

Adding frames to top bar and Warré hives

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You do need a frame

Let's get a few things clear to start with:

- there is no restriction on hive shape in New Zealand. Vertical hives are legal, horizontal hives are legal, sloped sides and straight sides are legal.
- natural comb is legal. There is no requirement for foundation, either wax or plastic.
- screened or solid bottom boards, flat or peaked roofs, Warré quilts or hive mats, queen excluders or none, top, bottom, round or slot entrances—all these elements and more are down to the beekeeper's preference.

The one physical element of a hive's structure that is mandated is the use of a frame.

You don't have to get rid of your hive.

You don't have to change any other element of the hive.

You don't have to change anything else about the way you choose to manage your hive.

You just have to put proper frames in it.

So what constitutes a proper frame?

A proper frame must meet two objectives.

1. It must stop the bees from attaching comb to the inside of the hive, so the comb can be easily removed from the hive without cutting or damaging it.
2. It must support the comb to allow manipulation required for the prescribed manner of inspection for AFB, which means the comb must be able to be held horizontally. See the *AFB Elimination Manual* for the correct inspection method (available from <http://nba.org.nz/publications>).



Finding the light: depending on the time of day, it can take a little finesse to get the correct lighting angle. When you do, it's like turning on a light switch inside the cells.

The frame should also be sturdy enough that you can hold the frame, rather than the comb itself.

An enclosed frame built with minimum contact points in the hive, maintaining a bee space of 6–9 mm around all edges, will only be propolised in at the contact points and generally not attached to the interior of the hive otherwise. There's your first criterion fulfilled.

The other effect of an enclosed frame is that, because bee space is maintained around the whole outside of the frame, the bees will tend to build the comb to completely fill the frame, joining it around all inside edges, and forming a strong structure that, once attached, is easily manipulated as required. There's your second criterion.

What on earth is 'bee space'?

If you have only come to beekeeping through top bar hives you may never have heard this term. In short: a bee space measures 6–9 mm.

- A gap under 6 mm in the hive is too small for a bee to transit easily, so these



One of our girls obligingly poses in front of a ruler—and measures up at a little over 6 mm to the top of her wings.

are sealed up with propolis.

- A gap over 9 mm is too wide for bees to transit across easily, and wider than they need to move through, so bees will build comb to close these gaps down.

Why those measurements? Short answer: because the bees say so. Longer answer: bee space was identified through long and careful observation of bees' natural comb building behaviour by Lorenzo Langstroth. The bees tend to use the smaller measurement for transit spaces where usually only one bee passes at a time, and the wider where bees sit on opposite surfaces—as on the faces of two combs side by side.

Once bee space, a measurement of the bees' natural behaviour, is understood, it's a simple matter to make a frame to suit almost any hive.

Let's have a look at how standard Hoffman frames put bee space into practice in a Langstroth hive.



Hoffman frames sit in a jig awaiting wiring. Note the bee space gap between the top bars, which allow the bees to move up through the hive, and also between the sides and bottoms of the frames.

When sitting in a hive body, there is a bee space gap between the side bars and the wall of the hive body.

The wider upper sections of the side bars butt together to give the frames stability and prevent frames swinging when boxes are lifted.

Choosing materials wisely

I have seen samples of suggested frames for top bars made by curving a piece of No. 8 wire or a split bamboo rod under the top bar.

There are two major problems with these options:

1. size. Bees will build straight around and past the wire or bamboo (unless the bamboo is of significant width, in which case it would be too stiff to bend). The frame must be a significant enough structure to stop the bees building through it.
2. shape. While the wire could be bent to fit, a simple curve that does not correctly fit the hive will not deter the bees—they will build around and below the wire or bamboo as if it were not there.

Wood that is 25-mm wide and 10-mm thick is a better choice: sturdy enough to nail without splitting and wide enough to maintain bee space between frames.

How to make a frame

Good news: straight-sided hives are easy, and sloped-side hives come with a built-in template!

Horizontal top bar hive with sloped sides

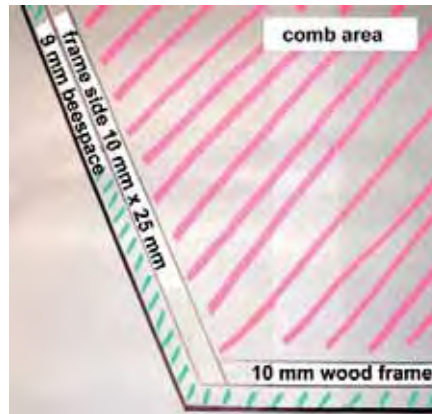
If your hive employs a follower board, congratulations—you have a built-in template.

Get a large sheet of paper, take your follower board and trace closely around its edges. (Drape a cloth into the space left by the follower board if you want to keep your bees settled inside their comb until you're done.)

Remember we are dealing with fairly small measurements: if your pen traces wider than your actual follower, adjust your template accordingly.



1. On your template, draw a line across the bottom of the top bar (dashed line in diagram).
2. Measure 9 mm in from the sides of your follower and draw a line along the slope.
3. Measure 9 mm up from the base of your follower and draw a line along the base.
4. Now repeat the previous two steps, but this time measuring 10 mm inside of your previous lines.



The outer gap (in green in the example above) is bee space—the empty space you are aiming to leave between your frame and the hive side. The large middle void is comb space for the bees to build in. The 10-mm gap between the two is your wood frame.



Lining up sidebars on the template to mark the required angle to be cut.

You now have a template from which you can establish the required length of your side and bottom bars, and the angles at which to cut them.



Cut and ready to assemble.

Assemble by driving two nails diagonally up through the sidebar and into the top bar, then two nails through each sidebar into the bottom bar.



Assembled and ready to go into the hive.

Caution: Make sure your follower is a good fit. A brand-new hive I viewed recently had gaps along the edge of the follower of perhaps 6 mm in places—enough for a bee to fit through, and enough to throw out your bee space measurements.

Bear in mind the issue may not be the accuracy of the follower so much as warping of the hive body itself. If unsure, use your follower board to check dimensions at both ends and in the middle of the hive. Warping may also be as simple as your hive not being set evenly on the ground—check with a spirit level.

Warré or vertical top bar hive, or straight-sided horizontal hive

You may be running a hive built of Langstroth boxes on Warré principles, in which case all you need to do is buy or build standard frames—either Hoffman or Simplicity. Manley frames should be avoided, as they are not suitable for brood nests, which of course all boxes in a Warré hive will be at some point.

If your boxes/hives are proper Warré or any other dimensions with vertical sides, read on.

The length of the sides and bottom of your frames are dependent on the dimensions of your hive cavity. →

First, measure the internal width of the box. The width of your frame to the outside edges is the width of the box minus 18 mm (one bee space either side of the frame). In a standard Warré box with an internal width of 300 mm, your frame width is 282 mm (measurement is from outside edge of sidebar to outside edge of opposite sidebar).

Next, measure the internal height of the box. The height of your frame to its outside edges is the height of the box minus 9 mm (one bee space—either at top or bottom depending on the depth of your rebate). In a standard Warré box with an internal height of 210 mm, your frame height is 201 mm.

You can, if you wish, easily make a template as for the slope-sided example above, using the internal dimensions of the box to create your template border instead of tracing around a follower board.

Now that you know your dimensions, you need only cut your wood to size and assemble with nails. If your carpentry skills are up to it, a box or finger joint adds strength to the joints, but realistically a butt joint will work just fine.

Traditionally, to join the top bar of a frame to the side, a nail is driven down through the top of the top bar and into the sidebar. Then, a second nail is driven diagonally up through the sidebar and into the top bar, giving a strong joint.

Transitioning from top bars to frames

Now let's discuss transitioning from top bars to frames in an occupied hive. Spring is the ideal time to start transitioning as the hive starts to expand and comb drawing starts up, so get your frames made up now and get ready to go.

Horizontal top bar hives

You have two options:

- either buy/make new top bars to build your frames onto so you can get a full hive set made and get the carpentry out of the way all at once, or
- make existing top bars into frames as they are transitioned out of the hive, which requires a few repeat visits to the workbench. This may be easy in early spring when the hive is compact and

you can work freely with all the bars behind the follower board in the void space, but might be a bit more difficult later into summer as the hive grows and perhaps all top bars are required in the hive space. If you go this route, I suggest getting a couple of extra top bars made into frames to remove time pressure on you to remove a bar, frame it and get it back into the hive immediately.

The process:

1. immediately remove any empty top bars behind your follower board (in the void space) and replace with frames
2. immediately remove any empty top bars within the hive space and replace with frames. If you have any empty partially built honey combs, remove and replace these too. (A note of caution in early spring: ensure the bees have enough feed stored, and do not remove so much comb that they have nowhere to put feed as they bring it in. Remember only young bees draw wax, so the hive won't be able to replace comb easily until the population starts to grow)
3. as the weather warms and you checkerboard the bars into the brood nest for swarm control, checkerboard in frames instead.
4. as the season picks up and the hive grows, take single bars of capped brood and (after checking the queen is not on the comb) move the bar to the outside of the honey stores. Add a frame to the brood nest to replace the removed bar. The objective is to let the brood emerge on the outside of the brood nest where the queen will not immediately start laying again as bees emerge, and the empty bar can then be removed. When the empty bar is removed, find the next bar of capped brood and repeat the process. Do this only one bar at a time—the objective is to move the capped brood only, not relocate the whole brood nest.
5. obviously as honey bars are harvested, they will be replaced with frames instead of returning the top bar to the hive.

Warré

For Warré hives, obviously any new boxes nadired under the hive in spring should have frames in them instead of top bars, but also take the opportunity to check existing boxes and exchange any undrawn bars, or

bars with empty comb for empty frames. It is perhaps a little harder in a Warré to exchange frame by frame, but you should make some effort to remove honey-full top boxes through the season and effectively push the bees downward as quickly as is practical.

Working to a deadline

It is important that, whatever style of hive is being converted, the process is started as early in the season as possible, and continuous progress is made towards conversion. As autumn closes in and hives lose their ability to draw new comb, no further progress will be able to be made.

It may be that a shakedown is required to remove the last of the top bars and convert the hive fully to frames within a season. If a shakedown is required, I suggest that this should be done in summer, well before autumn, to give the bees time to complete their building and get good stores in place. There is evidence that the lack of comb to put stores into reinvigorates comb-building ability in a hive, so get them finishing the rebuild while the summer flow is on, rather than having them caught short in autumn.

Bonus points

Comb collapse due to handling, the bane of many a top bar hive, will largely be alleviated with a full frame. The comb attached around the whole edge of the frame is many times stronger than the comb hanging solely from the top bar, and the integrity of the comb is not being damaged repeatedly by having to be cut out of the hive for inspection. Comb collapse due to heat stress may also be helped, but make sure to pay attention to the location and ventilation of your hive if this is an issue.



Natural comb being built in Langstroth frames. Two frames, by the way, not two combs in one frame. Note wire is readily accepted.

You may also wish to add a support wire to your frame. The photo above shows natural

comb being built in my Langstroth hives. The bees started with an empty frame and popsicle sticks glued into the frames top groove as a comb guide. Note that the bees build around and through the wire quite happily with no interruption to the comb pattern.



I have also found that the bees will tend to use the wires as a guide as they build down, ensuring straighter combs. Bees are master engineers, and without guidance or other support will tend to curve a comb slightly along its width, producing a stronger structure than a perfectly straight comb. With the frame and wire the comb is structurally supported and the bees are happy to build straight.

The wires also serve as a guide—bees build comb downwards according to gravity and if the hive is not set perfectly vertically can produce combs on a slope in the frame (of course, the problem is really the other way around—the bees know what they are doing, it's the hive that is lopsided). However, with wires in place the bees will build into the frames even if the hive is set a fraction off vertical.

Be aware, however, that this only works for minor corrections. One very important aspect of getting bees to build neatly into frames is that the frame should hang down as perfectly vertically as possible: not difficult if you take reasonable care with your frame building and hive levelling.

Granted, the wire is not a requirement of the frame, and they can be a bit of a nuisance if doing crush and strain honey harvesting, but for frames specifically intended for brood, they can be beneficial. (I assume you are not harvesting honey out of frames that have been used for brood or in the hive when you are using any chemical varroa control!)

While we're on the subject ...

I note an interesting approach to bee space between combs in some New Zealand-built top bar hives. The hive I viewed recently used 37 mm-wide top bars throughout the hive. This width might be appropriate for honey combs, but is too wide for proper brood comb spacing and will quite likely exacerbate cross-combing issues in the brood nest—an absolute no-no.

Why is this an issue? Because the bees typically build brood comb to a defined cell depth as well as width. In average Kiwi bees coming off standard foundation, brood comb will typically be about 24–25 mm thick. Add 9 mm bee space to that, and you have a measurement of 33–34 mm. Funnily enough, 33 mm is the width of a standard Hoffman frame.

If you are working on the basis of producing 'small cell' bees through natural comb regression, then the measurement is actually more like 32 mm thick for comb and bee space combined, making the measurement of 37 mm even further removed from an appropriate bee space.

If you find you have 37-mm bars throughout your hive, now might be an opportune time to consider paring them down to a better width. To avoid cross combing in the honey areas of the hive if the bees try to build out wider than the brood-sized bars, you can add in spacers between the honey top bars to help avoid cross combing. But your focus should be on providing correct brood area spacing and finagling the honey area, rather than the other way around.

If you find yourself muttering, "how much can a couple of mm matter?" at this point, turn it round and ask yourself "how tall is a bee?", and take another look at the previous photo of a bee and ruler.

Done and dusted!

With frames, a top bar hive will be able to inspected much more easily.

Incidentally – a Warré with frames is still called a Warré. Abbe Emile Warré included a frame option in his original plans.

Photographs and diagrams by Deanna Corbett.

