

AI-00808 Wheel Cross Patterns

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In road bike wheel 3 cross pattern, what is the science behind the crossing of spokes under and not over so that spokes will not touch at the crossing point?

In a **3-cross spoke pattern** for road bike wheels, the science behind crossing the spokes under rather than over is fascinating. Let's delve into it:

1. Tangential Spoking:

- A 3-cross spoking pattern means that every single spoke **crosses three other spokes** on its journey between the hub flange and the rim.
- Instead of going straight up and down from the hub, the spokes come out at an angle. The higher the number of spokes a spoke crosses, the more tangential they become.
- **Why?** When spokes intersect with other spokes, they brace each other when tensioned and support each other when compressed. This increases the **lateral rigidity** of the wheel.
- **Benefit:** Tangential spoking helps lengthen the time before your wheel needs truing and makes it fundamentally stronger.
- **Drive Side Preference:** 3-cross is preferred on the drive side of the rear wheel. These spokes transfer power from the hub to the rim, and the bracing prevents excessive flex.
- **Trade-off:** Longer spokes are needed for 3-cross, adding weight to the wheel¹.

2. 2-Cross Spoking:

- In a 2-cross pattern, every spoke **crosses two other spokes** between the hub and the rim.
- These spokes leave the hub at an angle closer to being straight up and down compared to 3-cross.
- **Lighter Spokes:** 2-cross uses shorter spokes, making them lighter than those in 3-cross patterns.
- **Sturdiness:** While 2-cross spokes have fewer brace points (only two), they can still be laterally stiff, especially on lower spoke count wheels¹.

3. Spoke Crossing Indicator:

- As the angle of a spoke relative to the hub becomes more tangential (less straight up and down), it crosses more of the other spokes.
- The "**cross number**" (e.g., 3-cross or 2-cross) is a good indicator of wheel strength and the time between truing sessions.
- So, the next time you admire your bike wheels, remember that these little pieces of magic—spokes—play a crucial role in keeping you rolling smoothly! 🚲🔧²⁴.

Source: Conversation with Bing, 3/22/2024

(1) Spoke Patterns: 3-Cross vs 2-Cross vs Radial – ICAN Cycling.

<https://icancycling.com/pages/tell-me-all-about-spoking-patterns>.

(2) Speaking of Spokes - Spoke Patterns – Pure Cycles.

<https://www.purecycles.com/blogs/bicycle-news/156387911-speaking-of-spokes-spoke-patterns>.

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(4) 3 cross pattern what's the right way? - Bicycles Stack Exchange.

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