

SEKA

EXAERA E₂

ONE FRAME - EVERY PATH

sekabikes.com



WHITE PAPER

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OBJECTIVES

The ExAero GR was born to help riders travel faster over more complex terrain and deliver a winning edge in every gravel race.

Here, we present our guide to some of the world's most exciting gravel races for 2025.

Event	Course Description	Single-day Distance, Elevation Gain (km/mi)	Cumulative Distance (km)	Min. Fuel & Hydration Volume (liters/gallons per rider)	Refuel Station Regulations	Rules for Dealing with Mechanicals	Percentage of Unpaved Sections	Recommended Tire Width	Men's 2nd Place Avg. Speed (kph)	Men's 2nd Place Total Time (h:mm:ss)
Unbound Grand 2025 (200)	Single-day ultra-endure Rolling terrain with a gentle average gradient.	Distance: 200.7 Elevation Gain: 1,040	Approximately 8,000-10,000	Bottles of water: 10-16 Energy Gels: 12-18	Two minimal and numerous and/or no minimal water stations; outside aid stands in designated areas.	For major repairs, they must reach a designated aid station. Unbound Grand 2025 rules require riders to carry spare tubes and a patch kit.	Absent 60%	40-50mm	37.13	8:17:19
Belgian Halfmarathon 2025 (24) (Long distance)	Single-day ultra-endure Rolling terrain with a gentle average gradient.	Distance: 173 Elevation Gain: 2,386	Approximately 4,000-6,500	Bottles of water: 5-7 Energy Gels: 6-10	Unaided and stations are for self-supported.	For major repairs, they must reach a designated aid station or official event support vehicle (assistance required). Belgian Halfmarathon 2025 rules require riders to carry spare tubes and a patch kit.	Approximately 60%	38-50mm	34.8	4:17:08
UCI Grand Worldis 2025 (Men Elite)	Single-day ultra-endure	Distance: 282 Elevation Gain: 1,400	Approximately 4,500-10,000	Bottles of water: 5-8 Energy Gels: 6-12	10km long courses, 100 km with two aid stations per lap. Support is strictly prohibited outside of designated aid stations.	For major repairs, they must reach a designated aid station. UCI Grand Worldis 2025 rules require riders to carry spare tubes and a patch kit.	Approximately 60%	38-50mm	38.75	4:09:12
Migration Grand Race Long and 2025 (Full distance)	Single-day ultra-endure Laps. The stages consist mostly of rolling terrain, demanding repeated power bursts for multiple ascensions.	$\approx 128 + \frac{1000}{100}$ Elevation Gain: 8,000	Single-day Approximately between 3600 and 6000	Single-day Bottles of water: 3-8 Energy Gels: 6-12	Two water stations, self-supported fuel.	For major repairs, they must reach a designated aid station. External assistance is permitted, exclusively with the rider's own gear. Migration Grand Race Long and 2025 rules require riders to carry spare tubes and a patch kit.	Absent 60%	40-50mm	43.8 (dependent on rider)	24:07:12 (dependent on rider)

"The Winning Formula" =

Highly reliable and simple tools, components, and significant customer education.
Exceptional reliability and compliance.

Long stages that demand substantial carry capacity per rucksack.
Simple Storage Reliability & Capacity.

A higher incidence of mechanical failures.

Significant variation in optimal tire width choices.
Clear-loading Tire Clearance.

High average speeds and long finish times, where the cumulative benefit of total gear is substantial.
Optimized Race Performance.



Racing performance has always been at the core of SEKA's products. This time, our goal is to conquer every gravel event.

PRODUCT OVERVIEW



TIRE CLEARANCE

Tire Width Range	Aerodynamic Performance	Rolling Resistance (Hard Packed Course)	Rolling Resistance (Loose Gravel, Mud)	Comfort	Grip	Handling & Stability	Events & Corresponding Courses and Surfaces
35-40mm	★★★★★	★★★★★	★★★★☆	★★★★☆	★★★☆☆	★★★★☆	UCI Gravel Worlds, BIR, Strade Bianche, High-speed, Gravel mixed with paved sections
40-45mm	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆	Grinduro, BWR CA, Short to Medium distance Mixed gravel and hard-packed dirt road
45-50mm	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★★	★★★★★	Unbound Gravel, Migration, Gravel Earth, Trika Long distance, Rough and chunky gravel roads with flint
50-56mm (= 2.2 inch)	★★★★☆	★★★★☆	★★★★☆	★★★★★	★★★★★	★★★★★	TransRockies, Migration Mixed gravel, hard packed dirt road, rocky and muddy conditions with technical sections

Tire selection is one of the most critical factors affecting Gravel race performance.

As shown in the table, different tire widths vary significantly in aerodynamic efficiency, rolling resistance, comfort, and stability:

35-40mm Optimized for speed on mixed surfaces with significant pavement;

45-50mm The balanced choice for long-distance compliance and control on rough gravel;

50-56mm Built for extreme conditions, prioritizing traction and puncture protection.

A well-chosen tire width balances aerodynamics, grip, and handling for optimal performance.

The ideal width is not a fixed value but should be tuned to specific course conditions.

The ExAero GR accommodates this need with maximum tire clearances of **56mm (front)** and **52mm (rear)**, giving riders the freedom to choose the optimal setup for any race or terrain.



7 ExAero GR — WHITE PAPER—**STORAGE AND MODULARITY**

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STORAGE AND MODULARITY

Down Tube Integrated Internal Storage Compartment

In long-distance gravel races, riders typically need to carry 0.8–1.5L of nutrition, tools, and emergency gear. While traditional external storage solutions offer sufficient capacity, they often create significant aerodynamic drag.

Wind tunnel and CFD data indicate that a 1L externally mounted saddlebag increases the effective frontal area ($\Delta C_d A$) by approximately **0.003m²**.

The resulting power loss can be calculated using the following equation:

$$\Delta P = 1/2 \cdot \rho \cdot \Delta C_d A \cdot v_{\text{air}}^3$$

Where:

ρ (Air density) = 1.225kg/m³

$\Delta C_d A$ (Increase in effective frontal area) = 0.003m²

v_{air} (Relative wind speed) = 40km/h = 11.11m/s

Calculation conditions:

Total mass = 65kg, Rolling resistance coefficient (C_r) = 0.005

Relative wind speed = 40km/h

Substituting these values gives:

$$\Delta P \approx 2.5W$$

This 2.5W power loss corresponds to approximately 0.3% reduction in speed under a constant power output, culminating in a time loss of roughly **20 seconds** over an 80 km course.

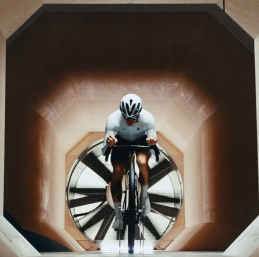
The ExAero GR features a fully integrated down-tube storage compartment, engineered to securely hold essentials like spare tubes, CO₂ cartridges, and tools. Its design achieves an optimal aerodynamic form without compromising storage capacity.

The compartment utilizes a Fidlock magnetic latch, ensuring a seamless, secure, and clean interface that performs reliably in all racing conditions.

For further versatility, the frame includes modular mounting interfaces on the down tube, top tube, and seatpost. This comprehensive system allows riders to tailor their setup based on race distance, nutrition needs, and preference—or run a clean, ultra-lightweight configuration when extra cargo isn't needed.

By seamlessly integrating storage and expansion, the ExAero GR delivers an unprecedented balance of aerodynamics, weight, and versatility, offering a more complete solution than any other racing gravel platform.





AERODYNAMICS

A gravel bike must master diverse terrains without compromising on speed and racing performance.

When it comes to a frame's racing performance, no factor is more critical than aerodynamic efficiency.

Our philosophy therefore focuses on the complete system's aerodynamics in a real-world racing configuration. We optimize not just the frame's drag coefficient, but the entire ecosystem: frame geometry, tire clearance, integrated storage, and modular expansion systems.

CFD (Computational Fluid Dynamics) served as the core development tool in the early stages of the ExAero GR project. It enabled the analysis of airflow characteristics and pressure distribution around the frame prior to wind tunnel testing.

Throughout this process, we conducted multiple rounds of numerical analysis and localized geometric refinements under standardized boundary conditions. The focus was on optimizing tube cross-sections, transitional zones, and rear wake structures to enhance flow continuity and minimize energy loss across the entire frame.

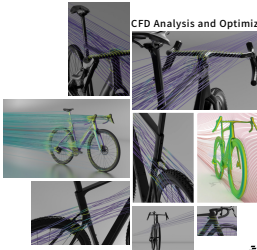
During the Computational Fluid Dynamics (CFD) analysis of the complete ExAero GR prototype, the primary focus areas were:

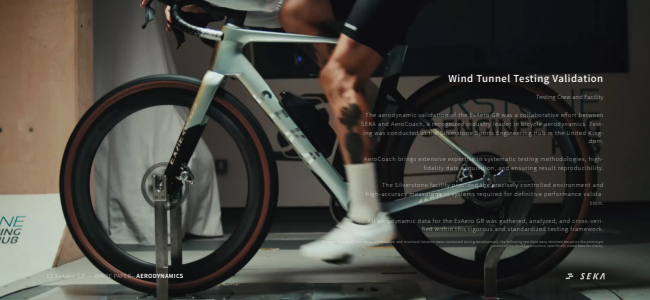
1. Frontal Area Optimization: Analyzing and improving airflow pattern around the integrated handlebar, head tube, and fork;
2. Overall Flow Field Management: Optimizing the complete bike's airflow and pressure distribution;
3. Wake Control: Evaluating and refining the "WindEye" structure's ability to manage wake behavior;
4. Component Analysis: Simulating the aerodynamic drag difference between aero bottles and standard round water bottles.

Through multiple iterative cycles of CFD analysis, we established the core aerodynamic design direction and key structural features of the ExAero GR.

Subsequent wind tunnel testing validated these CFD predictions and provided precise quantification of the final product's real-world aerodynamic performance.

CFD Analysis and Optimization



A cyclist is shown from the waist down, wearing black shorts and white socks, pedaling a white and black road bike. The bike is mounted on a silver wind tunnel testing rig. The background is a dark, industrial setting with a large circular opening in the wall. The text "SILVERSTONE SPORTS ENGINEERING HUB" is visible on the wall behind the cyclist.

Wind Tunnel Testing Validation

Testing Crew and Facility

The aerodynamic validation of the ExAero GR was a collaborative effort between SEKA and AeroCoach, a recognized industry leader in bicycle aerodynamics. Testing was conducted at the Silverstone Sports Engineering Hub in the United Kingdom.

AeroCoach brings extensive experience in systematic testing methodologies, high-fidelity data acquisition, and ensuring result reproducibility.

The Silverstone facility provided the precisely controlled environment and high-accuracy measurement systems required for definitive performance validation.

All aerodynamic data for the ExAero GR was gathered, analysed, and cross-verified within this rigorous and standardized testing framework.

During periods of solid stress, pressure GR and structural flexure were monitored during development, the following raw data were obtained based on the prototype presented the build-up structure, specifically noted here for clarity.



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ExAero GR: Wind Tunnel Aerodynamic Data Validation
(A joint study conducted by SEKA and AeroCoach)

Test Objective:

To validate the aerodynamic performance of the ExAero GR prototype, following CFD optimization, under controlled wind tunnel conditions.

ExAero GR Complete Bike Configuration		Rider & Setup		Test Environment	
Frame/set	ExAero GR 54	Total Mass (Rider + Equipment)	85kg	Crr (Lower Surface / Clay Surface)	0.009
Wheels	Zipp 303 SPLR SW	Saddle height	745mm	Relative Wind Speed	40km/h
Tires	Schwalbe G-One RS Pro, F45mm, R45mm	Hood Reach	660mm	Air Density	1.2234kg/m³
Integrated Handlebar	Gladus GR 400mm-110mm	Hood Stack	300mm	Gradient	0
Water bottle	ExAero Mag bottle*2	Hand position	Hood position	Test Method & Validation Basis: Drifts were conducted at the maximum speed, engineering maximum control efficiency and time. New material and system-related tests designed by the research team. Interference measurement between floating parts (cables, wiring) in open air (e.g. handle, gripped cables, a virtual gas distribution). Testing conditions: 40km/h, 40°C, 40% RH, with the rider wearing a maximum of 10 kg. High-speed data with repeated measurement of a sampling rate of 10 Hz, yielding a 100 Hz data point, per minute for total recorded air flow.	



Through wind tunnel testing and application of the Barry (2018) weighted averaging method, the ExAero GR was validated with a CdA of **0.3938m²**.

This result closely aligns with the aerodynamic targets set during the CFD simulation and optimization phase, confirming the efficacy and accuracy of our virtual design process in real-world conditions.

To contextualize this CdA value of **0.3938m²**, we conducted a comparative wind tunnel test under identical conditions, using SEKA's **Spear** road model as a benchmark.

Yaw angle	Weighting function (Barry 2018)	ExAero GR Front 45mm Rear 45mm	Spear
-30	0.09	0.037366006	0.026971672
-27.5	0.158	0.064907198	0.061587609
-25	0.337	0.095209390	0.091194206
-22.5	0.577	0.15165237	0.144565042
-20	0.543	0.197058094	0.109496573
-17.5	0.683	0.172660090	0.162324217
-15	0.857	0.137634175	0.127695769
-12.5	0.953	0.173315263	0.164627353
0	1	0.185986867	0.183573578
2.5	0.953	0.173315708	0.164349631
5	0.857	0.13133873	0.119689696
7.5	0.683	0.164634268	0.124361544
10	0.543	0.194636373	0.101797164
12.5	0.337	0.146017628	0.145684052
15	0.158	0.094668436	0.09631758
17.5	0.158	0.063905813	0.061623664
30	0.09	0.037089564	0.026492187
Weighting	0.749	0.19382513	0.181977951

Throughout yaw-angle parameters were defined according to the Barry (2018) standard.



Wind tunnel testing was validated by comparing results from a fair rider with those from a static human body mannequin.

The SEKA Spear represents a benchmark for aerodynamic efficiency in road racing, while the ExAero GR is engineered as a competitive, aerodynamically-optimized gravel platform. This comparative test aims to quantify the aerodynamic performance gap between a dedicated gravel bike and an aero road bike, providing a clear and intuitive reference.

Given their distinct purposes, the bikes were tested in their typical real-world configurations. The specific setup differences between the ExAero GR and the Spear are detailed below:

Frame model	Size	Wheelset	Tires	Integrated Handlebar	Groupset	Water Bottle	Rider, Kit, and Bike Total Mass
ExAero GR	54	Zipp 303 XPLR SW	Schwalbe G-One RS Pro, F45mm, 845mm	Gladius GR 400-110	Sram Red XPLR	ExAero Mag bottle *1	85KG
Spear	M	Zipp 404 Firecrest	Pirelli Pzero 38C	Rapier 305-100	Shimano Dura-ace	500ml round bottle* 2 (holding space bottle-cap)	81.8KG

Apart from the model-specific configurations for the ExAero GR and Spear, all other test parameters—including environmental conditions and measurement procedures—were held constant.

The wind tunnel test measured the Spear's CdA at **0.3820m²**. This results in a CdA difference (Δ CdA) of **0.0118m²** between the two models under their optimal, real world setups.

Based on this Δ CdA, the aerodynamic power difference between the two bikes was calculated as follows:

$$\Delta P = 1/2 \cdot \rho \cdot \Delta CdA \cdot v_{air}^3$$

The test results confirm that the ExAero GR requires approximately **3.9W** more aerodynamic power than the Spear, which aligns with expectations given their distinct design purposes.

This difference is primarily attributed to the ExAero GR's wheelset and tire configuration. The combination of wider tires and larger-section rims accounts for roughly **18W** of additional aerodynamic drag.

Furthermore, the comparison underscores a key advantage of the ExAero GR: its integrated storage. To match the capacity of the ExAero GR's down-tube compartment, the Spear would require an external saddle bag, which we previously estimated would induce an aerodynamic penalty of approximately **3.5W**.

Parameter Description:

ρ (Air Density) = 1.2034kg/m³,
 Δ CdA(CdA-Increment) = 0.0118m²,
 v_{air} (Relative dragwind) = 40km/h = 11.11m/s.

Note:

Due to variations in tire width and tread pattern across brands, the power difference between 38mm gravel and 28mm road tires typical flybills within a 0.11W range. The subtle differences in shape and mass resulting from the frame geometry itself are compensated for by adjusting the position of the handlebars.

Wind Tunnel Testing: The Aerodynamic Impact of Tire Width

Tire selection is one of the most critical performance factors in gravel racing.

Characteristics like size, pressure, and casing structure collectively influence a bike's aerodynamics, rolling resistance, handling stability, compliance, and puncture resistance.

A clear industry trend has seen gravel tire widths evolve from 35mm to 45mm, 50mm, and beyond, as riders recognize the superior control, comfort, and rolling performance wider tires provide on rough terrain. However, quantitative data on the aerodynamic cost of this increased width has remained limited.



To address this, we conducted controlled wind tunnel tests on key tire-width configurations. Our goal was to obtain definitive data, quantify the aerodynamic trade-offs, and provide riders with actionable insights for selecting the optimal tire.

The results are presented below:

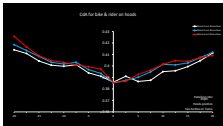
Tire Width Configuration	Front Tire Width	Rear Tire Width	CdA	Δ CdA
A	45mm	45mm	0.3938	0
B	50mm	45mm	0.3962	0.0024
C	50mm	50mm	0.3974	0.0036

Wind Tunnel Test Environment
 ρ (Air Density) = 1.225 kg/m³
 v_{∞} (Relative Windspeed) = 48 km/h = 33.33 m/s

All parameters except for the tire width configuration—including rider position, bike fit (reach/stack), wheelset, and bottle/bottle cage configuration—were held constant.

Yaw angle	Weighting function (perg unit)	Front 35mm Rear 35mm	Front 35mm Rear 35mm	Front 35mm Rear 35mm
0°	0.09	0.037560048	0.0376171	0.0368147
+17.5°	0.168	0.066927188	0.0663229	0.0668180
+15°	0.237	0.096603883	0.0967581	0.0966076
+12.5°	0.377	0.16120037	0.1610168	0.1625608
+10°	0.643	0.217598084	0.2180963	0.2089501
+7.5°	0.683	0.215600040	0.2161180	0.2088000
+5°	0.897	0.337681178	0.3400160	0.3403079
+2.5°	0.892	0.373203263	0.3730986	0.3760060
0°	1	0.389606887	0.3882375	0.3896068
-2.5°	0.892	0.3732041708	0.3688687	0.3681288
-5°	0.897	0.33120872	0.336548	0.3364637
-7.5°	0.683	0.266674208	0.2687088	0.2706808
-10°	0.643	0.216616373	0.2179683	0.2079688
-12.5°	0.377	0.149027608	0.1410180	0.1420204
-15°	0.237	0.096688438	0.096643	0.0967587
-17.5°	0.168	0.066903812	0.066030	0.0666898
-20°	0.09	0.037508884	0.0370880	0.0368148
Weighting	8.748	0.38803813	0.3863827	0.3874037

The weighted yaw angle parameters were defined according to the Barry (2018) standard.



Test Results & Analysis

Under identical speed conditions, the test results reveal minimal differences in CdA and aerodynamic power across the three tire widths, with a maximum variation of **less than 2.5W**. This indicates that tire width has a relatively limited impact on overall aerodynamics within this specific performance envelope.

Notably, at a 0° yaw angle, the aerodynamic performance of all three setups was **nearly identical**.

(Note: More pronounced differences in tire shape or higher test speeds could increase this aerodynamic variance.)

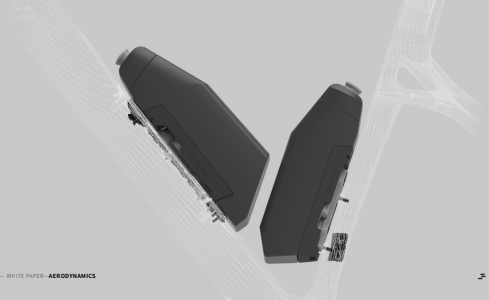


The primary advantages of different tire widths lie in their terrain-specific performance:

Narrower Tires: Excel on hard-packed or paved surfaces, offering superior aerodynamic efficiency and lower rolling resistance.

Wider Tires: Provide enhanced grip, stability, puncture protection, and compliance on loose gravel or clay terrain.

Designed with maximum clearances of up to 56mm, the ExAero GR offers riders broad compatibility and flexible setup options, empowering them to select the optimal tire for any race or terrain.



Aerodynamic Comparison: ExAero Mag Bottles vs. Round Bottles

To further optimize the ExAero GR's aerodynamic performance, we developed a **proprietary magnetic aero water bottle system**. We conducted independent wind tunnel testing to quantify their impact on the bike's overall CdA compared to standard round water bottles. The results demonstrate a clear aerodynamic advantage for the ExAero Mag aero bottles design.

Bottle Setup	CdA	Δ CdA
Round bottle *1	0.3457	0
ExAero Mag bottle*1	0.3383	-0.0074
ExAero Mag bottle*2	0.3398	-0.0059

Wind Tunnel Test Environment

ρ (Air Density) = 1.225kg/m³
 v_{air} (Relative Speed) = 40km/h = 10.1m/s

All parameters except for the water bottle configuration...including riding position, bike fit (seat/steer), wheelset, rims, and coverage...were held constant.

Note on Test Configuration

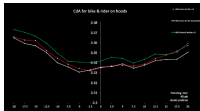
The baseline CdA value of 0.3456m² measured in this test is not directly comparable to the 0.3500m² from previous versions, as the overall bike configuration differs.

However, this does not affect the validity of the bottle comparison. The objective here was to isolate the effect of the bottle type. All other variables were held constant, making the measured difference...a -0.0067m² CdA reduction with aero bottles...a reliable result.



Yaw angle	Weighting factor (kg/m³)	Extero Mag °C	Extero Mag °C	Round bottles °C (average from both sides)
-20	0.09	0.02369099	0.02369097	0.023691176
-17.5	0.156	0.023732637	0.023732636	0.023732634
-15	0.237	0.023684201	0.023684206	0.023684208
-12.5	0.377	0.023789696	0.023789696	0.023789696
-10	0.630	0.0237115626	0.023696023	0.023696023
-7.5	0.880	0.0232337961	0.0234116661	0.023333333
-5	0.887	0.0268112023	0.0234607638	0.023246028
-2.5	0.952	0.0236626696	0.0236927168	0.023692696
0	1	0.0236277623	0.0236277623	0.0236277623
2.5	0.952	0.0237342987	0.0236969696	0.0236969697
5	0.887	0.0268213226	0.0234622167	0.0233113275
7.5	0.880	0.0268212	0.0236927668	0.023271322
10	0.630	0.023696023	0.0233333796	0.023696023
12.5	0.377	0.0247732637	0.023692696	0.023473263
15	0.237	0.023732636	0.023732637	0.023732636
17.5	0.156	0.023684206	0.023732636	0.023684206
20	0.09	0.023732637	0.023732636	0.023732636
Weighting	1.769	0.109636267	0.108327182	0.108726883

The weighted yaw angle parameters were defined according to the Barry (2008) standard.



Relative dragred	Round bottles °C (average from both sides)	Extero Mag °C	Extero Mag °C
45km/h	0W	-6.9W	-8.7W
30km/h	0W	-4.6W	-5.7W

The test results confirm that the bottle system plays a critical role in the bike's overall aerodynamics. Across all test scenarios, the aero bottles consistently outperformed standard round bottles in aerodynamic efficiency.

This aerodynamic advantage stems from a co-optimized design between the aero bottle and the down tube's cross-sectional profile. The bottle's streamlined shape reduces the turbulent wake area, thereby minimizing localized pressure drag.

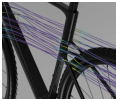
*This test was conducted using the second prototype of the Extero Mag bottle system.

Reference Bibliography:

This analysis is based on theoretical modeling.

Under the assumption of an ideal fluid, the CdA is treated as invariant with airspeed and fluid constant.

The CdA value was measured in the wind tunnel at 45km/h. This same value was applied within the power equation to calculate the theoretical power demand at a riding speed of 30km/h.



WIND EYE

THE WINDEYE STRUCTURE

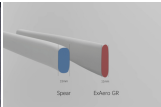
The WindEye structure creates a functional zone between the seatstays and seat tube that combines air deflection with vertical compliance.

This design enables smoother airflow while allowing controlled rear-end flex to absorb road vibrations—delivering both aerodynamic and compliance advantages that have been validated through wind tunnel testing and feedback from thousands of *Spear* riders.

For the *ExAero GR*, the WindEye structure was redesigned and refined to meet the specific demands of gravel riding.



The rear triangle lateral stiffness test was conducted following ISO 6246-4, Section 5.3 ("Lateral bending test of the frame").



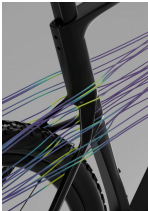
Test Item	Prototype A	Prototype B	ExAero GR
Test Load	80kgf (≈ 784N)	80kgf (≈ 784N)	80kgf (≈ 784N)
Lateral Deformation (mm)	13.47mm	12.9mm	12.47mm
Lateral Stiffness (N/mm)	21.83N/mm	24.72N/mm	25.63N/mm

To accommodate a maximum rear tire clearance of 50mm and maintain compatibility with dual-chainring systems, the ExAero GR introduces tighter spatial constraints on the drivetrain side.

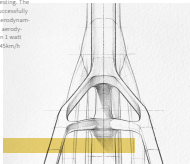
This is most apparent in the chainstay profile, which measures just **11mm** at its thinnest point. This geometric necessity inevitably impacts rear-triangle lateral stiffness. To counter this, we performed targeted structural optimizations, refining the WindEye structure to enhance rear triangle **lateral stiffness** without compromising tire clearance or drivetrain compatibility.

Specifically, the upper and lower connecting plates of the WindEye were thickened through multiple design iterations to provide increased lateral support. This refinement ensures efficient power transfer and meets the rigidity demands of competitive gravel riding.

Validation tests confirm the success of this approach: the final ExAero GR achieves a rear-triangle lateral stiffness of **25.63N/mm**, a figure that is **generally consistent with, and even shows a slight improvement over, the benchmark SEKA Spear**.



This design was validated through both CFD analysis and wind tunnel testing. The optimized WindEye structure successfully balances lateral stiffness with aerodynamic efficiency, resulting in a total aerodynamic drag increase of less than 1 watt under a relative wind speed of 45km/h and a $\pm 20^\circ$ yaw range.



The three-dimensional space formed by the WindEye's upper and lower connecting plates functions as an **"airflow diffuser"**. This design optimizes the turbulent wake and reduces the low-pressure zone behind the seat tube, allowing turbulent airflow generated during riding to pass through this area more efficiently.

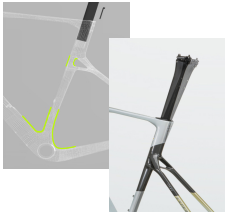
To preserve this aerodynamic performance after the structural reinforcement, we performed multiple rounds of CFD optimization on the connecting plates' **cross sectional profiles and angles**.

Following the reinforcement of the WindEye's upper and lower connecting plates, we strategically reduced the wall thickness at the junction of the seat tube and the WindEye structure and incorporated a slimmer profile at the seat tube's lower section. This achieves a more uniform vertical compliance profile.

This targeted approach of **reinforcement and strategic material reduction** achieves a more balanced stress distribution. The result is a significant enhancement in lateral stiffness for efficient power transfer, without compromising the vertical compliance essential for comfort.

Validating this design, the ExAero GR's rear triangle demonstrates a vertical compliance of 105N/mm.

For the demanding conditions of long-distance, rough gravel races, the WindEye structure significantly enhances riding comfort, helping riders finish faster.





WEIGHT, STIFFNESS & STRENGTH

Lightweight design remains a paramount concern in SEKA's philosophy, but never at the cost of overall performance.

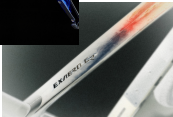
For a performance gravel frame built to conquer demanding terrain, We prioritize a robust structure with high stiffness and impact resistance—ensuring exceptional strength and durability without compromise.

To achieve this optimal balance, we conducted extensive validation of materials, carbon layup, and manufacturing processes. After passing fundamental ISO 4210 and ASTM Condition 2 tests, we further elevated our targets for frame stiffness and impact strength.

Through successive iterations—with frame weight evolving from 900g to 950g, and finally to 980g—we systematically reinforced critical stress zones.

The result is the ExAero GR: a size 54 frame (metal parts and paint excluded) with a final weight of **980g**.

This figure represents the optimal equilibrium between lightweight performance and high impact strength, achieved through rigorous optimization and testing.



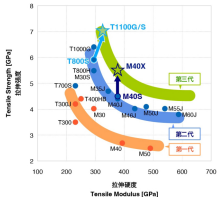
Reinforcement Strategy Based on PAN-Based Carbon Fibers

Unlike the ultra-high-modulus, pitch-based 65T/80T carbon fibers typically used in road bike development, the ExAero GR utilizes **TORAYCA® T1100G** and **TORAYCA® M46J** as its primary reinforcement materials. This is not a simple material substitution, but a deliberate structural optimization strategy focused on achieving superior mechanical balance.

Compared to pitch-based fibers, the PAN-based **T1100G** and **M46J** offer significantly higher tensile strength and fracture toughness. This enables the frame to maintain a high stiffness-to-weight ratio while **substantially improving impact resistance and energy absorption capacity.**

This material approach allows the ExAero GR to withstand gravel impacts, vibrations, and shock loads while **preserving exceptional structural integrity and fatigue life.**

While the T1100G and M46J solution entails a marginal weight increase compared to pitch-based fibers, the superior balance of stiffness, strength, and toughness it delivers in competitive off-road environments is far more valuable than mere gram shaving.





True One-Piece Monocoque Structure

Compared to multi-section molding or tube-to-tube bonding, the core advantage of the monocoque process is **its continuous load path**. It allows the carbon fiber to perform at its full potential.

This structural approach delivers superior overall stiffness and power-transfer efficiency while **significantly enhancing impact resistance and fatigue life**. This forms the foundation of the ExAero GR's exceptional strength, durability, and long-term reliability.



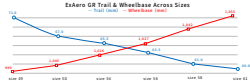
AGE	WEIGHT	HEIGHT	WING	CL	HC	H	RC	WBL	L	IV	Q1	Q2	F	C (Standing)	Remounted height (cm & feet)
40	524	100	70	400	428	74	587	1000	91.4	509	70.4	75	50	401	3.67 150-162 40 11in-50 4in
42	540	175	87	400	428	74	587	1000	111	526	70	74.8	50	401	3.71 160-172 50 5in-50 8in
54	558	100	45.5	510	428	77	604	1000	157	547	70.8	74	50	401	3.92 170-180 50 7in-50 11in
56	579	100	43.5	550	428	77	619	1000	162	558	70.8	74	50	401	4.01 170-180 50 7in-50 7in
58	602	100	81	550	428	79	630	1000	174.5	578	72	73.8	50	401	4.07 180-190 50 7in-50 9in
60	620	100	81	550	428	79	641	1000	185	588	72.2	75	50	401	4.06 184-200 50 8in-50 9in

The ExAero GR's geometry is engineered to strike an optimal balance between agile handling and confident stability on rough or loose terrain.

Key to this balance is a carefully calibrated **trail figure of 71-80mm** (based on a 350mm wheel radius), which ensures direct steering feedback and predictable control during rapid line changes.

This is complemented by a 74-70mm bottom bracket drop and 433mm chainstays. Working in concert with a wheelbase optimized for trail balance, these dimensions deliver both sharp acceleration response and unflappable composure.

To fine-tune the fit, the Es Aero G8 is available in 6 frame sizes and offers 15 handlebar (integrated) sizes and two seatpost offsets (8mm / 15mm setback).



²² *Salmon, Johnson, and Lee* is discussed in section 2. Note that, unlike Hall, we are wary of different time periods and measures.

Gladius L2
INTEGRATED HANDLEBAR



The Gladius GR is an integrated handlebar system engineered specifically for the ExAero GR. With **15 combinations** of stem length and handlebar width, it provides a precise fit for riders of all proportions and riding styles.

The drops feature a **16° outward flare** on each side, which optimizes wrist ergonomics for comfort while significantly enhancing control and stability on technical terrain.

A slight **backswEEP** design increases the forward reach space.

Furthermore, the top section incorporates a **micro-textured, anti-slip surface**. This ensures a secure grip in wet conditions or on rough surfaces, providing confident control and stable front-end handling.



Widths (3 options) : 380/440 - 400/460 - 420/480(mm)

Lengths (5 options) : 80 - 90 - 100 - 110 - 120(mm)

Any width and length can be freely combined.
Compatible with the Rapier computer mount.

Weight (400/460-90 combo): ≈395g(excluding hardware)
Reach:69mm , Drop:118mm

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