BuildMath

Bevel Back Cladding

One worked example, with the maths behind each result - follow it in the app and check it by hand.

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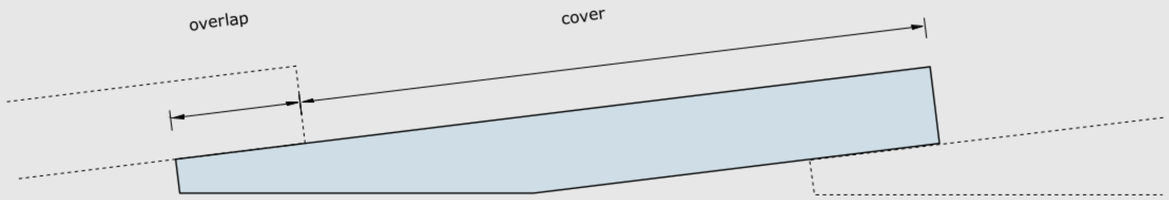
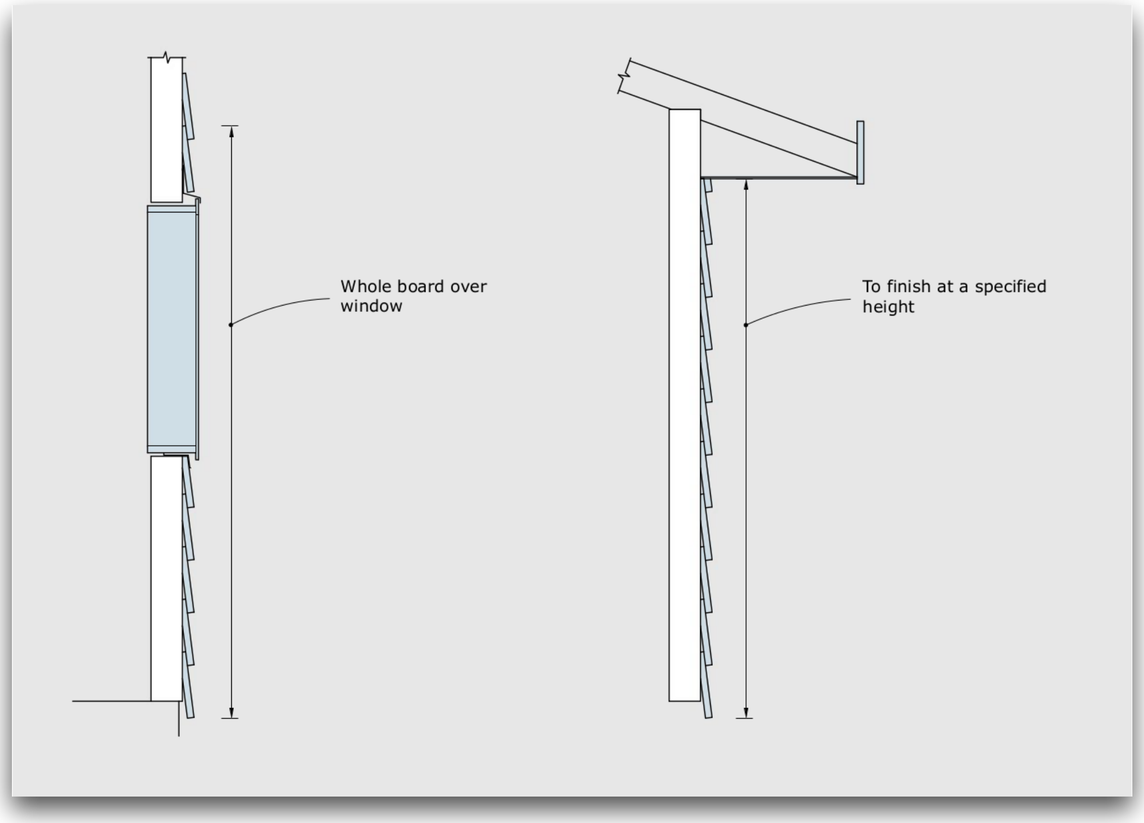


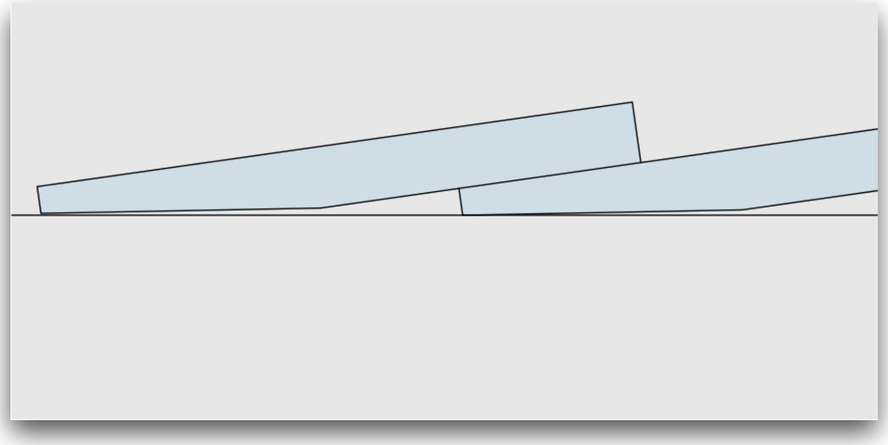
Bevel Back Cladding gives a running markout for bevel back weatherboards, fitted to a height or at a fixed cover, and the cuts and lengths up to a gable or over a roof.

The boards lean out from the wall, so the cover on the board is not the spacing on the wall.

Board angle = $\tan^{-1}$(thickness ÷ cover)
Wall spacing = cover ÷ cos(board angle)

Note:
For a running list at a fixed spacing that you already know, use Create a Sequence.





Fit to a given height

Most windows and doors have their tops at the same height, so set the spacing to get a whole board over them - or finish at a set height with a workable board.

We can’t make the overlap any smaller than the manufacturer specifies.
So to adjust the spacing we need to increase the overlap slightly.

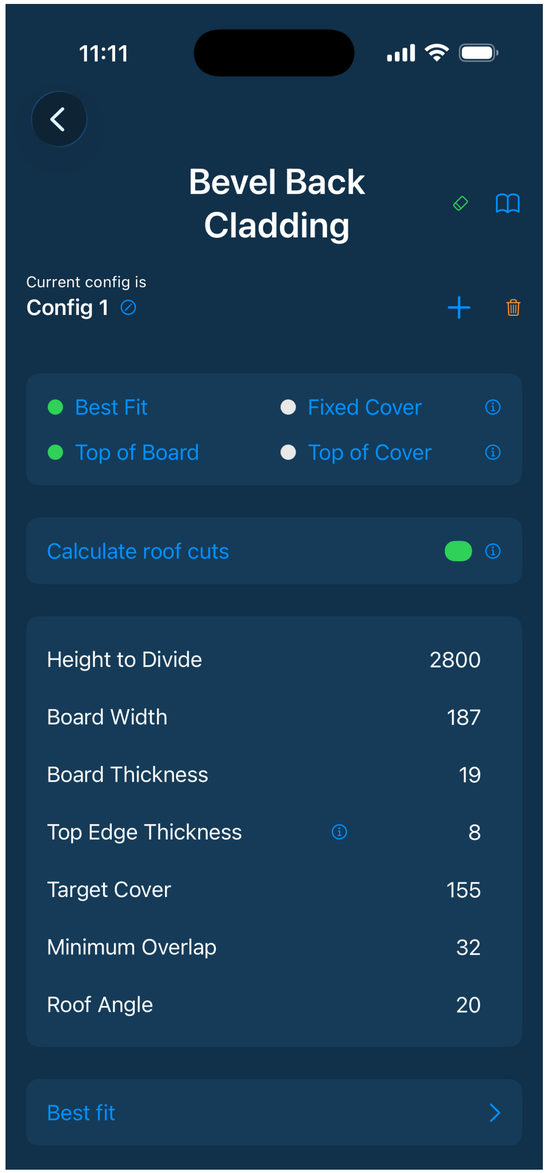
There are limitations to how much a bevel back board can be closed up.
The detail at left shows a board where the overlap has been increased by 25mm.

The back is lifting off the framing and the fixing nail that should penetrate the top board just above the top of the board below, would be too high up the board to be effective in preventing cupping.

This is an extreme case as you would probably want to buy a smaller board at this point.

Moving up to 15mm in most cases is enough to obtain a suitable set out and the rotation off the framing will be negligible.

Inputs



Choose a mode

Best Fit - divides a fixed height. Top of Board or Top of Cover.

Fixed Cover - keeps the cover and counts the boards. On wall or On board.

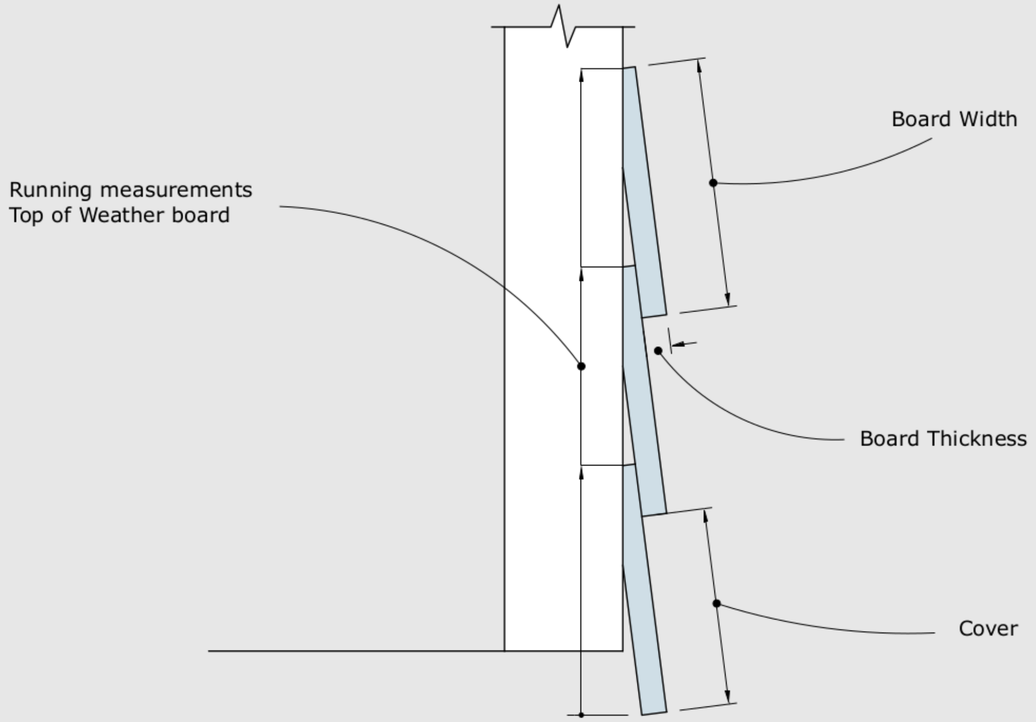
Turn on Calculate roof cuts for boards up to a gable or over a roof.

Enter the values

Height to Divide	2800 - bottom of the first board to the top.
Board Width	187 - the whole board, not the cover.
Board Thickness	19 - the thick edge.
Top Edge Thickness	8 - optional. Shows the cladding thickness.
Target Cover	155 - adjusted to fit.
Minimum Overlap	32 - the manufacturer's minimum.
Roof Angle	20 - shown with Calculate roof cuts.

The next page shows why the wall spacing is different from the cover.

Entering values, saving configs and projects: see Build Math - the basics.



Mark the wall from one list of running measurements.
Measuring board to board adds up the errors.

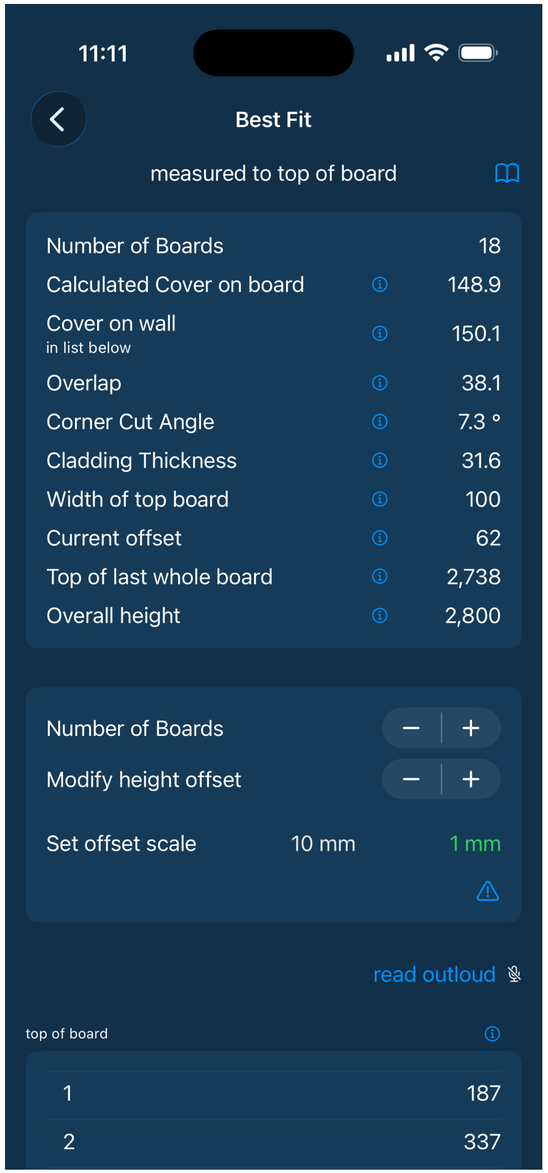
The cover is measured on the board, which leans out from the wall. The list is measured up the wall.

With a cover of 155 and a 19 board:

Board angle	$\tan^{-1}(19 \div 155) = 7.0°$
Wall spacing	$155 \div \cos(7.0°) = 156.2$

The first mark is the top of the first board, then add the wall spacing for each board. Making that list by hand is slow - it's what this calculator does.

Best Fit - Top of Board



The height is divided to the top of the last whole board. The overlap goes on top of that.

Number of Boards	18 - 17 boards gives an overlap of 24.8, under the 32 minimum, so add one.
Cover on wall	(2800 – 186.9) ÷ 17 = 153.7 - the spacing in the list.
Corner Cut Angle	$\sin^{-1}(19 \div 153.7) = 7.1°$
Calculated Cover on board	$153.7 \times \cos(7.1°) = 152.5$
Overlap	187 – 152.5 = 34.5
Cladding Thickness	$8 \times \cos(7.1°) + 187 \times \sin(7.1°) = 7.9 + 23.1 = 31.1$ - out from the wall.
Width of top board	34.5 - just the lap.
Top of last whole board	2800
Overall height	2800

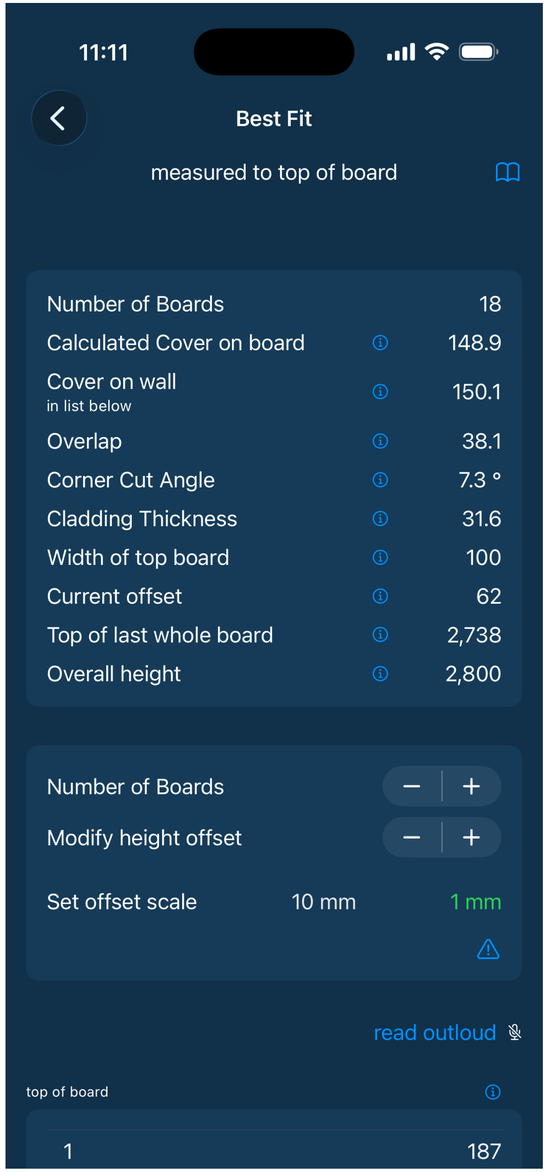
Top of board list	
board 1	$187 \times \cos(7.1°) + (19 – 8) \times \sin(7.1°) = 185.6 + 1.4 = 187$ - the top of the first board.
then + 153.7 each	341, 494, 648 … 2800

Corner Cut Angle is the board's angle off the wall - the cut where boards meet at a 90° corner. Wraps, flashings and tapes at the corner can change it a little.

The next page shows how to change the result.

Read the list out loud: see Build Math - the basics.

Modify



Number of Boards

Change the number of boards with + and –. You'll get an alert if the overlap goes under the minimum, or more than 15 over it. Tap ⚠ to override the alert and see it anyway.

Modify height offset

Makes the top board bigger, so the last whole board finishes lower. Use it to get a whole board over the windows, or a workable board at the top.

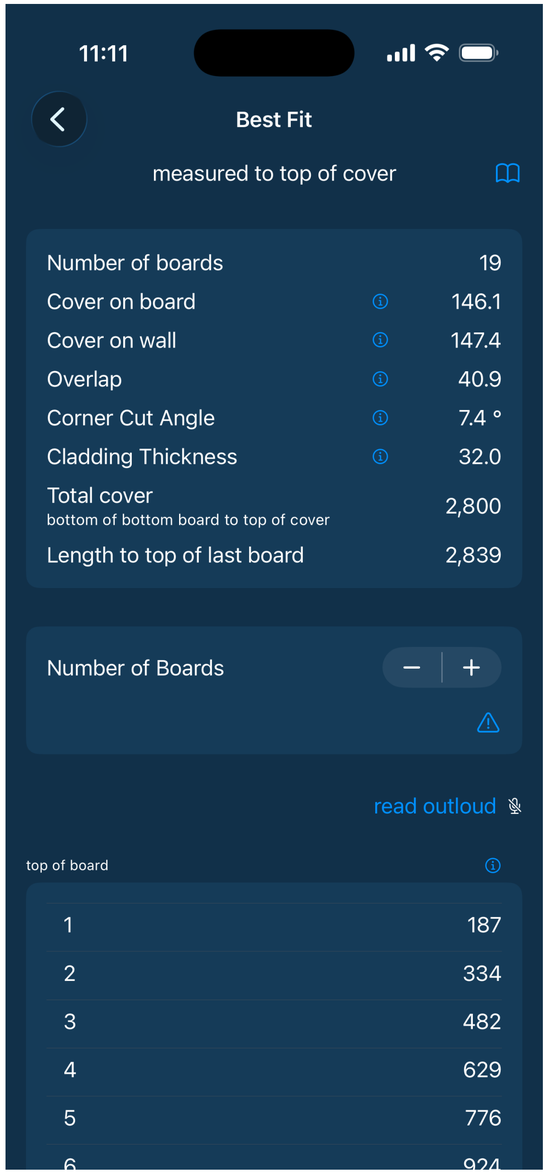
Example: offset 62

Top of last whole board	2800 – 62 = 2738
Cover on wall	(2738 – 186.9) ÷ 17 = 150.1
Overlap	38.1
Width of top board	38.1 + 62 = 100

Set offset scale - 10 mm or 1 mm a tap. The one in use is green.

Limitations: see Fit to a given height, Page 3.

Best Fit - Top of Cover



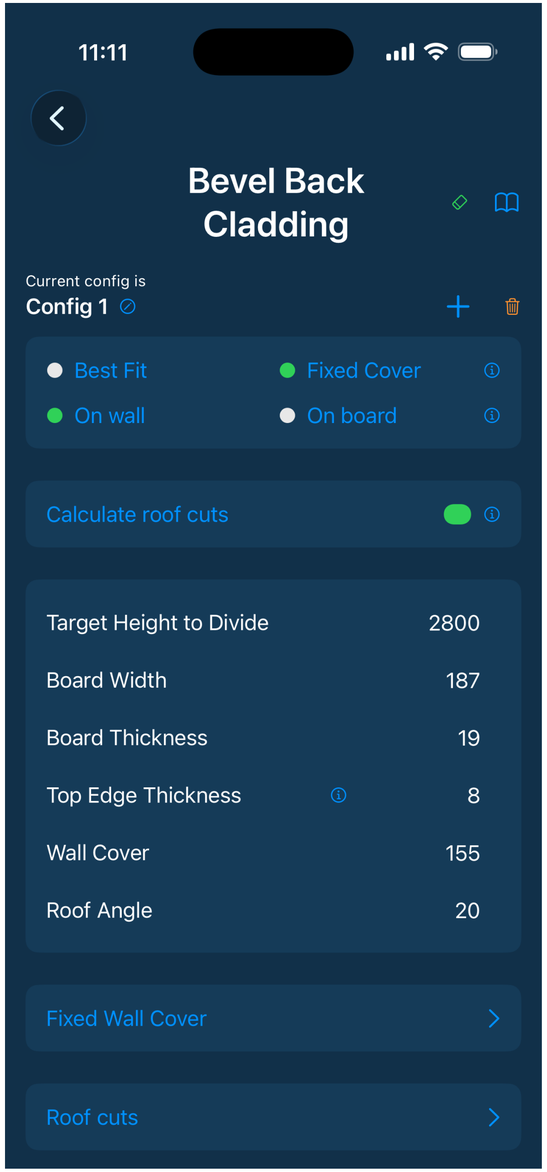
The height is divided to the top of the cover. The lap is cut off the top board, or goes under a board above.

Number of boards	2800 ÷ 155 = 18.1, rounded up to 19
Cover on wall	2800 ÷ 19 = 147.4
Corner Cut Angle	$\sin^{-1}(19 \div 147.4) = 7.4°$
Cover on board	$147.4 \times \cos(7.4°) = 146.1$
Overlap	187 – 146.1 = 40.9
Total cover	19 × 147.4 = 2800
Length to top of last board	2839 - the top board's lap above the 2800.

Top of board list 187, 334, 482 … 2839

There's no height offset here - the top is fixed at 2800. Use Top of Board to change the top board.

Fixed Cover



The cover stays as entered and the app counts the boards to reach the height.

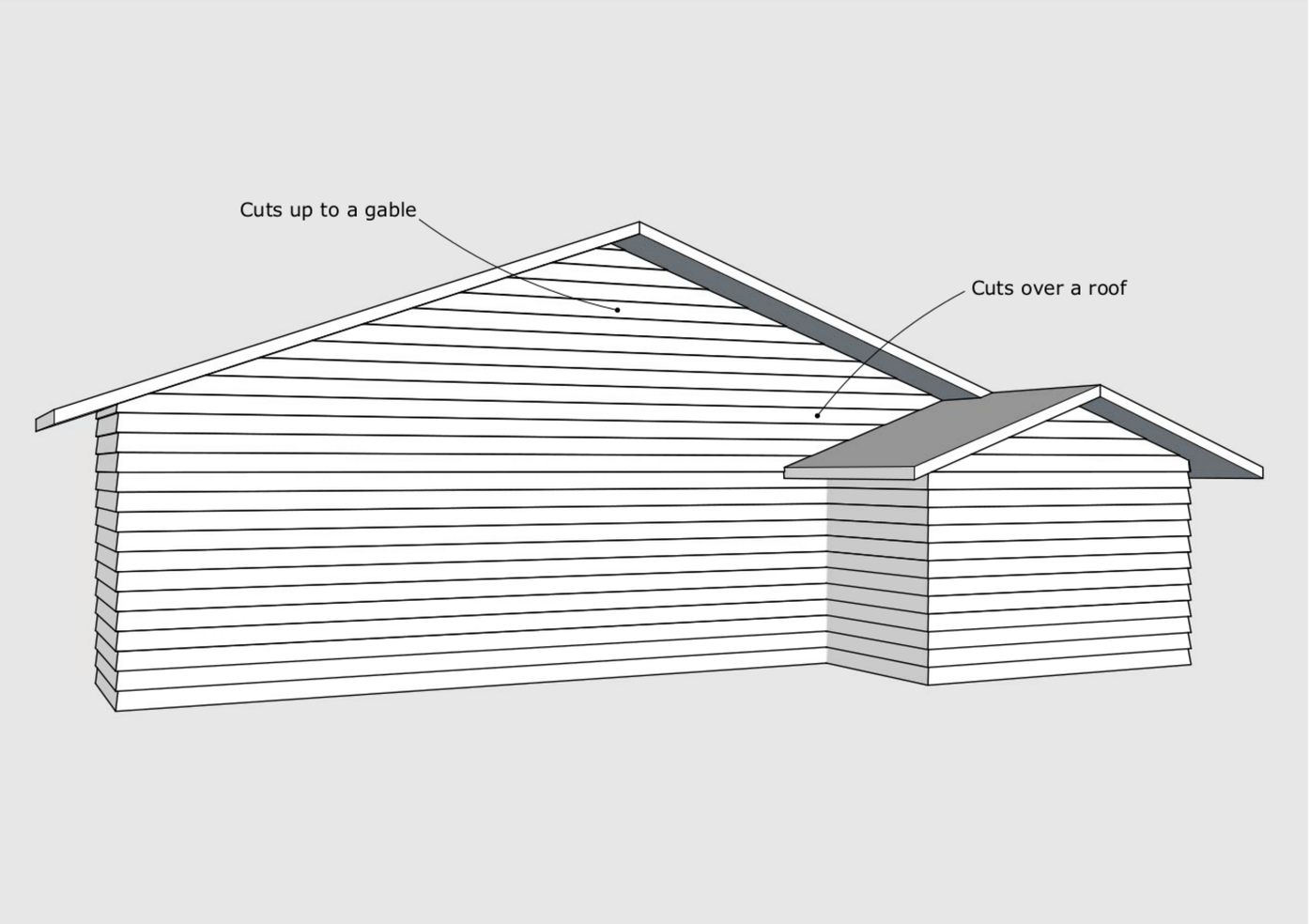
On board -	155 is the cover on the board (the manufacturer's cover).
Cover on wall	155 ÷ cos(7.0°) = 156.2 - board angle $\tan^{-1}(19 \div 155) = 7.0°$
Number of boards	18 - the last board passes 2800.
Top of board list	187, 343, 499 … 2842

On wall - 155 is the spacing on the wall.

Corner Cut Angle	$\sin^{-1}(19 \div 155) = 7.0°$
Cover on board	155 × cos(7.0°) = 153.8
Number of boards	18
Top of board list	187, 342, 497 … 2822

Change the number of boards with + and –.

Roof Cuts



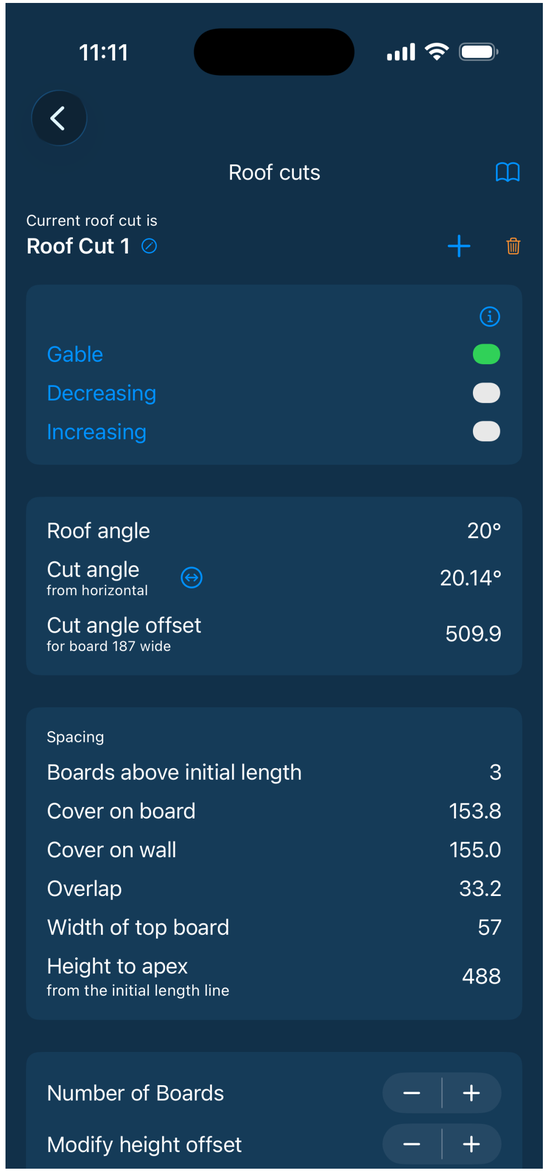
Turn on Calculate roof cuts and tap Roof cuts on the main screen.

The board leans out from the wall, so the cut up to a slope isn't the roof angle. The angle on the face is slightly steeper, and each board is a bit shorter than the one below.

Modes
Gable - cut both ends, getting shorter to the apex.
Decreasing - cut one end, getting shorter.
Increasing - cut one end, getting longer. Choose the number of boards.

The next pages work through a gable, then the Ascending and Descending work flow.

Roof Cuts screen



Roof angle	20°
Cut angle	from horizontal 20.14° - $\tan^{-1}(\tan(20°) \div \cos(7.1°))$. Tap the button by Cut angle for the angle from vertical (69.86°).
Cut angle offset	$187 \times \cos(7.1°) \div \tan(20°) = 509.8$ - mark it along the bottom edge.

Initial length	2684 - on the wall, along the top of the first board that meets the slope.
Width of board top edge	8 - the same as Top Edge Thickness.

Spacing - from the initial length line

Height to apex	$2684 \div 2 \times \tan(20°) = 488$ - from the initial length line.
Boards above initial length	3 - 488 ÷ 153.7 = 3.2
Cover on board	152.5 - the wall spacing carried up.
Cover on wall	153.7
Overlap	34.5
Width of top board	$34.5 + (488.4 - 3 \times 153.7) = 34.5 + 27.3 = 62$ - what's left at the apex.

If the top board is too small or too big, change the Number of Boards or Modify height offset, the same as on the Best Fit screen. The spacing above the initial length line changes. Reset to wall spacing takes it back.
Example: offset +10 → cover on wall 150.4, overlap 37.8, top board 75.

Increasing always uses the wall spacing.

The next page has the lists.



Wall marks list - on the top edge of the board, height from the initial length line

Each board is 2 × 153.7 ÷ tan(20°) = 844.6 shorter (both ends).

board 1 height	0	2684
board 2 height	154	2684 – 844.6 = 1839
board 3 height	307	995
board 4 height	461	150

Cutting list - bottom of board, front face

Add the two cut angle offsets, less a small allowance for the top edge:

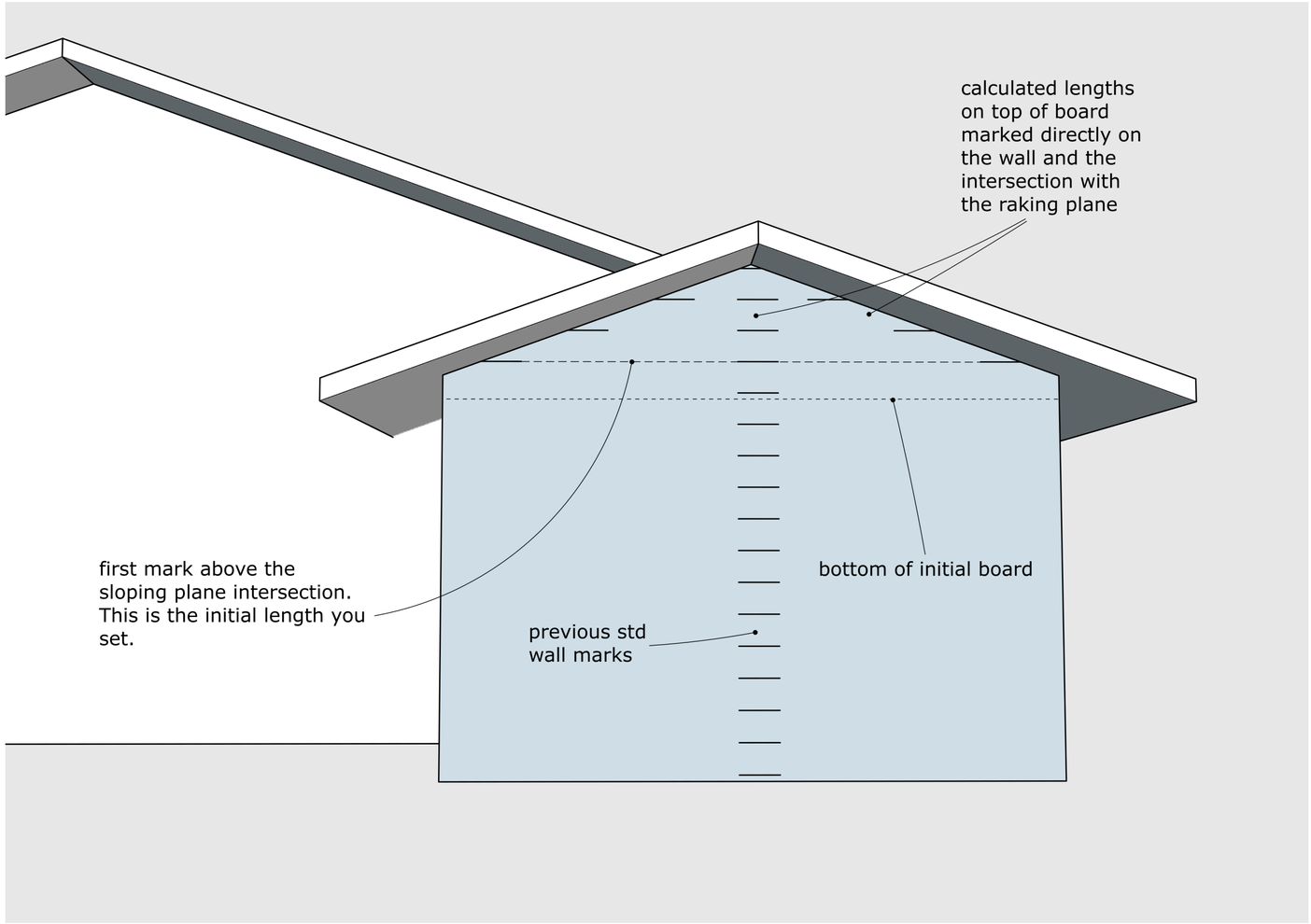
2 × (509.8 – 2.7) = 1014.2

board 1	2684 + 1014.2 = 3698
board 2	2854
board 3	2009
board 4	1164
board 5	320 - the top board at the apex.

Decreasing and Increasing have Set an offset - extra length on the cut end, e.g. the cladding depth (31) to mitre a corner.

Use the wall marks list to check the angle - see the next page.

A Gable Work Flow



The building won't be perfect - the more accurate the walls, slope and measurements, the better the result. Use a laser for level.

Setout

The wall spacing has usually been set by windows and doors. If the gable ends up with a tiny top board, change it on the Roof Cuts screen (Number of Boards or Modify height offset).

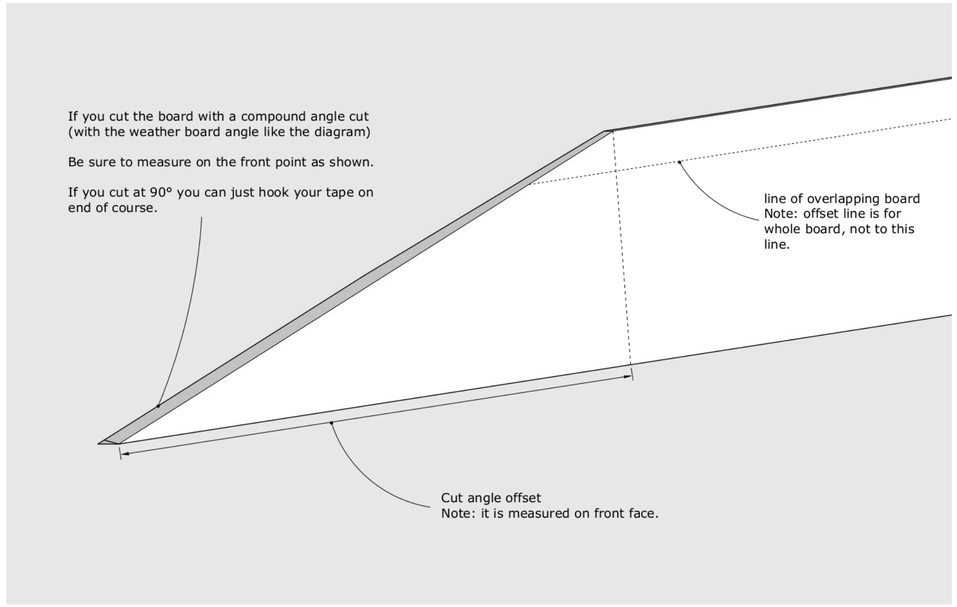
Initial length

Carry the wall marks up and out to the slope. Measure the first mark above the start of the slope, on the wall, end to end. Enter it as the Initial length. The board below it is in the cutting list - trim its ends to the corners.

Check the angle

Open the wall marks list and check the lengths on the wall at the given heights. If they don't match, open adjust roof angle and step the angle until they do (0.1° or 0.01° a tap - the one in use is green).

If the two sides of a gable are different angles, make two configs - one Decreasing each side - with the initial length measured from the centre, and add the two together.



Cutting List and Angle Offset

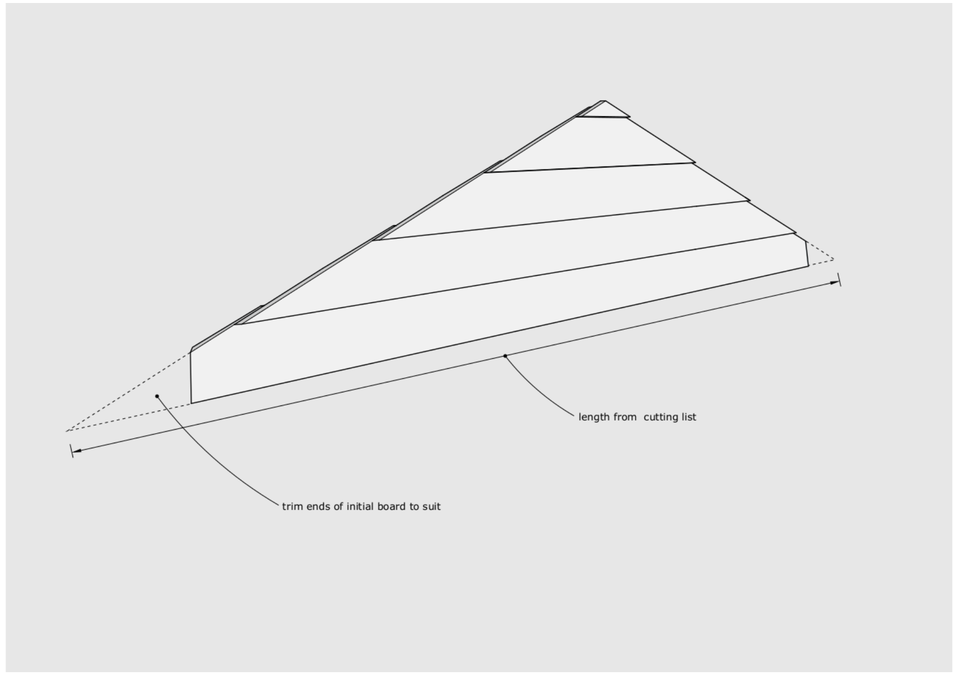
The cutting list is the length along the bottom edge, on the front face.
Cut with the board's angle (whole face on the slope): measure from the front point on the face.
Cut square to the face: it's the long point of the cut.

Angle offset

Mark the cut angle with the offset instead of a bevel. Measure 509.8 along the bottom edge, square up, and draw from your start point to the square mark.

The board must be the Board Width you entered (important!).

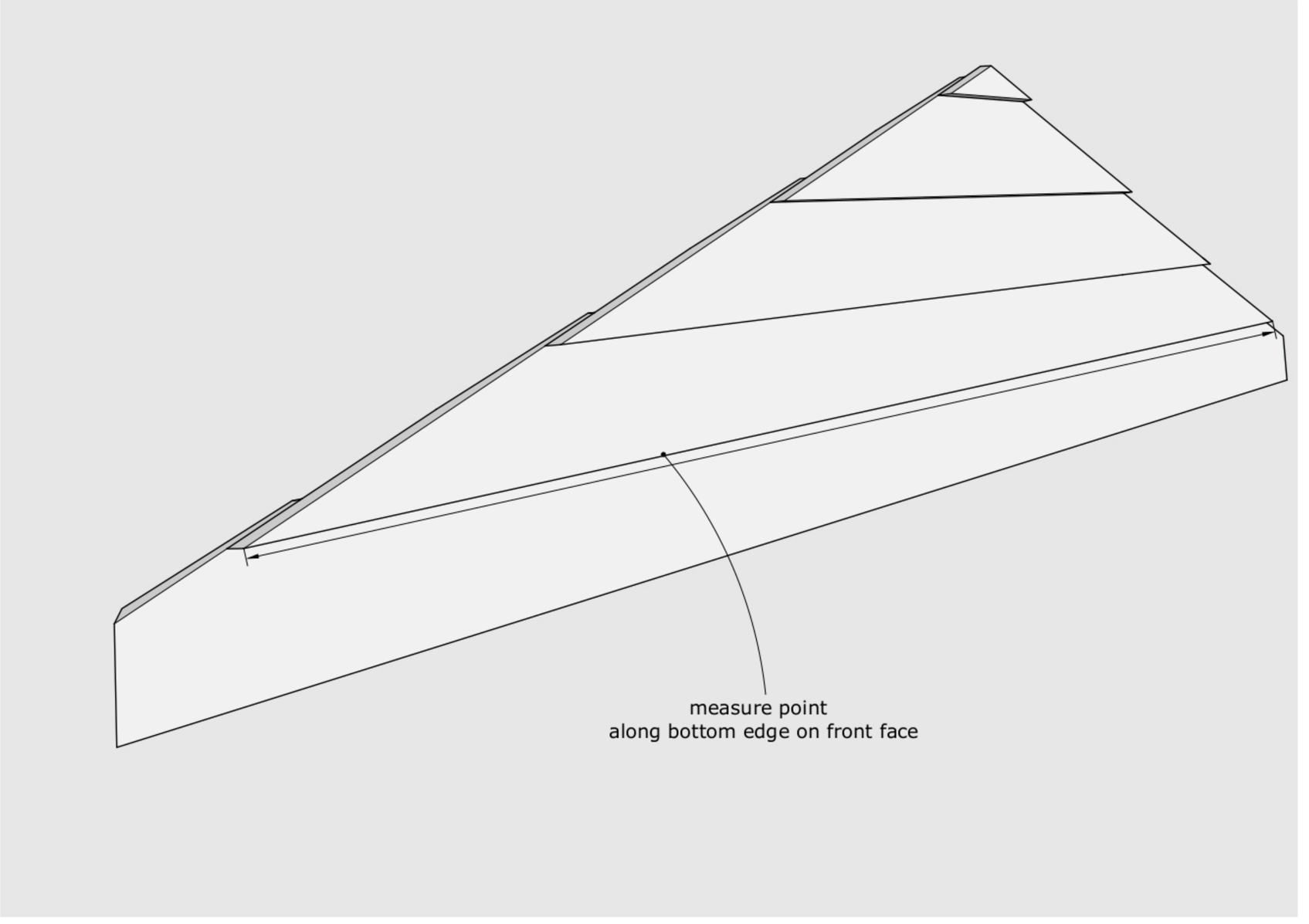
Cut an accurate one once and use it as a template.

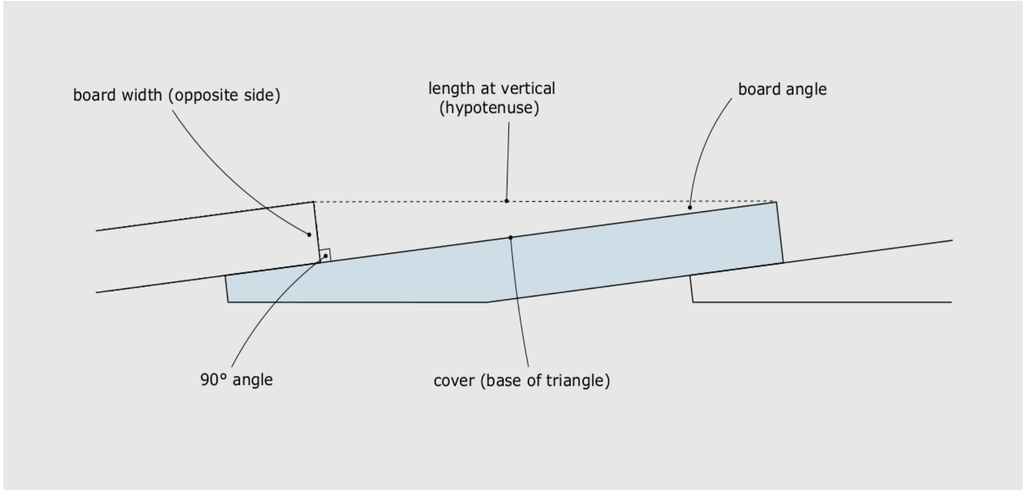


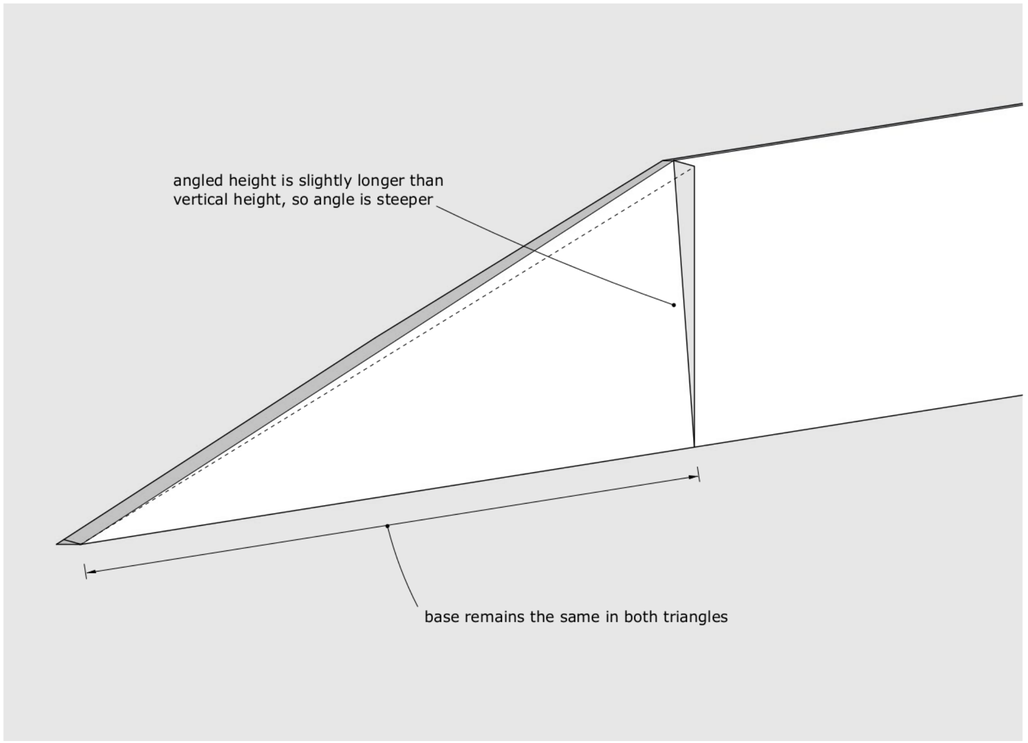
Trimming the initial board

Its length in the cutting list is worked out like the boards above, point to point. Trim its ends to suit the gable or the corners.

The Length measure point







Working out angles and offsets

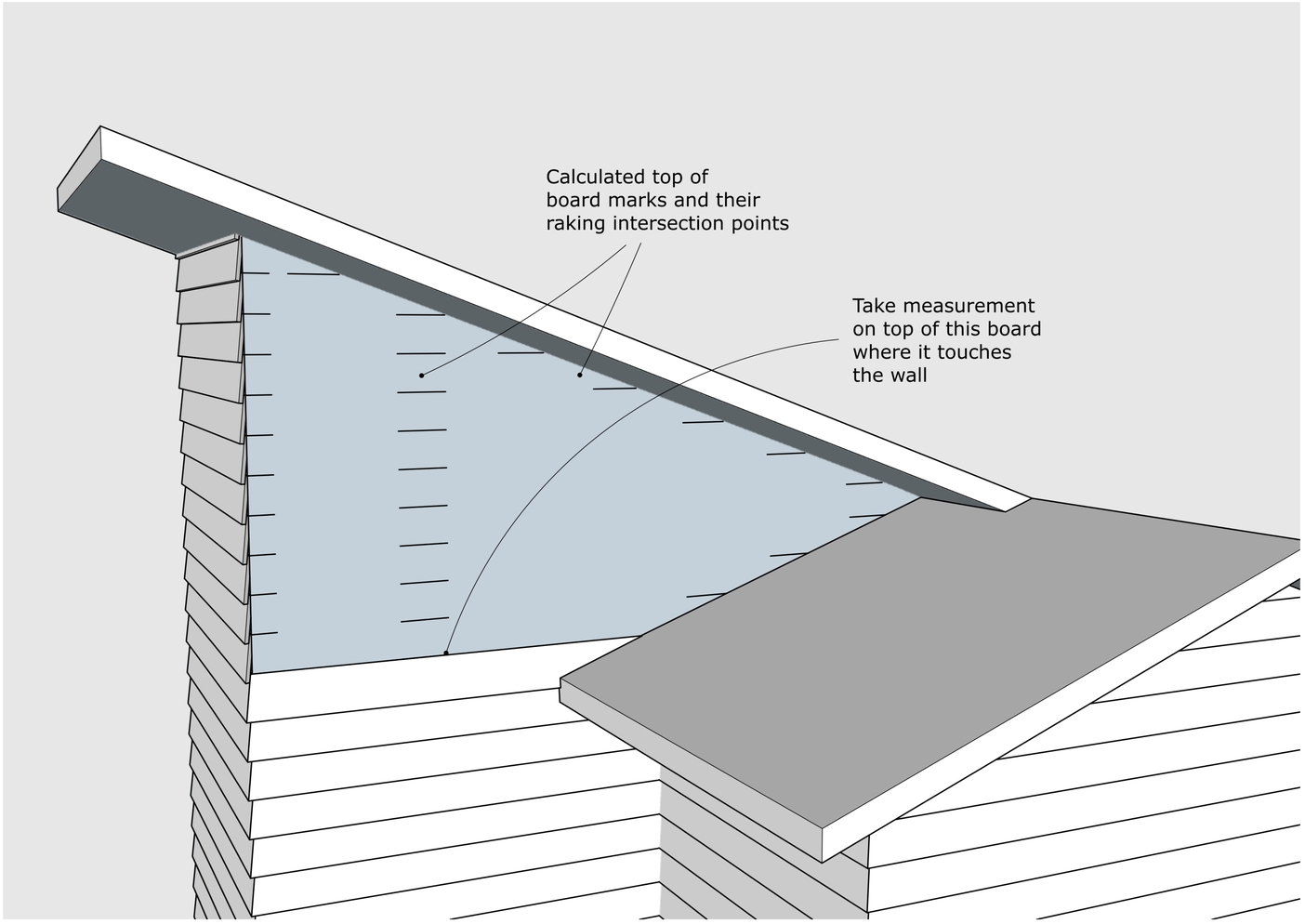
Board angle $\sin^{-1}(19 \div 153.7) = 7.1°$ (example spacing)

The triangle drawn on the face of the board stands up from the roof plane. Its vertical side, its base and the slope make a 20° triangle, but the board's face is longer than its vertical height.

Vertical height of the board	$187 \times \cos(7.1°) = 185.6$
Common base (the offset)	$185.6 \div \tan(20°) = 509.8$
Angle on the face	$\tan^{-1}(187 \div 509.8) = 20.14°$

0.14° doesn't sound like much. On a 7 m gable, to the centre 3.5 m:
$3500 \times \tan(0.14°) = 8.6$ mm out at the apex.

An Ascending or Descending Work Flow



The building won't be perfect - the more accurate the walls, slope and measurements, the better the result. Use a laser for level.

Decreasing - up to one slope

Starting from a corner, or one side of a gable. Each board above the initial board is shorter.

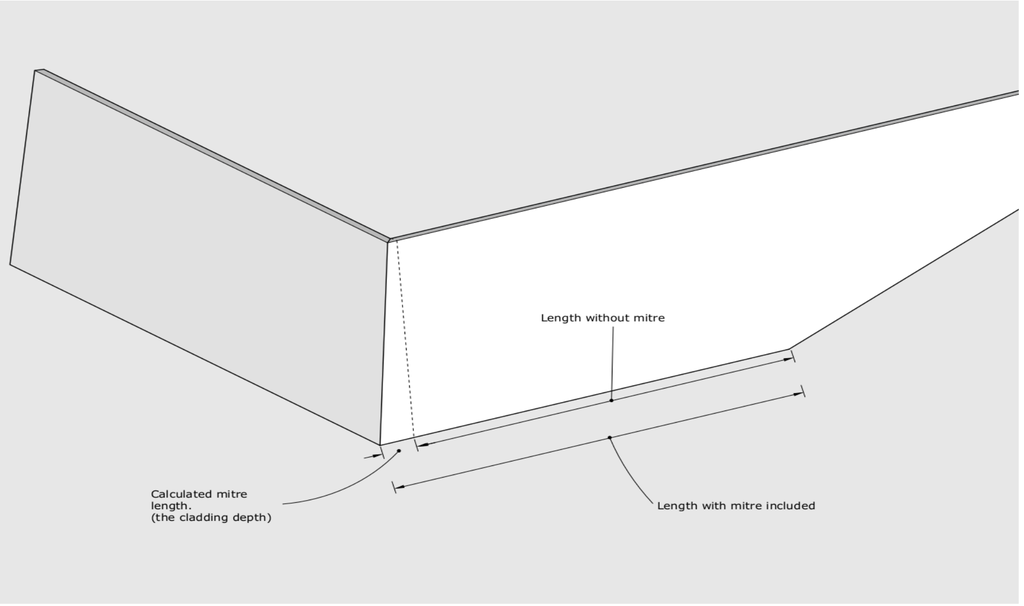
Carry the wall marks up to the slope. Measure on top of the first board that meets the slope, where it touches the wall, from the end of the wall to the slope. Enter it as the Initial length.

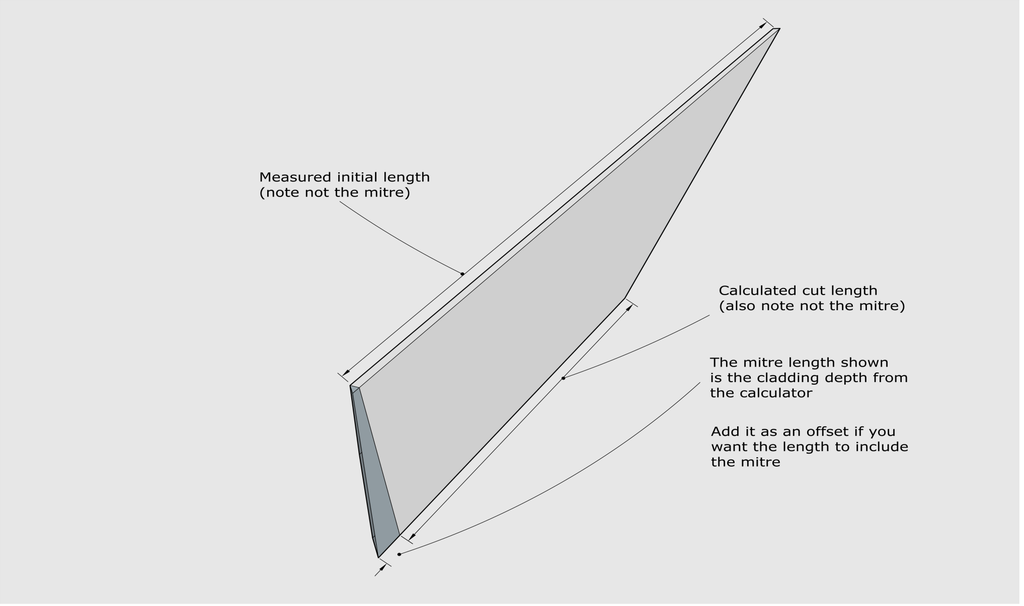
Increasing - over a roof

The boards above a roof get longer as they go up. Measure the first board above the roof the same way and enter it as the Initial length. Set the Number of boards you need.

Check the angle

Mark the calculated top of board heights on the wall and carry them out to the slope. Check the lengths against the wall marks list. If they don't match, adjust the roof angle until they do.





Mitred Corners

Decreasing and Increasing have Set an offset, for boards that mitre at a corner.

The initial length is measured on the wall, without the mitre. The cutting list doesn't include the mitre either.

The Cladding depth on the Roof Cuts screen (31 here) is the length of the mitre. Enter it in Set an offset and the cutting list includes it.

For a butt joint, leave Set an offset blank.