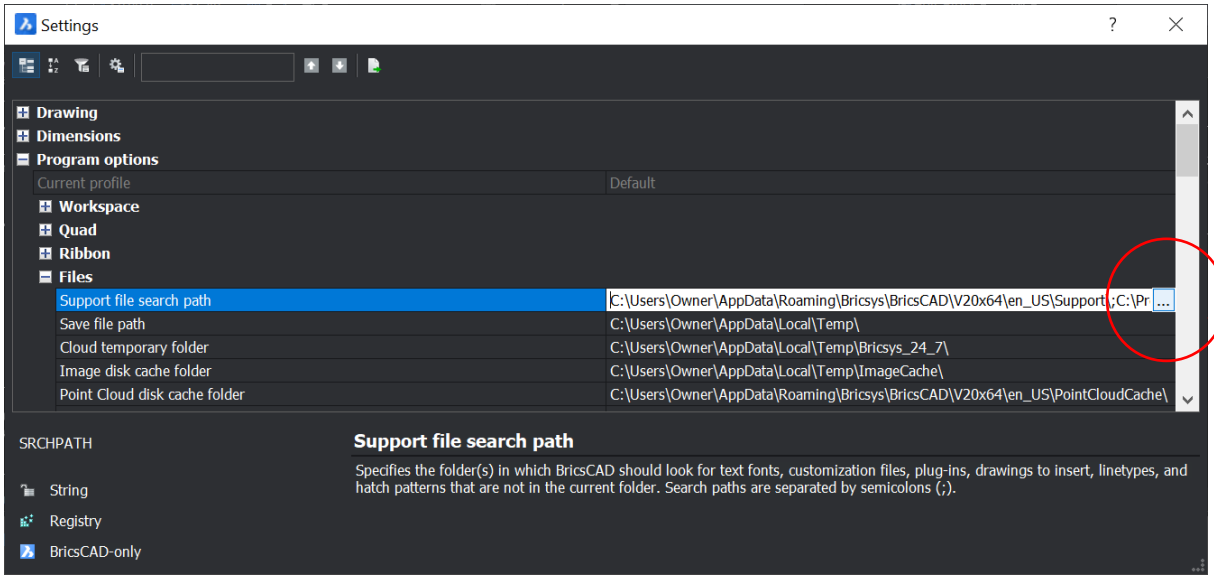
2. Open AutoCAD

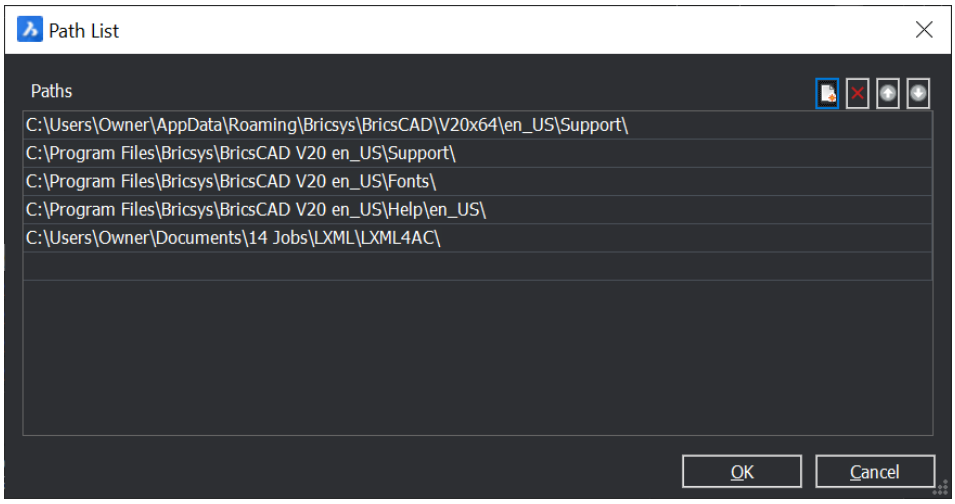
3. Type *options*

4. Under the files tab, press the plus on the “Support file Search Path”, press Add, Browse, and find the folder you specified in 1. Then press ok.

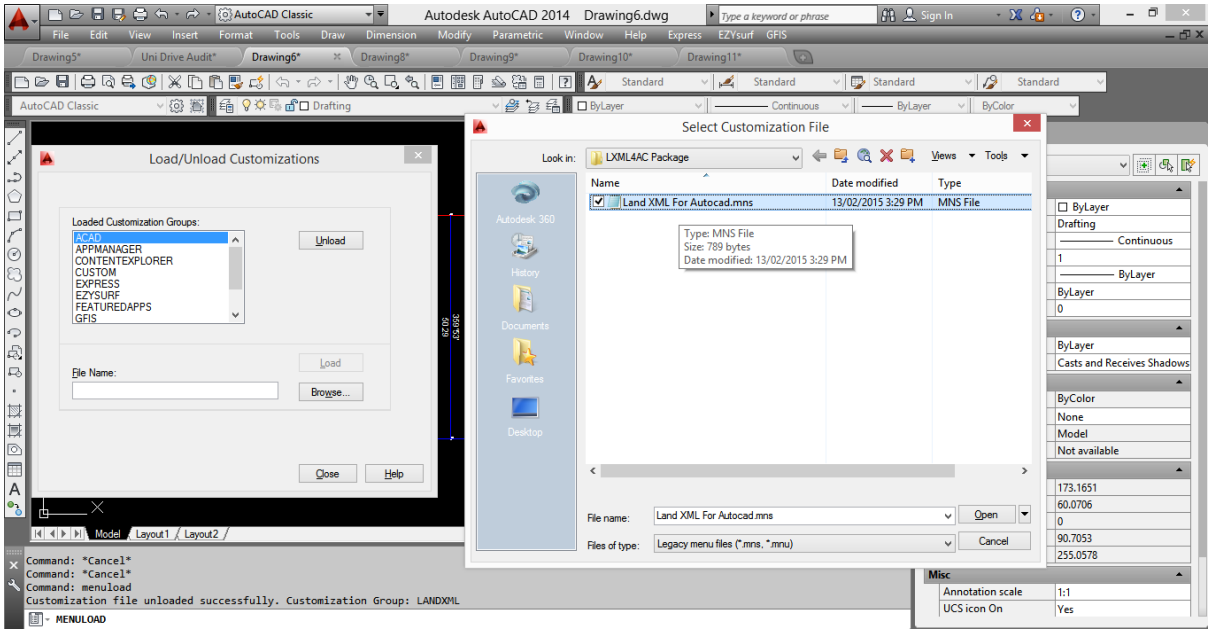


Or in Bricscad, + on program options and then + on files then press the three dots and add the sam locations as above.



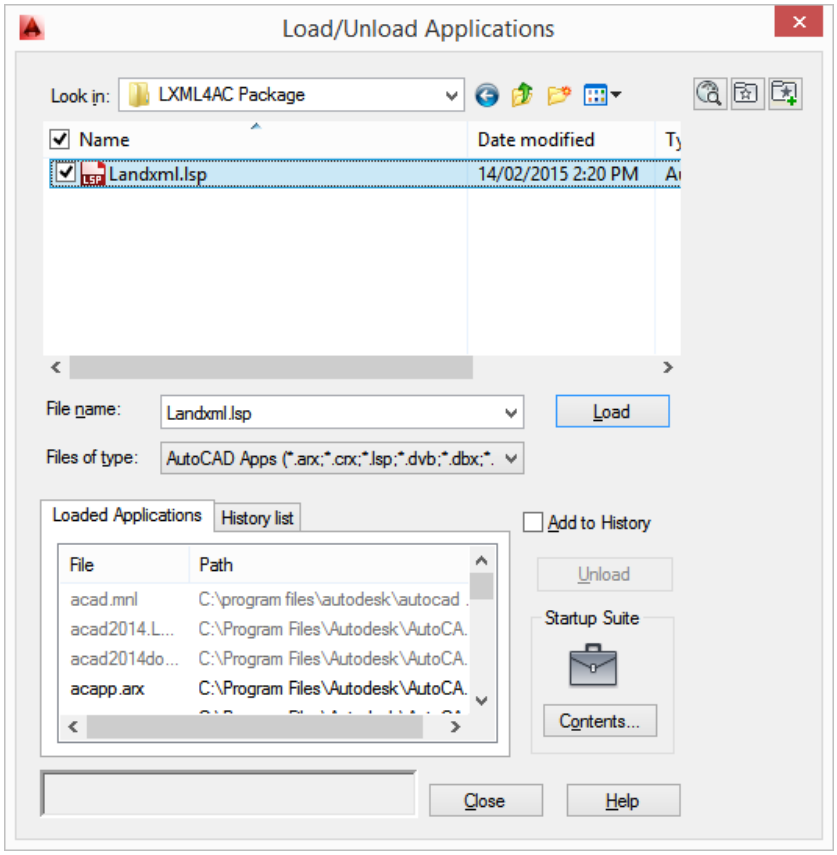


5. If you would like the drop down menu, type *menuload*, select browse and find the 'LandXML for Autocad.mns" file. Then press load and OK. The LandXML dropdown menu should then be added. The dropdown menu contains all commands excepting the drafting tools.



Each use Installation instructions

Each time you would like to use the LandXML functionality you need to load the lisp program. Either drag the LandXML.lsp lisp file onto AutoCAD, or type *appload,* then find the lisp file and load it that way.



A number of things happen when you load the program.

1. The LandXML linetypes are loaded from LANDXML.lin
2. LXML4AC Layers are added, assigned colours, thicknesses, linetypes and plotability
3. A number of checking lists and AutoCAD system variables are defined. The system variables are not changed back at the end of the program. The variables that are changed are:
   Osnapcoord – stops auto-snapping when drawing elements
   Angdir – sets angles to clockwise
   Angbase – sets 0° to north
   Attreq – prompts for attributes when inserting blocks
   Dimzin – gets rids of trailing zeros when making a string
   The annotation list is reset to defaults
   Cannoscale – set to 1:1
4. The textheight of the current text style is set to 0 so when drawing a DTEXT autocad prompts for height.

Licencing

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And to a lesser extent a beerware licence

THE BEER-WARE LICENSE (Revision 42):
Phillip Nixon wrote this file. As long as you retain this notice you can do whatever you want with this stuff. If we meet some day, and you think this stuff is worth it, you can buy me a beer in return.

The GNU licence is required to cover me as obviously land definition can have large legal ramifications if some mistake is made. This is in case there is some mistake in my coding (or others modified coding) that leads to some definition error which ends up in a boundary dispute. I sincerely hope there is none of these errors, but I need to be covered.

Land XML for AutoCAD – The basics

AutoCAD uses many different object types, but LXML4AC only uses 6; the point, line, arc, polyline, text and block. LXML4AC works by adding what is known as xdata to the object. Xdata is not a new thing, and has been around in AutoCAD since 1985. Things such a lot names, RM types and bearing and distance are assigned to the objects, so they can be exported into the XML format. Understanding that this is happening is critical to understanding how LXML4AC works.

Point

As you would expect, point features are for defining things at a single point. The following are a list of things points are used for

1. Reference Marks (RM's)
2. Corner marks (e.g., DH&W on corner)
3. Permanent Marks (PM's & SSM etc.)
4. Datum points (A-B, X-Y) line
5. Occupation of a point type
6. *Coordinate geometry points (after import or export)*

Lines and Arcs

Lines and Arcs go in the same category because they define the same thing. They are used for defining the edges of lots, connections to things and occupation related objects. Each proposed lot polyline needs to have a series lines and arcs over the top of it to denote the geometry. The lines and arcs are stored in the Reduced Observation section of the LXML file (*except some occupation offsets*) and are generally the same format except for their layer. Lines are used for the following purposes

1. Boundary lines – edge and back of lots
2. Road frontage lines – *a particular feature of land xml is the requirement to have road frontages of new lots defined as a road line*
3. Irregular Right lines – Lines used to define/approximate the geometry of an irregular line
4. Connections – these are connections to adjoining monuments and lots and are used to show how the definition was obtained. These connections will quite often go over adjoining boundaries.
5. Road Extents – Used to separate road widenings and one street lot definition from another.
6. Easement lines – these look like boundary lines in the reduced observations section, but are different in the lot section. They are denoted differently in LXML4AC so they can be plotted as a dashed line.
7. RM connections – this is the line between a reference object and the corner it references.
8. PM connections – this is the line between a corner and a PM and from PM to PM. They are also no different in the LXML file to normal connections, but differentiated here as they are a dashed line when plotted.
9. Height difference observations – this is a line used to join to points with it's measured height difference only.
10. Occupation offsets – These lines are not recorded as a reduced observation. They are recorded in the plan features section.
11. Plan features – e.g. fences, walls, kerbs. These are all stored in the plan features section of the LXML. No reduced observation data is stored on these lines, so they can be created using any method and there is no need to assign information to the lines but it can be done.

Polylines

Polylines are a series of joined lines and arcs. They can be either a lot definition, adjoining lot definitions, a plan feature or an irregular boundary.

1. Lot definitions – this is a closed polyline that shows the area of a lot, easement or new road. They are all stored under the layer "Lot Definitions". It is important that the vertexes (end points) of the polylines directly overlay the geometry. For example if there is a line with the same bearing but two distances, there must be a vertex between them, not a line all the way through. In strata mode the width of the line also defines it's structural type.
2. Adjoining lot definitions – These are the same as Lot Definitions excepting there is no requirement to have overlaying geometry objects or a closed lot. They are plotted, where a proposed lot definition is not.
3. Existing easements – Existing easements in a proposed lot don't require reduced observations (lines and arcs) so to get around this a polyline placed in the "Easement" layer will plot the existing easement
4. Plan features – Walls, fences, buildings and kerbs. These will be stored in the plan features area of the XML.
5. Irregular Boundary – A polyline which follows the line of an irregular boundary (eg Mean High Water Mark, or centre of creek etc). Note that these may not be directly over the "right lines" that are used to represent the shape. Irregular boundaries can also be 2d polylines, so a splined polyline can be used to create a smoothed polyline.

Text

While building the file, LXML4AC will create many text objects, mostly on the drafting layer. This is to display the information stored on the line for checking, but also to allow for the creation of a standard plan, as these are still required to be submitted. Every effort has been made to make the pieces of text go in the proper place, but overwriting may still occur, and will need to be moved for clarity. None of this text is exported, and it is all recreated in the default position when you reimport a LXML file.

Blocks

Blocks are for a variety of utility tools as follows:

1. The administration sheet (Planform6 or 3) has all attributes currently shown on the sheet and a few others required by LXML
2. The layout sheet (Planform 2) has attributes as shown on the current sheet
3. Drafting blocks including the RM, PM, POP, Vinculum and direction of flow arrows

Programs in the Lisp File

A list of the commands is presented here and further expansion of each tool, how it works, and what is going on in the background is also presented. As mentioned earlier, every effort will be made to present how the program works, so if a problem arises, you can have a crack at finding a solution; it is freeware after all.

Global Tools
XSS - Set Drawing Scale
XRD - Set Drawing to Round
XMLC - Redefine Lot Centre Positions

Entry tools
XTR - Traverse
XTA - Arc Traverse
XCL - Create Lot
XCE - Create Easement or secondary interest Lot
XCR - Create Road Lot
XRM - Create reference mark
XDRM - Create Double reference mark
XCM - Create mark, add non peg mark to corner
XPM - Create PM mark (PM or SSM)
XBM – Create a Benchmark for Stratum Plans
XSF - Add combined scale factor information to line
XHD - Add height difference to line
XDP - Create Datum Point
XOC - Create occupation offset
XOQ - Create Queensland style point occupation
XCP - Create Pops on Lot corners
XAS - Create Admin Sheet
XLA - Add Layout Sheet
XEL - Create Easement Legend

Assigning tools
XAL- Assign line to XML
XALN - Assign line with note
XALC - Assign line as compiled
XALCN – Assign line as compiled with note
XAA - Assign arc to XML
XAAN - Assign arc with note
XAAC - Assign arc as compiled
XAACN – Assign are as compiled with note
XAP - Assign Polyline Lot to XML
XAE - Assign Polyline Easement or secondary interest to XML
XAR - Assign Polyline Road to XML
XJL - Assign Polyline to Adjoining Boundary
XJR - Assign Polyline to Existing Road

XJO - Assign Polyline to Other boundary type
XAM - Assign Reference Mark from points
XAI - Assign Polyline as Irregular Boundary
XAO - Assign description to Occupation

Drafting/Editing tools
XSL - Assign lines to Short Line Table
XSC - Assign arcs to Short Line Table
XUP – Assign use of parcel to lot
XSW - Swap text positions
XSP - Spin text 180°
XCB - Create Brackets around text
XRT – Recreate text from xdata
XDE - Edit xdata manually
XBE - Edit bulk data single attrribute
XHV - View xdata by hovering
XCT - Tidy coordinates
XAUD – Compare line geometry to xdata

Strata Tools
XSA - Assign Polyline to Strata lot
XST - Total Strata Areas
XVI - Assign Level to Vinculumn
XLV - Assign Level to Object
XSD - Draft Strata walls
XSDR - Reverse draft strata walls
XALS - Assign strata line
XALSN - Assign strata line with note
XALSM - Assign strata line with manual distance
XALSMN - Assign strata lines with manual distance and note
XAAS - Assign strata arc
XAASN - Assign strata arc with note

Import Export Tools
XIN - Import XML file
XINO - Import XML file from observations
XINS - Import simple XML file from observations
XOUT - Export XML file

NSW Land XML Format

LandXML is a text based (ASCII) format, designed in the XML style. Each object starts with <Something> and ends with </Something>. It is basically broken into a few main sections in the following order

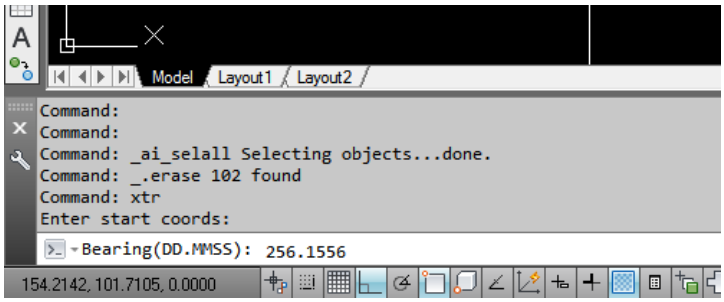
1. The header – contains information about the XML and some definition of where the plan might sit.
2. A list of points which many objects are linked to (known as CG points)
3. A list of lots, whose corners are defined by the CGpoints. This includes easements, roads and adjoining information
4. A list of plan features whose corners are defined by the CGpoints. This section covers things such as occupations.
5. Plan metadata, surveyor, firm, date of survey etc.
6. A list of instrument stations (think of these as a link between the next step and the CGpoints). Don't think of these as setups in the field.
7. A list of observations. This is where it gets a little complicated. An observation is a line on the plan which will be denoted with a bearing and distance. The bearing and distance are recorded in the xml as are two CGpoints which define where the line starts and finishes. **This bearing and distance have no real relation to the CGpoints which the line goes between**, think of it as a recording of textual information about a line.
8. A list of monuments, including RM's, RM's that have gone, nonstandard corner marks and occupation offsets.

If you want to learn more, read the LandXML recipe from the LPI.

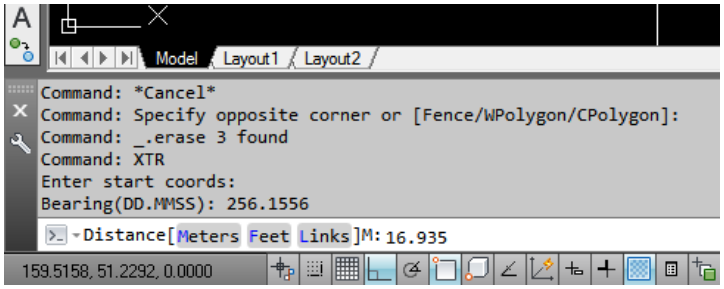
XTR – Traverse

This is a line traverse. The line is entered using a bearing and a distance. The bearing is entered in Sexagesimal format (DDD.MMSSdddd), and the distances can be entered in metric, imperial or links by pressing the appropriate key. Comments can also be added to the line, for example, “Per Original”, “By Me”, or “Occ to Occ”.

The program draws the first line and then goes into a continuous loop to keep drawing lines from the subsequent endpoint. Press esc to get out.

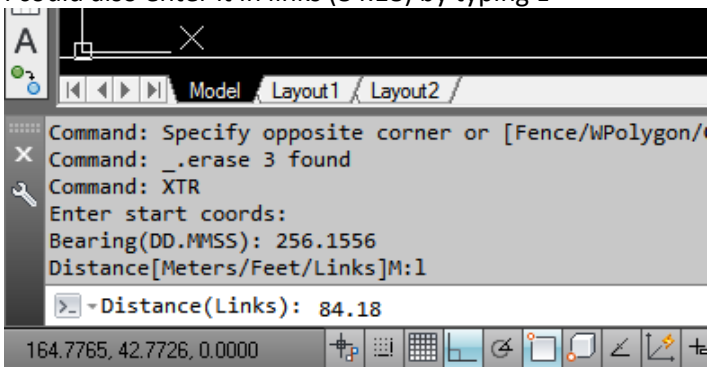


So here is the bearing 256°15’56”. There is also a function here where if an R is added to the front of the bearing it is automatically reversed. E.g. if the plan had read 76°15’56”, but I wanted it to head west, I could have typed in R76°15’56”. (Using R also means bearings are recorded exactly how they are shown on the existing plan even if you are travelling in the wrong direction). Bearings can also be entered as survey bearings, in this case S76.1256W. Many old Crown plans prior to 1900 use this format.

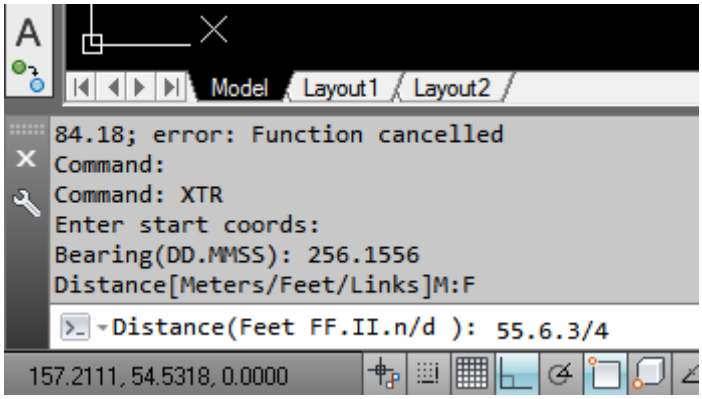


Here is the distance 16.935

I could also enter it in links (84.18) by typing L

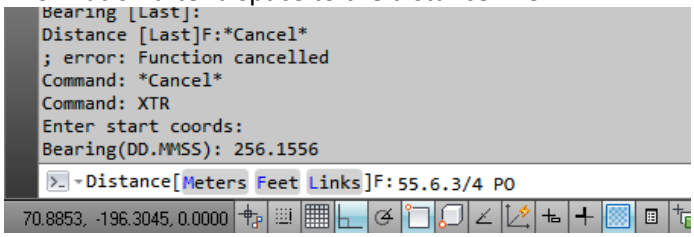


or in Imperial by typing F



Note that imperial measurement are entered as so - Feet.Inches.Fraction/OfanInch. When entering old style distances (feet or links) the entered distance will be written below the metric distance in italics. This is to aid in finding input errors. To remove these use a quick select and select all text obliquing at 70.

If there is a requirement to add a comment to the distance, for example PO or OCC-OCC, add the information after a space to the distance line.



This information is recorded in the LXML file as a field note attached to the reduced observation. This should **not** be used for recording information about the ends of the lines (e.g. GI Nail placed etc.) as there is no way to determine which end of the line this comment refers to. Use a XCM (corner mark) for information about a corner.

Once one line is input the bearing or distance from the last line can be used again by pressing enter at the prompt or typing L. The program will remember the units from the last traverse until it is set back to metric (or links)

The program takes this information, does all the necessary conversions to convert it to metric, and then combines the measurement into a string which it types into the AutoCAD command line to create the line. It then runs a labelling routine, which labels the bearing and distance along the line. If the line is smaller than the text will fit, and autoshrink is turned on, the routine currently shrinks the text down to a suitable size. This was seen as preferable to doing a callout or short line table, as it keep all the information plotted where it belongs, not hidden in the corner of the page. The text is placed on the layer drafting, and is not exported as part of the LXML file. There is a small function here that makes sure the text is rotated to the ISO standard (reads from bottom or right)

The bearing and distance information is also assigned to the line object at this time for future export to XML. The information connected to the line (*or any LXML4AC object*) can be examined by typing XDE and selecting the line.

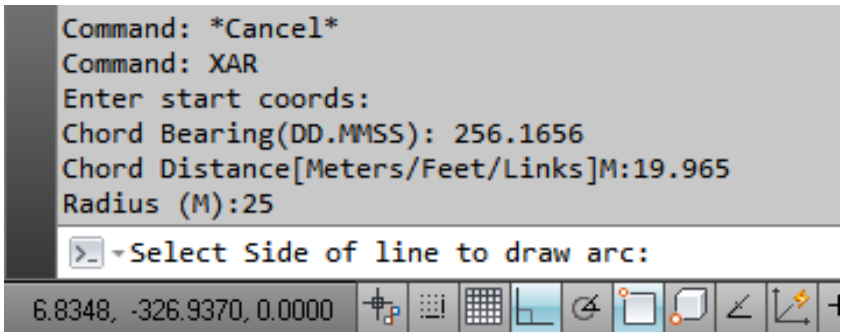
The type of line (road, connection or boundary) is based on the layer, so all of the information can be input into AutoCAD, and then assigned to a layer post entry, by picking it up and changing the layer. This is design to speed up entry, as a lot might have one road and three boundary lines for example. Assigning the layer post entry means the lot can be drawn as one long traverse.

What to do when things don't close perfectly

The problem with recording things as a vector (bearing and distance) eventually a situation will arise where geometry will not close on itself. This is not a big problem. In LXML4AC the line will retain its inputted xdata regardless of what you do with the line. **This can be very dangerous as end of lines can be moved large distances and still look the same in xml.** When you get to the end of a loop that does not close, and the closing distance **is within tolerance**, simply grab the end of the line and snap it to the starting point. Alternatively extend the lines to each other. (This is a rudimentary method of closing a lot, if you wish to use a Bowditch or other such coordinate adjustment you will need to use external software and look into using the XAL and XAA tools).

XTA – Arc Traverse

This is an arc traverse. The arc is entered using a bearing, a chord distance, a radius and selecting a side for the arc. The bearing is entered in Sexagesimal format (DDD.MMSSdddd), and the distances can be entered in metric, imperial or links by pressing the appropriate key. Comments can also be added to the line, for example, “Per Original”, “By Me”, and “Occ to Occ”. It works in a similar manner to the XTR function (traverse) so refer to that section for entering imperial or link measurements, and comments.

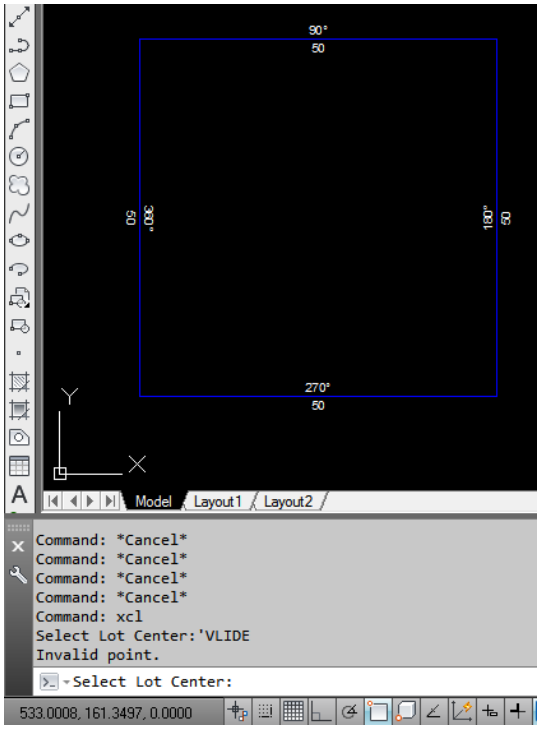


Here is an arc with a chord bearing of 256°15’56”, and chord distance of 19.965 and a radius of 25. At this point the program draws this chord as a line and will ask for a side to draw the arc on. Move the cursor to the side of line the bulge will be on. Bearings can also be entered as survey bearings, in this case S76.1256W. Many old Crown plans prior to 1900 use this format.

The program then runs the arc labelling routine as well as assigning some xdata to the line. It is probably worth noting here the LXML doesn’t store the chord distance and this is an interpolated distance based on the radius and arc length, but most surveyors prefer to enter the chord distance and it is recorded on the plan.

XCL – Create lot

This tool is uses to take the lines and arcs created with the previous tools and defines a lot. In LXML a lot is defined by a series or reference to points, a centre point and other information, for example a lot number and area. The tool works by creating a hatch, then tracing a polyline over the top of the hatch. The use of hatches was originally designed so that the tool HPGAPTOL could be used to define unclosed lots, but this is unadvisable for LXML.



So here is my nice simple lot, and I have typed XCL, and it asks me to select the centre. This will be the point where the lot text is added and is also written to the LXML as the lot centre. It is also used to flood the lot to create the hatch. A number of layers are turned off while the lot is being defined by the hatch flood.

The program will then create the hatch, put a polyline around it and the delete the hatch. The preview of your lot should come up as a green hatch. You are then prompted for the lot number, this will increment automatically if it can. For a *multipart lot type PT as well as the lot number. (If your Autocad is stopping at this point, it could be that the hatch pattern "solid" is not available, this may be fixed by switching the "measurement" system variable to 1).*

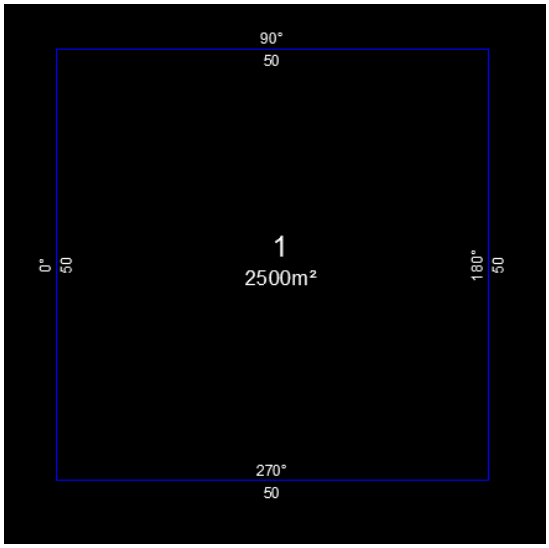
The next prompt will be the area. It can be calculated by typing C, or entered directly from an existing plan. There is a checking routine that will alert you if the entered area is out by more than 10%. The program will also finish by displaying the area difference (in percentage) when it finishes. If you don't wish to define an area (for example an existing lot), just press enter.

There is the ability to type acres, rood and perches here, by entering in the format acres.rood.perches. The two decimal points indicate that it is an imperial area, so if you enter in this format you might need to add 0 eg 200 acres is 200.0.0.

It will then prompt you for whether the lot is proposed or existing.

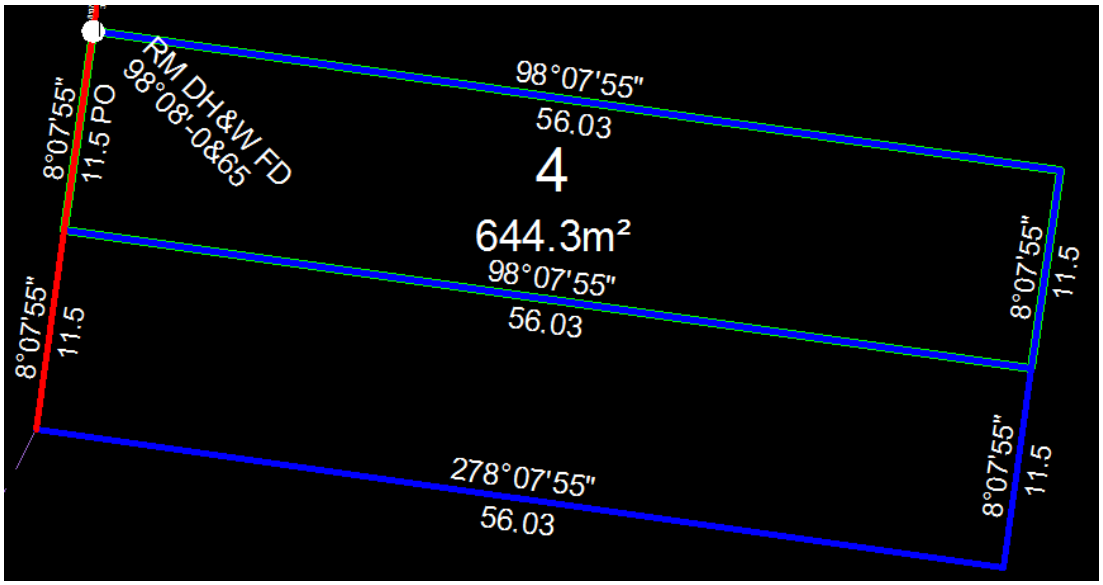
The program will then store this information as xdata on the polyline.

After this step the lot number and area are annotated and the lot polyline is moved behind the boundary geometry. The area annotation will be rounded to 4 significant figures but will be stored to 3 decimal places as a square meter value, as xdata for export to LXML. By default the area will be rounded down at the last digit (eg 546.16 becomes 546.1) so you don't ever imply the lot is bigger than it is. This can be turned off using the XRD fuction and selecting no for the last prompt. If using a UCS the text will be rotated with regard to the current UCS, but centre point geometry will be related to world coordinates



Here is my annotated lot.

The lots can be seen underneath the overlying geometery by turning on the line thickness  . Lot definitions are given a thickness of 0.7. Note the slightly green tinge to the lines on the northern lot in the figure below.



One of the bugs that still exists in AutoCAD, is the hatch tool. There are certain geometrical situations where AutoCAD will not be able to hatch the lot and the program will bug out. This seems to happen often when curves are involved. In this situation, trace the outline of the lot with a closed polyline and then use the XAP tool instead.

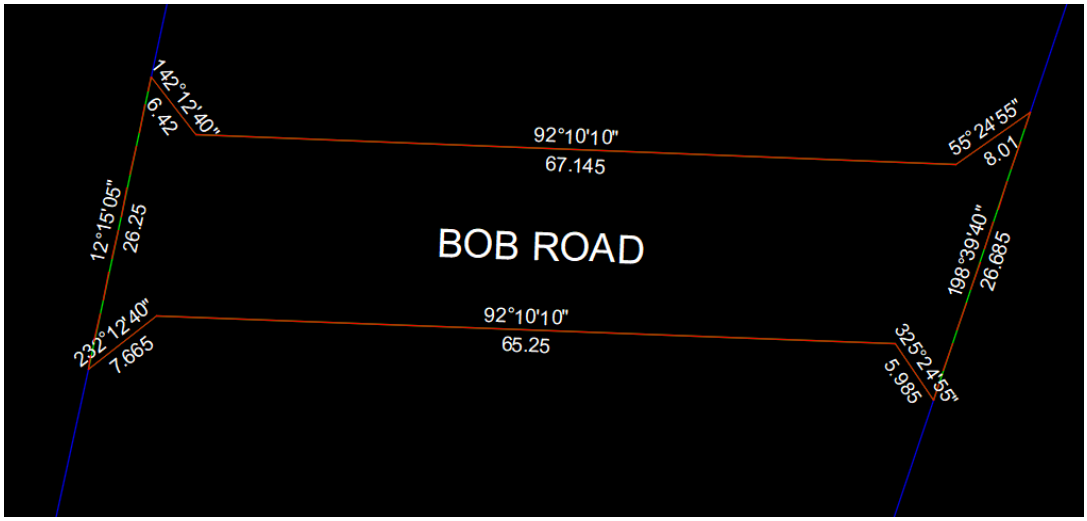
There is also a bug involving curves or short lines where the hatched polyline vertexes will not be placed directly on the existing line/arc ends. LXML4AC will find these point when exporting and alert you to their location and inserts orange (color 30) objects over the top. If there are a lot of these the XCT function may be able to clean up a lot of these. If there is still a problem after XCT a solution is to trace polylines with curves or zoom right in on the auto-created polyline and snap the vertex to the corner of the line/arc after the LXML exporter finds them.

XCE and XCR – Create Easement or Road lot.

These are special lots, which work in the same way as the XCL tool, but the user is prompted for an easement description or road name instead of a lot number. The easements will be labelled with the next parcel name E designator (after doing a search of all easements in the drawing). If the description of the easement starts with (#) the E designator will be placed on the non-plotting layer lot definitions, and the bracketed character will be plotted on the plan. This better matches current plan drafting formats. The Xdata assigned to the polyline is also slightly different.

XCE is also used to create other secondary interests (restrictions, caveats etc). The user is prompted for the secondary interest type.

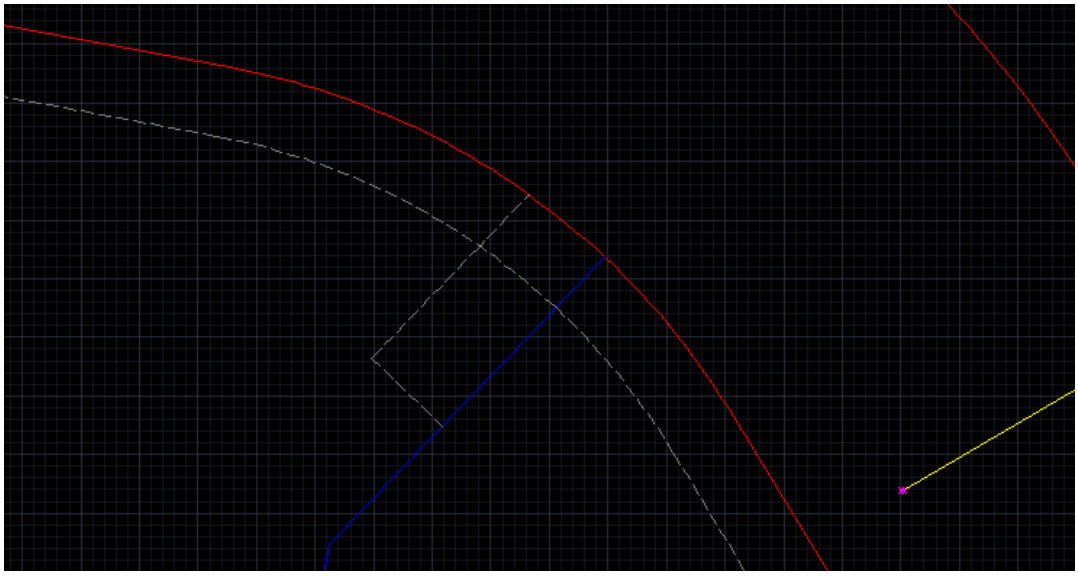
There is also a routine in here to find the closest line or arc to the centre point and aligns the easement or road name to this.



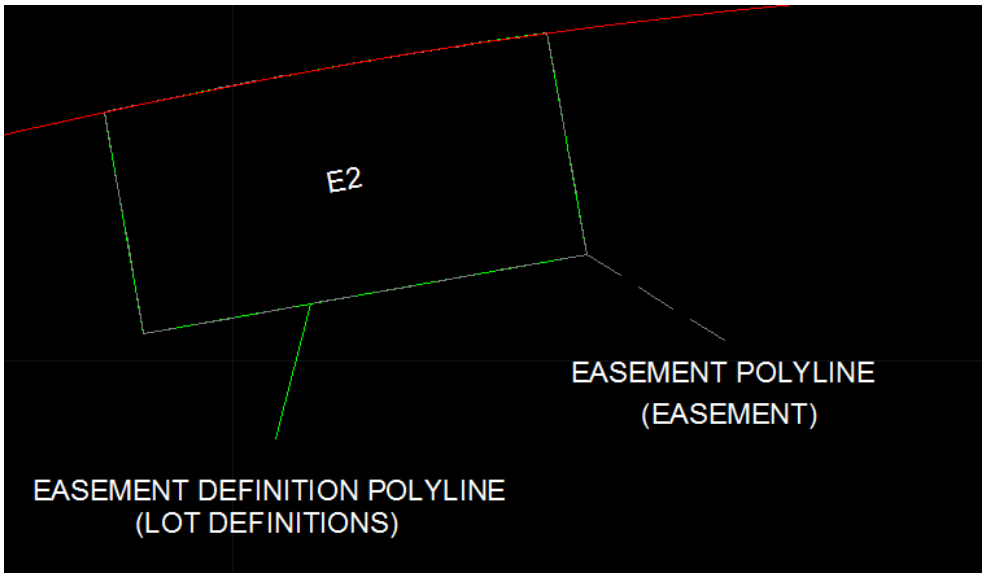
Here is an example of a simple labelled road. Note that road lots are only created for proposed roads in LXML. To add an existing road use the Adjoining Road tool (XJR).

When an easement exists, it is important to create the lot before the easement, as the edge of the easement will affect the lot finder.

Where two easements exist over the top of one another and are crossing for example below, it can be easier to define the lot using the XAE tool or create the lot using XCE and then move then corners of the lot definition manually, as the polylines will block the hatch flood tool.



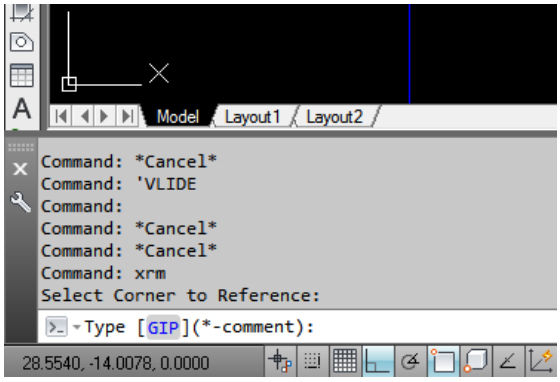
Existing easements are also a special case as the geometry of an existing easement inside a proposed lots does not necessarily needs to be defined. As the lot definition polylines are not plotted, a polyline placed over the top of this lot in the “easement” layer that will allow the easement to be plotted. Any line or arc in the easement layer would bug out as it will does have any xdata attached, but a polyline in the easement layer is not exported, but will plot as a dashed line. The XIN command also identifies these lots and places polylines in the easement layer over the top of the lot definition. An example is shown below.



XRM – Create reference mark

A reference mark in this format is a mark which is remote to a boundary corner, and has no other connections coming from it. The function asks you which corner you want to reference, the type of mark, whether it was found or new, an optional condition and then a bearing and distance from the reference to the corner. This might cause a little bit of confusion, but is designed for entry, where the boundary corner will exist before the reference, but the reference will be labelled as described above on the plan. If "found" was chosen, it will prompt for a DP number.

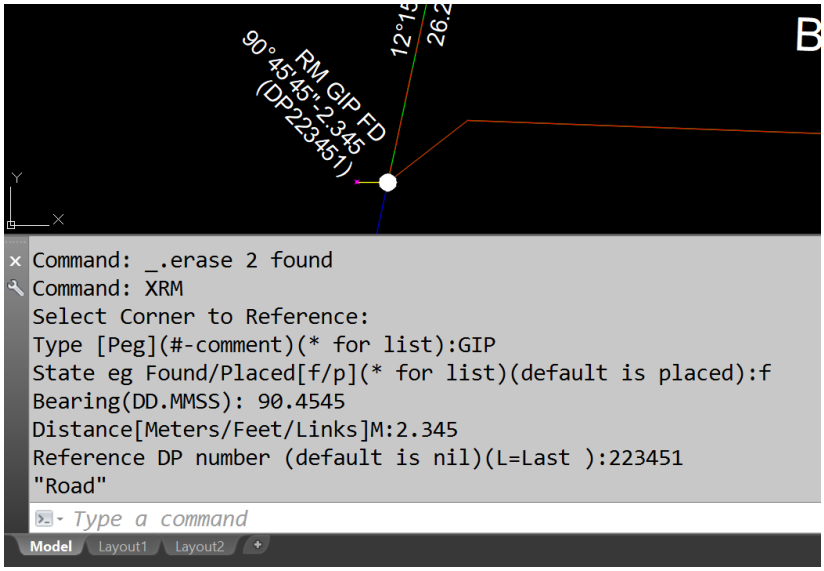
There are a series of prompts as follows



Type: At this point a comment can be added by adding a '-", e.g. GIP-in Concrete. This will be stored as a description in the LXML data on the RM point. It is possible to add another comment further down which is related to the geometry information and is stored on the line between the RM and the corner. You can also type * in any one of these prompts to bring up a list of possible selections. If you want to add a comment as well as select from the list box type "*-*my comment*". If manually entered the mark type will be checked against a series of known types, shown in the enumerations section of the LXML recipe. The list is case sensitive, which is why the selection box has been added to the prompts here. A concrete block which is a common mark in NSW can be entered as CB and will be recorded as "Conc Block" to match this enumeration. If the correct type is not entered an alert will come up and a list of possible entries will be presented for the user to select from.

The next prompt is state, either found or placed. There are other options here in the enumeration for monument state, e.g. Found Now Gone. Once again * can be used for a selection box. A check is made on this entry as well.

You are then required to enter the bearing and distance, similar to a traverse entry, including the ability to enter a comment.

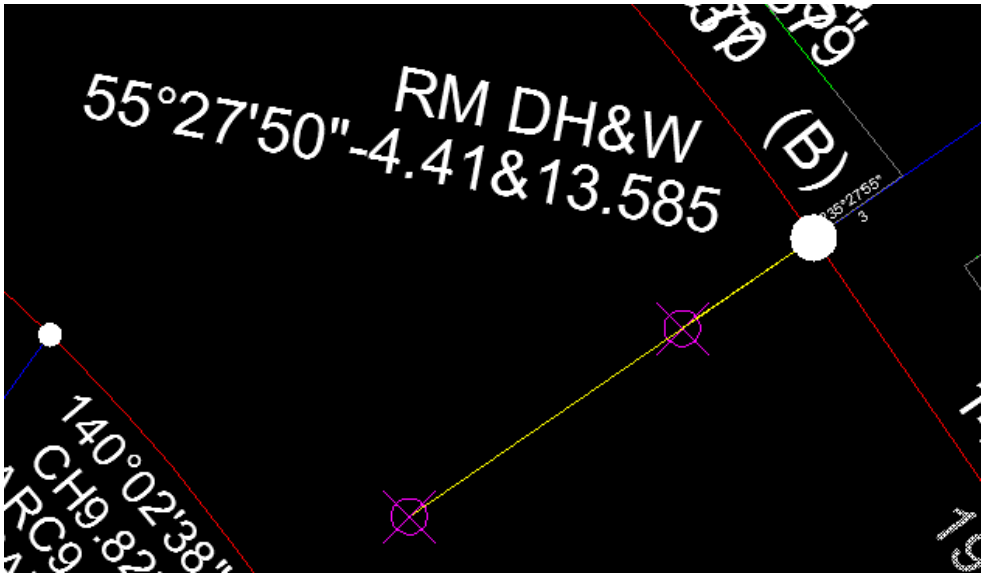


Here is an example of the output. The function does four things.

1. Draws a line between the corner and the RM and adds reduced observation xdata to it.
2. Places a point on the monument layer and adds monument xdata to it
3. Takes what you typed in and labels the information in the Drafting layer. The position and rotation of the text is dictated by the bearing of the RM + 45°
4. Adds a RM block on the corner.

XDRM – Create double reference mark

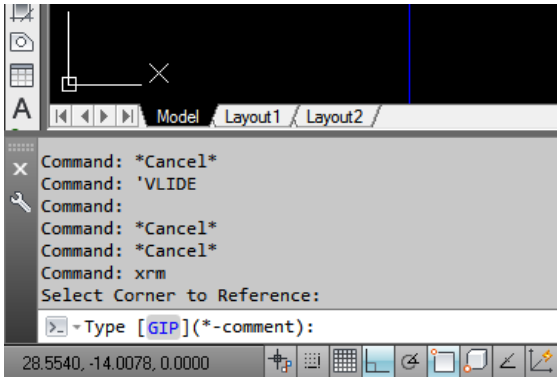
This tool works exactly the same as XRM except you are prompted for a second distance. It is for references where there are two marks at the same bearing from the same corner. For example either side of the road.



XCM – Create mark (monument) on corner, Non peg mark on corner

This program is used to place a monument on the corner of a lot that is not a placed peg. In survey drafting if a "pop" or circle is placed on a corner it assumes that a peg has been placed on the corner, but if a different type of mark is placed on the corner, the surveyor is required to denote it. This tool is also used for reference marks on corners that are found, for example an adjoining peg. It works very much the same as XRM tool.

There are a series of prompts as follows

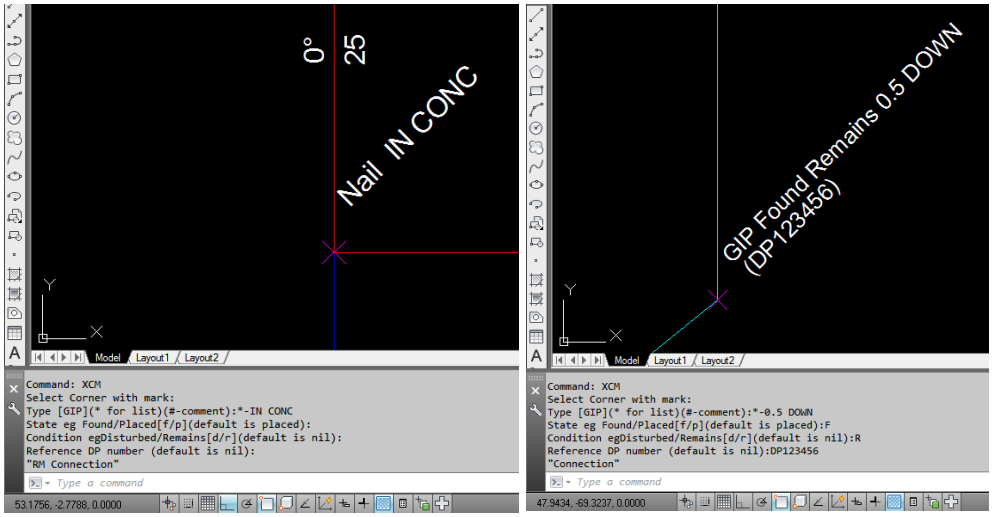


Type XCM to run and select the corner to place the mark on. At this point a comment can be added by adding a -, e.g. GIP-in Concrete. This will be stored as a description in the LXML data on the monument point. You can also type * in any one of these prompts to bring up a list of possible sections. If you want to add a comment as well as select from the list box type "**-my comment*". The mark type will be checked against a series of known type, shown in the enumerations section of

the LXML recipe. The list is case sensitive, which is why the selection box has been added to the prompts here. A concrete block which is a common mark in NSW can be entered as CB and will be recorded as “Conc Block” to match this enumeration. If the correct type is not entered an alert will come up and a list of possible entries.

The next prompt is state, either found or placed. There are other options here in the enumeration for monument state, e.g. Found Now Gone. Once again * can be used for a selection box. A check is made on this entry as well.

Here are two examples of the output.



The function does two things.

1. Places a point on the monument layer and adds monument xdata to it
2. Takes what you typed in and labels the information in the Drafting layer. There is not yet a way to determine the rotation of the surrounding lines, the label will always be at 45°

Occupation Points

This tool can also be used to denote occupations on corners, for example the end of party walls or corners of buildings. An occupation is selectable from the type list. The point will be placed in the occupations layer. You will be prompted for a description of the occupation.

It is important that the description does not start with a number (e.g. 0.23 Wall, instead use Wall 0.23) or the importer program will identify this mark as an offset and run a function to find the closest line to the number for text orientation. There also needs to be a description when using an occupation corner mark, otherwise nothing will print on the plan. The program will prompt you for a description if you choose occupation without a comment.

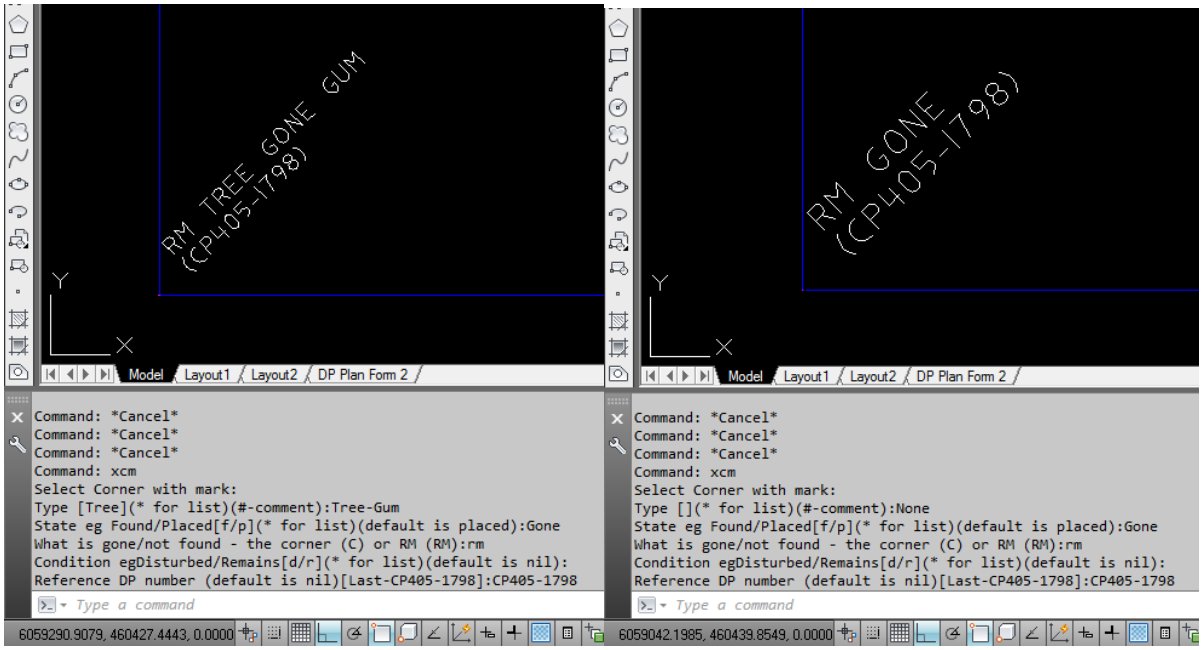
Regardless of whether an occupation is found or placed (unlikely) it will not be labelled as found/placed on the plan, but will be stored in the xml as such.

Corner mark gone

This tool is used to show a corner mark that is no longer there. It refers to a mark on the corner not a RM from it. Choose the type of mark that is gone and select or type “Gone” or “Not Found” as the state. You will then be prompted for corner mark or RM, type “C”.

Mark (RM) gone

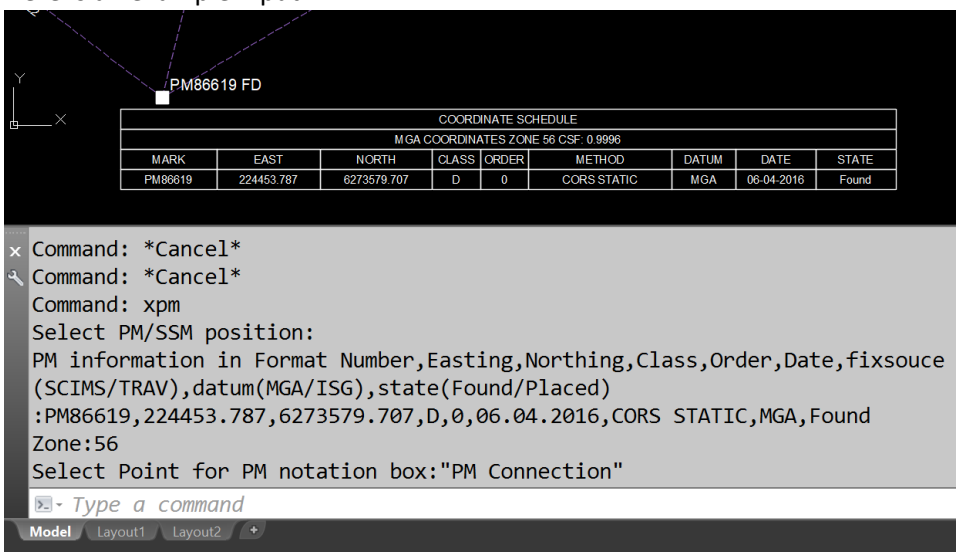
This tool is used to place a “Gone” Reference mark. Select the type of mark and select “Gone” or “Not Found” as the state (or type them in). You will then be prompted for corner mark or RM. If RM is selected a description of “RM” is added to the xdata (and joined with the existing description if there is one), and the appropriate labelling is added. If you don’t wish to specify the type of RM that is gone select “none” from the bottom of the type list.



XPM – Create PM

This program is for creating a Permanent Mark (PM), either a PM or SSM or other mark. In the LXML file the PM is stored as a reduced position observation (as opposed to a reduced line or arc). If you want to use the PM as a reference for a corner you need to use the XCM or XRM tool to put a monument on this corner. I had thought to make the entry of the information required directly copy-able from a SCIMS csv output, but there is a lot of redundant information in that type of entry (i.e. height) and the datum and fixsource are not listed there. The input is a comma delimited entry of information. This is designed so with a little bit of rearranging information from SCIMS or other sources in excel, a csv could be copied to the command line, speeding up entry for existing information, rather than asking for each individual item. The package includes a simple excel spreadsheet (PM CSV Maker.xlsx) that will concatenate the entered information, and then it is a matter of copying the concatenated cell to the command line in Autocad.

Here is an example input



The program does the following things

1. Creates a point and attaches the reducedpositionobservation xdata to it.
2. Adds the PM block symbol in the drafting layer
3. Adds the PM text in the drafting layer.
4. If the mark has its source as SCIMS and class is not U it will add the word (EST) under the mark.
5. Adds a line of information to the Coordinate box. (If it is the first entry it will ask for a position for the coordinate box so it can draw the header information. This will be the top left hand corner. It will also attempt to find the zone from the admin box if it exists, and find a combined scale factor on PM lines if they have been created. If either of these items are missing it prompts the user for them).

Since the introduction of MGA2020 the order has been replaced with positional uncertainty. The program examines the datum of the PM and will interpret the value in the order/PU position accordingly. If the mark has no PU use “N/A”, and program will not record an xml PU value, but the table will be populated with notation N/A.

Special Case were RM is used like a PM

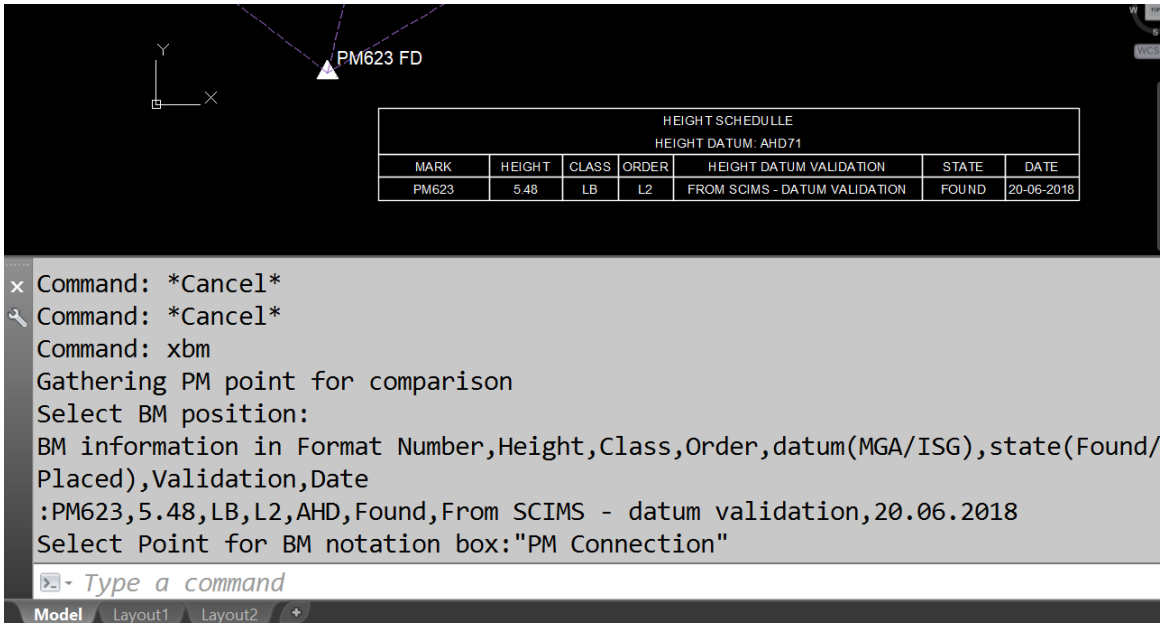
Where one end of the line is listed in the coordinate table, for example when it is being used to determine the MGA datum through GPS, the mark can be put in as per normal, but the name must be in the format Type '#' where the type is the monument type and the # is the datum letter, for example GIP 'A'. It is important to use the ' as this is where the name will be stripped to for oid export, ie. The GIP portion of the name will be removed. It is also important there is a normal monument (created with XCM) on this point as well as that will be used for rebuilding the name on import.

XBM – Create Benchmark

This tool is used to define a reference level on a PM, SSM or other mark for stratum plans. In the xml file the vertical position of a BM is stored under a reducedVerticalObservation. The input is a comma delimited entry of information. It is designed so with a little bit of rearranging information from SCIMS or other sources in excel, a csv could be copied to the command line, speeding up entry for existing information, rather than asking for each individual item. The package includes a simple excel spreadsheet (PM CSV Maker.xlsx). The second sheet of the excel file has a function that will concatenate the entered benchmark information, and then it is a matter of copying the concatenated cell to the command line in Autocad.

Geometrically the vertical position of the BM doesn't need to be correct in the z axis and won't be recorded on export, only the inputted text value recorded on creation.

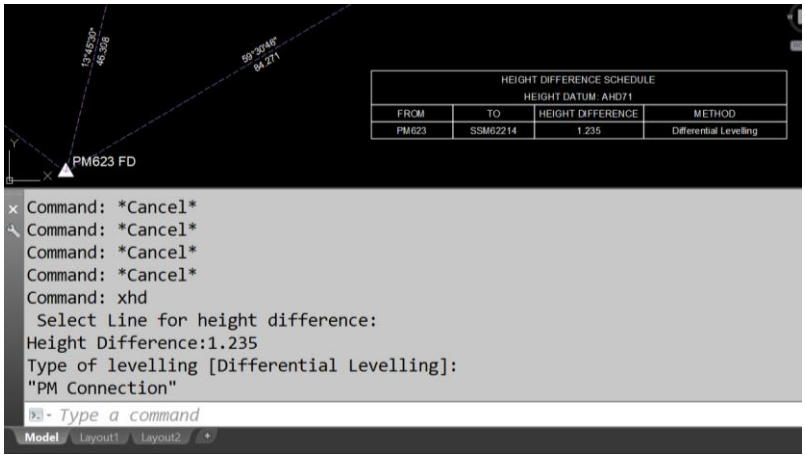
Before running the program it will go through and get the positions of all existing PM's. If the position selected is not one of these positions a BM symbol will be applied and the BM labelled. The information is then added to the height schedule.



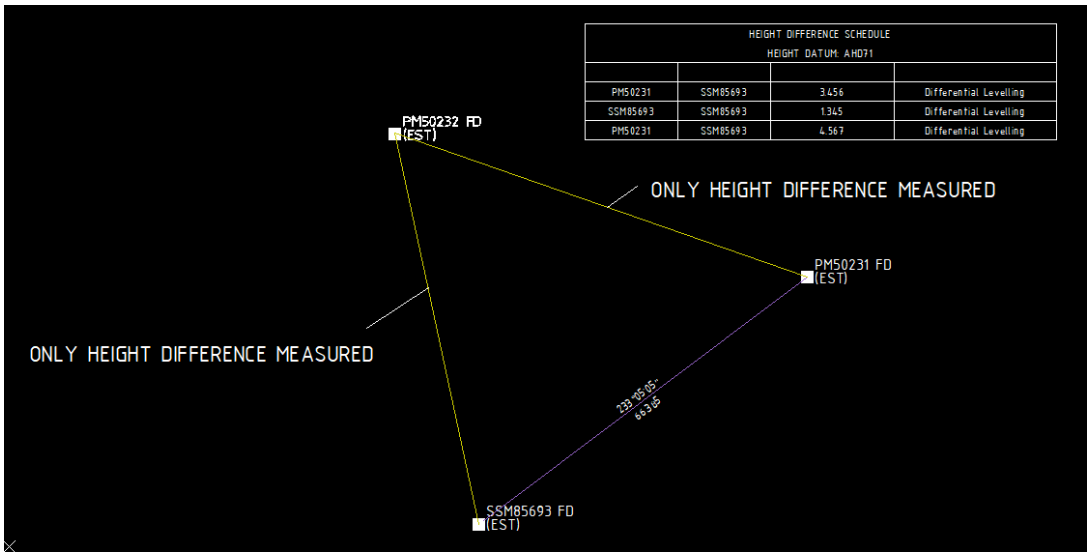
Since the introduction of MGA2020 the order has been replaced with positional uncertainty. Because the horizontal datum isn't recorded with the point the datum can't be used to interpret if order or positional uncertainty are being used, so there is two prompts. Leave the one you are not using (the order or positional uncertainty columns) blank – don't fill in both. If the mark has no PU use "N/A", and program will not record an xml PU value, but the table will be populated with the notation N/A.

XHD – Add height difference to line

This tool is used to add a height difference to a connection line, for the purposes of BM validation. The tool does not examine the selected line, it just records the difference entered by the user and the method used. The delta height entered needs to be in the same direction as the line. The information is added to the lines xdata, and a height difference schedule is populated.



If there is already xdata stored on the line, the height difference and type will be amended to the line. If there is no xdata, it is assigned to the "height difference" layer and only the height difference and type will be stored. The height difference lines are not plotted.



XSF – Assign scale factor to line

This tool is used to add the distance adoption factor, otherwise known as the combined scale factor to the PM connection observations. It will only select lines in the PM connection layer, and does no mathematical conversion or changes to the line. If the line doesn't already have a distance adoption factor then program will find the word "Measured" in the xdata and then after that add the given combined scale factor to the xdata of the line. If it a scale factor already exists on the line it will replace the existing value with the new value.

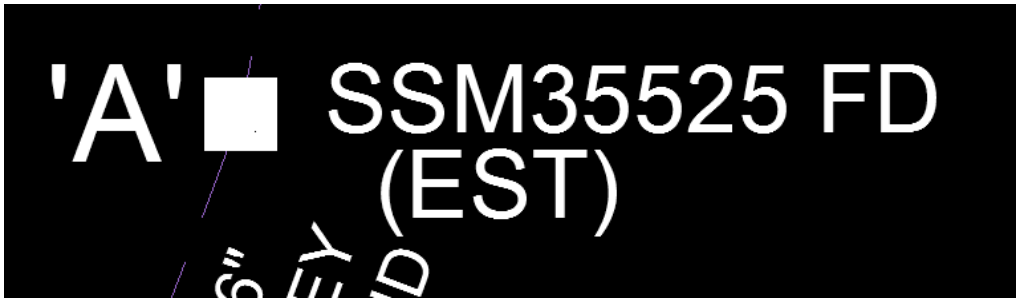
Scale factors need to be applied to lines between PM's. This allows the LPI Validation services to complete checks between the listed marks in MGA and the bearings and distances shown on the plan in Ground.

XUP – Assign Use of Parcel to lot

This tool is used to add a use of parcel attribute to a proposed lot. Lots such as drainage reserves and public use land will be labelled on the plan with this attribute. Only uses relevant to deposited plans (in my opinion) have been added to the list. The lot must already exist, and the useOfParcel will be added to the xdata and the label added below the area of the lot. If the lot is adjoining the XJO tool can be used.

XDP – Create Datum Point

Every plan is required to have two datum points, denoted either X and Y or A and B. The datum points are stored in the LXML file CGpoint section under the label “desc”. To place a datum point, select where you would like the datum point to be and then type the letter of the datum point. **Note – in LXML only A and B are allowed, so if your plan has X and Y change it to A and B**. If you accidently type X or Y in here, the program will automatically change it to an A or B.



The program does two things

1. Creates a point and assigns the Xdata of the datum point description to it.
2. Switches to the Drafting layer and types the datum letter in. Note that the letter is positioned not to interfere with the PM number as these are often the same point (and should be the same points in new plans).

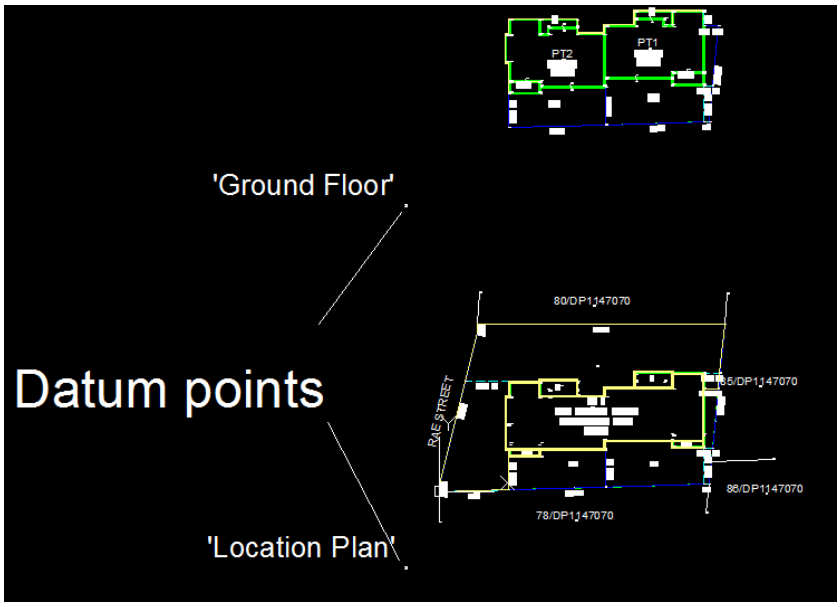
Datum points can also be used to create plan note markers, for example “No vehicle access is permitted across boundaries marked P-Q-R-S”, keeping in mind that X,Y will automatically be changed to A&B.

Datum points can also be used to create plan note markers for basic two level inclined stratum plans. If the datum point does not contain a word listed in the strata datum point word list or A,B,X or Y and the point selected has a 3d position or RL it will be assumed to be a stratum point and the RL will be labelled.

Datum points in strata plans

Datum points are also used in strata plans. Strata plans are required to be stacked. This means all levels and the location plan are stacked on top of one another. This is extremely hard to work with in a cad situation, so the datum points are used in this case to stack the data on export. The coordinates will be aligned to the location plans' datum point. Each level needs a datum point, and the label needs to be the same as was entered by the XSA tool.

The datum point will be the same as the level, for example the datum point label for the Location plan will be "0,Location Plan", the lowest basement will be "1,Basement 2" and so on. The number will be stripped off for the level label. On export all the levels are stacked based on the location plans datum point, as this should exist in almost all strata plans. The datum points are not exported to the xml and on re-import the levels are unstacked with a default gap of 500m in the northing. Strata datum points must have one of the following words to enable the program to identify it as a strata datum point and not an ordinary DP datum point: "Basement" "Carpark" "Level" "Location" "Plan" "Mezzanine" "Upper" "Floor" "Ground". *If your building has a level that does not contain one of these words the list can be edited by opening the lisp file in Notepad and searching for "setq stratadpwl".*



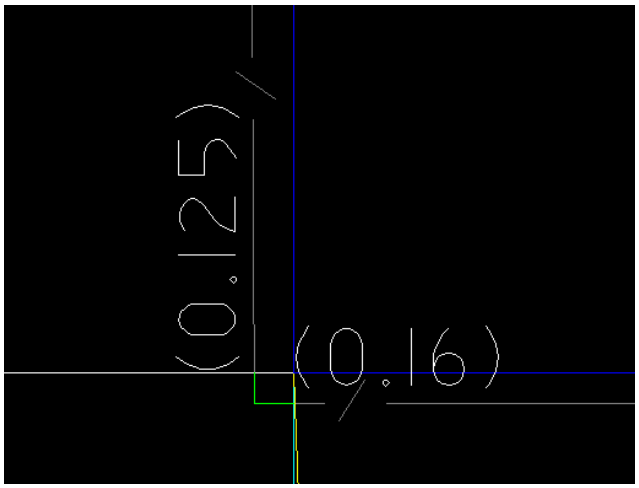
XOC – Create occupation offset

This is the first of the occupation tools and will probably be the most common one used. It is used to denote the perpendicular distance from the boundary line to an occupation, be it wall, fence, building or kerb.

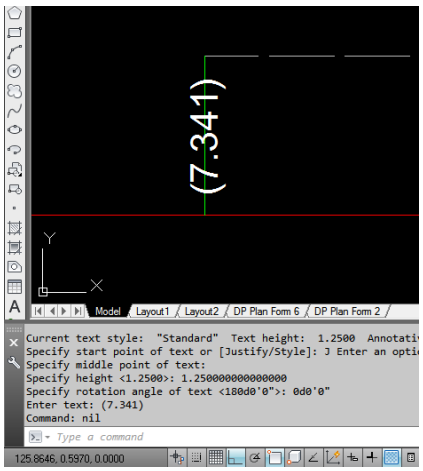
The program will ask for the occupation point, select the point on the occupation
It will then ask for the boundary to offset
It will then ask you for an occupation comment, for example is the occupation “over” or “clear”, or “wall to bdy” etc. This doesn’t need to be completed.

The program will then place an occupation line and attaches the xdata which will be stored in the plan features section of the LXML file.

Here is an example of a double fence line offset. A green line is drawn from the occupation point perpendicular to the boundary, and the annotation placed over or to one side of the occupation.



Here is an example of a kerb line occ. Note the green line under the text is not printed when plotted.



The occupation objects, e.g. fences, buildings, kerbs and walls, if in the occupation layers, will be exported to the LXML as plan features and have no Xdata unless it is assigned using XAO, so they can be created using the ordinary AutoCAD tools (e.g. offset, move, copy etc.) and can be lines, curves or polylines.

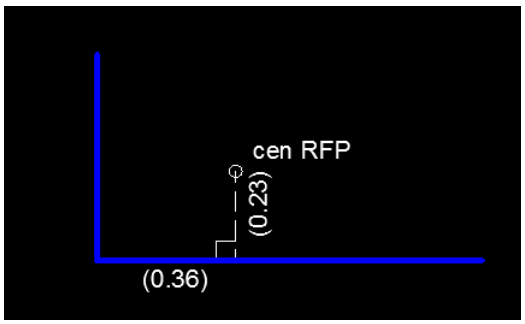
There are other types of occupation offsets, where information is stored as a monument. Earlier versions of the program (pre 1.8) stored the offset as a monument on the point and went to the trouble of comparing all boundaries to the offset in the description on import. This type of offset in no longer created by the program because it lacks or is hard to determine the direction, but can be made manually using the XCM command and selecting occupation. If the description starts with a number or bracket then a number the importer will still try to match with number with an offset to a boundary.

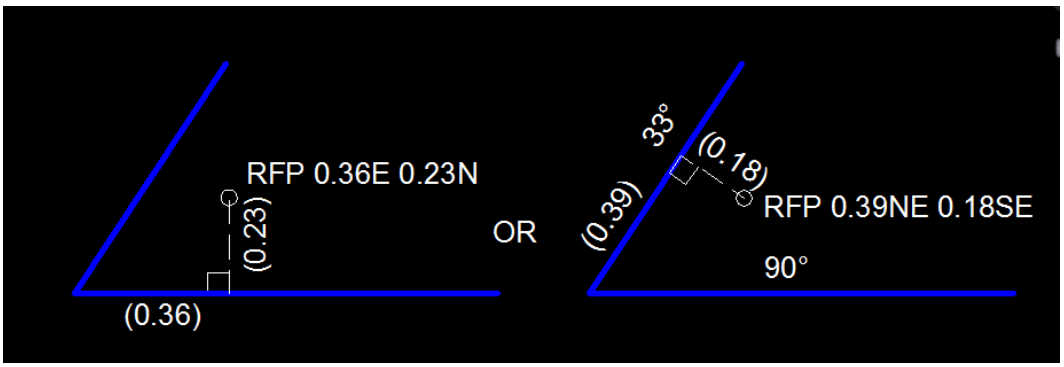
XOQ – Create Occupation – Queensland style

I will have to plead ignorance here, as I have only ever seen occ's shown like this on Queensland plans. The inherent problem with showing occs as a distance North/South or East/West, is it can get confusing if the boundary lines are running at 45°, but they would be useful if you were picking up a series of front posts instead of lines of fence. Regardless of my opinion, they can be done and here is the tool to do it.

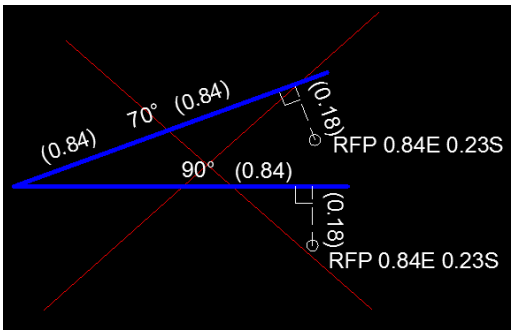
The offset is measured from one boundary line, first along the line and then square to it. The first direction indicating which boundary line is to be used.

This works in all cases except where both boundary lines are in the same octant. The diagrams below show the difference, and attempts to demonstrate what happens in a non-square situation.





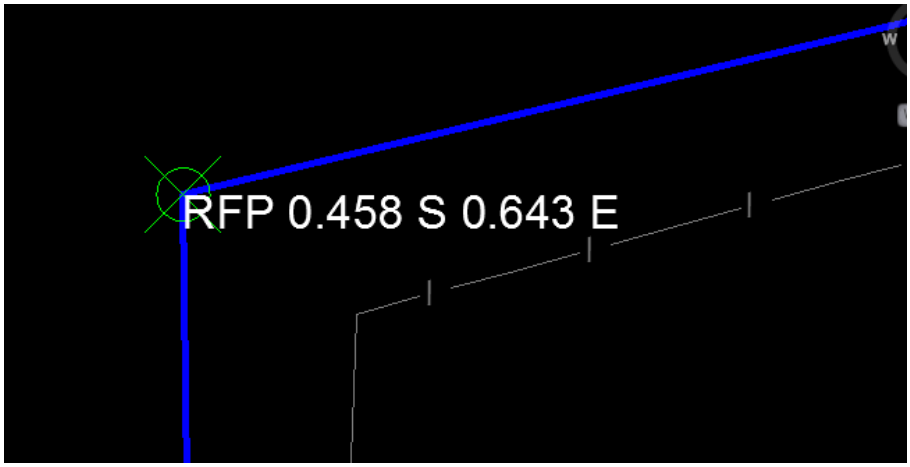
Options when using non square boundaries



Situation where tool is not appropriate

To use the program:

Select the occupation point
Select the boundary corner
Select the reference boundary line
Give the program a description of the occupation point (e.g. Cen SFP)



The program will calculate the offsets to the boundary and their cardinal direction. It then does the following

1. The program will place a point on the boundary corner and assign the monument xdata to it.
2. It will then label the boundary point with the calculated information in the drafting layer.

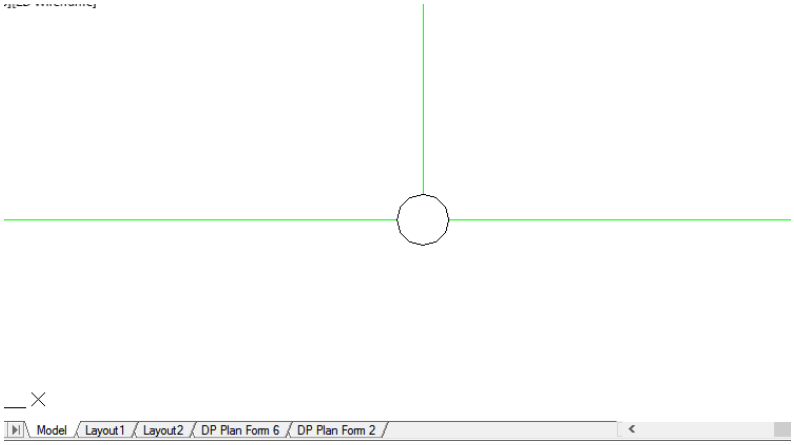
To determine what type of monument occupation when importing these occupations from a LXML file later on the program looks at the first letter of the "desc" section of the LXML. If it is a letter it will assume this is a Queensland style occupation or standard description occupation. If it is a number or a number after a bracket it assumes it is an offset type occupation observation, if it finds a comma in the desc it assumes a double road offset.

XCP – Create auto pops

LandXML for AutoCAD has been designed to create a background recording of XML data, while drafting a plan that looks similar to normal survey. The pops, RM's and PM block have been built so that the line work does not need to be cut inside the circles of these blocks. This has been done by creating a white hatch that sits behind the circle, which blocks out the line work underneath.

If at any stage you notice the line work is on top of these block, as will happen if you draw a line after the block has been put in, use the quick select tool, select all blocks in the job (e.g. colour = bylayer) and type "draworder" "f".

The autopop tool does exactly what you are thinking. It puts a pop block on every boundary corner. It uses the lot definitions (polylines) to place the pops on the corners. The program makes a list of corners so that corners that belong to multiple lots are not popped twice. I have changed the background colour to white here to show how the pops look.



XAS – Create Admin Sheet

The admin sheet is used to store all metadata related to the plan. It is designed around the current plan forms 6 and 3 with attributes added out the side for things that are in the LXML that are not currently recorded on this sheet. The program will do the following checks and bring up the some choose lists. If you want to edit some of these later on, you can either double click the title block or type attedit and select the box.

- DP number – DP will be added if you just type in the number only. If it is a CP or other type type in the full name
- Format- * brings up a list of formats. Hitting enter defaults to Standard
- LGA – no checks or corrections
- Locality – no checks or corrections
- Parish- * brings up a choose box of parishes and counties, if you use the prompt the county prompt will not come up.
- County- no check or corrections
  If your survey covers more than one LGA, Locality, parish or county separate them with a "/"
- Surveyor-no checks or corrections
- Firm- no check or corrections "&" symbol will fixed on export
- Date of Survey – if the date is entered in normal format (dd.mm.yyyy or dd/mm/yyyy or dd-mm-yyyy) it will be corrected to (dd-mm-yyyy). It is corrected to xml format on export
- Urban/Rural- U or R shortcuts can be used here
- Terrain- L or S shortcuts can be used ere
- Plan of – no checks or corrections
- Purpose- * brings up a list of purposes. Subdivision is selected in the list by default
- Date or registration if the date is entered in normal format (dd.mm.yyyy or dd/mm/yyyy or dd-mm-yyyy) it will be corrected to (dd-mm-yyyy). It is corrected to xml format on export
- Surveyed or Compiled – S or C shortcuts can be used here
- Jurisdiction – hitting enter will default to NSW
- Parcel Notes- If this ends up being multi line and you need linefeeds, enter the first line and come back and edit the box using attedit, where it will allow you to press enter to linefeed
- Azimuth - * brings up a list of azimuths. MGA is selected in the list by default
- Zone - no checks or corrections, note here a ISG zone (subzones) are not valid, it must be an MGA zone
- Subdivision Certificate Number- no checks or corrections
- If plan of, plans used or parcel notes are not entered the default "none" or "not entered" values are used. The "none" values will be removed on export to LXML.

The second prompt, format, determines the type of title block to use and will omit some prompts in the case of a strata plan. Note that this needs to be "Strata Schemes" for strata plans.

DEPOSITED PLAN ADMINISTRATION SHEET

Office Use Only

Registered: 2014-06-30

Title System:

Purpose: Resumption Or Acquisition

Office Use Only

DP1196426

LAND TO BE ACQUIRED FOR THE PURPOSES OF THE ROADS ACT, 1993

LGA: BLACKTOWN

Locality: MARSDEN PARK

Parish: Rooty Hill

County: Cumberland

Survey Certificate

I, ANDREW RICHARD THOMAS

of CRAIG & RHODES PTY LTD

and the survey was completed on 2013-11-28

Surveyor's Reference: 12998

Type: Urban

The terrain is Level-Undulating

LOT 32 WILL BE REQUIRED FOR ROAD, AFTER CONSTRUCTION WILL BE DEDICATED AS PUBLIC ROAD UNDER SECTION 10 OF THE ROADS ACT, 1993

Plans used in the preparation of survey/compilation:
DP25693, DP233714, DP1075157, DP1191653

Jurisdiction: New South Wales
Format: Standard
Datum: MGA
Horiz Datum: Local
Vertical Datum: AHD
Zone: 56

Surveyor's Reference: 05-12-RMS-2013MT100(20026) PARTIAL SURVEY

XLA – Create Layout Sheet

This is a useful tool for printing. It goes back to the old system of not using autocads paper space; you place the sheet wherever you want to plot from.

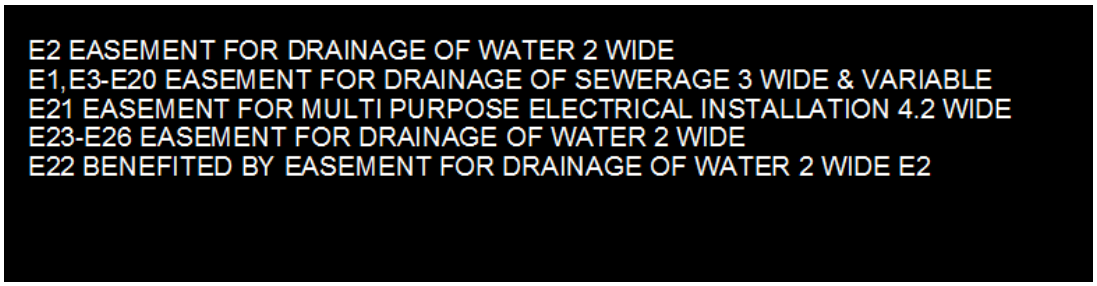
A white hatch has been used, similar to the way the pops and RM symbols work to mask out the layout information from the survey data behind it. If you want to see what is written on the layout, change your background colour to white.

If you already have an admin sheet, the layout will be filled out with the appropriate data if it exists, and placed at the bottom left of the admin sheet if it exists, otherwise it will prompt you for a position. Pick it up and move it from here to an appropriate location.

The layout will also auto-scale itself to the current scale.

XEL – Create easement legend

This tool is used to create an easement legend. It goes through all the easements in the drawing collects their E# designator and description, sorts these results based on the descriptions then uses this list to create a legend. If there are consecutive easements eg E1, E2, E3, E4, E5 all with the same description it will reduce this down to E1-E5. Here is a typical output of the function



The user is required only to position the top left corner of the legend, and it will be drawn. This function is also used by the importer and will place the legend underneath the admin sheet to the right of the coordinate listing.

The easement legend still leaves the E numbers on the start of the legend, unlike the easement creation tools which can identify an (#) designator on the front. This is to help with easement parcel tracking. These E numbers would need to be removed before plotting the plan.

XAL – Assign line to XML

The tools we have used so far are good if you are entering in DP into AutoCAD for storage as LXML, but we all have our favourite survey packages which have their apparent advantages. One thing that is fairly common in the industry is that deliverables are often required in AutoCAD or Microstation. Quite a lot of survey drafting is also done in AutoCAD. For this reason I have made tools to use line work and objects imported into AutoCAD, and assign the xdata to it.

All the assigning tools have the ability to round the information. This is controlled by the XRD command, were you can decide to round the information stored and displayed. This is fairly common on Survey plans, as it gives an indication of the accuracy that surveyors on the ground work to. It also makes redundant precision decisions on short lines.

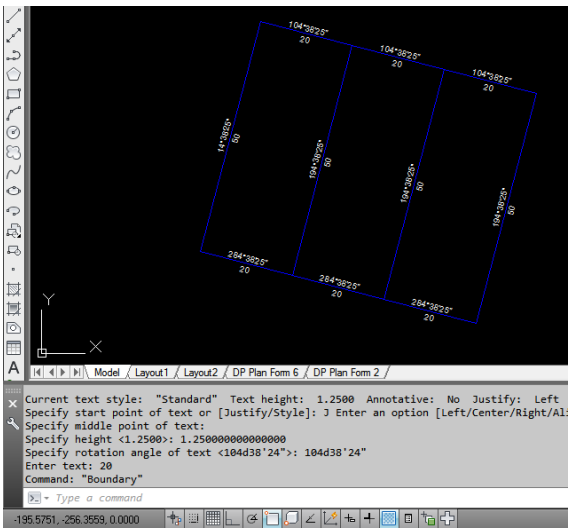
The XALN command also adds a note to be stored with the line (eg By survey, by DP1234 etc)

If turned on the default Auto-round round will do the following:

- All distances are rounded to 5mm
- Length of Line Bearing Round
- x<1 1’
- 1<X<10000 5”
- 10000<x 1”

Of course these values can be changed in the XRD prompt

The tool works almost exactly the same as doing the normal entry. You select the lines that you want to assign the xdata to, and the calculations are done between the end points, the information stored as xdata on the line, and the information is drawn on the drafting layer at the line midpoint. Many lines can be done at once, and the layer can be assigned after the command is run.



The program deletes the existing line and replaces it with another in the same layer. This is how previously assigned LXML xdata is deleted from the line (if it has already been defined before). If using a UCS the text will be rotated with regard to the current UCS, but geometry will be related to world coordinates.

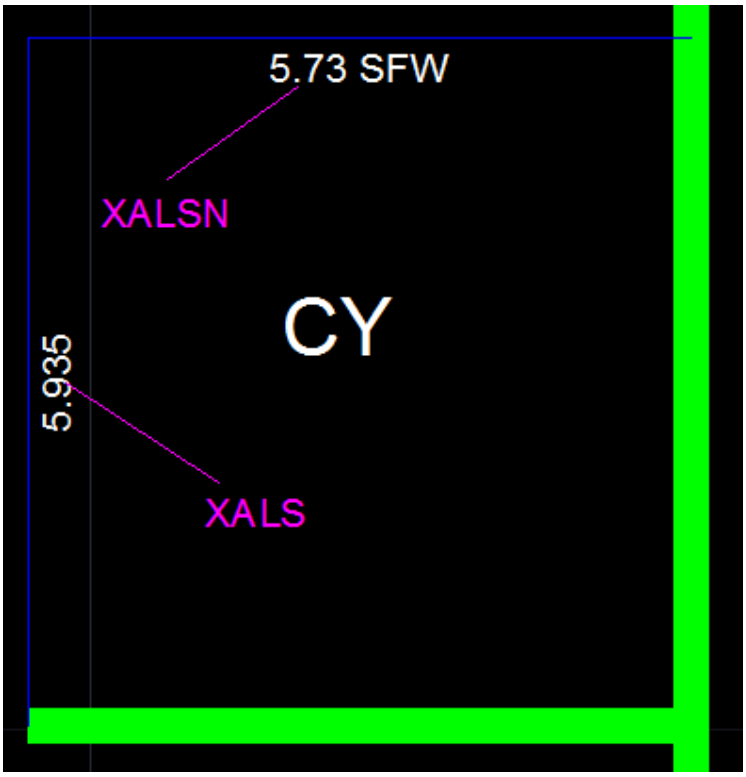
Compiled Lines

XALC is used to add a compiled line. It will ask you if you want to suppress bearings, as is quite common with compiled plans. This can also be combined with XALCN to add a notes as well.

Strata Lines

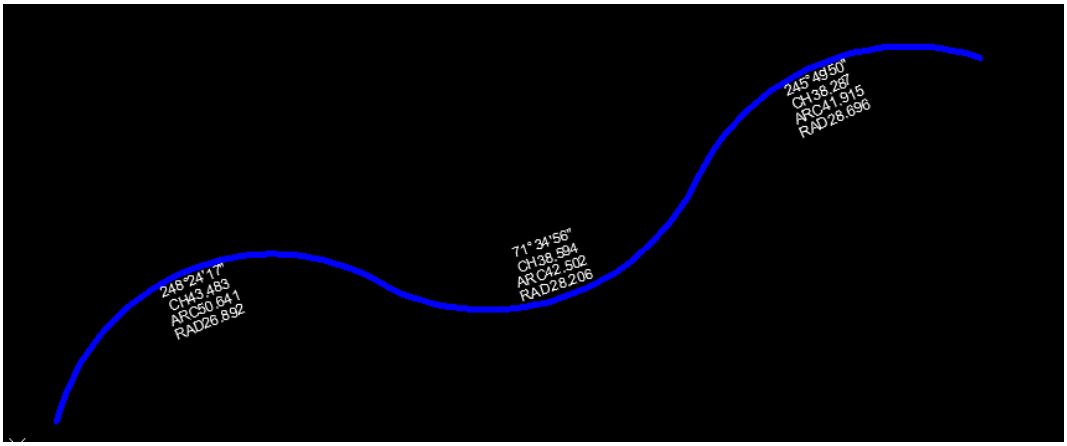
XALS is used to assign lines for strata plans. It can also be combined with XALSN to add a strata distance with note eg PFW – Prolongation of face of wall.

XALSM is used for manual line assignment. Strata plans are much more diagrammatic than a DP's so the need to manually assign distances was found quickly in testing. This can also be combined with XALSMN to do a manual distances with notes.



XAA – Assign Arc to XML

This tool works exactly the same as the line assigner. It deletes the arc and replaces it with another which is exactly the same, assigns the Xdata, and then runs the arc labelling routine. It will also autoround information if that is switched on. The XAAN command adds a note to be stored with the arc (eg by DP1234)
It will also do multiple arcs at once.



If using a UCS the text will be rotated with regard to the current UCS, but geometry will be related to world coordinates.

Compiled Arcs

XAAC is used to add a compiled arc. It will ask you if you want to suppress bearings, as is quite common with compiled plans. This can also be combined with XAACN to add a note.

Strata Arcs

XAAS is used to assign arcs for strata plans. It can also be combined with XAASN to add a strata distance with note eg “C –Boundary is common with lot boundary”.

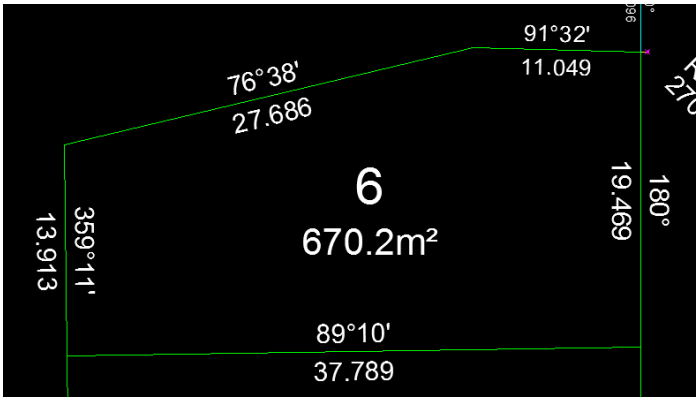
Strata arcs cannot be manually assigned at this point in time, due to their rarity but if the feature is asked for it can be added.

XAP, XAE, XAR – Assign Polyline

This tool can only be done one polyline at a time, as it needs to stop to ask for information. There are separate commands depending on what type of lot is being created. XAP for lots, XAR for roads and XAE for easements

The command asks for the following information

1. Select the polyline
2. Give the program the lot centre (if you press enter here the lot centre will be the centroid)
3. Then give the program a lot number, easement description or road name. *If it is a part lot, manually type in the PT, e.g. PT8*
4. If it is a standard lot you can the type the listed area or type C to calculate (or press enter if you do not wish to enter an area)
   If you give the program an area, it will check it against the polyline and let you know if your enter value is >10% different
5. Tell the program if it is a proposed or existing lot. Proposed is the default. Existing is only used for things inside the subject lot, for example an existing easement.



The program gets the area of the polyline, checks it against your entered value (if one was entered), assigns xdata to the polyline then draws the lot number and area at the point you defined as the lot centre.

The annotation area will be rounded to 4 significant figures for drawing, but the more accurate value (to 3 decimals) will be stored as Xdata and exported to LXML. By default the annotation area will always be rounded down (eg 546.16 plots as 546.1) so you don't ever imply the lot is bigger than it is but this can be changed by setting the last prompt in XRD to "no". If using a UCS the text will be rotated with regard to the current UCS, but centre point geometry will be related to world coordinates.

The easement will be labelled with the next parcel name E designator (after doing a search of all easements in the drawing).). If the description of the easement starts with (#) the E designator will be placed on the non-plotting layer lot definitions, and the bracketed character will be plotted on the plan. This better matches current plan drafting formats.

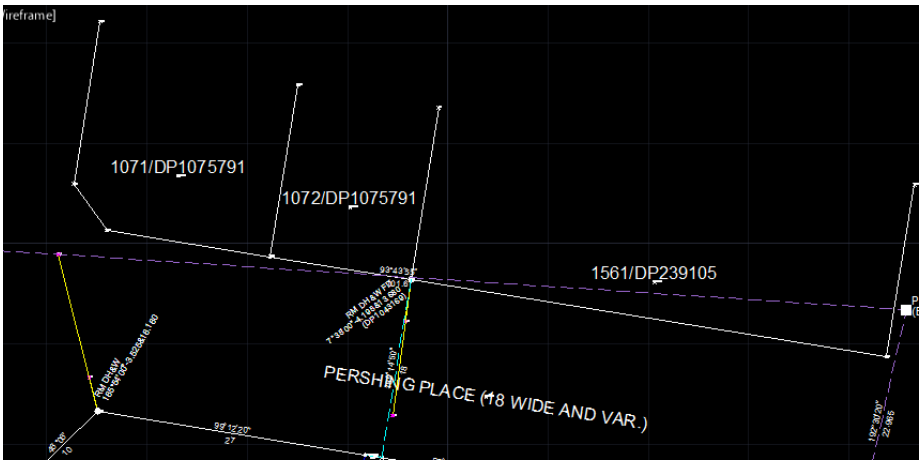
XAE can also be used to create other secondary interests (restrictions, caveats etc). The user is prompted for the secondary interest type.

XJL, XJR, XJO– Assign Polyline to Adjoining lot, existing road or other

This tool can only be done one polyline at a time, as it needs to stop to ask for information. There are separate commands depending on what type of lot is being created. XJL for adjoining lots, XJR for roads, XJO for other adjoining object (e.g Parish boundaries). Note that adjoining easements can be create using XAE.

The command asks for the following information

1. Select the polyline
6. Give the program the lot centre (if you press enter here the lot centre will be the centroid)
2. Then give the program a lot number, road name or name. The adjoining lot needs to be all one word eg "1/DP234567"



The program will put the polyline in the "Adjoining Boundary" layer and assign appropriate xdata to it.

There is no requirement to close an adjoining lot, in fact the information can be assigned to a two point polyline. It is relevant that the adjoining lots are plotted, so they need to cover all the connection lines that go along existing boundaries, otherwise they will be plotted as dotted lines.

Lot names can be copied directly from the google earth nswglobe.kml placemarks. The double \\ will be changed to a single if one in found. This means there is less chance of typos and your adjoining information is as up to date as it can get.

When using the XJO command depending on the class, the program may prompt for a parcel use, for example a Hydrography type will need a waterbody specification (river, creek etc) or an administrative area will need a type i.e. Parish. The XJO command may also change the line type of the subject depending on the class selected.

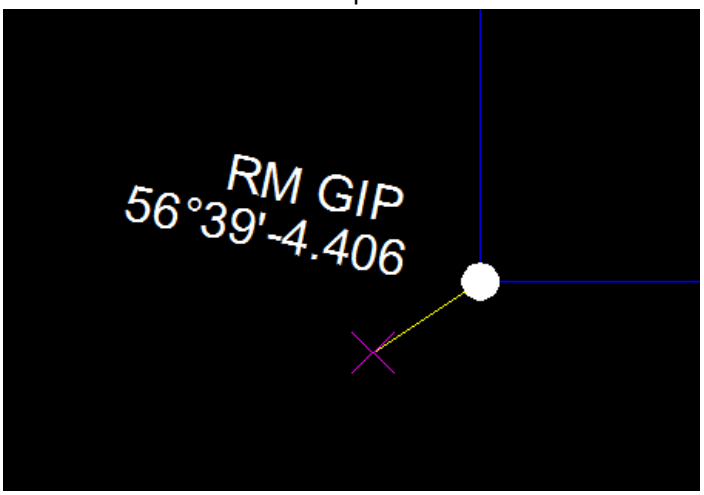
The XJO command is also used for adjoining uses such as drainage reserves or public use land which is labelled on the plan.

XAM – Assign mark as RM

This tool works exactly the same as the XRM tool but instead of entering the bearing and distance, you are required to select 2 points.

You run the program as follows

1. Select the RM point
2. Select the boundary corner to reference
3. Add a geometry comment (for example By me, PO). Just press enter if you don't want a comment
4. Define the type of mark, or type * for a list and add comment about mark after a minus if required.
5. Define if it was found or placed (* for list)
6. Define the reference DP if required.



The program does the following:

1. Performs the calculations to get the bearing and distance (*if rounding is turned on the distance and bearing is rounded)*
2. Draws the reference line on the layer "RM Connections" and assigns LXML xdata to it.
3. Labels the information in the "Drafting" layer using the Label RM function
4. Adds a point on the reference end of the line and adds the monument xdata to it
5. Inserts an RM block on the drafting layer on the boundary corner.

XSL – Assign line to Short Line Table

This tool is used where there is very short lines and you don't want to reduce the text. **The NSW LandXML recipe currently has no ability to facilitate short line tables, so they will not be reproduced on XML import.** This is just another section that makes it obvious no survey draftsmen were consulted in the compilation of the NSW land XML recipe. This tool can be used however, when drafting and will create a line with xdata, the same as any other assigning or traversing tool.

To run the program type XSL. It will prompt you to select some lines.

It will then prompt you for a short line starting number. The lines are assigned the in order that they were selected.

If it is the first time the XSL tool has been used in that session it will prompt you for a position to place the short line table.

It then deletes and redraws the line, assigns the reduced observation xdata to it, places a short line circle, and fills out the respective information in the short line table at the appropriate scale.

Note that the identification numbers are shared between the short arc and short line table, so the automatic number will be sequential for both program.

XSC – Short arc table

This tool is used to create a short arc table. **The NSW LandXML recipe currently has no ability to facilitate short arc tables, so they will not be reproduced on XML import.** This tool can be used when drafting and will create an arc with xdata, the same as any other assigning or traversing tool.

To run the program type XSC. It will prompt you to select some arcs.

If it is the first time the XSC tool has been used in that session it will prompt you for a position to place the short arc table.

It then deletes and redraws the line, assigns the reduced observation xdata to it, places a short arc circle, and fills out the respective information in the short line table at the appropriate scale.

Note that the identification numbers are shared between the short arc and short line table, so the automatic number will be sequential for both program.

XDE – Edit Xdata

This tool can be used to manually edit xdata on an object, for example, add a comment to a reduced observation, or perhaps do something that is not ordinary. It also makes it easier to examine the information stored on an object.

To run the program type XDE, then select the object you wish to change. Change the information in the text box (*this requires an understanding of lxml and how LXML4AC exports information)* and press ok.

XBE – Bulk edit data

Bulk edit data is similar to XDE but it can edit many attributes at once. The user selects the data they wish to change, then specifies which attribute they wish to edit (eg . "buildingLevelNo") and then the new value to place in the xdata. The program does a string search for the supplied attribute and changes the value. The program will only change objects selected with xdata and the supplied attribute.

XHV – Hover to show XML data

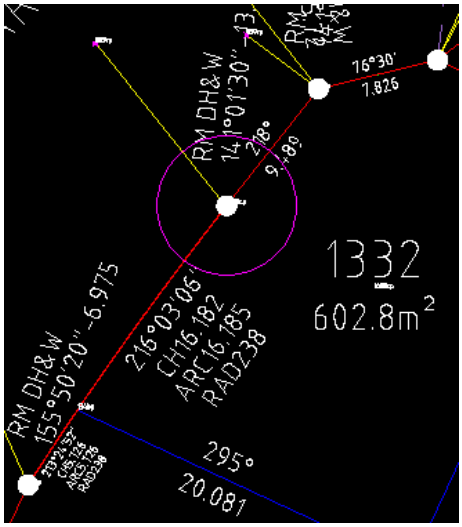
This tool given to me by Roumen Mollov allows the user to hover over objects and see the xdata attached. Type XHV and move the mouse over the object you want to see the information on.

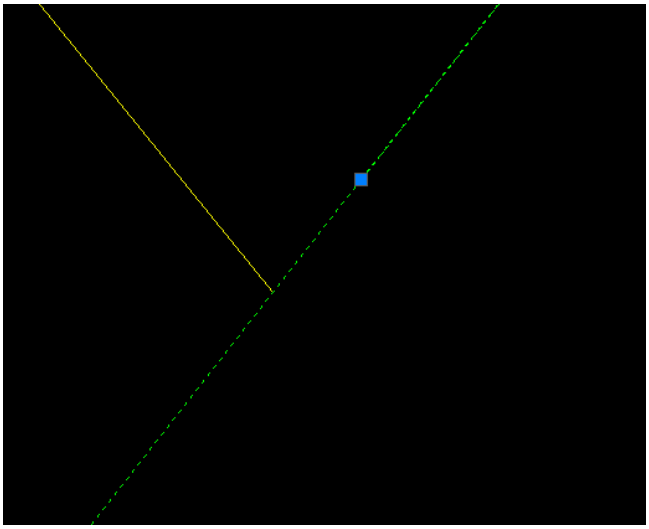
XCT – Clean & Tidy coordinates

This tool is used to help fix coordinates of lots that may not have been created exactly on the coordinates. This often happens when using XCL on lots involving arcs or very short lines, where a bug in the method used by autocad will place the polygon vertex not directly on top of the overlying objects.

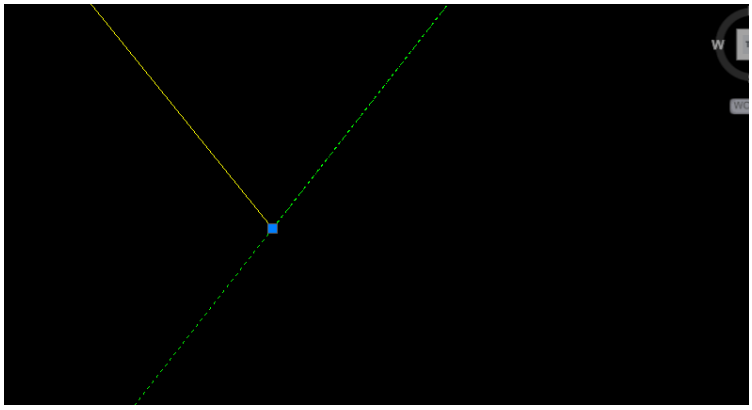
The tool will get all lines and arcs in the boundary, road and easement layers and store a list of the coordinates of their end points to 7 decimal places. It then gets all the lot definition polygons and compares the coordinates of each vertex to the list. If the coordinate is within 0.1mm of one found in the list it will change the lots coordinate. It also will give a list of the changes and by how much in on the command prompt.

Here is an example. Where the curve meets the line there is a small difference in the lot definition vertex. Zoomed in to the maximum we can see the vertex is not meeting the corner of the curve and arc by 0.00002092mm.





After running XCT the vertex is moved to the corner



XAUD – Audit geometry

This tool will compare the line geometry based on its coordinates to the xdata that is stored on the line and add a piece of text in the misscloses layer if the bearing is different by more than 1 degree or the distance is different by more than 0.1m. It will also change the objects colour to magenta. This tool is useful for problem solving xmls that may have been edited or created poorly.

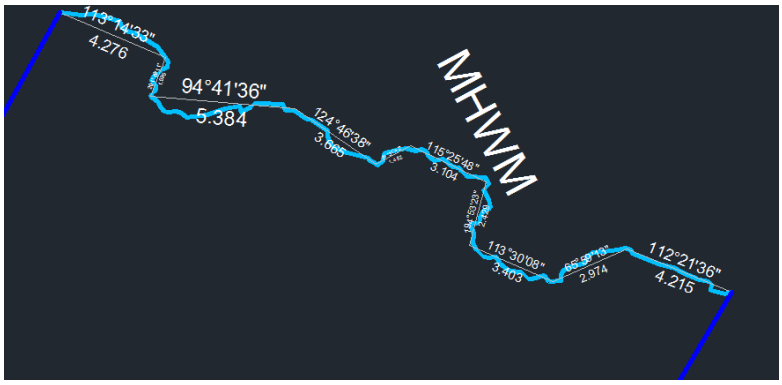
XAI – Irregular Line Boundary

Irregular line boundaries are for example the bank or centre of a water course, Mean High Water Mark, or other such natural feature boundary. These are normally (now) represented on the plan by a wavy line and a short line table that represents a reasonable fit of the geometry of the feature along the feature. In LXML4AC they are shown via a polyline in the "Irregular Boundary" layer and by short lines assigned or entered using the XTR or XAL tools (traverse functions) in the "Irregular Right Lines" layer. The Irregular Right lines will not be plotted, but the Irregular Boundary will, with the standard drafting annotations along the right lines.

The irregular boundary is preferably a series of small straight lines as a polyline, but allowance has been made for a 2dpolyline to be used. By editing a standard polyline using the PEDIT command and selecting spline a wavy line will be fitted along the standard polyline and the vertex definition will remain the same.

The XAI tool is used to assign a label or description to the Irregular Boundary. A very simple tool, it asks you to select the polyline, then select a downstream point if it is non tidal (if its tidal click anywhere but the ends of the line or just press enter) and then give it a description.

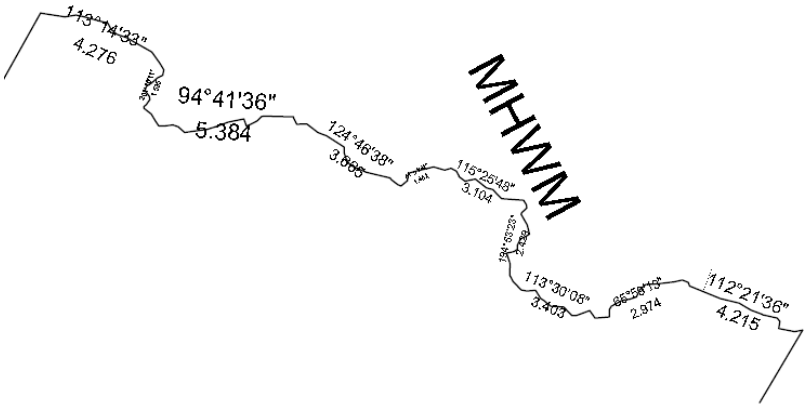
Note that automatically calculated areas are calculated to the Irregular Boundary, not to the right line boundary as is specified by the RG directions, so manual entry of areas may be required in these cases.



Here is an example of an Irregular Boundary. The light blue line is the Irregular Boundary while the grey lines are the Irregular Right lines.

If you are entering an existing lot which has an offset traverse, put the offset traverse in the "Connections" layers so it is plotted, instead of the "Irregular Right Lines" layer.

This is how the above would plot.

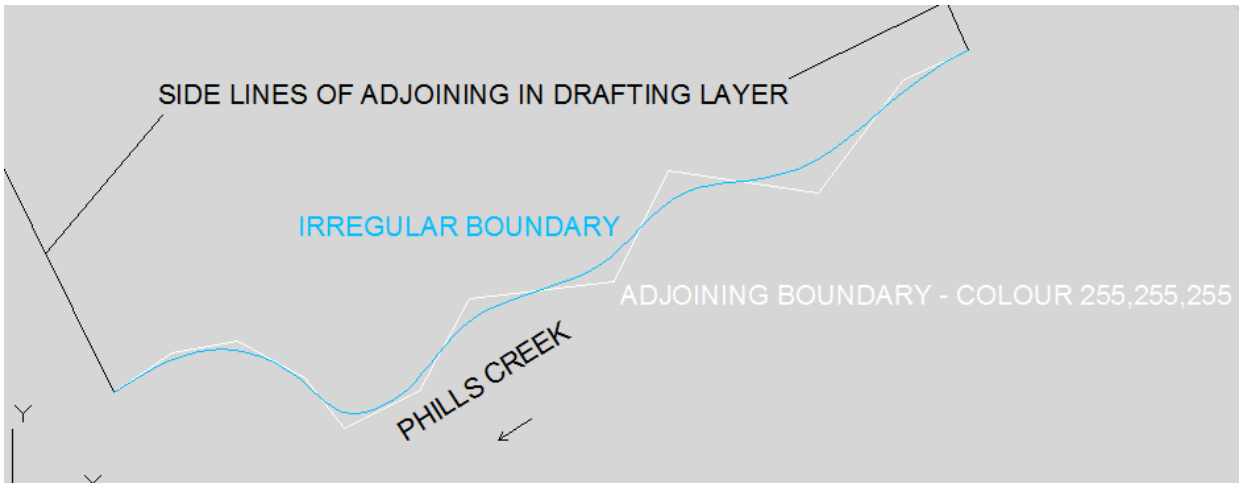


The XSL tool could be used from here to create a short line table, but it will not be recreated on xml import.

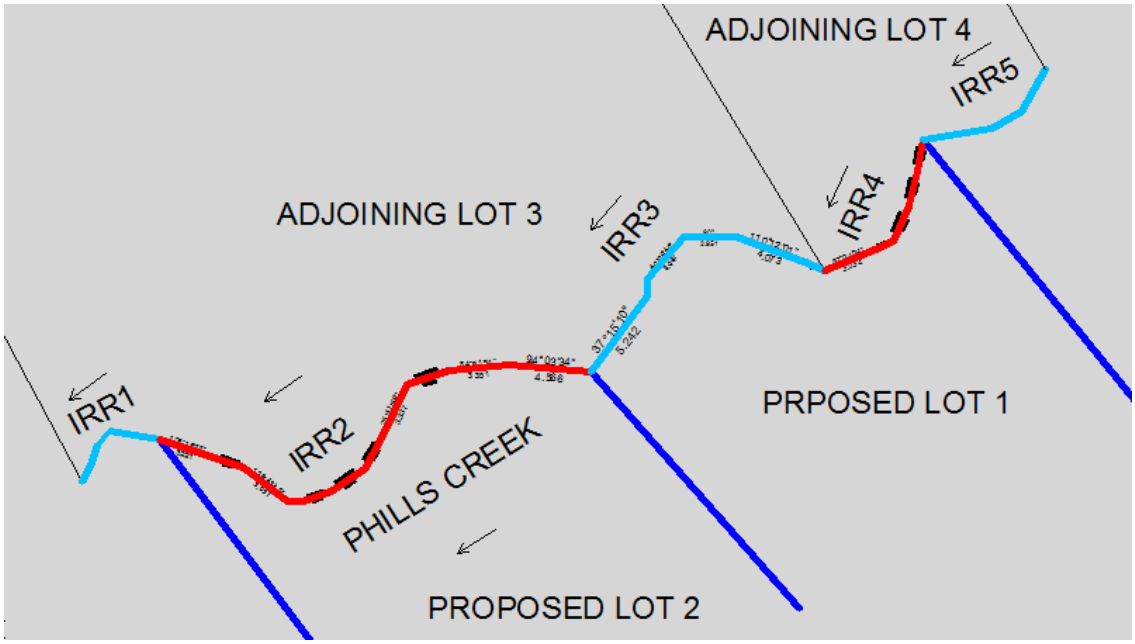
A flow arrow, which ends up in the survey header area of the xml as an annotation is automatically inserted at the same time. If a downstream point was picked the DFANT (direction of flow non tidal) block will be inserted with the arrow pointing in the appropriate direction. If there was no downstream point pick a DFAT (Direction of Flow Tidal) block is inserted. The start and end coordinates of the irregular line are stored on the flow arrow, as this is how the direction of flow is stored in lxml.

Dealing with adjoining irregular lines

The above example showed how to deal with a proposed lot with an irregular boundary. An adjoining lot can also use the irregular line created with the XAI tool. When plotting there may be problems, as the adjoining lots plot whereas the proposed lots do not. If this is the case it may be necessary to think outside the box, such as copying the irregular boundary to the drafting layer and removing the section covered by the irregular line, then making the irregular boundary in the adjoining boundary the colour 255,255,255 and sending it to the back (see following diagram).



Another complication caused by irregular boundaries is where the adjoining and proposed lots connect to the irregular boundary at different locations. There needs to be an irregular boundary for each segment along the irregular line. In the xml file this will create multiple irregular lines for each segment. In the picture below Proposed lot 1 would have two sequential irregular lines (Irr4 and Irr3), Proposed lot 2 would have 1 (IRR2) and Adjoining lot 3 would have 3 sequential irregular lines (IRR3, IRR2 and IRR1). Note here that I have used IRR# for display purposes. All the irregular lines would have the same description (i.e. Phill's Creek).



When importing the above file you end up with 5 irregular line labels and 5 flow arrows. There is currently no function written to identify concurrent irregular lines, identify the centre point and suppress labelling.

XIN – Land XML file importer

This is by far the most complicated piece of code in the program, but it is very simple to use. It attempts to follow as many of the rules of survey drafting a possible, as well as the rules set by the LXML4AC program.

To import an LXML file, type XIN, select the file and then wait patiently while the program loads all the information and plots it on the screen. It's that simple.

The rest of this description is an explanation of how the program works, in case you don't like what it is doing and want to edit it, or you have a LXML file that will not import for some reason.

1. Setup and empty all lists

2. Runs a standard get file routine

3. Checks to see if the file has linefeeds and re-writes non linefeed files with suffix WLF (with line feeds)

4. Checks for a strata scale value

5. Reads the header information that is available (datum, horiz datum, coordinate system)

6. Linefeeds until it finds the monument area and stores them in a number of lists (monument, pm, occupation)

7. Linefeeds to the instrument station list and stores them in a list

8. Linefeeds to the CGpoints section or calculates the cgpoint from observations depending on whether using XIN or XINO

9. Reads and draws each CGpoint

In the background of this process it is finding the maximum easting and the minimum northing. This position is used as the point to plot the Admin sheet and coordinate block and easement legend.

It also finds, draws and stores the datum points.

Many of the backcaptured files have description of the point being "COORDINATE ERROR". If this is the case the point is not classed as a datum point, and the notation is suffixed onto the CG point notation.

10. The next section reads the parcel information, including dealing with multipart lots and road and easement lots. To create the lots it draws a series of lines and arcs and then joins them with polyline edit -> join command. This is drawn in the "Lot Definitions" layer. It also:

- Adds the lot number and area, road name or easement description on the centre point as defined by the LXML file.
- Stores the easement lines as a list so they can be identified later in the program and plotted as a dashed line in the easement layer.
- Stores a list of the boundary corners for adding pops later on.
- Finds and draws and joins any irregular boundaries, with appropriate labelling.
- Adds polylines over existing easements
- If the lines have a structural description attribute it will give the polyline a thickness.

If the lot or road is adjoining it will perform the same functions but place the object in the “Adjoining Boundary” Layer.

11. The next section is the plan features section. This is used for occupation information, e.g. fences, building, walls and kerbs. It reads the information, draws and assigns the data to the correct layer. If it finds a boundary offset (the name will be “Offset” in the LXML file), these are stored in this area it will draw the occupation information.

12. The program then reads the Survey header. This is designed to deal with the sections that are required was well as areas that can be conditionally added. It then inserts an admin block and populates it with the information stored here as well as some on the information from the XML header. If a flow arrow is here found it will also plot the flow arrow.

13. The next section reads the reduced observation data. This is the lines and arcs that go over the top if the defined lot areas and connect to external reference marks. As each line goes in it is checked for type and sorted into Boundary, Road, Easement, Connection, RM connection, PM connection and Irregular Right Lines. If there is a monument on one end of the line the monument will be added. It also draws all the required information under the “drafting layer” for example bearing and distance, field notes and RM connections. As simple as the preceding sentence was, the process of getting the line or arc information, translating the instrument station back to a CGpoint, checking for monuments, easement lines, PM’s, checking for field notes and setting up the program to not draw the same line or information twice, then drawing the line, arc or monument and assigning the correct xdata and labelling the information is reasonably complicated.

Many of the backcaptured plans have a fieldnote indicating that they were not able to be read from the plan. If the field note associated with the reduced observation contains the word “ILLEGIBLE” the colour of the line and the notes will be turned orange, so “made up” distances can be filtered from the legible distances.

Also in this section there is the possibility of a reduced horizontal position observation (which are PM,s or SSM), which of course contains no reference to the PM or SSM number, which is stored in the CGpoint information, and the type (PM or SSM), which is stored in the monument section. This section places a point on the PM coordinate and stores all the required reduced position observation information. The reduced position observation information is also added to a coordinate box, located underneath the admin block. The same is done for benchmark information.

14. The program then goes through the occlist which was made from the monuments at the start to find all occupation offsets and plots these positions and labels the offsets in the drafting layer. As part of this program it goes through all lines and arcs to attempt to find the line that the offset originally references to align the offset properly.

15. The program then add pops to all the proposed boundary corners

16. The program then add pm blocks over the tops of the PM’s.

17. Any remaining RM’s not a PM or a SSM in the RM list, for example RM’s gone on adjoining boundaries with no connection to the corner, are plotted.

18. The program then adds an easement legend under the admin sheet beside the coordinate table

19. The program then add strata datum points and labels

17. Debugging – If your xml file is not importing the line where then importer failed can be found by typing “(linetext)” into the command line. This will give you the current line of text being using by the importer, however discovering what is wrong might require more examination than that.

XOUT – Export XML

This program is used to export an xml. This is another simple program to run, type XOUT, give the program a filename and the program will do the rest. As with the XIN program there is a lot on things going on in the background. Here is a list of the basics.

It does not do a lot of checking so you are required to ensure that:

-Boundary, Road, Easement, Lot Definitions, Occupations, PM Connections, RM connection and ordinary connections are all in the right layer. The lot definition polylines are completely covered by Lines and Arcs in the correct layer.

-All the RM's, PM's, corner marks and Datum points have been added

-That all lines, arc, points and polylines the LXML4AC layers have xdata assigned to them (except for occupation objects e.g. fence, kerb, building, and wall). The program will alert you when there are lines with no xdata, and change the first one it finds to the colour magenta and give a coordinate. You can use the quick select tool to find the object.

-An admin block exists

The program gets objects, extracts information and assigns CGpoints using the following hierarchy

1. Building levels for strata plans
2. Datum Points
3. Road lines
4. Road Arcs
5. Road Extent Lines
6. Road Extent Arcs
7. Boundary lines
8. Boundary Arcs
9. Irregular Boundaries
10. Irregular Right Lines
11. Adjoining boundaries
12. Easement lines
13. Easement Arcs
14. PM's & BM's
15. Connection lines
16. Connection arcs
17. PM connection lines
18. Monument points
19. Monument connection lines
20. Plan features, fence, line
21. Plan features, fence, arc
22. Plan features, wall, line
23. Plan features, wall, arc
24. Plan features, kerb, line
25. Plan features, kerb, arc
26. Plan features, building, line
27. Plan features, building, arc
28. Plan features, fence, polyline

29. Plan features, wall, polyline
30. Plan features, kerbs, polyline
31. Plan features, buildings, polyline
32. Plan features, occupation lines
33. Occupation points
34. Flow Arrows
35. Vinculums
36. Lot Boundaries

The CGpoints are deleted and reassigned at each export based on the hierarchy above. On each export the number of the CGpoints are plotted to assist with referencing the LXML file to the objects on the screen. AutoCAD does not use point numbers like Civilcad and other survey based programs. For this reason and a few other small changes (LXML4AC deletes duplicate identical lines on import) an exported LXML file may not be identical to the imported XML. They should however both contain and plot the same information.

Due to the way a polyline arc is recorded in AutoCAD and other high precision short line definitions there may be small changes in Arc centres and other points, causing there to be two points very close to each other. Every effort has been made to eliminate these problems, but rounding information to 5mm then recording in LXML to 6 decimal places is the cause of many of these problems. You may see a number of these warnings pop up on the command line during export, some may be worth investigating, as it may highlight areas where lines don't match lot definitions.

Where polylines lot definitions don't match up with road, boundary or easement geometry, orange (colour 30) objects will be placed over the top to show where this is happening. It can often be an unclosed line or curve to line auto-polyline problem, or perhaps a through distance where there should be a vertex.

As the elements are selected lists are populated with the information to be sorted in the following main lists

Cgplevel – A list of coordinates and corresponding building levels (strata)
dpl – datum point list
CGPL – CGpoint list
Lotlist – List of lot definitions
Monlist – List of monuments
Arclist – A list of observed arcs to help with centrepoint definitions
pmlist – List of PM's
pflist – List of plan features
rolist – list of reduced observations
obslist – list of the point which the reduced observations go between
iblselist- Irregular boundary start and end points
ibllist - Irregular boundary line point list for polyline shuffler
islist- Instrument station list
mplist – multipart lot list
mpalist –multipart assignment list
mpolist – multipart output list (what is exported)

If debugging the contents of these lists can be examined by typing the name in brackets (e.g. “(monlist)”) into the command line. If a list returns nil then it has not be created yet.

After going through all those objects it then moves on to the lot definitions, and checks each corner or arc centre is already in the CGpoint list. As mentioned above if a warning comes up it might be worth investigating, or it may be due to a short line, large radius definition problem. It also checks for and creates multipart lots. It will also check the direction of a polyline and reverse it if it is anticlockwise.

After that it gets the admin sheet and does a few changes to the information contained in there (e.g. change & to & , rearrange dates.

After that is all completed it asks for a file to write, then takes all the information it has gathered and writes it to the LXML file.

At the very end the program will add the CG point label next to the objects. Only the label is inserted, the point is not. This keeps the drawing simpler, when making small modifications.

Finally all the points are compared to each other and a report on any close vicinity points is added. These might need addressing.

XINO, XINS - Land XML file importer using reduced observations

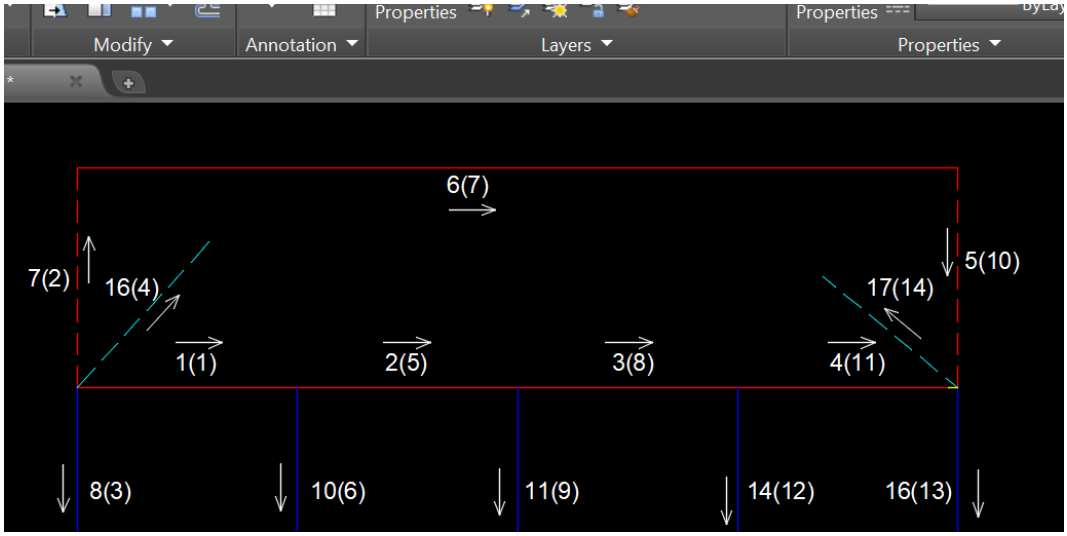
These tools work almost exactly the same as the XIN command. The only difference is the definition of the CG points. The user is asked to supply a starting point. From this point the lots and connections are built from the reduced observation section of the xml file instead of using the supplied CG points. The problem with using the reduced observations, or vectors which is what they are, is that eventually small miscloses will appear in the drawing.

It uses a priority system where the road and road extent lines are plotted first, then the boundary lines, and finally the connection and reference lines. This is designed to emulate what a surveyor might do when entering the plan. Most reference marks are along road frontages, so these are entered first, and the small miscloses will be forced into the rear of the lots. When the lines close back onto themselves the misclose (if there is one) is plotted on the plan as a degree and millimetres notations with a line showing the direction and distance at 100 times the misclose distance.

The program works following these steps

1. The first setup position is taken from the first road observation found in the file.
2. Create any road lines from setup position
3. Create any boundary lines from setup position
4. Create any connections lines from setup position
5. Make the first road lines' target position the setup position
6. Create any road line from new setup position found in observations
7. Create any boundary lines from new setup position found in observations
8. Create any connections lines from new setup position found in observations
9. Find the next created road line from the setup positions completed
10. If no road more lines were created from the completed setup positions find first boundary line created from completed setups and shift setup position to its target point and repeat from step 6
11. If no boundary lines were created from completed setup positions find first connection line from completed setup positions and shift setup position to that target point and repeat from step 6
12. If a loop is completed (a line's target point has already been a setup position or has already been projected from a setup position) and a misclose exists the misclose is labelled in degrees and millimetres and a line 100 times the length of the misclose is drawn on the plan.

Hopefully the diagram below provides some clarity from this description. Red lines are road, blue – boundary, cyan – connections and yellow- miscloses. The first number is the order the reduced observations are recorded in the XML files, the bracketed number is the order in which the program plots the observations (or lines). The starting point is the left hand side of point 1.



XINO will go on to add all the other information as per the usual xin command using the calculated CG points, while XINS just leaves the basic observations with misclosed lines intact. XINS doesn't do as much assigning of lines as XINO (eg doesn't identify RM connections and PM connections), but could be more useful for compiling more than one plan together.

Both of these tools only work where the geometry of a lot is all connected. If there are isolated points which aren't connected by reduced observations, the program will list these points and error out.

XSS – Set drawing scale

This tool is used to control the size of drafting elements. The program prompts "Type scale 1:". If you want a scale of 1:100 type "100". If you want a scale of 1:300 type "300". Make sense…. Good!

There is also an option here to turn the autoshrinking text off. If the line is smaller than will fit the text, with autoshrinking on the text height is reduced to display nicely. If it is off the text will be defaulted to the drawing scale, which could lead to overwriting and a messier drawing, but correct text heights are essential for creating a plottable tiff while these are still required.

The scale is also very important when creating strata plans, as it dictates the width of lines, and assignment of structural types on exporting. A strata plan also records and exports this scale.

XRD – Turn rounding on and off

Type in XRD, type Y or N to turn rounding on and off and Y or N to accept or change the default rounding values. This is used by the assigning tools XAL and XAA to round bearings and distances depending on the length. By default it is turned off. The default rules used are:

- If the length is less than 1m it will round bearings to the nearest minute
- If the length is less than 10,000m it will round bearings to the nearest 5 seconds
- If the length is greater than 10,000m it will round bearings to the nearest second.
- All distances are rounded to 5mm.

These can be changed but there are only the three categories in each type.

XMLC – Move the lot centre definition of lots

This is a tool used to move the lot centre definitions. The centre of a lot is stored in the polyline xdata separated by an "!". When moving the lots in the drawing the centre definition doesn't update. This tool gets the existing centre of the lot, and then compares it with the text insertion point of a selected lot centre text. It then can apply this shift to multiple lots, rewriting the xdata of each.

XAO - Fences, Kerbs, Buildings and Walls

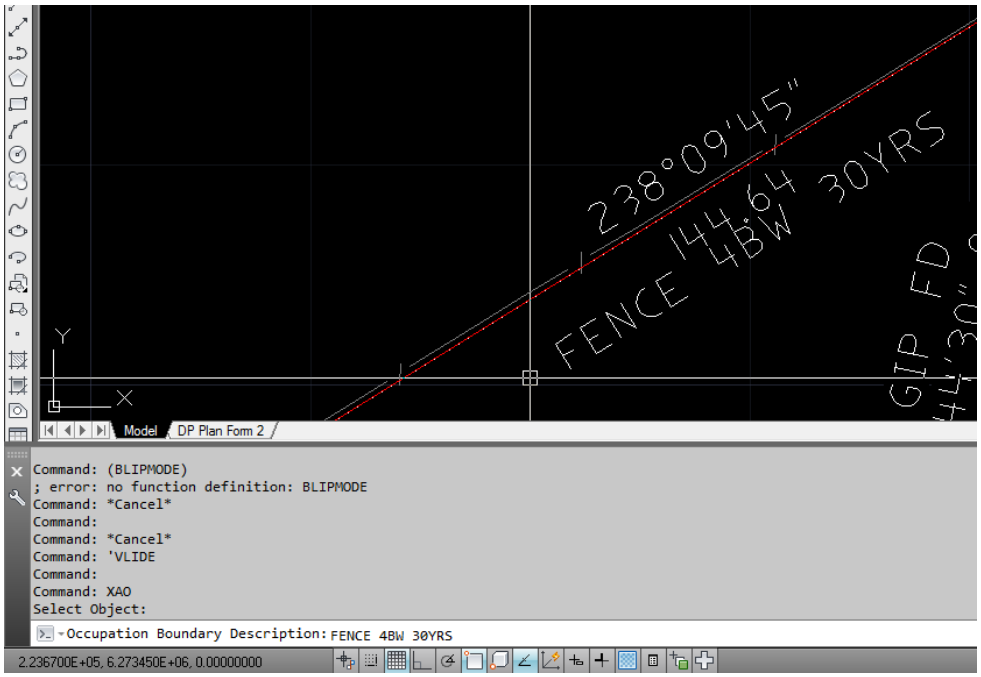
Fences, walls, buildings and kerbs can be entered in normal ways using the existing AutoCAD commands. There is no requirement for xdata to be attached to these objects, and they can be either lines, polylines or arcs. They are defined by the layer they are in. If the XAO tool is used to assign a description to the object it will be exported. If nothing is assigned the description will be fence or wall etc.

When doing walls, the hatching is always shown to the right of the line (as specified by the LXML recipe), so if your line is hatched the wrong way, use the reverse tool to correct its display.

Fences will always be shown as the standard fence type, not fence on boundary. It has not yet been written into the program to identify fences on boundary lines and change the linetype. *This is because these lines don't always run the length of the boundary (i.e. the fence might only cover half the line), so there is no way to identify if this line is on the boundary based on end points….yet.* The program LandXML.lin file does have a line type for fence on boundary, so on the drawing these can be changed, they just won't be reflected on an import.

These features are stored as plan features in the LXML file, and are designed to be diagrammatic only, however occupations are stored on the corners of these lines and offsets are calculated from them so it is a good idea to have them in the correct position. You may wish to draw exaggerated occupations in the drafting layer for plotting and suppress plotting on the respective occupation layer.

The program will ask you to select an object and then prompt for a description. It then stores the description xdata on the object and writes a piece of text in the centre of the object.



XMO – Export Monuments

This tool is designed for use with backcaptured plans for field preparation. It will take all the monuments and PM's from a drawing and export them to a csv. The idea is if you are preparing to do survey work, import the subject and/or abutting backcaptured xmls using XINO, then compile them together, use XMO to export them to a CSV, import into field equipment and start finding monuments.

XARP – Assign reference plan

This tool will add an attribute called refplan to the data in the following layers; Boundary, Road, Road Extent, Connection, RM Connection, PM Connection, Easement, Irregular Right Lines, Monument, PM. The number can be put in manually or added by selecting an admin sheet.

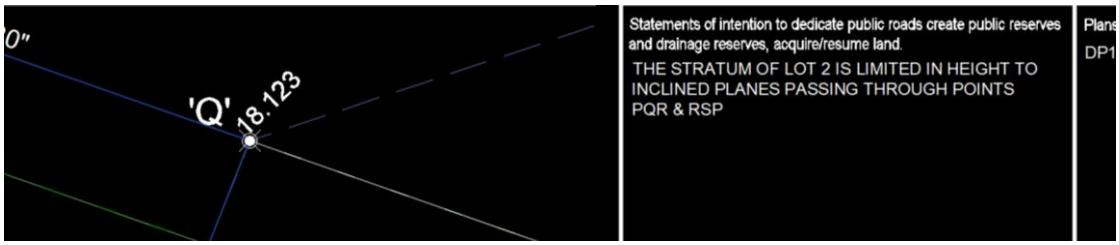
This is not a standard schema attribute and may cause problems if it is re-exported back to xml. It is designed for assisting with compiles in conjunction with the XMO tool to indicate where a plan has come from. The idea being- import an xml with XINO, group object using group tool, assign the plan number with XARP, move and rotate to match abutting data, once all required plans are imported export to csv using XMO. If you need to enquire where an object came from, use XDE to investigate the refplan attribute.

Stratum Plans

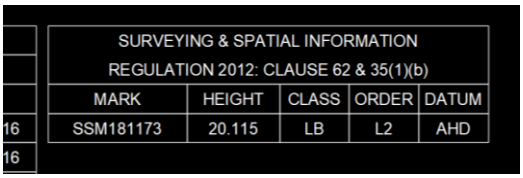
The only way to create stratum plan lots is to create the lot normally (XCL XAP) and then use xde or xbe to change the lots parcelFormat to “Stratum”

Simple stratum plans can be defined using the plan note part of the admin sheet. This allows a flat upper or lower definition.

Simple inclined plans can also be defined. This is done through the use of datum points. Datum points of one letter and a 3d position will plot the given RL. On export, if there is a stratum lot in the drawing, the points will be exported in 3d.

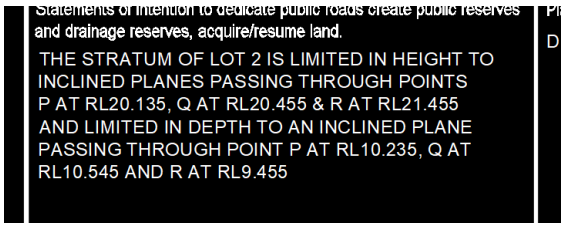


The Benchmark used to reference the RL’s is created using the XBM tool, which will create a separate PM box with the class, order and datum of the benchmark.



SURVEYING & SPATIAL INFORMATION REGULATION 2012: CLAUSE 62 & 35(1)(b)				
MARK	HEIGHT	CLASS	ORDER	DATUM
SSM181173	20.115	LB	L2	AHD

Note that complicated inclined plans cannot be done using this method (for example where there is an inclined plane level step at a boundary edge, or where the bottom and top of a stratum lot are defined by an inclined plane). These types could possibly be done using a plan note point and a more complicated plan note description as shown below.

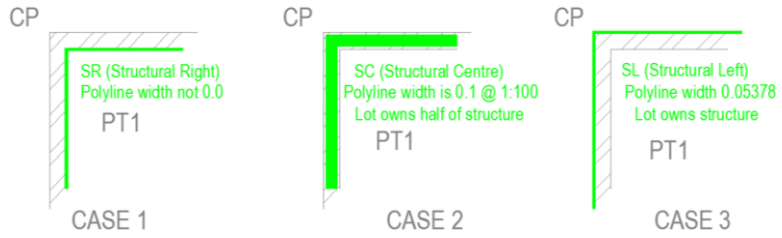


Strata Specific Tools

LXML4AC has the ability to add strata lots. The format has not been implemented by LRS's online validation or renderer yet, however the recipe includes all the guidance to create them. The difference between a normal DP lot and a strata lot is the buildinglevelno attribute, a more extensive use of descriptions, and cgpoints have a level description attached to them.

There are two main types of strata boundaries, those which are defined by structures and those which are defined by lines. To allow this to happen landxml4AC uses the thickness of polylines to determine this type. Polylines can be a different thickness throughout their length, so a lot can include structural and non-structural definitions. If there is a thickness other than 0 landxml will export the lines as a structural line.

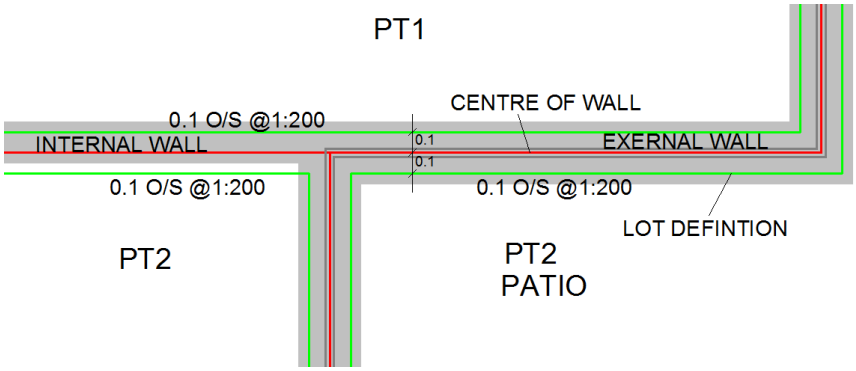
However there are 3 types of structural lines, structural right, structural centre and structural left. In order to facilitate this, different thicknesses represent the different types of structural object. Keeping in mind that the width of a structural line when plotted will be 1mm, an object plotted with the width at the correct scale will become structural centre. A line with a width of 0.05378 (0.0LEFT) will become structural left and any other line width will be exported as structural right. The structural definition is used to assist in determining the position of the boundary in relation to a structure. As the lot always travels clockwise in xml, the right/left definition translates to inside/outside of structure.



In the picture above case 1 being the most common case for strata plans while the other two are reasonable rare in NSW. Structural centre can however be useful for defining common property walls, especially in carparks.

However the picture above does not show the lines as they need to be drawn in Autocad, but merely indicates to future users of the xml file where the boundary is in relation to the structure. When defining the position of the lines in case 1 and 3, **these lines should be positioned at half the required plotting width from the centre of the structure**. For example at a scale of 1:100 the line should be offset 0.05m, at 1:200 offset 0.1m, at 1:500 offset 0.25m and so on. Considering that walls can change in thickness depending on a walls type this is the best way to represent these lines.

Hopefully the diagram below demonstrates how this works



There are a number of important things to know before starting to create a strata plan in Landxml for autocad.

1. Levels must be separated horizontally. In order to assign a level to cgpoints when exporting, two vertexes on different levels cannot sit on top of one another.
2. All objects must connect at one end to a parcel – the parcel is used to give the level number to the cgpoint so one end must connect to a parcel with a level assigned to it to give it this code. This is very important when using offsets, connections etc. Common property lots may need to be created just for the purpose of connections.

Datum points – When exported, all the levels are stacked upon one another. To facilitate this while being able to view and work of the levels the datum point tool is used. Create a Datum point at the same relative position on each level.

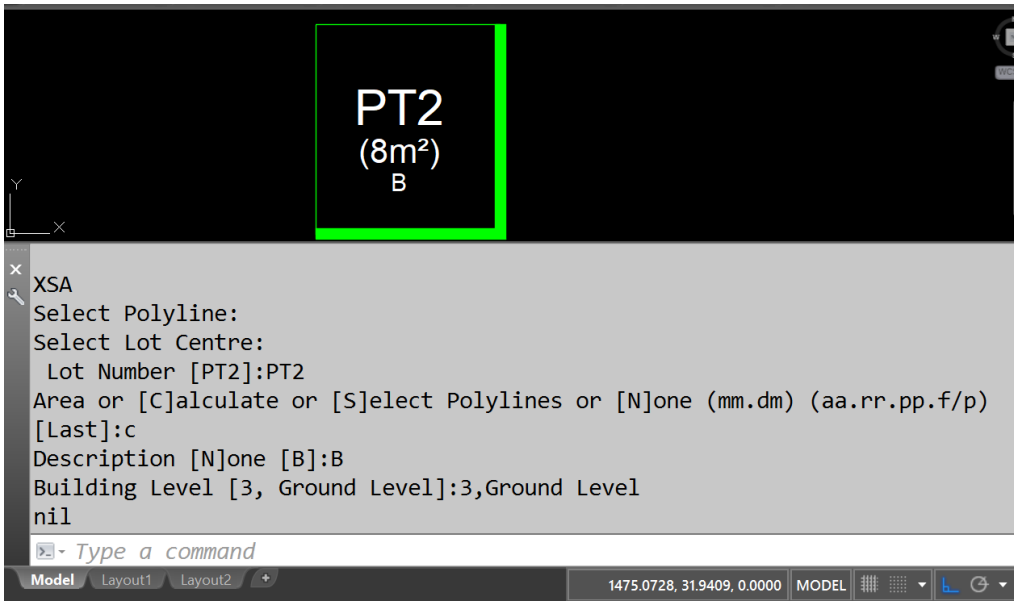
The datum point is named the same as the level, but with a numbered prefix indicating it's order in the building starting with "1" at the bottom. The location plan is "0".

The datum point will be the same as the level, for example the datum point label for the Location plan will be "0,Location Plan". On export all the levels are stacked based on the location plans datum point, as this should exist in almost all strata plans. The datum points are not exported to the xml and on reimport the levels are unstacked with a default gap of 500m in the northing. Strata datum points must have one of the following words to enable the program to identify it as a strata datum point and not an ordinary DP datum point: "Basement" "Carpark" "Level" "Location" "Plan" "Mezzanine" "Upper" "Floor" "Ground". *If your building has a level that does not contain one of these words the list can be edited by opening the landxml.lsp file in Notepad and searching for "setq stratadpwl".*

XSA – Assign polyline to strata lot

By assignment is currently the only way to create strata lots. Create the polyline. Thick and thin lines can be created either at the same time or separately then joined using the pedit tool.

Type XSA and follow the prompts



Note that the level needs to match the datum point – ie, it needs the level number prefix (eg "3,Ground Level". On export the number will be stripped from the xdata as this is what is required by LRS, but LXML4AC needs this number to assign the level code to the lots points.

Note that the PT needs to be entered manually and is not assumed. If doing areas that are vinculumed to the main lot only the subtotal area is required. This can be entered manually or can be calculated by selecting the all of the field measured polylines, which will truncate each area (using 0.7) and total them together. The area for adjoining pieces (eg Terrances, Balconies) is given as none (N).

There are a number of special cases.

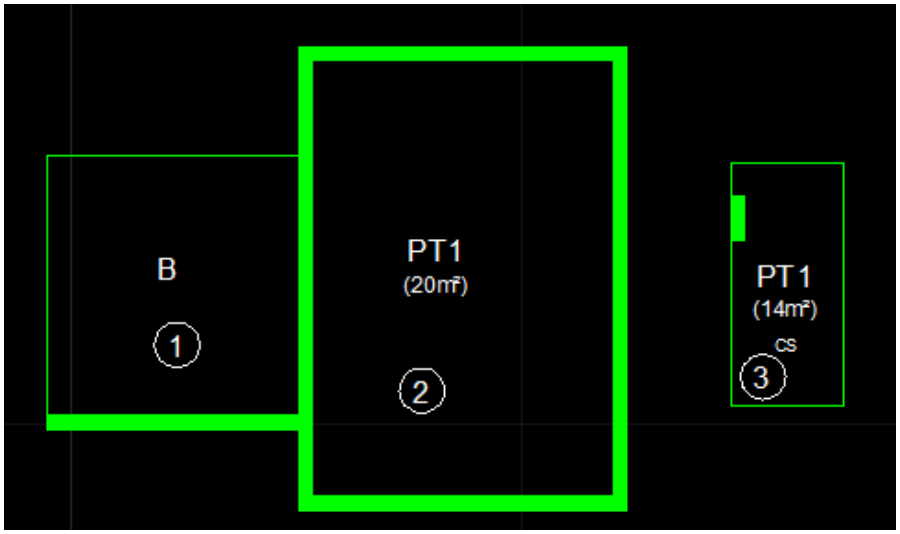
1. If no area is given and a description is, only the description will be plotted. The user is responsible for vinculums. (an example would be Balcony)

2. If an area is given but no description the lot and area will be plotted, with the area in brackets indicating a subtotal (example would be a main area lot)

3. If an area and a description is given the lot number, area and description will be plotted (example carspace).

4. If the lot given is CP and there is no area and description the CP will be labelled

5. If the lot given is CP and there is a description the CP and Description will be labelled.



Location Plan

If the level given is “0,Location Plan” a different set of rules apply. When assigning lots to the location plan the lot number needs to be the description with a numerator designator, eg B1, B2, CP1, CP2 etc.

6. If lot starts with “CP” and the level is “0,Location Plan” nothing is plotted

7. If the lot doesn’t start with “CP” and the level is “0,Location Plan” the numerator designator is stripped off the end and the lot number is plotted.

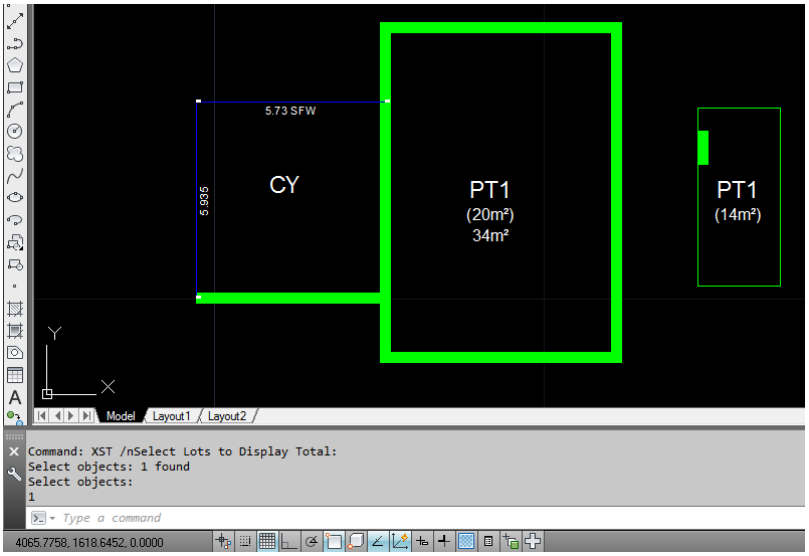
8. If doing the main building on the location plan and the start of the lot number is BUILDING you will be prompted for the building address number and an extensive description (eg 3 storey brick building with tile roof). The combination of these will be plotted in a multitext.

9. If the letters DP or SP are found in the lot name the use will be prompted for whether the lot is the base parcel (affect lot) or an adjoining lot.

XST – Total Strata Areas

This tool is used to calculate and display the total area of a lot. When using XSA as shown previously the total area cannot be calculated as there is the possibility that more areas are yet to be assigned. This tool will get all the polylines in the "lot definitions" layer, calculate totals for all areas, then draw the total area for the polyline's selected. The user is required to specify which polylines will have the total area drawn at their centre, and the total area shown is for **drafting purposes only**. The total will be recalculated when exporting. The strata total is also based on whatever area is stored in the xdata of the line, and not based on the subject polylines geometry.

To use the tool type XST and select the polylines of the main lot (number 2 in the previous diagram). Many lots can be done at once, so for example if you a changed the property of these main lots (eg made their colour red) you could use a quick select to calculate all the total areas at once.



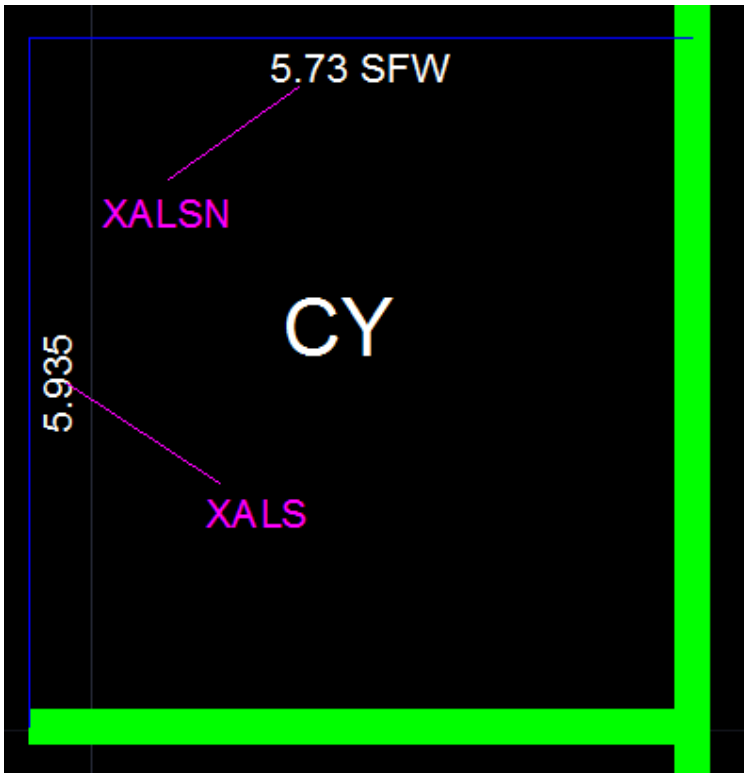
XALS, XALSN – Assign strata line to XML

XALS is used to assign distance for strata plans. It can also be combined with XALSN to add a strata distance with note eg PFW – Prolongation of face of wall. It could also use XALSM or XALSMN to manually assign a distance as the lines placed will often not represent the surveyed distance due to LRS's adoption of the "plotted half width" method.

All the assigning tools have the ability to round the information. This is controlled by the XRD command, were you can decide to round the information stored and displayed. This is fairly common on Survey plans, as it gives an indication of the accuracy that surveyors on the ground work to. It also makes redundant precision decisions on short lines.

If turned on the Auto-round will round all distances to 5mm

The program deletes the existing line and replaces it with another in the same layer. This is how previously assigned LXML xdata is deleted from the line (if it has already been defined before). If using a UCS the text will be rotated with regard to the current UCS, but geometry will be related to world coordinates.



XVI – Assign level to Vinculum

There is some debate over whether vinculums can be automatically created. They are currently not part of the draft schema, but my opinion is that it will be difficult to automatically create them. To allow for when the LPI decides they need to add them, a system similar to flow arrows has been added.

To add a vinculum insert the block vinc. Make the block scale the current scale – i.e. 1:200 = 200, and position it in the correct position. The tool is designed to be used in bulk, so position all of your Vinculums and then use the XVI tool to assign a level to them.

To use it type XVI, select all the Vinculums on a level and then type the level you are working on with the appropriate number prefix.

XLV – Assign a level to other objects

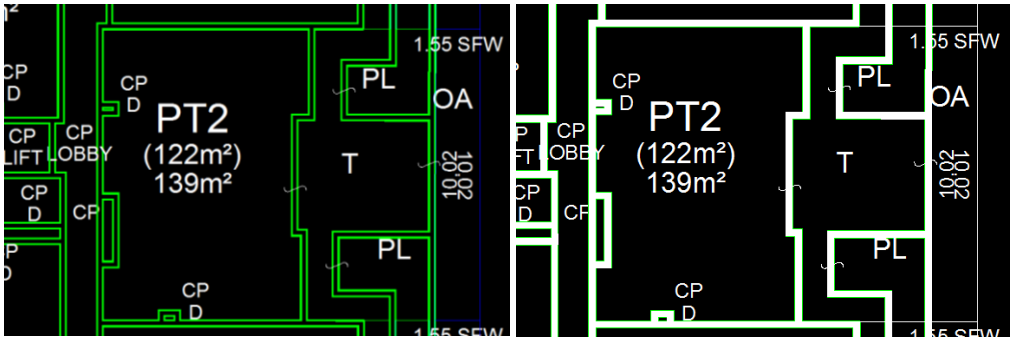
This tool is used to assign the buildingLevelNo attribute to other objects, for example easements, subject lot, or adjoining lots or roads. This allows many more items than are covered in the XSA tool to be used in strata plans.

To use, type XLV, select the objects you wish to add a level to and type the level with appropriate number prefix. This tool will mostly be used on the location plan.

XSD – Draft Strata Lines

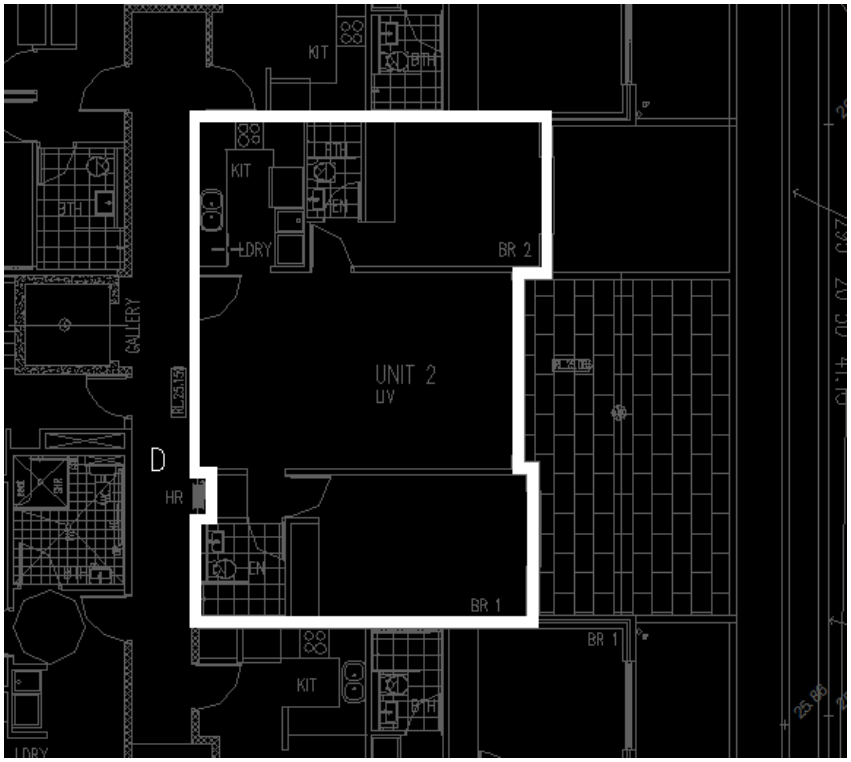
This tool is used to create plottable lines from the lot definition polylines. It examines the width of the polylines and creates an offset line on the drafting layer based on these widths.

To use type XSD, then select the lot polylines

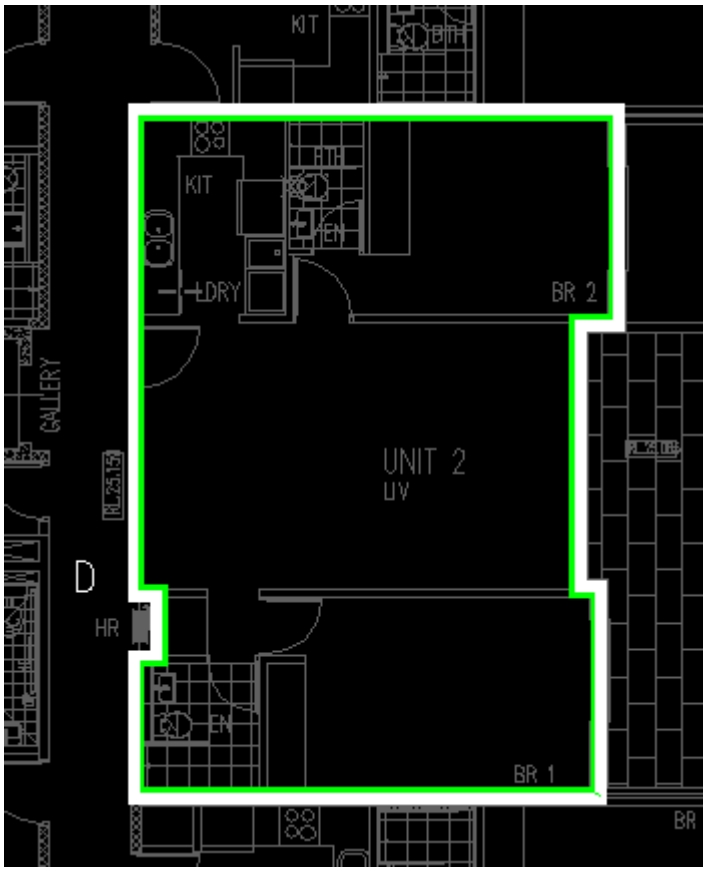


XSDR – Reverse Draft Strata Lines

This is a key tool to assist with strata xml compilation. Many draftsmen/surveyors' process to create strata plans is to trace walls from an architectural plan with a thick polyline, and the thin lines with a normal line. The process has been designed to be a small change in mindset, to create a strata lot. Instead of tracing walls with a thick polyline, and drawing these lines "willy-nilly" over the architectural plan, each part lot is traced by a closed polyline, with thick or thin polylines, depending on the wall type. The lot definitions are then created using the XSDR tool, which will offset the lines based on the current scale and create a new polyline in the lot definitions layer.

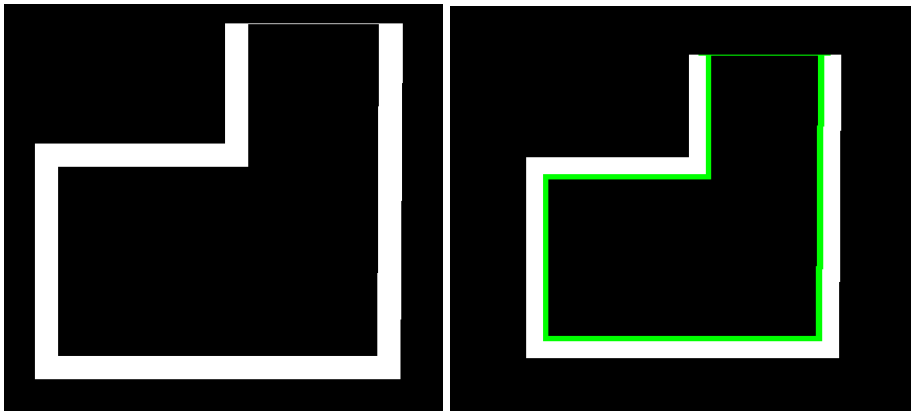


Type XSDR and select the polylines to offset

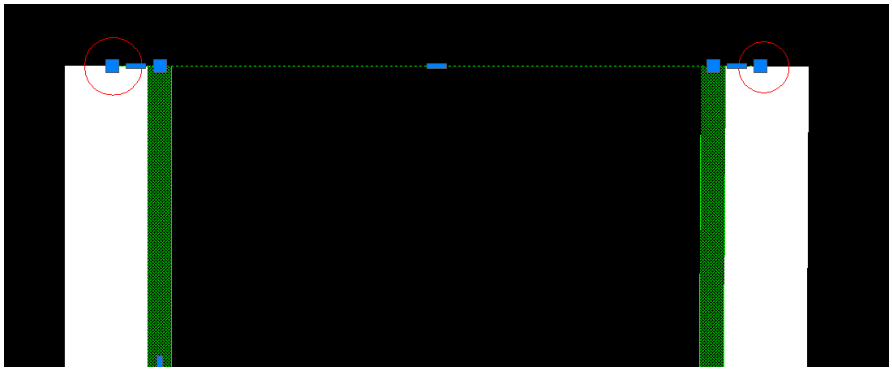


The tool creates the lot definition polyline, based on the scale which dictates the offset.

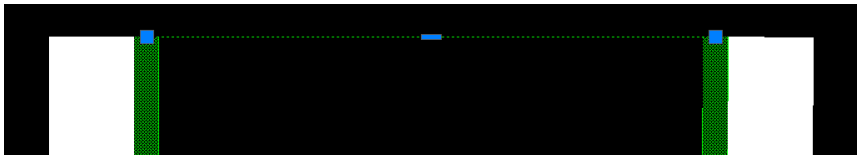
Be careful with thick to thin lines were they are at 90° to each other. Due to the process on other angles a small overrun will be created that needs to be snapped back to the end point.



Here is the thin line on 90° with the overrun that need to be removed circled in red.



Simply click the polyline, grab the vertex and snap it to the closest thick line vertex



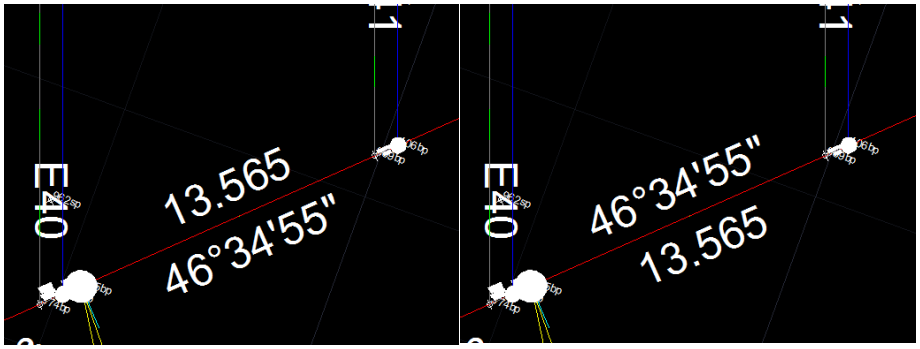
Drafting only Tools

The following set of tools are used to assist with drafting only. As many of the drafting settings are automated, sometimes the program doesn't do things strictly to survey drafting format, for example it is conventional that bearings be put on the outside of the lots, so they can be spread along a frontage.

Please note that xml has no ability to store the text position/rotation associated with anything in the drawing, and as such the rendering/importation of plans is very difficult. The changes made by these tools are not reflected in the xml, but are useful if you desire to submit your own tiff plan to LPI.

XSW – Swap text positions

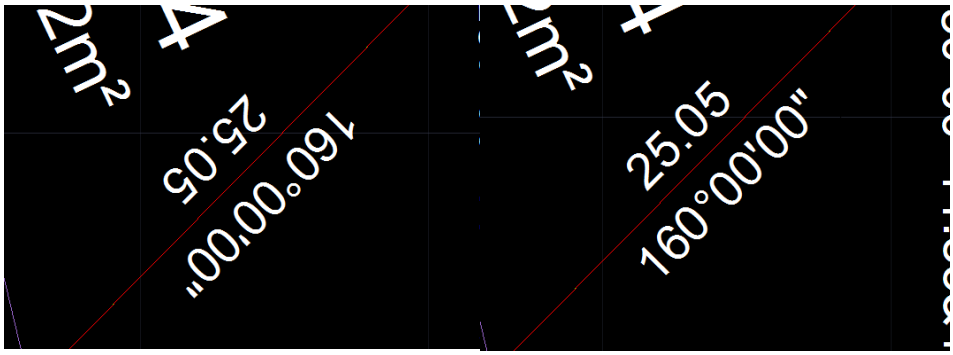
This tool is to swap the position of two pieces of text. Simply select the two pieces of text and right click. This tool only swaps two pieces of text at a time.



Before are after XSW

XSP – Spin text

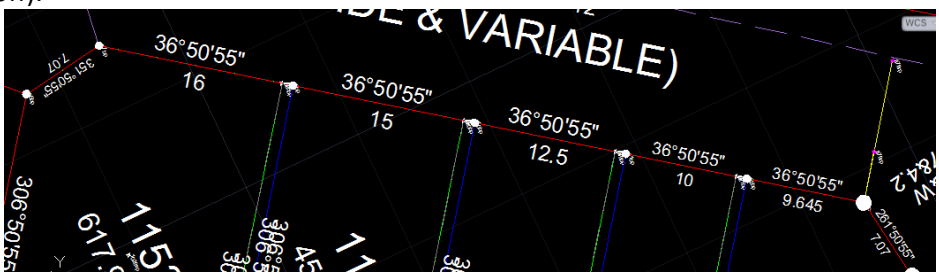
This tool is used to reverse the rotation of automatically assigned text, for example you wish to use a UCS (non-north orientation) on the plan. This allows you to quickly rotate the text so it complies with the ISO standard. This tool can be used on as many pieces of text as you like.



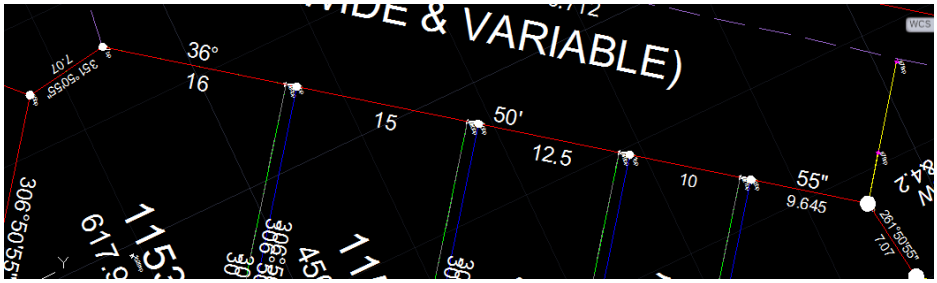
Before and after XSP

XSB – Spread bearings

Sometimes it is advantageous to spread a series of similar bearings along a lines. Personally I don't like this as I often don't see parts of the bearing when entering but it can speed up entry as the previous bearing function can be used, and makes a neater drawing. It works by finding the piece of text with the lowest and highest x values and using these as the new end points, and creating a midpoint at the average of these two points. The method however doesn't work when spreading bearings at exactly 0° as all the x values are the same (besides the minutes and seconds should be truncated off).



Before XSB



After XSB

XCB – Create brackets around text

A super simple tool, it adds brackets around the selected text.

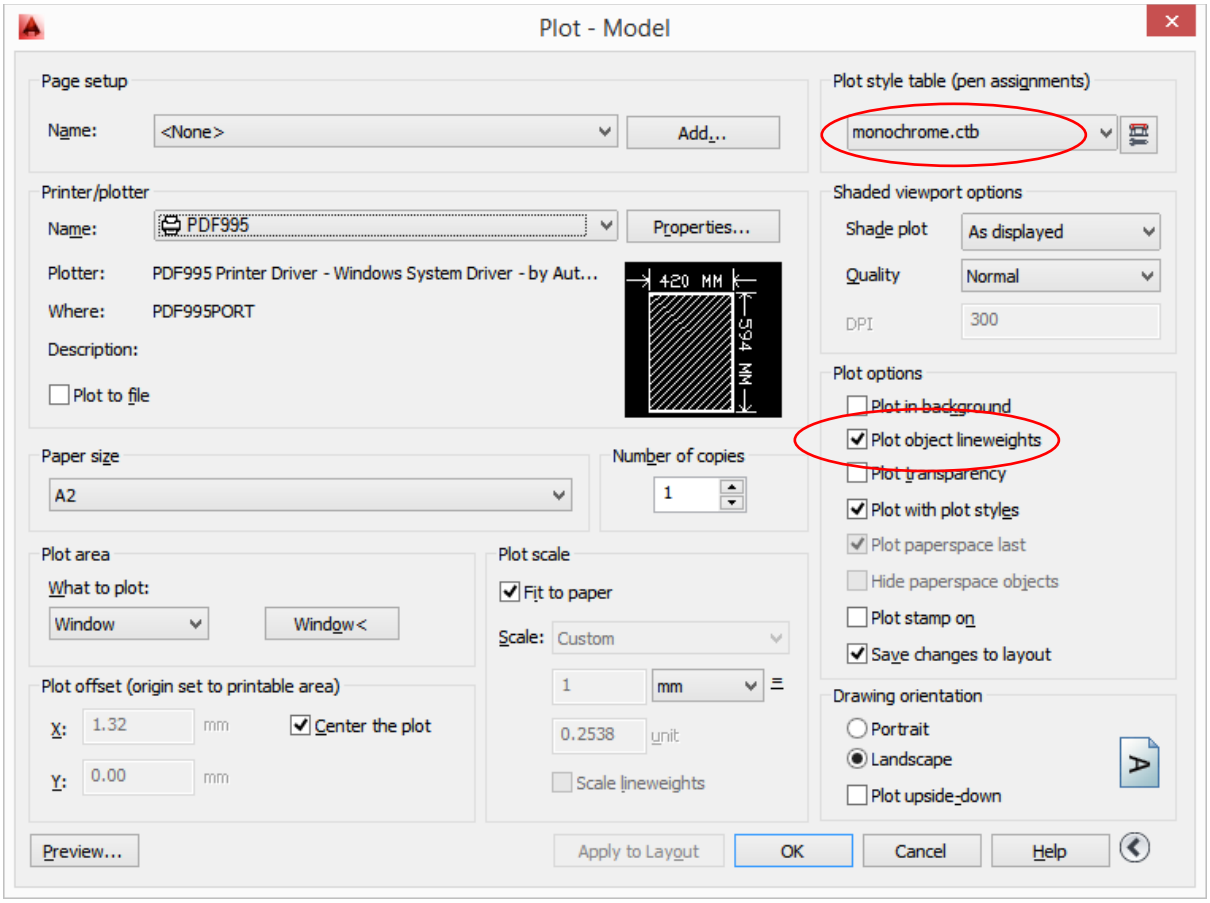
Unfortunately at this time in NSW's lxml definition there is no way to tell the difference between a connection that might say define where an easement cuts a boundary, or the connection along an adjoining boundary, one which would be bracketed, the other which wouldn't.

XRT – Recreate Text from Xdata

This tool is used to recreate the text from the xdata stored on lines, arcs, monuments, PM's and datum points. Say you want to reduced the size of the text for an enlarged diagram, using XSS you can set the scale to the scale of the diagram and recreate the text quickly at the smaller scale.

Plotting

The plan will print with the standard linestyles and thickness, if you use the monochrome.ctb file (supplied with autocad) and have “plot object lineweights” turned on. See below. Use a window to surround your layout (or the thing you wish to print)



It will not print the following

-CGpoints

-RM lines – the yellow ones

-Occupation Offset objects – the green ones

-Lot Definitions – Green polylines

-PM points – it will print the blocks

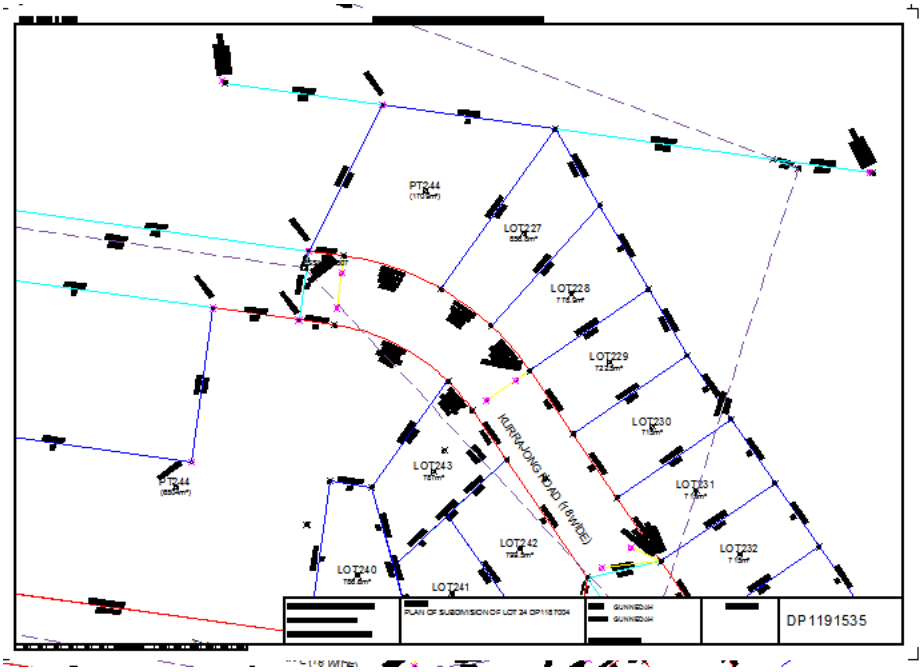
-Monuments – it will print the blocks

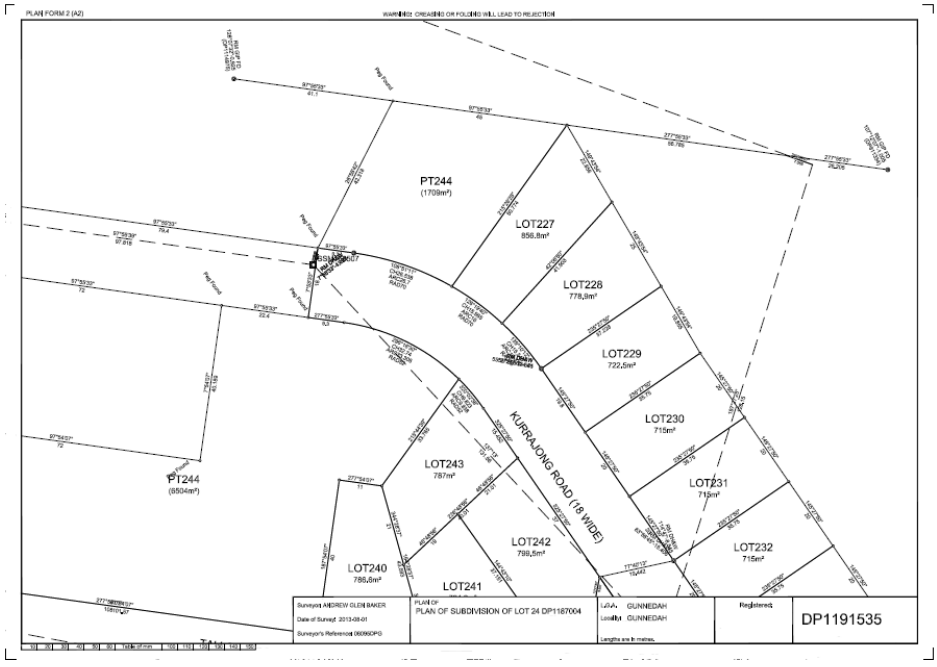
-Datum Points

-Irregular Right Lines

Much of the required information that is plotted with these objects is on the Drafting Layer and will be plotted from there.

Here is an example plot of what is in AutoCAD and what is plotted


PT244
LOT227
LOT228
LOT229
LOT230
LOT231
LOT232
LOT243
LOT242
LOT240
LOT241
KURRAJONG ROAD (18 WIDE)
PLAN OF SUBDIVISION OF LOT 24 DP1187004
GUNNEDAH
GUNNEDAH
DP1191535


PLAN FORM 2 (A2)
WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION
PT244
(1709m²)
LOT227
856.8m²
LOT228
778.8m²
LOT229
722.5m²
LOT230
715m²
LOT231
715m²
LOT232
715m²
LOT243
787m²
LOT242
798.5m²
LOT240
786.6m²
LOT241
PT244
(8504m²)
KURRAJONG ROAD (18 WIDE)
PLAN OF SUBDIVISION OF LOT 24 DP1187004
LGA GUNNEDAH
Locality GUNNEDAH
Registered:
DP1191535

What doesn't LXML4AC do?

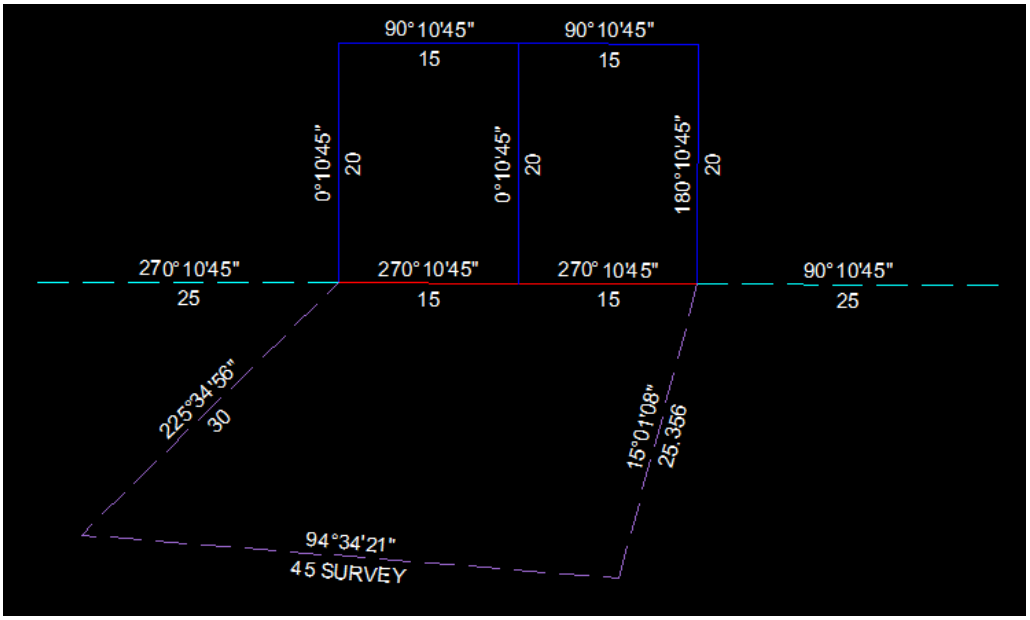
Currently there are a number of features of plans that LXML4AC does not cater for. The ones that are currently recognised are not deemed not common enough to warrant writing into the program at this time. Note that LXML4AC may struggle with the importation of these features, as they have not been accounted for.

1. Traverse easements – these could be created using a Kerb plan feature and normal lot definitions. The loop lot point mark will have to be removed manually in the xml file and the kerb description will also have to be edited.
2. Other types of plan features – these could be added by using the appropriate plan feature linetype and then changing the description in the XML.
3. Drawing bulbous arcs (arcs with an angle greater than 180). These can be drawn normally and assigned but can't be inputted yet.
4. Importing double referenced RM's. Due to the rule used to assign lines to the RM connection layer (a pntsurv=reference and connection line with a monument on the setup end), once the RM has been used it is removed from the list. This means that at the end of the reduced observations import all that is left in the monuments list (rmlist) is occupations and RM's which are shown as gone on adjoining boundaries. Because of this if an RM is referenced twice, the second line will be drawn as a connection line, rather than an RM connection. *This doesn't mean they can't be created and exported*.
5. Lease lots. Plan's for leases that are registered follow the normal DP lot format. The only way to create a normal lot with an area notation is the XCL or XAP commands. To create a lease plan, use the normal tools then use the XBE (bulk edit) to change to class from "lot" to "lease". Note that the recipe also "requires" a description for lease lots, but this may not always in a case.

Example Use Tutorial - DP

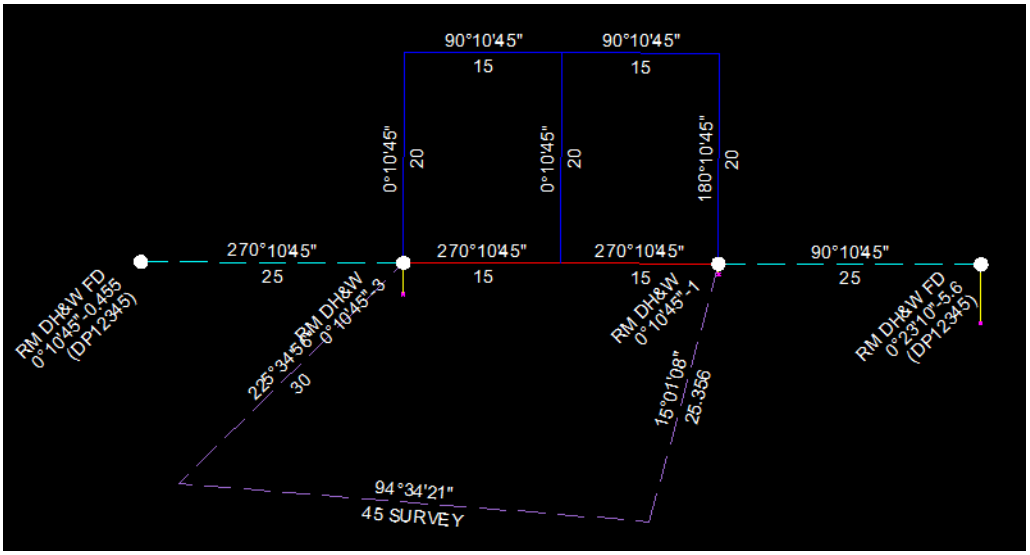
This is a basic tutorial covering the simple tools used by the program. Hopefully this covers the basic steps of the program.

1. Decide on the scale of the drawing and set using the XSS tool.
2. Enter the lots boundaries and connections using XTR and XTA tools and assign to the correct layer. This could also be done using imported geometry and the XAL and XAA tools

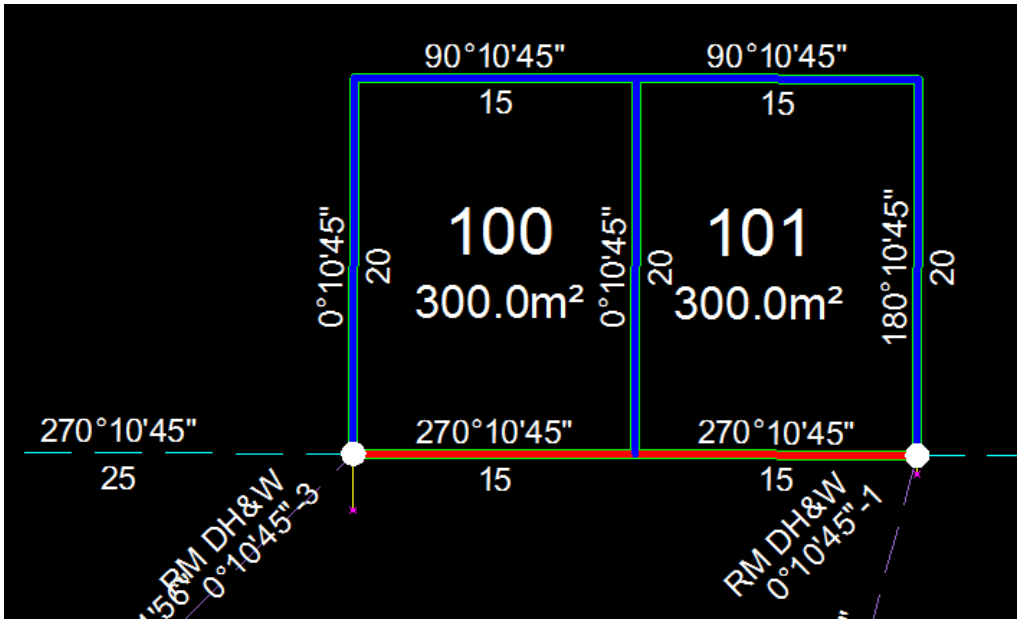


Here is my simple two lot subdivision, with connections to DH&W's on either side and PM connections.

3. Add the reference marks using XRM or XAM

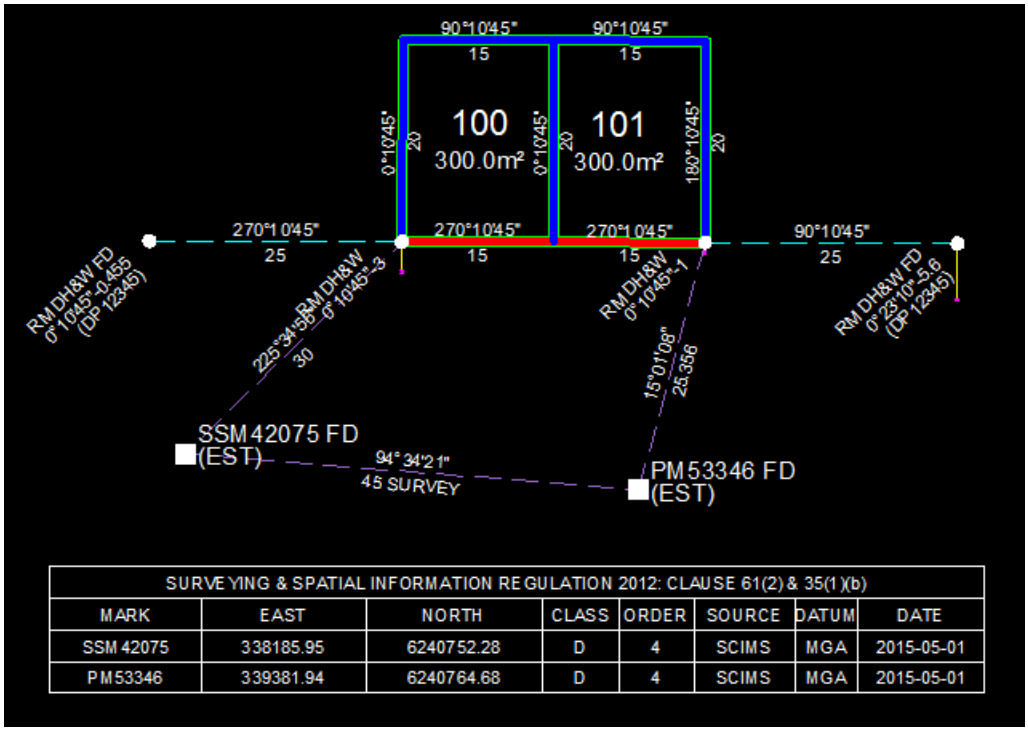


4. Create the lot definitions using XCL or XAP



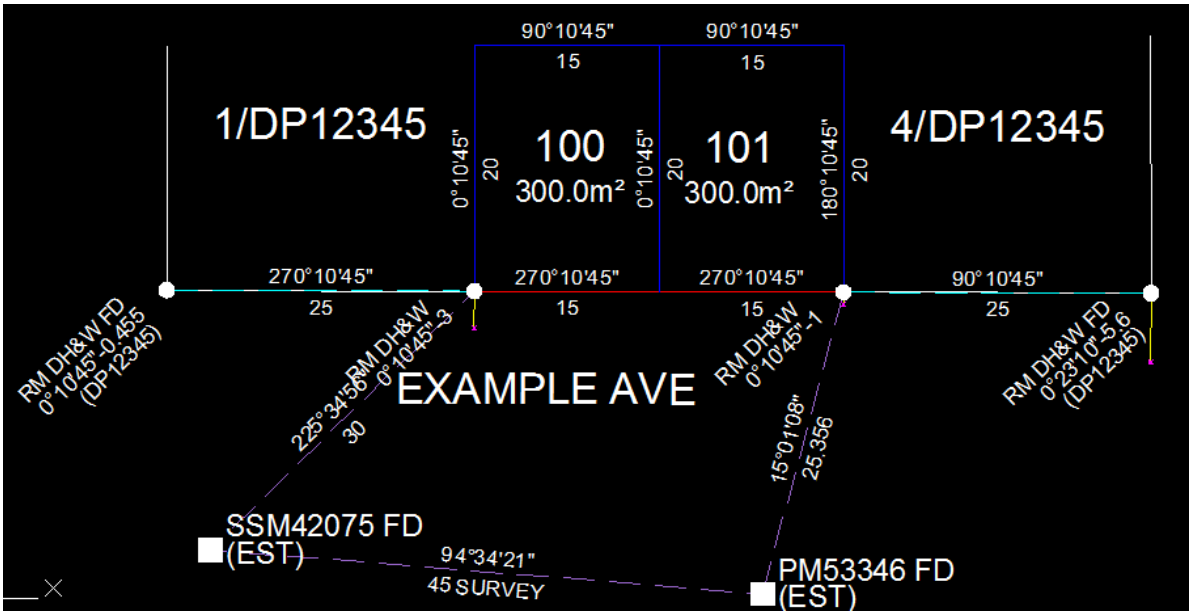
Note here I have turned lineweights on so I can see the background lot definitions as a green halo.

5. Add the PM's using the XPM tool and the PM CSV Maker

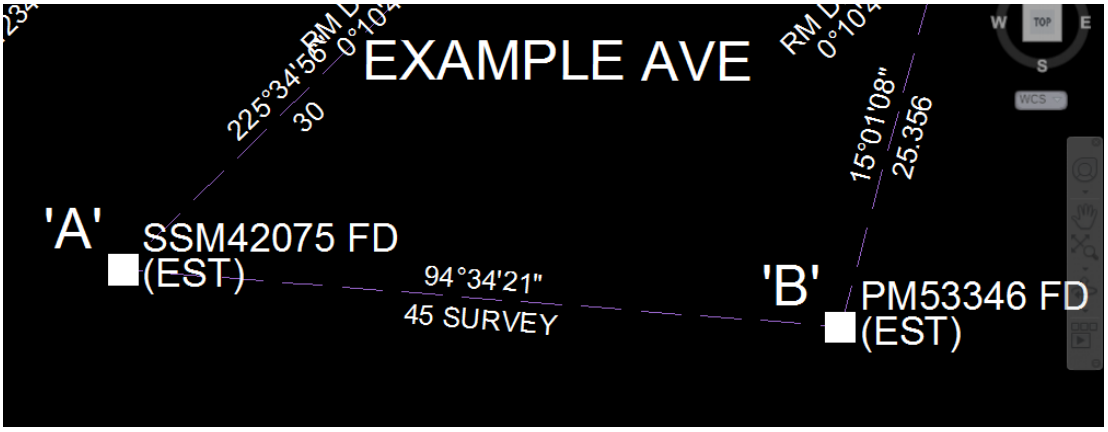


SURVEYING & SPATIAL INFORMATION REGULATION 2012: CLAUSE 61(2) & 35(1)(b)							
MARK	EAST	NORTH	CLASS	ORDER	SOURCE	DATUM	DATE
SSM 42075	338185.95	6240752.28	D	4	SCIMS	MGA	2015-05-01
PM 53346	339381.94	6240764.68	D	4	SCIMS	MGA	2015-05-01

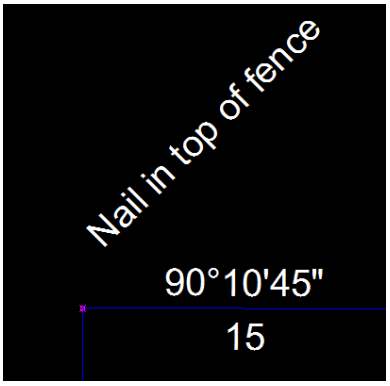
6. Add adjoining lots and road polylines. These objects need to be polylines and need to have xdata assigned to them using the XJR and XJL tools. In this case I have added a polyline along the front boundary to define my existing road. The adjoining lot polylines also go over the top of my connection lines. When assigned the polylines are put underneath other geometry, so the connection lines appear on top of the polylines.



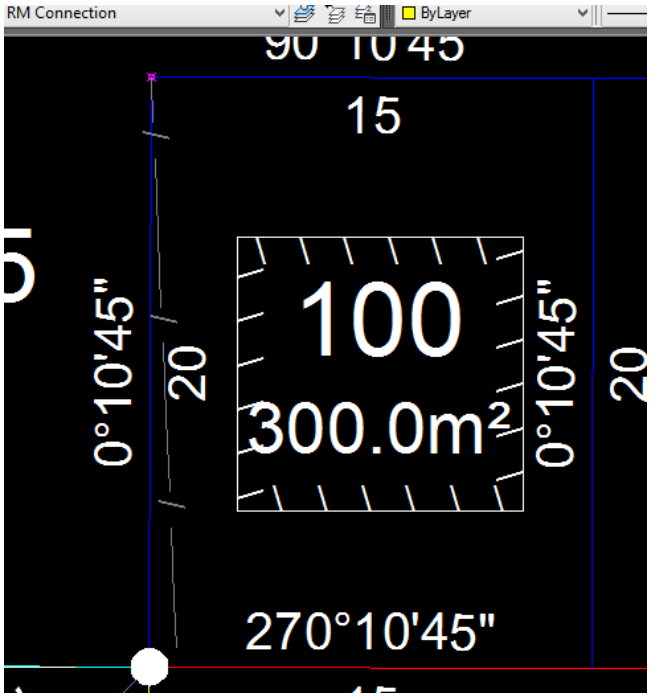
7. Add scale factor to lines between SSM's/PM's using XSF. In this case only between SSM42075 and PM53346
8. Add datum points using XDP. In this case my A-B line (or X-Y as is more commonly used) is between the PM's.



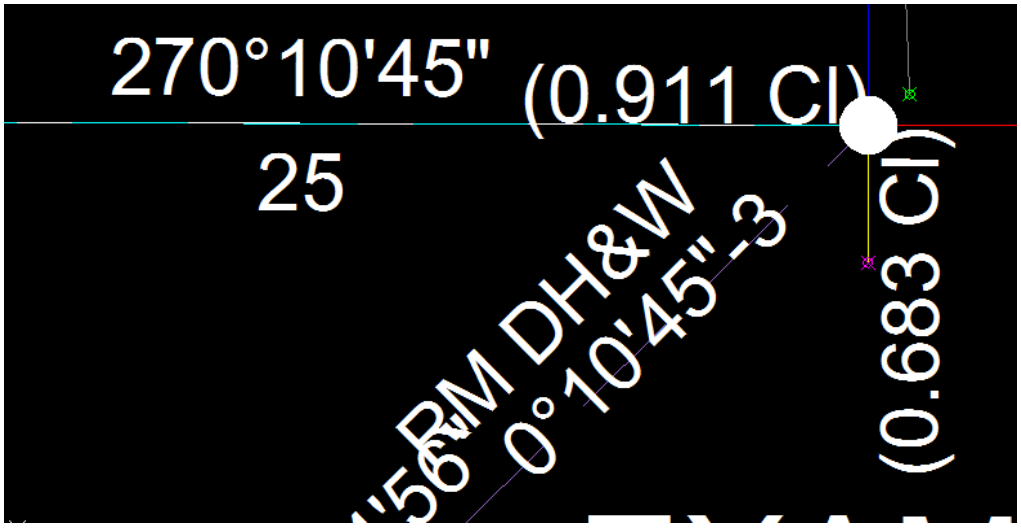
9. Add any non-peg corner marks (for example nail in top of fence) using XCM



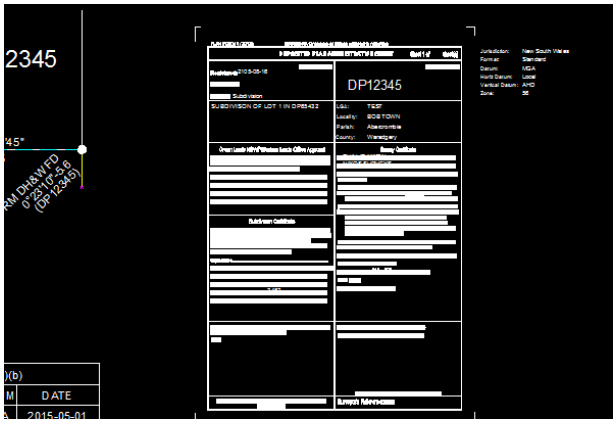
10. Add occupation information. I have an existing house and fence on the western boundary of lot 100. These just need to be drawn and put in the correct layer. They can be assigned descriptions if necessary using XAO



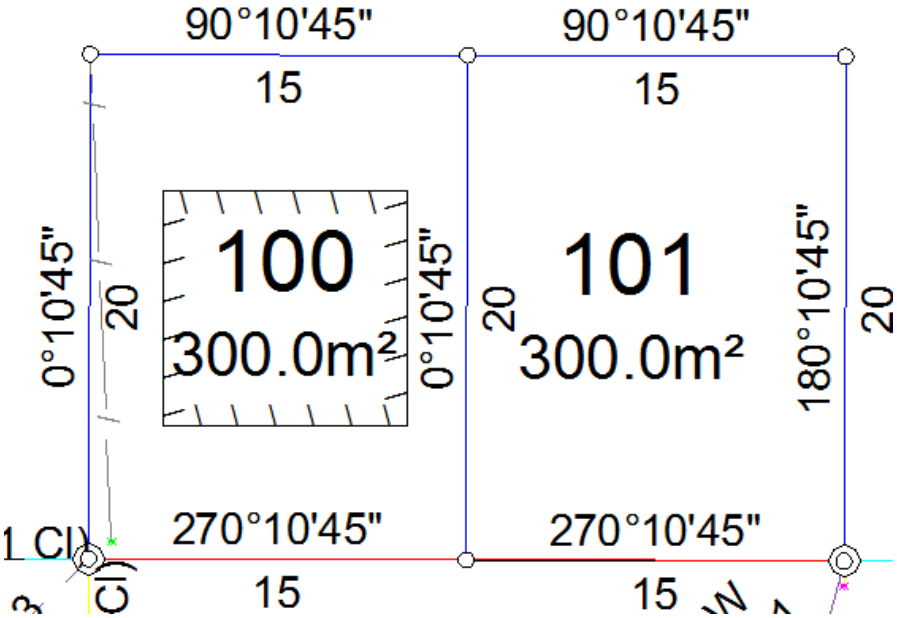
11. Add occupation offsets using XOC, XOQ



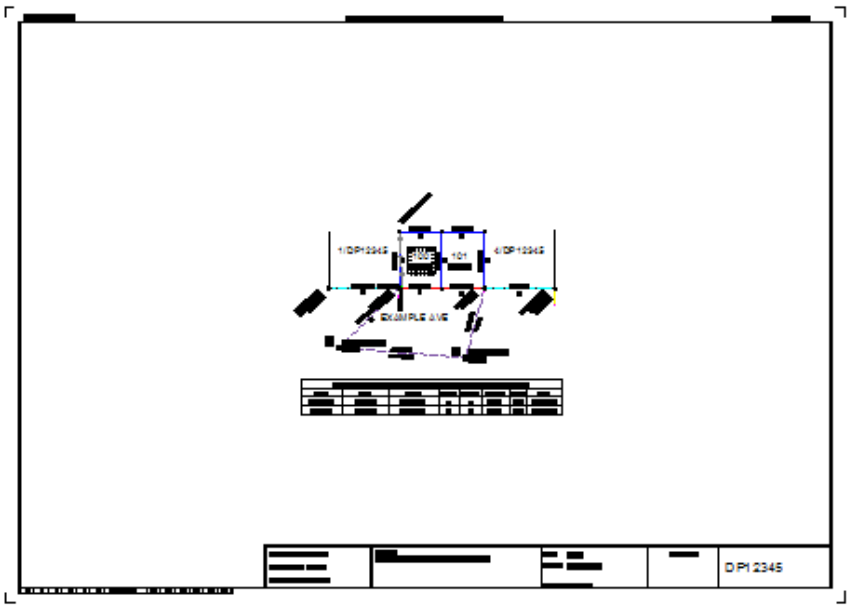
12. Add admin sheet using XAS



13. Add pops to lot corners with XCP

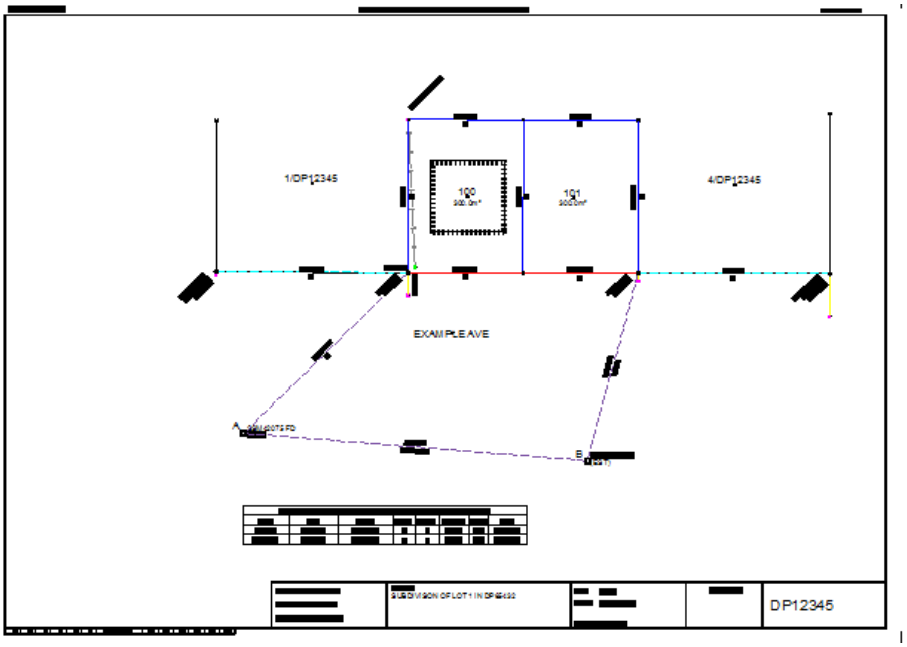


14. Add layout with XLA



15. Export to xml using XOUT and print using monochrome and lineweights.

This example is very simple, designed to show the main commands in a step through format. You might notice that the scale of 1:500 selected for this example leaves quite a lot of white space and could be scaled up a bit. I quickly deleted the info and imported the xml using the different scale of 1:200. At this point when happy with the scale and layout some of the overwriting text might need to be cleaned up. All changes to text will not be reflected in the LXML file or the imported LXML file, as there is no way to store this information.



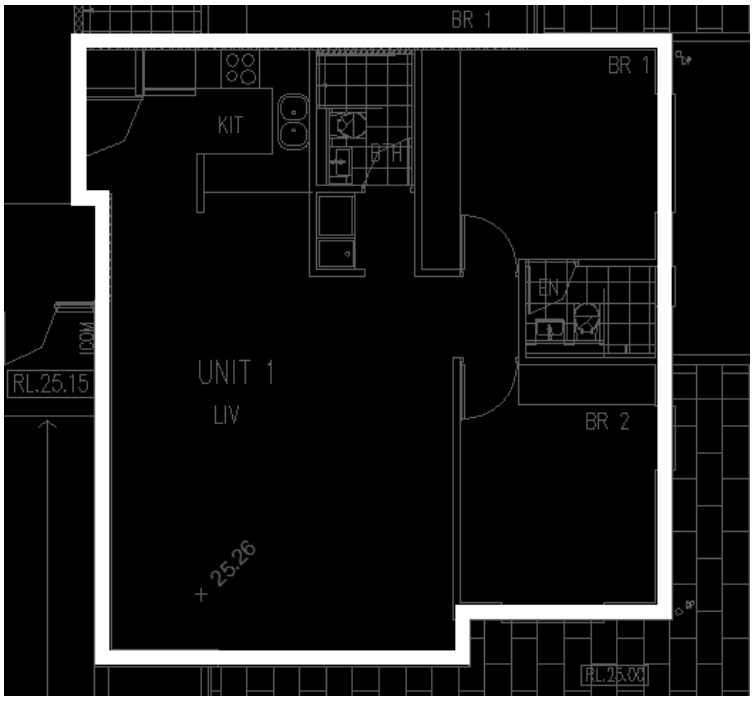
Example Use Tutorial – SP

This is a basic tutorial for strata plans designed to show how to use the program to build a strata plan. My example will be reasonable complicated, I will show the first lot and then build from there.

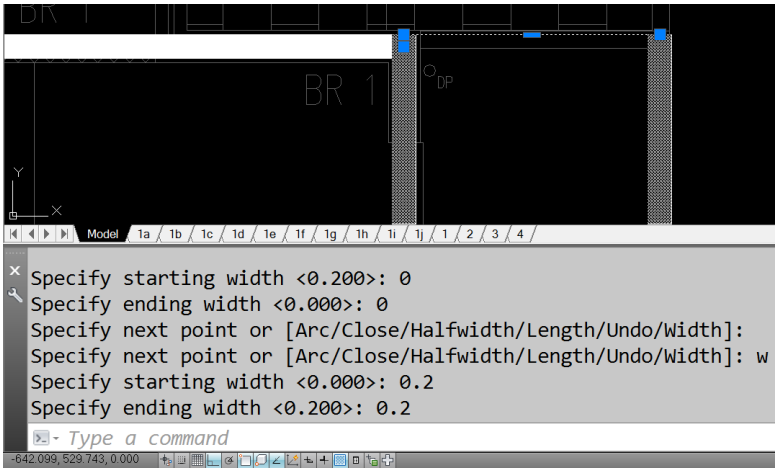
Many strata plans are built on top of existing architectural plans, for ease of use and often to create a draft strata plan. This tutorial will use this technique.

(In this example many of the diagrams show levels being assigned without the number prefix, eg "Ground Floor" instead of the new "3,Ground Floor" format. When the LRS start accepting and validating strata plans I will redo these examples, but for the moment it is a waste of my time to redo theses diagram, in case they change their mind again.)

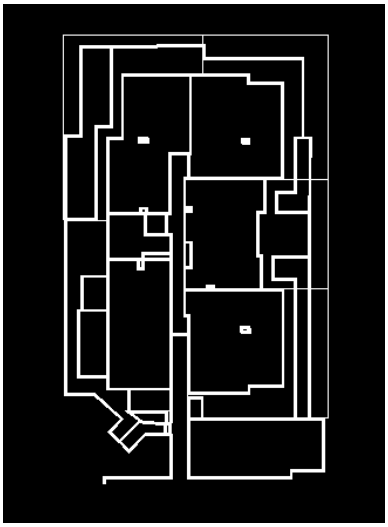
1. Decide on the scale of the strata plan and use XSS to set the scale. It is important to set the scale and be happy with it as it is difficult to change later on.
2. Load in the architectural plan at the correct scale in the background so that it can be traced.
3. Trace each lot using the centrelines of wall and a thick linewidth. I would suggest using the correct drafting thickness to make the polylines. For example at 1:200 the width would be 0.2



Solid lots are easy, but it can be a bit tricky with thin lines. When you get to a proposed thin line boundary, change the width back to 0

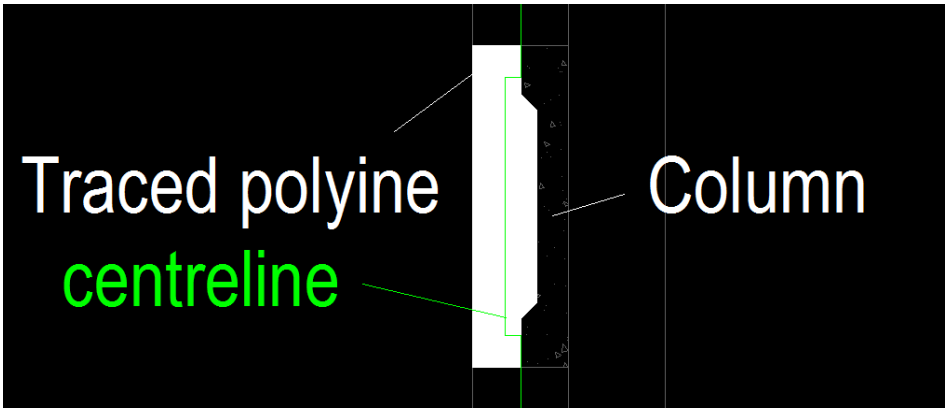


Repeat for all lots. Here is my ground floor.

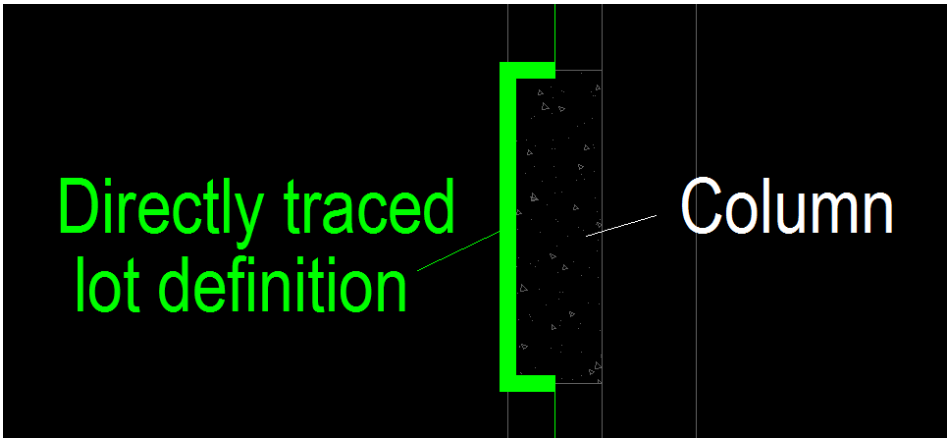


You might note I have also traced some of the ducts in the units.

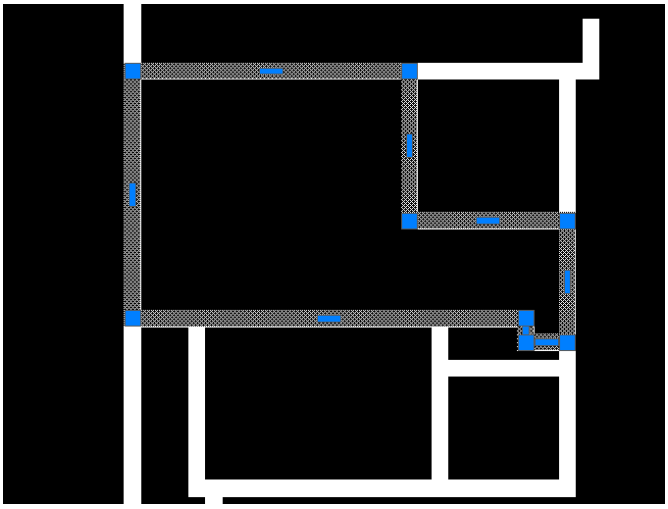
In the carpark columns can be a bit tricky to deal with. Knowing the size of your column prior to drawing can be an advantage. In my example my columns are 0.3X1.0m. To trace a solid line in the columns I need to draw a line 0.1 in around the outside.



In these situation is can be easier to directly trace the lot polyline and the use the XSD tool to draw the drafting line.

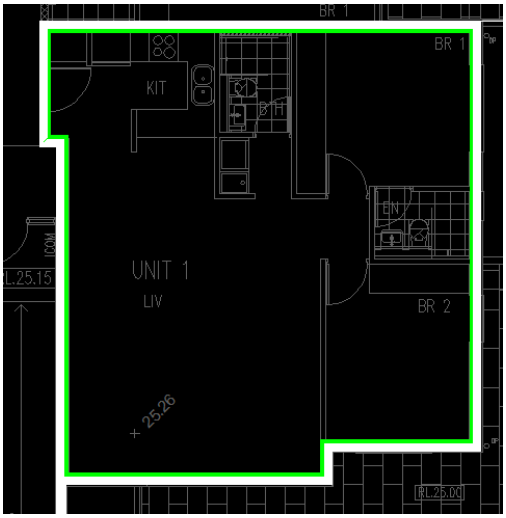


When doing common property lots, try to maintain the closed loop polyline structure so labels can be added later which make sense.



4. The next step is to create the lot definitions. In structures these are a “mythical” line half the width of the proposed thick polylines from the centreline. It has been made slightly easier by using the reverse draft tool. We really only need to use this on the proposed lots. The common property lots can stay as the centrelines, and just be copied to the lot definitions layer. This can make complicated unclosed common property walls in carparks simpler.

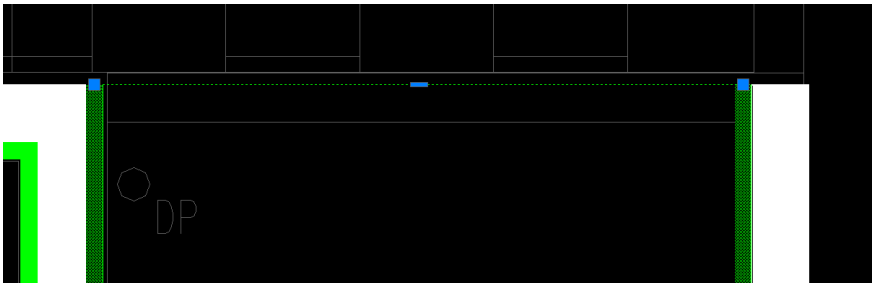
   So here is an XSDR on the first traced example.



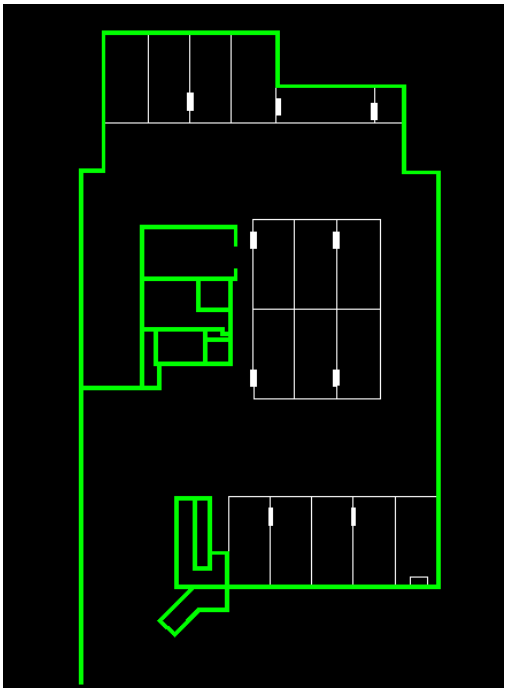
It creates a lot definitions polyline. Note that the thickness is 0.05. Any lot definition thickness, other than 0.05378 or the scaled wall thickness (eg 0.2 @ 1:200) will export as Structural Right (SR).

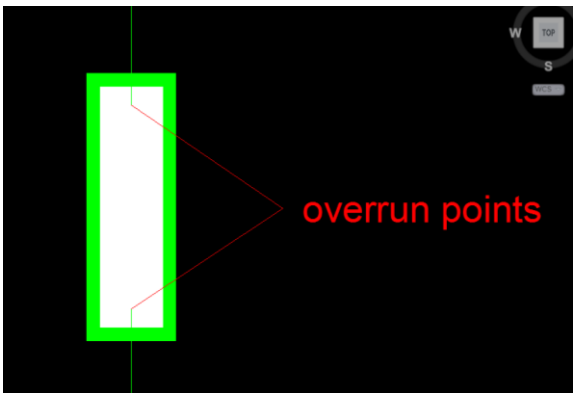
We can also do an XSDR on the external lot. We need to tidy the area where there is a thin line however as the XSDR leaves overrun points. These overrun lines area an unfortunate necessity to allow for prolongations of faces of walls.

To remove then simply grab the vertex and snap it back to the end of the thick line.

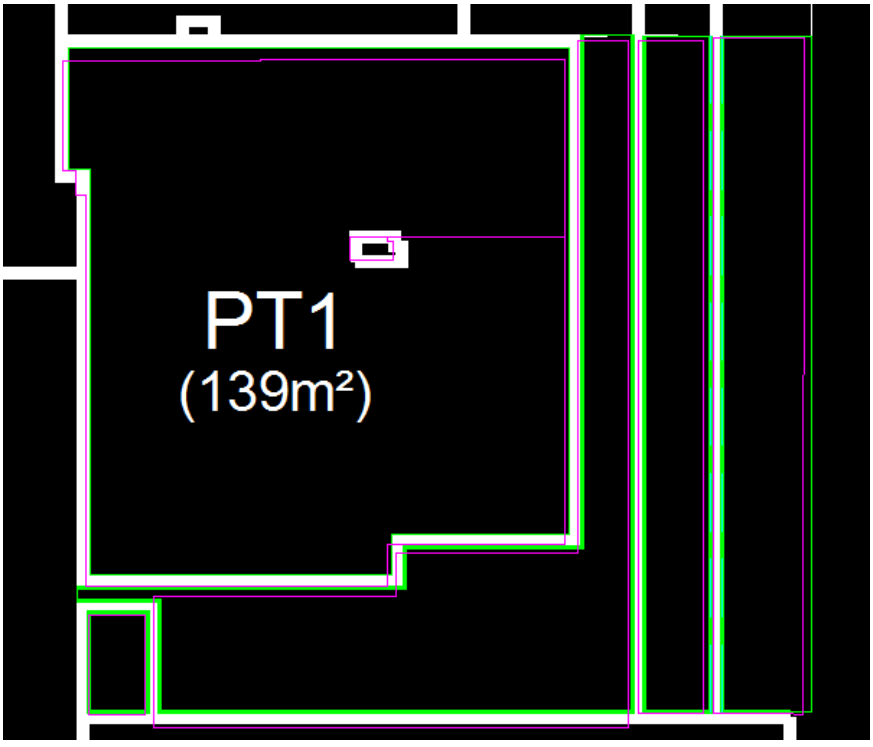


In the carpark we just copy the common property lines to the lot definition layer, and run the xsdr on the carparks, keeping in mind there will be overrun points on the walls and columns.



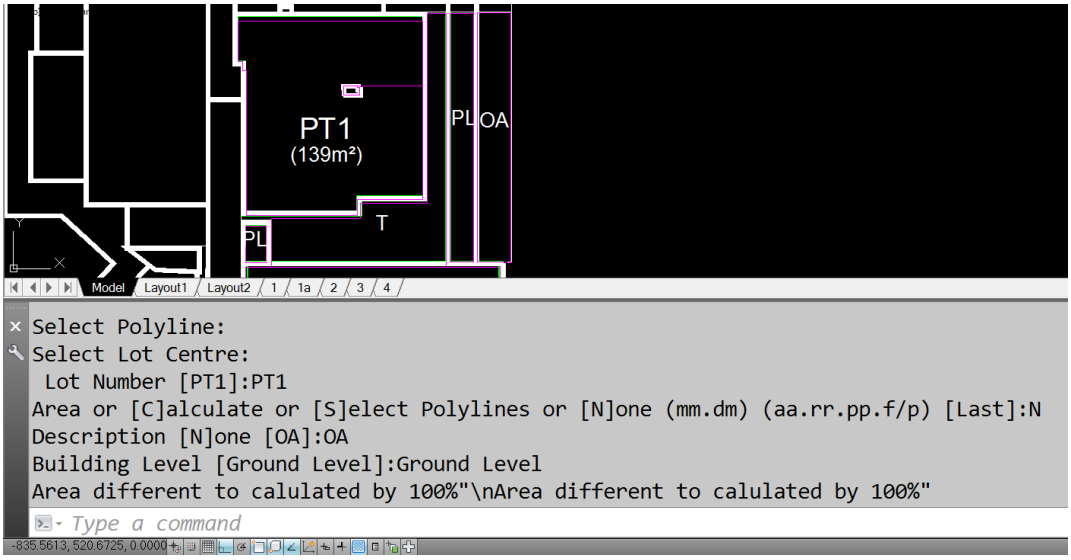


5. The next step is to start to assign lot information. We use the XSA tool to assign information. This is done lot by lot. A note here on areas. The LRS suggest having an area on every lot, but I recommend trying to keep subtotal areas on each floor, and giving adjoining part lots no area. When assiging there is the ability to calculate an area from the selected polyline, but I wouldn't recommend that based on how these lines have been created. There is also the ability to calculate them based on some user selected polylines. This would be a good way. In either draft or final format there are usually traced or measured polylines representing the areas of lots.

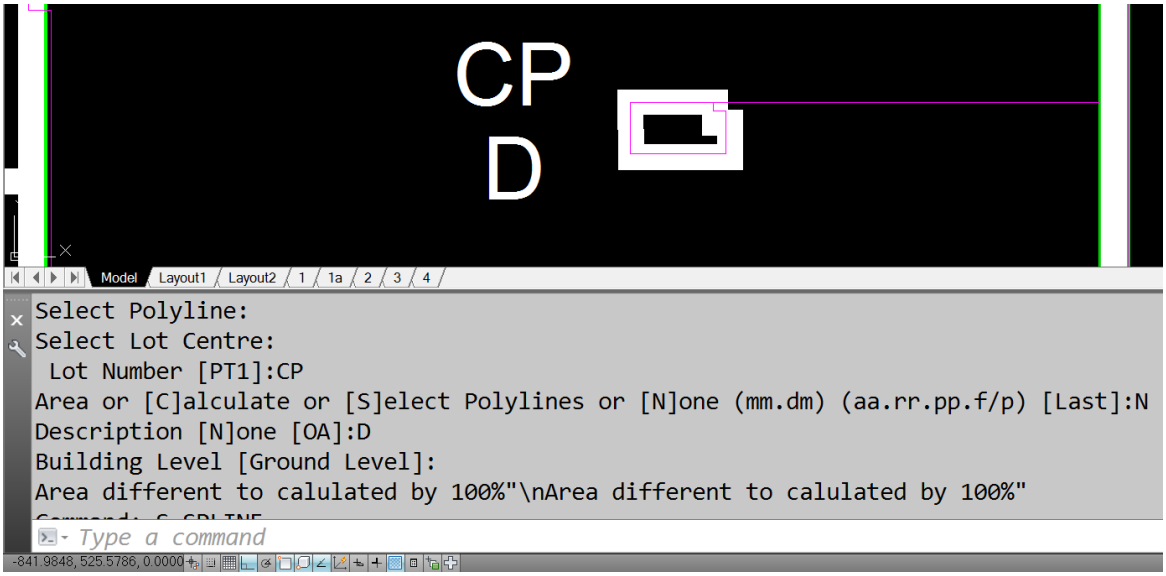


So here is my lot 1. I'm assigning the main lot of PT1, and giving it the subtotal area of the terrace, planters and outdoor areas which will be vinculumed (my field measured polylines are in pink). The tool truncates each area based on the 0.7 rule, and then subtotals these numbers. I also give it no description and the level "3,Ground Level". Some people like to make a more in depth analysis of the area's than this, so manual entry of the area is an option in this case.

I then want to assign the connected lots. In this case I give it the same lot number (PT1), but type N for the area to make it none. I also give these a desription, generally using a letter to indicate what they are. I also assign the level as "3,Ground Level". The description with no area tells the program this is a vinculumed area and only labels the description.

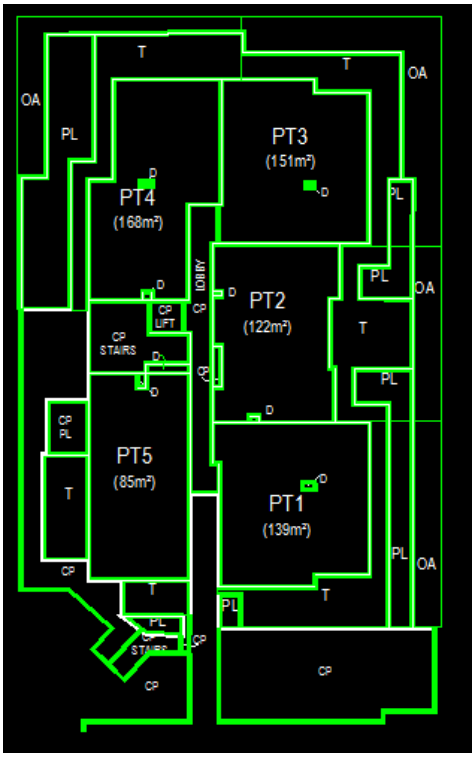


The small duct in the middle of the lot also needs to be assigned. It will be assigned to common property so it doesn't need to be an offset polyline, but we do need to copy it to the lot definitions layer. We then do a XSA giving it the lot CP, no area and an optional description.

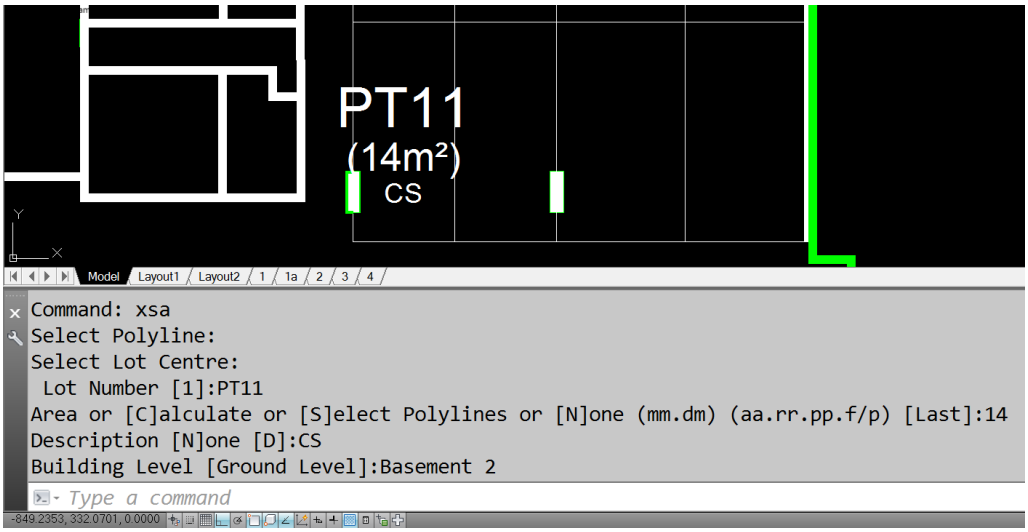


You might have to manually add a spline from the centre point, or if you wish to have it render, an arc in the occupations kerb layer might do the job. The LPI's renderer at the time of writing doesn't respect the xml lot centres but manually calculates it's own, so this would be pointless. I also got rid of the CP labels on my ducts as they are covered by my annotations legend.

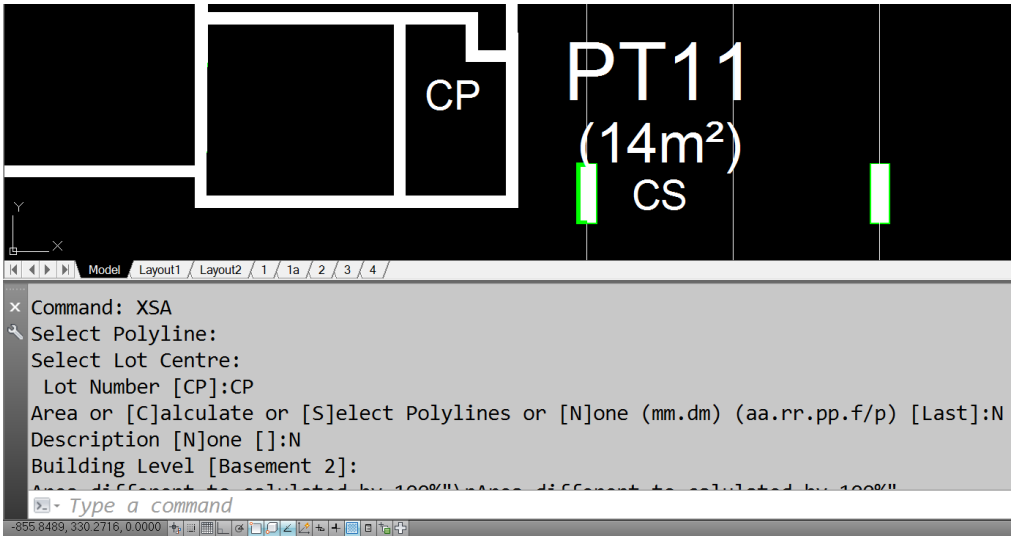
So…. Rinse and repeat.



Seems easy enough. Let's do one in the carpark.



This time I added the area, and a description which are both labelled. The common property to the left of this carpark can be treated like the duct and copied to the lot definitions layer and assigned.

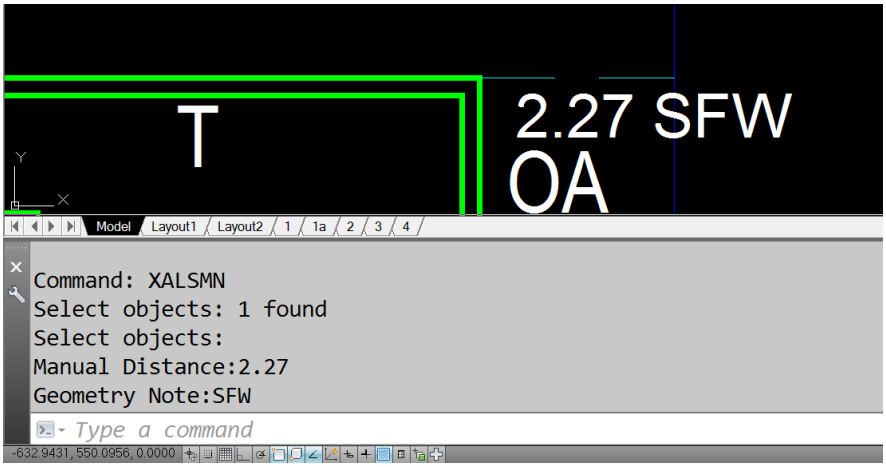


Once again rinse a repeat…

6. Boundary and connection dimensions

   The boundary dimensions are added by using the XALS tools. They are traced over the top of the boundary definitions. It is important one end of each of these lines is coincident with a lot boundary. This is so a level can be assigned to its points, as a reduced observation doesn't have level assigned to it. *It is a bit disappointing to me that after making a digital version of a strata plan that these distances can't represent the measurement that is assigned to them, but the thickness of a wall is determined by its scale, and not the real world thickness. If LRS removed their restriction for one line thickness, and we could dictate a wall thickness in the xml file, the xml file would much better represent the real world conditions.*

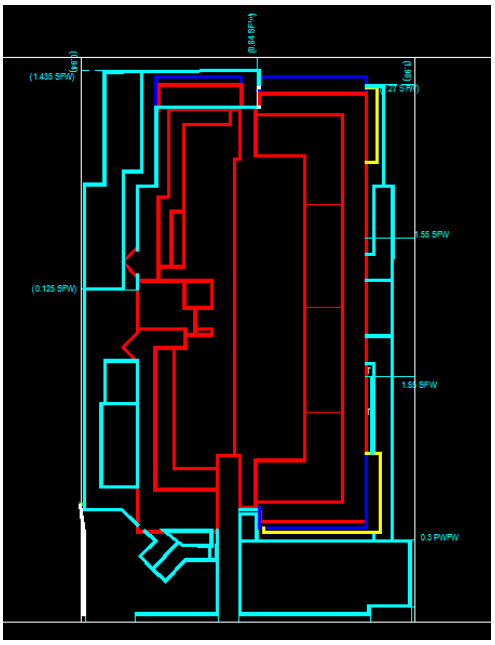
So as a result, the numbers will have to be assigned manually most of the time. This is done either using the XALSM or XALSMN tools. Type the command and select the line. The notes are used to dictate how a line is related to a structure, for example square to/prolongation of face of wall.



If we are doing a connection line, we can then add brackets using XCB (noting that these aren't reflected in the XML export)

So we dimension all lots and connections lines on the floor plans.

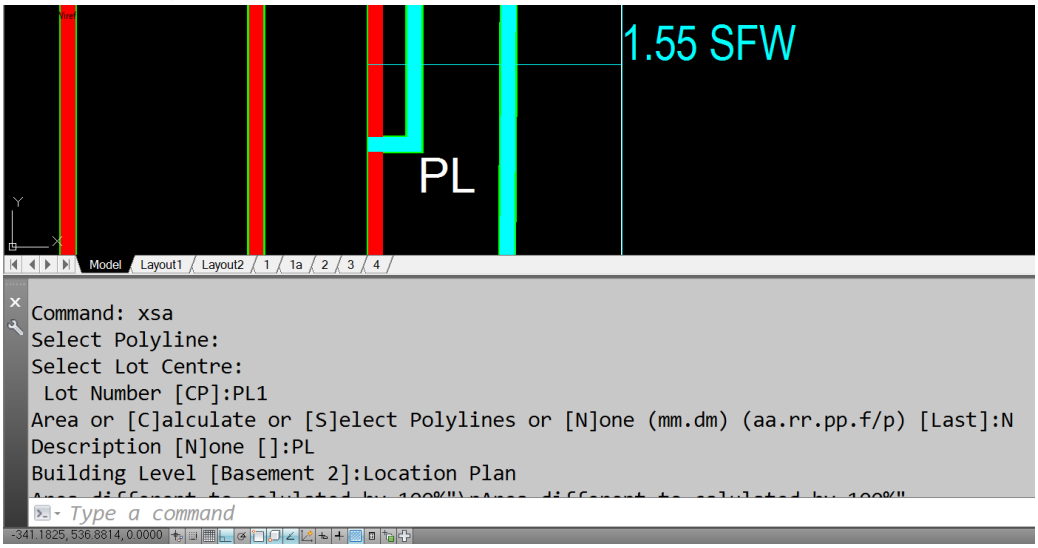
7. The next job is to create the location plan. I copy the drafting lines from the different levels, change the colour of each level, then stack them on top of one another slowly trimming and joining polylines, until we get a stack showing the main building and the external lots as viewed from above. This is also the point where we draw the subject and adjoining boundary lines.



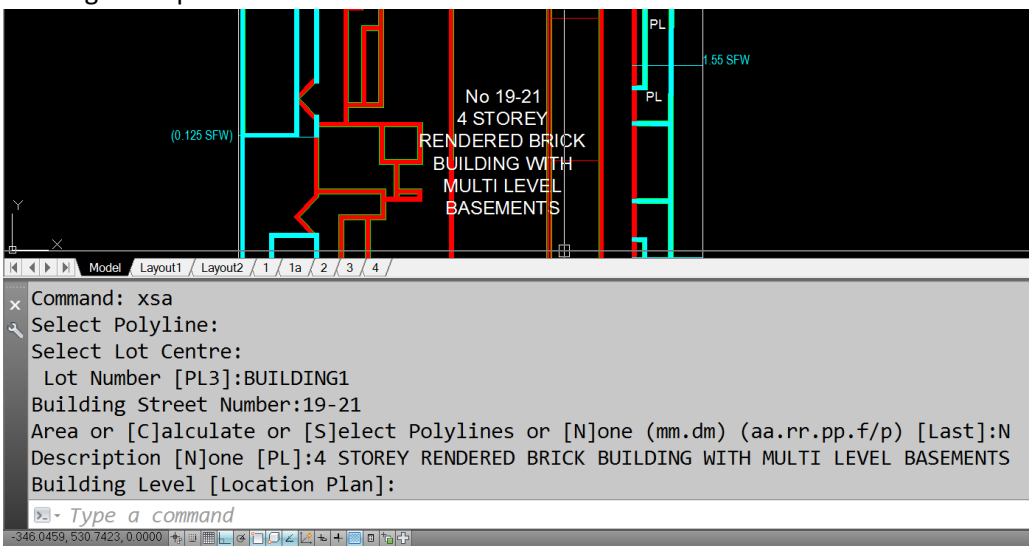
We then need to use XSDR to recreate lot definitions for the location plan. Doing it this way, rather than keeping the original lot definitions from the floor plans means new polylines are created, reducing the chance that a lot will be missed, or end up in the wrong floor.

8. Assigning location plan lots. These need to be given their own lot numbers without the PT prefix. For example the lots numbers would be T1, T2, T3 and so on, or CP1, CP2, CP3 and so on. The program will suggest incremented numbers, so it is a good idea to do all of one description type at once.

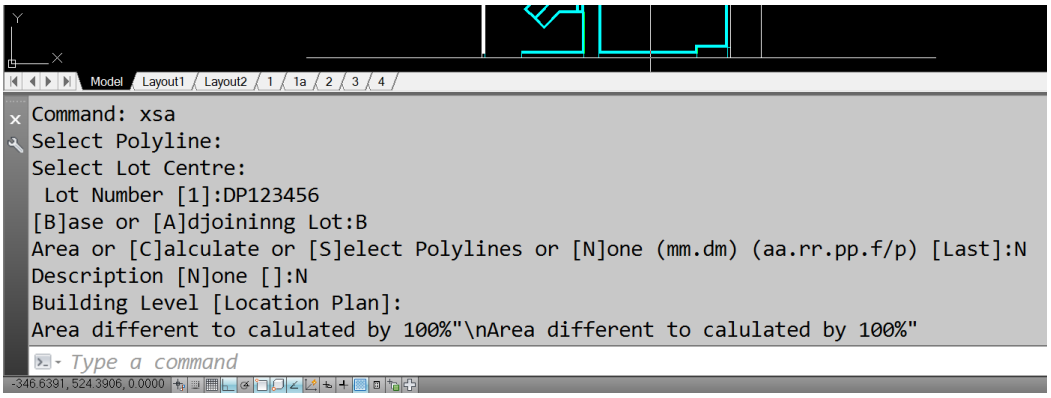
   It is also important that the floor level is "0,Location Plan", spelt and case sensitive to exactly this way as there are different rules for labelling on the location plan (eg common property is not labelled).



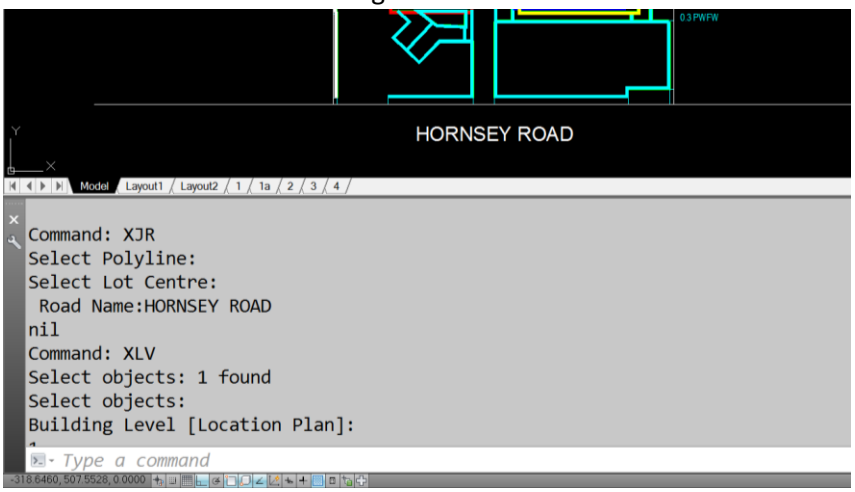
   The main building lot also need to be given the lot number BUILDING. If there is more than one building on the strata plan suffix these with a number. If using the BUILDING lot number you will be prompted for house number. The description in this case should be the building description.



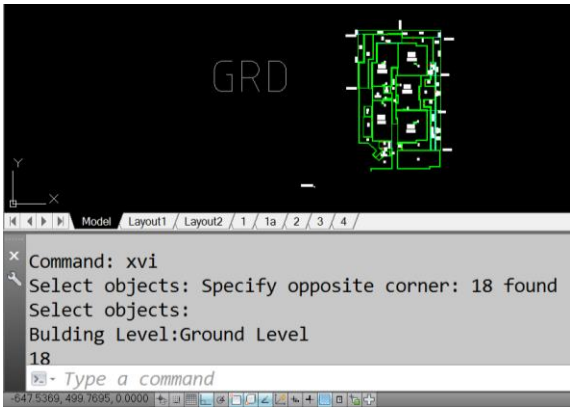
9. Next we need to assign the subject lot and adjoining lots. Using XSA again we select the polylines for our subject lot, and give it the underlying DP number. The DP or SP prefix identifies this as a base/adjoining lot and will then prompt for this



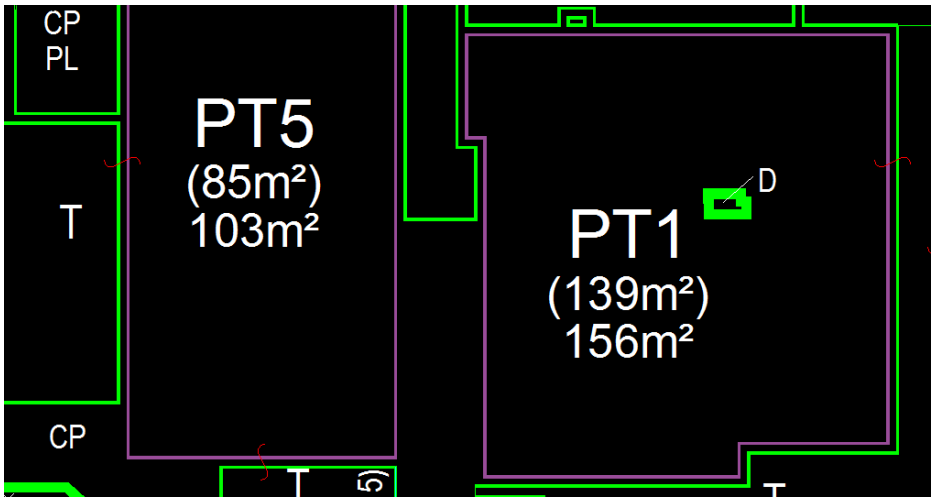
The same technique can be used to do the adjoining lots. Alternatively adjoining lots can be created normally using the XJL tools, and then assigned a level using the XLV tool. The advantage of using the later method is more tools can be used, for example XJR for the road and XAE for easements that might need to the shown.



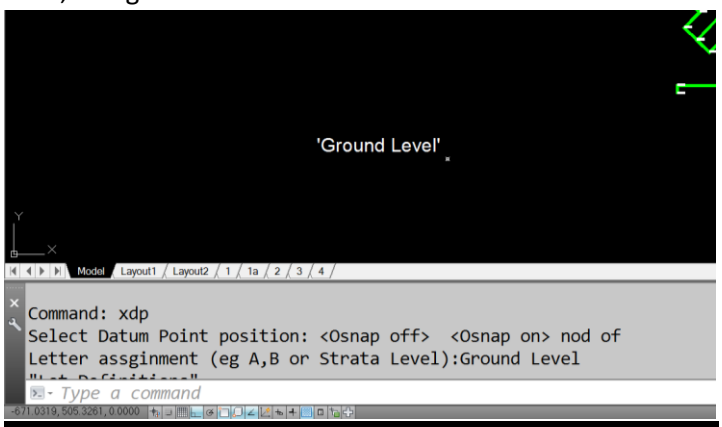
10. From here we need to go back and finish our floor plans. Insert the block VINC and add it to all lots were it is needed. The scale of the block is the scale of the drawing, for example if the drawing is at 1:200 the block needs to be a scale of 200. We then give the vinculums a level using the XVI tool. This can be done in bulk by floor.

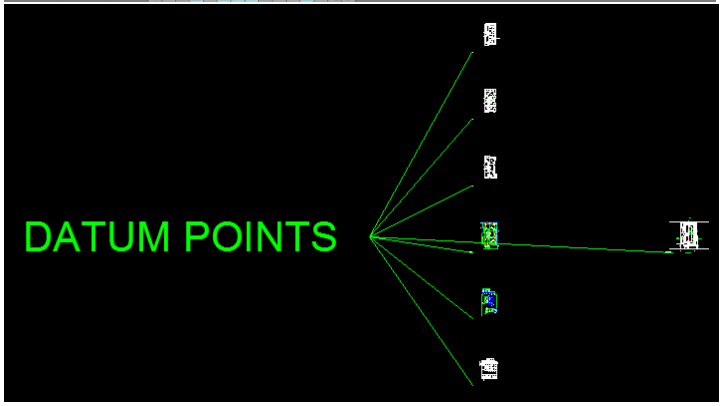


11. The other thing we need to do is total our strata areas. While assigning the lots using XSA, it is a good idea to change the colour of the main lots, so the totals can be quickly added up at the end. Eg do a quick select of all the main lots then type XST. It can also be done one lot at a time. Type XST, select the lot for the total area and press enter. The program will then find all the lots associated with that number and add the total text to that lot. This total is diagrammatic only and will be recalculated on the xml export.



12. Datum points. In the xml file the levels need to be stacked on top of one another. This would make it very difficult to work on the floors, so the datum point tool is used to stack the levels on export. The location plan datum point is used as the base, and all other levels are related to this. We use XDP to place a datum point at the same relative position on each level, and give it the name of the floor.





13. We then add the title block. By choosing “Strata Schemes” at the format prompt, planform 3 will be used and there will not be a prompt for rural/urban and terrain type. A few things on the title block need to still be filled out, eg bylaws, certifier etc, which is done manually.

14. The next thing is to add some layouts using XLA. If the admin sheet exists and the format is “Strata Schemes” planform 1 will be inserted. Otherwise it will prompt you for the location, plan type and other attributes.

15. From there we print similar to a DP.

16. Before or after that we can use XOUT to export to an xml file. On exporting other than the normal warnings, there is also warnings if a line has no level assigned to it. This is probably due to it not being snapped to a lot corner. We also need to make sure that before exporting the scale matches the scale of our lines, otherwise the structural descriptions will not work.

This tutorial is design to cover most of the strata tools and hopefully gives guidance for using LXML4AC to create a strata xml plan.

Version control

Old versions can be downloaded at the following link. The link is periodically updated every couple of versions.

https://drive.google.com/open?id=1Uz1gkbK0NlWy1UqU5tAZMyUyhrWiQdQz

Rev 1.0 – Beta Issue 01.06.15

Rev 1.1- Email for issues added 07.06.15
–Occupations Buildings added
-Adjoining Boundaries Added (XJL XJR)
-PM RM reference changed to PM connection
-Easement designator changed to parcel name
-Easement legend creator added

Revision 1.2 - Fixed reverse PM coords in coordbox
- Fixed arc observation checking on adjoining boundaries
- Fixed initial value for road/easement location when ray caster does hit any edges
- Change the requirements for "Occupation" to different spelling
- Added OFFSET as a occupations variable type (case problem)
- Fixed irregular line reading too many lines from the file and also adding a space at the end of the 2dpntlist
- Added adjoining easement change line type to dashed
- Added XINO & XINS command
- Rewrote line reader to deal with XML comments <!-- -->

Revision 1.3 -Fixed pickstyle hatch creation object deletion on XCL, XCR, XCE
-Added setting to reset and set scale list to fix custom scales affecting line types
-Made thickness of lot definitions 0.7 so with line thickness turned on lots are visible.
-CG points labelled on export.

Revision 1.4 -Added function to reverse lot definition polyline direction to clockwise on export

Revision 1.5 -Added better xml searching functions to deal with tabbed spacing
-Added CG point labeller to xino command
-Adjoining lot with no xdata's now identified
-Got rid of residual AEC objects from Planform blocks causes problems with block inserts
-Problem with adjoining lots and plan features not closing fixed
-Fixed issue with XOC not calculating from buildings
-Fixed easecount being a function as well as a variable
-Existing easement lots are no longer checked for geometry on XOUT and linework is now placed over the top on XIN so they plot, this is in the form of a polyline
-Dates changed so they match existing plans format (dd-mm-yyyy) but are changed to xml format on export
-Adjustments to code so it also works with BricsCAD V16. Changes checked against AutoCAD 2016, edits from file changed by Jason Bourhill at http:\\www.cadconcepts.co.nz.
-Corrected misspell of 'PICKSTYLE
-HATCHEDIT BricsCAD V16 is missing some of AutoCAD's options using HATCHGENERATEBOUNDARY instead, which works the same in both
-AutoCAD uses a "d" as a suffix to angles in DMS Format, BricsCAD uses a "°" Adjusted code so that DMS angles are in the expected AutoCAD format
-INSERT. AutoCAD uses a different command syntax to BricsCAD when inserting blocks without attributes adjusted these INSERT calls to declare scale first, which works without issues in both applications.

Revison 1.6 -Added datum description when using MM
-Added ability to use survey bearings on input (eg N45W instead of 315) on XTR, XTA, XRM and XDRM
-Added extra line to PM box which labels the zone and CSF in both XIN and XPM (gets data if available on XPM)
-Doesn’t reverse dates on PM box labeller

Revision 1.7 -fixed non truncating numbers in XAL and XAA
-fixed hatch generation problem in Autocad 2012 where hatchgenerateboundary finishes with polyline selected
-added SS to SSM conversion on PM creator
-added XALN & XAAN commands to add notes by assigning lines and arcs
-added ability to use 2d polylines (splined polylines) for irregular boundaries
-Allowed spaces in XPM
-Added facility for flow arrows
-Added ability to add non connected RM's (eg RM gone on Adjoining lot with no connection)
-Added state determinations for PM, eg found/placed
;Revision1.13.5-Removed spaces on either side of - in pm csv maker SCIMS-Datum Validation (found by Brian Raaen)

-Allowed no value of PU in xin and N/A on XBM and XPM will not record pu in xdata
-Add ability to work with UCS with XAL, XAA, XAP, XCL, XCR, XCE, XJR, XJL to correct text rotation when north is not directly up the page
-Fixed problem with bulbous arcs in XAA and XIN

Revision 1.8 -Added XAO command for assigning description to occupation plan features
-Revised Direction of Flow Arrows to match recipe and insert automatically when using XAI
-Fixed adjoining lot with no xdata error finder pointing to wrong point
-Added drafting tools XSP, XSW and XSB
-Added stages notification to XOUT to assist users with error detection
-Made provision for linefeeds in ptlist2d
-XOC revised, all offsets now plan feature offsets which allows direction
-All text now written in uppercase to meet RG Dir 6.
-RM Gone using XCM changed to incorporate type and print RM at start
-XOUT hierarchy revised to move adjoining boundaries to number 7.
-Minor enumeration list changes
-Ability to deal with lxmls with no monuments added (for example complied plans)

Revision 1.81 -Problem with more than one multipart lot fixed
-Allow spaces in Occ comments

Revision 1.8.3-Fixed problem double spaces where there was a monument condition

Revision 1.8.4-Added short line tables for arcs (as requested by Jacek Idzikowski)

Revision 1.8.5-Fixed bug with reverse arc traverse (found by Greg Smiths smart young draftsman)

Revision 1.8.6-Reverted back to 6 decimal places

Revision 1.8.7-Added an entered bearing validator

Revision 1.8.8-Re-reverted back to 6 decimal places after some sort of stuffup by author

Revision 1.8.9-Made any leftover boundary parcels pntsurv boundary instead of sideshot and respects the lots state (found by David Loftberg)

Revision 1.8.10-Fixed fieldnote "" being added to arcs and PM's on import (found by Greg Smith)

Revision 1.8.11-Made allowances for only irregular boundary for lot edge (eg. track in use)(example from Greg Smith)

Revision 1.9 -Added slanty text entries when entering "ye old" distances in XTR
-Added compile type lines to XALC
-Added ability to have a line with just a bearing on import
-Fixed "Not Marked" state "Not Marked" label
-XRD values changed, now rounds to 5" for all distances under 10km long. For PM connections turn rounding off
-Fixed problem with monument condition importer
-Added peditaccept setting (found by Roumen Mollov)
-Change set to setq on non-entered plan of attribute (found by Roumen Mollov)
-Added double // remover so adjoining lots names can be copied from Google Earth nswglobe.kml placemarks
-Added XCB for drafting to add brackets around text
-Modified XAA and XOUT to work with arcs not in world UCS
-Fixed trig station (and other PM types) exporting TS to cg points (example from David Loftberg)
-Fixed XAM not recording decimal point when exactly square
-Added XHV tool (supplied by Roumen Mollov)
-Added XBE tool to allow bulk attribute editing
-Added XJO tool for other objects (suggested by Brain Raeen)
-Fixed problem with RM's referencing natural boundary lines (example from Ziemowit Wierzchowski)
-Added XCT tool to tidy coords at 4th decimal place
-Add ability to have bearing symbols and & in comments and descriptions
-Updated monument states to complete list
-Major changes to allow for strata plans and the level and wall codes
-XSA, XST tool added for assigning and totalling strata lots
-XALS, XALSN, XALSM and XALSMN added for strata lines and strata lines with notes
-XVI and XLV added to assign levels to vincs and adjoining information
-Added ability to use planform 3 and 1 for stratas

Revision1.9.1 -Fixed problem with decimal point storing when adding cardinal bearings (eg 90,270etc) found by Ahmed El-Kiki

Revision1.9.2 -Dealt with files with no linefeed (example from Stringer eplan by Ahmed El-Kiki)
-Shifted attdia and attreq to either side of the admin sheet importer (request from Greg Smith)

Revision1.9.3 -Fixed xino cgpoint reader (found in Non linefed file by Ahmed El-Kiki)

Revision1.9.4 -Dealt with fieldnotes and irregular lines in non linefed files (found by Ahmed El-Kiki)
-Dealt with brackets around text in point occupations
-Changed to match new adjoining Hydrography format, but still allow old format to import and export

Revision1.9.5 -Made more polylines go clockwise on creation and assignment (request from Jacek Idzikowski)
-Fixed bug with areas less than 1m²

Revision1.9.6 -Fixed bug with calculated areas in XSA (found by Roumen Mollov)

Revision1.9.7 -Fixed "" on XAA xdata assignment (found by Libby Whyte and Ziemowit Wierzchowski)

Revision1.9.8 -Improvements and repairs to xdata checking on xout (as requested by Ziemowit Wierzchowski and to make sure Gavin Murray doesn't go bald)
-Updated planfeature symbol replacer
Revision1.10 -Added ability to add other secondary interests using XCE and XAE
-Added XUP tool for assigning some useOfParcels attributes
Revision1.10.1-Compilation plan type now changes "Date of Survey" to "Date of Compilation"
Revision1.10.2-Adjoining Easements Added to XAE
Revision1.10.3-Ends of Irregular line change to boundary for irregular easement centreline
-Fixed fractional part error for recurring 9's in area calculations
Revision1.10.4-Fixed XRD on lines rounded to 60" (found by Michael Kadziela)
Revision1.10.5-Added format to multipart parcel definition on export
Revision1.10.6-Added irregular boundary error checker (to reduce Gavin Murray's hair loss)
Revision1.10.7-Fixed problem with extra centerpoints being exported when exporting a pntlist2d and change adjoining centres back to existing
Revision1.10.8-Changed Datum points to allow other letters for marking plan notes
Revision1.11 -Changed Datum points to allow for RL and added XBM command for creating stratum benchmarks
Revision1.11.1 –Changed the requirements for strata datum points.
Revision1.11.2-Fixed bug with stratum datum point list counter
Revision1.11.3-Minor bug fixes to XSD and XSDR tools and other strata fuctions (thanks to Michael Homsey for a fresh exmaple)
-SSIR2017 wording changes
-Fixed problem with missing <Parcel on XJO
-Rounding and scale values now stored in DWG
-Scale value read from strata xml on xin
Revision1.11.4-Add ability for multiple admin areas (lga,locality,parish,county) seperated by a /
Revision1.12 -Added road extents for ends of proposed roads and road widening
-Made coordinate boxes more compliant with SG Direction 7 (2017) example
-Allowed for number prefixes' on strata levels and datum points
-Added XHD to add height difference to line
-Condition removed from XRM, XDRM and XCM
-Changed RM Connections to Reference on output and added distanceAccClass and adoptedDistanceSurvey to line
-Centroid calculator added to XAP,XAR,XAE,XJL,XJR and XJO
-Fixed problem with rounded chord distances in Short Arc Table (found by Gavin Murray)
Revision1.12.1-Fixed problem with RM or corner mark gone still looking for a condition (found by Michael Kadziela)
Revision1.12.2-Readded brackets and letter labeller when easement description starts with (#)
-Changed text height to 0 at beginning of xin (found by Greg Gruber) - Bricscad does seem to change at start
-EST requirement on PM's changed from "SCIMS" to include also "From SCIMS" and fixed problem with BM is imported first (found by Michael Kadziela)
-Added old versions link
Revision1.12.3-Fixed XPM where no pm connection lines exist
-Removed selector from XCL
-Minor bug fixes to menu and spelling
Revision1.12.4-Fixed bug where not importing two reference lines to one monument not setting layer to RM Connection (found by Michael Kadziela)
Revision1.12.5-Fixed bug where PM or BM points were not incrementing on export when on top of each other (found by David Loftberg)
Revision1.12.6-Fixed bug with replaceitem function not adding list item in a list
-Added allowance for Height Difference layer and height difference lines with no azimuth or horizontal distance
-XHD updated
Revison1.12.7-Fixed error where HDT goes from non pm point - no label
-Allowed marks other than Scims mark types to be reducedhorizontalpositions (found by David Loftberg)
Revision1.12.8-Fix problem with extra " when adding XHD to exsiting line (found by Michael Kadziela)
Revision1.12.9-Removed xout command hardwiring, would not run in Bricscad (found by Michael Kadziela)
Revision1.13 -Change XJO to add "parish/county of" text
-Added default "" value for date of survey for compiled plans
-Added XAUD audit tool for comparing/ identifying differences between xdata and line geometry
-Updated admin sheet EPAA section reference
-Fixed problem with recurring 9's when converting then getting integer portion of manually entered areas to real numbers (found by Robert Booth)
Revision1.13.1-Added MGA94 and MGA2020 to datums
-Order and positional uncertainty mixed together for XPM and XBM
-XIN XOUT modified to deal with order/PU and 2020 headers
-XRT Added to recreate text from xdata
Revision1.13.2-Problem exporting irregulars when using lwpolyline (found by Roumen Mollov)
Revision1.13.3-Changes made to import PM/SSM used as reference mark using post V8 recipe (found by Roumen Mollov)
-Auto "used as reference mark" commenter removed from XAM, XRM etc

-Bug in order/pu fixed
-Fixed xino to ignore height difference only reduced obs (found by Ahmed El-Kiki)
-Amended xino code to deal with instrument heights that are not connected by geometry (eg height diff lines)
-Changed reader where DSM files have extras spaces on datum points, horizontalfix, horiztonaldatum and vertdistance
-Fixed problem with BM's not showing as EST when higher in file than PM
Revision1.13.4-Restirciton of the use of land with no description will plot class as desc
-Fixed problem with roads with areas not being labelled
-Fixed problem with optional date on reduced vert's
-Move PM connections up in Redobs decision tree to draw line for RM on point 2 and change to RM Connection line(pre V8 recipe PM as ref point with non-peg mark at cnr)
-Default scale set to 1:200
Revision1.13.5-Removed spaces on either side of - in pm csv maker SCIMS-Datum Validation (found by Brian Raaen)
-Allowed no value of PU in xin and N/A on XBM and XPM will not record pu in xdata
Revision1.13.6-Fixed bug with commment variable preventing feild note import (found by Roumen Mollov)
Revision1.13.7-Fixed fieldnotes prefixing with <Fieldnote> when linefed
-When cg desc is "COORDINATE ERROR", point is not classed as a datum point and description is suffixed to cgpoint text
-When reduced observation field note contains the work "ILLEGIBLE" colour of line and notation turned orange
Revision1.13.8-Change vertical observation date allowance of null value on XBM and XIN
-When value of Null on verticalfix coordinate box is populated with blank
Revision1.13.9-Ajoining boundaries were not recoding a default strata code value
-Requirement for lot areas removed (for eg. existing lots)
Revision1.13.10-Rebuilt allowance of rm referenced twice (found by Roumen Mollov)
Revision1.13.11-Added vl-load-com
Revision1.13.12-Added adjoining boundaries to XMLC
-Fixed warning when no height difference connection lines are found
-Fixed prompt for XAN
-Fixed problem when adding additional roads to an imported xml
Revision1.13.13-Fixed problem when cardinals calced 0 minutes
-Added example file
Revision1.13.14-Addd close vicinity point checker into xout
-Modernised some prompts to 2020 version (found by Kim Meijer)
Revision1.13.15-Fixed problem with PM's not exporting to islist when not connected to geometry (thanks to Brian Raaen)
-Fixed problem comments and translation of & ' from xml to text when doing an xin (thanks to Brian Raaen)
Revision1.13.16-Allowed non-schema enumeration red obs desc "irregularline" and converted to Irregular Right Line layer
-Added more orange coloured lines for other backcapture feildnote
-Attempted Speed enhancements to xin and xout by replacing member with vl-position
Revision1.14.0 -Added XMO for exporting monument and XARP for store plan origins for compiles
Revision1.14.1 -Added checker for oid requiring monument
-Fixed isolated point checker in XINO
Revision1.14.2 -Removed bring RM to front - was bugging out in Bricscad and was unneccsary
-Fixed default text height to match scale
Revision1.15 -Added option to stop areas always rounding down to XRD which affects XCL, XAP and XIN (as requested by Gavin Murray)
Revision1.15.1 -Fixed bug in header export version
Revision1.15.2 -Fixed semantic error in landxml.dcl and set dcl auditing to 0 (found by Elliot Griffiths)
Revision1.15.3 -Fixed bug with assigning scale factor to lines with field notes (found by Elliot Griffiths)
Revision1.15.4 -Fixed ² not exporting properly for road names
-Added area prompt for roads in XCR and XAR
Revision1.15.5 -Expanded XRT
Revision1.15.6 -Annotation scale 1:1 added for custom templates where it doesn't exist (found by Michael Vincent)