(https://plus.google.com/106678199895601272963)

Strength Test: Dowel joints are fast, easy and flexible to make, but how strong are they? We put this popular joint through some tests to figure out if they are as good as they seem.

(/sites/default/files/images/articles/doweljoint_lead.jpg)

How Strong is a Dowel Joint?

Photos by Steve Morris; Lead photo by Rob Brown

The woodworker has many options when it comes to selecting ways of joining solid wood. Some joints are easy to machine but don't offer much strength. Some are difficult but when made well last a long time. Most joints fall somewhere in the middle. The dowel joint, whether made with the help of an aftermarket jig, dowel center or other hole-location method, is easy to make and offers a lot of flexibility. To find out if the dowel joint could stand up to a beating, I selected two other methods of solid wood joinery and tested them all to failure: the biscuit joint is commonly used for its ease of machining, and mortise and tenon – although more difficult to make, and known traditionally for its great strength – is the other joint in the test. I believe these three commonly used joints will provide a fair cross-section of strength results.

Usually furniture parts join each other at 90°, so I decided to test them at that angle, and chose to mimic the joint commonly found in cabinet door frames. Leaving the door panel out of the mix allowed us to get strength results regarding just the rail to stile joint.

Because dowels are often used in melamine kitchen cabinet construction I did a separate set of tests mimicking the joint used to fasten the gable to the cabinet base. There are two other joints offering up competition in this case

as well; biscuits with a butt joint, and a rabbet joint. Both of these joints are commonly used in kitchen cabinet construction.

When finished I found the melamine results so surprising that I did two additional tests regarding dowel joint strength when used with sheet goods.

Testing Details

In the solid wood test ¾" thick clear flat sawn red oak was used. For the sheet good test ⅝" thick melamine coated particle board was used. Each test was performed on five samples and the results were averaged. The testing apparatus was carefully set up so that the tests were as repeatable as possible.

Mortise and tenon joints were created using accepted methods for the home workshop. Mortises were cut using a dedicated shop built jig, a router and a new ⅜" dia. spiral bit. Mortise dimension were ⅜" wide by 2" long and 1" deep. The ends were squared up using a regular ⅜" chisel. Tenons were created using a sliding table and a dado set. Tenon thickness was set to create a tenon with a tight fit into the mortise and adjusted with a handplane for a snug, friction fit; i.e., the joint required minor tapping with a mallet to close, but didn't fall apart if turned upside down. Tenon dimension was set for a ⅛" clearance in both length and depth. Both pieces were jointed and planed to final thickness. Glue was applied to both the mortise and tenon.

The dowel joint was created using the Dowelmax jig. Three 2" long, ⅜" dia. dowels were used in each dowel joint. Holes were drilled to a depth of 1 ⅛ in both pieces and glue was applied to both the holes and the dowels with a small brush ensuring enough glue to create a slight amount of squeeze-out.

There were two biscuit slots per joint and they were all cut with a new blade. The #20 biscuits were a drop-in fit and glue was applied to both the slot and the biscuit.

The sheet goods test samples were all 5" wide. Two sets of dowel joint samples were created using three and five 1 ½" long ⅜" dowels, evenly spaced along the test sample. The dowels penetrated 1" into the case bottom and ½" into the gable piece. Two #20 biscuits were used for the biscuit test samples. In the final test sample the rabbet was machined on a table saw and was cut ¼" deep in the gable piece.

All test joints were glued with Titebond 1 and clamped for 24 hours.

(/sites/default/files/assets/images/doweljoint_1_0.jpg)
***Testing equipment** – I used this machine to test the strength of all the different joints*

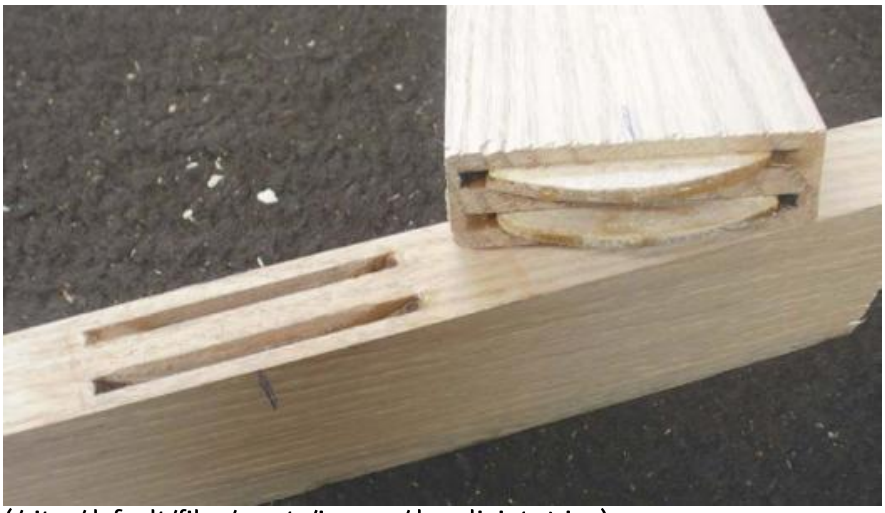
Test Results
All the solid wood joints failed in a similar manner – the wood around the tenon, biscuits or dowels let go of the mating surface. A small amount of wood fibre was still adhered to the tenon, biscuit or dowel, but for the most part the joint failed at the glue line. This indicates that glue surface area and glue penetration into the surrounding solid wood fibres is a key to joint strength.

Test results show that dowels are the strongest method for creating this type of joint. The dowel joint in solid oak failed at an average of 650 pounds pressure, mortise and tenon joints failed at 500 pounds and biscuits failed at 325 pounds. Variations in the pressure at failure was less than 5 percent.

In the sheet goods test, dowels were far superior to any other method. The dowel joints failed at 240 pounds pressure, the biscuits failed at less than 100 pounds pressure and the failure point for rabbet joint was immeasurably low.

(/sites/default/files/assets/images/doweljoint_2.jpg)
***Broken dowel joint** – The strongest of the bunch, the dowel joint held together until the gauge read 650 lb.*

(/sites/default/files/assets/images/doweljoint_3.jpg)
***Broken mortise and tenon joint** – Coming in a close second, this joint withstood 500 lb. of pressure.*



(/sites/default/files/assets/images/doweljoint_4.jpg)
***Broken biscuit joint** – The biscuits broke at 325 lb.*

(/sites/default/files/assets/images/doweljoint_5.jpg)

***Great for cabinets** – In the sheet good test, the through dowels ranked the highest.*

Surprise, Surprise

The above results compelled me to complete two further tests, slightly modifying the dowel joint in sheet goods scenario. For the first test I used five dowels on the same size part. Turns out more joints don't create a stronger joint. The test with three dowels in the 5" wide piece was stronger than the five dowels by almost 50 percent. The second group of sample joints involved three dowels with full penetration through the gable side. This resulted in a joint almost twice as strong as the "blind" dowel joint with three dowels.

Conclusion

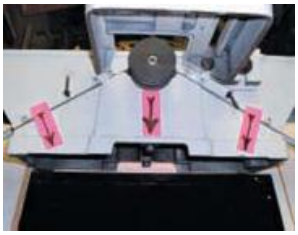
It's nice to know that dowels can provide a strong option when making furniture or cabinetry. Because a dowel jig assists in machining evenly spaced holes that are square to the surface, and doesn't allow the drill bit to wander during drilling, they provide a snug fitting joint with a surprising amount of strength. This is particularly true in sheet goods. The ease of joinery and fast construction make dowel joinery extremely attractive to both professional and hobby woodworkers.

STEVE MORRIS

(/sites/default/files/assets/images/Steve%20Morris.jpg)

stevemorris_6@hotmail.com

Related Articles



Reduce Jointer Dust

Dust Collection

(/get-more/reduce-jointer-dust)

King Canada 6" Benchtop Jointer Review

A great combination of performance, precision, portability and price.

(/tool-review/king-canada-6-benchtop-jointer-review)

Stopped Dado Joint

Wood Joinery: A stopped dado provides the same strength and flexibility that a dado joint does, however it hides the dado itself for a cleaner look on the fronts of bookshelves and other similarly constructed projects. It doesn't...

(/tipstechniques/stopped-dado-joint)

RECOMMENDED

> **FREE Digital Issue (/free-digital-issue)**

> **FREE Plans/Projects (/free-plans)**

> **FREE Tool GiveAway (/give-away)**

> **FREE Monthly Newsletter (https://www.canadianwoodworking.com/newsletter-signup?trackcode=HPMPL)**

> **Know Your Tools (/know-your-tools)**

> **New Tool Reviews (/reviews)**

> **Top Ten (/woodworkers-top-ten-lists)**

MOST POPULAR

> Carhartt Rugged Flex Loose Fit Canvas Work Pant (/carhartt-rugged-flex-loose-fit-canvas-work-pant)

> Kershaw Taskmaster 2 Saw (/kershaw-taskmaster-2-saw)

> Wiley X WX BREACH Protective Sunglasses (/Wiley%20WX%20BREACH)

> DEWALT Announces New FLEXVOLT 20V/60V MAX 15.0 Ah Battery (/DEWALT%2015.0%20Ah%20Battery)

> Woods to Know: Avodire (/woods-know-avodire)

> Meet Helly Hansen's Versatile Workwear Collection - Built to Protect and Last (/meet-helly-hansens-versatile-workwear-collection-built-protect-and-last)

> Grizzly’s Newest 10" Cabinet Table Saw Now Available (/Grizzly%20Cabinet%20Saw)

LATEST FORUM TOPICS

WTB Book (https://forum.canadianwoodworking.com/forum/the-swap-meet/the-swap-meet-aa/1346328-wtb-book)
Looking for this Home Workshops book

9" black cherry (https://forum.canadianwoodworking.com/forum/woodworking/turning/1346323-

9-black-cherry)
Had a hard time turning this one, lol full of cracks that I...

Cheap planer (https://forum.canadianwoodworking.com/forum/the-swap-meet/the-swap-meet-aa/1346262-cheap-planer)
Not mine,seen it on Facebook marketplace,says feed roller is...

MOST RECENT GET MORE

> The Cast Iron American Style Block Plane (/get-more/cast-iron-american-style-block-plane)

> Building Furniture from Scraps (/get-more/building-furniture-scraps)

> Portable Work Support (/get-more/portable-work-support)

> Burl Vase (/get-more/burl-vase)

> Woodchuckle: A Home in the Woods (/get-more/woodchuckle-home-woods)

(https://twitter.com/canwoodworking)

(https://www.facebook.com/canwoodworking/)

(https://www.youtube.com/user/canadianwoodworking)

(https://www.pinterest.com/canadianwoodworking/)

(https://www.instagram.com/canadianwoodworking/)

PLANS)
WOODS TO KNOW (HTTPS://WWW.CANADIANWOODWORKING.COM/WOODS-KNOW)
LUMBER DIRECTORY (HTTPS://CANADIANWOODWORKING.COM/LUMBER-DIRECTORY)
SHOPTOOLS (HTTPS://WWW.CANADIANWOODWORKING.COM/SHOPTOOLS-NEWSLETTER-0)