Packaging Decoded

Simulation in Packaging Development

Introduction: Why Packaging Is Tested Before Manufacturing

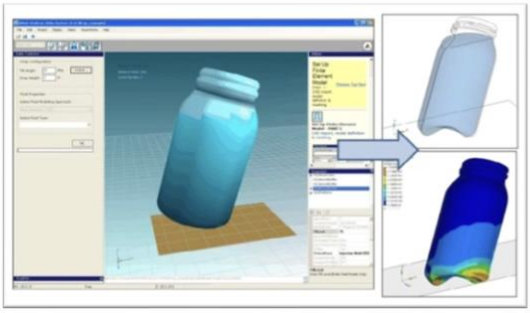
Once a customer places an order, packaging becomes responsible for protecting the product through handling, storage, and transportation. Simulation-led packaging development allows teams to anticipate real-world failures early, reducing damage, returns, and corrective actions after launch.

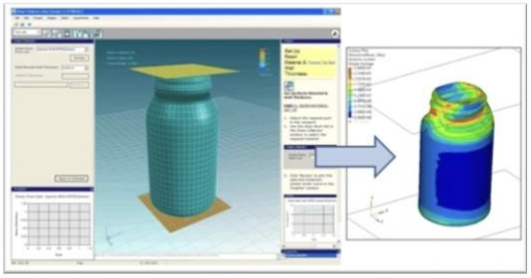
1. Why Simulation Matters in Packaging Development

Traditional validation methods depend heavily on physical testing after samples are produced. Simulation shifts this validation upstream, enabling faster iterations, lower development costs, and improved first-time-right packaging designs.

2. Understanding the Bottle as a System

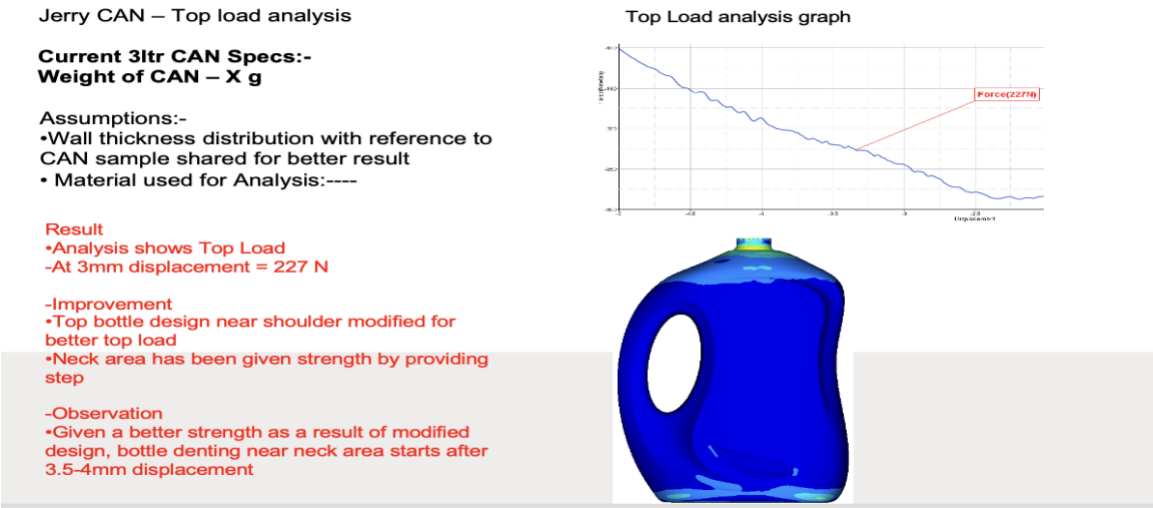
In simulation, a bottle is treated as a system rather than a standalone object. Geometry, material properties, wall thickness distribution, neck finish, and closure interaction collectively determine performance under impact and load.





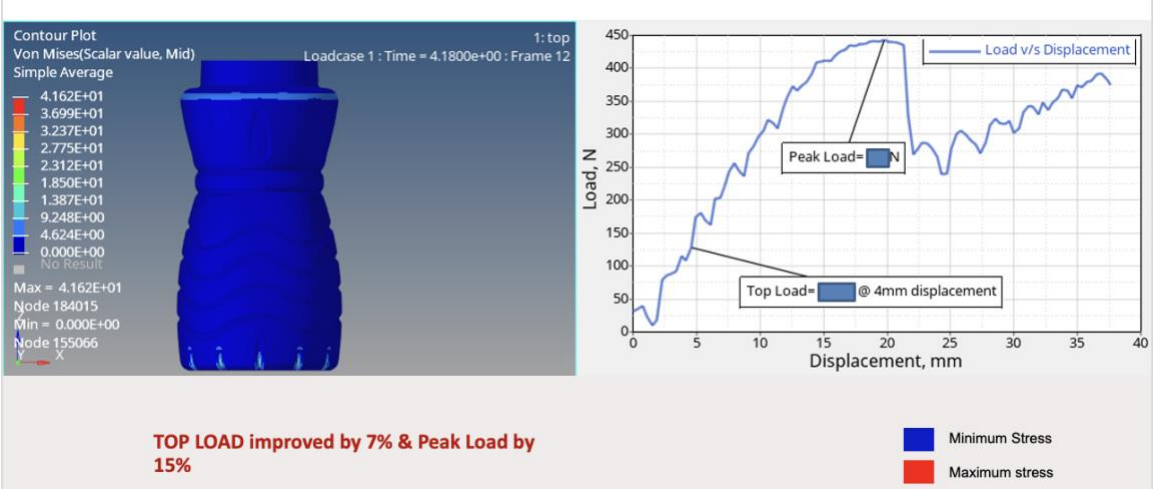
3. Defining Realistic Use and Testing Scenarios

Simulation scenarios must reflect real supply chain conditions. This typically includes vertical base drops, angled impacts, horizontal falls, and compression during stacking and secondary packaging.



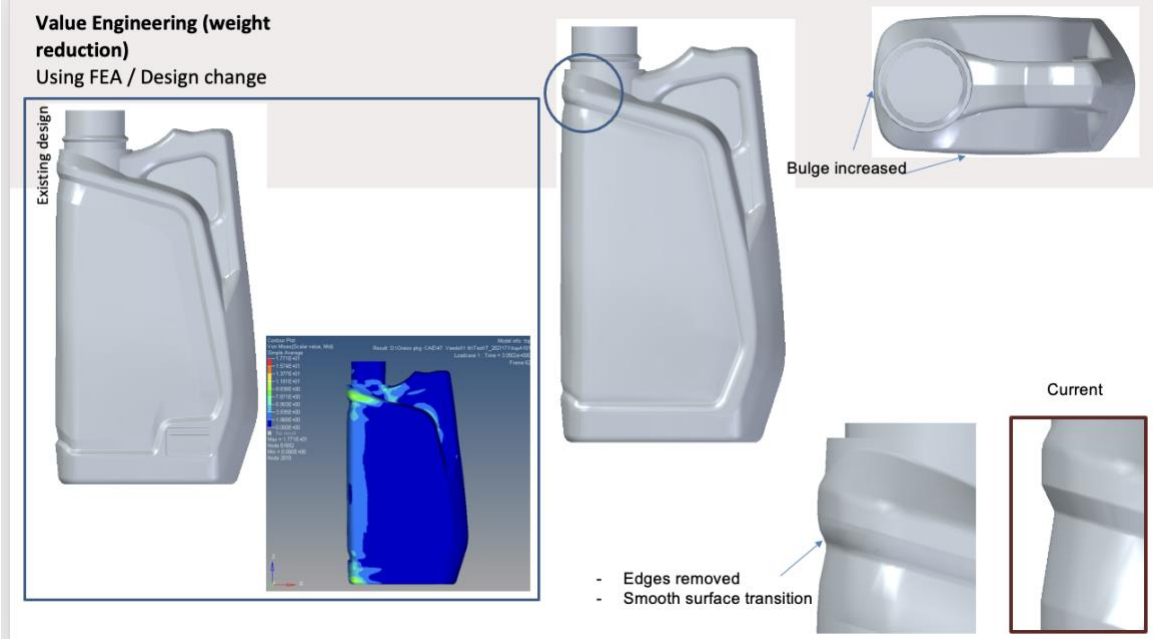
4. Reading Stress Analysis Results

Stress analysis outputs are presented as color-coded maps. Low-stress regions indicate safe zones, while high-stress regions highlight potential crack initiation and deformation points that are not easily identified in CAD.



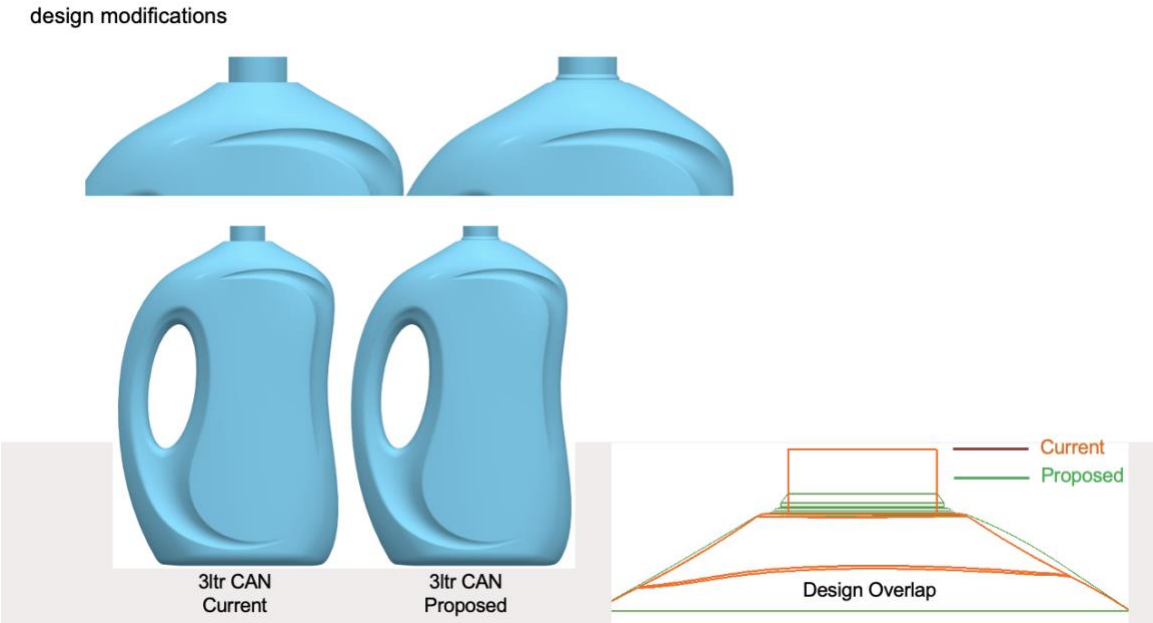
5. Design Optimization Through Simulation

Simulation enables targeted design refinement such as local wall thickness adjustments, geometry smoothing, or material optimization. This approach avoids unnecessary material increase while improving structural performance.



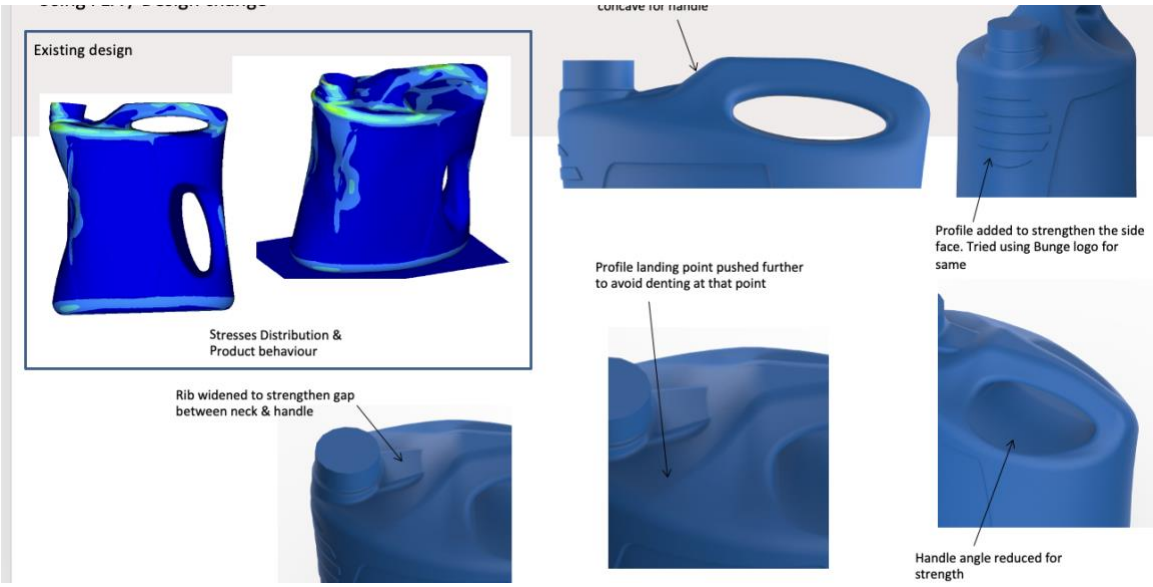
6. Importance of Simulation Before Tooling

Conducting simulation prior to mold manufacturing allows rapid, low-cost iteration. Once tooling is finalized, design changes become time-consuming and expensive, limiting corrective options.



7. Relationship Between Simulation and Physical Testing

Simulation complements physical testing rather than replacing it. By identifying high-risk areas early, simulation reduces the number of physical trials required and improves the relevance of final validation tests.



8. Customer Impact of Simulation-Led Packaging

Customers may never see the testing process, but they experience its results. Packaging that survives transit protects product integrity, reduces returns, and reinforces brand trust.

Packaging, Decoded

Effective packaging is defined by performance throughout the product journey. Simulation enables data-driven decisions that replace assumptions with confidence. This approach lies at the core of packaging—decoded.

Packaging Development Roadmap

From Concept Design to Production-Ready Packaging

Design Intent & Project Breifing

Concept Design & Geometry Development

Material Definition & Assumptions

Simulation & Virtual Validation (Critical Step)

- Predict failure under stress
- Reveals weak zones before tooling
- Informs design refinements

Design Optimization Based on Simulation

Prototype Development

Physical Testing & Compliance

Tooling & Production Readiness

Production & Market Launch

- Deliver a reliable customer experience at scale
- Reduce damage, returns, and costs

Simulation is the bridge between design ambition and production reality.It allows packaging teams to make confident decisions early—when change is still easy.