Build a Wooden Hand Plane

by Paul Proffitt

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Materials needed
Plane Iron – Hock Straight Edge 1 3/4" with chip breaker as an example
Dowel – 3/8" x 2.5" (hardwood or metal such as brass or steel)
Wood for the plane body – approximate rough size 11" L x 2 5/8" W x 1 3/4" T

Tools Needed / Recommended

Jointer	to flatten faces and remove saw marks
Table saw, miter saw, etc.	to cut plane body to length and cut 45 degree bed angle
Bandsaw	to cut sides / cheeks off the rough plane body
Table router, 3/4" straight bit	to route a dado for the chip breaker screw
Drill press	to accurately drill 3/8" hole for the dowel
Sharpening stones or other	to flatten and sharpen the plane iron
File, scraper, rasp	for smoothing and shaping
Small mallet	to adjust the plane
Clamps	four to six 6" clamps with 2" min depth
Marking tools	Square, straightedge, pencil, angle gauge, protractor
Eye and ear protection	For safety when using power tools

Estimated time to complete this project: 1 hour to 2 hours

Steps to Build Your Own Wooden Hand Plane

1) **Select a plane iron and chip breaker (optional) and flatten and sharpen the iron**
2) **Select and cut the plane blank to approximate dimensions (11" x 2 5/8" x 1 3/4")**
3) **Flatten and square the bottom, top and sides of the plane black**
4) **Rip the sides of the plane blank to leave a center block about 1/16" wider than your selected plane iron**
5) **Mark, cut and sand the bed angle and relief angle on the center block**
6) **Glue the two center blocks between the sides you created in step 4**
7) **Flatten the bottom and square the sides of the plane blank**
8) **Mark and drill the hole for the dowel**
9) **Cut, sand, and fit a wedge to hold the plane iron in place**
10) **Relieve the edges, customize the shape and try it out**

1) Selecting and sharpening a plane iron and chip breaker (optional)

Buy or make a plane iron

You can make your own plane iron if you have the material (carbon steel bar stock) and the skill. However, most people will buy a plane iron (see sources in Appendix A). Most hand plane irons are hardened to Rc 60 (some to Rc 64 or even higher).

Size of the plane iron

Commonly available plane irons for wooden planes are 1" to 2.5" wide in various lengths and thicknesses from 1/8" to 1/4". The plane iron for a wooden hand plane needs to be thicker for extra rigidity to reduce chattering. It is common for plane irons for wooden hand planes to come with a chip breaker, but you should verify that this is the case. A chip breaker is recommended, but not required.

Sharpening a plane iron

A plane iron should first be flattened on the back. This is normally accomplished using sandpaper on a glass, marble or other very flat surface (table saw table will work, but is not recommended), but can also be done using a variety of sharpening stones from Arkansas to Japanese water stones. Some plane irons will come with hollow ground bevel. If yours did not come that way you will need to grind the appropriate bevel on the iron with a slight hollow grind. Once the back is flattened and the hollow ground bevel is in place sharpen the plane iron on a stone or sandpaper system.

2) Select and cut the plane blank to approximate dimensions (11" x 2 5/8" x 1 3/4")

What wood to use?

The wood hand plane should be made from a straight grained hardwood. The harder the wood, the slower it will wear and the longer your plane will last. Woods such as purpleheart, jatoba, lignum vitae (pau santo, ironwood, greenheart), yellowheart, cocobolo, rock maple, white oak, and birch will all make fine hand planes. You could choose pine, walnut, cherry or regular maple, but they would wear more quickly and some might deform slightly under the stress when in use. Whatever wood you choose the grain should be oriented so it slopes downhill from the front to the back of the plane.

What size plane blank?

The plane blank width will be determined by the width of the plane iron you selected. The plane blank needs to be 3/4" to 1" wider than your plane iron. The length of your plane blank is up to you. A typical length is 9" to 11" which

yields a finished plane approximately 8.5" long. This is a comfortable length, but you could make a plane that is shorter or longer using this same technique. Shorter planes are used for smaller surfaces. Longer planes are used for flattening larger surfaces. The thickness of the plane blank should be 1 3/4" to 2" and is determined by the length of your plane iron and your personal preference. It could start from a much thicker blank depending on your plane body design.

Mark the blank to indicate the front and top so that you maintain the intended grain orientation.

3) Flatten and square the bottom, top and sides of the plane blank

Flatten the bottom of your plane blank using a jointer or sandpaper secured to a flat surface. Then square the sides of the plane blank to the bottom using a jointer, table saw or other similar method. Having the plane blank flat and square will contribute to the accuracy of the next steps. *Be sure to re-mark the blank's front and top for reference.*

4) Rip the sides of the plane blank to leave a center block about 1/16" wider than your selected plane iron

Our project plane iron is 1 3/4" wide so we need to have a finished center block that is approximately 1 13/16" wide. Making the center block much wider than the plane iron will make it more difficult to keep the iron straight in the plane while adjusting the cut. Note that you will be jointing the sides of the center block prior to glue-up so the rough width of the center block needs to be about 1/16" wider than the finished width or about 1 7/8". If the initial plane blank was 2 5/8" wide and we use a bandsaw that cuts approximately a 1/16" kerf then we will need to cut off a 5/16" slice on the side. Calculate the thickness of both slices using this formula:

Slice Thickness = (Rough block width – rough center block width – (2 x saw kerf))/2

In our case this would be: slice thickness = (2 5/8" – 1 7/8" – (2 x 1/16"))/2 or 5/16"

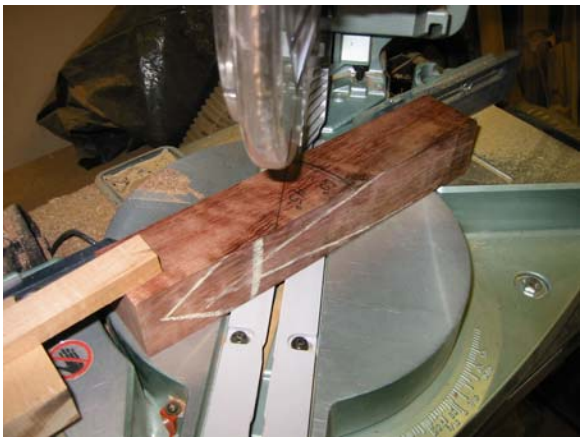
So our sides will be roughly 5/16" thick. Now joint away the saw marks on the inner face of each side piece. Be sure your alignment marks are still in place.

Next joint the sides of the center block to remove the saw marks, but *remember that the finished center block thickness must be 1/16" more than the width of our plane iron* or about 1 13/16". Now you should have three pieces from your original plane block, two sides about 5/16" thick and one center block about 1 13/16" thick.

5) Mark, cut and sand the bed angle and relief angle on the center block

The bed of our wood block plane is the angled surface that the plane iron will sit on. *This surface must be as flat as possible so the iron will not rock and it must be exactly perpendicular to the length of the plane body.*

Make sure you note which end of your center block is the front. The bed angle will be cut towards the back of the plane. Mark the center of the length of the center block on one side at the sole (bottom) of the block. Next mark a 45 degree angle up from the mark you just made toward the *back* of the block. This will be the cut that defines the bed or seat for your plane iron. The angle of this cut may be varied depending on the bevel angle of your plane iron and the desired cutting angle for your plane iron. If you want to pick another angle you will need to know some plane geometry which is left as an exercise for the student.

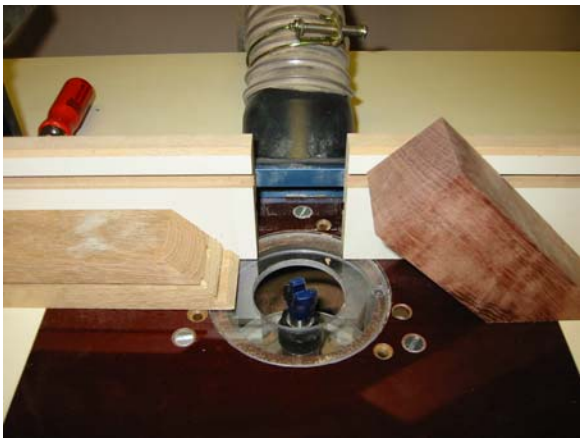


You can cut this bed angle on a miter saw, table saw or several other ways. With a good blade both the miter saw and table saw will likely leave a finished cut that requires NO further work. *Remember this surface must be flat and square.* If it is not square you may be unable to tune your plane because the

blade edge will never be coplanar with the sole of the plane. If you have to sand it, you must be sure *not to round the surface* in any direction.

Mark a relief angle, this time toward the front of the center block, from your previous center mark at the bottom of the block. This angle is not important, but is typically about 60 to 65 degrees. This provides clearance to remove shavings. Now draw an arc using the relief degree angle you just drew as base.

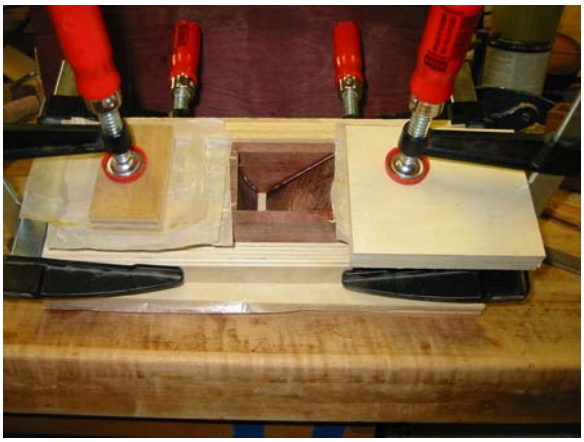
This arc cut is best cut on a bandsaw. There are other ways, but the bandsaw is the quickest and easiest way. You will need to sand this cut to remove saw marks. This sanding is best done with sandpaper wrapped around a large (1.5" or larger) dowel. The smoother you get this arc surface the easier it will be to clear shavings. The final work on this front half of the center block is to file the sharp edge at the sole of the block to about a 1/8” flat that is angled slightly toward the front of the plane. This flat will form the front of the mouth of the plane.



If your plane iron came with a chip breaker as ours did you will need to make a stop dado in the bed so the screw that attaches the chip breaker to the plane iron will not be touching anything. This is most easily done on a router table with a 3/4" straight router bit and a stop block cut to the same angle as the bed angle. The 3/4" straight bit worked for our example because in one pass it cut a dado wide enough and deep enough to clear the chip breaker screw.

6) Glue the two center blocks between the sides you sliced off earlier

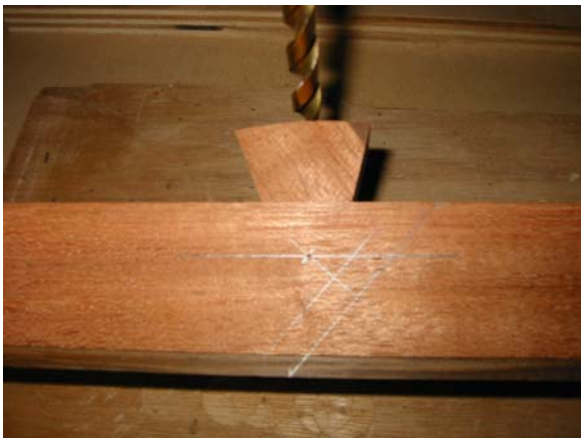
Clamp the right side slice (cheek) to the back half of the center block to temporarily hold the two pieces in alignment. On a flat surface place the front half of the center block in its approximate position. Place the plane iron with the chip breaker attached on the bed. Adjust the position of the front center block so that this block holds the plane iron about 1/16" above the sole. Now mark the positions of the front and back blocks on both sides / cheeks. These marks will be your reference marks to align the pieces for gluing. *Tracing the bed angle and relief angle on the inside of both sides will help you apply glue to the appropriate areas.*



Apply standard yellow glue to all mating sides to be glued. Be careful not to get any glue in the area where the plane blade will sit. Any glue squeeze-out that does end up in the center area is most easily cleaned out before it dries with a soda straw. Make certain that your alignment marks match up. Misalignment of the center blocks to the sides will cause significant difficulties in proceeding with your wooden hand plane.

7) Flatten the bottom and square the sides of the plane blank

Clean up excess dried glue with a scraper once the glue has sufficiently cured. Then joint the bottom of the plane block flat. Be careful to maintain the bottom of the plane square to the sides and specifically square to the face of the bed of the plane. *If you are off you will notice that the mouth of the plane becomes a trapezoid instead of a rectangle. If that happens then rework the sole of the plane until you get the mouth back to a rectangle.* Now make sure the sides are perpendicular to the bottom.



8) Mark and drill the hole for the dowel

On one side of the plane draw a line, parallel to the sole, that is about 1 1/4" up from the sole. Next mark an angled line that corresponds to the bed of the plane. Now, using the plane iron as a pattern, mark a second angle for the

thickness of the plane iron. Here's where you need to know the diameter of your dowel. In our case 3/8". Draw a line perpendicular to the second angled line you just drew so that the distance between that angle and the 1 1/4" line is 3/8" (or the 3/16" plus 1/2 the diameter of your dowel. You should end up with two angled lines, one horizontal line, and one perpendicular line intersecting the other three. The point where the horizontal line and your perpendicular line intersect will be the center point for your 3/8" hole for your dowel. Use a center punch or awl to mark the center. Use a drill press to drill the 3/8" hole straight through both sides of the plane. Use one corner of the scrap piece that was previously cut out of the middle of the center block as a waste block during your drilling to prevent tear-out on the inside faces of both sides. *Remember though you will be using a portion of this waste block (the straight grained edge) to make your wedge. So use the bottom corner of the block to back your drilled hole.* It may be helpful to chase the holes using the dowel. *If you are using a steel or brass dowel, chuck a piece of that dowel in your drill press on a slow speed and slowly feed it though the hole on one side then the other to burnish the inside of the holes.*

9) Cut, sand, and fit a wedge to hold the plane iron in place

Now draw a cut line for your wedge on the scrap piece you have left over from the center of the plane blank. The middle section of the wedge should be about 3/16" thick. Once you have cut the wedge on the bandsaw you will need to sand it smooth with the large dowel and sandpaper making sure the two faces are parallel. Then bevel or relief the sides of the wedge so that it will slide into the plane bed without jamming on the sides.

Next you will need to test fit the wedge. With the dowel in place insert the plane iron, and chip breaker if applicable, then insert the wedge. Slightly tap the wedge into place then remove it and examine the burnish mark left on the wedge by the dowel. It should be even across the entire width of the wedge. If not, you will need to tune the front surface of the wedge until it develops an even burnish mark. This ensures that the plane iron will not rock.

10) Relieve the edges, customize the shape and try it out

Now your wooden hand plane is finished except that all the corners and edges are square and the sides, ends and top are all flat. You can custom shape these surfaces to whatever fits you and your use of the plane.

Adjusting your wooden hand plane

Adjusting your wooden hand plane is done using a small hammer. Plane adjusting hammers often have a brass or other metal end and a plastic or other non-metallic end. The non-metallic end is used for tapping the wedge and the plane body. The metallic end is used for tapping the blade. A small wood mallet will also work.

Set the blade in place so that it is even with the sole of the plane. Snug the wedge in place to hold the blade. Now you adjust the blade by tapping on various parts of the plane body or blade until it cuts the way you want. There will be lots of trial-and-error until you get the hang of setting and adjusting the plane blade.

To extend the blade

Tap the front end of the plane or tap the top of the plane blade

To retract the blade

Tap the back end of the plane or the front top of the plane
Be sure to retighten the wedge after you back up the blade.

To level the blade with the sole

Tap on the left or right top corner of the blade

Acknowledgement: This method of making a wooden hand plane can be found through many sources. The inspiration for the exact version came from **David Marks' Woodworks** show called "European Hand Plane" (episode WWK-606 via DIYNETWORK.com). A similar construction can be found in the "Working with Handplanes" book referenced below starting on page 121 by author David Welter.

Appendix A – Local Sources in Atlanta

Plane Irons

- Highland Woodworking - http://www.HighlandWoodworking.com - carries Hock plane irons and may have others
- The Japan Woodworker – http:// www.japanwoodworker.com - carries Hock plane irons as well as a variety of Japanese plane irons

Hardwood

Most of our local hardwood suppliers will carry some variety of wood that will work fine for a wooden hand plane.

- **Suwanee Lumber** and **Georgia Hardwoods** both carry mostly domestic species.
- **Atlanta Wood Products**, **Peach State Lumber** and **Carlton's Rare Woods** all carry a variety of domestic and exotic hardwoods.

There are numerous other local suppliers of air dried or kiln dried domestic and exotic hardwoods. Rockler and Woodcraft also sell various hardwoods locally, but may not often have 8/4 (2" nominal) stock.

Dowels

- Hardwood dowels can be found in local hardware and big box stores as well as many local lumber yards. Of course you can also turn your own.
- 3/8" Steel rod can be purchased at Lowe's and maybe Home Depot as well as many local hardware stores.
- 3/8" Brass rod will be harder to find locally, but some hardware and metal specialty places carry it.

Appendix B – Resources of Interest

Woodworker's Guide to Tool Steel - http://www.threeplanes.net/toolsteel.html. No affiliation with or knowledge of the individual behind this site. It just seemed like pertinent and interesting information for anyone wanting to make their own plane iron.

Working with Handplanes, The New Best of Fine Woodworking, 2005 by Taunton Press. This is an excellent book on understanding, using and building hand planes.