COLNAGO

V5RS

WHITE PAPER

V5Rs
Built to win

#BuiltToWin

V5Rs is the lightest frame ever produced by Colnago, but that’s not all. Average speed and power in races are increasing more and more, which means very little demand for a lightweight-only bike as riders request to use more aerodynamic components, such as deeper wheels or aero cockpits.

That’s the reason why the V5Rs is much more than a light bike.

COLNAGO HAS PERFORMED DEEP ANALYSIS IN:

1. **Weight and carbon lay-up**
2. **Aerodynamics**
3. **Frame stiffness**
4. **Handling and frame geometry**

This analysis has enabled Colnago to create the ultimate all-rounder racing bike. V5Rs is just at the UCI weight limit with standard race components used by the Team UAE Emirates – XRG and Team UAE ADQ. It provides improvements in aerodynamics, handling and acceleration.

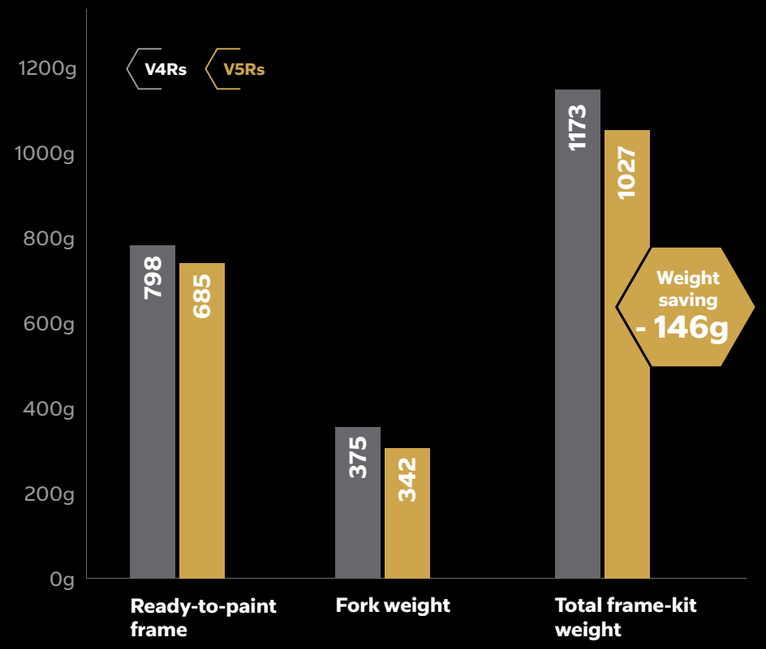
1. WEIGHT AND CARBON LAY-UP

Size 485	Ready-to-paint frame [g]	Fork weight [g]	Total frame-kit weight [g]
V4Rs	798	375	1173
V5Rs	685	342	1027

-146g

Ready-to-paint frame weight is measured before the painting phase, without the removable parts (seatpost clamp, RD and FD hanger).

Total frame-kit weight is the sum of the ready-to-paint frame and fork weights.



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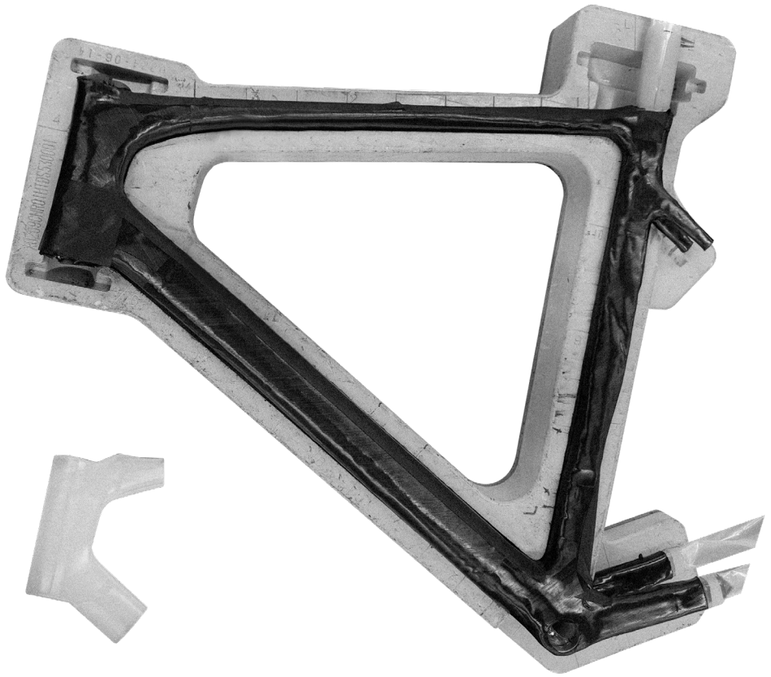
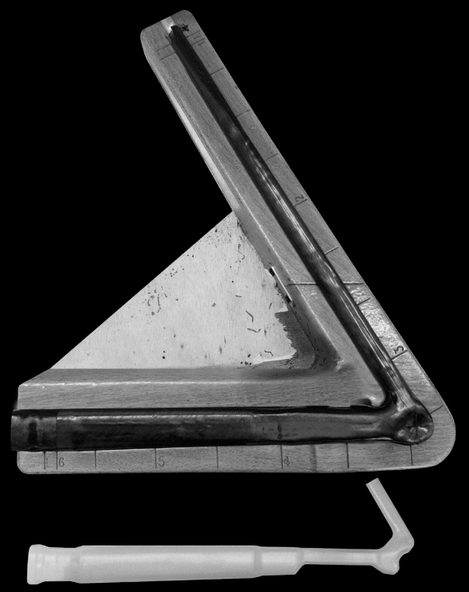
The weight saving comes from the combination of new lamination and manufacturing techniques

The initial step is the definition and optimization of the carbon layup in the crucial sections thanks to FEM* analysis. Once the carbon stacking sequence has been defined, the high strength and stiffness prepregs* are carefully positioned and combined on specific mandrels and then cured in the molds.

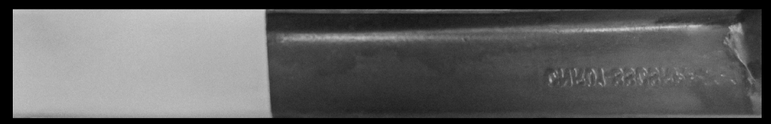


Pre-formed main triangle before curing & HT mandrel.

Notes for reading Plot and Table:
***FEM:** Finite Element Method (FEM) is a popular method that, thanks to mathematical modelling and equation solving, enables the simulation of engineering situations and system behaviors, in this case the structural analysis of bicycle frames.
***Prepreg:** A composite material made from pre-impregnated fibers and a partially cured polymer matrix, such as epoxy resin.



Pre-formed rear triangle NDS before curing & CS-Dropout mandrel.



Internal surface finishing after curing.

Using these mandrels the uncured frame can be precisely preformed, laying each carbon layer in its design position and direction, even in very complex junctions and small radius sections. Therefore, during the curing process, the fibers are not allowed to move, and they maintain the direction to exactly sustain the stresses they are conceived to resist.

Consequently:

1- It is not necessary to add extra material over the design, reducing the weight
2- The final frame performance is more aligned with calculation, increasing strength and stability
3- The overall quality and surface finishing also improve.

2. AERODYNAMICS

During the development of Y1Rs, Colnago partnered with Khalifa University (Abu Dhabi, UAE) and Politecnico di Milano University (Italy) to improve the CFD models used in the developments of their products. The result was a boost in model accuracy. The average delta between CFD measures and real-life measures decreased from 30% (Colnago's data shows this number is the current industry standard) to 15%. This model is now used in the development of all the new Colnago bikes, including the V5Rs.

جامعة خليفة
Khalifa University

POLITECNICO
MILANO 1863

Colnago used the same approach along with digital tools developed and fine-tuned with work on the Y1Rs.

A - The tube profiles of V5Rs were initially studied with CFD.

B - Once the most promising tube and joint shapes were finalized, 1:1 scale prototypes were made using 3D printing.

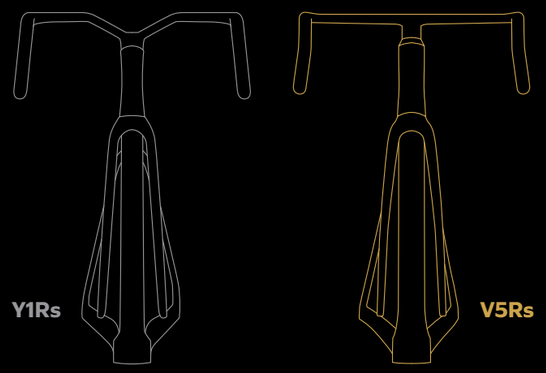
C - Then they were fully assembled as regular reference bikes and, finally, fully tested in multiple wind tunnel test sessions.

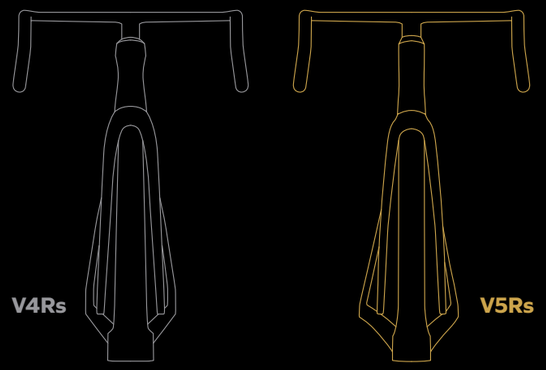
The result of this process is:

2.1 - FRONTAL AREA* REDUCED BY 13% WITH RESPECT TO V4Rs

-13%

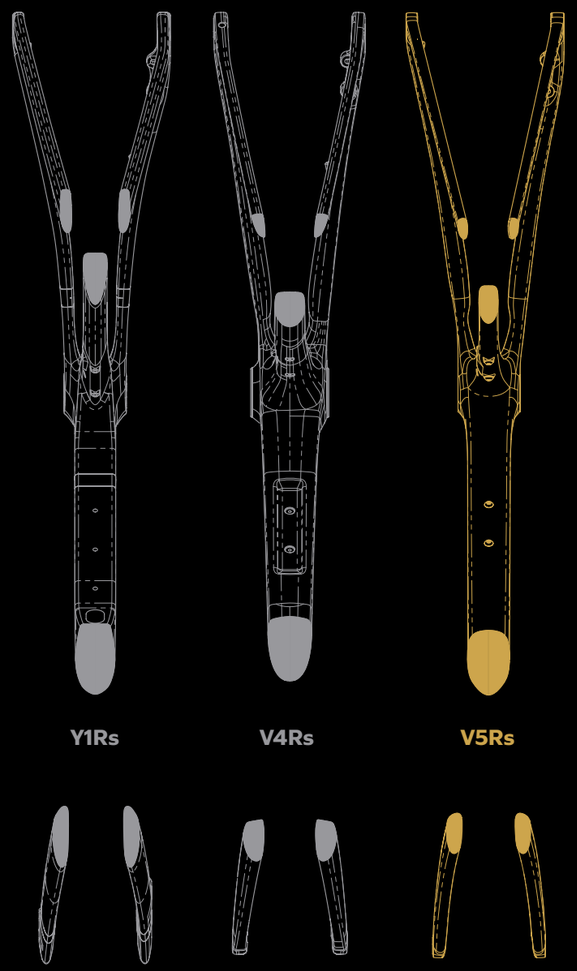
Y1Rs*	V4Rs*	V5Rs
23.438 mm2	28.698 mm2	24.902 mm2





2.2 - MORE AERODYNAMIC TUBE PROFILES

with respect to V4Rs:



A - New fork blade profiles
to combine light-weight,
stiffness and better aerodynamics.

B - Thinner head tube,
especially in the top part,
thanks to the 1-1/8 top bearing.

C - Significantly thinner
and deeper seatpost
and seat tube profiles.

WINDTUNNEL RESULTS:

The results are presented both for the reference speed of 50 km/h, used in all the comparisons since it is the reference speed for professional riders in a breakaway or in the crucial race phases, and at 35 km/h which is closer to amateur riders' average speed or professional riders on mountain stages.

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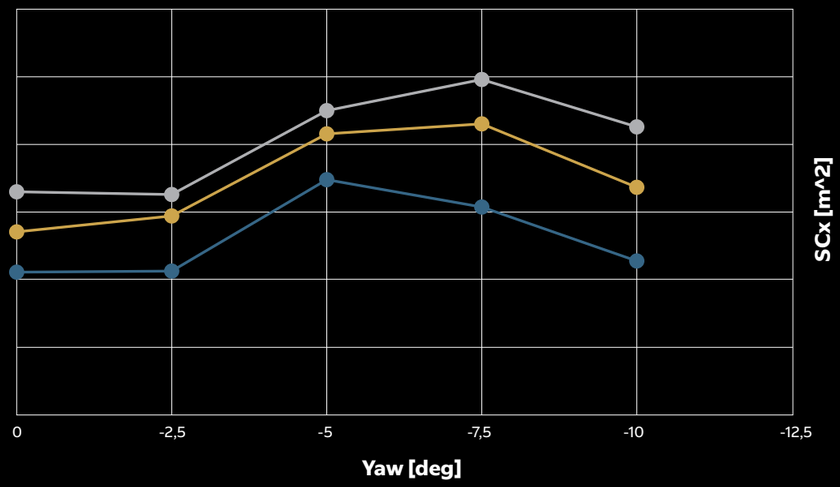
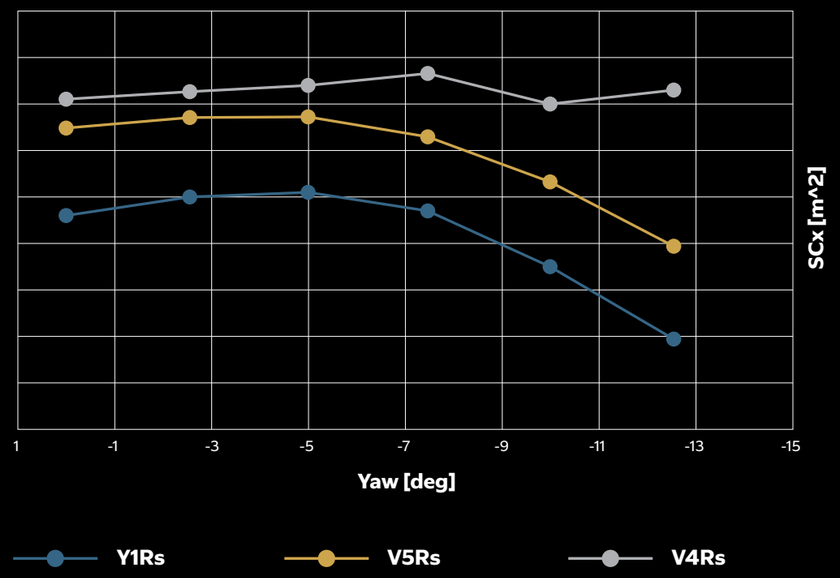
Drag area comparison - Bike with Mannequin - 50 km/h



Drag area comparison - Stand-alone bike - 50 km/h



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Windtunnel results

50 km/h	Bike with Mannequin		Stand-alone bike	
	Power 0° [W]	WAD [W]	Power 0°	WAD [W]
V4Rs	415	499	123	145
Y1Rs	395	474	103	117
V5Rs	406	490	118	134

35 km/h	Bike with Mannequin		Stand-alone bike	
	Power 0° [W]	WAD [W]	Power 0°	WAD [W]
V4Rs	141	155	43	45
Y1Rs	135	147	36	37
V5Rs	139	152	40	42

***CFD** (Computational Fluid Dynamics): is a branch of fluid mechanics that, thanks to specific software, uses numerical analysis to solve problems that involve fluid flows. Related to cycling, it is useful to simulate the airflow around the bike and drag force of different design solutions.

***Frontal Area:** the surface of the cockpit without drops, whose contribution is affected by the presence of brake levers and hands, headtube and fork in frontal view. It is a simplification, since the real frontal area also includes other parts of the frame (but is difficult to quantify because of the presence of the riders) and changes with yaw angle. This is what is generally what is used to refer to the product of drag coefficient and frontal area (CdA).


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2. FRAME STIFFNESS

Creating lighter frames and more aerodynamic tube profiles usually means a trade-off with frame stiffness.

Once the frame preliminary design has been defined and its aerodynamics assessed, joint positions and shapes – first – and then, finally, carbon lay-up have been optimized using FEM before proceeding with physical prototypes. Using FEM it is possible to simulate the behavior of the frame under specific loading conditions. Several designs can be simulated to achieve the required performance.

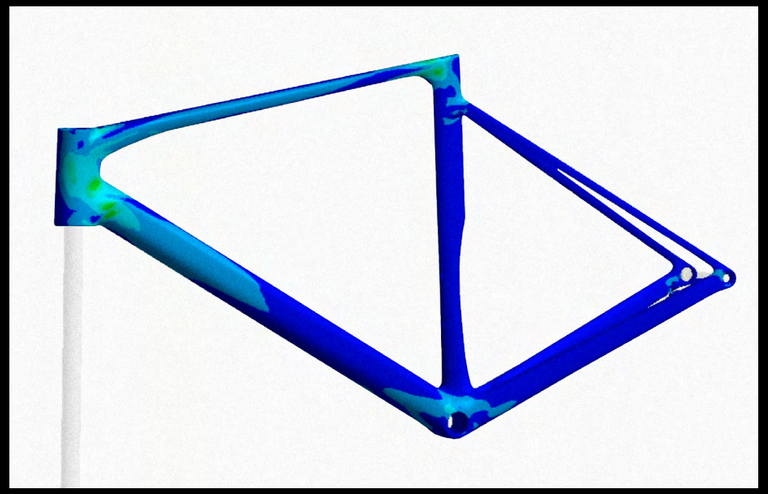
Optimization of seat tube joints to optimize pedaling efficiency

Reducing the width of the seat tube for aerodynamics required a deep study of shapes and lamination to prevent loss of stiffness and thus pedaling efficiency. Consequently, the seat stay has been raised to increase the stiffness of the seatpost joint. The transition from the seat tube to the bottom bracket has been shaped with optimal radius and the same analysis has been carried out for the joint between the down tube and bottom bracket.

Example of a simulation where the frame is mounted on a non-deformable fork, with the rear hub free to rotate. An out-of-plane load has been applied to the bottom bracket to simulate the pedaling load. The shapes and lamination have been tuned to sustain stresses and accommodate the minimum deformation in this condition, before creating physical prototypes. Color scale blue-green-yellow-red reproduces increasing stresses.

Front end design to improve handling and riding precision

Headtube and downtube shapes have been fine-tuned to not deform under steering loads. The result of this optimization is direct feedback from the road, precision in all the leaning phases and support in sprint phases.



Frame stresses simulation in a frame with center of BB and rear hub clamped. Torsion has been applied in the steering axle area and the frame structure has consequently been adjusted to resist stresses, resulting in minimal deformation. Color scale blue-green-yellow-red reproduces increasing stresses.

> ***Thanks to the combination of overall new lamination and joint shapes optimization, the Real Riding Stiffness of the V5Rs is aligned with its predecessor, the V4Rs, the reference for stiffness, despite a more aerodynamic profile and lower weight.***

4. UPDATED RACING GEOMETRY

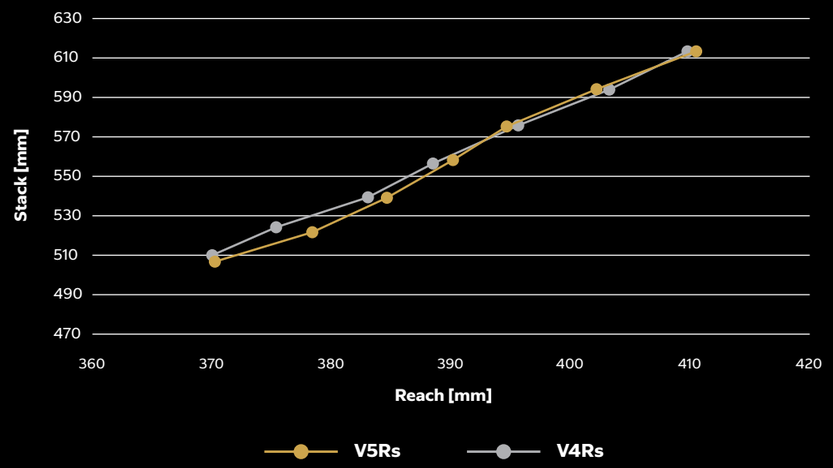
V4Rs geometry has been already validated in major WorldTour races. All the small updates were undertaken to make V5Rs slightly more aggressive and efficient and to better accommodate modern riding positions:

- Two fork rakes (47 mm for sizes 420-510 and 43 mm for 530-570). The purpose is to reduce the trail, especially on smaller sizes and with oversized tires increasingly common, keeping it more even across sizes. The updated trail makes V5Rs more responsive in direction changes and quick maneuvers.

- Slightly higher HT and ST angle with respect to V4Rs, to accommodate a more forward oriented and tuck position and optimize aerodynamics and power transmission.

- Available with 2 seatpost (0 and 15 mm seatback)

- Tyre clearance up to 32-622



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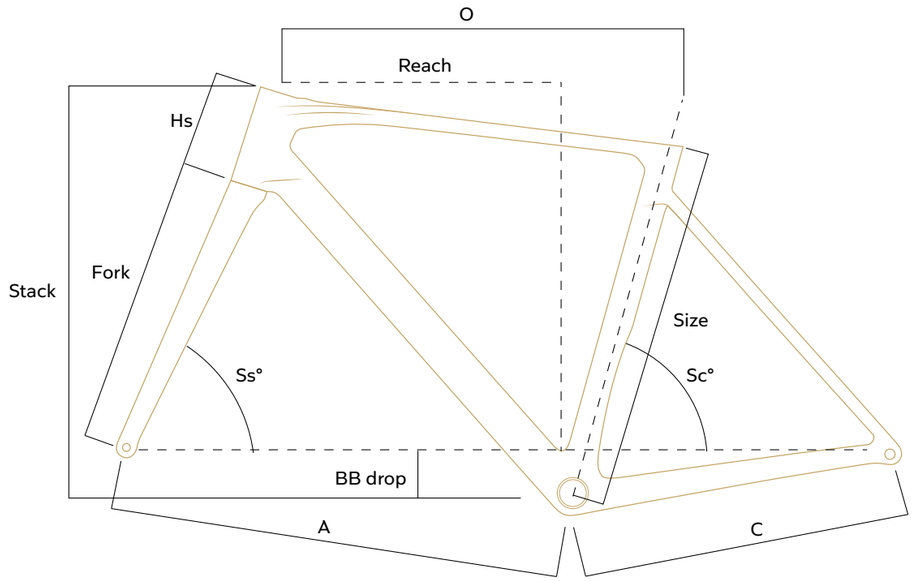

Sloping

Size	Cf	Fork	rake	Sc°	A	C	Hs	Ss°	bbdrop	O	Stack	Reach	Trail (28-622 tire)	Standover (28-622 tire)
420	420	377	47	75.5	579	408	101	70.6	74	503	509	371	70	683
455	455	377	47	75.3	581.5	408	112	71.5	74	514	523	377	65	714
485	485	377	47	74.8	586.5	408	127	72.3	72	530	539	384	59.5	743
510	510	377	47	74.5	596.5	408	146	72.5	72	544	557	390	58.5	766
530	530	377	43	73.8	600	408	162	73	72	564	575	397	59.5	784
550	550	377	43	73.5	612.5	408	181	73	72	578	593	404	59.5	801
570	570	377	43	73.3	622	408	199	73.5	72	595	612	411	57.5	820

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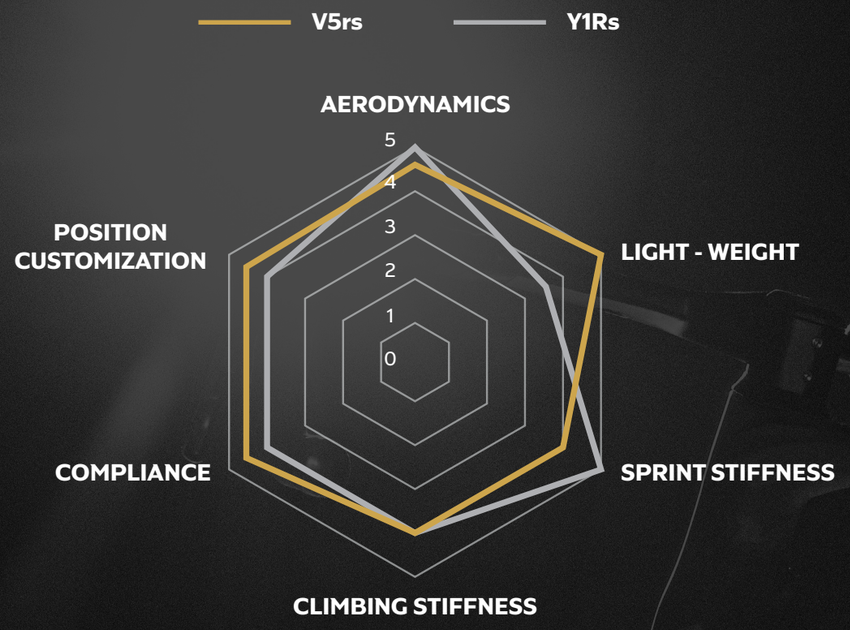

The Colnago racing line-up has been completely renewed for the 2025 season and now comprises the V5Rs and Y1Rs. Neither the Y1Rs nor V5Rs accept compromises regarding handling and riding precision in the most demanding conditions such as WorldTour races.

V5Rs is the perfect racing allrounder. It achieves the lower UCI weight limit with standard and even aerodynamic components. Furthermore, the improved aerodynamic performance and the balanced stiffness mean that the V5Rs performs better than its predecessor, already proved as a winning machine in all conditions, from cobblestones and sprint to mountain stages. If the rider is looking for extreme aerodynamics and maximum responsiveness in a sprint, Y1Rs is the best choice.

WorldTour Teams use both and the riders are making that choice according to the race and their riding style. It is not only a matter of elevation gain. As already seen in competitions, depending on the expected average speed, on the wind and weather conditions, on the different riders' style and role within the team, etc., the final bike selection is no longer merely the traditional choice driven by weight only.

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colnago.com
info@colnago.com