AppliCad

Advanced Software for Roof and Wall Modelling and Material Estimating

Roof Wizard

Block-Cutting Tutorial

How to effectively save waste on metal roofing

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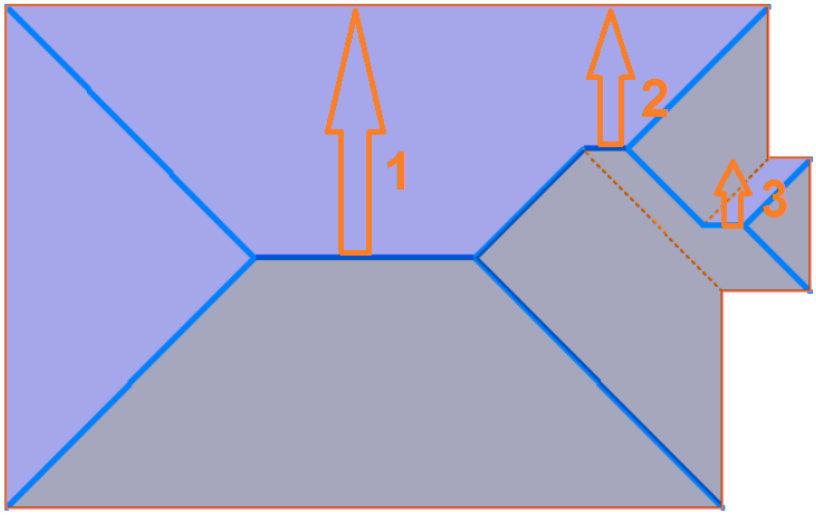
Block-Cutting

A development of the long established 'Blocking' process is available where the estimator determines where roof sheets can go and more particularly, shows via a coloured roof 'map' where the offcuts must go, as part of a block, to substantially reduce waste material – this is called '**Block-Cutting'**.

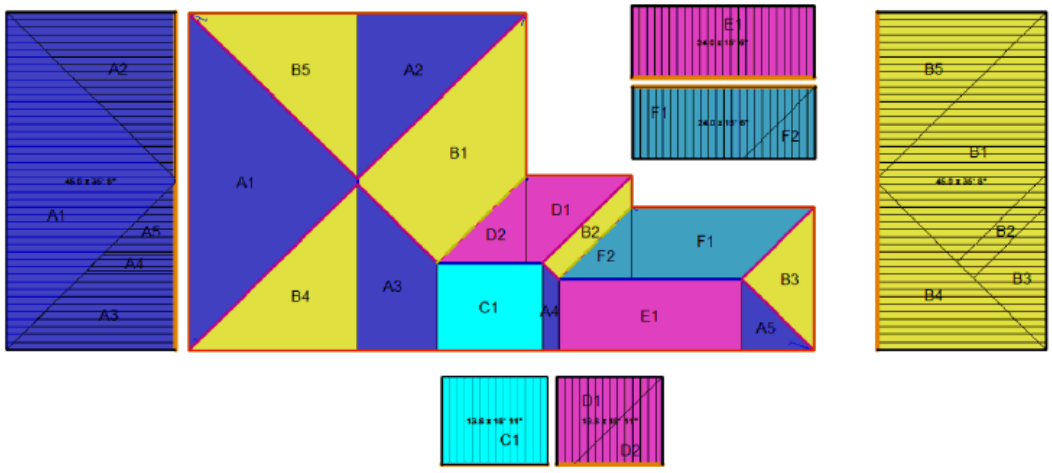
Developing a Block-Cut layout drawing is an interactive process that may result in multiple 'correct' results. In many respects this is what makes learning how to do this quite difficult – there is often more than one correct answer.

Overview

The first thing to look at is how many different ridge-to-eave lengths are there? In this example, there are three, so we are aiming for three sheet lengths in our sheet order cutting list.



And the completed 'Block-Cut' layout has three sets of sheet lengths – blocks A/B are one length, C/D another and E/F are the remaining lengths.



The result is effectively, **zero waste** as all offcuts have somewhere to go on the roof. Installation is more efficient with one cut for two sheets.

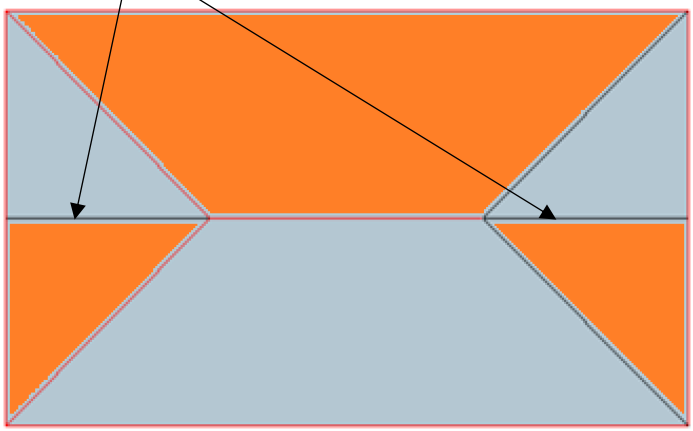
This description does assume that you are already very competent in the use of AppliCad's **Roof Wizard** software.

It All Fits into a Four Hip Roof

The basic premise for splitting roof areas is to reduce adjacent areas to a four hip roof when joined together. Let us look at a four hip roof, as the most simplistic example of the whole notion of 'Block-Cutting' – when you use a symmetrical panel, the offcuts 'flip' into an adjacent area as shown below. This will also take account of the lay direction too.

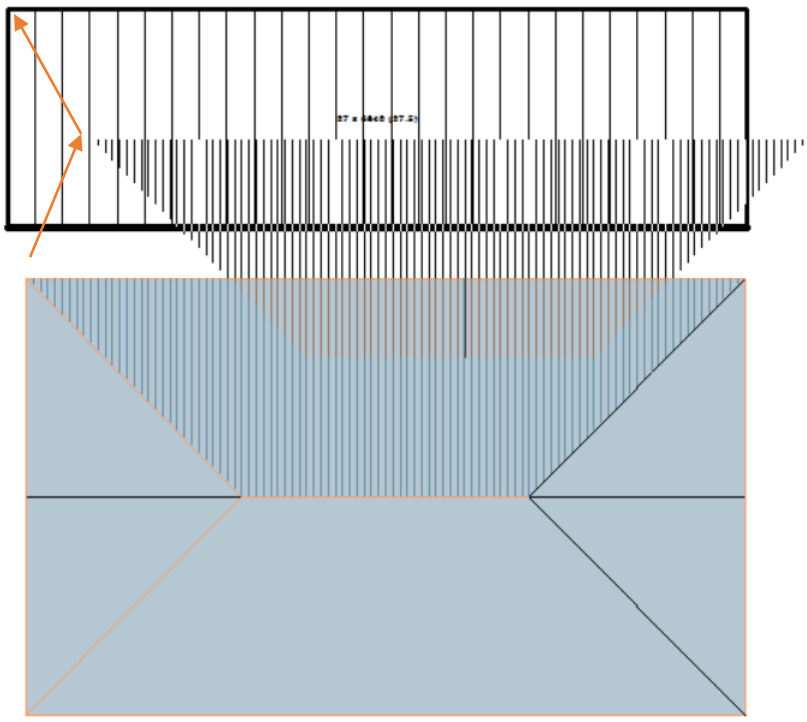
The exact steps are described below, but first we must understand what we're aiming to achieve. Step one is to divide or 'Split' the roof panels so that the offcut can be flipped as shown here.

'Split' lines

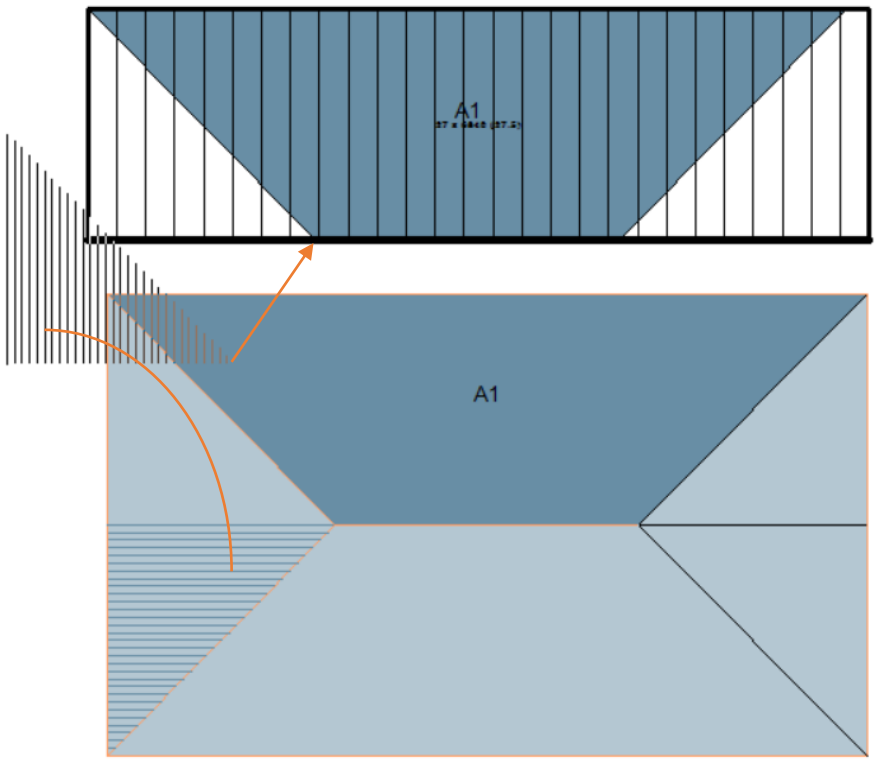


Using the **Block-Cutting** toolbox described below, we create a block of panels, the exact cover of one whole side of the roof. The block is automatically created and placed in your work-space.

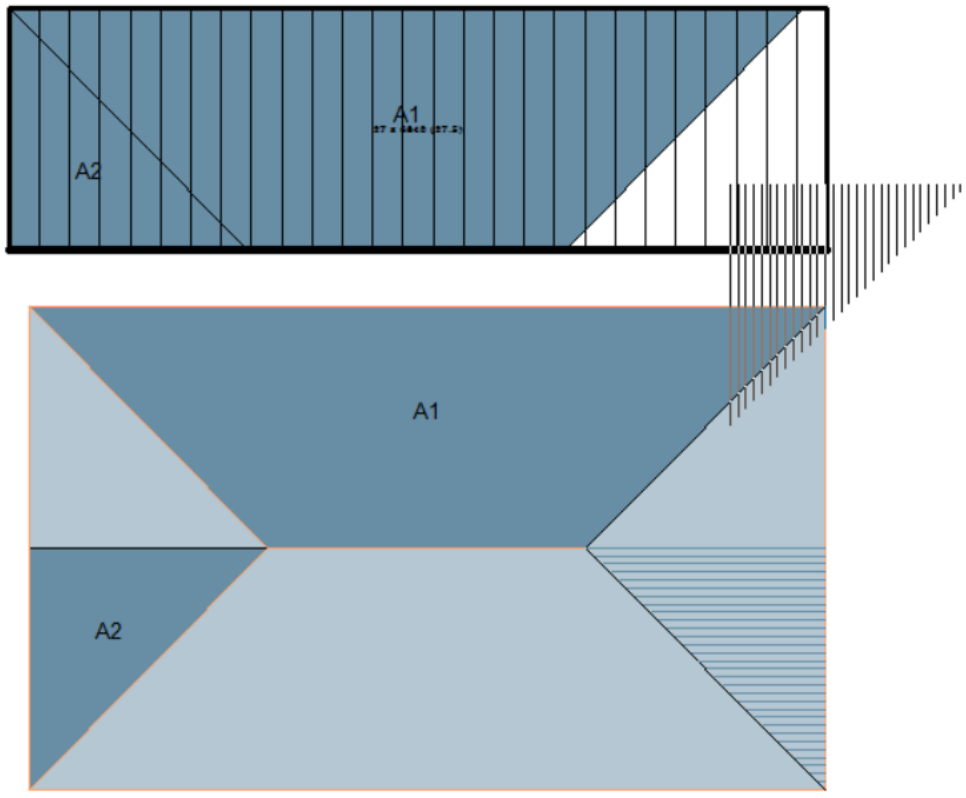
We then click the associated roof plane and drag it into the block. Repeat for each triangle area that completes our block of sheets.

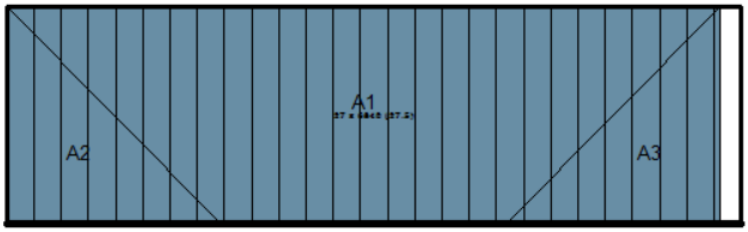


The triangle areas need to be rotated to fit (using function keys **F1** and **F2**). Notice that the panel direction is indicated by the lines on the area helping you put the panel areas into the correct block location.



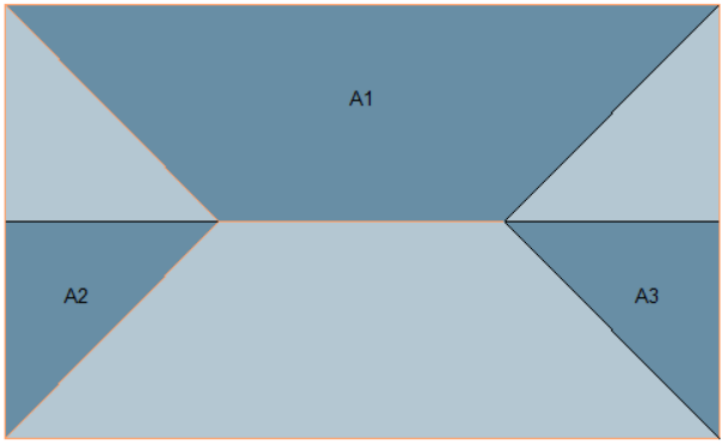
The panel area is 'attached' to your mouse curser, so you can use the middle mouse button to snap to the required location. Repeat for the second triangle area, using **F1** or **F2** to rotate the area and 'snapping' that to the corner of your first sheet area. You will also use function keys **F3** and **F4** to change the corner that acts as the handle for the block.





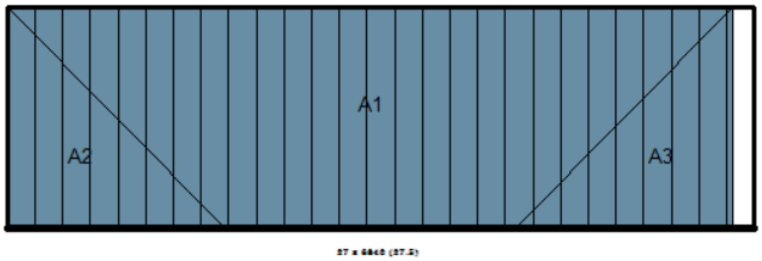
Once all the sheets for block area ‘A’ are placed, you can proceed to area ‘B’.

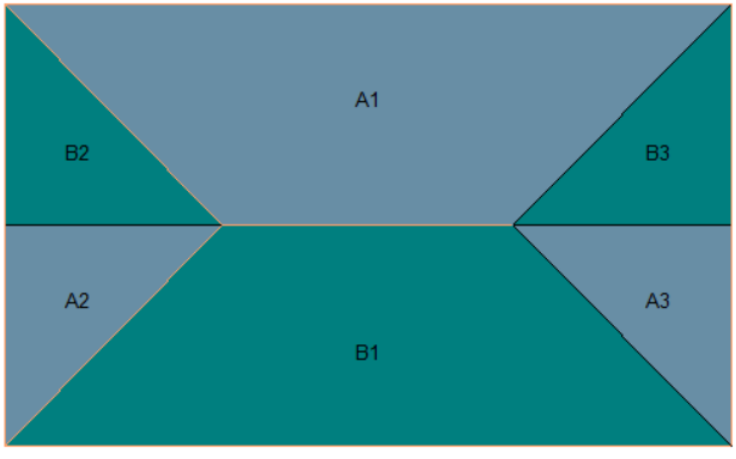
Notice that there is a small rectangle on the right hand end of the block, this is waste as the block is an exact multiple of your sheet width, in this case 762mm cover.

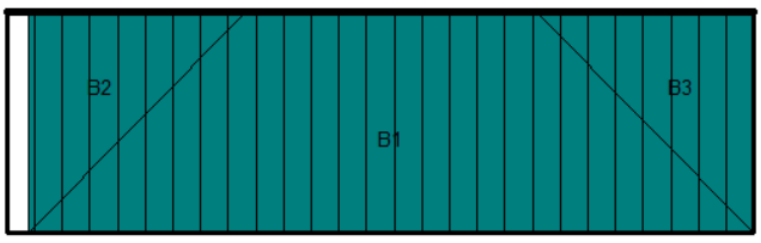


Then repeat the process for the next block, we have designated that to be block ‘B’.

This job is now complete and there is no appreciable waste, installation is a breeze and is completed in the most efficient way possible.



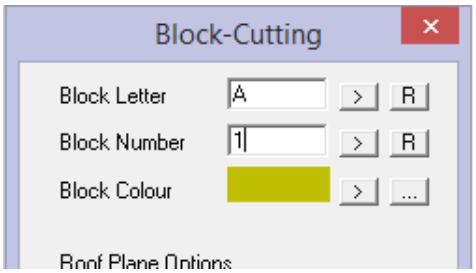




Block-Cutting Options in Detail

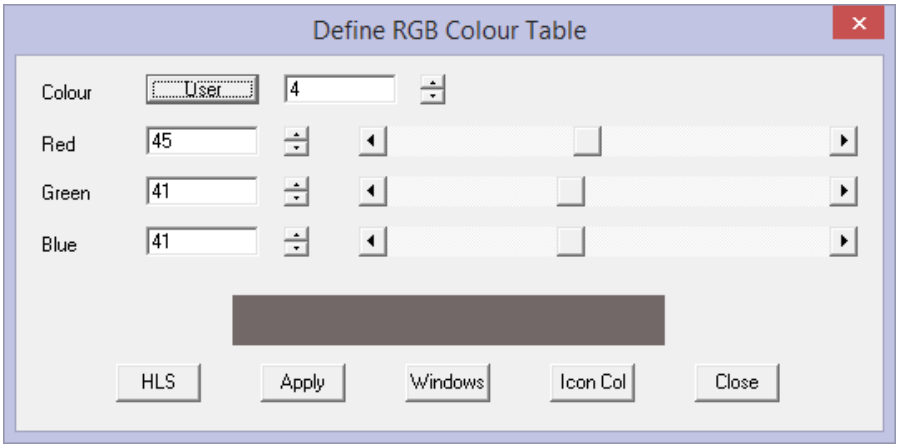
Select **Estimate Panels > Auto Blocking > Block-Cut** and the Block-Cutting tool box dialog is displayed.

The block Letter, Number and Colour options set the designation that you will use to identify each block as they are associated with the respective roof planes.



They automatically increment, as each block-piece is applied to the block. The [>] button takes you to the next letter or number in the sequence; the [R] button resets to A or 0.

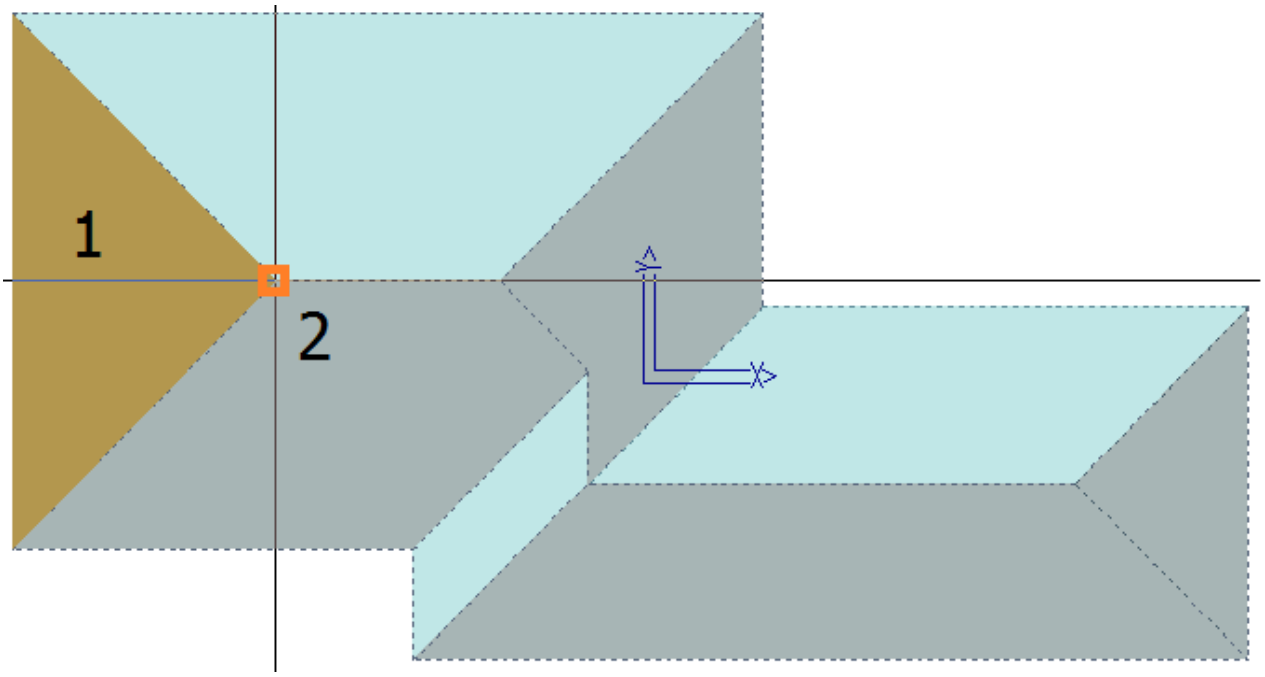
The block colour can be any of 256 colour numbers and any colour number can be any colour as defined under **CAD > Defaults > Colour Table**.



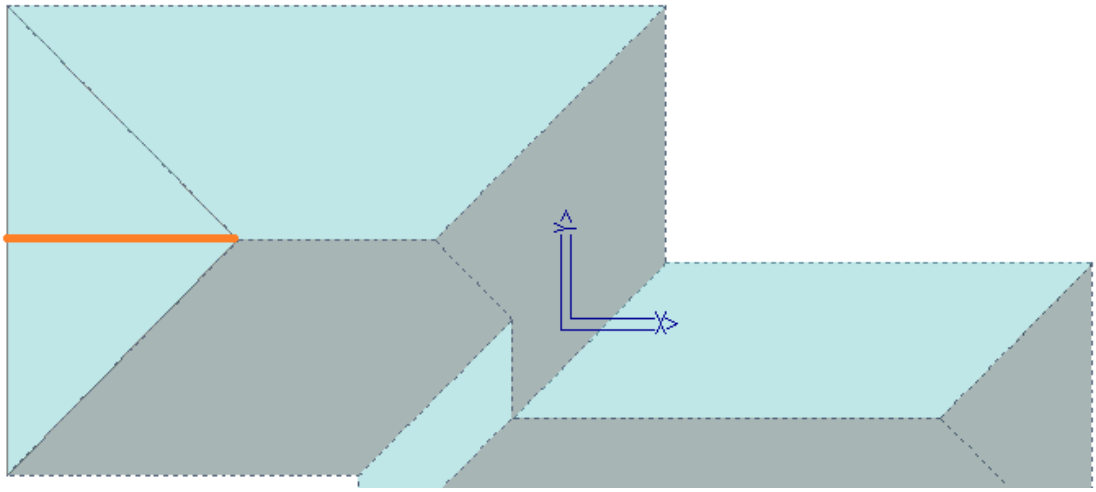
Now let's look at each function in turn.

Split Plane at Point

This function allows you to select a plane, in the example, the plane at the hip end (1), then middle button snap the apex of the ridge and hip for a point to split the plane through (2).

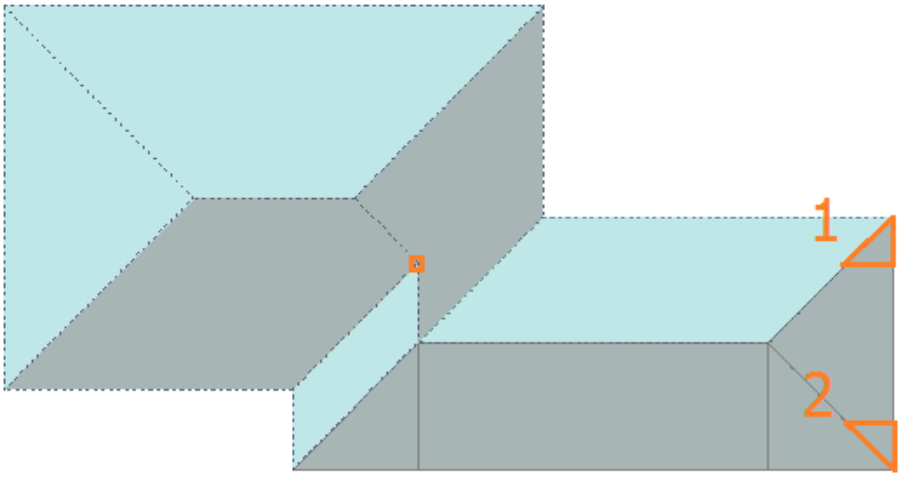


The hip end plane is split to form two block-piece planes that are available to use on the blocks as you create them.

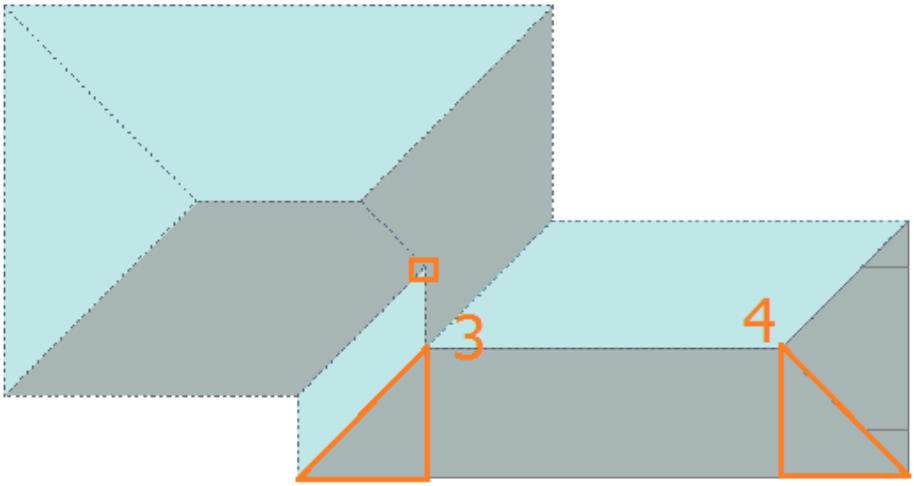


Split Plane Mirror

There are other situations where you need a bunch of extra block-pieces defined on the roof. The command **Split Plane Mirror** will give you a mirror image of a split point on the same plane.



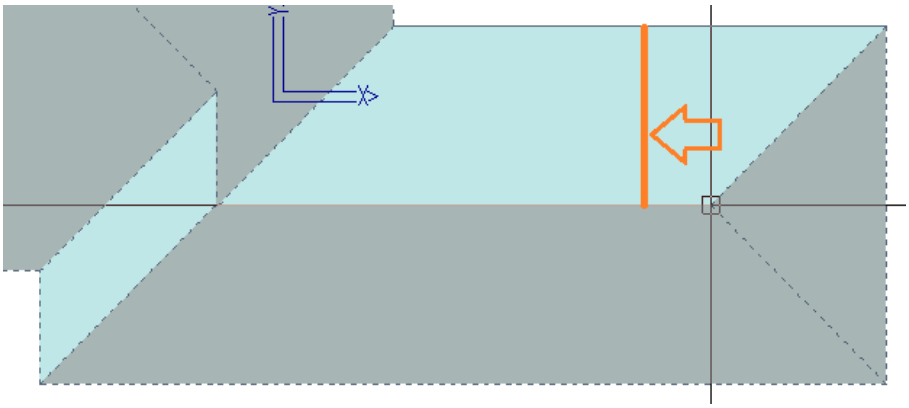
And the adjacent roof plane can be split in a similar manner to create block-pieces 3 and 4 using the same snap point.



Split Plane Distance

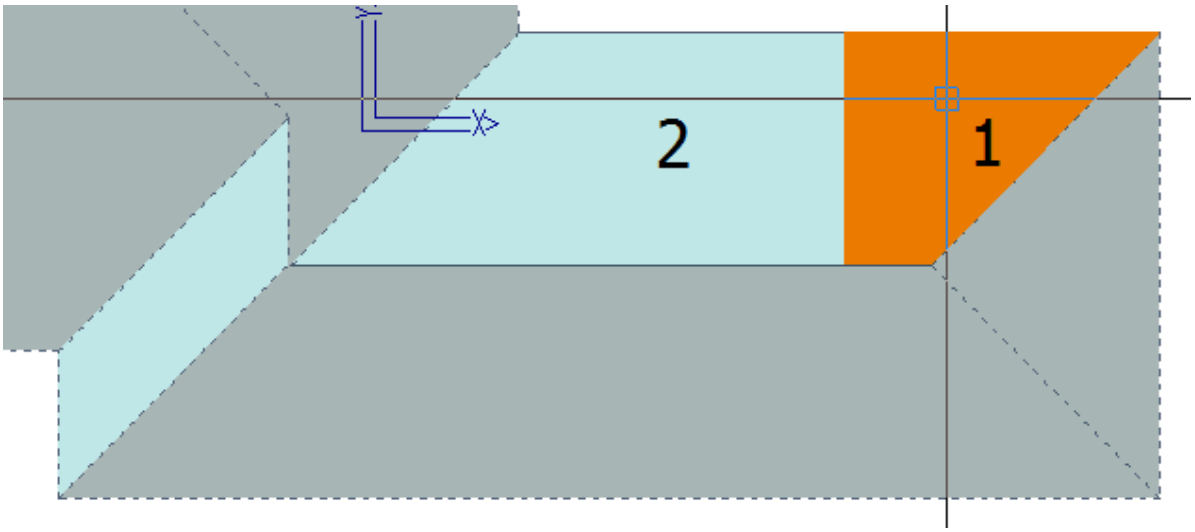
This function allows you to split a plane to create a block-piece of a specific distance from a reference point. Follow the prompts carefully as you must define the reference point, the *distance from* and the *distance to* the location of your split line.

In this example, we needed a split line 1200mm (~4') from the apex point to create a block piece that suited how we intended to utilise the block pieces.



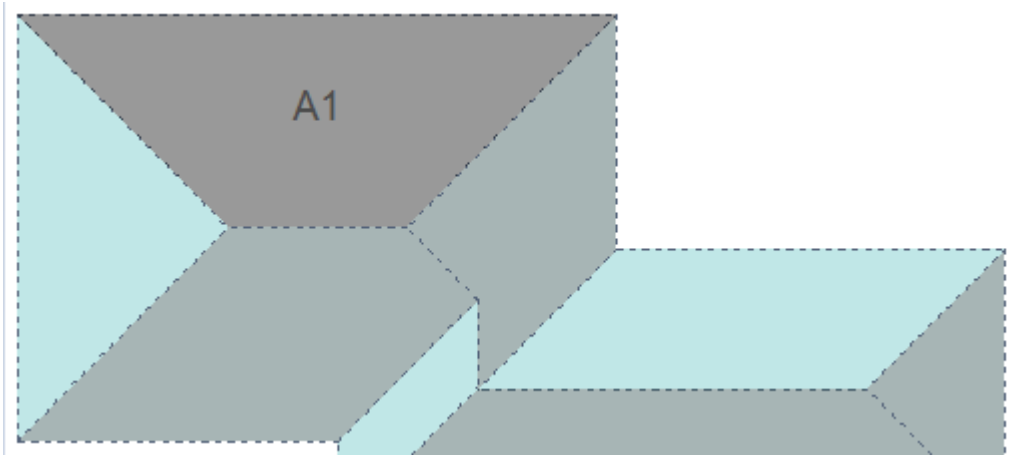
Merge Planes

This option allows you to remerge planes that you might have mistakenly split. Planes 1 and 2 will become one again.

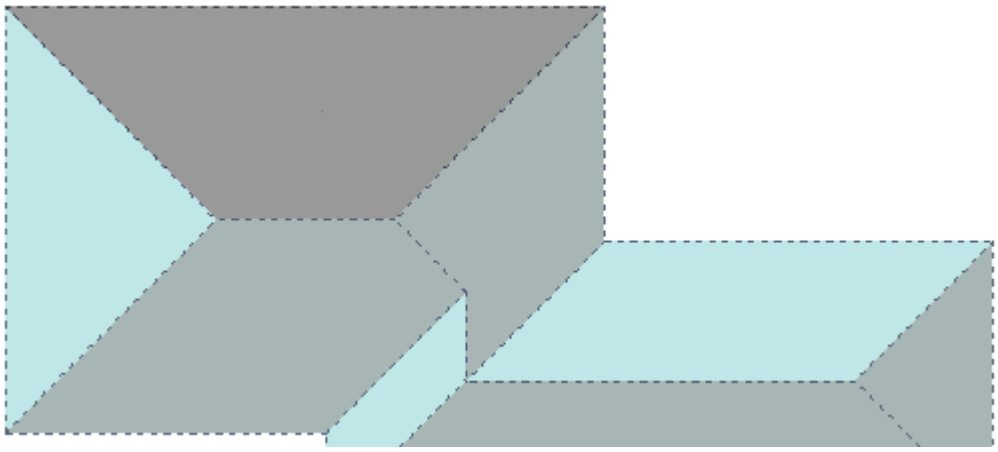


Reset Roof Plane

Removes the annotations that might have been placed incorrectly and allows you to do it again with new annotation.

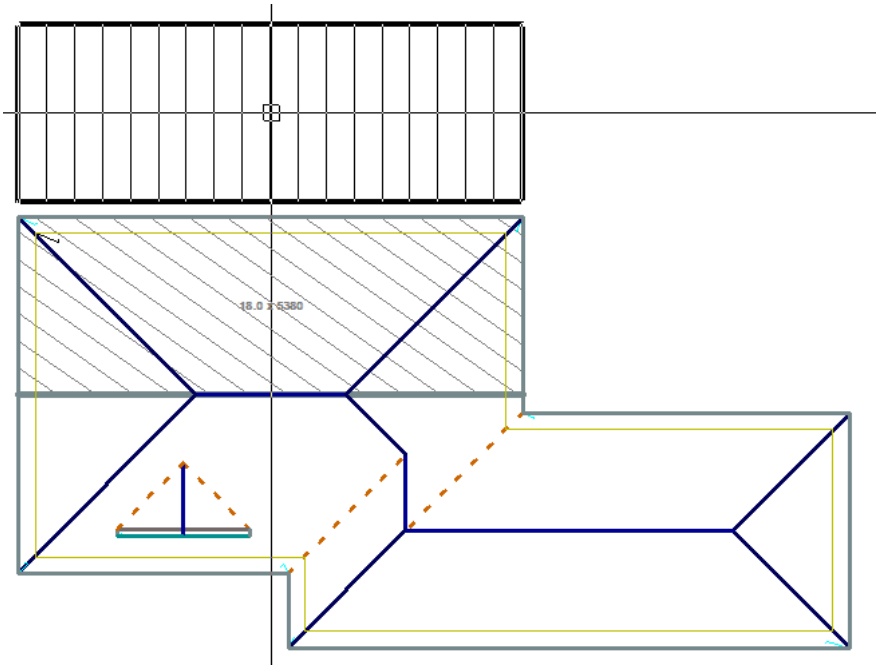


Nowyou see it, then you don't.



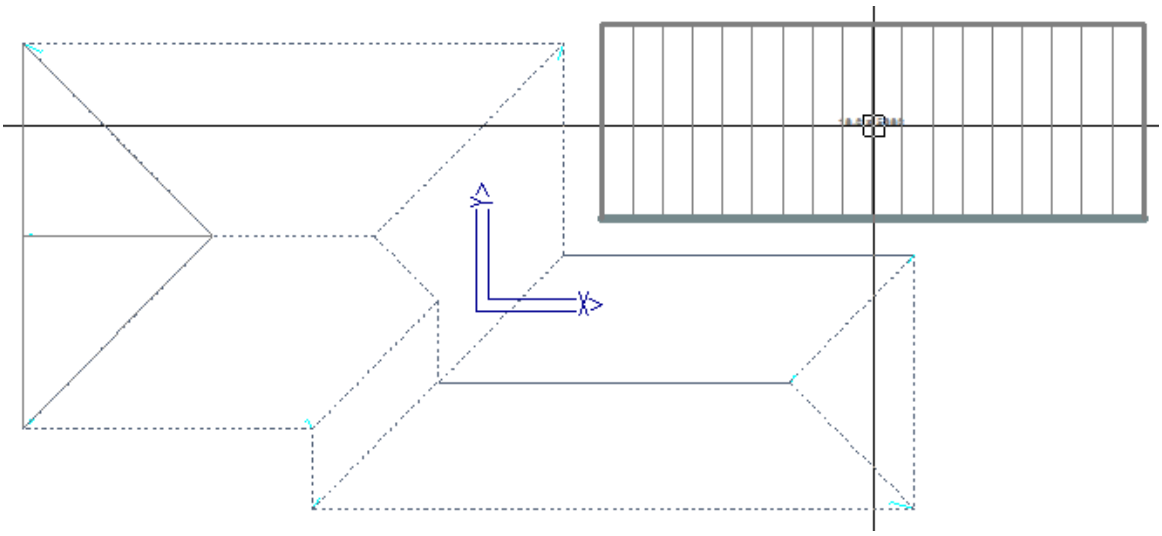
Define Block

This function automatically creates a block about the extents of the roof plane selected, then prompts to extend the block edge, if required. If the block is the correct size, then right click [Cancel] to place the block ready for placement of block-pieces.



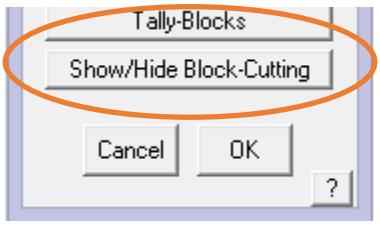
Move Existing Block

Once a block is placed, you may decide to place it elsewhere to make room for new blocks around the roof model.



Modify Blocks

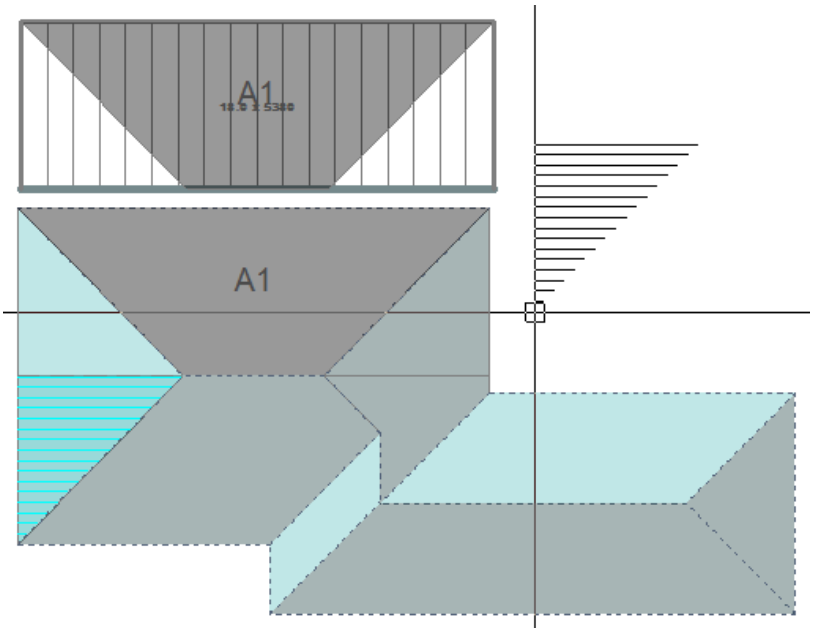
This brings up the **Modify Blocks** toolkit that allows all manner of modifications to the automatically created blocks. These functions are well described in the Reference Manual on Blocking (as distinct from Block-Cut).



The key function specifically relevant to the Block-Cutting process is the option **Show/Hide Block-Cutting** which turns the Block-Cut outlines on and off.

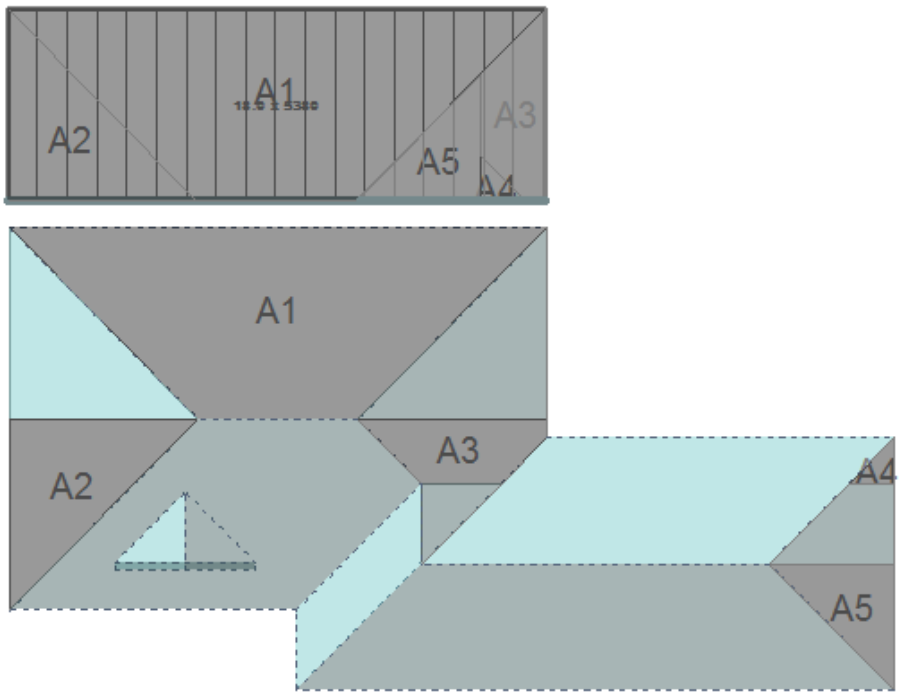
Assign Planes to Blocks

Once you have created your blocks and split the roof planes into block-pieces, you then assign the block-pieces to the block.



You do this typically starting with the largest and most obvious block-piece and it will be annotated block-piece 1 – in this case block-piece A1. Then select the next block-piece to be placed and this will be annotated A2 etc.

As the block-pieces are selected, they may not be oriented to suit the placement onto the block, so use function keys **F1** and **F2** to rotate the block-piece. If the 'snap-handle' is not in the correct corner, use **F3** and **F4** to change the handle so you can middle mouse button 'snap' it to the block, repeating the process until all block-pieces are placed and that block is complete.



Select Block

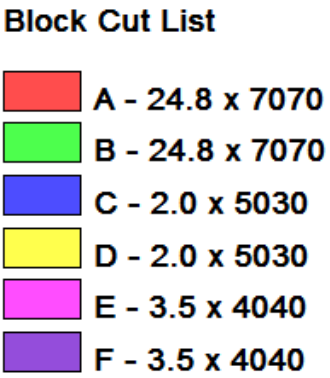
If you have been moving around the model and changing blocks etc, you may need to re-select the block so that you can assign the block-pieces to the correct block.

Delete Cut Plane

This function deletes a cut plane that you might have created so that you can create a new one.

Place/Move legend

After all Blocks have been accounted for, you can use the function Place/Move Legend to annotate the Block-Cut drawing with the summary of the cutting list – for example:



Note that this example shows fractions of sheets. This can be adjusted to round up to whole numbers of sheets by changing the settings in Allowances.

Delete All Block-Cut Planes

Deletes all the cut planes so that you can start again. Sometimes you learn a more efficient way to do a job only after doing it a different way. Since this is so quick, don't be afraid to try alternate ways to block and split planes.

Move Text

Moves the annotation text so it is easy to read.

Move Group

Allows you to move an entire block and all its block-pieces to a different part of the screen sothat the report is more easily read.

Undo

Undo the last operation.

Redo

Redo if you Undo too far, or you decide that the Undo was actually correct.

The Block-Cut Process in Detail

Now let's do a complete roof, with a detailed description of each step.

The process takes the blocks created and allows the operator to identify roof plane areas and block-pieces effectively sub-dividing the block to account for each roof plane, and to show on the block where each off-cut is expected to be extracted from and applied to the roof plane.

This Block-Cutting process is taking what roofing installers (at least those who reduce waste by flipping sheets around) actually do in the field and shows them exactly how to achieve the best fit, before they get to the job site. It is an interactive process that is 'driven' by the operator to get the required result.

It is like a '***dress rehearsal***' for the final job.

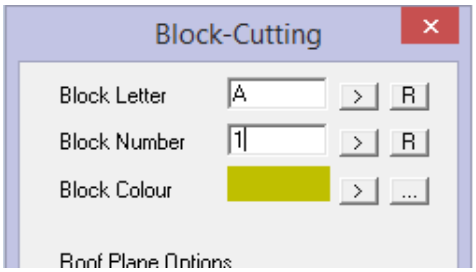
The Block-Cutting process can be loosely broken into three steps – Define the Block; Place the Block and Assign Roof Plane block-pieces.

Select **Estimate > Block-Cut** to bring up the Block Cutting dialog.

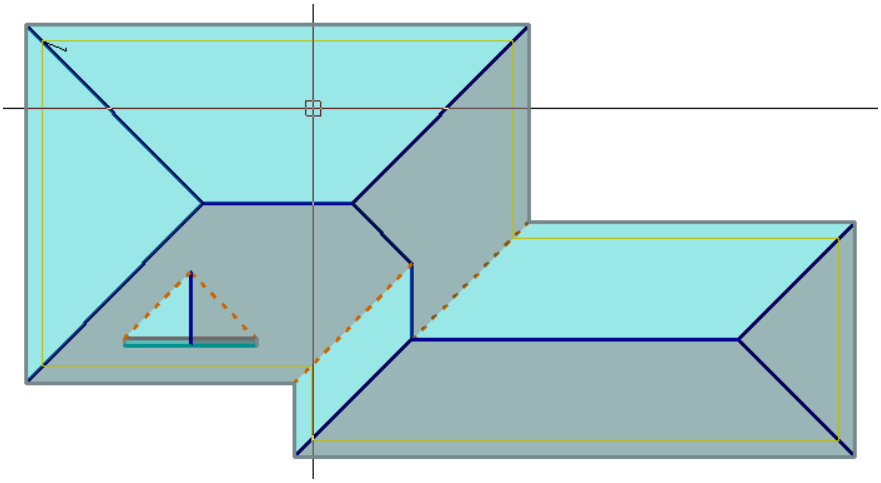
Set the first Block Letter, colour and number. If a roof panel has not been selected, then you will be prompted to select one from your previously defined panels.

Define Block

Select **Define Block** and select the first roof plane you wish to put a block on.

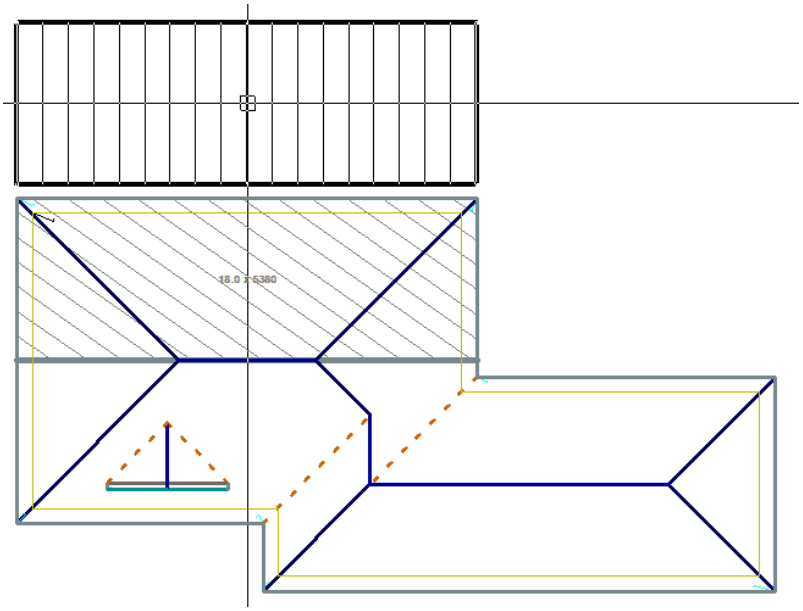


Once you click on the plane the software asks you to locate any **Block Edge Lines** you want to Stretch. (This may be required if the automatically inserted block doesn't extend into the area that you wish to apply the block to). This can be any of the lines you just need to stretch them one at a time.



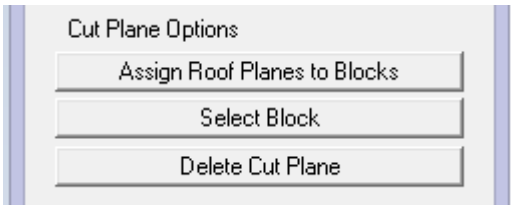
In this case this block is [OK] as it is, so right click [Cancel], and the **Block** will attach itself to your cursor and you can place it outside of the roof area ready for roof planes to be assigned to the block.

Place Block



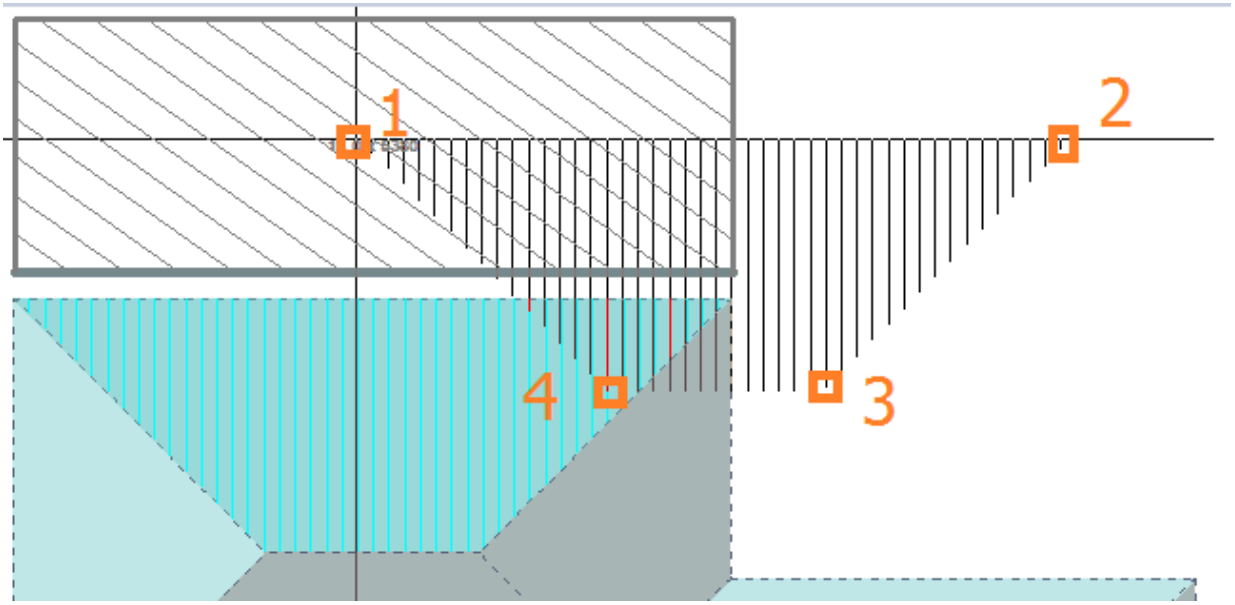
Next select **Assign Roof Planes to Blocks** and select the section of roof you want to be called A1.

Rotate Plane/Change Snap Point

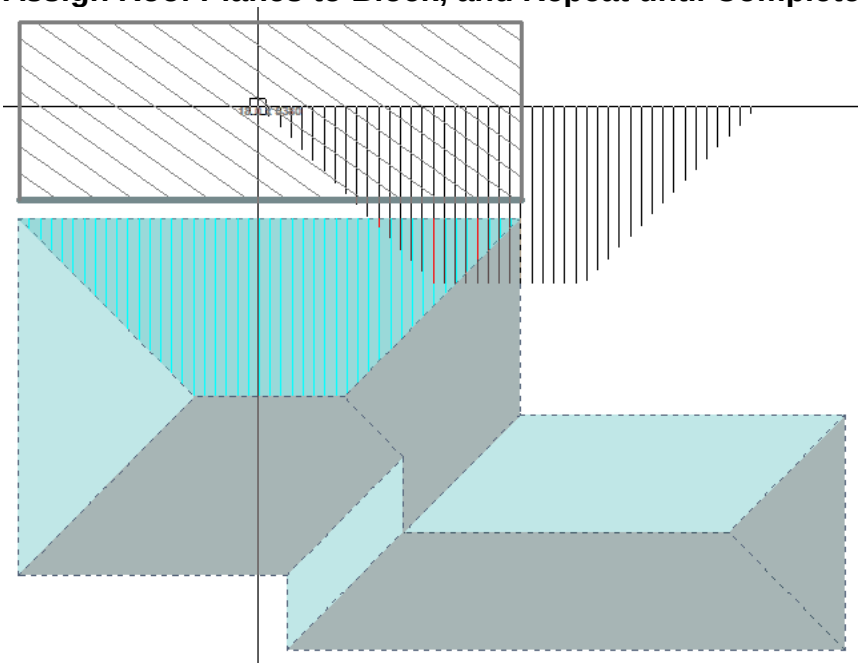


This will attach the roof plane to the cursor and you can use function keys F1 & F2 to rotate the plane and use F3 & F4 to select a point on the plane that makes it easy for you to attach it by 'snapping' to a point on the block outside the roof.

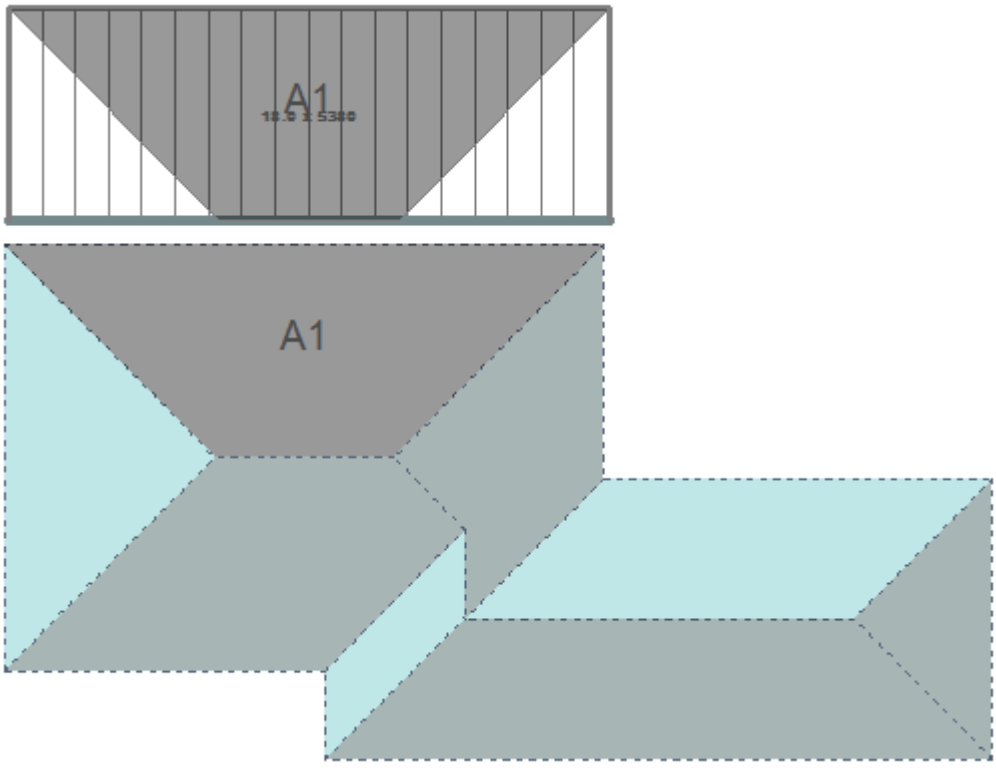
Alternate 'snap points' using F3 and F4 to conveniently snap to the corner of a block.



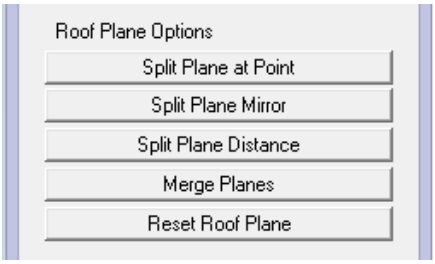
Assign Roof Planes to Block, and Repeat until Complete



Middle mouse button, to 'snap' the roof plane to the exact corner of the block. Once attached to the block it will display as A1.

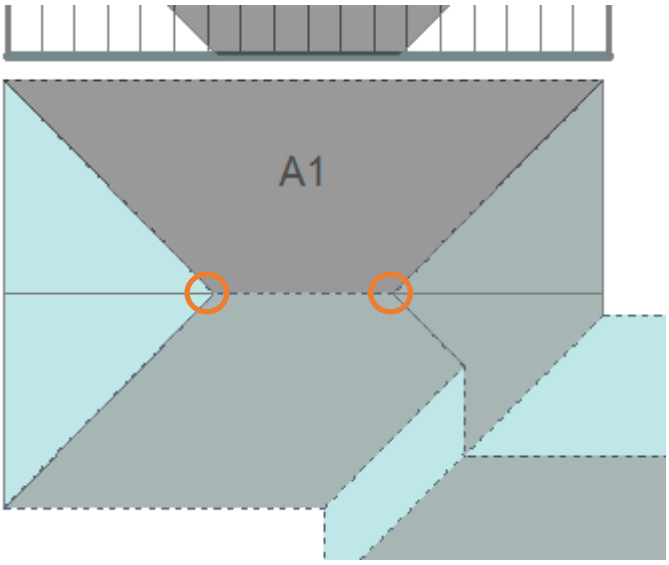


To get the off cuts into the correct place right click to cancel from the Assign function, and select the **Split Plane at Point** command.



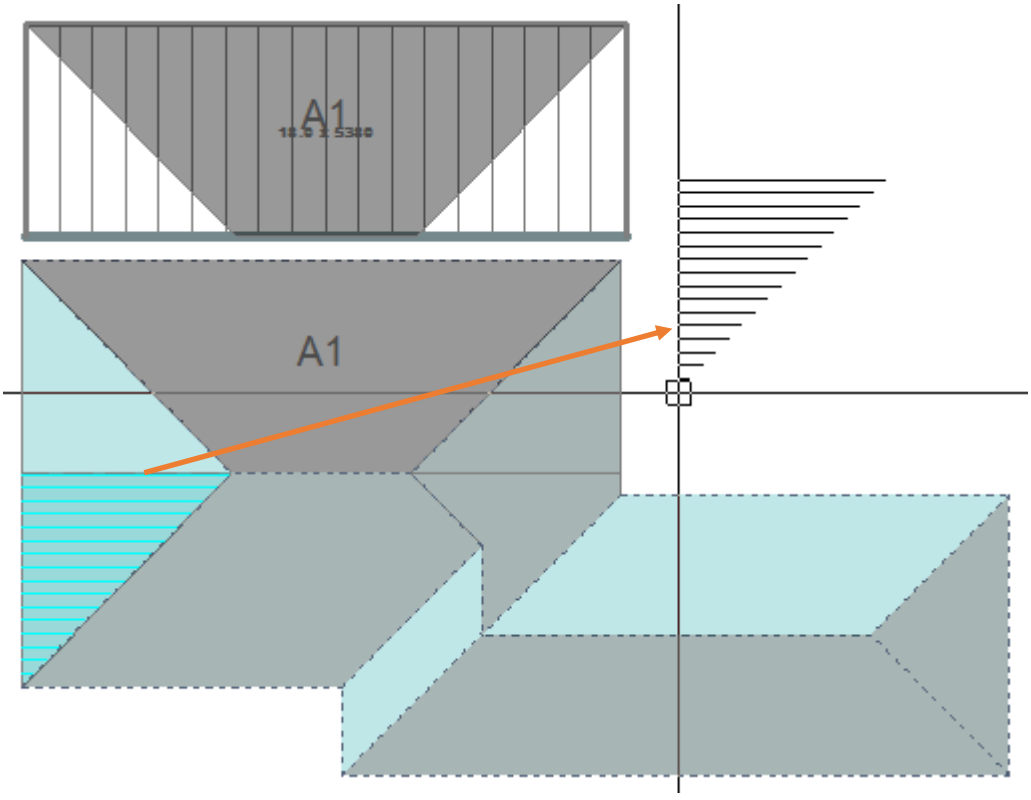
Using the far left plane as a starting example, select the roof plane to divide and then snap to the point at which you want to split the plane - in this instance it's the apex of the two hip lines, you should now see a line that separates the 2 halves of the hip end triangle.

Select the opposite hip apex by 'snapping', and divide that roof plane as well.

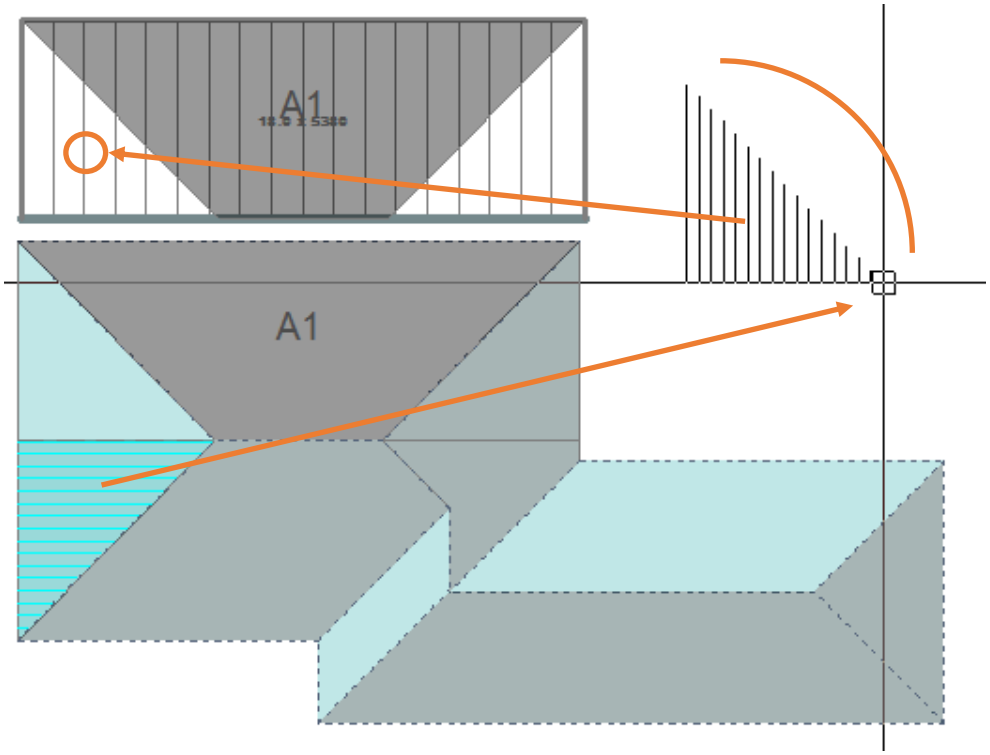


Assign Roof Planes

Now go back to **Assign Roof Planes to Blocks** and by selecting one side of the split line and using **F1** or **F2** to rotate the block-piece until it fits in place on our block taking note of the pane lay direction indicated by the hatch lines.



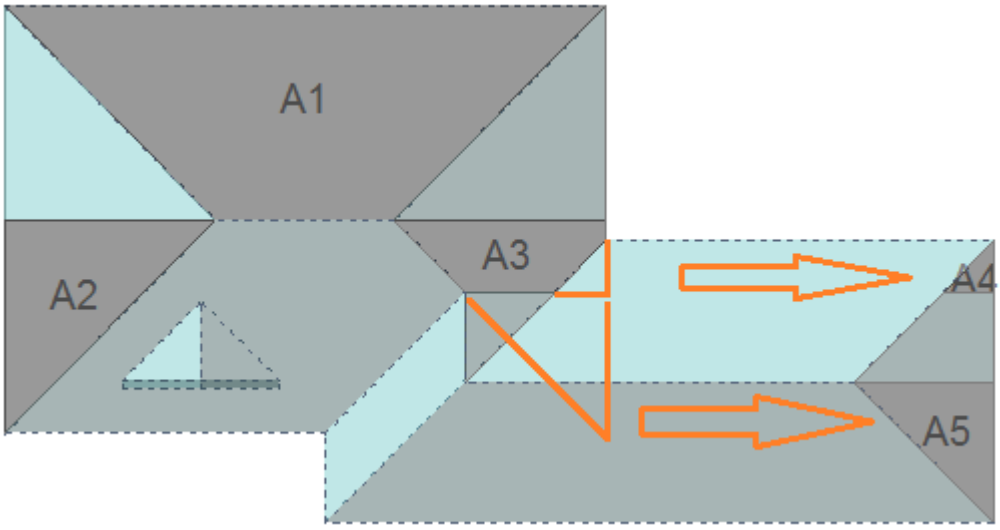
F1 or **F2** to rotate into the correct orientation, then snap to the corner of the block. Note that the block-piece designation automatically increments to the next number ie A2.



Repeat on the other side, finding the appropriate place for block-piece A3 by using rotate until that block-piece fits.

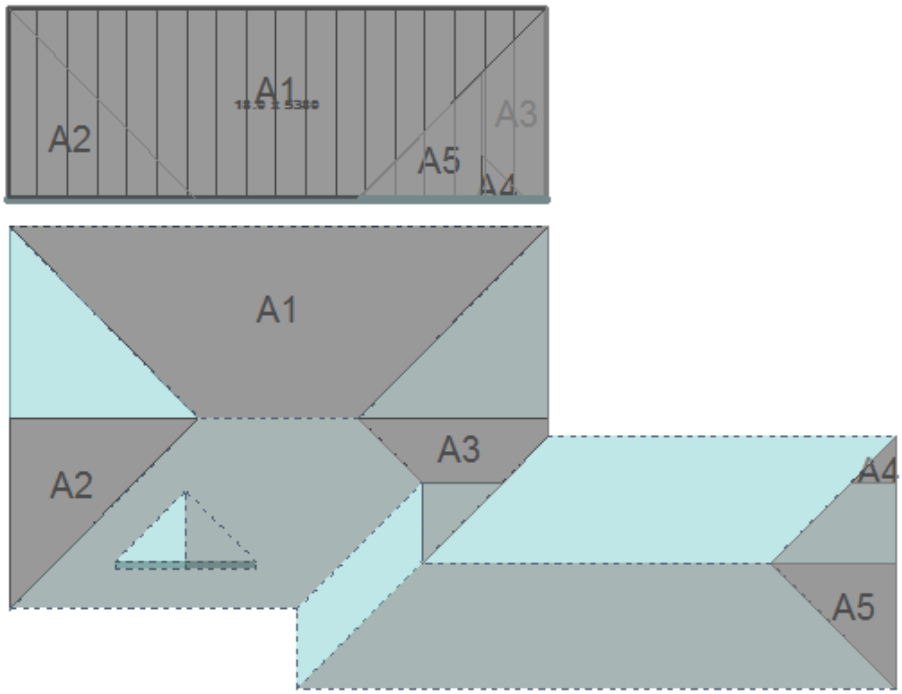
Split Plane at Point

Split the hip end at the right using **Split Plane at Point**, so that two areas are created to reveal A4 and A5,



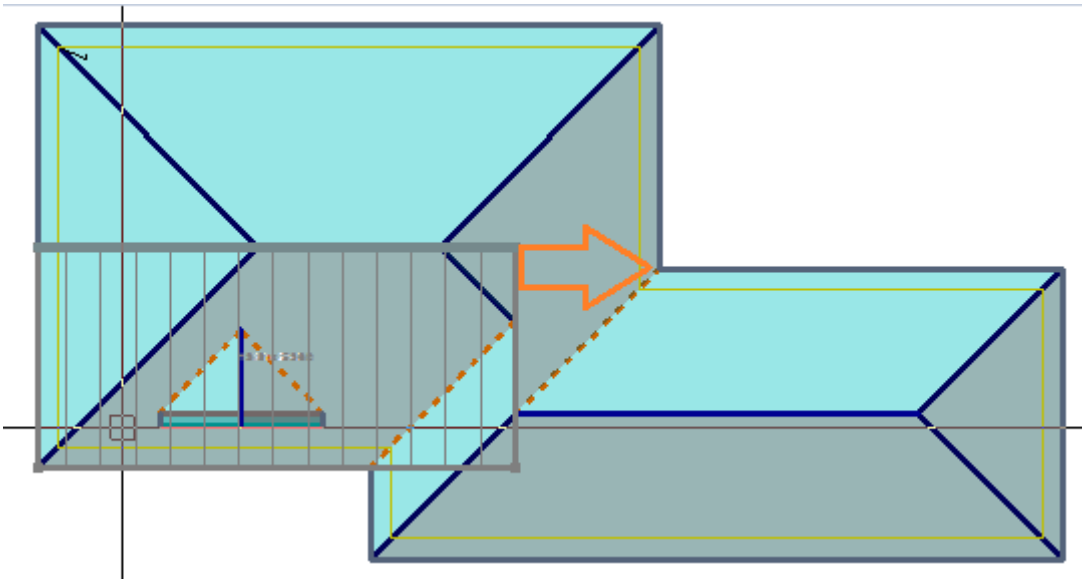
Assign Planes to Block

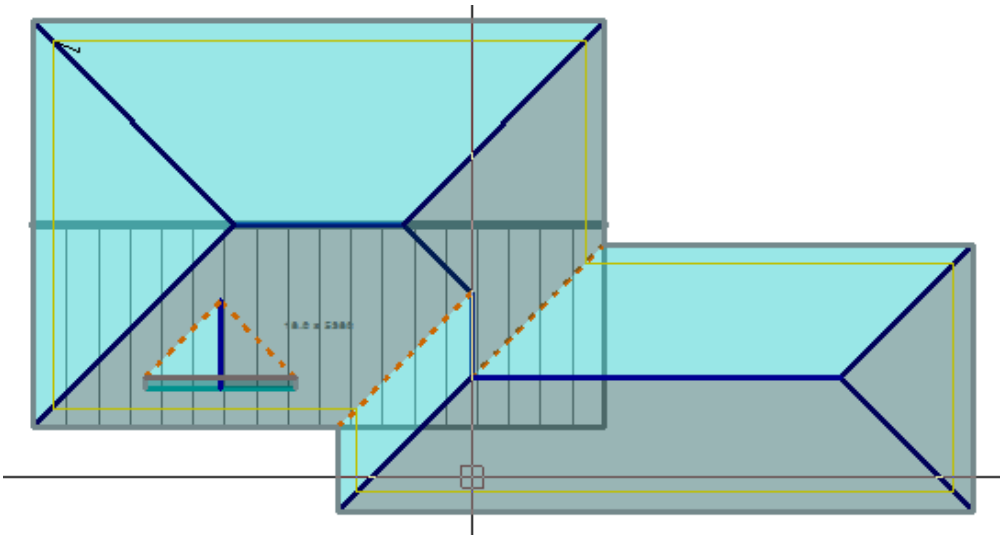
Now assign the 2 planes that were just created to Block A as A4 & A5.



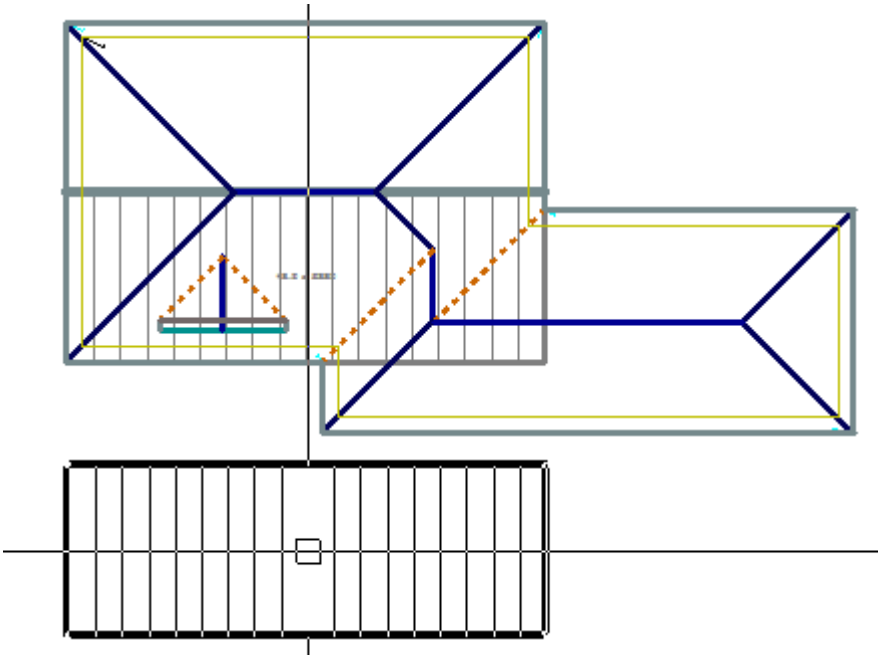
Define New Block

Now that all of block A has been filled, we must define a new block which will be block B. Select the plane area that will define block B; select the right hand edge to stretch, and stretch the edge as shown, using the middle mouse button to snap to the corner.

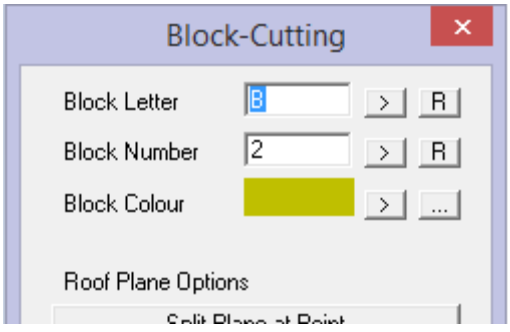




Right click to cancel that operation (assuming that you stretched it correctly), and move the block to a spot outside the roof area so that block-pieces can be assigned to that block.

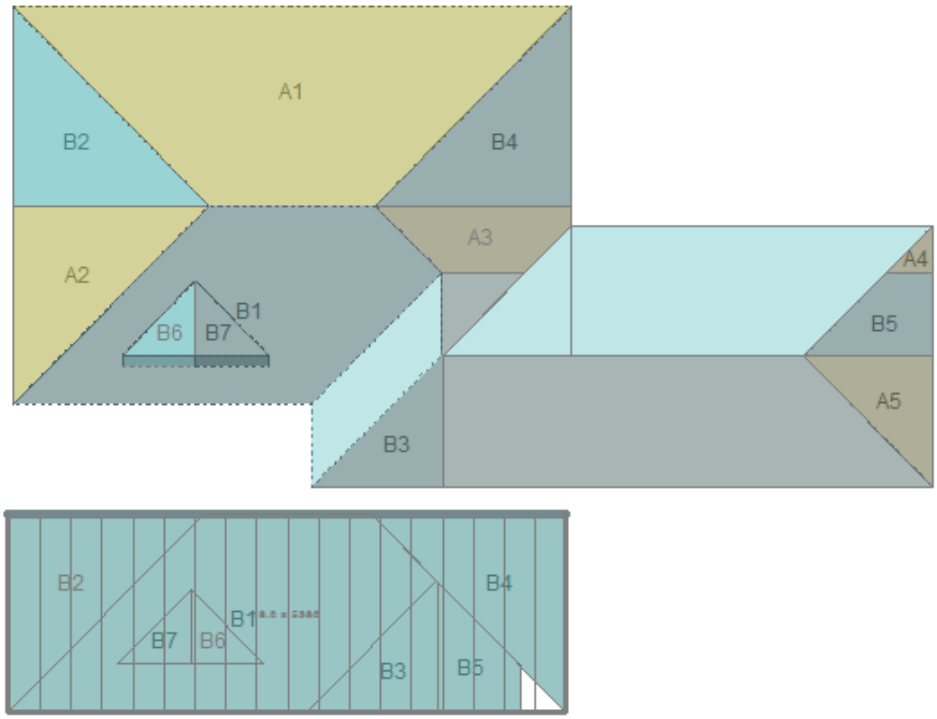


Once that is done and the Block-Cutting dialog box comes back up, click [**>**] at Block Letter to increment it to the next letter or R to reset it back to A, with Block Number Clicking [**>**] takes it to the next number or clicking R takes it back to 1. With Block Colour clicking > takes it to the next colour in the pallet or clicking [**...**] lets you pick any colour in the colour table that you have set up (**CAD > Defaults > Colour Table**).



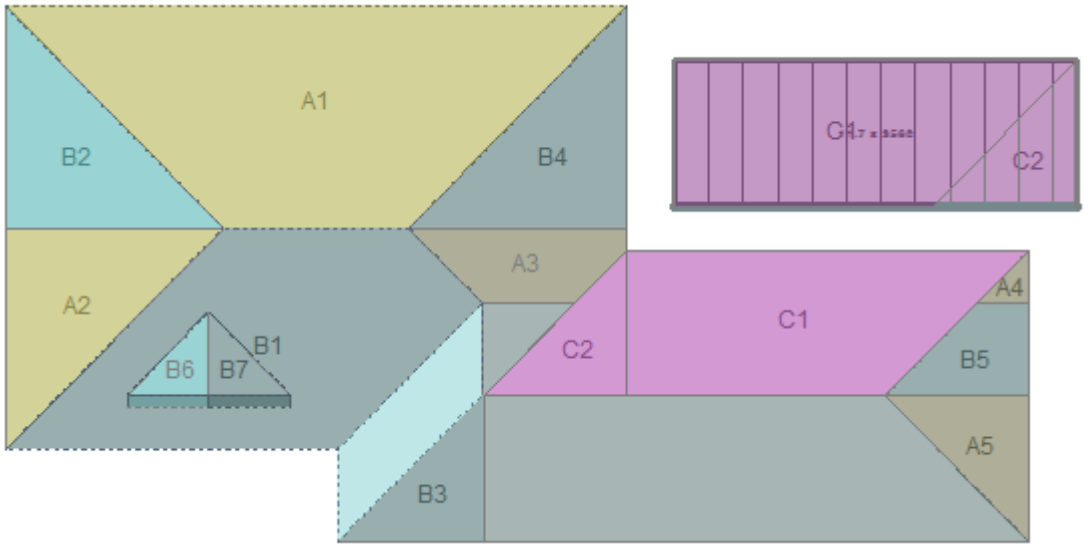
Assign this block to be “B”

That gives us B1 & B2 which are obvious. Then split the planes as shown to give us B3 and then assign block-pieces B3 and B4 to the block. Next, move block-piece B5 onto our block.



Split the planes on the dormers at the bottom of the valley. And **Assign** those as B6 and B7. Then move the block-pieces B6 & B7 onto our block B.

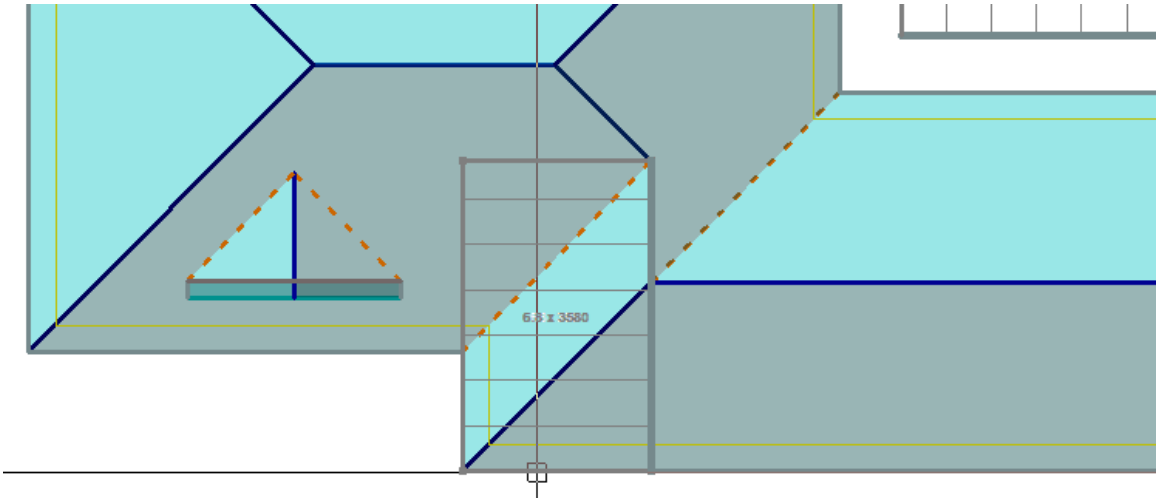
Then define a new block which will be labelled C.



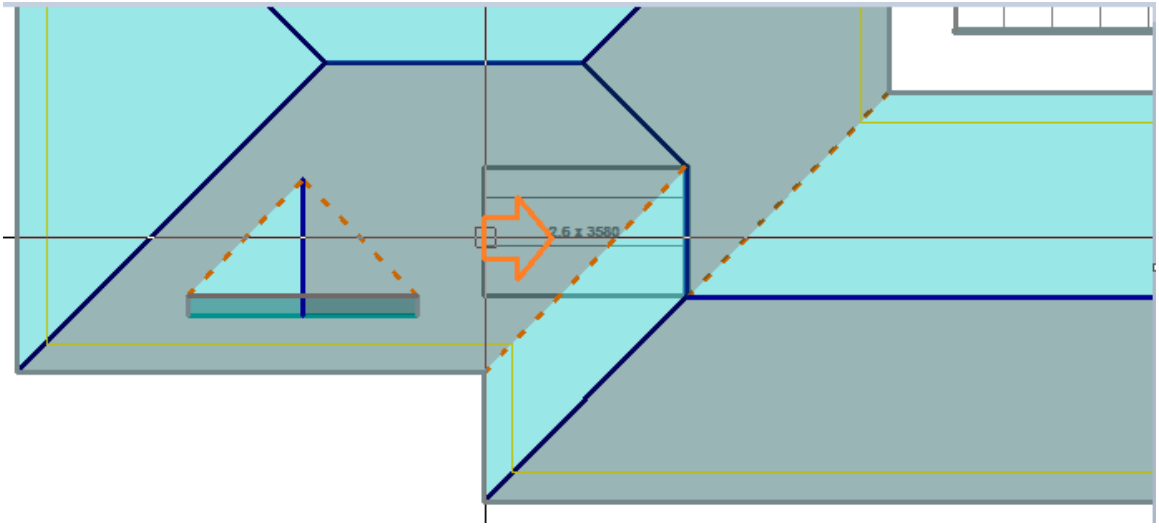
Continue this process for each subsequent block, splitting and assigning until they are all accounted for.

In the case of the small hip/valley (where E1 and E2 will be placed) don't have a point to snap to, so scroll zoom in and select a point close as you can to the valley.

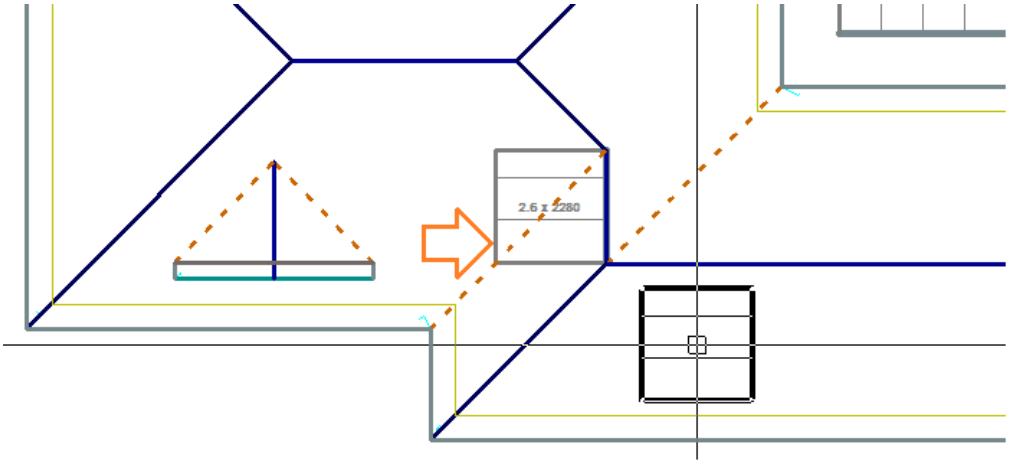
Select extend edge and then click on one of the block lines then snap to the top of D2 and B1 depending on which edge you started on and then repeat on the other side.



Stretch the edge back to the apex of the hip and ridge by snapping to the apex point. Then stretch the outer edge and snap to the geometry on the valley.



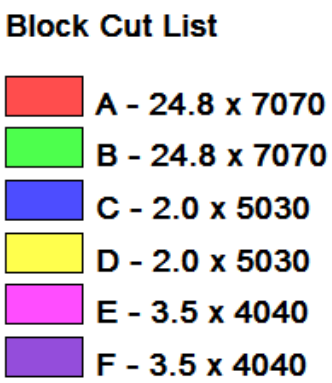
Can now move the block out and insert the remaining corners to create E1 and E2.



Note: If you have jumped in and out of the Block-Cutting dialog it is possible that the software has lost track of which block you're trying to associate with which roof plane.

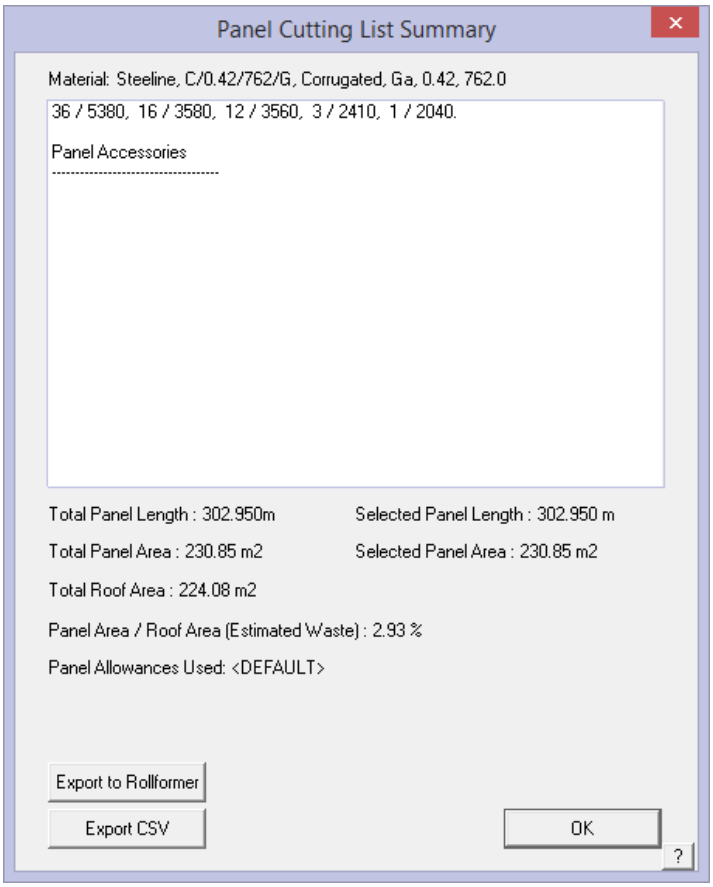
Use the **Cut Plane Option – Select Block** before you select **Assign Planes to Blocks** to get yourself back on track.

After all Blocks have been accounted for, you can use the function **Place/Move Legend** to annotate the Block-Cut drawing with the summary of the cutting list – for example:



Note that this shows fractions of sheets. This can be adjusted to round-up to whole numbers of sheets by changing the settings in **Estimate > Allowances**.

Then to finish it off completely, 2 straight sheets for F1 & F2 on the front of the dormer.

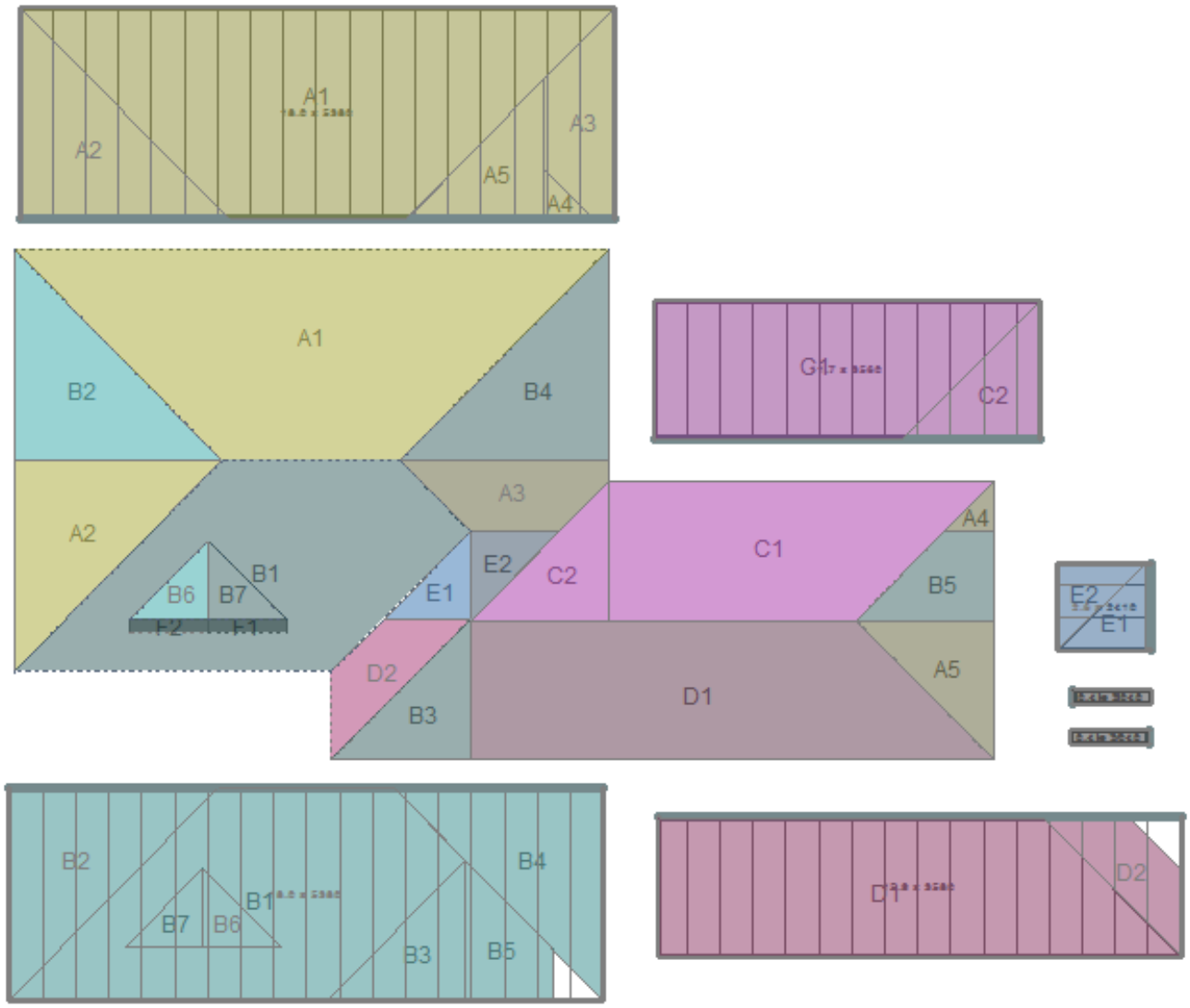


Cutting List Summary

Using **Estimate > Tally-Blocks** we see the correct cutting list and optimised for re-use of the waste - just 2.93%.

This method takes some adjusting to but after many years of using this exact same process manually, most roofers will find this interactive process for generating what they currently do with coloured pencils, a real bonus.

It shows the estimator that everything has been accounted for and the automated report is then available for the installers as well.



Spend a little time understanding how this came together. If you need help understanding it, sit with your installer and discuss with them what they would do in particular situations – after-all, they will be the guys that take your suggested output and try to make it work.

Block-Cut Output

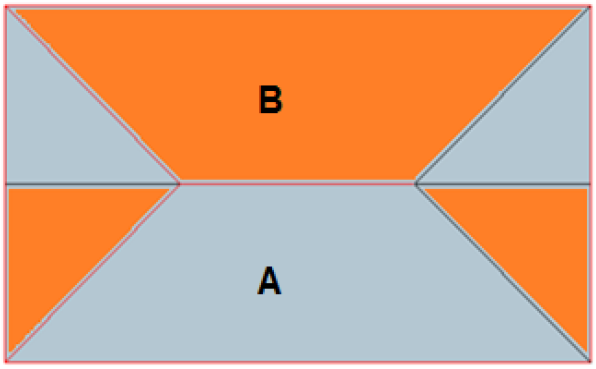
The Block-Cut template for MS Word creates the required report for your installers.

The template for this is in the ...\User folder.

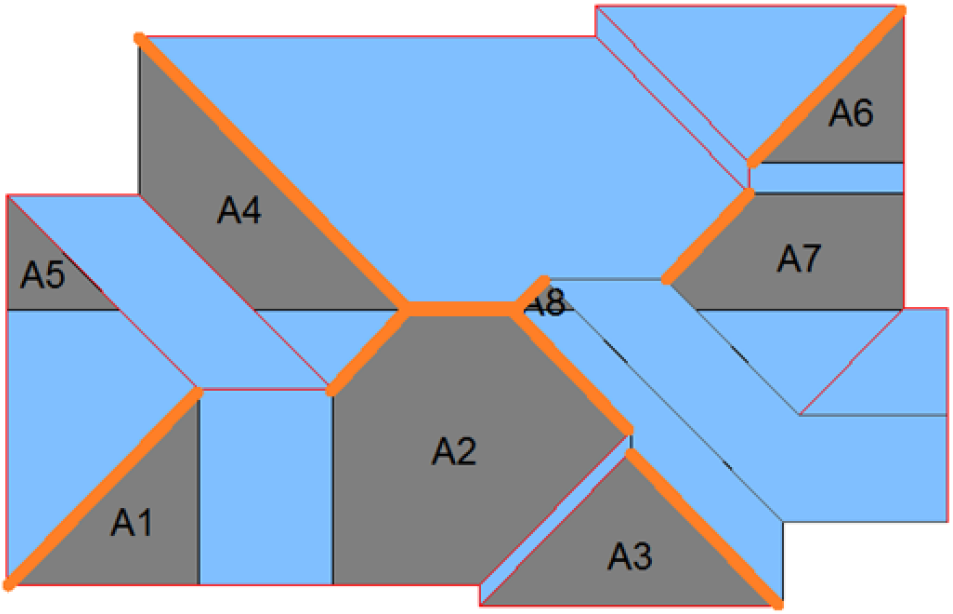
Refer to Templates and Key Text Strings for more details.

Block-Cutting Advanced

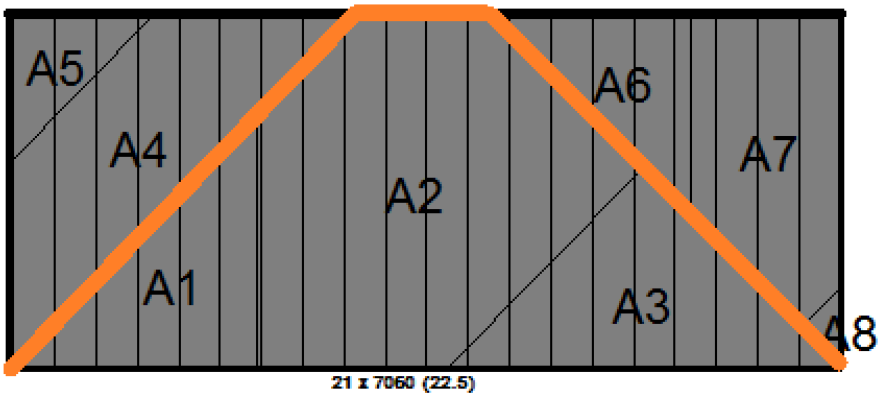
As we will see in the following example, these can become quite complicated, simply because there are so many options for slicing up the roof planes so that each offcut has a place to go on the roof. Keep it simple and take one situation at a time



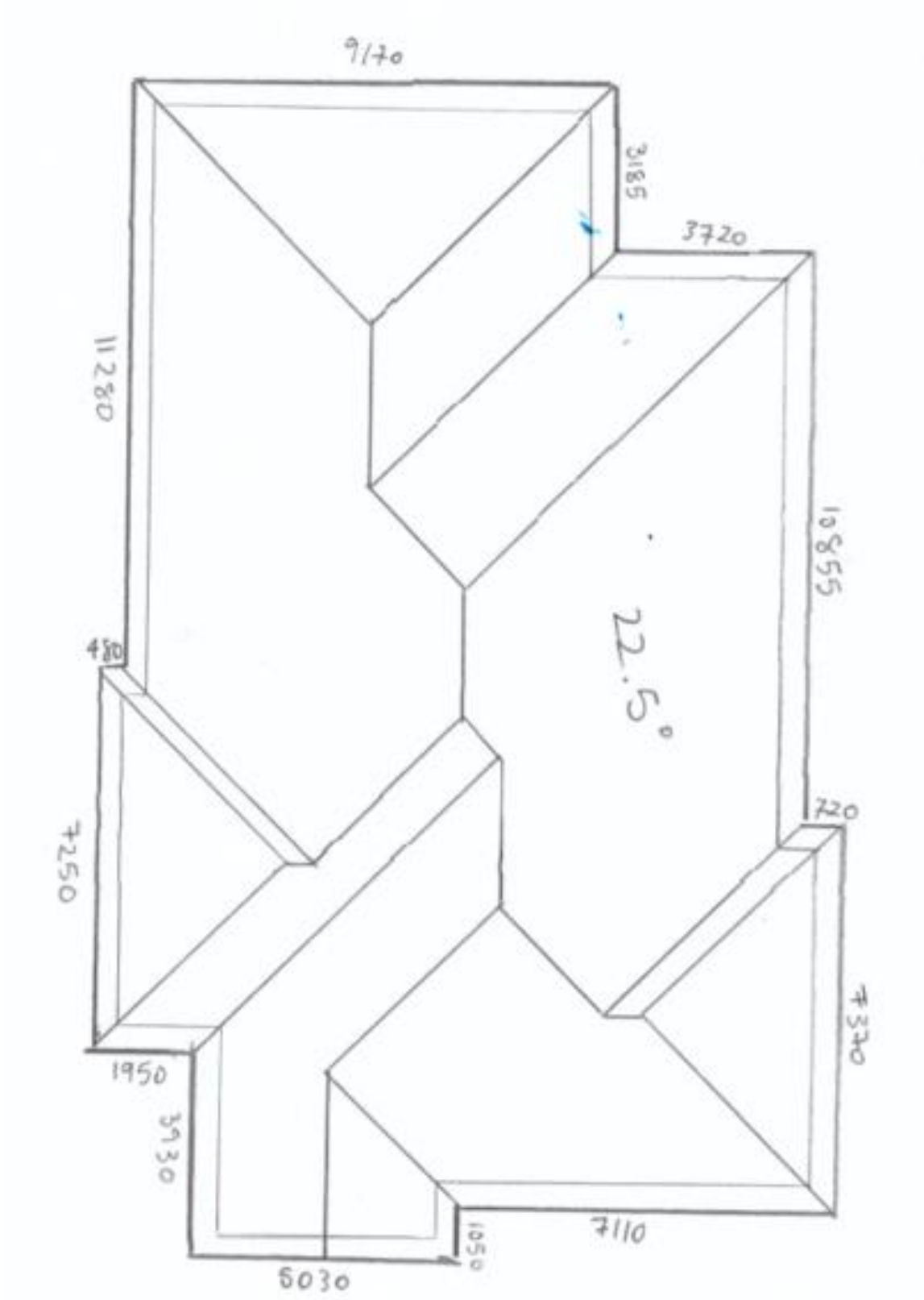
First thing to do on a cut-up roof is to visualise where your 'four-hip' roof is. To help with this, get your big fat marking pen and draw the hips that will define the four-hipper. This will help you define where to split the planes. Study this for a bit, and it will become obvious what we're doing here.



Once all the roof planes are dragged into the block (**assigned** to block A), the result looks like this, and you can see your identified hips. The opposite would typically be done next and that would be Block B and so on.

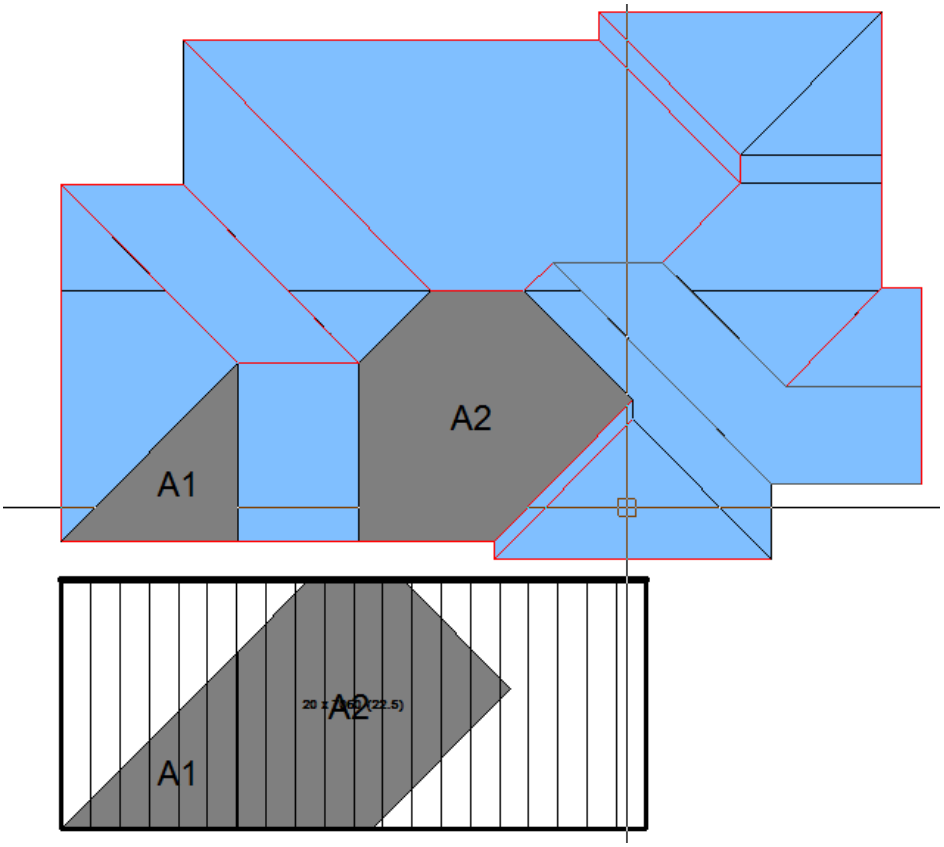


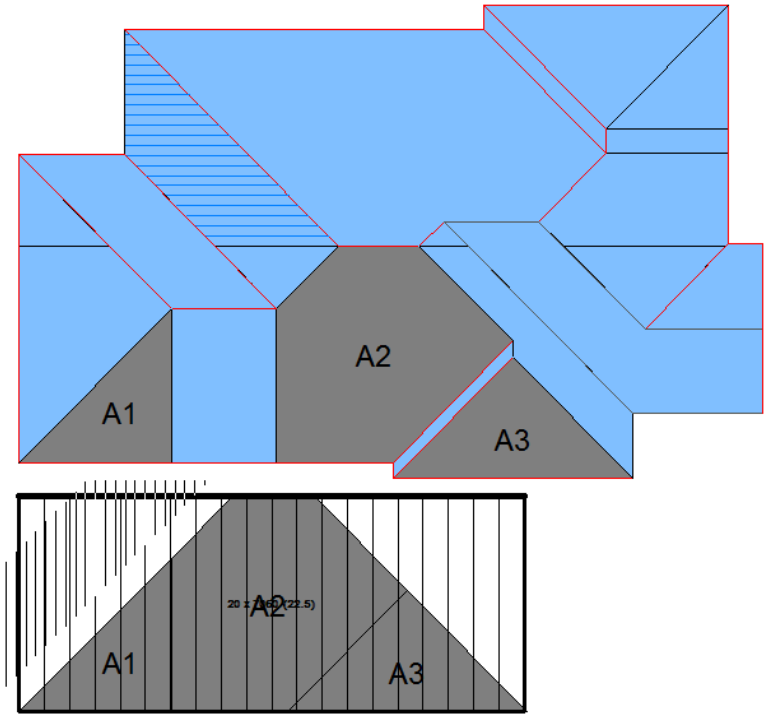
To work through this example, first create model using the dimensions shown below. Don't forget to use the **Tools** options to check that your model is correct (pitch, dimensions, etc).

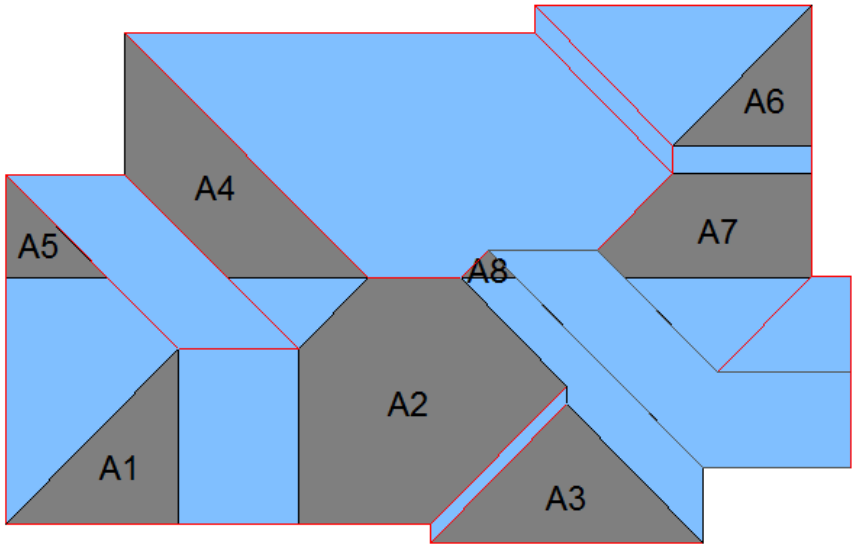


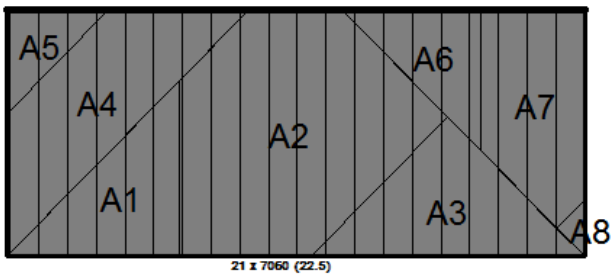
Then go to **Estimate Panels > Block-Cutting** and split the roof planes as shown below. Using the steps described above, start by defining the first block which will become block 'A'.

Assigning Roof Planes to Blocks is an iterative process, selecting, rotating and snapping each one into place until all of block ‘A’ is full. Study this carefully.

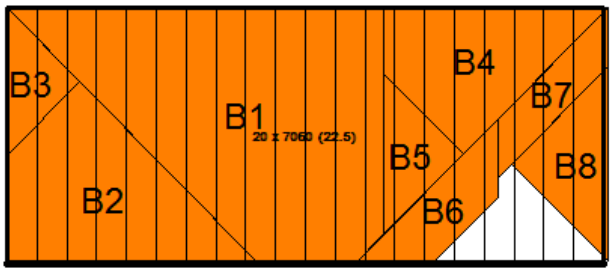


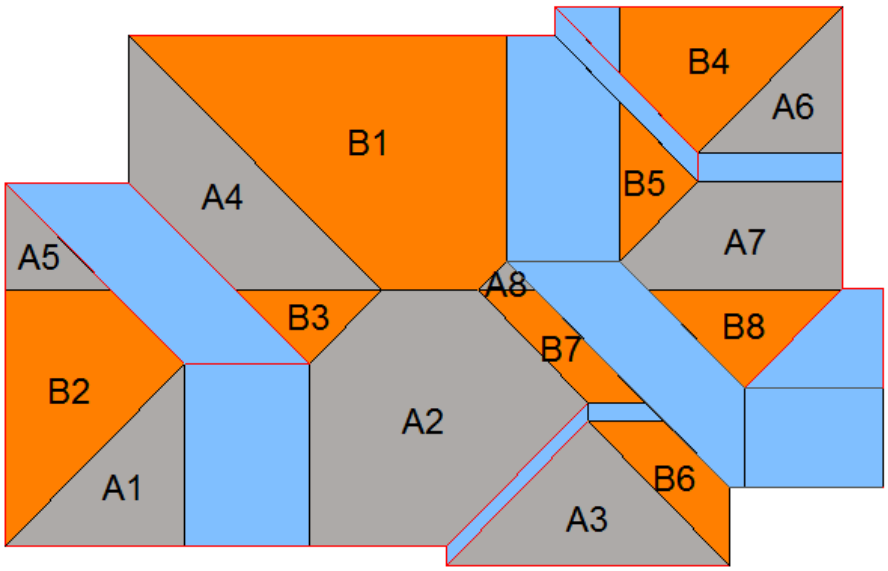




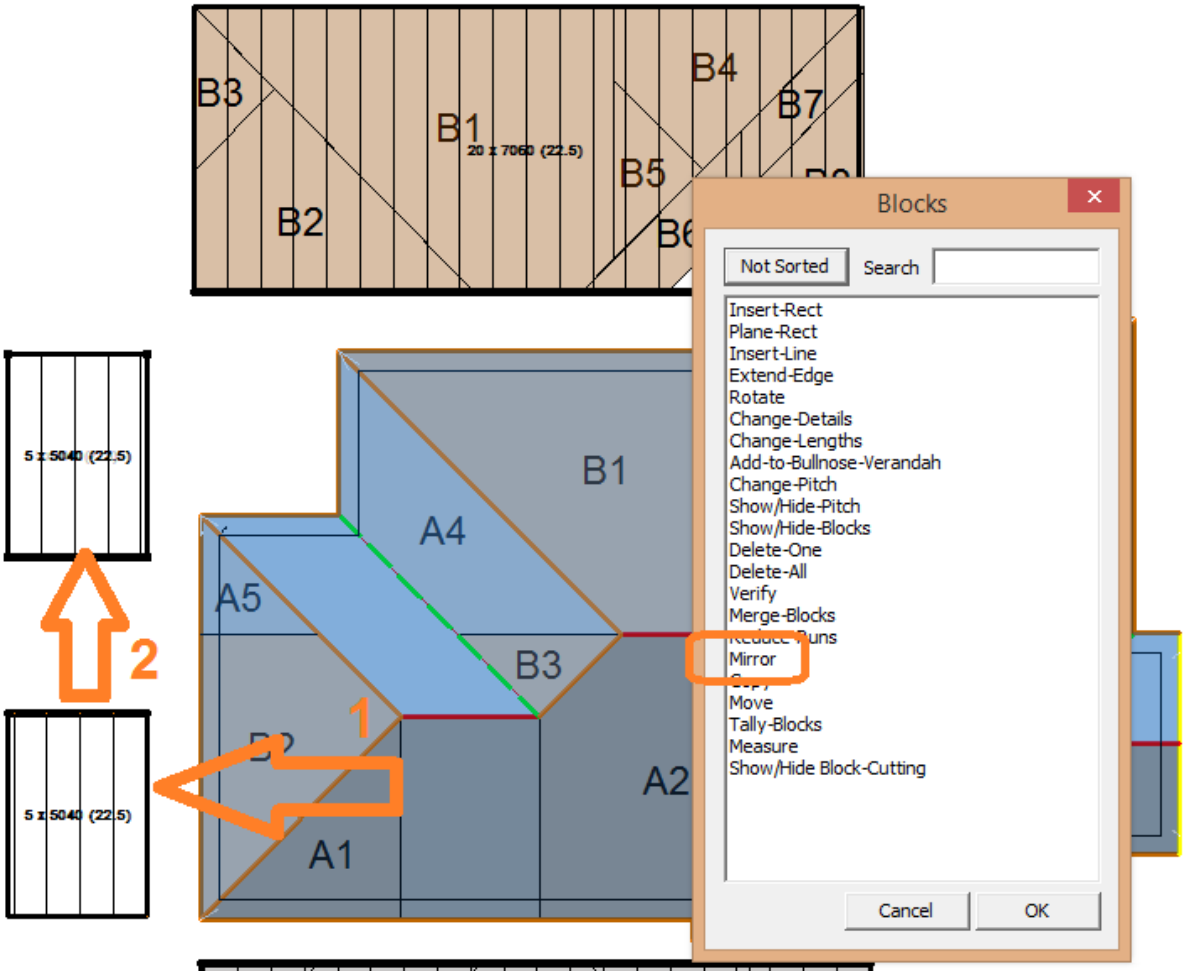


And then the 'B' side of our 'four-hip' roof. We will do as much as is easy to figure out, then move to the rest of the roof. We can come back to the last corner of block 'B' later.



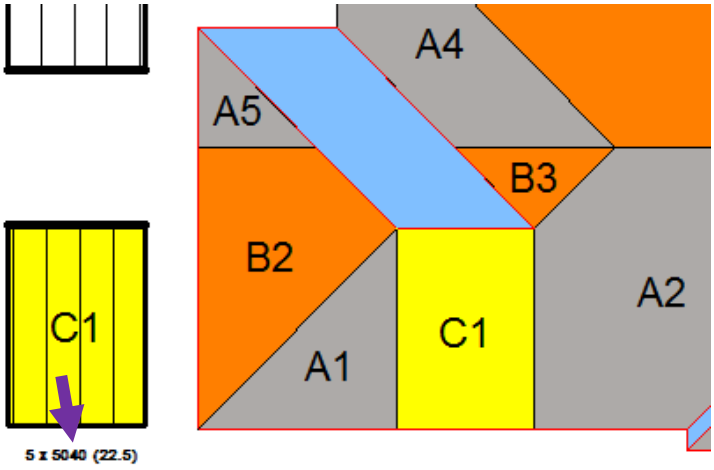


Now to move on to the rest of the roof. Define a block between A1 and A2 – this will require resizing by stretching the edges – **don't forget to read the prompts**.



Modify Blocks

Then we need another block the same size so we use the [**Modify Blocks**] button, and select [**Mirror**]. Select the block to mirror (making a copy of it) by drawing a box around it with the curser. Then select the line adjacent to A5 as the line to mirror about. Now we have two blocks of the same size and shape.

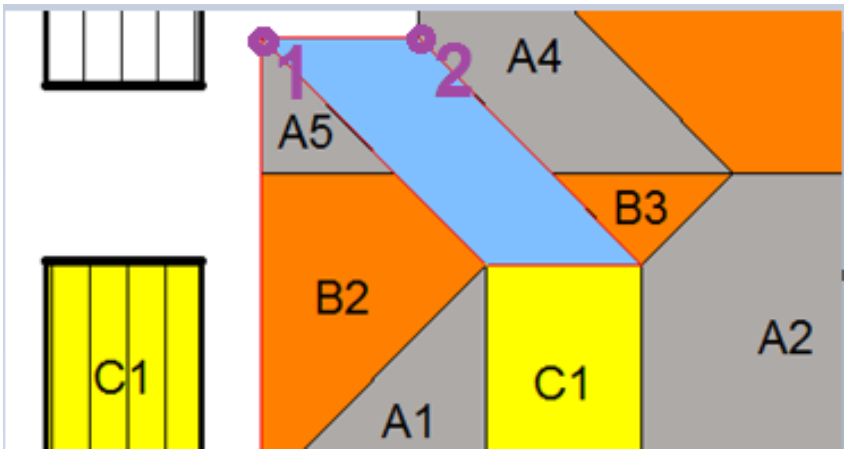


Now assign the rectangle to block 'C'. Notice that the block cut list text has moved. You can do this too. Use the [**Move-Text**] button and move the text so that it is easy to read under the block identifier.

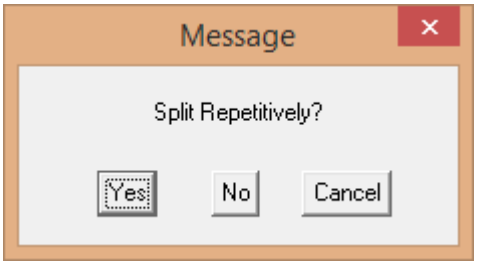
The next step is a little tricky because we have to divide or split the roof plane by the amount that equals the width of the block.

Split Plan Distance

Use the [**Split Plan Distance]** option, select the plane, and then middle mouse button snap to the first corner (1), then the second corner (2).

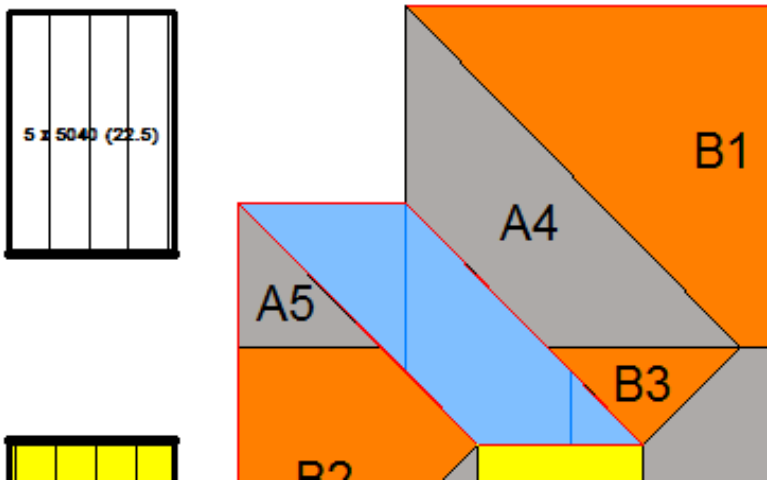


You will get a split line, then be prompted if you wish to split repetitively in the same direction on the same plane.

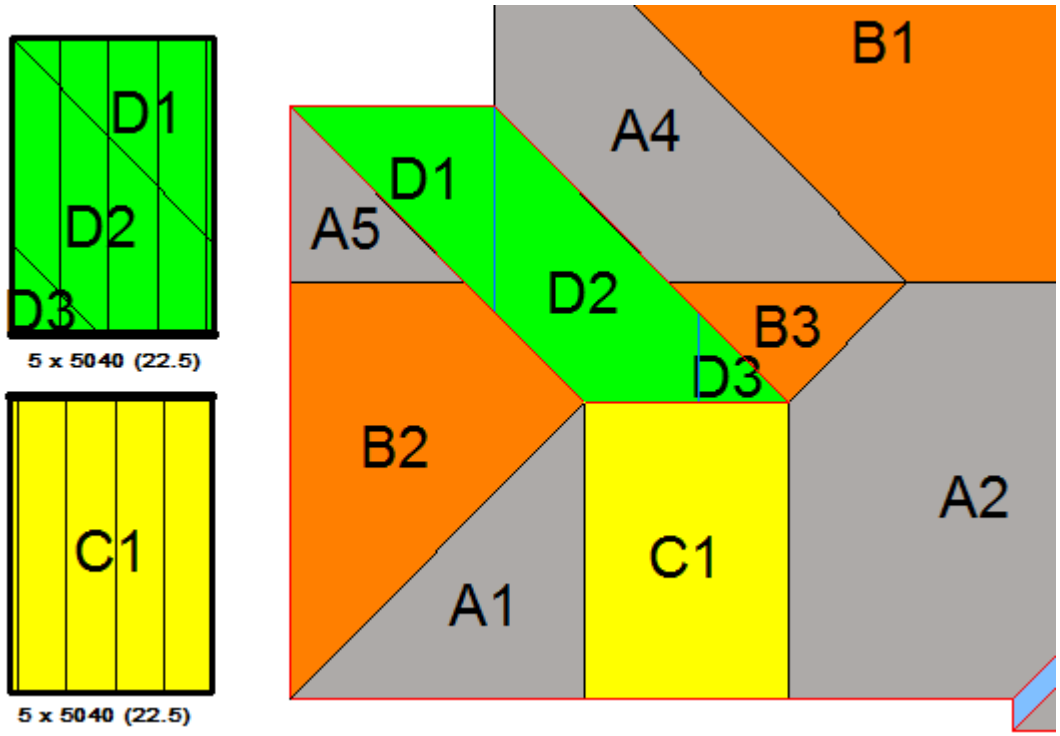


Select [**Yes**] to this.

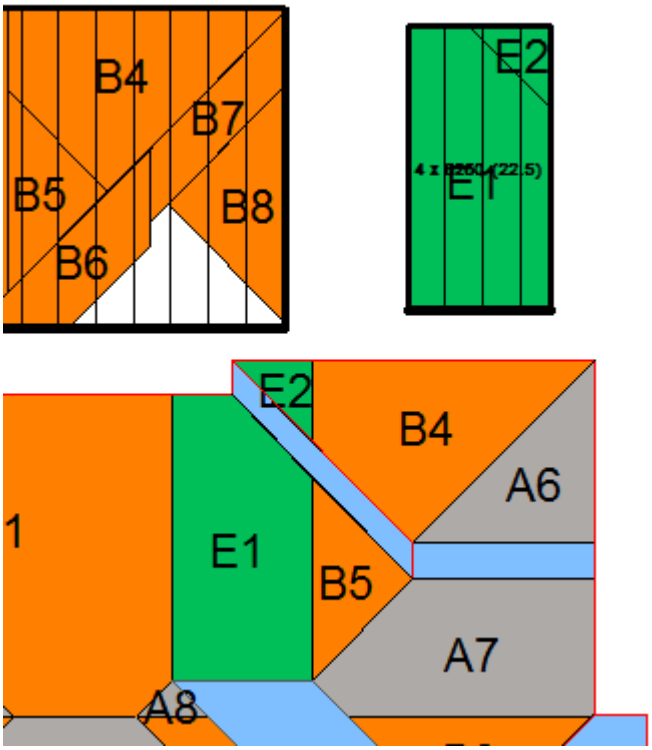
This is a function you will use a lot, so get used to it.



You can now assign the individual planes to the newly created block 'D'.

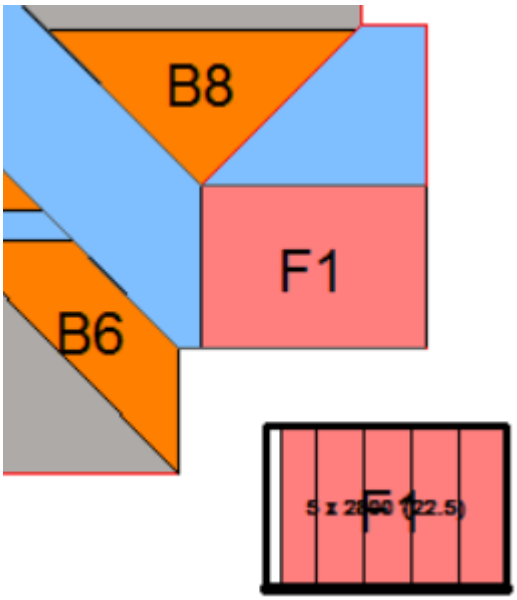


Define a new block to cover the area that will become block 'E'. Assign roof planes to that block.

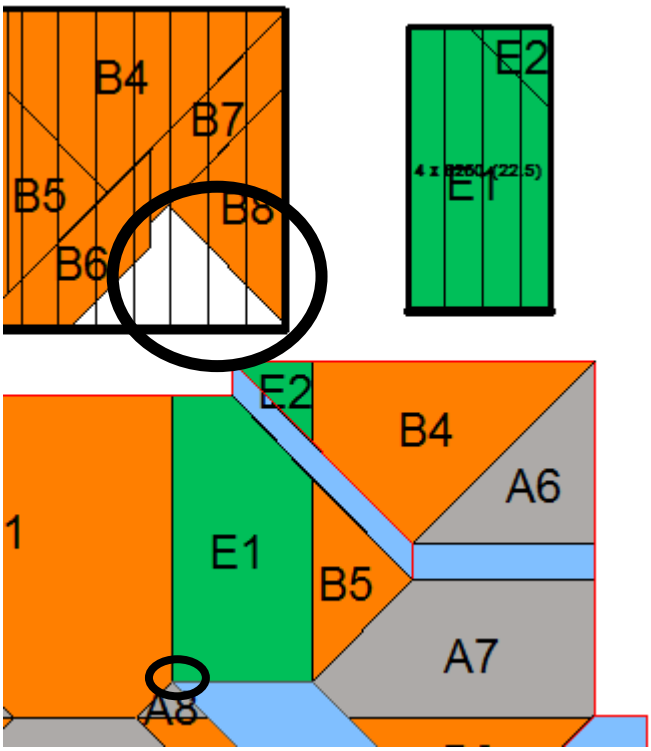


Your job is looking OK. Now the last few bits.

Define a new block around the gable end corner and place on the workplace, set the designation to ‘F’ and assign to our new block.



Filling in the Gaps



We can see from the block layout in block area ‘B’ that we can extract a triangle equivalent to three panel widths (our job has corrugated panel, 762mm cover).

So it will help utilise offcut material if we can get this from one of our plane areas, and an appropriate area is just below the area E1.

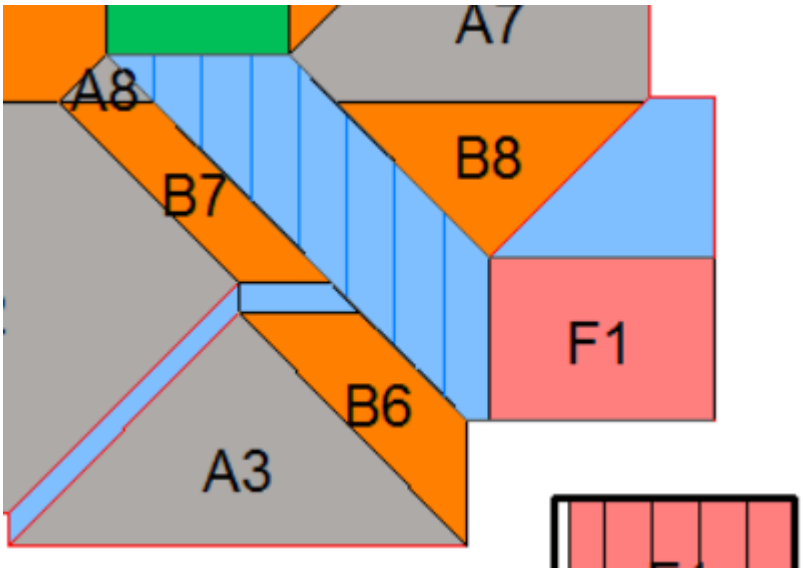
So let’s split this plane a multiple of three sheets (in our case 762mm).

Using the [**Split Plane Distance**] option, snap the first corner, then type **R762** in the Prompt area, and [Enter].

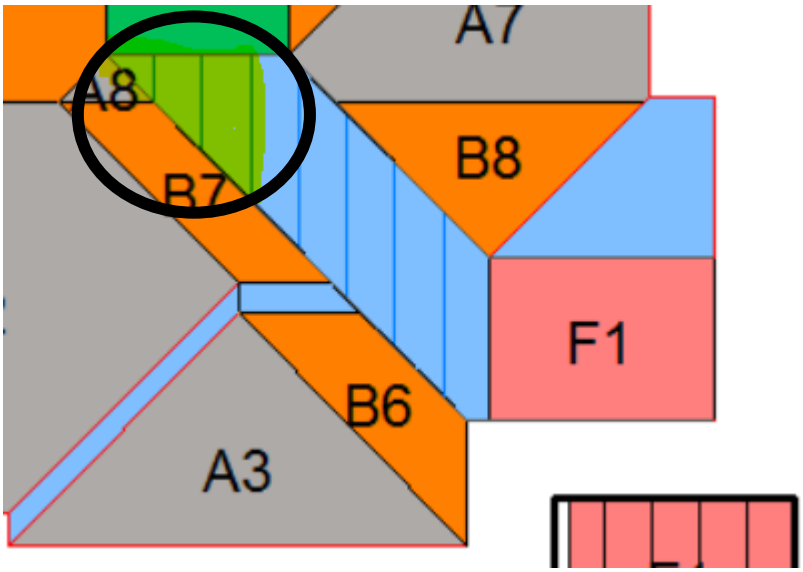
The split line is inserted.

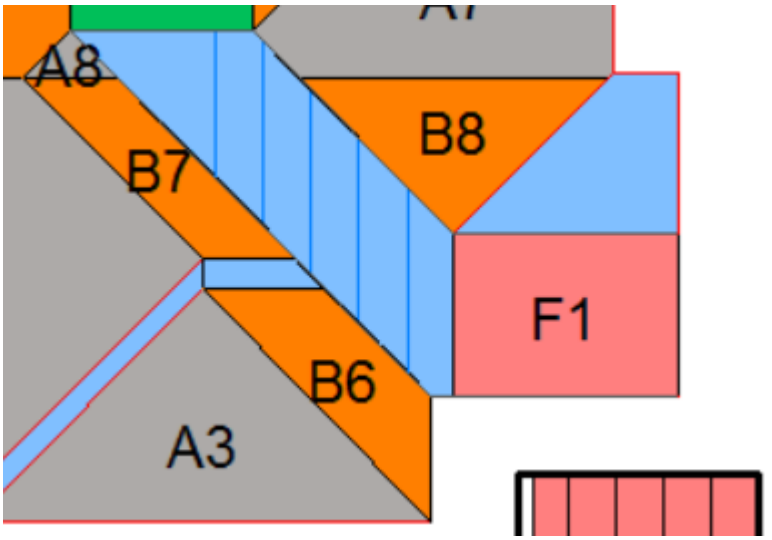
You will be then prompted to “**Split Repetitively**?” and the correct answer in this case is [**Yes**].

You will have the roof plane divided into sheet width areas as shown below.

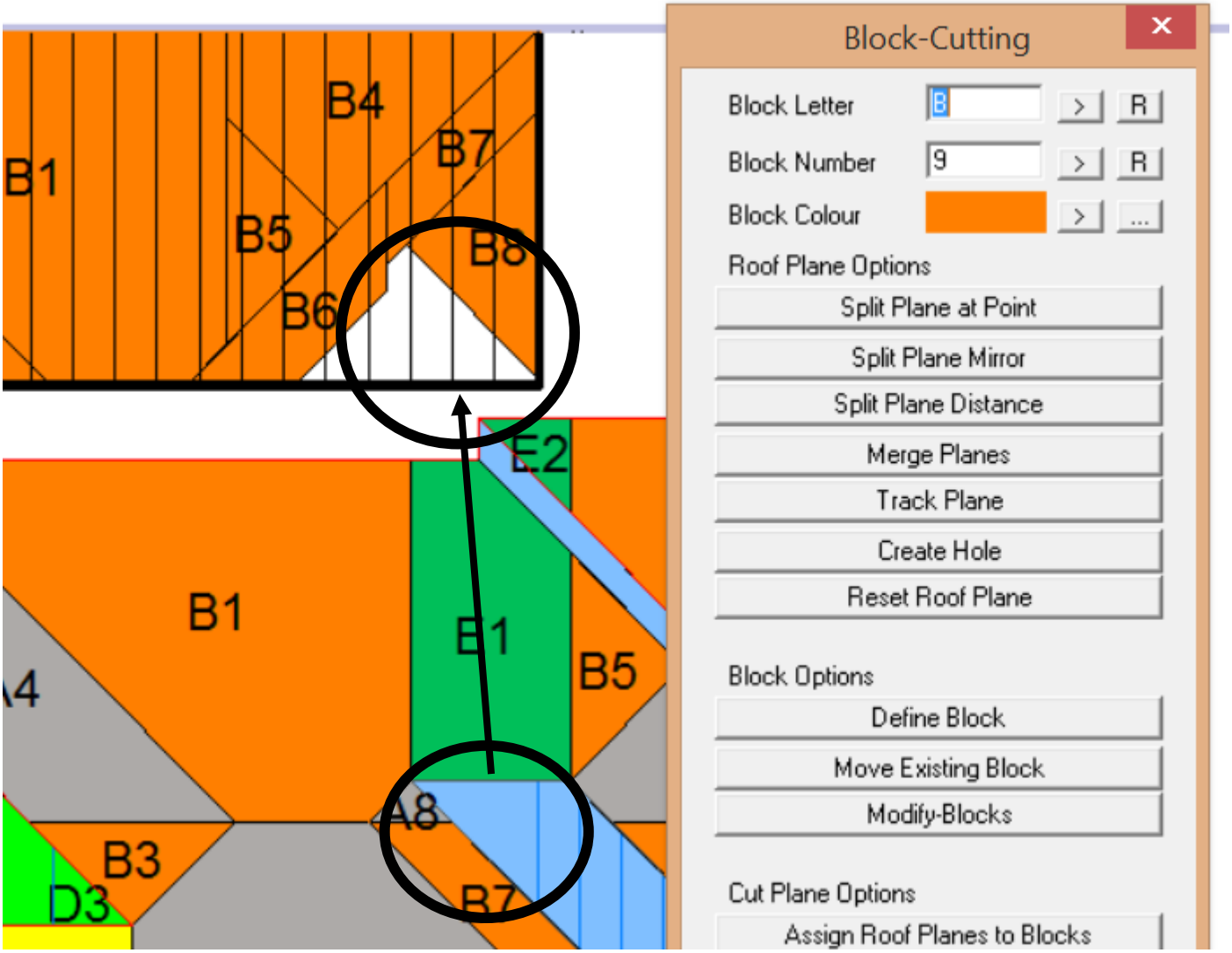


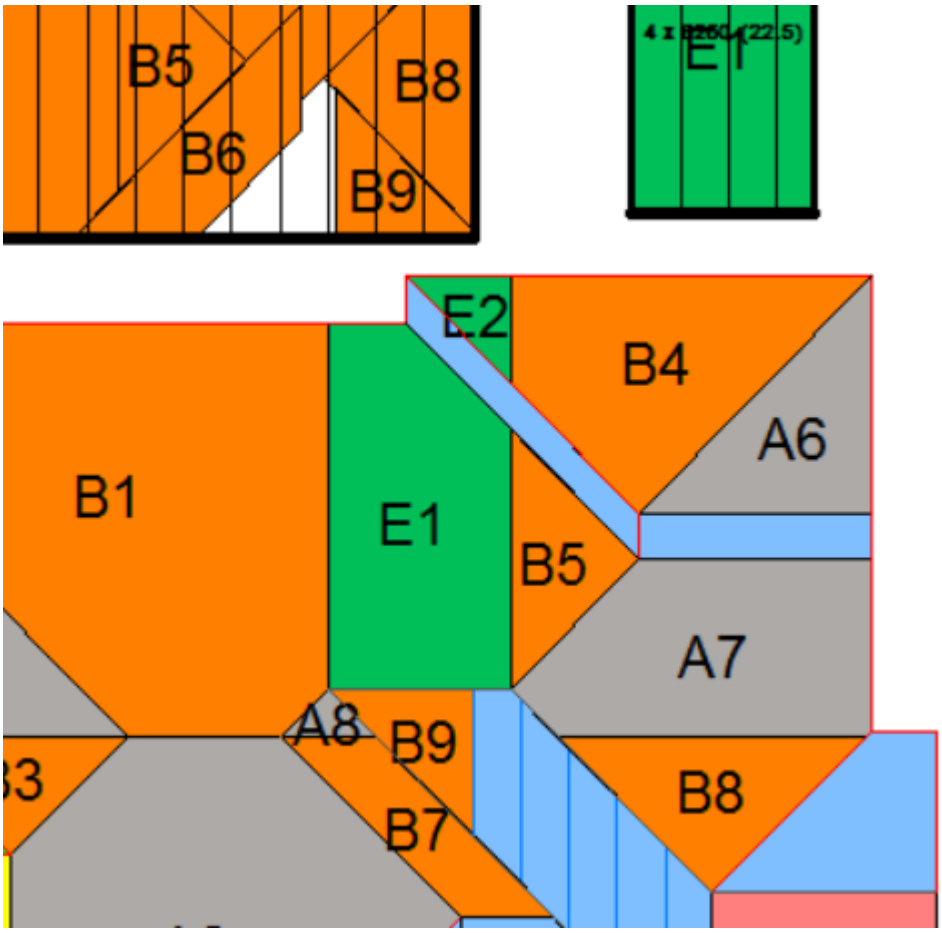
Now it is evident that the three sheets highlighted can be merged into a single triangle [**Merge Planes**] and assigned to our Block 'B'.





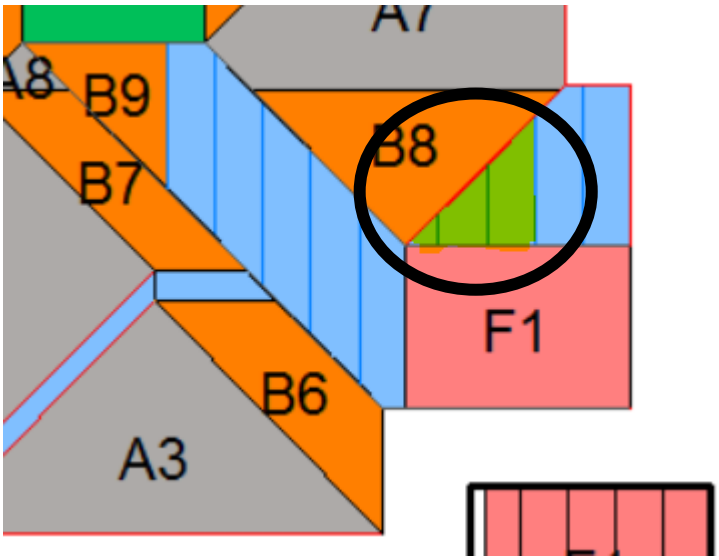
Check the settings for Block Letter and Block Number and the correct Block Colour, then assign that triangle to block 'B'.

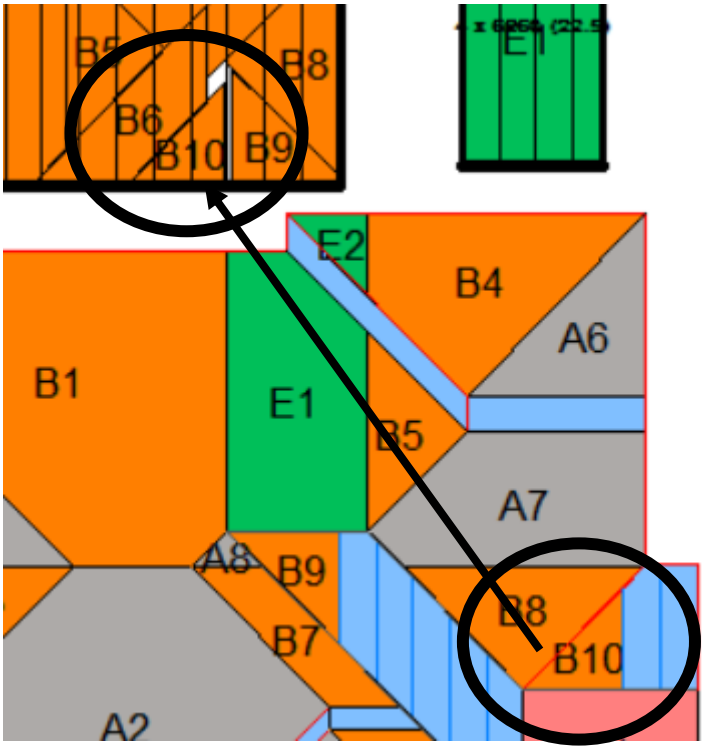




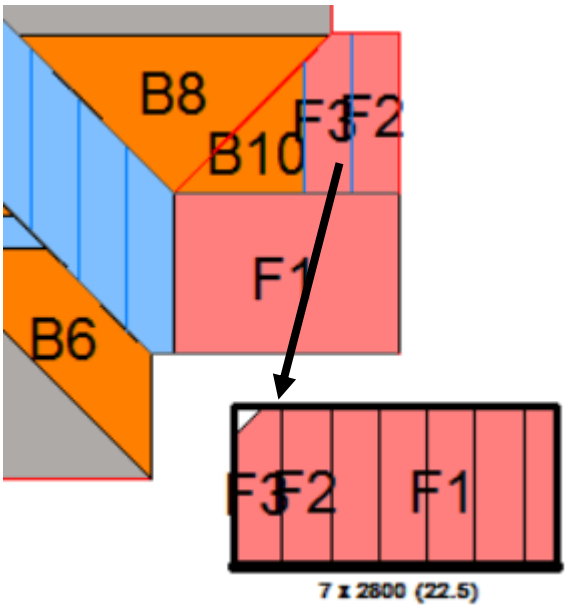
We might also do the same thing for the area just below B8, splitting into sheet widths. Make sure that you select the gable end to split from – you want full width sheets working from the gable back to the valley.

Merge the three smaller panels and assign them to block 'B'.

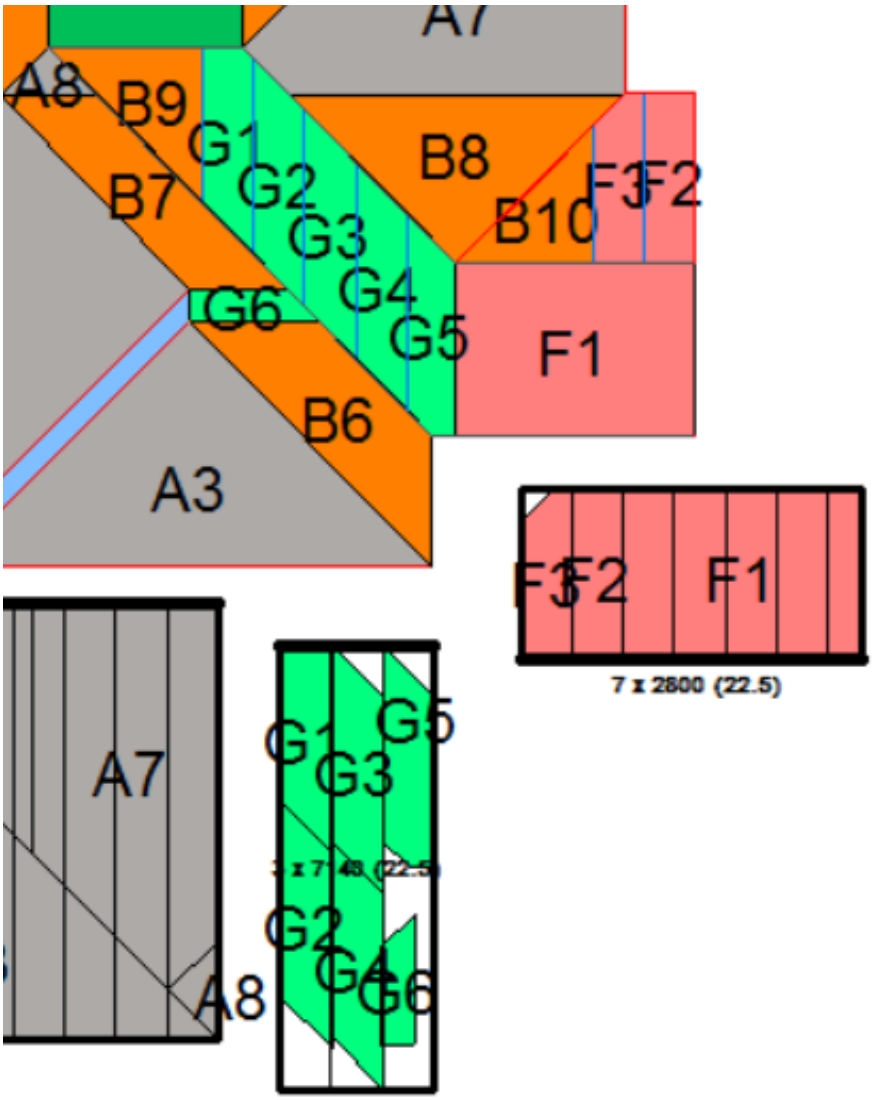




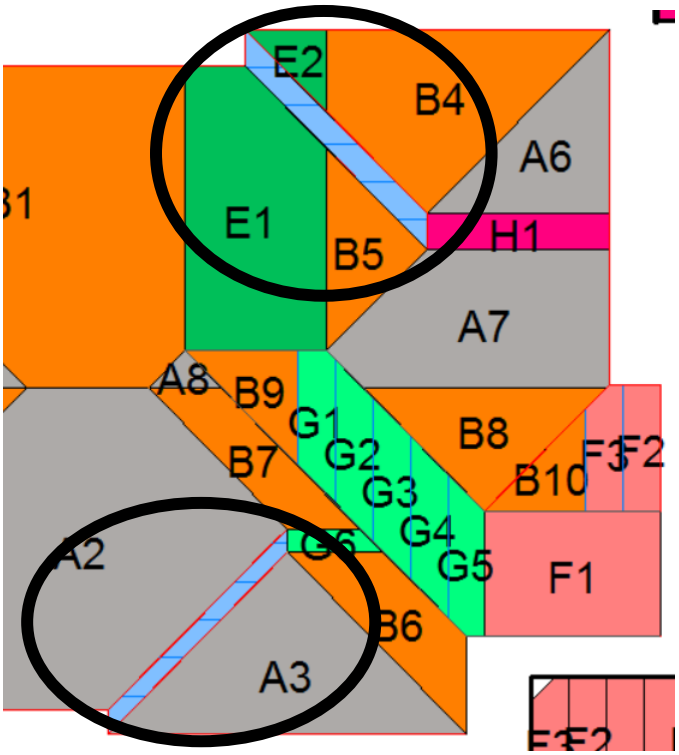
The Sheets next to B10 can go into the block we designated ‘F’, as they are the same length and we can extend the block edge to suit (**Modify-Blocks > Extend Edge**).

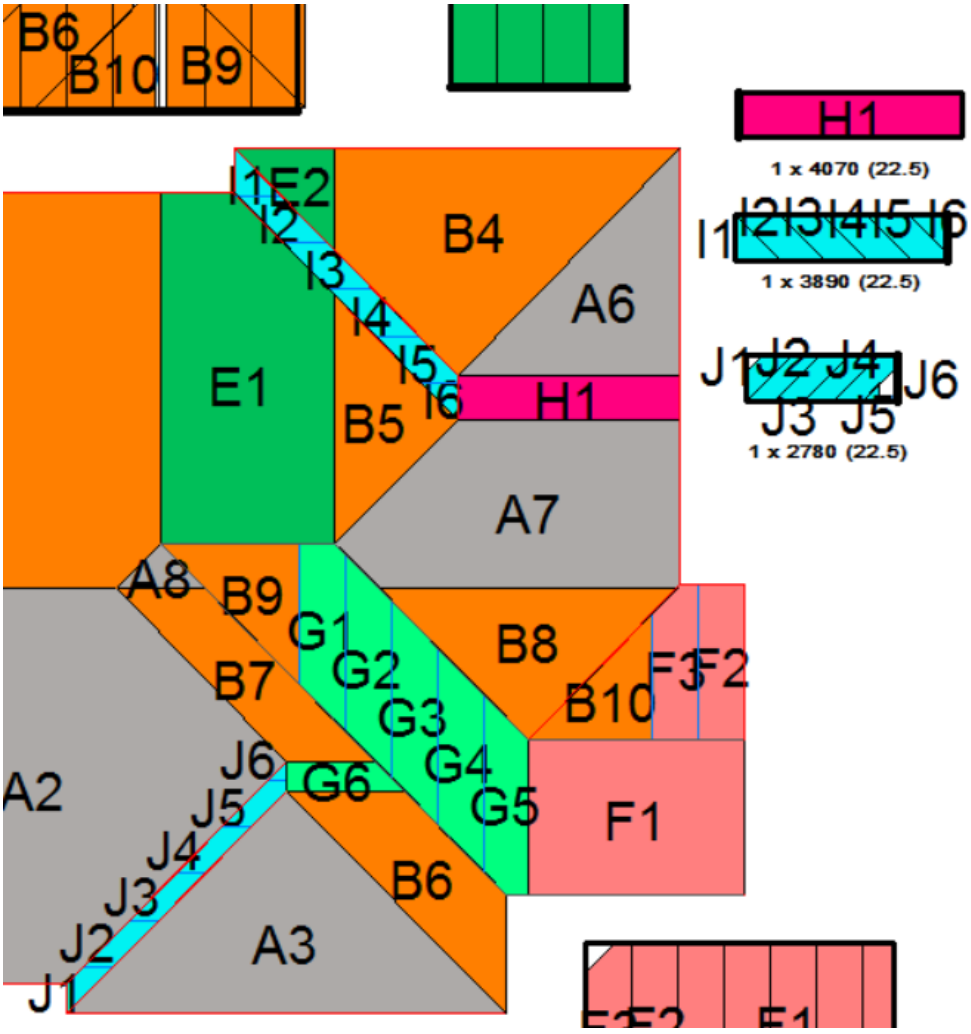


Now Define a block to assign the area that we will designate as ‘G’ and assign the sheets to it as shown below. You should be in the swing of it now and not detailed instructions.

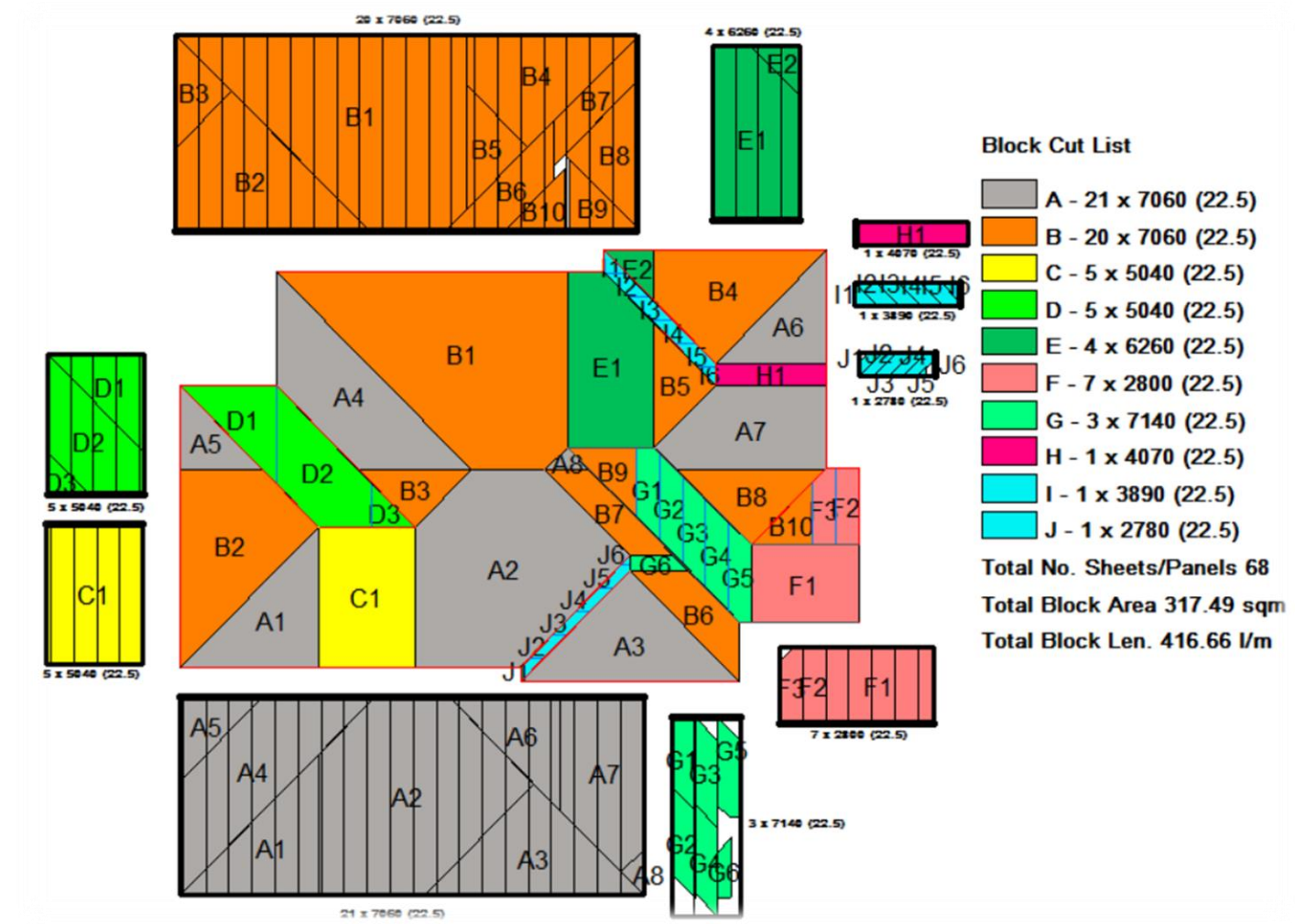


Split the remaining narrow areas into individual sheets and assign these to new blocks that you create.


E2
B4
A6
E1
H1
B5
A7
A8
B9
G1
B8
B7
G2
F3
F2
B10
G3
G4
G5
F1
B6
A3


B6
B10
B9
H1
1 x 4070 (22.5)
I1
1 x 3890 (22.5)
J1
J6
J3
J5
1 x 2780 (22.5)
E2
B4
A6
E1
H1
B5
A7
A8
B9
G1
B8
B7
G2
F3
F2
B10
G3
G4
G5
F1
J6
G6
J5
J4
J3
J2
J1
A2
B6
A3

The last thing to do is check that everything is accounted for as expected, checking that you have optimised this to the extent that you can, adjust if required, and then add the Cutting List Legend.



Generating the report for your installers is also quite simple – go to **Reporting > Print Drawings > Block-Cutting** and select the report to print.

Why do we do it?

Now remember that this is just like a **dress rehearsal** for the installation. It is quicker to mess with this, than have guys on site cutting the wrong sheets or trying to figure it out WITHOUT your roof map.

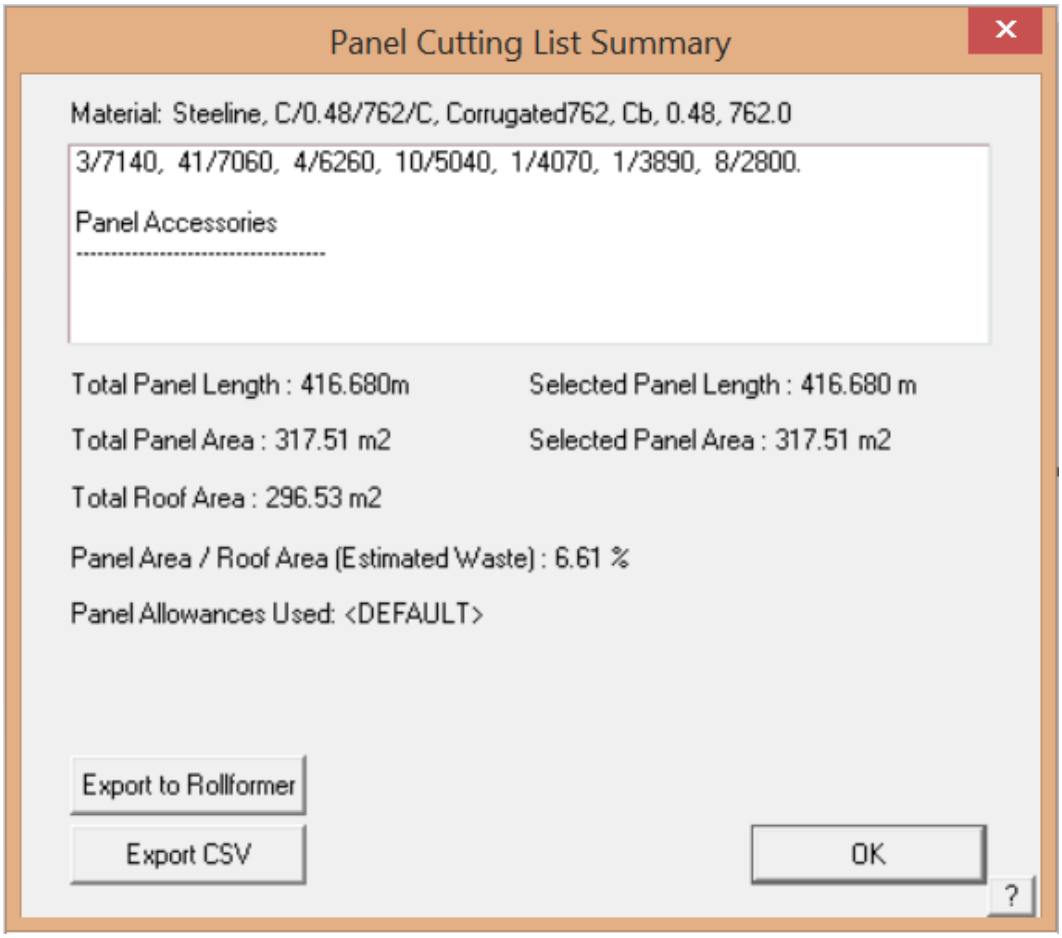
A few minutes here will save hours on site. As cranky as some of these roof shapes are, this is quicker and cheaper than mucking around AFTER the sheets have been ordered, delivered and cut.

Comparing the Options

AppliCad's Roof Wizard software has various options for calculating a sheet or panel cutting list. Blocking is most often used in Australia and New Zealand, but Block-Cut is rapidly catching on. The reason is the sheet placement 'map' so that the installers know where you want the sheets placed to reduce waste. It is appropriate to use these methods on sheets that have a wide cover, such as corrugated or Ag-Panel with a cover of 36" or 762mm where two offcuts is nearly a square metre of waste.

Block-Cut Output

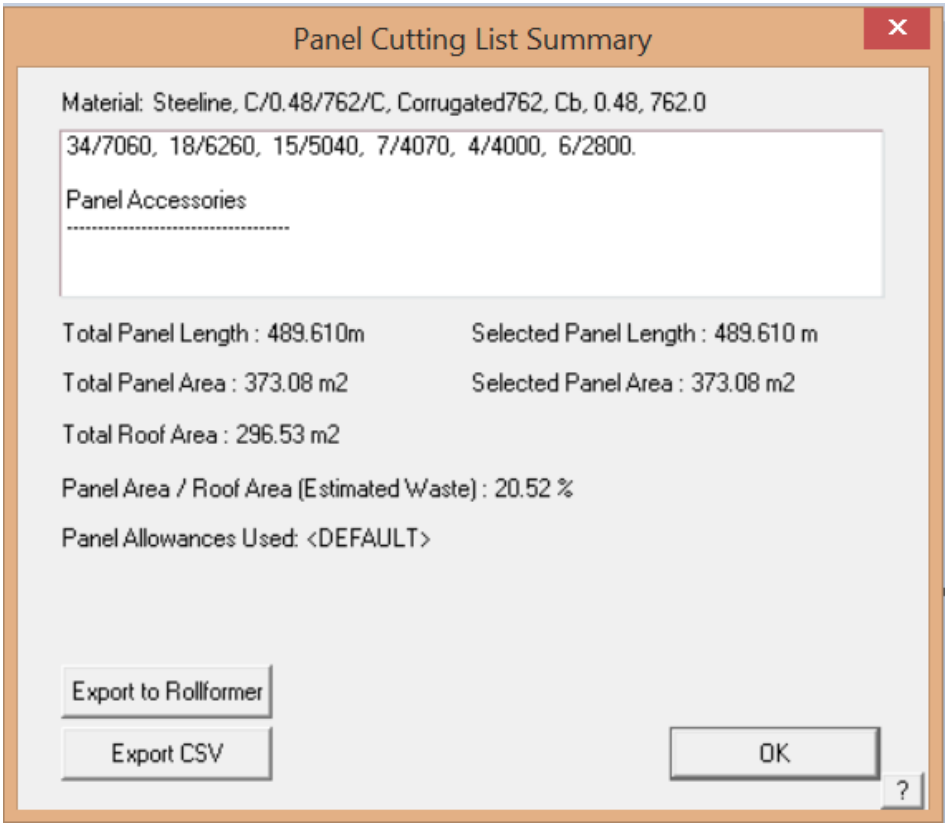
There is a very good reason to try to reduce how many offcuts stay on the ground and end up in landfill. For the job we have just completed, the calculated waste is just **6.61%.**



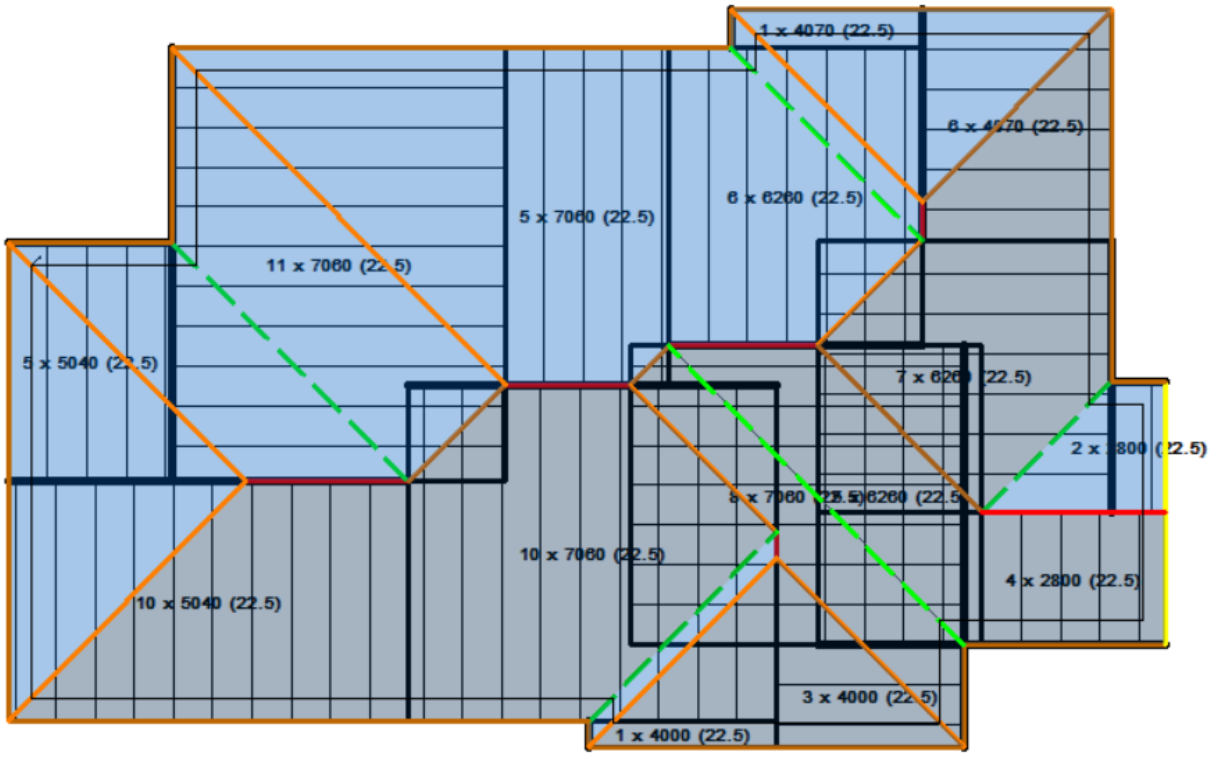
Using the standard **Auto-Block** routine which automatically assigns blocks to areas, would typically require quite a bit of manual adjustment of block areas, but without knowing how the installer will work, this is very hard to do and the result gives no clue to the installer, what you thought you would do.

It is clear that the Block-Cut method is way more informative for everyone involved.

Auto-Block Output

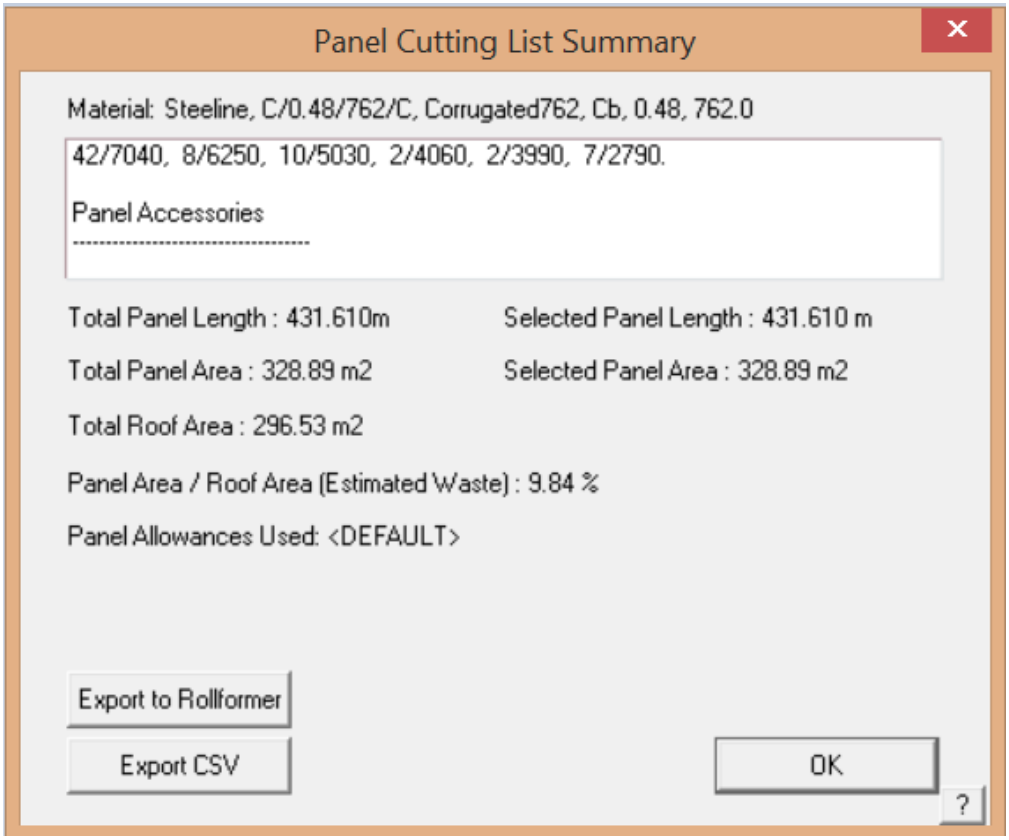


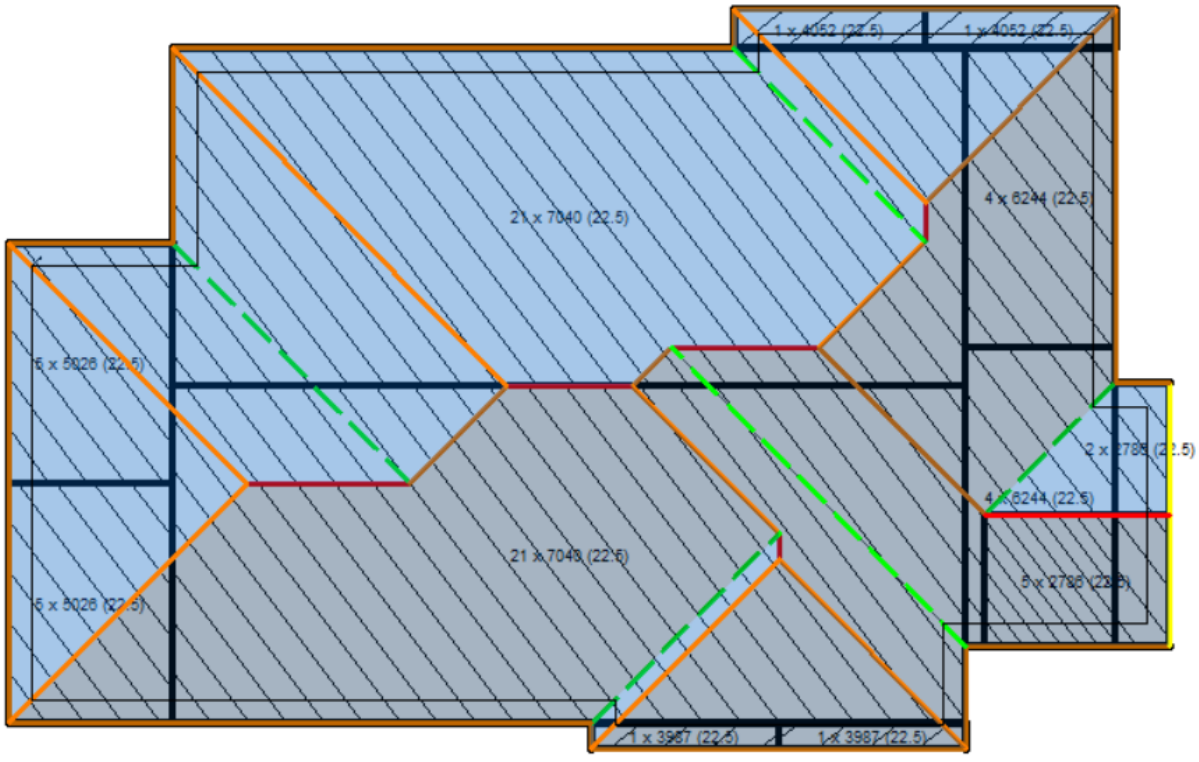
The Cutting List Summary shows **20.5% waste**, but closer inspection of the automatically generated layout does indicate areas that might be manually adjusted using the Modify-Block options. Many estimators don't bother however, simply accepting the automatic result.



AutoBlock2 Output

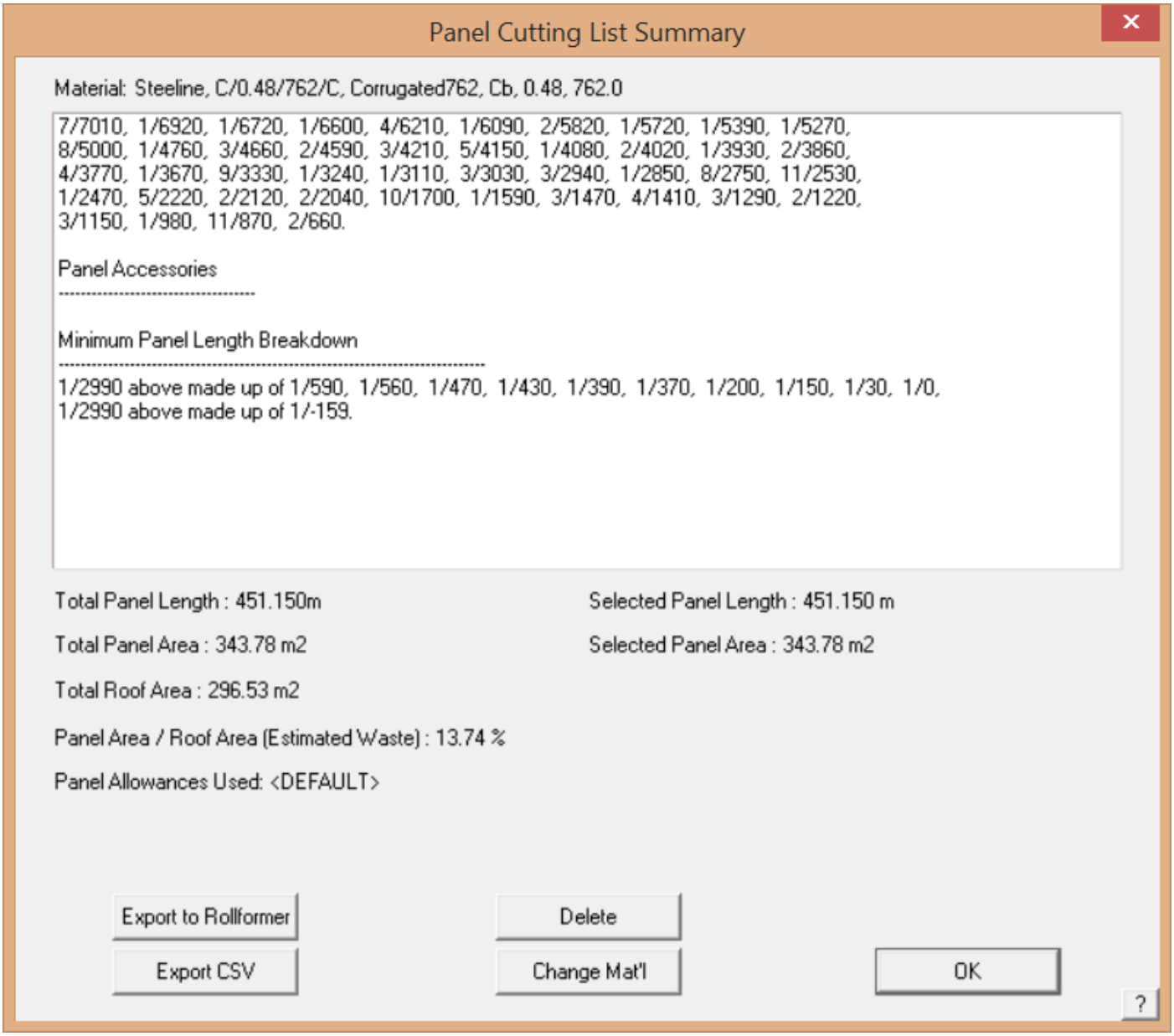
AutoBlock2 is a function that attempts to replicate the result of **Block-Cut**, but gives no indication where the cut and off-cut sheets are placed, relying entirely on the skill and experience of the installer. The resultant waste of **9.84%** is quite close to the interactive **Block-Cut** result.





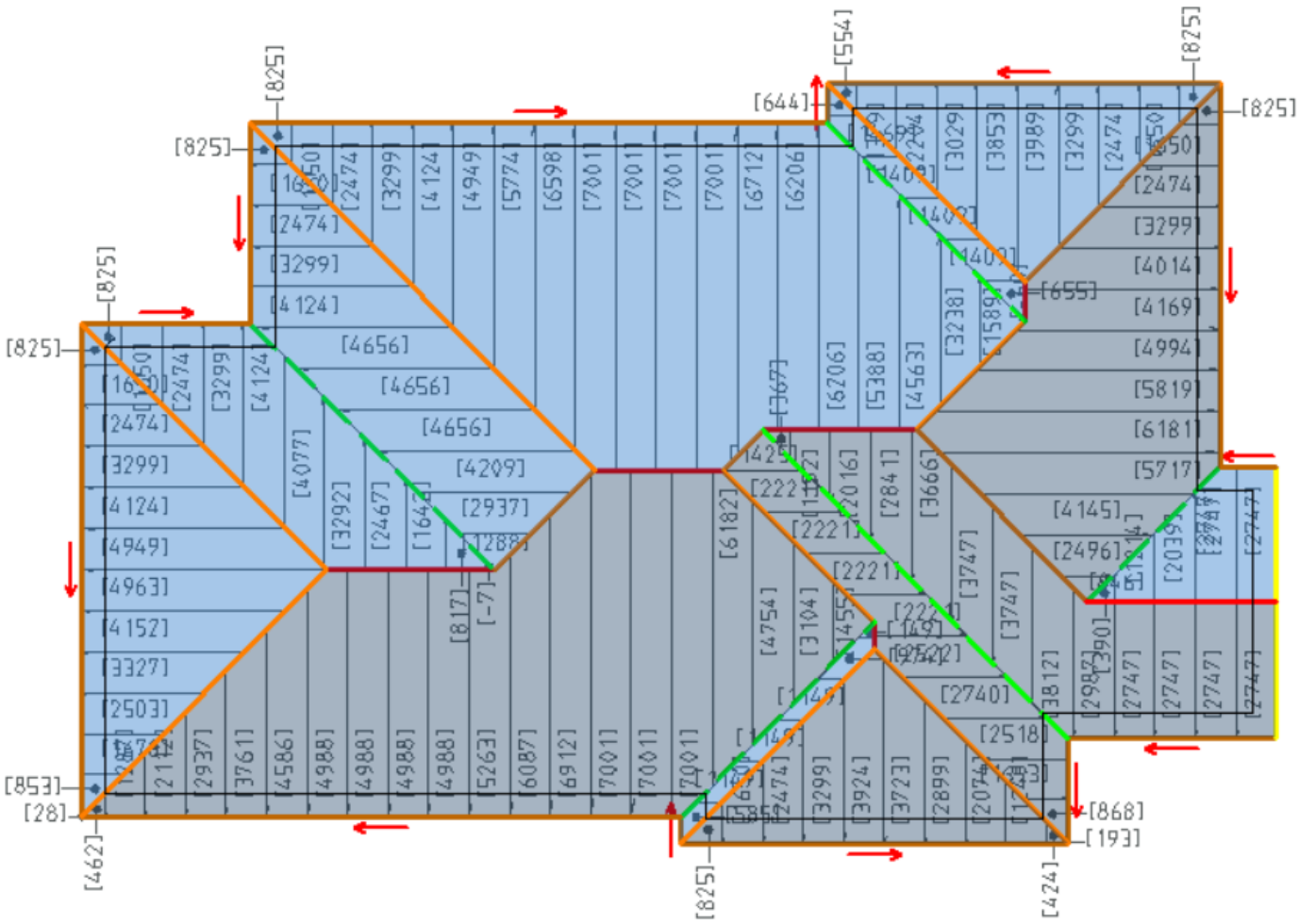
Gen-Panels Output

Generating individual panels (**Estimate > Gen-Panels**) is most often used in the USA and Africa for various reasons. The results look like this:



The **actual waste** as calculated by the software is **13.74%**. And the cutting list contains heaps of different sheet lengths, which may result in errors keying into the roll forming controller. Note that this utility is quite sophisticated and does merge short lengths into longer lengths, saving waste and reducing the number of sheets to cut and pack.

This doesn't suit everyone's production capability, but works well enough. It is controlled by parameters set up in the sheet/panel allowances settings.



So, what to do?

The best approach will be determined by what works for your business. If your installers understand the process of 'flip-flopping' sheets around a hip end then, it is well worth the investment in learning how to produce the Block-Cut roof map and using the **Block-Cut** tool kit.

If the roof geometry is simple, then either Auto-Block or Block-Cut will work for you, and reduce offcut waste.

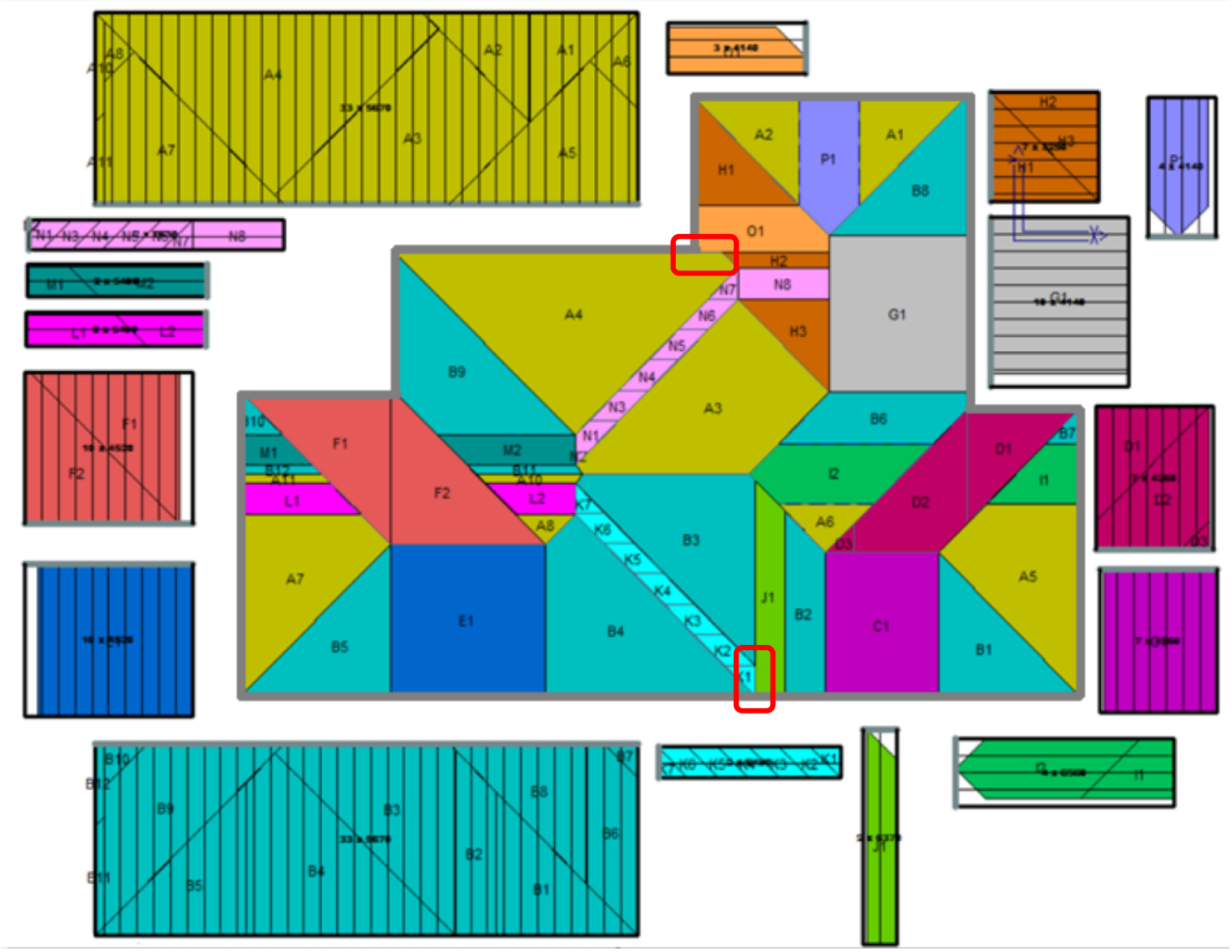
If your installers don't or can't do that, then you will use the **Gen-Panels** process.

Comparing the Output Options

Est. Method	Roof Area m2	Panel Area m2	Total Panel Length lm	Waste %
AutoBlock	296	373	489	20.5
AutoBlock2	296	328	431	9.8
Gen-Panels	296	343	451	13.7
Block-Cut	296	317	416	6.6

So Block-Cut delivers waste savings up to ~14%, a 'roof map' for your installers and a chance to easily explore the most cost effective way to install the roof panels – **saving time and money, and reducing errors** during installation. It really is a dress rehearsal for the installation.

Looking at other examples will assist you figure out how to handle variations in roof geometry. The job below has a raised area with two barge lines – (highlighted) adding to the complexity for applying the Block-Cutting rules.



Even with this complication, the waste factor is still around 6%.