

THE QUICK 'n DIRTY ON

WHEELS

Other than the fit of a bike, wheels have the highest impact on how a bike rides. Out-of-true or out-of-round wheels can make a bike wobble and hop, and can slow you down by rubbing on your brakes.



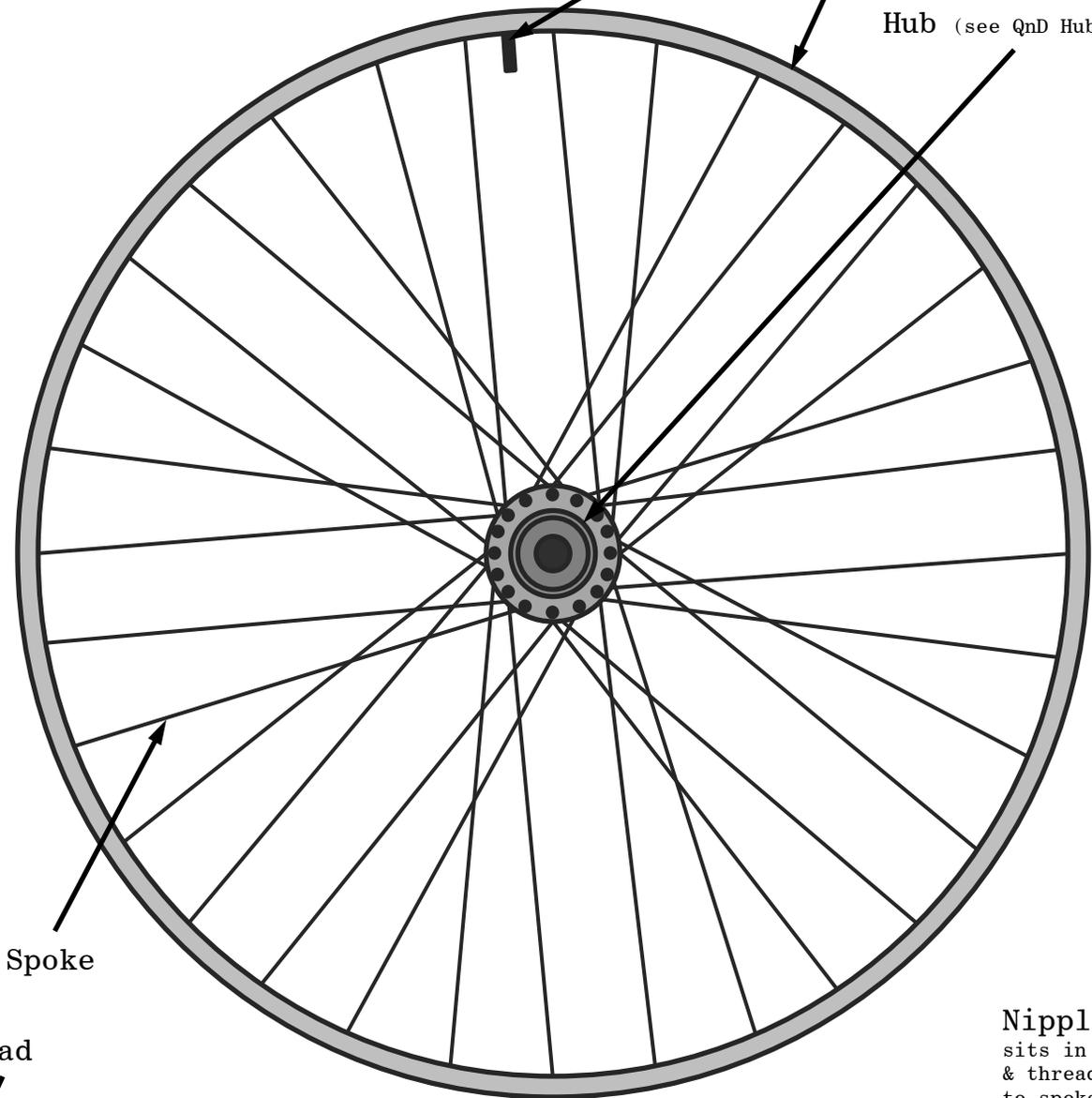
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ANATOMY of the wheel

Valve hole

Rim

Hub (see QnD Hubs)



Spoke

Head

Elbow

Spoke threads

Nipple
sits in rim
& threads
to spoke



Last week's session focused on hubs, so this week we'll focus on the rest of the wheel. We'll start with common spoke-rim problems.

BENT OR BROKEN SPOKES

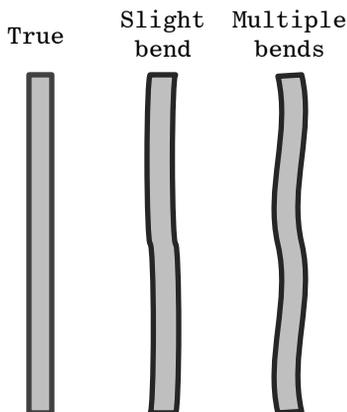
Spokes can become damaged in several ways. 1) Direct trauma from an impact can bend or break spokes. 2) Shifting a chain off the inside of a cassette can damage the leading spokes on the drive side of the wheel. 3) Improperly tensioned or aging spokes may break under stress, either from impacts (potholes, railroad tracks, curbs) or from drivetrain forces (usually during quick accelerations).

Replacing Damaged Spokes

- 1) If the freewheel, cassette, or disc rotor is in the way of spoke removal or installation, remove first.
- 2) Remove the broken spoke by unthreading it from the nipple – most spokes break at the flange.
- 3) Measure an intact spoke to get the length needed for the replacement. On a rear wheel, note that the drive and non-drive sides may have different length spokes.
- 4) Thread the replacement spoke(s) into the wheel taking care to follow the crossing pattern.
- 5) Before truing the wheel, use a spoke wrench to tension the replacement spokes.

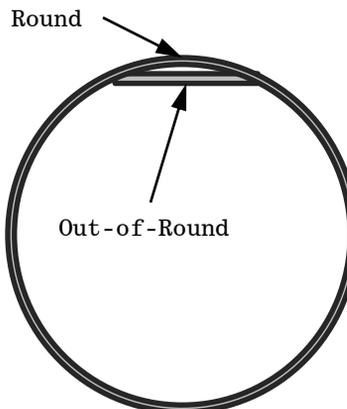
TRUENESS AND ROUNDNESS

Trueness refers to the lateral alignment of the rim relative to the hub. This is usually what people mean when they say a wheel is "straight."



NOTE: It is a rather simple task to fix an out-of-true wheel, given the right tools. Single, slight bends are easier to fix than multiple large bends.

Roundness refers to the vertical alignment of the rim relative to the hub. Out-of-round rims have blips, hops, or flat spots.



NOTE: It is very difficult to bring a wheel back into round once it has a flat spot. Sometimes it is best to live with imperfection or find a new wheel.

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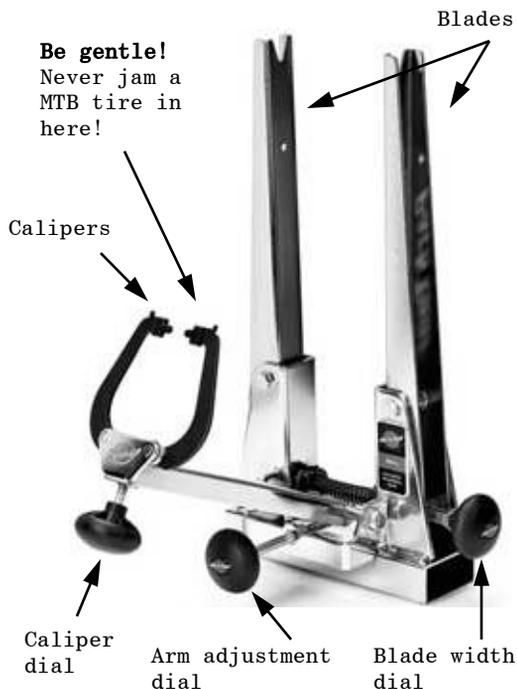


The wheel station includes many expensive, precision tools. Please be gentle with them!

TOOLS to work on wheels

Truing Stand

Used to hold the wheel and locate out-of-true portions of the rim.



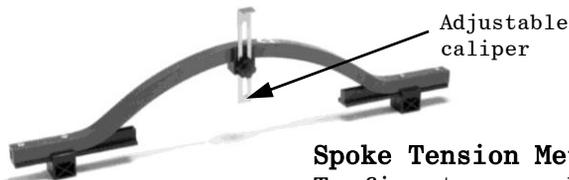
Spoke Wrenches

Used to tighten or loosen the spokes by turning the nipples



Dishing Gauge

Used to test the centering of the wheel.



Nipple Driver

For speedy nipple driving.



Spoke Tension Meter

To fine-tune spoke tension to riders of different weights.



REPAIRING a dented rim

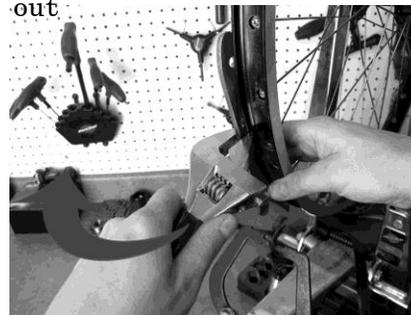
1) Locate dent



2) Grab a steel tire lever and a large crescent wrench



3) Use the tire lever as a flat guide and the wrench to bend the dent out





Some mechanics (usually wheel specialists) claim that truing wheels is an art form. Yes, there is a bit of a “feel for it,” but the concept is rather simple.

TRUING a wheel

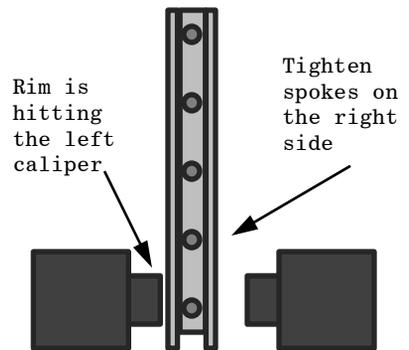
1) Place wheel in stand and adjust the calipers



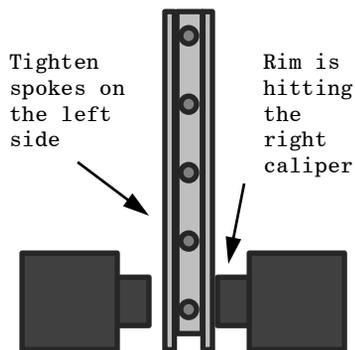
2) Spin the wheel and tighten the calipers until you locate the most severe (largest amplitude) bend in the rim. The calipers should ONLY hit the rim in one spot.

NOTE: try to judge the length of the bend to determine how many spokes to tighten.

3) Using a spoke wrench, tighten on the opposite side of the wheel to “pull” the rim away from the caliper it’s hitting.



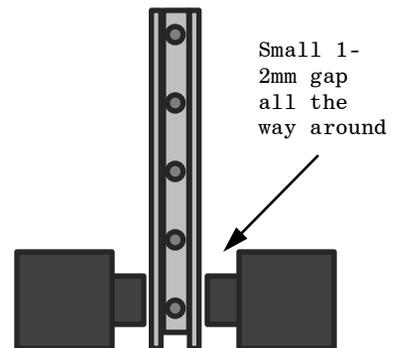
4) Spin the wheel again. If it doesn't rub on the calipers, that spot is fixed. Tighten the calipers to locate the next “worst” spot.



5) Repeat as many times as necessary. De-stress the wheel between every couple iterations by grabbing groups of 4 spokes and squeezing with your hand. This will spread the changes in tension throughout the wheel.

NOTE: if you continue to only tighten spokes you might encounter too much spoke tension. Instead of tightening spokes on the opposite side, try loosening spokes on the same side.

6) How do you know when you're done? Most rims will be fine to ride when they're within 1-2mm of true.



TIP: if spokes are difficult to turn, apply a drop of TriFlow to each nipple. Alternatively, squeeze adjacent spokes to loose the tension.



TROUBLESHOOTING wheel problems

1) Take a good look at the entire wheel

The biggest problem we see with beginner and experienced mechanics is wasted time spent fixing part or parts of a wheel that wasn't worth fixing in the first place, i.e. something was fatally wrong with the rim or hub. The effort that should be spent to fix a wheel depends on several factors including need (is this the only wheel that will do the job), quality of the wheel, past history (has it been limping along with constant problems), and the tolerance of the end user for imperfections (does the wheel have to be perfect to fit their needs?). Evaluate these conditions before working hard on a wheel!

2) Inspect the rim closely

Look for fatal signs, such as the taco, the chip (aka curb shot), the blip (aka flat spot), or the about-to-explode concave braking surface. If you find any of these troubling signs, don't spend any more time on the wheel - send it to recycling.

3) Inspect the axle closely

If it's missing, bent, or broken it may be worth finding the replacement parts, but be careful to match the axle length, diameter, thread pitch, hardware, and outside locknut dimension (see QnD hubs for more info on this).

4) Check the bearings

If the axle rotation is loose or binding, readjust the bearing preload (again see QnD hubs for more info). If the axle rotation is rough, check the cones and bearings for wear. Replace if necessary.

5) Inspect the spokes closely

Are any bent, broken, or missing? If only one or two have problems, it's probably worth making a repair. Find the appropriate replacement(s) and install. Inspect the spokes for rust or corrosion. Do the nipples turn smoothly or are they seized in place? If you can't turn the nipples you can't true the wheel! Inspect the drive side leading spokes for the classic "jammed chain" damage. Don't trust a wheel if ½ of the drive side spokes are damaged in this fashion.

6) True the wheel

True the wheel, checking for both trueness and roundness.

7) Check the dish

Our truing stands are not perfectly calibrated. Use the dishing gauge to check if the rim is centered relative to the hub.

8) Stress (or de-stress) and fine-tune it

Stress the wheel to relieve the tension caused by twisted spokes. Throw it back in the truing stand for one last check. Loosen spokes on the final true.

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A few helpful tidbits on spokes and rims. For hubs refer to the QnD hubs handout.

RIM FEATURES

Double-wall versus single-wall

Double-wall rims are stronger and usually a sign of higher quality – use for heavier or abusive riders.



single-wall



double-wall

Rim width

Rim width can influence brake function (for rim brakes), tire compatibility, and tire deflection (particularly for high volume mountain bike tires). In general, skinnier rims should be used for road biking and wider rims should be used for mountain biking.

Eyelets versus no eyelets

Some claim that brass or stainless steel eyelets make rims stronger, but there are plenty of high-quality rims without eyelets. Eyelets do make wheel building and truing easier.

no
eyelets



eyelets



Rim wall surface

If using rim brakes, rim wall machining is ideal, providing a textured surface to brake on. Some cheap rims have smooth walls. Some expensive rims have special surfaces for ceramic brake pads. Rims found on disc brake rims may have completely smooth rim walls or profiles that do not accommodate rim brakes.

SPOKES

Materials

High-quality spokes are typically made of stainless steel. Low-quality spokes are made of carbon steel with a chrome plating. Some high-end wheels will have straight-pull oversized aluminum spokes. Rarely, you will encounter carbon or titanium spokes. Stick with stainless steel for durability and easy of maintenance.

Gauges, butting, threading

Spokes are made in different gauges (diameters) for different uses. Thinner spokes can save weight, but are not as strong. There are also butted spokes, which taper to a thinner diameter near the center of the spoke. In general, for heavier and abusive riders larger diameter spokes should be used. For lighter riders or for road riding, smaller diameter or butted spokes may be appropriate. A nipple threaded to fit a 1.8mm spoke will not work with a 2.0mm spoke and vice-versa.

Crosses

There are different spoke patterns that can be used to lace a wheel, ranging from radial (spokes do not cross each other) to 4-cross. The more times the spokes cross, the stronger the wheel will be. Many manufacturers void warranties on hubs and rims if they are laced radially. The advantage of radial lacing is lower weight, because you can use shorter spokes. Most wheels have 3-cross patterns for general use, or 4-cross patterns for heavy uses such as touring.

Brands

DT (D and T crossing each other on the head of the spoke) and WheelSmith (W on the head of the spoke) are the most trusted brands for wheel building. Search for spokes of these brands when making repairs or when building up a wheel from scratch. Low quality spokes can be ruled out by their strong attraction to the magnet.

For information on wheel building check out <http://sheldonbrown.com/wheelbuild.html>