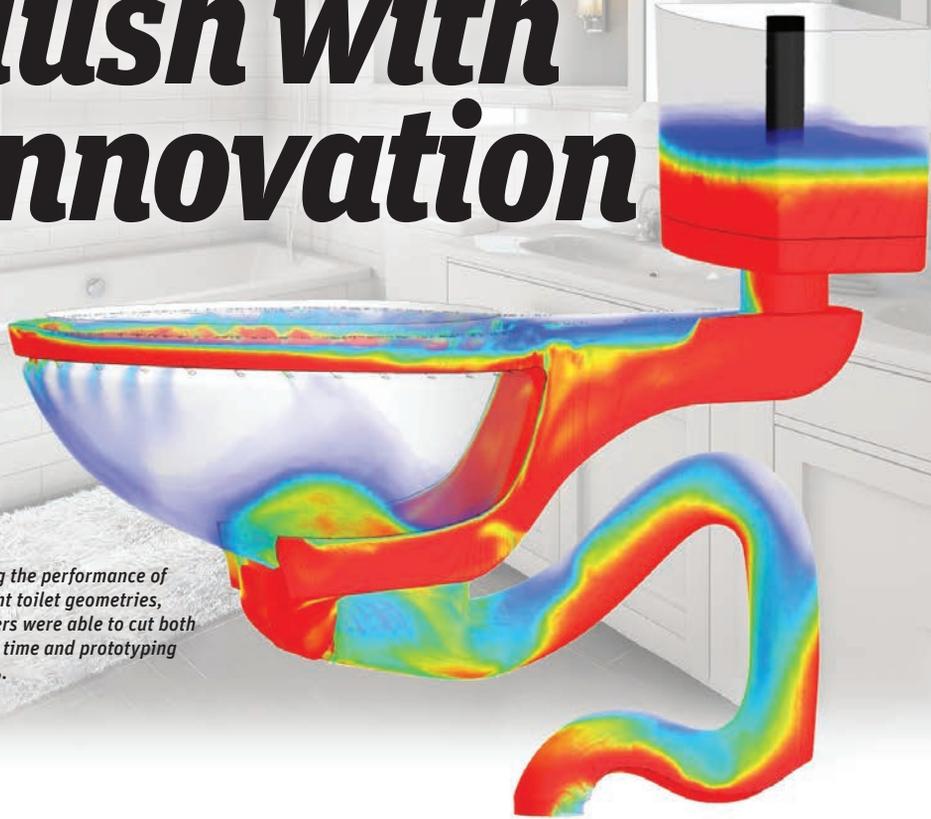


# Flush with Innovation

*By simulating the performance of many different toilet geometries, Roca engineers were able to cut both development time and prototyping costs by 66%.*



**AS A GLOBAL LEADER IN BATHROOM PRODUCTS**, Roca faces a significant engineering challenge: It must make incremental design changes to a mature product line to meet evolving consumer needs and new regulatory requirements. The company relies on simulation to accelerate these ongoing engineering activities — without investing in time- and cost-intensive physical testing.

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To capture new sales opportunities, Roca, a worldwide leader in bathroom products, continually searches for ways to innovate and adapt its designs, increasing the diversity of its global offerings. Because the company designs plumbing solutions that include toilets, sinks, faucets, bathtubs and shower columns for 170 countries — each of which has different regulatory guidelines and consumer preferences — Roca's product line is necessarily diverse.

Innovation can be challenging for a well-established company like Roca, which has been manufacturing industry-leading bathroom products since 1917. The majority of its products are mature, time-tested designs that have maintained the same basic configuration for decades. Roca's engineers rely on ANSYS simulation to quickly and cost-effectively identify innovations that address changing regulatory requirements around water usage, deliver customized products for different regions of the world, and position the company to lead the industry with new features.



Introduction to Multiphase Models  
in ANSYS CFD  
[ansys.com/multiphase](https://www.ansys.com/multiphase)

## GROWING SALES VIA SIMULATION

In the U.S. and Asia, consumers are used to toilet designs based on siphon jet technology, which creates a vacuum effect in the trapway of the toilet bowl as water is released. The waste is pulled out by the water. In Europe, consumers prefer a wash-down design in which water is flushed very quickly into the bowl via a rimless design that was pioneered by Roca. The water pushes the waste out.

While Roca had optimized the low-consumption performance of its toilet designs using wash-down technology, the company wanted to reach the same level of performance via a siphonic toilet design.

This new toilet design would meet minimum water-consumption standards while also delivering maximum drainage power. However, very different physics are involved in pushing water versus pulling it.

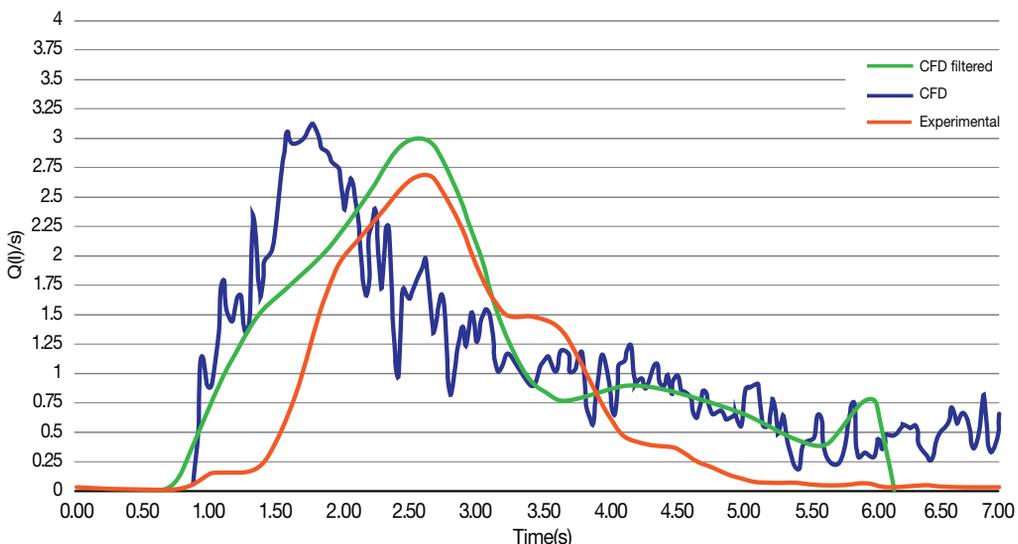
Roca turned to the power of computational fluid dynamics (CFD) simulation via ANSYS Fluent software to understand and optimize this unfamiliar technology. To verify the accuracy of their simulations, Roca's engineers first constructed a real siphonic toilet that could be used as a calibration model to ensure the accuracy of future simulations that include physical parameters such as water pressure and flow rates. The results of the physical tests and initial simulations were strikingly similar, giving Roca's engineers the confidence to rely on ANSYS software and begin to reduce physical testing.



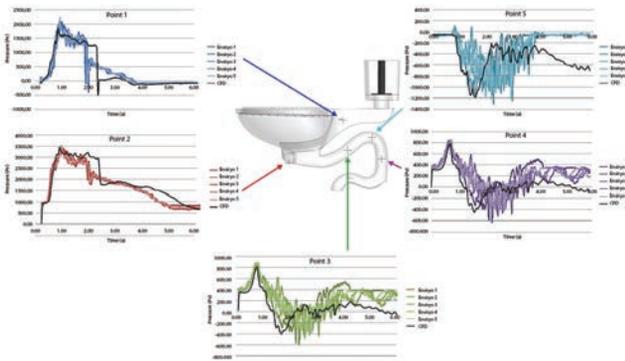
By first constructing a physical toilet model, Roca engineers were able to compare and verify the results of their early simulations — giving them the confidence they needed to eliminate some physical testing.

Over the ensuing months, Roca's engineers leveraged simulation to optimize many aspects of the new product's performance, including water distribution in the toilet's rim and jets, reaction times and refill volumes. Understanding how water flows through a toilet is extremely complicated, because every single parameter affects the final performance. Roca's CFD simulations enabled engineers to focus on the right radius, the right contour, the right tolerance range and other critical design parameters.

Roca simulated many different geometries in its efforts to optimize the new product's design. Each of these simulations required a week to prepare, run and analyze the results. If the team had



Flow rate comparison between an ANSYS simulation and real-world results from a physical model demonstrates the accuracy of simulating toilet performance via ANSYS solutions.



Pressure comparisons between CFD simulations and the physical toilet model — captured at different design points — proved to Roca engineers that they could rely on simulation.

constructed physical mock-ups of these different geometries, each one would require three weeks — so, in addition to the prototype cost savings, Roca engineers were able to cut development time by two-thirds using simulation. The new design gives Roca a critical opportunity to enter new markets and increase sales revenues substantially.

**PRODUCT CUSTOMIZATION: A GLOBAL CONCERN**

This landmark product introduction is an extreme

example of the kinds of product customization activities Roca engineers are engaged in daily to make its offerings more attractive to customers in different markets. ANSYS simulation enables engineers to put together diverse components such as tanks, bowls, nozzles, jets and traps in a simulated environment before constructing physical prototypes of updated toilet designs.

Simulation also enables Roca engineers to modify its existing designs quickly to address changing water consumption regulations in different countries. As consumers and government regulators alike continue to press for lower and lower water levels for toilets, showers and other plumbing products, Roca’s engineers are working on innovations to maximize their products’ efficiency at these lower and lower water levels. Although more intangible, the impact of these innovations for the environment is making a difference.

**FLUSHING OUT NEW IDEAS**

To date, Roca’s product development team has devoted most of its simulation time to toilets, which represent one of the company’s core products. However, as Roca adds new ANSYS licenses and new users, it is turning its attention to innovations across its product line, including electronic shower toilets, faucets and shower trays.

While many of Roca’s products are mature and proven, the company is committed to differentiating itself in order to capture the rare opportunities when consumers buy bath fixtures — typically during new construction or renovation. If Roca can lead with innovation, it can capture these opportunities and continue to make best-in-class plumbing solutions.

For the Roca engineering team, that means changing the shape of nozzles and pipes, testing new flow dynamics and making other incremental changes. But it also means pioneering new product concepts. In all of these efforts, simulation enables an early look into how new bathroom fixture designs will perform under real-world conditions, allowing the product development team to be first to market with newer, and better, customer solutions. By using ANSYS simulation software, Roca’s engineers have cut the typical number of prototypes for new products by up to 66%, which results in an equivalent reduction in time and costs. <sup>A</sup>

**“Roca’s engineers leveraged simulation to optimize many aspects of the new toilet’s performance.”**

