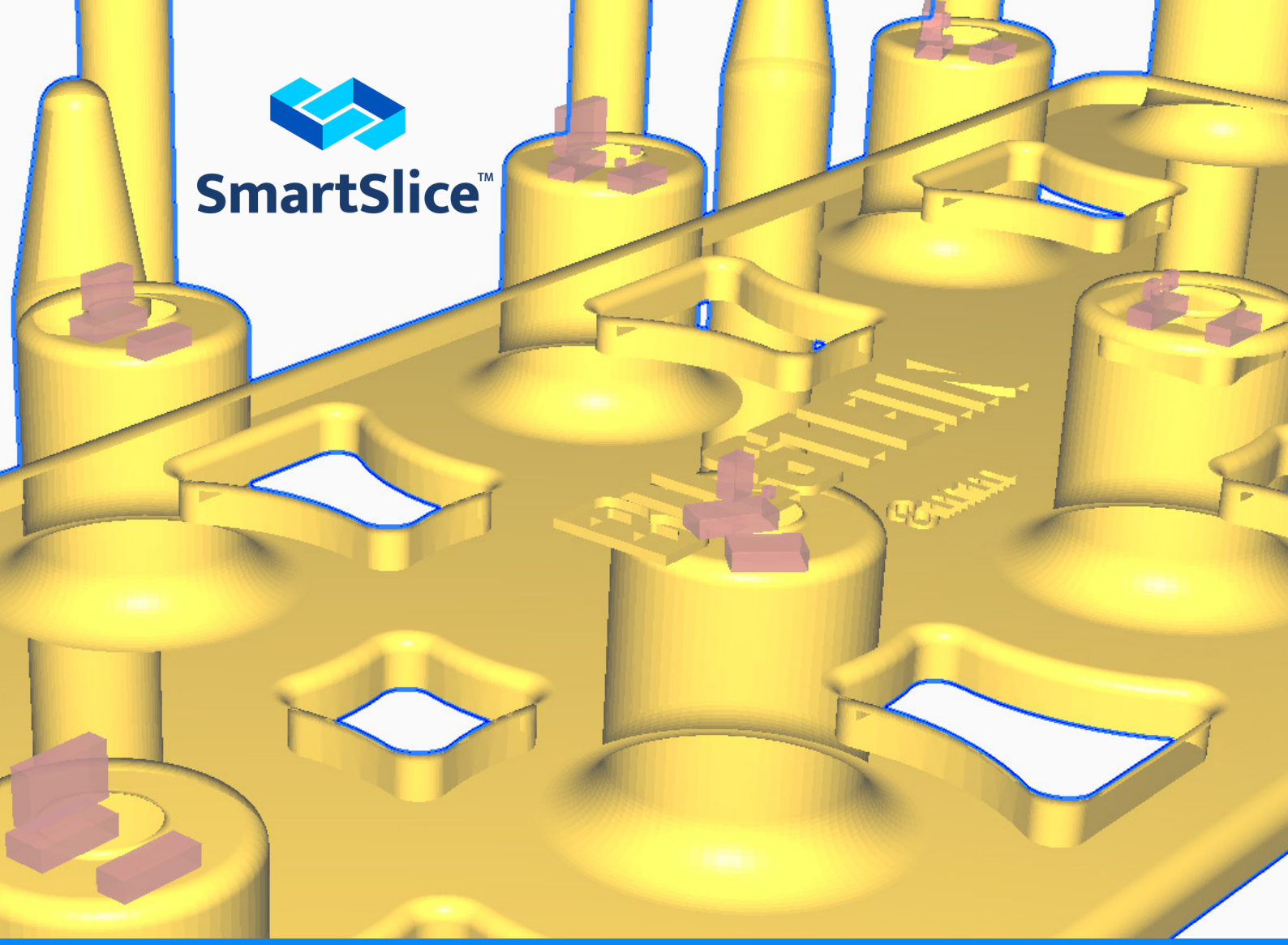
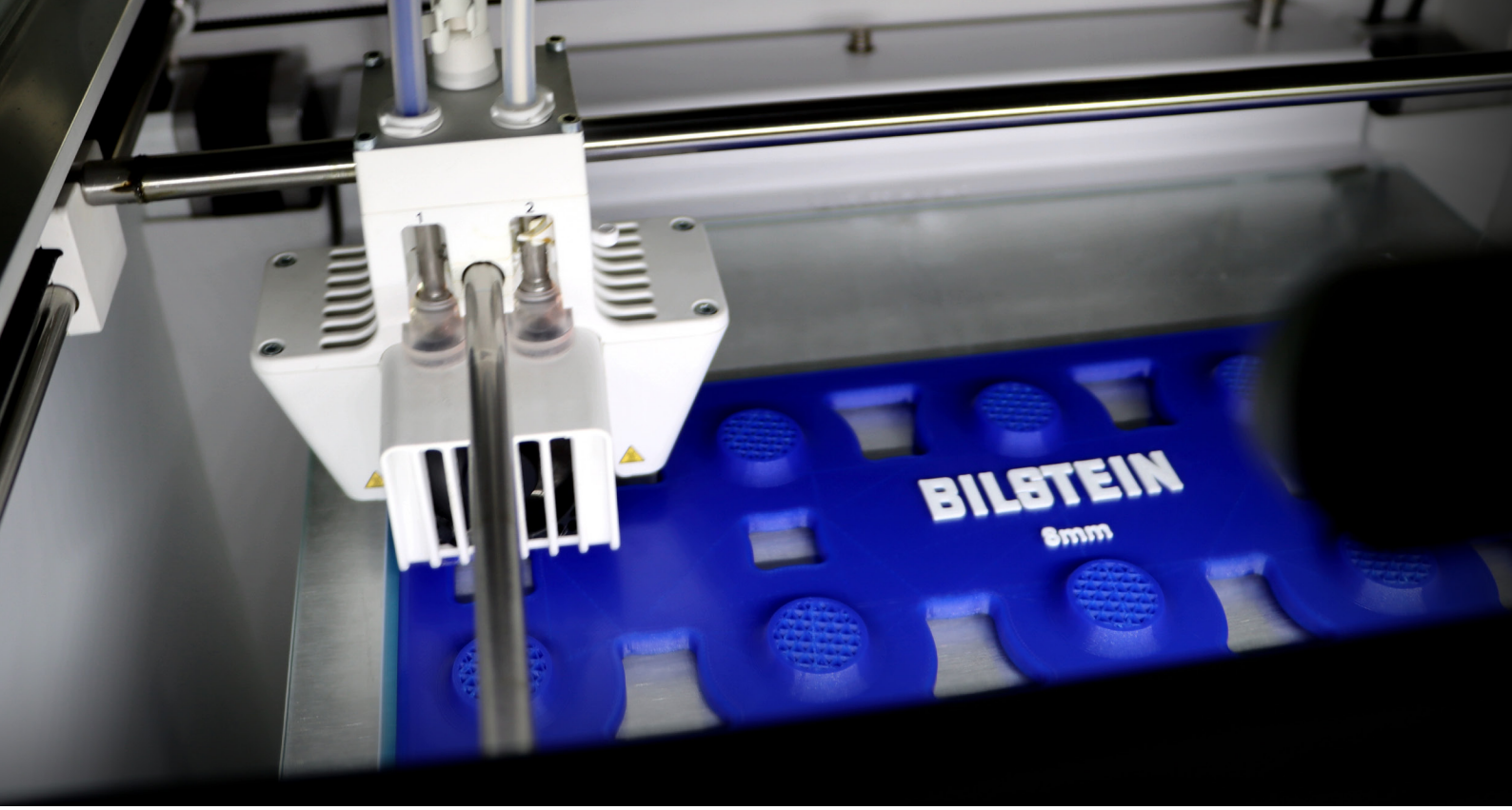


CASE STUDY

Virtually testing parts and optimizing part performance using SmartSlice™

Teton Simulation



The Customer

RE Suspension is an industry leader in advanced suspension technology located in the heart of motorsports country, Mooresville, North Carolina. Offering a full line of suspension parts and tools designed by their in-house engineering department, RE Suspension services dirt, asphalt, drag, and road racers across the United States.

Additive Manufacturing without Simulation

Before they started using SmartSlice™, the additive manufacturing workflow for RE Suspension was like the workflows of nearly every company using 3D printing. They would design a part in a CAD program, print it, test it, and repeat this cycle to try and achieve a functional part that meets specifications while not being overbuilt. Prior to sending the part to the printer, the team at RE Suspension would make their best attempt at determining the slicer settings needed to produce a functional part. Common questions that would arise with nearly every part were: “What is an appropriate infill density?”, “How thick should the walls be?” and, “What build orientation is strongest?”. Without any analysis or simulation, the RE Suspension team relied on guesswork informed by their knowledge gained over the time they had been using additive manufacturing. Often, this would result in a printed part that was either too weak (it would break when put into service) or too strong (the part would be much stronger than necessary and would therefore be inefficient in terms of print time and material costs).

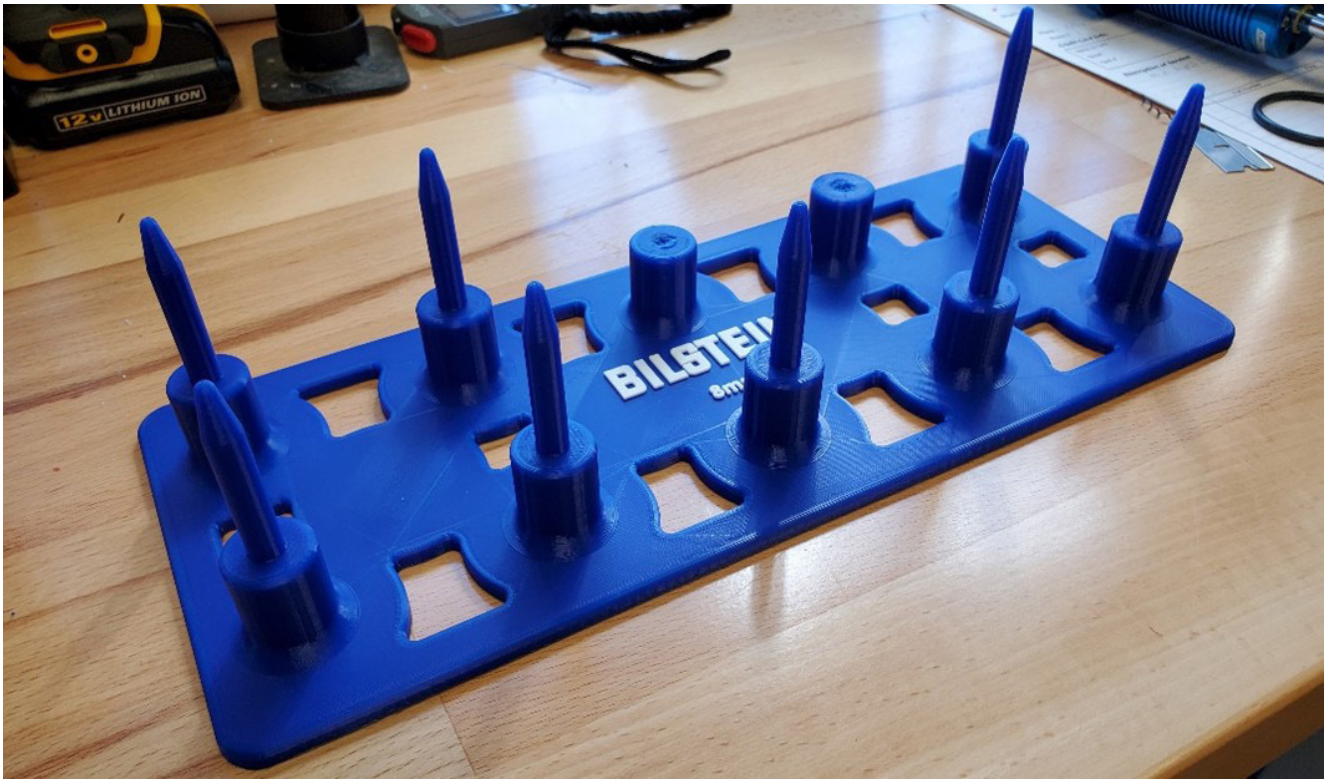
The result of this workflow was that there was uncertainty the parts being produced were going to perform as intended. In some instances, RE Suspension had parts with high failure rates, which was simply not acceptable for their standards.

SmartSlice™ is the Solution

As soon as Jason Enders, the owner of RE Suspension, was introduced to SmartSlice™, he immediately realized the impact it would have on their additive manufacturing workflow and their ability to configure parts for the FFF process. With SmartSlice™, RE Suspension is virtually testing their parts and optimizing part performance, directly within their slicer and prior to any printing. Having the SmartSlice™ tool integrated in the slicer, there is no need to leave your software to perform any of the functions. The three examples shown here highlight how RE Suspension is using SmartSlice™ to solve a range of problems on parts with different requirements and functions. All, while working on the projects within the slicer.

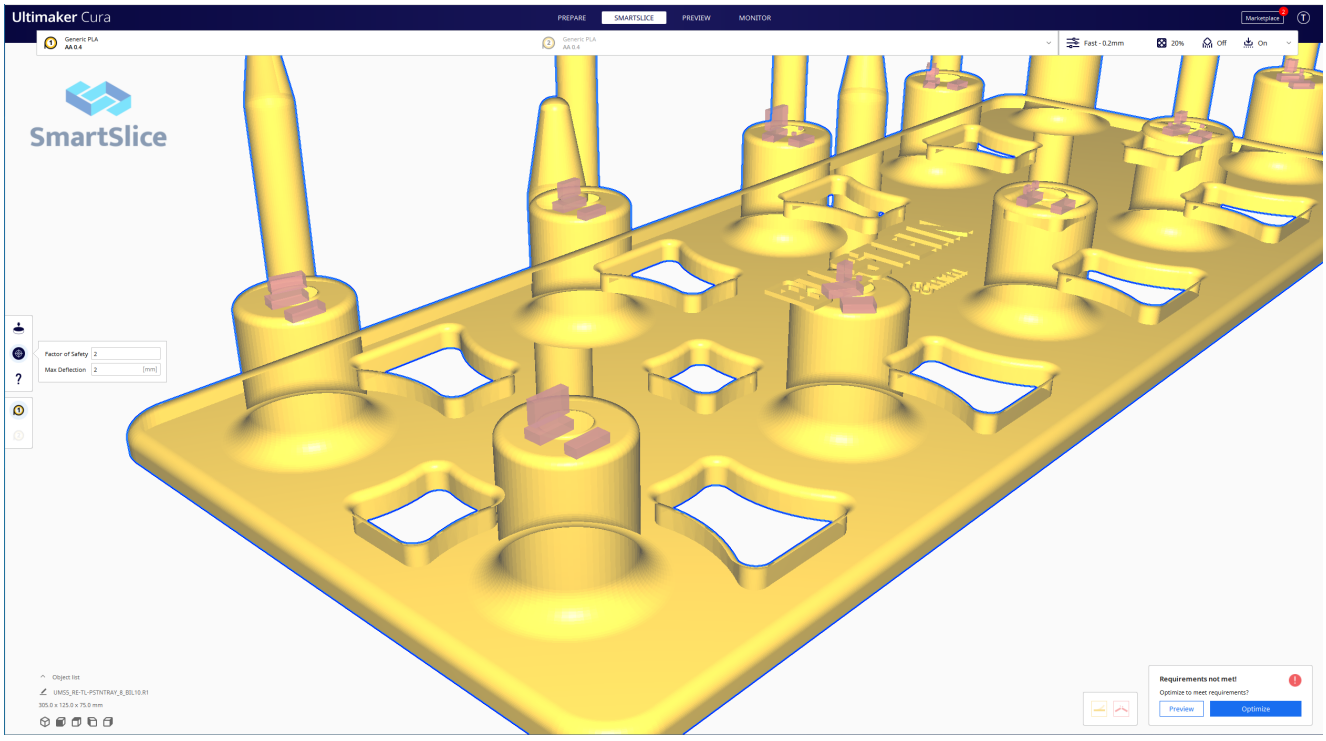
Piston Tray

RE Suspension prints and sells piston trays that are designed to hold the internal shim stacks and pistons for serviceable shocks. The tray is used by race teams when disassembling, rebuilding, and tuning shocks for high-performance vehicles. The trays come in different sizes and shapes and were initially printed with standard print settings for PLA. However, when put into service the pins would break off from the base as shown in the image below. During normal use, the failure rate was approximately 30%, which is far too high.



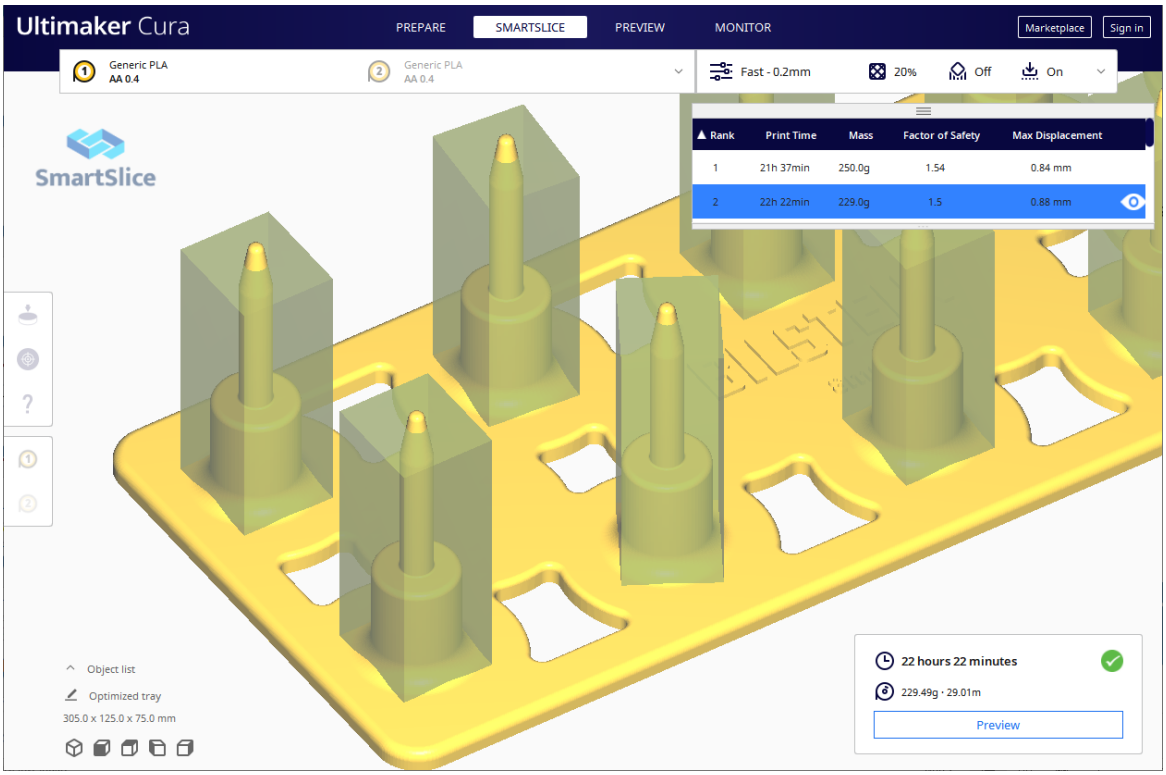
Piston tray with broken pins.

After acquiring SmartSlice™, RE Suspension used the validate tool to quickly identify the weak regions in the tray. These weak regions are highlighted in red in the image below and correspond to regions where the factor of safety is less than the requirement.

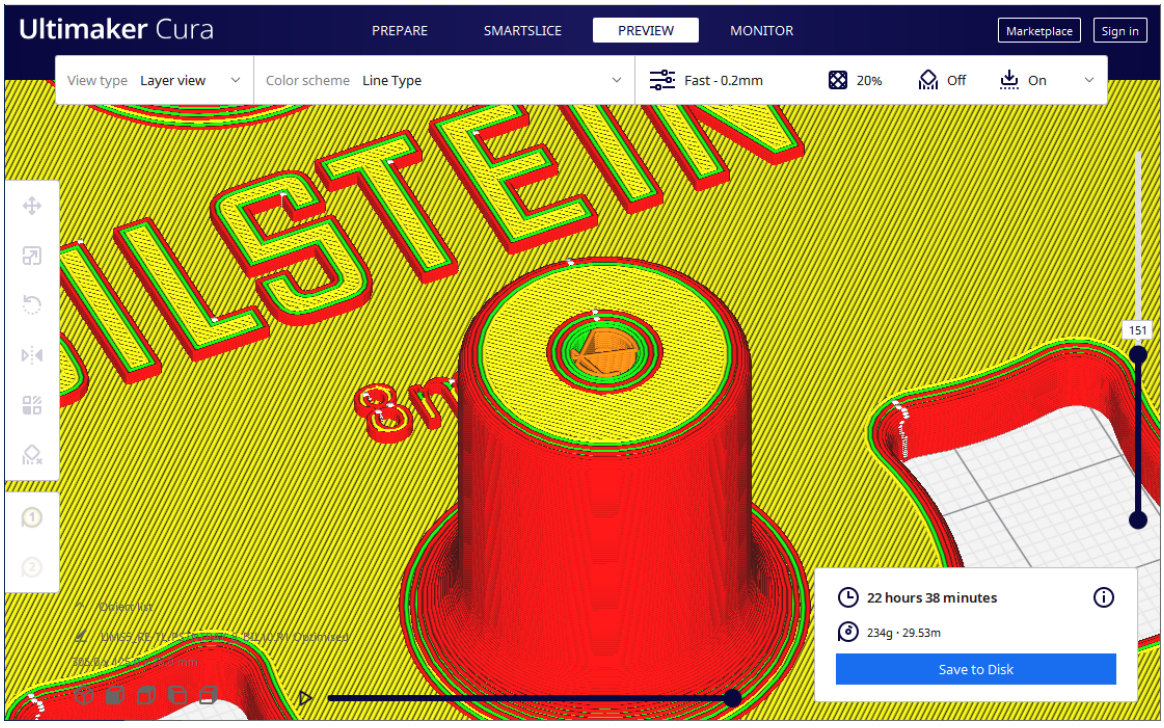


SmartSlice™ validation of the Piston Tray with failure locations identified.

With the failure regions correctly identified, RE Suspension wanted to correct the problem by increasing the strength of the tray in the failure regions. Using the optimization feature in SmartSlice™, modifier meshes were automatically added to locally strengthen the part. These modifier meshes increase the shell thickness in the regions where they overlap the tray which boosted strength where it was needed without unnecessarily strengthening the non-critical regions.



SmartSlice™ optimized solution with modifier meshes.



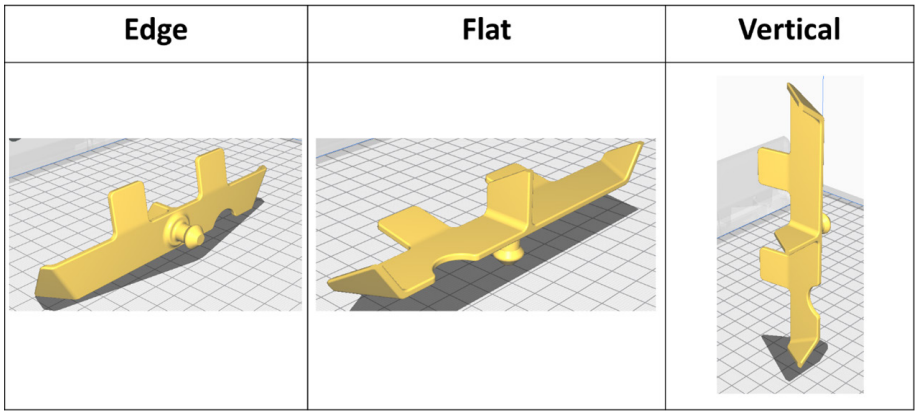
Slice view of SmartSlice™ optimized solution showing extra wall thickness in problem regions.

Traditionally when a part is printed and fails in service, most technicians will increase the infill density and/or shell thickness in an attempt to prevent part failure. In many cases, they will resort to printing a solid part to maximize strength and stiffness, but this comes at the cost of excessive print times and material usage. When comparing the print times and material usage between the SmartSlice™ optimized piston tray and a piston tray that is printed solid, the savings are considerable. As an example, last year RE Suspension received an order for 40 of these piston trays. For this single order, RE Suspension is saving 93 hours of print time and 4.1 kg of material by using the optimized tray instead of the solid tray.

Motorcycle Dashboard Bracket

In addition to suspension parts, RE Suspension also creates custom restoration parts. They were tasked with a dashboard bracket to secure a new carbon fiber dashboard to a vintage Indian Motorcycle. The bracket is a perfect candidate for 3D printing because it is produced in very small numbers and has complex features that would be difficult to produce using traditional manufacturing techniques.

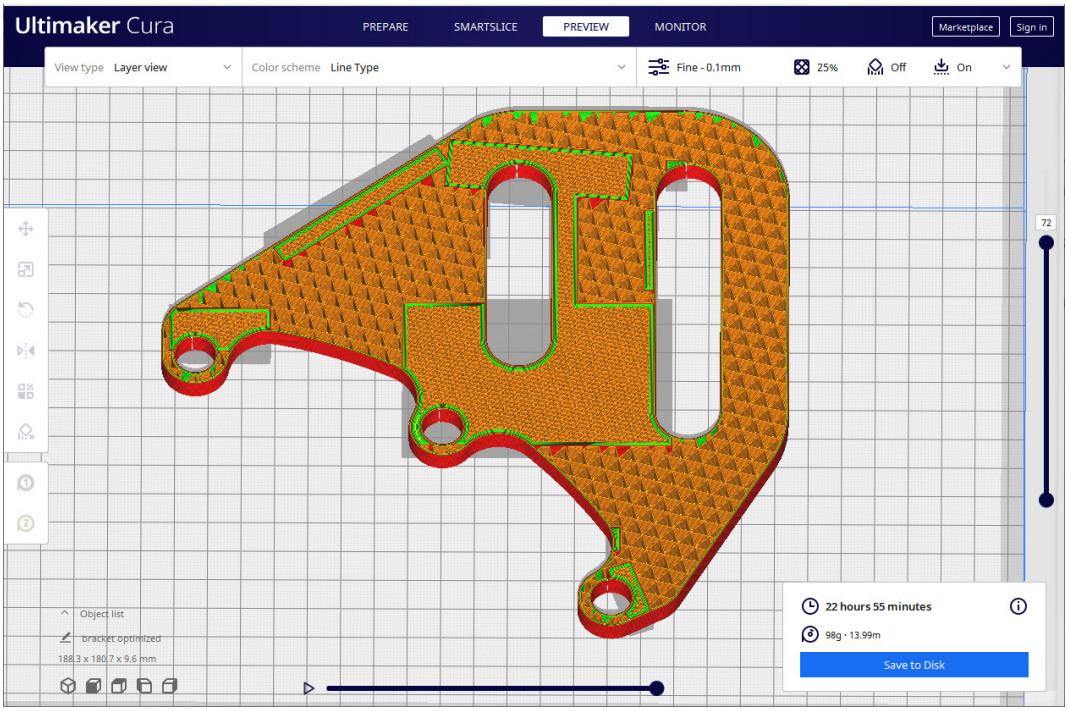
This part is thin-walled and was therefore printed solid so there was no need to optimize the print settings. RE Suspension took advantage of the opportunity to use SmartSlice™ to determine the build orientation that produces the strongest part. In just a few minutes, they were able to assess 3 different build orientations and they found that the vertical orientation was strongest, coming in 49% stronger than the edge orientation and 56% stronger than the flat orientation.



Dashboard bracket build orientations.

Rear Suspension Bracket

Suspension parts are among the most heavily loaded parts on vehicles. These parts are almost always made from metal to withstand the high stresses seen during regular use. Prior to settling on a design for suspension components, it is important to test the fitment of the parts to ensure proper suspension alignment and function. Testing for fitment is where 3D printing can streamline the design process. Parts that are destined to be machined from metal can be 3D printed and tested for fitment prior to manufacturing the final part. If any issues are found during fitment testing, changes to the design can be made and another part can be rapidly printed and tested. Prototyping with metal parts, on the other hand, requires many hours of setup and machining for in-house manufacturing and can take days and weeks if outsourced to a local machine shop.



Slice view of optimized suspension bracket.

RE Suspension had a suspension bracket that they wanted to print for fitment testing and design optimization, but they were unsure if the part would be strong enough to handle the loads seen during testing. Specifically, the bracket shown below needed to be able to support the weight of an entire rear axle while being cycled through suspension travel. Using SmartSlice™, RE Suspension's technician defined the load case and optimized the print settings. The resulting configuration from SmartSlice™ uses modifier meshes to locally reinforce the part where extra walls and infill density are needed. In a matter of minutes, the technician was able to virtually prototype the bracket and optimize the settings to ensure it is able to withstand the loads seen during fitment testing.

The Future

Jason Enders is pleased that RE Suspension has incorporated SmartSlice™ into their additive manufacturing workflow. “Before we learned about SmartSlice™, a lot of our prints were failing unexpectedly and we hadn’t fully embraced 3D printing because we lacked the analysis we needed to print with confidence. Now we have a structural simulation tool that is super easy to use but more importantly, guides us to part configurations that we trust will meet our standards.” Jason adds, “We feel like we have a competitive advantage now because we are able to get to the final part configuration so much faster and because we are able to use 3D printing in ways we had not previously imagined. What used to take days or weeks, we can accomplish in just a few minutes or hours.”

The three parts in this case study are just the beginning of what RE Suspension will be able to do with SmartSlice™ and their expanding use of additive manufacturing. By embracing additive manufacturing and SmartSlice™, customers of RE Suspension can rest assured knowing that RE Suspension has what it takes to keep them competitive so that they can get to victory lane year-after-year.

Feature Comparison

Piston Tray

SmartSlice™ Feature Highlighted
Failure prone regions identified and automatically strengthened using modifier meshes.

Savings and Costs
Savings compared to a batch of 40 solids parts:
- 93 hours print time
- 4.1 kg material

Dashboard Bracket

SmartSlice™ Feature Highlighted
Strongest build orientation identified.

Savings and Costs
Time to print and test 3 build orientations: 16 hrs

Time to simulate 3 build orientation in SmartSlice™: 5 minutes

Suspension Bracket

SmartSlice™ Feature Highlighted
Print setting validation and optimization to discover if a printed part will work as prototype for traditional metal part.

Savings and Costs
Cost to outsource machining for metal part: $450

Cost to print plastic part: $35

Lead time to machine metal part: Minimum 2 weeks

Lead time to print plastic part in-house: None

Teton Simulation

RE SUSPENSION incorporated