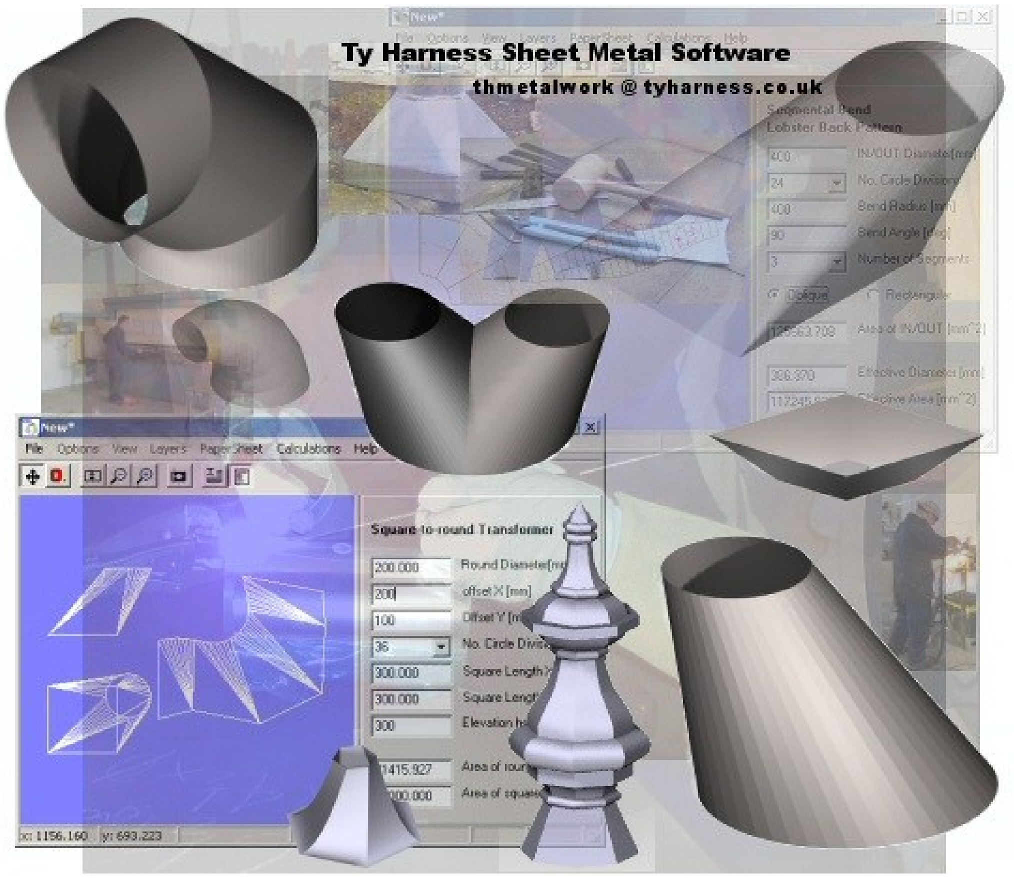
Ty Harness Sheet Metal Software Manual 1.0



http://www.tyharness.co.uk/sheetmetal

Square To Round (STOR)

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Thank you for purchasing the Ty Harness Sheet Metal Software Version 1 Range.

The members website is the place where all new versions and updates can be found:

https://sslrelay.com/sheetmetalsoftware.tyharness.co.uk/membersadmin/smadmin.htm

Contact: *thmetalwork<-at>tyharness.co.uk*

Frequently Asked Questions FAQs:

http://www.tyharness.co.uk/squaretoround/faqs.htm

Preface

I'm an ex-sheet metal worker by trade but I work mainly as a draughtsman these days in the welding and fabrication industry. When I was an apprentice, CAD was a 'pipe-dream' for shop floor workers and tradesmen in 1980s. At Grimsby College we developed patterns on the drawing board in the morning and then in the afternoon made up the transformers in the sheet metal shop.

I've been developing software since 1983 and CAD software since 1997 and have produced many work-around solutions, fixes and tips for many of the main stream and not so main stream applications. Most main stream CAD applications pre 2000 had little or no tools to make sheet metal pattern development easy. I needed faster ways to produce sheet metal patterns in CAD so I made the Square TO Round (STOR) application and I was encouraged to make it more commercial by colleagues. The first beta release of the sheet metal software was made available in 2005. I want to thank all the early adopters of the software because without you I wouldn't of been able to release any more versions of the software, pay for the web-site administration and all the other costs that arise in the world of software development.

I now write this preface in 2008 and most CAD applications like AutoCAD (TM), TurboCAD(TM) and SolidWorks (TM) have sheet metal pattern development tools as standard. Some people say now that CAD applications can now achieve what my software does that £25 is too expensive for a singular development solution but I still feel their is a place for parameter input and instant redrawing of the pattern for quoting and ease of use on the shop floor. A modern CAD system has a steep learning curve. I don't want to just reduce the cost of the software because I feel it's not fair to the early adopters so I offer free updates and additional free software to registered members and I think the software will pay for itself within 1 or 2 jobs. Please email with any comments or software features you would like to see incorporated into the software.

Ty Harness.

Introduction

Many sheet metal workers are highly skilled draughtsmen who can not only draft accurate scaled plans to high set of standards but have a significant role in the engineering and planning of a product or system. Pattern drafting skills are taught from day one of an apprenticeship. Great geometers and mathematicians such as Appollonius[1], Descartes [2], or Monge[3] to unfairly name only three have formulated geometrical techniques and generalised pattern drafting techniques that can be used to solve an infinity of problems. The radial line, parallel line and triangulation techniques are stock techniques taught to modern sheet metal workers. These are fast and efficient drawing board techniques and the famous course text book in the UK is 'The Geometry of Sheet Metal' by A. Dickason[4] and the equally as good but out-of-print book 'Practical Sheet and Plate Metal Work' by E.A. Atkins.[5]

Computer Aided Design and Computer Aided Manufacture (CADCAM) is no longer the 'buzz word' that it once was in the 1980s and has become the standard method for design and issue of drawings. Very few draughtsmen are still using a drawing board. There are many great advantages to using CAD such as electronic archive and delivery, fast plotting and tidy drawing revisions which is a great deal simpler than the old-ways. Unfortunately equivalent CAD techniques of drawing lines and arcs to develop patterns is rather difficult and tedious in comparison with the aforementioned old-ways. I would strongly urge that sheet metal apprentices must learn pattern development on a drawing board either at college or from books.

The Ty Harness Sheet Metal Software applications are to allow CAD draughtsmen and shop floor workers to generate patterns fast in a working environment. Engineering drawings are often revised many times between quotation and approval and it is not only a tedious having to develop the same pattern several times in one week but it is costing money. Typically a quotation drawing will be used to price the work and inform the customer what the quote does and does not include for, but the working drawings may need calculations and site measurements before a final draft can be issued for fabrication. Also, you may need to explain or visualize the transformer and the full versions can create a 3D DXF (based on polyfaces) which is suited for import into CAD applications and the 3D VRML is suited for internet plugins which means your customer does not need a CAD system view the model.

Square To Round (STOR)

STOR is not just an alternative method to the manual drawing of patterns but an engineering tool to help design the transformations from square to a circle. Figure 1 shows some screen shots of version 1.2 where by changing the dimensions in the right hand side pane redraws the square to circle immediately. Within the construction industry, tradesmen and especially sheet metal workers need to know how to construct square-to-round transformers. The square-to-circle is such an elegant geometrical form and has always been the first great challenge for any apprentice sheet metal worker. It is very easy to underestimate the complexity of sheet metal pattern development.

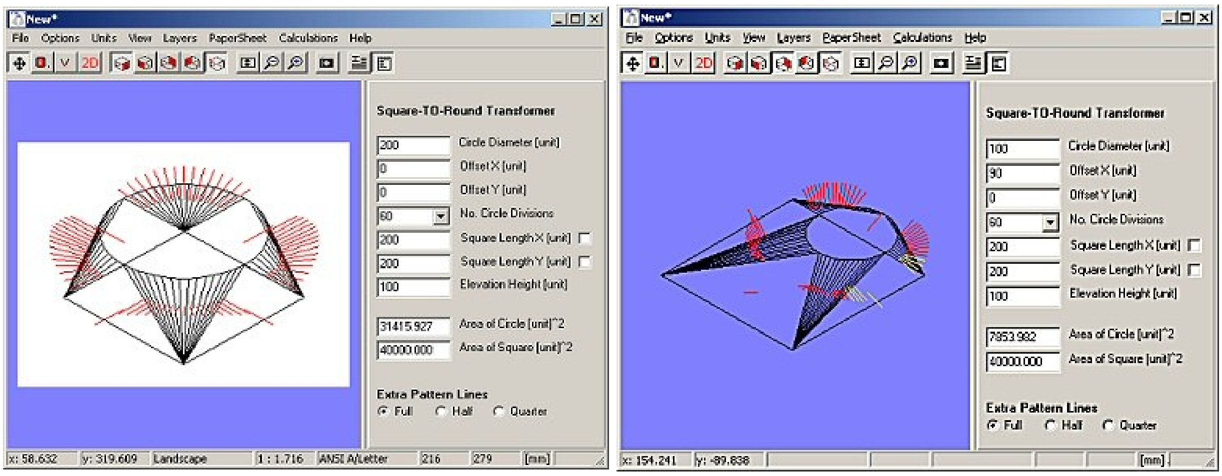


Figure 1 - Screen shots from version 1.2 with the new isometric views and face normal calculations.

You can control key geometrical parameters and perform advanced calculations like finding the internal volume and once you have designed your square-to-circle then the pattern has already been developed and you are ready to go whether your needs are printing a template as shown in figure 1 or supplying a DXF to the laser cutters.

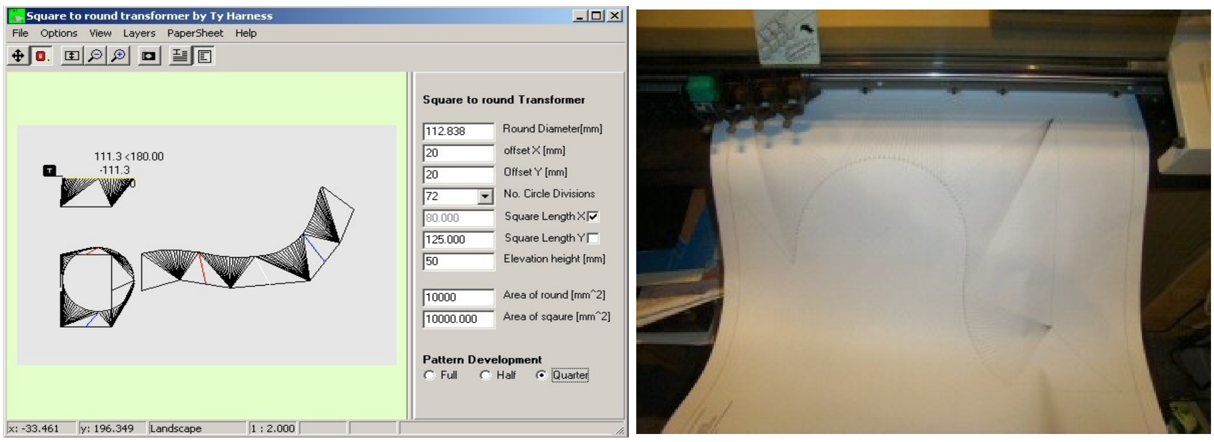


Figure 2 - Paper sheet mode allows you to visualize your paper dimensions and the drawing can be scaled to that paper size.

Square-to-rounds are often used for hoppers, stove chimney hoods, HVAC pipe work systems, fan nozzles etc. Figure 3 shows a rain water hopper and some fan nozzles.

Figure 3 - Hopper for rain water guttering made from 3 mm galvanized mild steel and 2 thin sheet fan nozzles where the area of the rectangle equals the area of the circle.

The software is designed not only for the sheet metal worker to draw a square-to-circle but also for managers and estimators who need know how much material is required. The laser cutters may need a DXF file to quote from or you may just be out-sourcing the work and require a simple part drawing. The web site designer may need a 3D graphic. There are functions for the engineer like setting the area of the circle or rectangle. In fact you can design the area of the circle to be equal to area of the rectangle and then lock off either rectangle side lengths and the adjustment of the area will only occur in the unlocked axis as in the case of the fan nozzles shown in figure 3. Additional calculated properties (from the menu bar) are available like the 2D pattern area and minimum blank area and hence any wasted area which you will need to-hand when preparing quotations.

Segmental Bend (SEGB)

With SEGB you can control key geometrical dimensions and perform advanced calculations like finding the internal volume. Once you have designed your segmental bend then the pattern has already been developed out for you. In the case of the right segmental bend as shown in figure 4 the start and end segments are half patterns of the full segments which ensures the cylinder is always cut square and makes a circular input and output connection. To make a full segment you just mirror the half pattern and this is the case regardless of how many segments are used or whether the bend angle is 90 degrees or not.

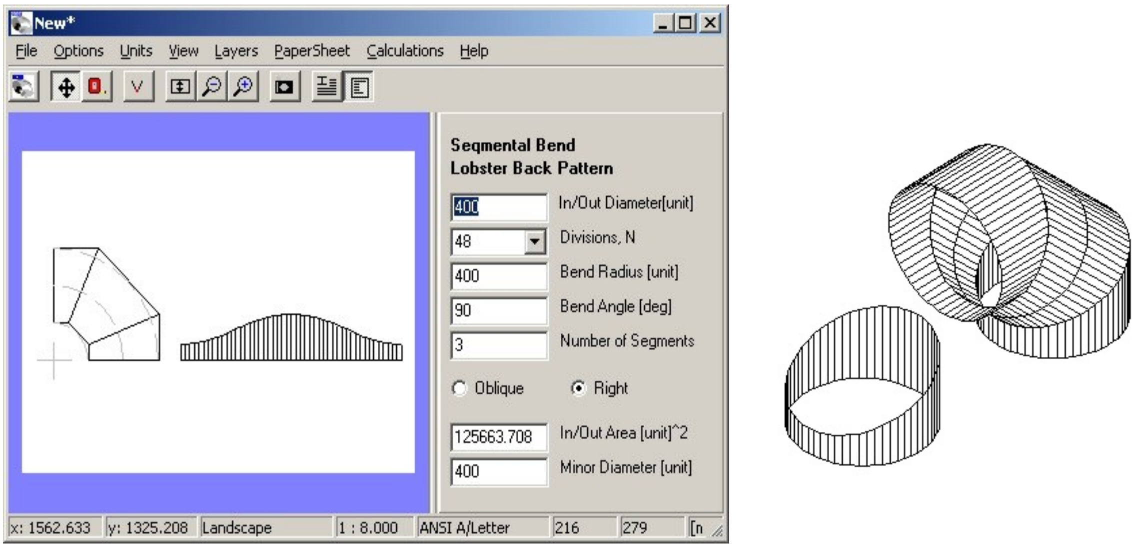


Figure 4 - Right segmental bend

Right segmental bends have a circular cross section which allows you to use stock Circular Hollow Section (CHS). If you have a large enough band-saw then the right segmental bend is just a mitring exercise but for large diameter CHS then wrapping the paper template around the pipe allows you to centre dot the cut line for cutting by (say) flame as shown in figure 5.

† Figure 5 – Using paper templates to mark a cutting line.

Oblique segmental bends, as shown in figure 6, have an elliptical cross section but still maintain a circular input and output. You can buy elliptical tube stock but it is not readily available like CHS or designed for segmental bends in any way. If the material thickness is under 16 SWG then it is easy to form the elliptical cross section by hand after rolling and there are many times when the oblique bend is more aesthetically pleasing to the design rather than using a right segmental bend for everything.

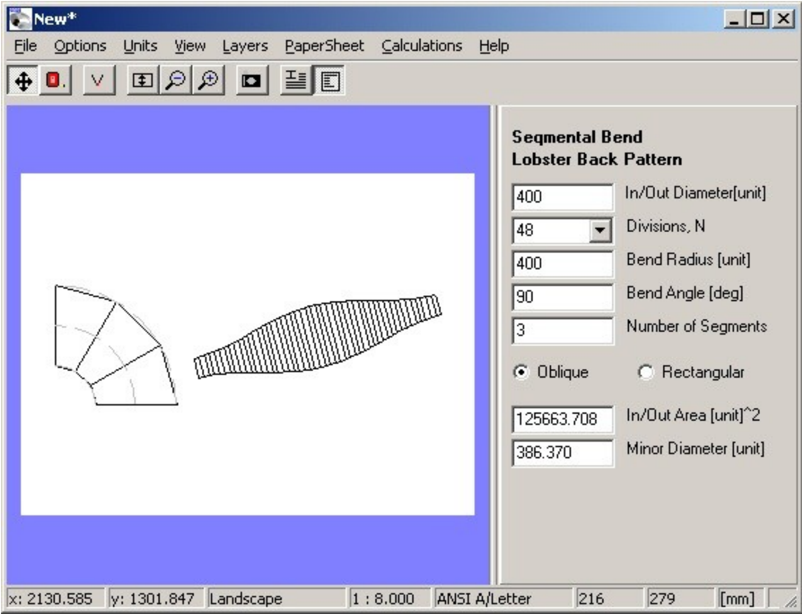


Figure 6 - A 3 segment oblique bend - note that the input/output area is circular.

Figure 7a,b - Oblique segmental bend.
Left: hand cut with shears   Right: †Laser cut profiles.

Figure 7 shows that you can stagger your joints for both right and oblique bends to minimize the amount of material waste and cutting time whether by hand or by CNC laser.

The key design properties associated with a segmental bend are:

- In/Out Diameter - Both right and oblique bends have circular inputs/outputs.
- Divisions - the greater the number of divisions the less truncation error and greater pattern curve accuracy.
- Bend Radius - not an easy site measurement to take. Use a folding rule or two flats to find

the centre of the radius.

- Bend Angle - even if the bend angle is not a right angle you can still use a right segmental bend. You can use a protractor against your folding rule.
- N segments - A right segmental bend always has two half segment in and out which is automatically calculated by the software.
- Area In/Out - useful for engineers who need to consider the fluid inside or the flow rate.
- Minor Diameter - This parameter is useful when designing oblique segmental bends where the cross section of the tube becomes elliptical and the In/Out Diameter is the major axis. The perimeter and area of the ellipse can be calculated in the advanced properties section.

The segmental bend is a common component for Heating, Ventilation and Air Conditioning (HVAC) systems. Frequently, you will be able to buy off the shelf bends made up for all the common diameters and various angles like 22.5,30,45,60 and 90 deg but it is important to be able to design and make a bend of unusual dimensions and to understand the difference between a right cylinder cut obliquely and an oblique cylinder. Ultimately, we would all like smooth elbow bends but they can only be made to limited sizes, and the next best thing is the segmental bend. The greater the number of segments the closer the approximation to a smooth elbow. 6 segments per 90 degrees is usually acceptable for sheet metal work. Any more than 6 and you have got a lot of welding. For a large bend radius compared to the pipe diameter it is not unusual to use 12 segments per 90 degrees.

For the oblique bend then the greater the number of segments the less elliptical the cross section becomes, and again this is another reason why 6 segments per 90 degrees is so often recommended. One of the worst cases which can arise is a 1 segment circle to circle connection, as shown in figure 8. You would normally mitre the in and out pipes in effect producing a right bend to ease the problem if possible.

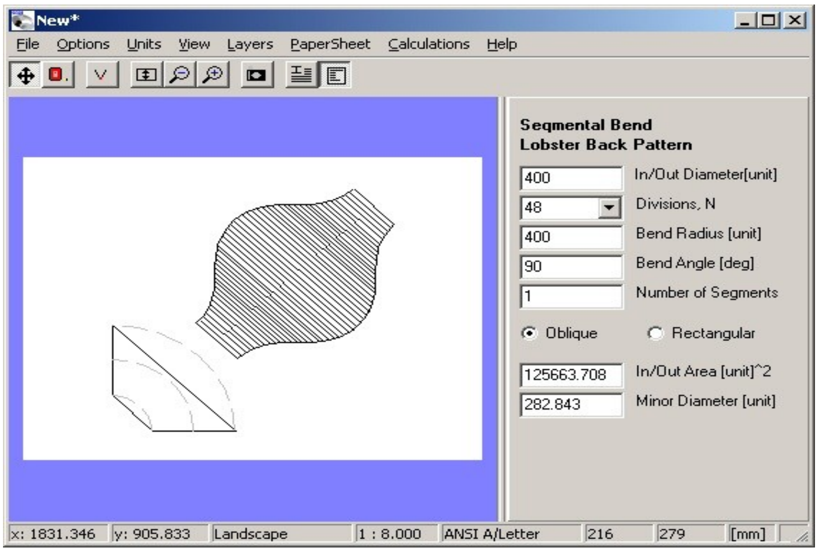


Figure 8 1 piece circle to circle connection

Cone Transformer (CONET)

CONET makes the design of standard sheet metal conical work very easy and the pattern draughting of a cone surface flattened onto a 2D plane is reduced to entering a few key dimensions. CONET can handle right and oblique, and full or frustum cones. Figure 9 shows an oblique frustum cone. Like with all Ty Harness Sheet Metal applications you control the design via dimensions like the base diameter and the elevation height. Cones are often used as hoppers, nozzles and transition pieces between pipes of different diameters.

The parameters describing a cone have been chosen to suit different users. CONET allows a tradesman/sheet metal worker to work with the dimensions that are easily measured on site or in the shop: Base and top diameters, frustum height, and frustum offset. The sheet metal worker may not care about the surface area, volume or apex position. The costing department will need the perimeters and areas for quoting and ordering etc. The engineer may need the mechanical properties such as internal volume for calculations. The parameter input method means you do not need any draughting or CAD skills to design sheet metal components - there is no learning curve.

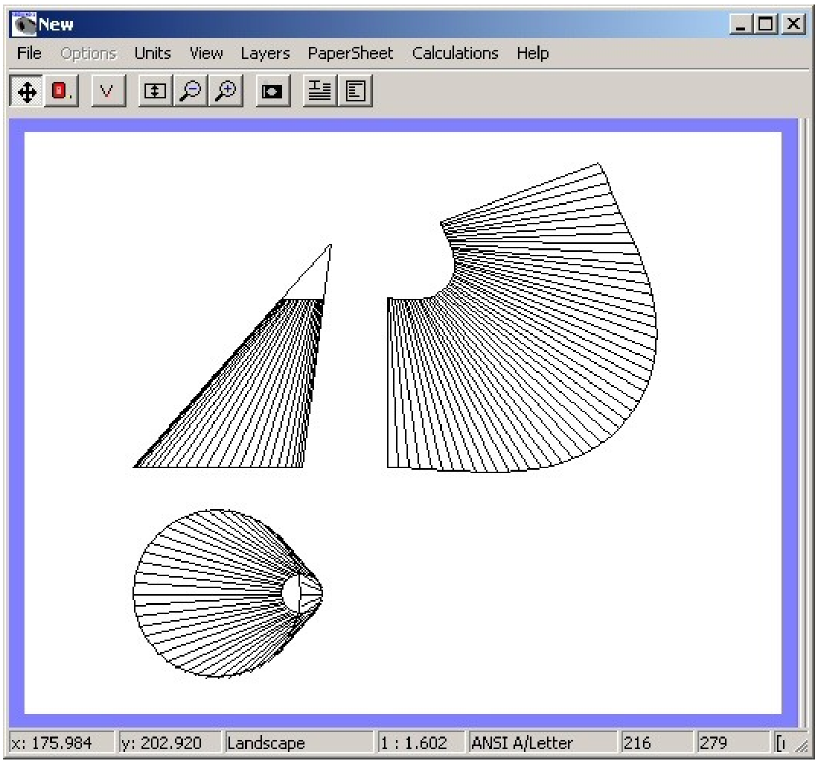


Figure 9 - An oblique frustum cone

CONET draws the front elevation, plan and pattern development. You can specify the two diameters to create a frustum cone. You can then specify an offset in the x direction making an oblique cone as shown in figure 9.

Figure 10 a,b - A right cone (parallel cuts - producing a circular input and output)
and an
oblique cone (which also has a circular input and output)

For a full cone either the base or top diameter is entered as zero, see figure 11.

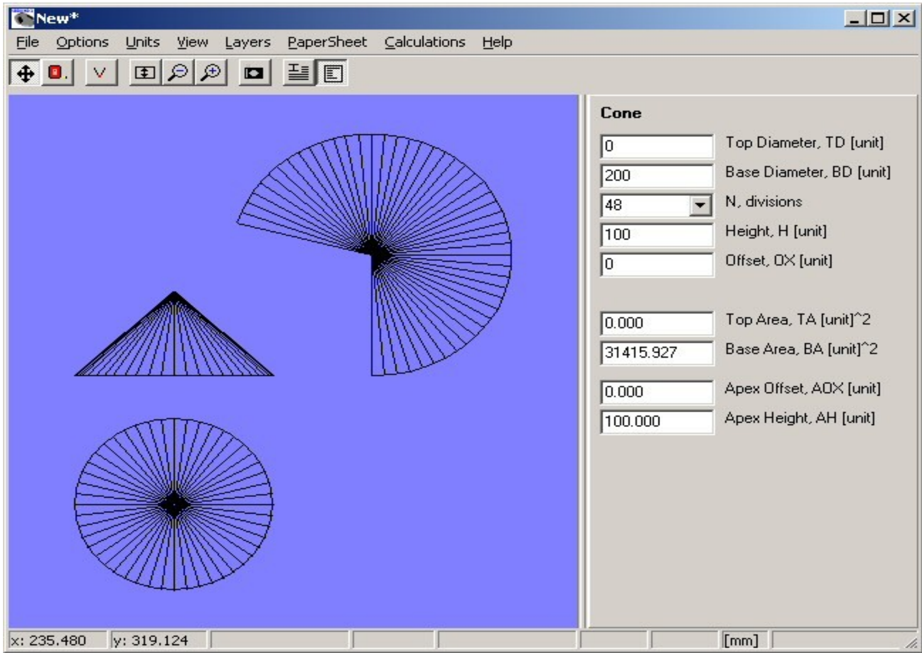


Figure 11- A full right cone

It is not often you need a full cone in sheet metal work apart from a "Chinese hat" for a chimney stack. Typically the "Chinese hat" is made from thin sheet and does not a have a great deal of height so you can form the cone by pulling the joints together by hand. Thick materials will often need to be pressed and made in two halves. The software is not exclusively for the sheet metal worker as there are many other applications outside of sheet metal work that deal with cones.

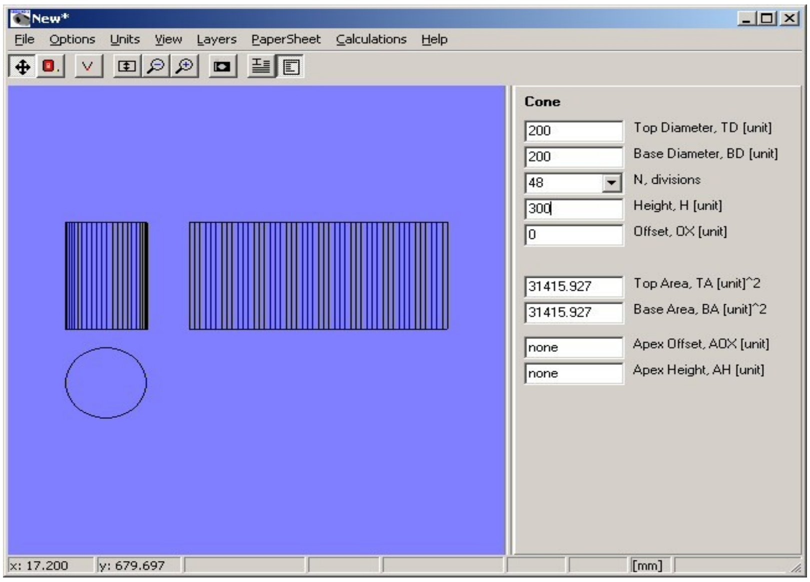


Figure 12 - A simple right cylinder

Figure 12 shows a simple cylinder - nothing clever here but an essential component in most HVAC systems. OK, you'll probably buy off-the-shelf CHS or spirally welded tube stock but the software generates the right cylinder as a mathematical consequence of having the base and top diameter equal and with no offset.

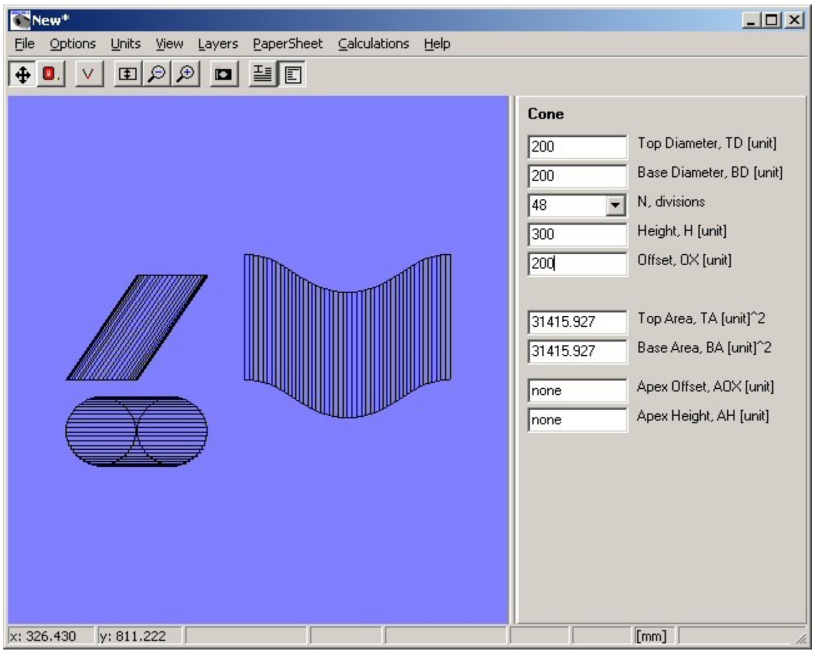


Figure 13 - An oblique cylinder

The more interesting case is the oblique cylinder as shown in figure 13. Using the offset you can produce an oblique cylinder - i.e. a circle to circle offset piece. Everyone gets this one wrong and falls into the trap of thinking you can use ordinary tube stock but the actual cross section area is elliptical and not circular. Only the parallel input and outputs are circular with one exception which is the subcontrary section. There's more on the subcontrary section at:

http://www.tyharness.co.uk/cones/conemath.htm. Figure 6 shows an oblique cylinder with an off set of 200mm over 1000mm with circular flanges at each end.

†*Figure 14 - D&D Engineering Ltd. fabricate an oblique cylinder from 1.6 mm thick steel sheet*

The oblique cylinder is a useful 'get out of jail card' for a sheet metal worker that needs to connect misaligned pipes or to avoid an obstacle in a pipe run. You can roll the thin sheet as normal and then just squash the tube into the elliptical form to make the ends circular. You can't just squash thick plate or roll it into an ellipse and therefore a lot of thought needs to go into the manufacturing process for thicker materials. Figure 7 shows a U shaped channel (3mm thick) which falls maybe 50mm over 3000mm but has to have semi-circular flanges each end so the plate was pressed to achieve the elliptical cross section.

†*Figure 15 - D&D Engineering Ltd. fabricate an oblique U shaped channel from 3mm thick stainless steel plate*

Square TO Square (STOS)

The square-to-square frustum is probably the most common sheet metal transformation. There are many applications: boxes, trays, moulds, hoppers, skips,etc. Trays and skips are very often tapered to allow for stacking and moulds for concrete lintels or fence posts are all slightly tapered to aid release. If you work in the welding and fabrication industry then you have probably made a 1000 hoppers because they are used absolutely everywhere. There are many occasions when you can weld all 4 corners and the full pattern development is not always required which means you don't really need this software. When the square-to-square is oblique it can be much more difficult to visualize, and this is when the software becomes very much needed.

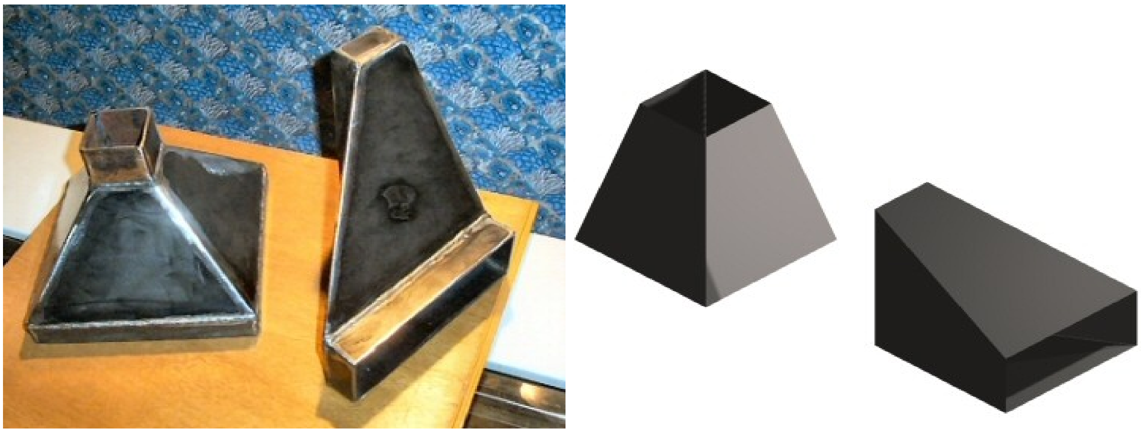


Figure 16 - A simple hopper and a more unusual rectangle-to-rectangle twisted through 90 deg

The rectangle twisted through 90 degrees shown in Figure 16 is often used in combination with a slip piece to route a square duct behind another pipe. This is similar in principle to oval slip joints.

STOS tries to make the design of a square-to-square as easy as possible. From a geometric point you have to "marry" the dimensions to an existing structure or maybe you need to know the volume inside the frustum to find the concrete weight for a mould application.

‡ *Figure 17 - Stainless Steel where the internal volume was the important key aspect of the design*

Also, you may need to explain or visualize the hopper in 3D and the full version of the software can create a 3D DXF (based on polyfaces) which is suited for importing into CAD applications and a 3D VRML which is suited for internet plug-ins like Cortona(TM) which means your customer does not need a full-blown CAD system view the model.

STOS is the first Ty Harness Sheet Metal application to give the user more control over the pattern development. Typically, the earlier applications could only produce a full pattern and now you can enter a start point and end point of the pattern i.e. the joint line.

The plan view is given a suitable labelling system 0 is east going anticlockwise through 1,2,3,4,5,6,7,8 for the base square and the top square. Mid points are included because you may prefer the joints to be in the face rather than on a corner but the software does not draw the mid point lines to avoid confusion with the bend lines, and that is also the case for the triangulation lines.

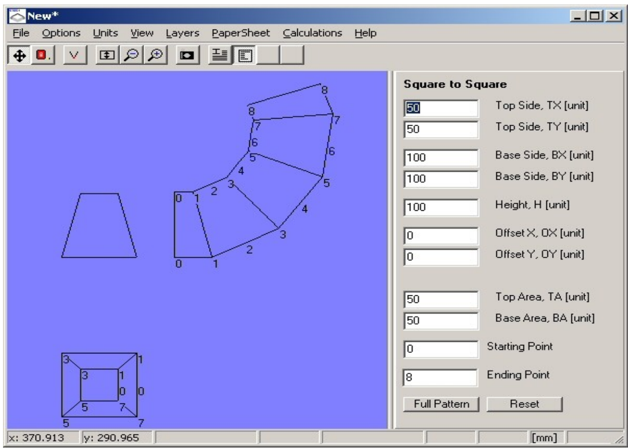


Figure 18 - A full pattern starting at 0 and finishing at 8

From Figure 18, points 8 and 0 are really the same points in 3D but when flattened onto the plane the joining points are assigned a new label: n+1. The n+1 point, in the case of STOS, is 8.
A square-to-square is one of those pattern developments where most fabricators would leave the joint on a corner (which is my own personal preference) therefore start the pattern development at (say) point 1 - 1, as shown in figure 19.

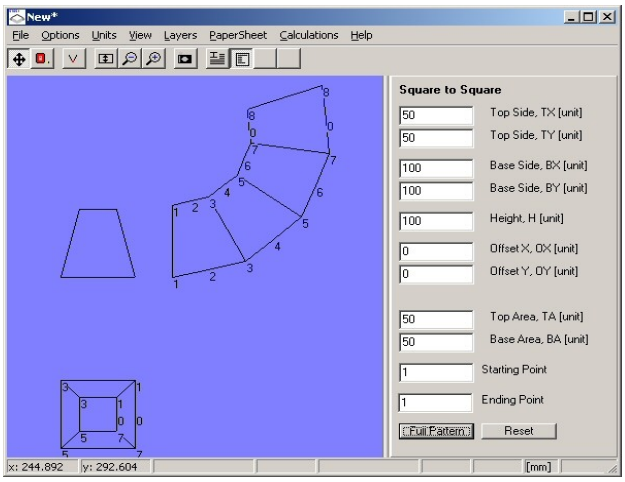


Figure 19- A full pattern starting at 1 and finishing on 8 (where 8 is really point 1 again)

You can reset the pattern to start from point 0 to the end point 8 by clicking the reset button or if you require an alternative full pattern starting at any other point then either type 1 - 1, 2 - 2, 3 - 3 etc. for the start - end points respectively.

You also have the ability to create smaller patterns like half patterns or just a one sided pattern for (say) a stake socket. If it is a simple right hopper and you are prepared to make all 4 welds then the one sided pattern is the most economical because you can cut all 4 sides out of a parallel strip of material.

Figure 20 a,b - Tapered stake socket - sometimes it's simpler to cut each side from a parallel strip

Figure 20 shows a tapered stake socket where a one sided pattern was used and all 4 sides were welded together. If a folding process had been chosen then a half pattern is generally chosen (as shown in Figure 8) for thick materials. For very thin sheet you can make a square-to-square from a full pattern using a press brake and sliding the work off the blade which is common with duct makers.

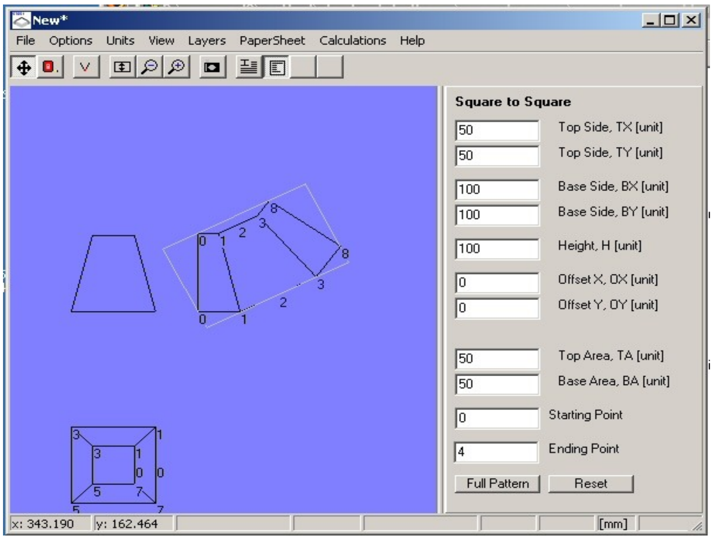


Figure 21 - A half pattern starting from 0 and ending at 4.

One interesting application of the STOS is you can design a square-to-line or a square-to-point which is similar to roof geometry either gable ended or the more complex hipped styles as shown in figures 20 and 21. Please note this software does not calculate purlings,braces and rafters just that you can save a 3D DXF or VRML and use the output to extend the design in (say) a CAD system.

You will need to know the volume of a roof space for a building regulations application and this software can calculate the volume.

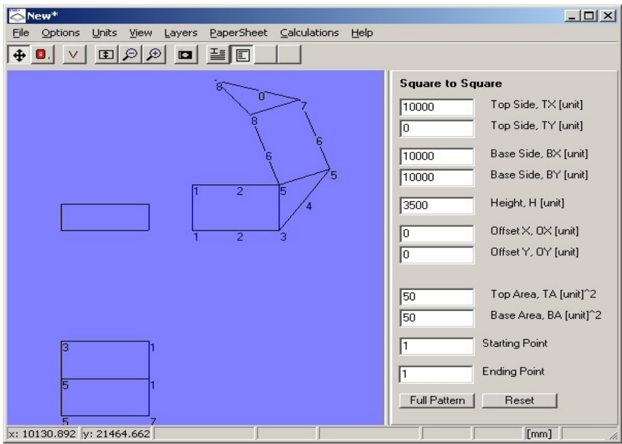


Figure 22 - A gable ended roof - rectangle-to-line chisel point

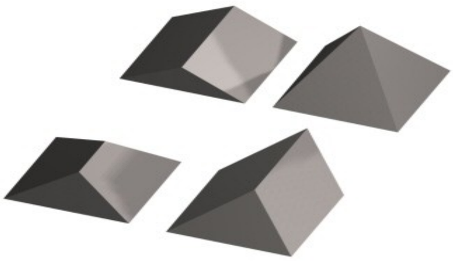


Figure 23 - Using the 3D DXF export to create several roof styles

Again, it's so hard to visualize the roof without being able to spin it around and this is where the VRML plays an important role. You can find more out about VRML at:

http://www.tyharness.co.uk/vrmlsheetmetal/vrmlsheetmetal.htm

The Sheet Metal Software User Interface (UI)

The sheet metal user interface is fairly basic by today's CAD standards but it is still evolving. The drawing canvas is only 2D and is really is no more than the Windows GDI canvas. Using the Windows GDI is particularly useful when translating the screen contents to the printer canvas. In fact the coordinate system is really based on the current printer and paper size allowing you to scale the geometry for printing.

Features

- 1:1 Drawing mode and Scaled View against paper area.
- Zooming and Panning
- Layers and visibility of layers
- Dynamic redrawing of elevations and patterns when the geometrical parameters are changed
- On screen measuring which now includes snap measurements.

Like most CAD systems these days you start your drafting in model space so you do not need to think about working in scaled units and then the application scales the model space (or some view inside model space) to fit the actual paper plot. You can zoom into specific areas of the drawing to see more detail which means the screen:drawing ratio does not have to be 1:1. The sheet metal UI scales the geometry against the paper size you intend to plot on. By going into paper mode you can then set the scale of the geometry by zooming in and out. Note you can force the geometry to be a specific scale by right button clicking on the scale panel and choosing the scale you need to plot out. e.g. 1:1 1:2 etc. Then (in pan mode) you can pan the geometry around and place the pattern anywhere on the paper you need. Do not go too close the edge because your printer may have inherent margins.

The use of tablets used to be regarded as fastest way to draft but the Windows, Icon, Mouse Pointer (WIMP) has become so intuitive that even kids pre-school can use a computer. So it makes sense to design for a WIMP system. Laptop mouse equivalents like trackballs, touch sensitive pads and buttons can be nightmare to use with CAD and I recommend a scroll wheel mouse for the sheet metal UI because you can zoom in and out quickly with the scroll wheel and zoom extents by pressing the scroll wheel down.

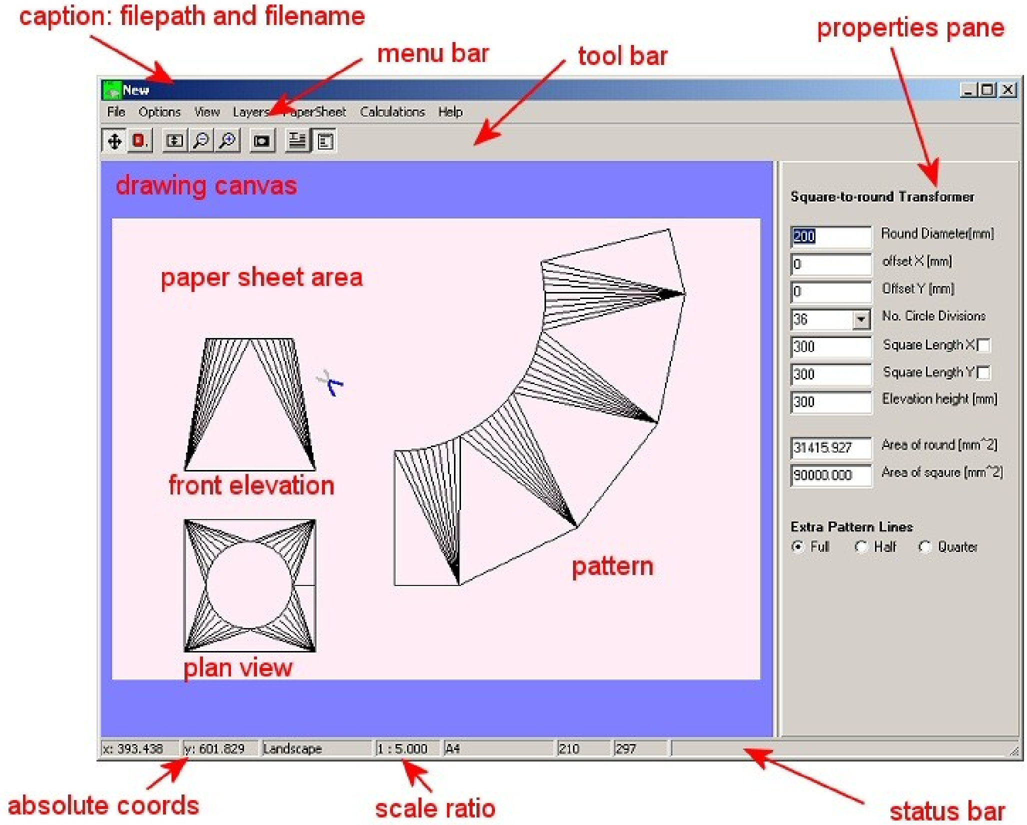


Figure 24 - User Interface Screen Shot

The application has a drawing canvas, as shown in figure 24, where you will see the scaled elevations and flat pattern. These will be will redrawn when the dimensions are changed via the properties pane. If you make a typo and miss-out (say) the decimal place then you can see immediately that something is wrong. If you enter a invalid entry then the input boxes will turn red to warn you that the geometry cannot be redrawn as shown in figure 25.

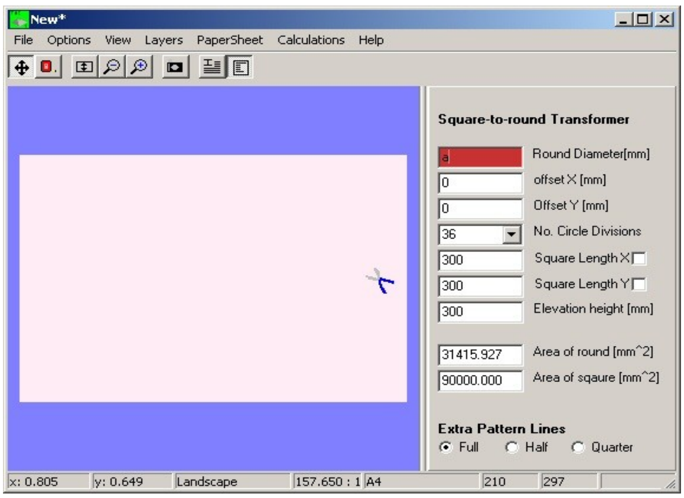


Figure 25 – Invalid diameter - a non-numeric entry

Like a CAD application you can pan around (Pan mode) and even drop a tape measure (Tape mode) onto the canvas and measure point-to-point. The easiest way to navigate around the canvas is using a wheel mouse. Where by pressing the wheel (third button) the application will perform a zoom extents and scrolling will zoom in and out. A left button down drag in pan mode will move the drawing elements in the direction of panning or in tape mode display the distance from A to B. The tape is a 'ghost' image applied over the canvas and shows the Cartesian x and y dimensions, polar length and angle.

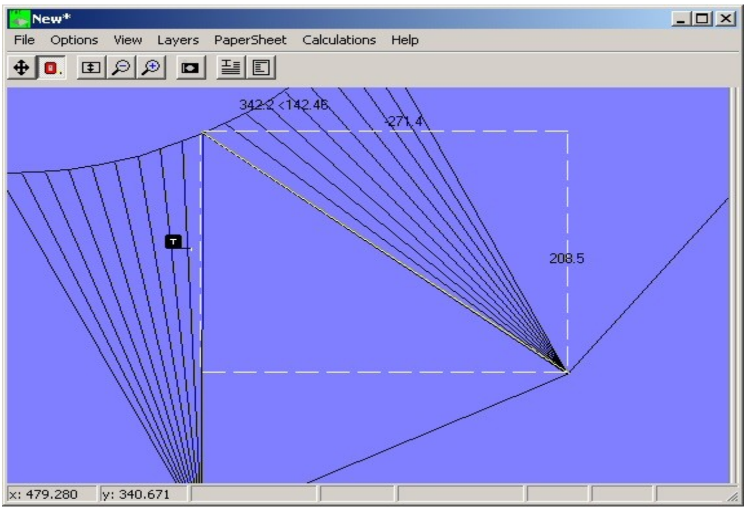


Figure 26 - Use the tape mode to get rough measurements (free-hand)

The segmental bend application was the first to introduce snap measurements. By going into tape mode and selecting the snap vertex tool bar button you can measure from the end or mid-point of a line. The snaps appear as circles as shown in figure 27.

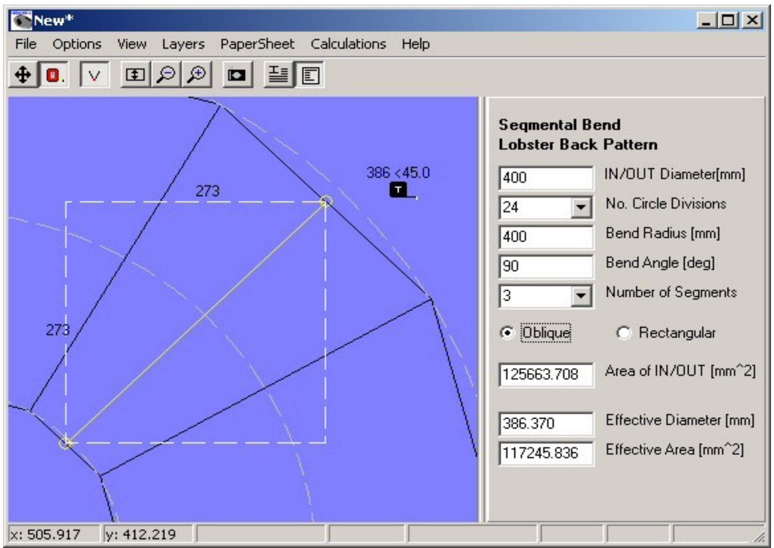


Figure 27 - Using the snap to make measuring easier

To zoom in on (say) the front elevation: move the mouse to the front elevation and scroll up one notch and you will see the front elevation get a little bigger and move a little closer to the centre of the canvas. Again move the cursor to the centre of the front elevation and repeat. With a little practice you will be able to zoom in or out about any part of the drawing. There are, of course, also menu and tool bar options for zooming. You can set a percentage zoom factor from the view menu if the operation is too fast or slow (1 slow to 10 fast). Different PC's, mouses and MS Windows set-

ups behave slightly different. Negative (-1 to -10) values reverse the direction of scrolling.
Using the Pattern Properties first introduced in STOS 1.04 you can control the pattern start and end points (the joint lines) of the development. Figures 28 and 29 both show full patterns of the same breeches piece branch but with different joint starts.

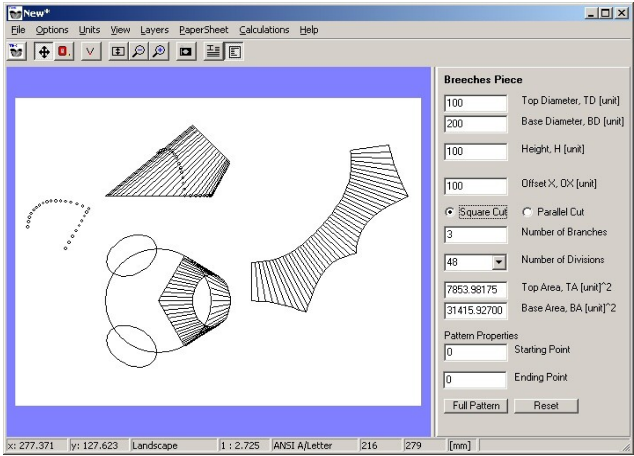


Figure 28 - A full pattern Start position. 0 End Pos. 0 (or End Pos. of 48 would be the same)

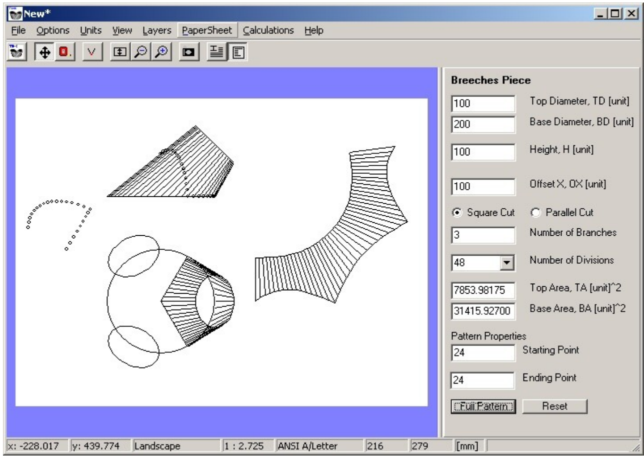


Figure 29 - A full pattern with the joint line at position 24

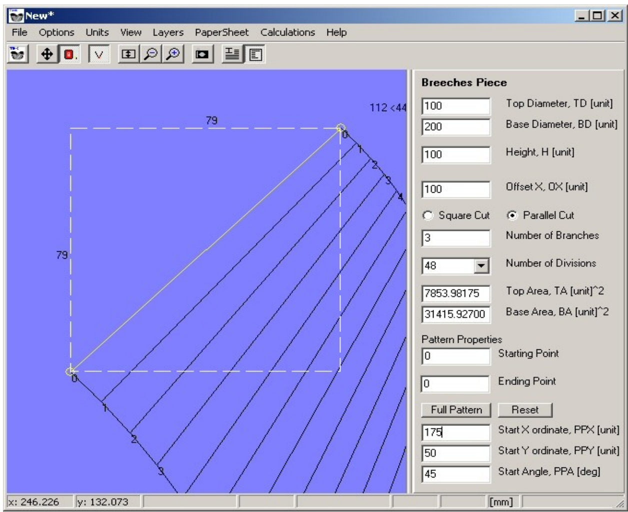


Figure 30 - Translation and rotation of the joint line 0 - 0

A new feature for version 1.05 is the ability to translate and rotate the pattern to any desired position. From figure 30 the pattern point 0 on the base curve has been translated to a coordinate of 175,50 and the joint line 0-0 is rotated to 45 degrees anticlockwise from east. Using the min. bounding box calculation (from the calculations menu) you can now orientate the pattern either portrait or landscape. So for the specific geometry below, shown in figure 31, and rotating the joint line to 36 degrees aligns the minimum area bounding box with a landscape view.

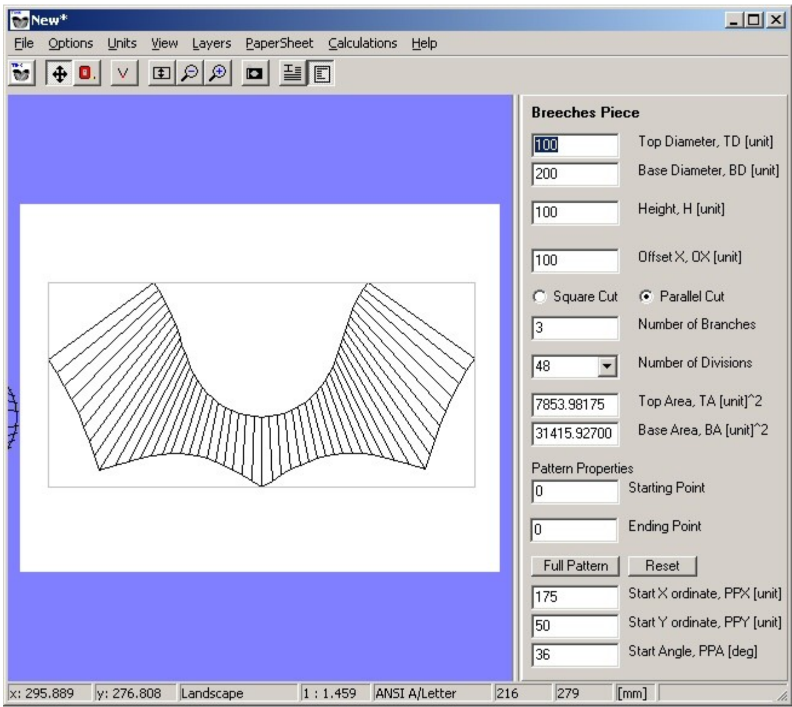


Figure 31 - The pattern orientated to suit landscape paper.

Menu Bar functions

File

Open and saving files

Use File from the menu bar to access the open, save and saveas functions. The current file path and file name are displayed inside the caption bar. An asterisk is appended when any changes have occurred since the last save.

A conventional save will overwrite the existing file, where as a 'save as' will allow you save the file under another name using the common windows save dialogue. e.g. Job1.tystor, Job1RevA.tystor etc.

Print Simplex: You can print out simple page containing the properties and a simple non-scaled sketch which is useful for quotations and reference etc. You don't have to include all the drawing elements in the sketch by using the layers option you can turn off (say) the pattern.   See Appendix B for an example of the print simplex method.

Print Complex: The ability to plot a scaled drawing to paper. See Appendix B. If you need then to transfer the information to the material there are various techniques to copy the pattern over to material. There is more detail on the web site:

http://www.tyharness.co.uk/squaretoround/measurement.htm

Printer Calibration: If you find your printer is not accurately printing the drawing to scale then you can tweak the printer calibration factors a and b. First print out a calibration sheet and if a and b do not measure 100mm then you can set a and b to what your actual printer has produced. Most printers should be within 1mm but remember the further the scale is from 1:1 then the error is magnified. You might find you only need to set a or b = 100.1mm.

Exporting alternative file formats

Export 2D DXF: This is useful for CAD operators who want to include a plan and front elevation within a bigger assembly drawing.

Export DXF Pattern: This is the pattern perimeter on its own. This is useful CADCAM operators who only need the pattern profile as continuous 2D poly line.

Export 3D DXF: Again ideal for 3D CAD operators. Each Triangulation is a 3D poly face which allows for immediate rendering.

Export 3D VRML: Useful for 3D graphics on the web and most 3D polygon renderers out there like computer games.

Export BMP and JPG: JPG is very suitable for web and email attachments. BMP, it's there if you need it. Note the captured width and height are the same as the canvas displayed on the screen and controlled by re sizing the application window.

Export to HTML: This one is useful for when you need to explain a transformer to someone else - maybe the other side of the world. Simply export to html and a new folder will be created containing the tystor file. All the DXF files,VRML file, and a HTML web page with a consistent file name and folder to keep things nicely packaged together. This can be uploaded to your server and then all concerned can access what parts they need. It's not a very exciting looking page but you can go on to edit the html to match the look and feel of your own web site. Any web site designer can take the core files and improve on the look.

See Appendix B for an example of the html output or visit:

http://www.tyharness.co.uk/squaretoround/test50/test50.htm

Options

Cap top and bottom - Typically a games engine will only render one side dependent on the direction of the polygon normal so it can produce a strange effect where you can see the front but not the inside back. You'll need to use double sided rendering, double skin the structure or I've got an option to cap the top and bottom off which gives it a solid appearance, see figures 32 and 33.

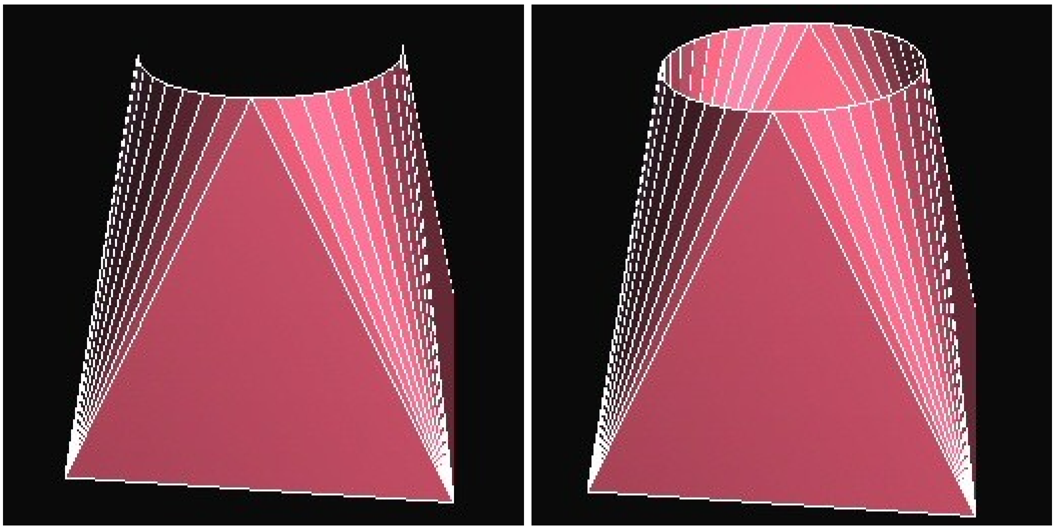


Figure 32 - XDSOFT 3D Explorer - Single sided render and then the option for double sided rendering

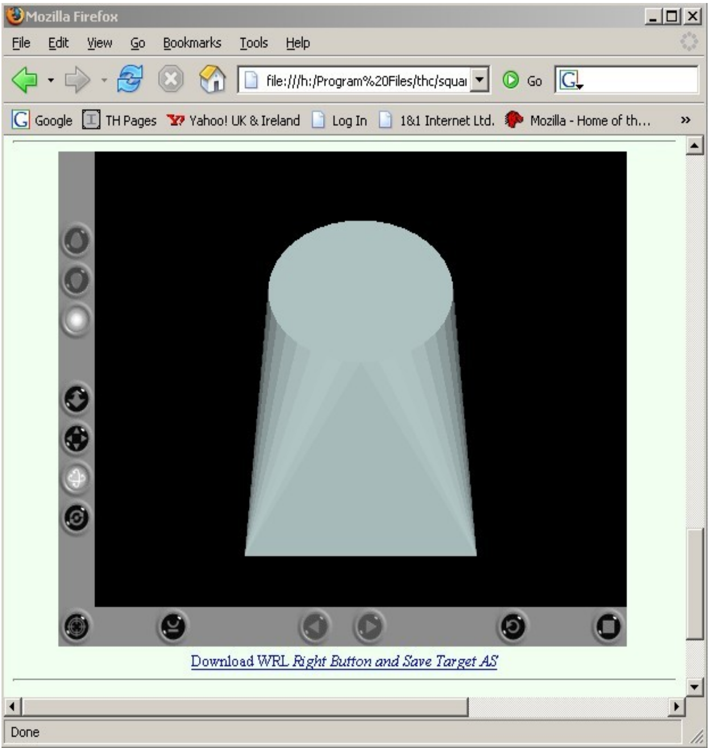


Figure 33 - FireFox(TM) with Cortona VRML plugin(TM) - capping off the top and bottom.

More information on VRML can be found at:

http://www.tyharness.co.uk/vrmlsheetmetal/vrmlsheetmetal.htm

There will be a free 3D viewer (figure 34) available for you the check your design in 3D which has double sided rendering. Also anybody who wants to use the 3D data in their applications then the tyface file format will be fully detailed and free to use personally or commercially.

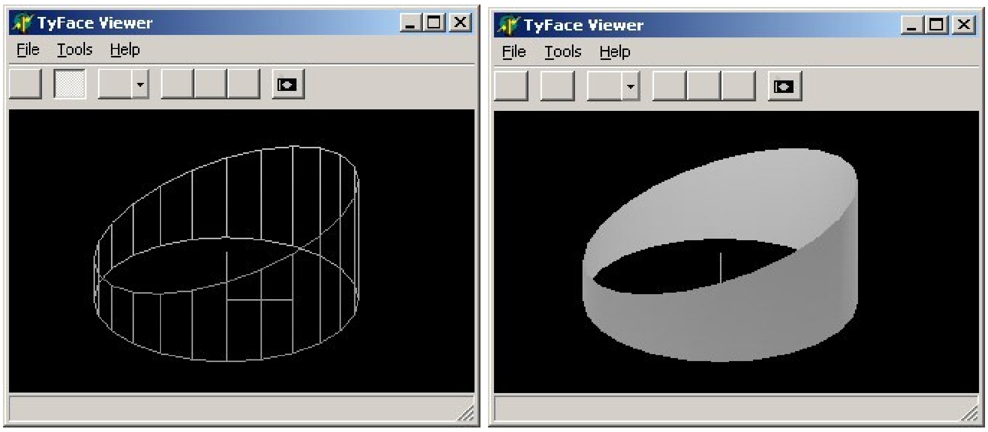


Figure 34 - Sheet Metal transformers are best rendered both sides to give a realistic view

More information on the 3D viewer can be found on Ty3Dviewer development page:

http://www.tyharness.co.uk/ty3dviewer/ty3dviewer.htm

View

Zooming functions are mostly self explanatory. Please note in paper sheet mode you are scaling against the paper area displayed in the canvas.

Lists: This is the house-keeping side of the software from where the graphics and the additional calculations are executed. The true lengths and the pattern points offer another way to transfer the geometry to the material or to other software applications like spread-sheets if you need to perform even more analysis.

Centre of extents: move the drawing back to the centre of the canvas.

Restore Default colours: It is possible to change everything to black by mistake so you can't see your drawing elements. This option will return to the default colour scheme if you get into a pickle.

Background,Paper and Pen colour: You can set up your own personal colour scheme.

Snapshot: You can capture the whole window including caption bar. I've found it useful not only for making this documentation but also for creating animations. You can press F10 hot key to take a snap and then modify the properties and take another snap and so on. The files are saved as BMP in the output folder. Use (say) Jasc Animation shop(TM) or a similar product to compile the BMPs into an animated GIF or AVI file.

Layers

If you only need to see the pattern then the other layers can be turned off independently - the layer names are self explanatory.

Paper Sheet

PaperSheet Mode allows you to scale the drawing against the intended sheet of paper you wish to print on. Use Page Set-up from the Paper Sheet menu and choose your printer, paper size and orientation. e.g. Samsung, A4, landscape.

You will then see the paper area displayed on the drawing canvas. When you are zooming you are scaling against that paper size. Roughly scale your drawing and drag the drawing onto the paper in pan mode. The scale factor is shown in the status bar. Let's say the drawing fits well on your paper at 1:5.157 scale then I recommend you right button click on the scale ratio in the status bar and force it to 1:5.

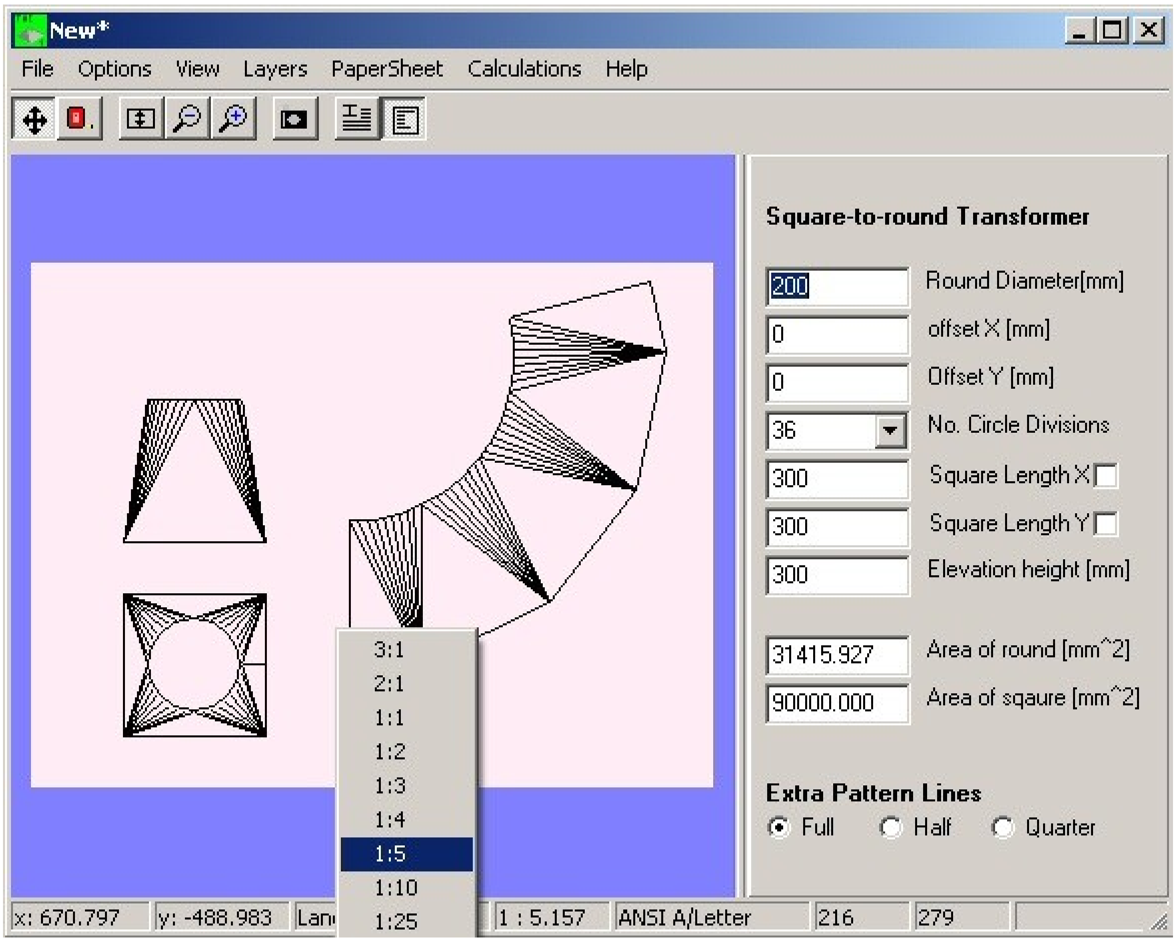


Figure 35 - Right button on the status bar to force a specific scale ratio

Once the scale ratio is set be careful not to catch the mouse wheel when positioning the drawing on the paper. Choose file from the menu bar and print complex. See Appendix B for an example of the print complex output.

Calculations

Show rotated min. area bounding box: The minimum rectangular area required to encompass the pattern surface area.

Show bounding box: This gives you the ability to try out different bounding boxes by specifying the angle on the box . East is zero degrees moving anti clockwise positively(e.g. 90 deg north).

Clear Bounding box: Erases all the bounding boxes drawn. The bounding boxes are also erased when and geometry has been changed.

Advanced Properties: Lists out all the properties that an engineer may find useful.

Calculated properties (More information can be found for each specific development at):

http://www.tyharness.co.uk/squaretoround/stormaths.htm

http://www.tyharness.co.uk/lobsterback/segbmaths.htm

http://www.tyharness.co.uk/cones/conemath.htm

http://www.tyharness.co.uk/squaretosquare/stosmath.htm

Help

The about box is useful to identify which version of the sheet metal software you have installed in case you need further support or need to see if you have the latest version.

References

[1] "The Growth of Physical Science", Jeans, J., Readers Union, The University Press, Cambridge, 1950.

[2] "The Geometry of Rene Descartes", Dover Publication, Translators: Smith., D.E. And Latham., M.L, 1956.

[3] "Geometrie Descriptive",Gaspard Monge , 1847 (Available at Google Books)

[4] "The Geometry of Sheet Metal" Dickason., A. Pitman Publishing 1967

[5] "Practical Sheet and Plate Metal Work" Atkins.,E.A., 1944 Pitman & Sons

Acknowledgements

† Photograph used with kind permission courtesy of D&D Engineering Ltd. Lincolnshire.

‡ Photograph used with kind permission courtesy of CawMc Engineering Ltd. Lincolnshire.

Appendix

A) Installation Instructions

Full version users can download all the latest software from the Members Area:

https://sslrelay.com/sheetmetalsoftware.tyharness.co.uk/

The download passwords will change regularly so you will need to initiate the download from the members area to obtain the latest password.

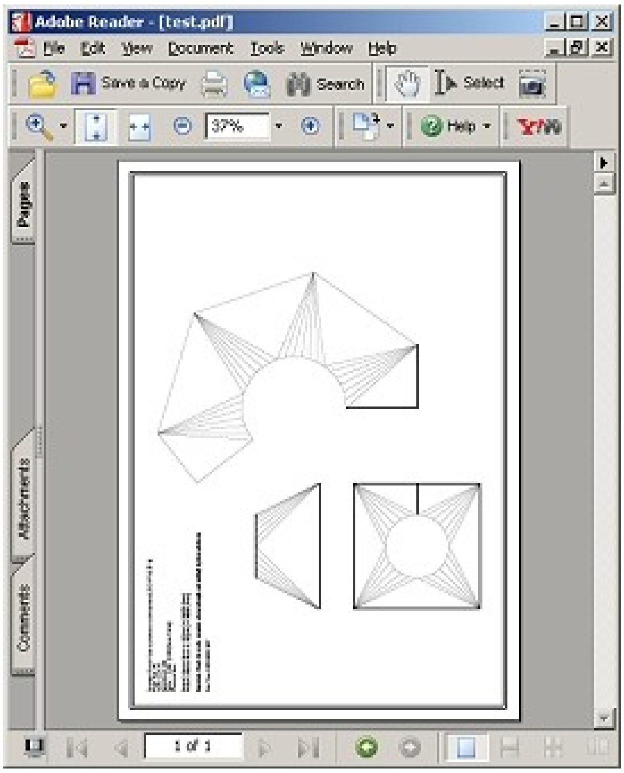
If you forget your members area password or serial codes then please email with the same email that you ordered the software from ShareIT and any ShareIT order codes or emails from when you purchased the software.

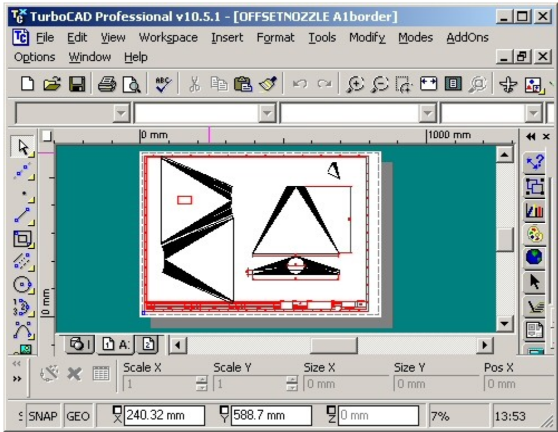
Once downloaded to your PC then extract the zip file using the right mouse button and select extract to folder. Enter the folder and double left mouse button click and follow the Installshield (TM) wizards to complete the installation.

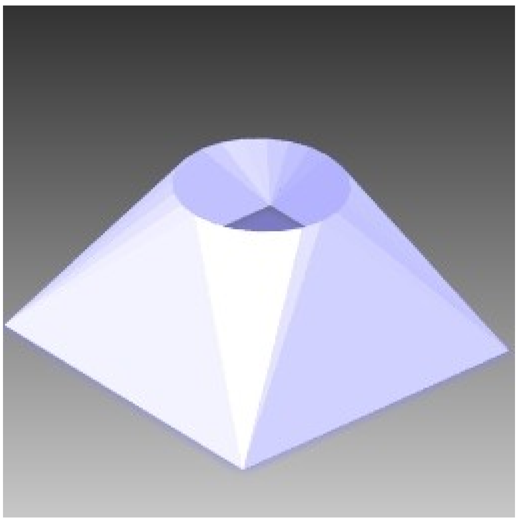
Un-install is initiated from the Control Panel and Add/Remove Programs

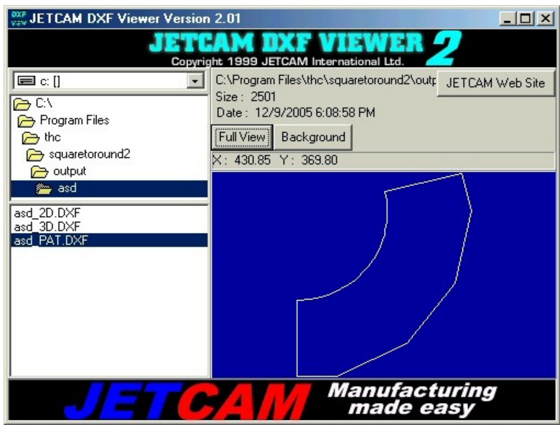
B) Software Output

You can print to a virtual printer or a plot file (say) CutePDF(TM), DESKPDF(TM) or Adobe Acrobat(TM). Then you can send electronic PDF copies by email to various people for (say) approval because practically everybody has Adobe Reader(TM) installed and can produce accurate 1:1 print outs. You might not have an A0 printer you can send a PDF to someone who has. The DXF output imported into TurboCAD(TM) and then further dimensioned into a parts drawing. The 2D DXF continuous poly line imported into JetCam (TM) used by many CNC laser cutters. You can use the 3D DXF with some rendering software such as Deep Exploration(TM) to create quality graphics for web site design through to marketing brochures.





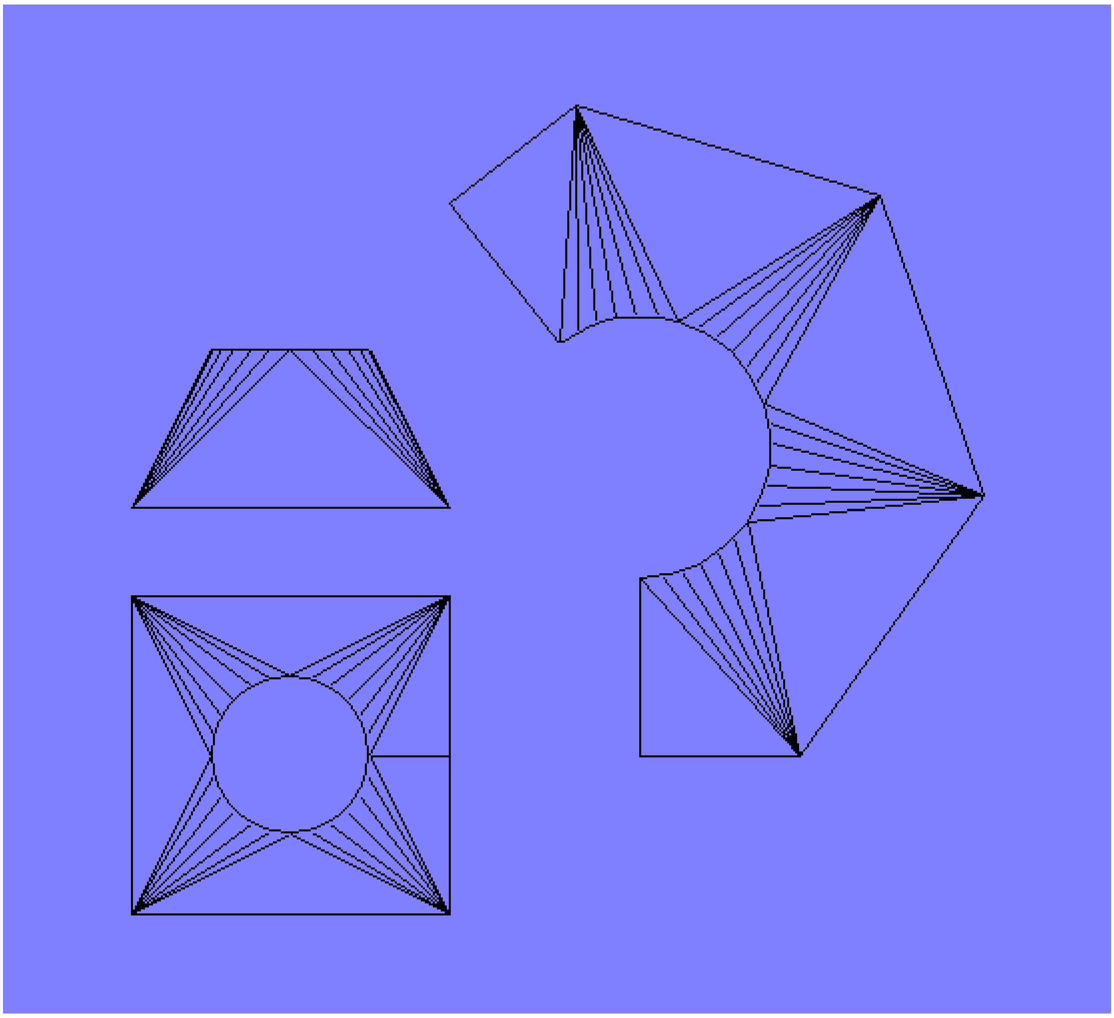




I've no affiliation with any of the software mentioned other than that I use it daily at work.

The following few pages are examples of the print simplex and complex methods.

Square-To-Round Transformer Version 1 (www.tyharness.co.uk/sheetmetal/)



New

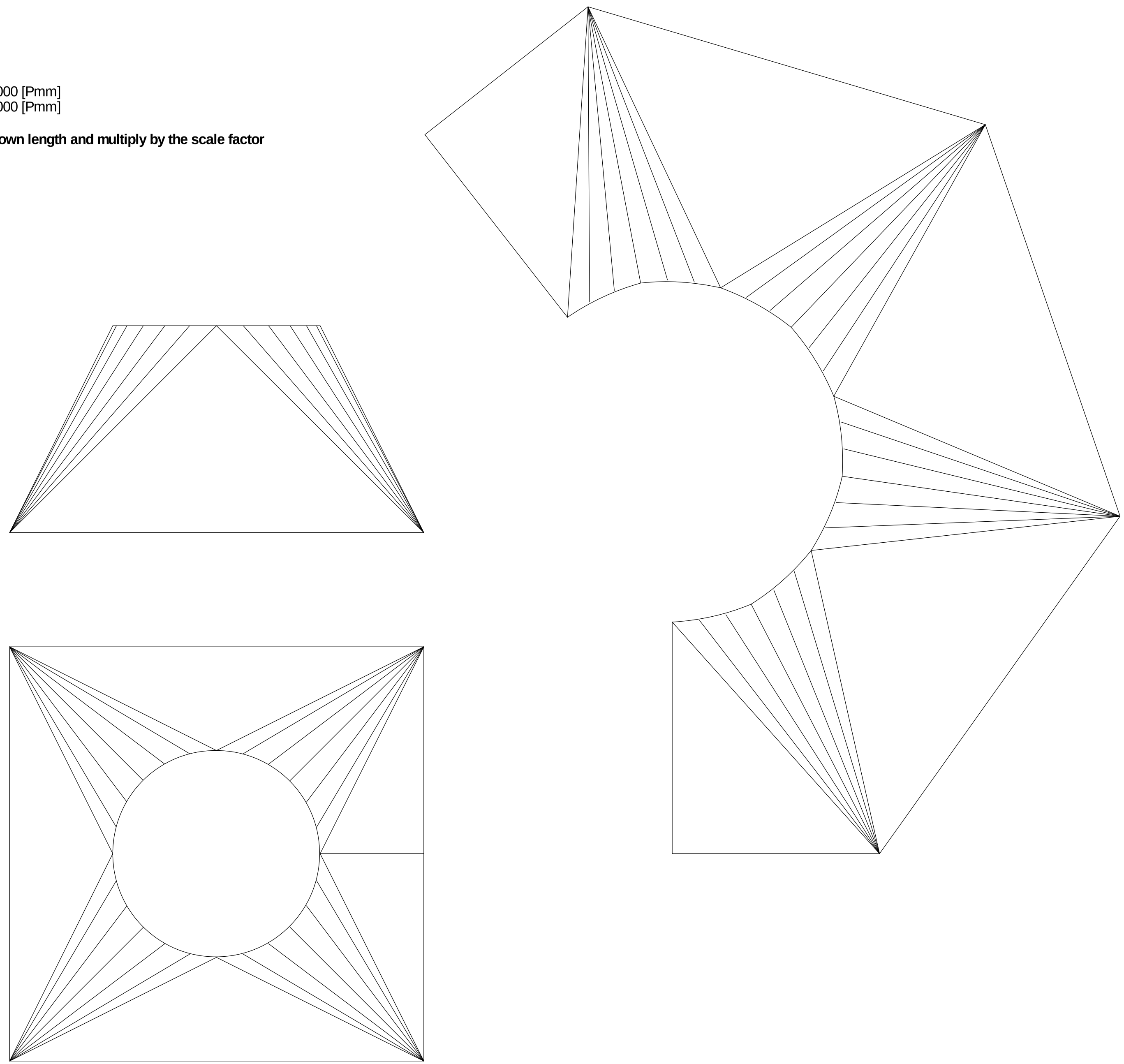
Properties	**Values**
Diameter, D [mm]	100.000
Off centre X,OX [mm]	0.000
Off centre Y, OY [mm]	0.000
Number of Circle Divisons, N	24
Square X Length, SX [mm]	200.000
Square Y Length, SY [mm]	200.000
Height, h [mm]	100.000
Round Area, RA [mm]^2	7853.982
Square Area, SA [mm]^2	40000.000
Circle Circumference, C [mm]	314.159
Rectangle Perimeter, RP [mm]	800.000
Pattern Perimeter, PL [mm]	1337.766
Pattern Area, PA [mm]^2	64650.003
Blank width, BW [mm]	111269.323
Blank height, BH [mm]	257.412
Wasted Area, WA [mm]^2	46619.321
Internal Volume, V [mm]^3	2258819.045

Square-to-Round V1(www.tyharness.co.uk/sheetmetal) [7421-FFA0-2711]
Paper Type: A4
Width [mm]: 297
Height [mm]: 210
Scale: 1 : 3.000   (3.000 {Scale Factor})
Filename: New*

Printer Calibation Factor a: 100 [mm] = 100.000 [Pmm]
Printer Calibation Factor b: 100 [mm] = 100.000 [Pmm]

Important: Check the scale - measure a known length and multiply by the scale factor

Date Time: 27/03/2008 13:56



Square-to-Round V1(www.tyharness.co.uk/sheetmetal) [7421-FFA0-2711]
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Width [mm]: 297
Height [mm]: 210
Scale: 1 : 3.000   (3.000 {Scale Factor})
Filename: New*

Printer Calibation Factor a: 100 [mm] = 100.000 [Pmm]
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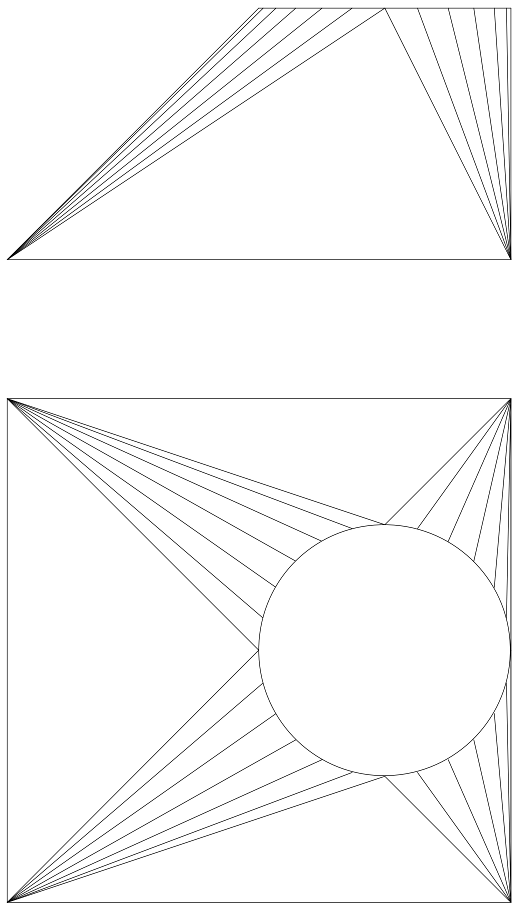
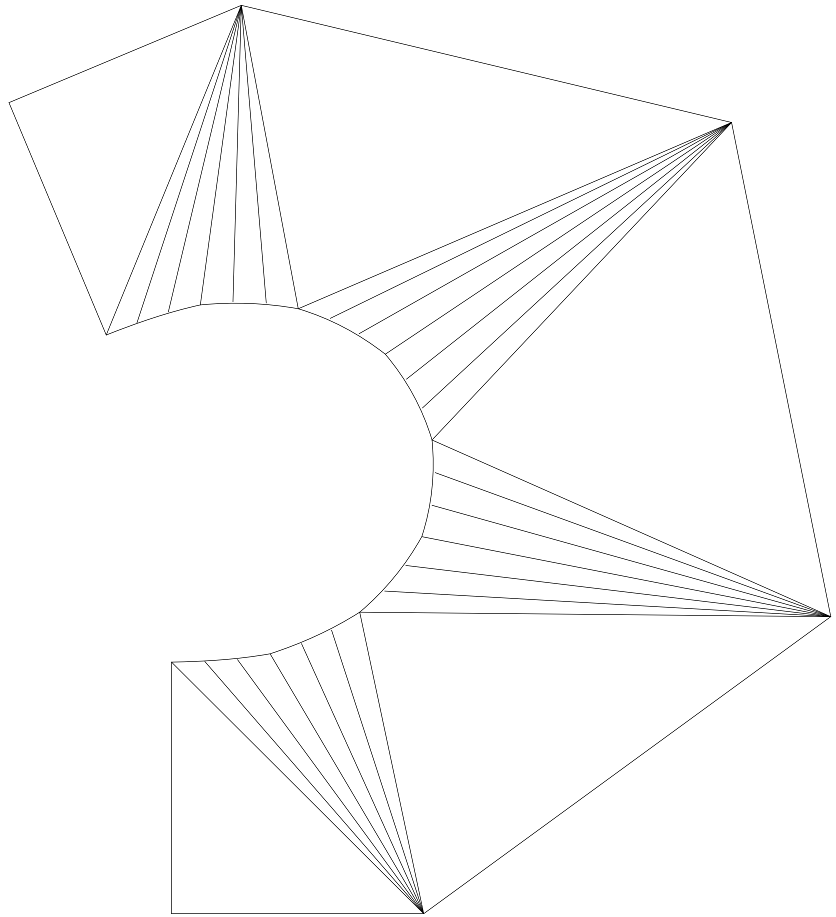
Important: Check the scale - measure a known length and multiply by the scale factor

Date Time: 27/03/2008 13:57



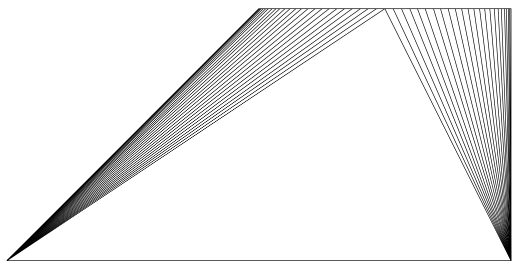


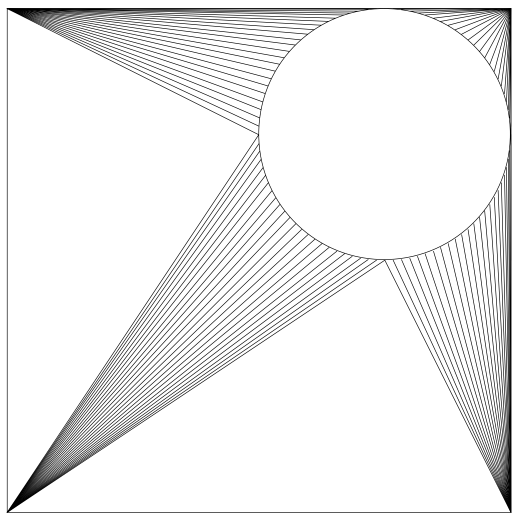
Square-to-Round V1(www.tyharness.co.uk/sheetmetal) [7421-FFA0-2711]
Paper Type: A4
Width [mm]: 297
Height [mm]: 210
Scale: 1 : 3.000   (3.000 {Scale Factor})
Filename: New*

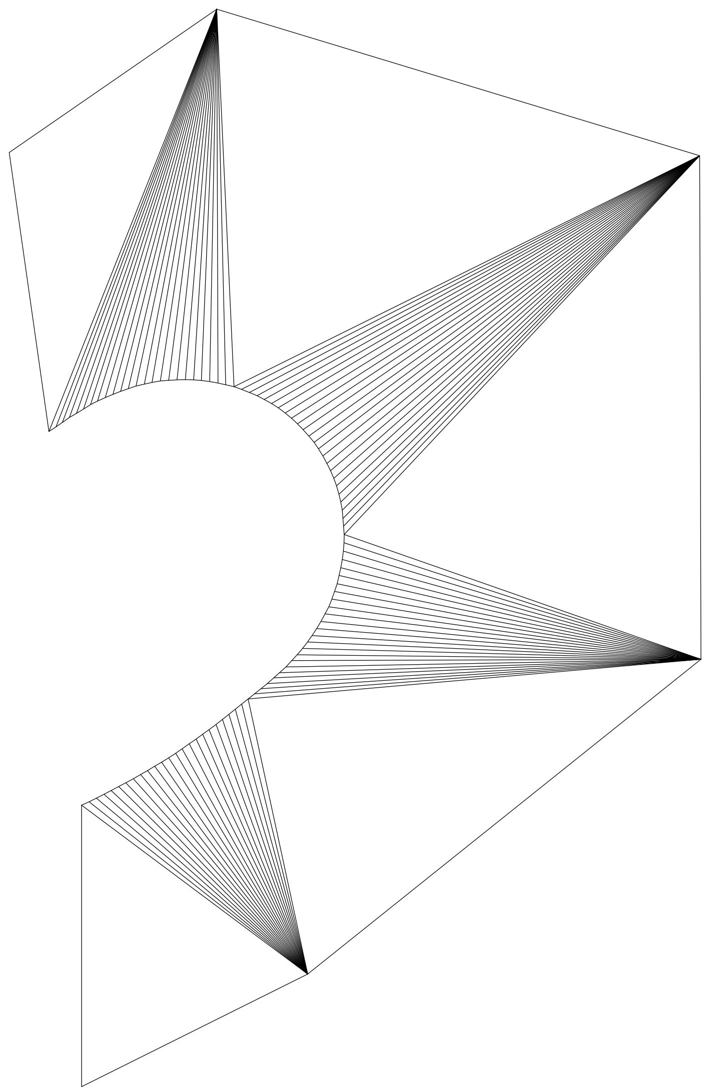
Printer Calibation Factor a: 100 [mm] = 100.000 [Pmm]
Printer Calibation Factor b: 100 [mm] = 100.000 [Pmm]

Important: Check the scale - measure a known length and multiply by the scale factor

Date Time: 27/03/2008 13:57







Square-to-Round V1(www.tyharness.co.uk/sheetmetal) [7421-FFA0-2711]
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Height [mm]: 210
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Filename: New*

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Important: Check the scale - measure a known length and multiply by the scale factor

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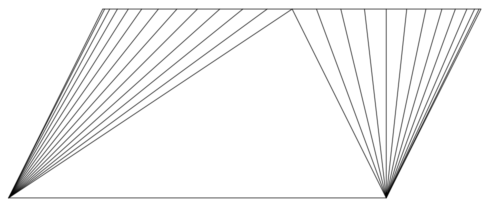
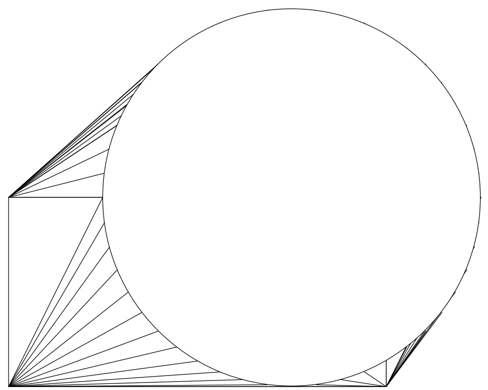
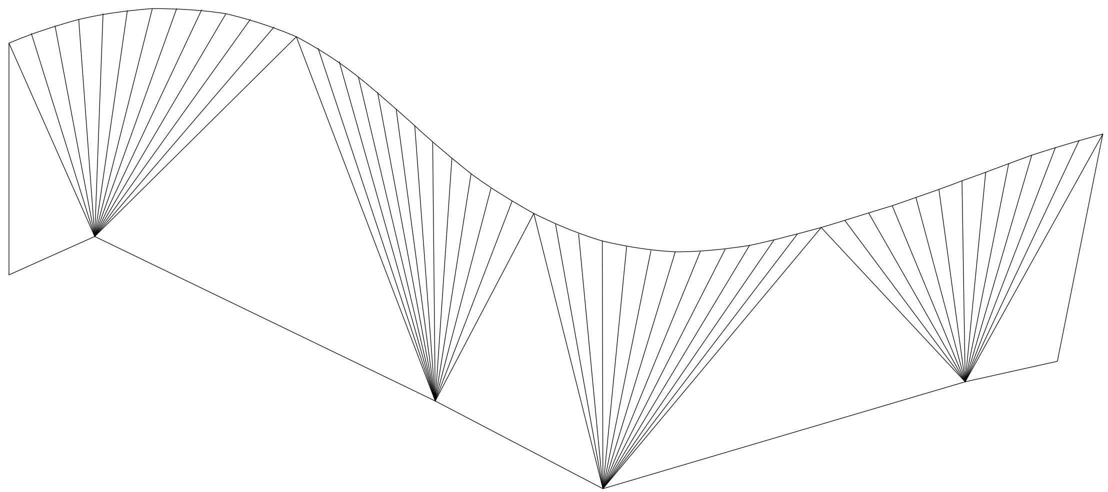




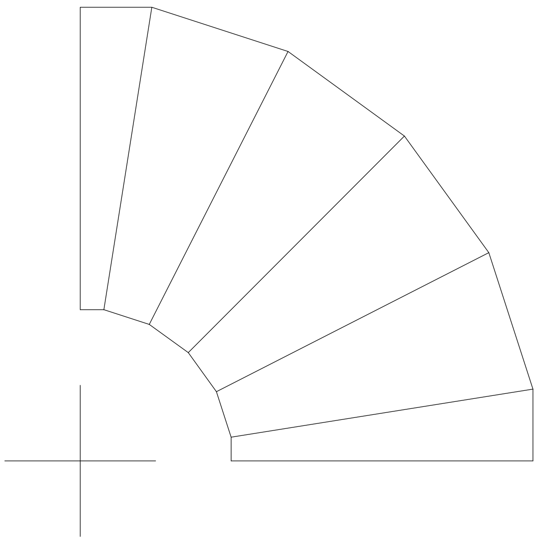


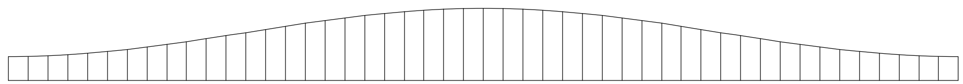
SEGmental Bend V1(www.tyharness.co.uk/sheetmetal) [7421-FFA0-2711]
Paper Type: A4
Width [mm]: 297
Height [mm]: 210
Scale: 1 : 10.000   (10.000 {Scale Factor})
Filename: New*

Printer Calibation Factor a: 100 [mm] = 100.000 [Pmm]
Printer Calibation Factor b: 100 [mm] = 100.000 [Pmm]

Important: Check the scale - measure a known length and multiply by the scale factor

Date Time: 27/03/2008 14:00



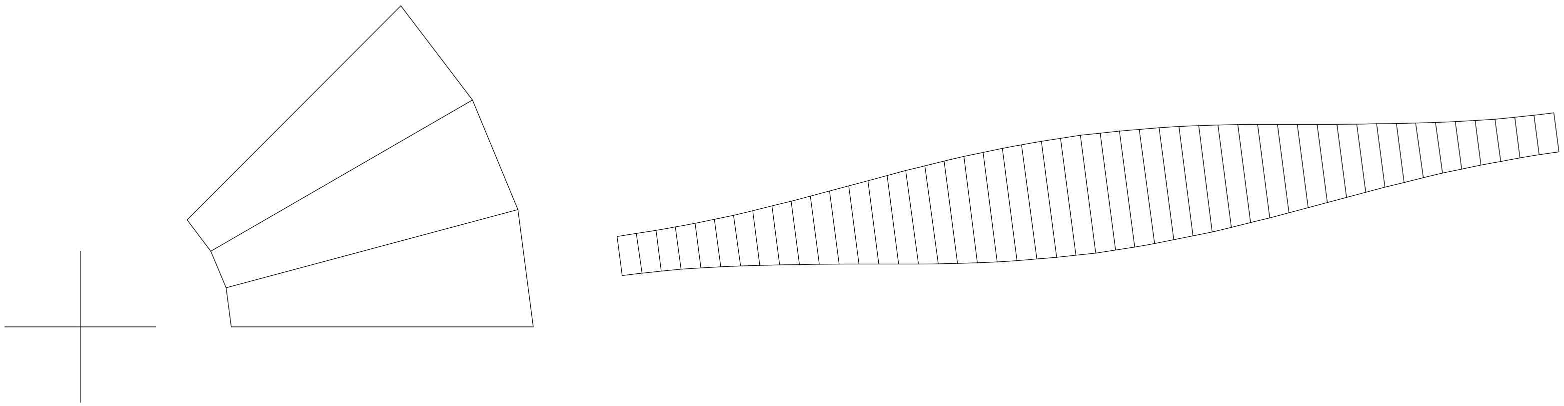


SEGmental Bend V1(www.tyharness.co.uk/sheetmetal) [7421-FFA0-2711]
Paper Type: A4
Width [mm]: 297
Height [mm]: 210
Scale: 1 : 10.000   (10.000 {Scale Factor})
Filename: New*

Printer Calibation Factor a: 100 [mm] = 100.000 [Pmm]
Printer Calibation Factor b: 100 [mm] = 100.000 [Pmm]

Important: Check the scale - measure a known length and multiply by the scale factor

Date Time: 27/03/2008 14:00



Cone Transformer (ConeTran) V1(www.tyharness.co.uk/sheetmetal) [7421-FFA0-2711]
Paper Type: A4
Width [mm]: 297
Height [mm]: 210
Scale: 1.000 : 1   (1.000 {Scale Factor})
Filename: New*

Printer Calibation Factor a: 100 [mm] = 100.000 [Pmm]
Printer Calibation Factor b: 100 [mm] = 100.000 [Pmm]

Important: Check the scale - measure a known length and multiply by the scale factor

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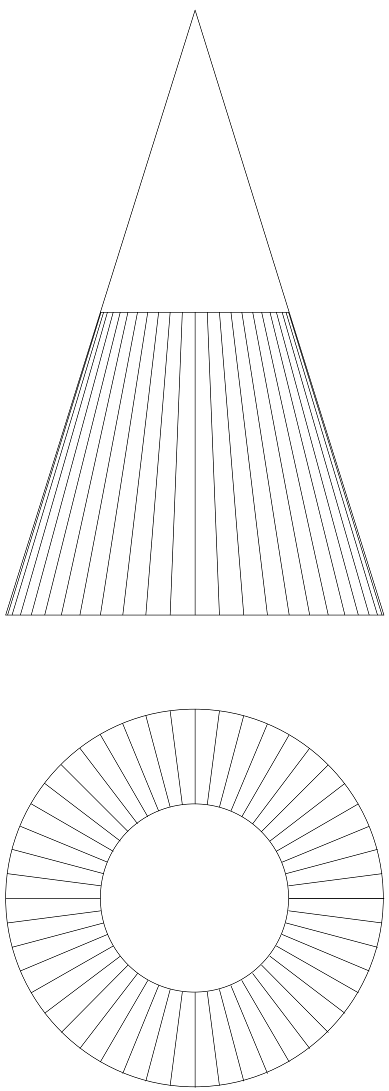

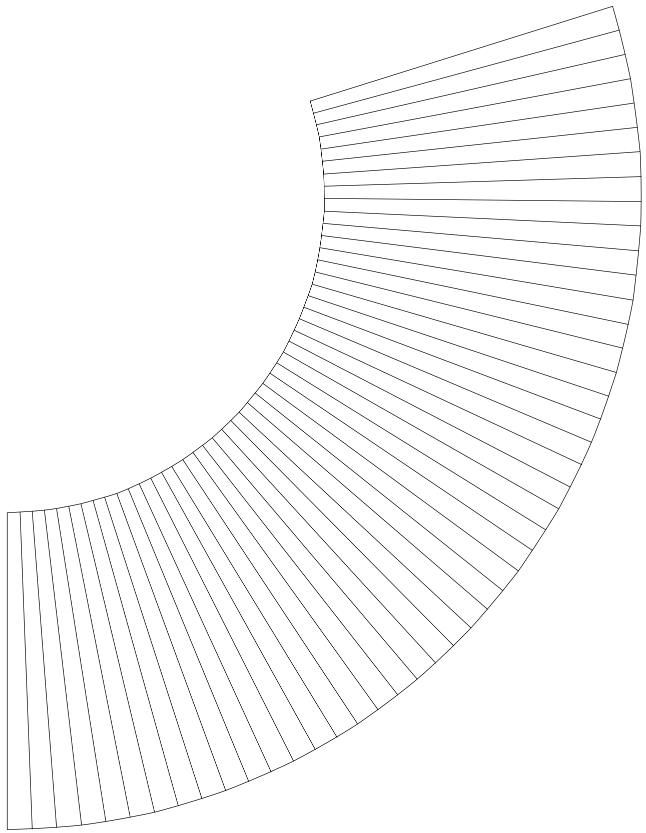

Cone Transformer (ConeTran) V1(www.tyharness.co.uk/sheetmetal) [7421-FFA0-2711]
Paper Type: A4
Width [mm]: 297
Height [mm]: 210
Scale: 1.000 : 1   (1.000 {Scale Factor})
Filename: New*

Printer Calibation Factor a: 100 [mm] = 100.000 [Pmm]
Printer Calibation Factor b: 100 [mm] = 100.000 [Pmm]

Important: Check the scale - measure a known length and multiply by the scale factor

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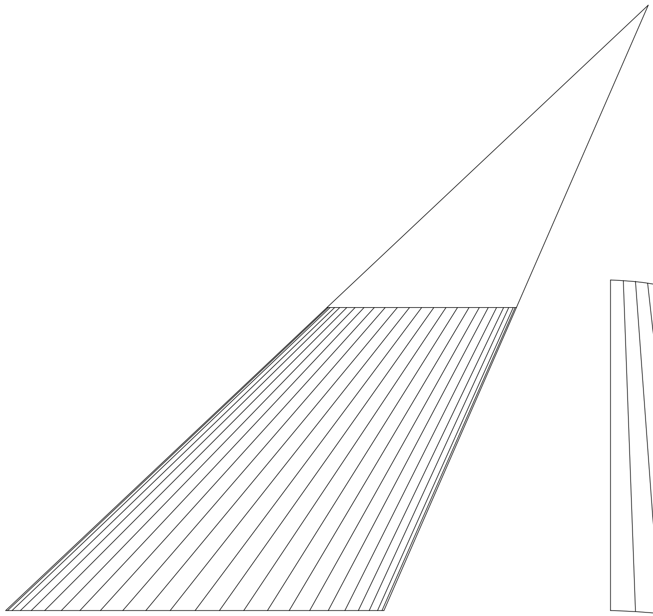

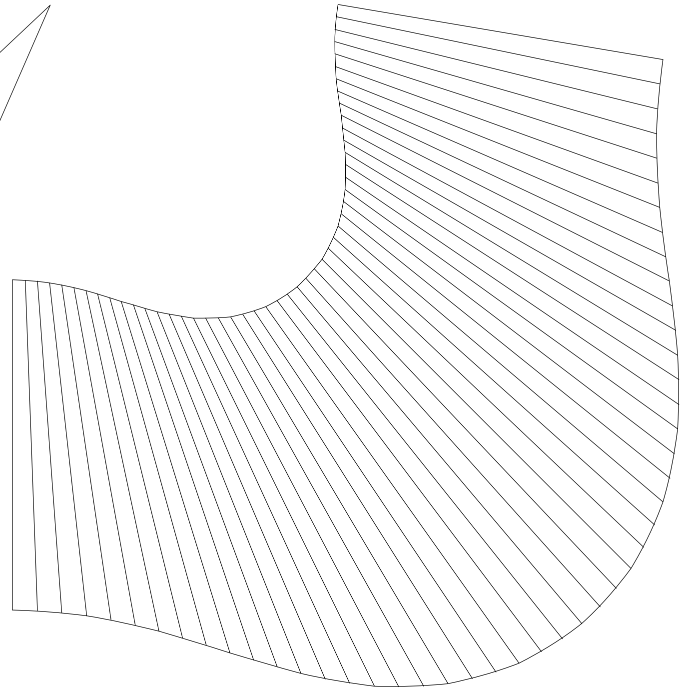

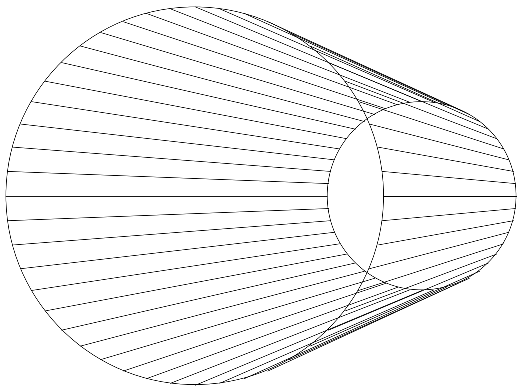

Square TO Sqaure (STOS) V1(www.tyharness.co.uk/sheetmetal) [7421-FFA0-2711]
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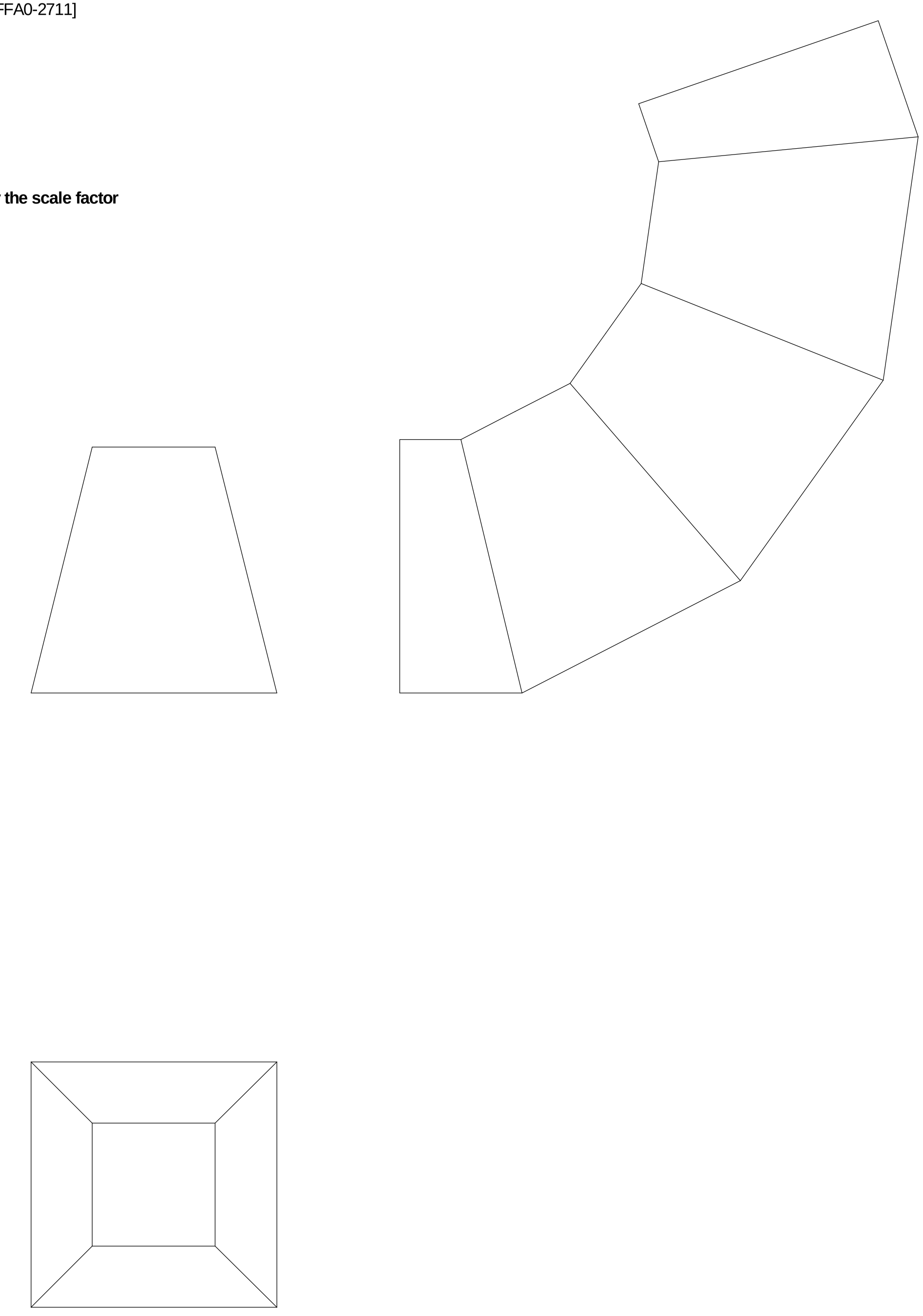
Height [mm]: 210
Scale: 1 : 3.000   (3.000 {Scale Factor})
Filename: New*

Printer Calibation Factor a: 100 [mm] = 100.000 [Pmm]
Printer Calibation Factor b: 100 [mm] = 100.000 [Pmm]

Important: Check the scale - measure a known length and multiply by the scale factor

Date Time: 27/03/2008 14:02



Square TO Sqaure (STOS) V1(www.tyharness.co.uk/sheetmetal) [7421-FFA0-2711]
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Height [mm]: 210
Scale: 1 : 3.000   (3.000 {Scale Factor})
Filename: New*

Printer Calibation Factor a: 100 [mm] = 100.000 [Pmm]
Printer Calibation Factor b: 100 [mm] = 100.000 [Pmm]

Important: Check the scale - measure a known length and multiply by the scale factor

Date Time: 27/03/2008 14:03