Design Considerations for a Wide-Rail BT3K Mobile Cabinet

Having built my own BT3K wide-rail mobile cabinet, I thought that it might be useful to those who are still at the design stage, to those just thinking about it, or to those just interested in the concept, to read about the process I followed and what core design issues were involved. This may not result in a definitive design for you, but may, at least, focus on the critical elements of the project. I have included drawings and photographs to assist, not all to the same scale, or even to scale at all.

Why do I need one?

If you only rarely need to cut large pieces of stock (mostly board material, such as plywood or MDF), this may be an expensive way to do it, especially if your supplier has a “cut to size” facility for customers. However, if the standard rip capacity of the BT3K is restricting you, or you want to support larger pieces of stock safely, then this is a more effective way to go than trying to use, for example, roller stands as side support.

The spin-off benefits include:

- Greater mobility, but with stability throughout and increased rip capacity
- Integrated storage for all relevant saw table parts and accessories
- Ability to add and extend the cabinet later (for example, with an out-feed table)

Will it fit my space?

Fitting a set of additional rails will exactly double the overall width (side-to-side) of the standard saw. However, two other points need stressing here:

- When fitting additional rails, extra room will be needed for manoeuvring the cabinet from (and back into) its storage position. Reckon on at least another foot of width between walls as a minimum here.
- If you don’t need to use the full width that an additional set of rails will provide, don’t dismiss the possibility of cutting down the additional rails to suit you requirements - if you cut them in half, for example, you may be able to sell on the remaining halves to other BT3Kers with similar requirements.

So, in other words, you can make the cabinet any width you choose. The cost-effectiveness of buying rails and then cutting them down to size is a matter of personal choice, but it has been done, frequently and successfully. Your only limitation is the physical space in the workshop, garage, basement, or wherever your cabinet will live.

Where do I start?

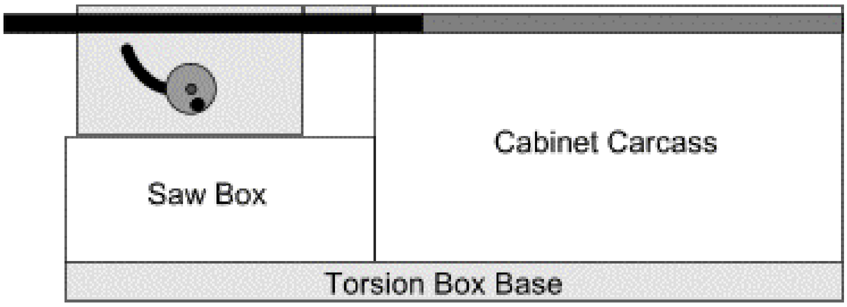
If you’ve read this far, then you’ve *already* started! Measure up your space; work out whether a full-size wide-rail cabinet will fit, or whether you’re better off with a cut-down version. It doesn’t matter which you choose (although all following examples use a full-width model), the next step is to take some accurate measurements.

What, no plans?

I have not sought to provide any plans, as there are plenty of existing models to look at already, although the line drawings and photographs included will hopefully add clarity. A torsion box base is an essential inclusion and has many benefits in addition to keeping the saw and its rails perfectly level and correctly aligned. The cabinet is really three boxes: the torsion box base, the main carcass and the saw stand. The reason for keeping the saw stand as a separate unit may not appear to make much sense, but the saw must line up exactly with the finished cabinet top, so any slight adjustments here are easier to make when working with a separate unit. The ability to hinge (flip-up) the saw for ease of maintenance needs additional work, which is also easier to do on the separate unit before finally fitting it to the cabinet.

Calculations Required

There will only be simple math involved and all other measurements must suit your own unique circumstances, so each individual plan will differ. There are, however, some critical measurements that need to be established first. Two are down to you, the other is fixed - but vitally important - and we'll look at those now.



Here's a simplified front view of one possible cabinet format. The standard rails are shown black, with the additional (full-length) rails shown gray. The major consideration here is the overall width and this is affected by other considerations, which must be made at an early stage, such as:

- Will you want the additional rails to protrude to the right of the cabinet so that you have the option to, for example, fit the accessory table on the protrusion and mount a router underneath?
- Do you want the saw to be able to hinge upwards (to the left) to make both cleaning and maintenance easier?

Both of these options affect how the top is constructed and how the accessory table is fitted and so can affect the **overall width** (side to side) of the top. I have a separate router table, so I made my cabinet slightly longer than the extended rails in order to protect them when moving the cabinet about in the workshop.

The next major consideration is the **overall height** of the cabinet. You may already have your BT3K set up to your perfect working height - if so, good - simply measure it accurately! If you have always wondered about the height, or wanted to experiment with a higher tabletop, then you may be able to pack, or shim, your existing stand or location before finally deciding. **Please be safe when doing this** and use it only as a "dry run" experiment. Please don't attempt to cut anything with the saw unless it is ***perfectly*** stable, that's asking for trouble.

If you're starting from scratch, a good guide to an effective working height is to stand upright in your usual working boots or shoes and take the measurement from the point where your wrist meets your hand to the ground, when your arm is relaxed by your side. This is possible to do yourself, but much easier with an assistant. This measurement will be subject to further calculations later, but is an important initial reference.

Having sorted out two variable measurements, it's time to check the most important fixed measurement (and the only one that is beyond your control) - the distance between the inside faces of the front and back rails, which sets the **maximum depth** (front-to-back) of the cabinet. This distance must be measured with the fence locked, as there can be some slight flexing towards the free ends of the rails. Another option is to slide the accessory table along to the right-hand end of the rails, lock it into place, then measure the distance between the rails on the outside of the table and then the blade side as a double-check. This measurement is ***absolutely vital***, so it's worth taking some time to make sure you've got it right. Whatever you do, use the same measuring device (usually a steel tape) that you will use when constructing the project, as this will avoid any slight discrepancies between tapes or rules.

The reason why this measurement is ***so*** important is that, unless the rails are fixed to the cabinet as seamless extensions of the originals, the rip fence will not slide from side to side smoothly and it may not even lock correctly. This would be totally unacceptable and highly dangerous. Remember that if you make the cabinet a little on the *narrow* side, you can always shim the rails out to the correct distance, but if you make the cabinet too *wide* - even by a fraction - then the rails will not match the existing ones, the fence will not slide or lock and the cabinet then becomes expensive, un-necessary workshop furniture!

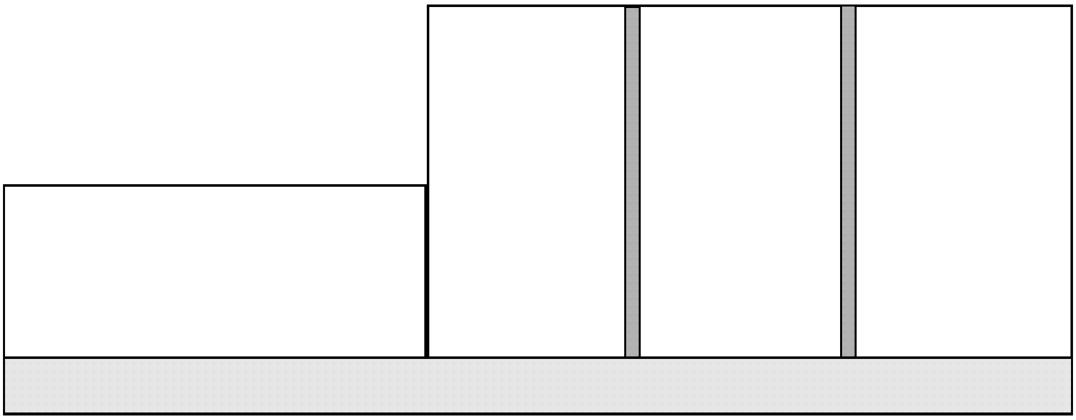
The Design Begins

You now have the three important measurements upon which to base your design. They will dictate the overall dimensions of your cabinet, but the variations within the cabinet itself are vast - you only have to look at some existing examples to realise that, practically, the only limit is your imagination. What storage options will suit you best?

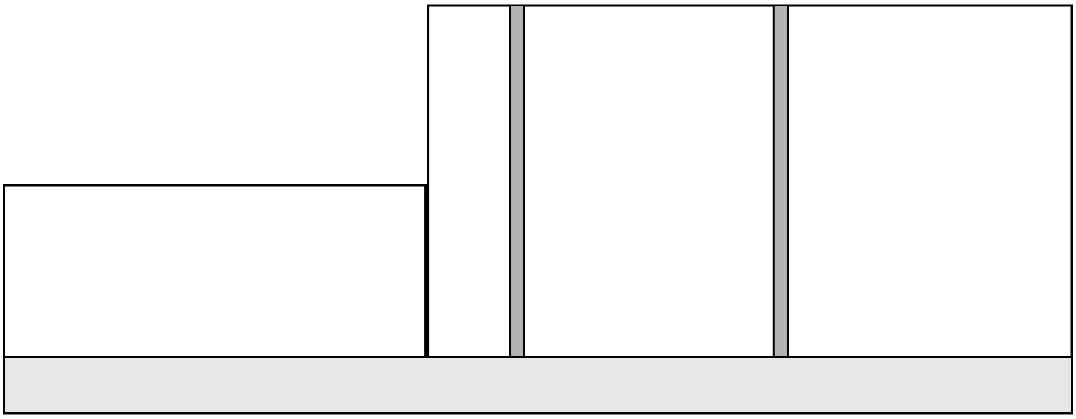
- All cupboards, with hinged doors and fixed or adjustable shelving (or pull-out trays)
- All drawers, probably in two stacks of three or four, with another beneath the saw
- A sawdust collector beneath the saw, instead of storage drawer(s)
- One cupboard with shelving and some drawers alongside
- Open partitions, for free-standing items
- What about a blade caddy?

The choices you make here will affect the number of vertical panels within the cabinet and the amount of additional work you will need to meet your storage options. These are worth thinking over carefully, as once you make a start there will probably be little chance for a major change halfway through. The addition of drawer mechanisms and other hardware is also much easier to do during the construction than it is once the cabinet is fully assembled. This is *especially* true of the blade caddy, as they tend to be narrow, making the fitting of internal hardware after construction at best difficult, at worst impossible!

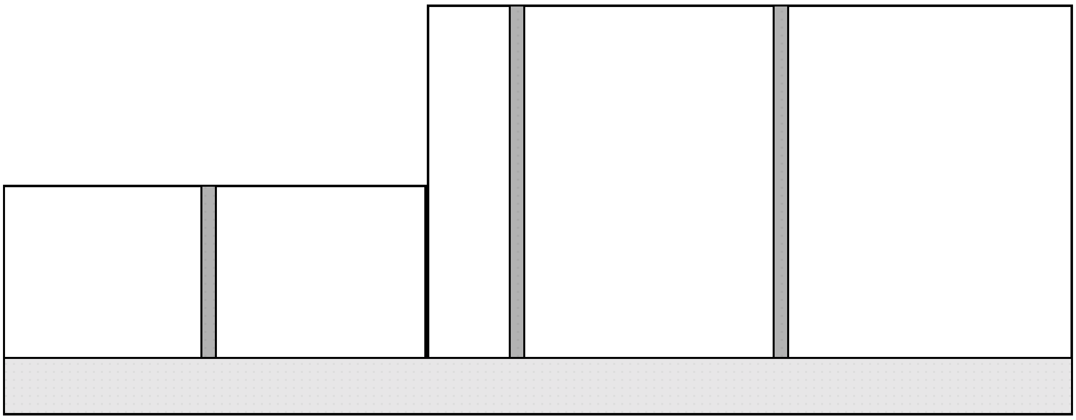
Here's what I mean in diagram form:



1. Two intermediate vertical panels, forming three cupboards or drawer units.



2. Two intermediate vertical panels, forming a blade caddy compartment and two cupboards or drawer units.



3. Additional vertical panel in saw stand for two small cupboards / drawers.

The saw stand also has a bearing on the overall design, because it needs to be wide enough to provide correct line-up of your chosen saw tabletop configuration to the cabinet top. If you have an additional miter slot, use two accessory tables, run the SMT on the right, or have any other modifications to the standard layout, you will need to account for these when measuring. Don't forget to leave room to access the power supply!

Given that the cabinet will be made from board material, you also have choices to make here. I chose Medium Density Fibreboard (MDF) throughout, although I could have used ply, which would also have been less weight. Both materials have "raw" edges, which are not only unsightly, but soak up moisture and finish, as well as being prone to damage if they get knocked (as they are *likely* to do in a workshop). I chose to wrap all exposed raw edges in oak. I used MDF simply because I prefer the finish, the ease of machining and the total lack of splinters! The downsides are more weight and dust that needs very good collection or extraction. A good quality facemask is absolutely essential, as the dust is also highly irritant.

Once you have chosen the configuration you need, there's one more thing to sort out before you can make your rough sketch - the size of castors. I would recommend braked swivelling castors, with sealed bearings if possible. I used 4" castors - overall dimensions are available from catalogues, both postal and on-line. Once you've chosen your castors and noted the dimensions, it's "first sketch" time. If this can be to scale, so much the better, it will save time later. Graph paper is a good idea if you don't have a suitable drawing program on your computer.

Remember to allow for wrapping the exposed edges in your calculations - I used oak planed to ¾” (19mm) square, although there are other edge treatments, including iron-on tape, but I don’t believe this is robust enough for workshop duty. Fixing hardwood wrapping could be by glue alone, by gluing and pinning, by tongue and groove, conventional dowels or flat-plate dowels (biscuit jointing). I used biscuits throughout, as I was familiar with them and tooled up.

Here Comes the Math!

Known measurements:	Overall height required (e.g. wrist to floor)	34” (865mm)
	Overall maximum width (side-to-side)	84” (2135mm)
	Overall maximum depth (front-to-back)	22$^{7}/_{16}$” (570mm)
	Thickness of MDF	¾” (19mm)
	Height of Castors	4¾” (121mm)
	Hardwood wrapping	¾” (19mm) square

Therefore, to make a torsion box base that is 4” high, all ribs will need to be cut to 2¾” high. (Top and bottom thickness of ¾” = 1½” Ribs would be 2½” without dados [4” – 1½” = 2½”], but need to be a further ¼” [i.e. 2¾”] in order to sit in the $^{1}/_{8}$” dados inside the top and bottom)

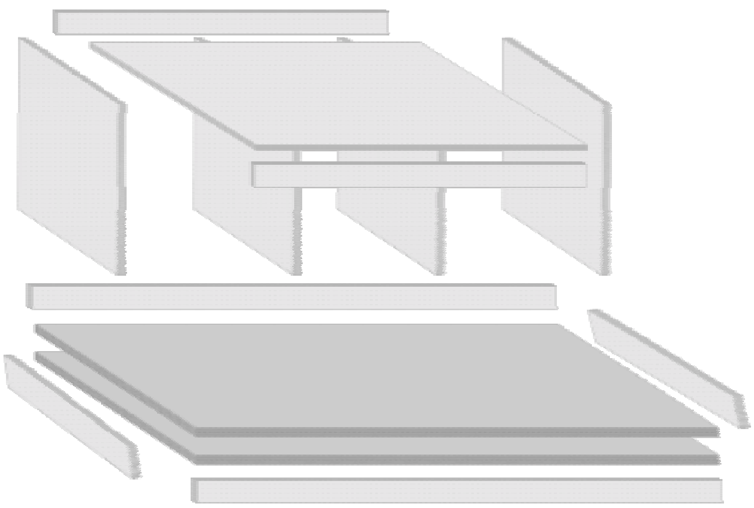
An overall height of 34” results in a vertical panel height of 25¼”
(34” minus 4¾” castors, 4” torsion box, ¾” top [total 9½”], plus $^{3}/_{8}$” (9mm) to seat in dado in underside of top and $^{3}/_{8}$” to seat in lower locating dado or rebate [total ¾”] equals 25¼”). Please note that there are alternative methods for fixing the outside vertical panels, described later.

The overall depth (front to back) **cannot** exceed 22$^{7}/_{16}$” (570mm), but with hardwood wrapping of ¾” (19mm) on both edges [totalling 1½”], the cut dimension of the board is reduced to 20$^{15}/_{16}$” (532mm).
This dimension is also used for the depth of the cabinet top. The depth of the vertical panels depends upon the way you construct the back of the cabinet carcass. Your choices would include:

- Not having a back (beware: back panels greatly add to rigidity and keep dust out),
- Having a single panel externally affixed to the verticals
- Having a single panel rebated into the carcass
- Having individual panels rebated between the verticals.

I chose a single panel, rebated into the carcass and reinforced by joining the verticals to it with biscuits. This choice was almost inevitable, as I had by then decided that I would use vertical panels 4” (100mm) deep below the top on which I would fix the extension rails.

Once these major dimensions are set, the rest is attention to detail, choice of joints, planning the order of assembly and the accurate cutting of materials. An “exploded diagram” may help you to visualize the joinery required, but keep it simple, straightforward and strong!



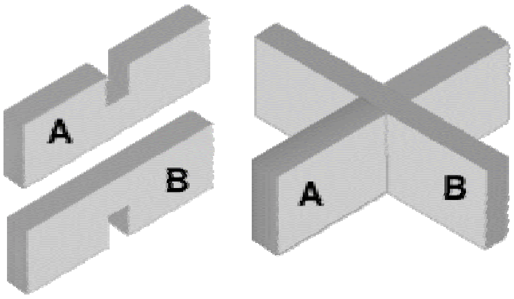
N.B: The diagram does not include the back panel, doors/drawers or the saw stand.

Firm Foundations

The whole cabinet should be built on a torsion box base for maximum stability. Any flexing, or twisting (either front-to-back or side-to-side) will affect the set-up and alignment of the saw, rails and fence and could render the whole project un-useable. Many have found that minor problems with cutting disappeared once they had made sure that their BT3K was set up level on its stand and the use of a torsion box base removes such problems permanently.

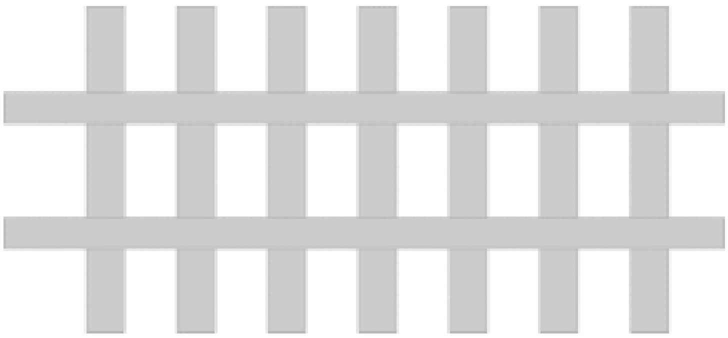
Torsion boxes are not difficult to make, but require some precise cutting - exactly what the BT3K delivers! Torsion boxes work on the principle of an internal core of ribs, which prevent deformation or flexing. If the ribs run from front to back, then the base cannot flex in that direction. If the ribs run side to side, the base cannot flex in that direction. If the ribs run in both directions, flexing is totally prevented in any direction.

The rib joinery I used was cross-halving joints, as shown below:



Rib “A” is notched halfway through, as is Rib “B” - the width of the notch equal to the thickness of the material. They can then interlock, as shown, when “B” is lowered over “A” at right angles.

This method is used to construct a waffle-pattern core, like this:

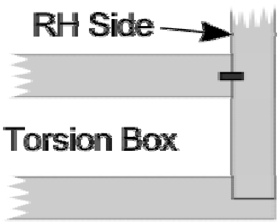


The number of ribs will depend upon the size of the overall construction, but the object is to make a box that will cope with a considerable load without deforming in any direction. Given that the core will be sandwiched by two sheets of board material, it would be adequate to make the ribs from 2½” - 3” (62 - 75mm) strips. If the top and bottom of the torsion box is ¾” material, it would be possible to make the ribs from ½” material, although I preferred to keep the ribs of the same thickness as the main boards and used ¾” stock throughout.

In the full-width cabinet I built, I took an extra step to ensure a more accurate glue-up when assembling the torsion box. I decided to register the ribs in both the top and the bottom of the box by cutting **1/8**” (3mm) housing joints (dados) to locate them. Whilst this meant a little more work initially, the resulting glue-up was so easy that I was able to complete it without any assistance - even when turning the part-assembled box over. Cutting the shallow dados first makes laying out for the cross-halving joints easy, as you can dry-fit the ribs in their dados prior to marking them, using a combination square.

At this point, it is wise to consider how you intend to fix the outside vertical panels that form the sides of the cabinet carcass. Accepting that seating them in dados adequately provides for the internal vertical panels, the sides will benefit from some more robust fitting. This will add a lot of strength to the cabinet overall, as well as totally preventing any racking during construction. Again, whilst this is a little more work, you will only be making the cabinet once and you'll need it to last a while, so the stronger the better!

With regard to the right-hand side of the carcass (when viewed from the front), this could be attached by seating the base into the bottom board of the torsion box, as shown below:

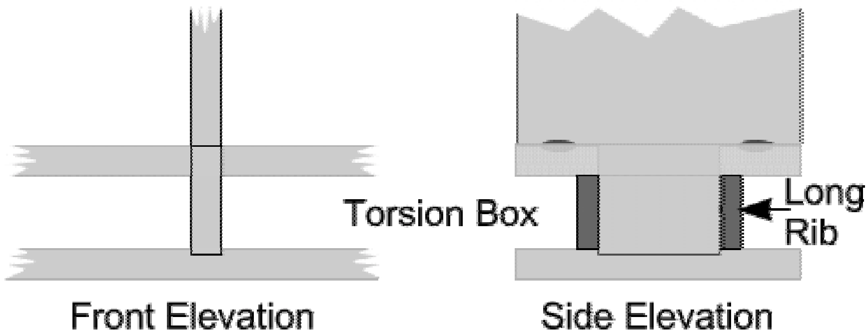


This method involves a rebate cut into the bottom of the torsion box and biscuit joints between the top of the torsion box and the right-hand side (and the end of the long ribs) for added strength and rigidity. This needs very careful attention when gluing up, as the right-angle here is very important. The side could be pinned through the rebate from below to assist before clamping, but it will be the glue that does the work in this joint - MDF does **not** take screws very well, especially near to an edge.

The left-hand side gives rise to another possibility - using the lower portion of an extended "T" shaped panel to replace one of the front-to-back ribs, sitting it in the shallow rib dado in the bottom of the torsion box, via a slot cut accurately in the top.

Marking out the slot is simple, as you will have already cut the dado in the underside, so it's just a matter of extending the lines across the top. The dimension between the long ribs is achieved by the same method.

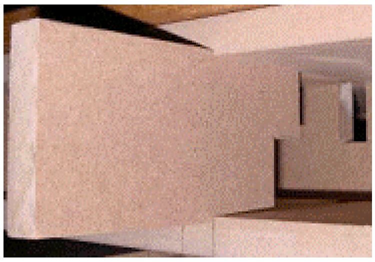
A plunge cut with a ¾" straight cutter, run against a clamped straightedge guide, completes the job. I added a couple of biscuits to absorb any side forces acting on the cabinet side when being pushed. The design detail looks like this:



Here's a photo just prior to assembly:

These alternatives need to be considered in the overall design of the torsion box, as they affect the overall width (side-to-side) of the top of the box, which needs to be reduced by the thickness of the side panel. The length of the long ribs will also need the same reduction if you decide to adopt this feature. It would be better to cut biscuit slots in the end of the long ribs (if you decide to add strength by beefing up the connection in that way) prior to assembling the torsion box. Another advantage of the shallow dado cuts is that they make dry fitting for additional measurements (e.g. the additional biscuit slots) very easy to achieve.

The resultant “gap” in the front-to-back rib (outboard of the long ribs on each side) can be filled by cutting two simple inserts, which are then slid into the shallow dados after the torsion box is assembled. This is how I did it:



Whilst I could have used a stacked dado cutter mounted in the BT3K to cut the shallow dados, I wasn’t comfortable working with a large board on a comparatively small surface and a ¾” stacked dado blade - after all, that’s why I was making the cabinet in the first place!

Instead, I decided to use a router with a ¾” straight cutter - a fence dealt with the two long dados on both the top and bottom boards (constant distance, set once, then used four times), whilst a straightedge clamp dealt with cutting the seven width-wise dados. To make certain that these lined up, I clamped the top and bottom together, side-by-side, insides uppermost, cutting the dados through both boards at once.

Here are the dados after cutting, with a dry fit in progress:

Apart from cutting the cross-halving joints as accurately as possible (so that there was no “slop” in the resulting joints), the use of the shallow dados really helped to register the core with both the top and bottom of the box, preventing any racking or sliding when assembling. It really was well worth the effort!

I made a torsion box that needed panels around the outside to enclose it. The reason for this was that fitting the castors would be easier. I could have driven some captive nuts into the base beforehand, but I wanted to reinforce the fixing points for the castors anyway, so I needed access to each corner of the box assembly. In order to provide a good fixing, I cut panels of MDF that were glued into the corner castor wells. The castors were then placed, marked and holes drilled through both the bottom and the reinforcing panels. Coach bolts were introduced from below and the castors mounted with locking nuts and washers, like this:

The fitting proved to be really rigid and the Ny-lok nuts are unlikely to be a problem, even with heavy use.

Once enclosed, replacing the castors *will* be difficult, but I did not worry about this, given that the castors have sealed bearings and are very robust units. Captive nuts would have been the absolute ideal.

The reinforcing plates benefit from additional support on two sides by also being glued to the ribs.

The Cabinet Begins to Rise

Once the torsion box is completed, construction of the cabinet carcass can begin. Now is the time to attach drawer runners or to drill holes for adjustable shelving ***before*** assembling the vertical side panels. This is especially true of blade caddy hardware - think carefully about your order of assembly, because once the glue has cured, it's too late to moan!

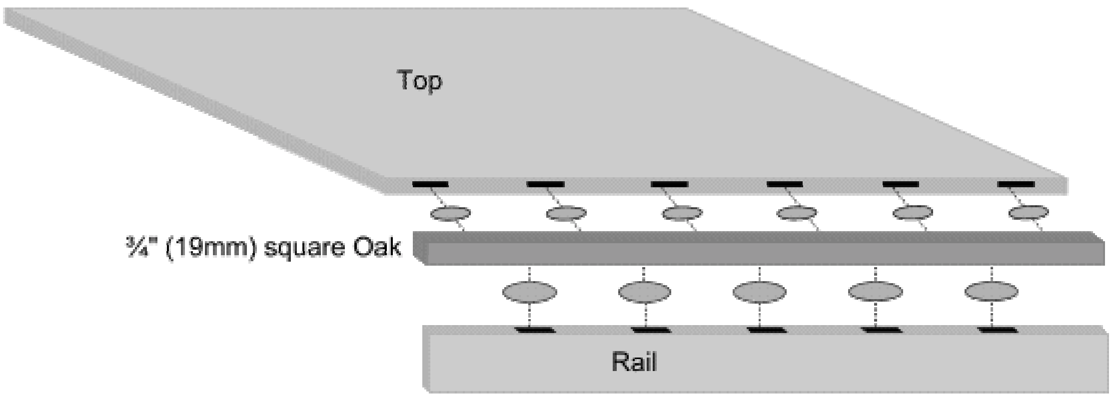
There are a variety of ways to design a blade caddy, but most use a slanted surface to reduce the possibility of the blades dropping from their mounts through vibration when the cabinet is being moved around the workshop.

Some designs use drawer runners, mounted horizontally, but I have concerns that drawer runners will not last very long if they are being loaded in a manner that they were not designed for. I used modified pocket door hinges, mounted vertically, so that the caddy pulls outward by running between them and I believe that they will easily last the life of the cabinet.

Topping Out

Because my design gave increased rigidity to both vertical carcass sides, once these had cured I was able to cut and dry-fit the cabinet top. Next came the vertical top panels (rails) to which the extension fence rails would be attached. I made them to match the thickness of the torsion box, to give the design some symmetry. I found that the oak wrapping gave me an ideal way to join the panels to the top, using biscuits. Whilst this is a bit time-consuming and fiddly, it results in a very strong, rigid and right-angled joint. There are, of course, other methods that I could have used, but I would use this method again, without a moment's hesitation.

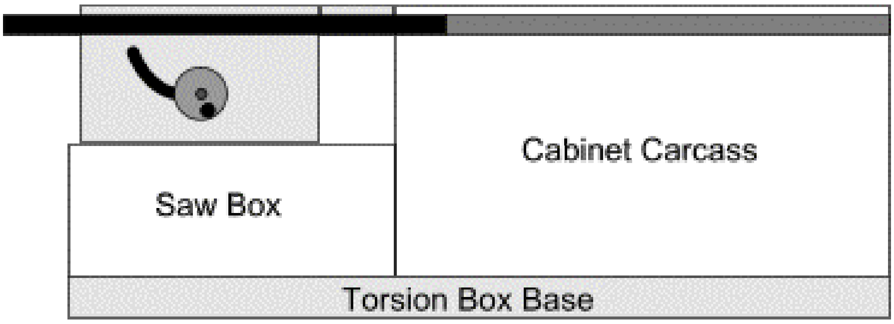
Here it is, in diagram form:



The biscuits need to be alternated on the adjoining faces of the oak wrapping, otherwise the vertical slots will clash with the horizontal slots, which would weaken the structure. Luckily, biscuit slots are very easy to set out, so this is not a major problem. The oak wrapping should be biscuited and glued to the top first and allowed to cure before the rail is then biscuited and glued on. If you choose, as I did, to reinforce the rail by joining it to the internal vertical panels, then you will need to cut biscuit slots prior to assembling the rail to the top.

The rest of the cabinet carcass, back panel, doors, shelving, drawers, etc. does not need detailing here, as it is a matter of personal choice, with designs to suit your needs. The saw box is the only remaining component that needs further attention.

Box Clever



Returning to the very first diagram, it becomes apparent that if the height of the saw box is not absolutely correct, then the BT3K saw table will not match the cabinet top, which was the whole purpose of the project! Therefore, this part of the construction requires some **very accurate measuring.**

Rest assured, the torsion box base ***will*** be flat and level and can take an exact measurement from the top of the torsion box to the cabinet top itself. At this point, please do not forget to allow for any surface laminate still to be fitted - it only adds a little, but if you include that amount in your measurement now, that's a future shimming problem eliminated.

Having taken that measurement, the next vital figure is the exact height of the saw - from fixing point to tabletop. Totally ignore the fence rails when measuring, they don't come into this calculation at all - it's the **saw table** that must align exactly with the cabinet top surface, not the rails!

Once you're sure that the measurements are accurate, subtract the saw's overall height from the cabinet height and you have the height of the saw box. You can now turn your attention to designing it. If you want storage beneath the saw, choose drawer(s) or door(s). If you want sawdust collection, a slide-out box will do the job. You might want to include a sawdust hopper with an extractor port into the design - that's another option. If you want the saw to flip up, you will need to include that in your calculations. All these "extras" need to be worked out and constructed before the saw box is dry fitted to the torsion box base. That's when you'll put the BT3K up on there for the first time (with all the accessories, SMT, fence and both rails removed!) to do a final check for finished height. If the saw is a little high, out with the plane. If it's a little low, shim under the saw fixing points rather than under the saw box, as the latter option could interfere with the drawer(s), door(s), whatever you chose. If you've measured accurately, don't worry, it'll be right first time!

It Hinges On This

If you are going to hinge the saw, remember that you will need to cut out an access hole from the hinged platform. This needs accounting for in the design of the platform, as it needs to be strong enough to carry the weight of the BT3K at right angles and outside one edge, ensuring that the saw remains fixed to the platform at all times. This is how I did it:

An oak frame, built with mortise and tenon joints, carries an MDF panel. The panel is set into the frame using biscuits, although a groove or rebate would have been an acceptable alternative. The whole idea is that the panel must be able to resist twisting and flexing when hinged upright and a plain MDF panel with most of the middle removed would simply not be up to the job! The top of the saw box carcass was made in the same way, so that I had a decent amount of oak into which to let the hinges. Solid brass hinges mortised into oak is a fairly strong combination and one I was prepared to trust my precious BT3K to!

Fitting the saw box to the torsion box is again a matter of personal choice. Biscuits and glue did the job for me, but I could have used other methods, including a simple fixing through the left-hand vertical side panel.

On the Rails

Once the saw is on its saw box and centered correctly, it's time for the best bit – fitting the extension rails. My design incorporated panels for this purpose, but this method still relies on transferring the heights of the existing rails accurately.

First, I mounted the standard rails on the saw and aligned the measuring scale with the blade. This meant that the rails were now in position relative to the top and I doubt if you will be able to resist running the fence across to check if it works - I couldn't! The rails fit via T-nuts, which ride in slots in the rear face of each rail, so the vertical center of these slots is what you're after, relative to the cabinet top. I found that the best way of transferring this measurement along the cabinet was to use a mortise gauge.

I had already selected bolts of the correct thread, long enough to reach through the vertical panel, together with some large washers as shims (against the bolt heads, inside the cabinet) if required. I then drilled through the vertical panels in positions along the cabinet that gave me good access from the inside.

Next, I prepared the joining plates that came with the Wide Table Kit (there are alternative methods of joining the rails) and slid the supplied T-nuts into the slots in the bottom of both rails. Loosely fitting the rails to the sliding plates and starting the through bolts at the same time was a bit of a fiddle, but once you've got the bolts started, you're away.

The final check before tightening is to make sure that the extension rails are absolutely butted against the existing set, in order for the fence to slide seamlessly along.
Gently tighten and test – yes! Snap in the end caps and you're done. Here's my result:

For the full story of the build, with more pictures, visit http://www.raygirling.com/sawtable.htm

I hope that you found some of this article useful. Good luck with ***your*** mobile cabinet!

Ray Girling