

Engineering

Unit C3 – UNIT C3: Physical and Visual Prototyping Tools

Lecture LC3.5 – Physical and visual
prototyping of outsole



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T2.2 – Development of modular
courses and training
material.

C3. – Modular Course in
Design Engineering

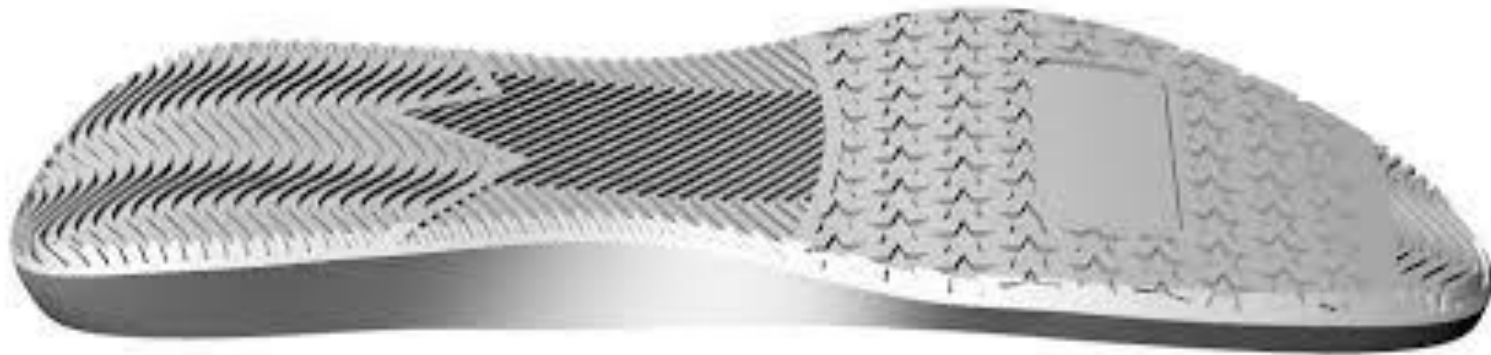


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Physical prototyping of outsole

- Physical prototyping of outsoles is a vital step in footwear development, where designers and engineers translate digital concepts into tangible components to test performance, durability, and aesthetics. Here's how it's typically done:



Key Methods for Outsole Prototyping

- **3D Printing:**

Lightweight materials like TPU are used to print outsole prototypes with intricate tread patterns and structural features. This method allows rapid iteration and



Key Methods for Outsole Prototyping

- **Injection**

Molding: EVA foam is commonly used for midsoles and outsoles.

Prototypes are molded to test cushioning, flexibility, and wear resistance. This technique is ideal for simulating mass



Key Methods for Outsole Prototyping

- **CNC Machining:**

For high-precision prototypes, CNC machines carve outsoles from rubber or foam blocks, enabling detailed evaluation of grip and geometry.



Key Methods for Outsole Prototyping

- **Handcrafting:**

Artisans may manually cut and assemble outsole layers to test fit and feel, especially in early design stages or for bespoke footwear.



Performance Testing

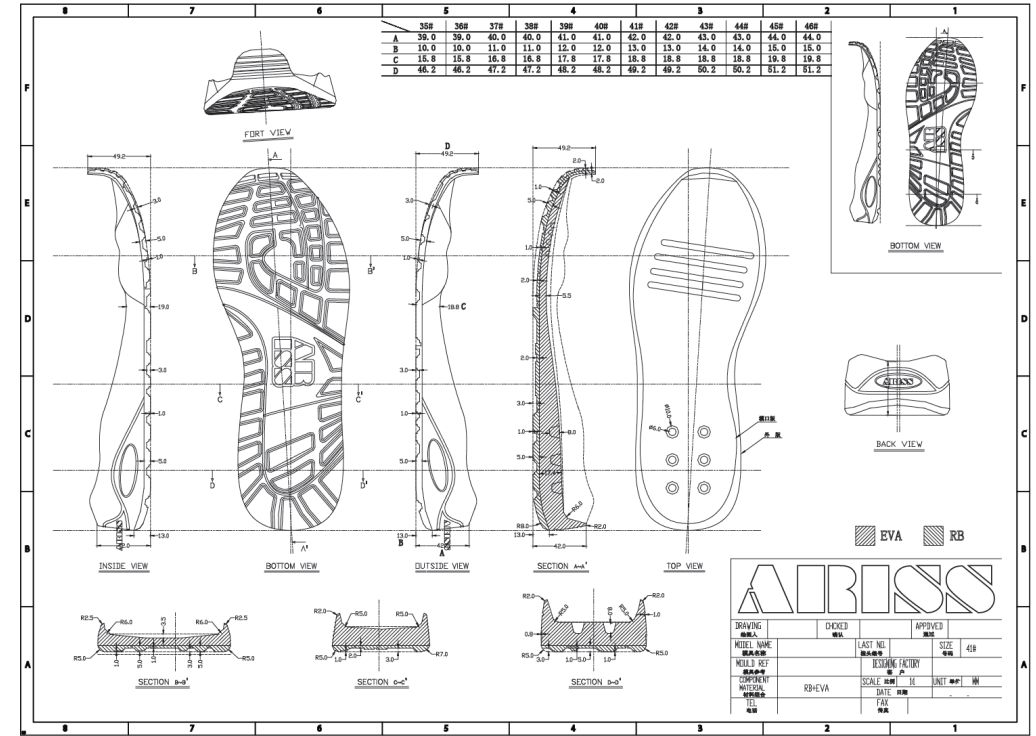
Once prototyped,
outsoles undergo:

- Abrasion resistance tests
- Flex and torsion evaluations
- Traction and grip analysis
- Comfort and ergonomic



Visual prototyping of outsole

- Visual prototyping of outsoles is a powerful technique in footwear design that allows teams to digitally simulate and refine the look, structure, and performance of the sole before physical production. Here's how it's typically done:



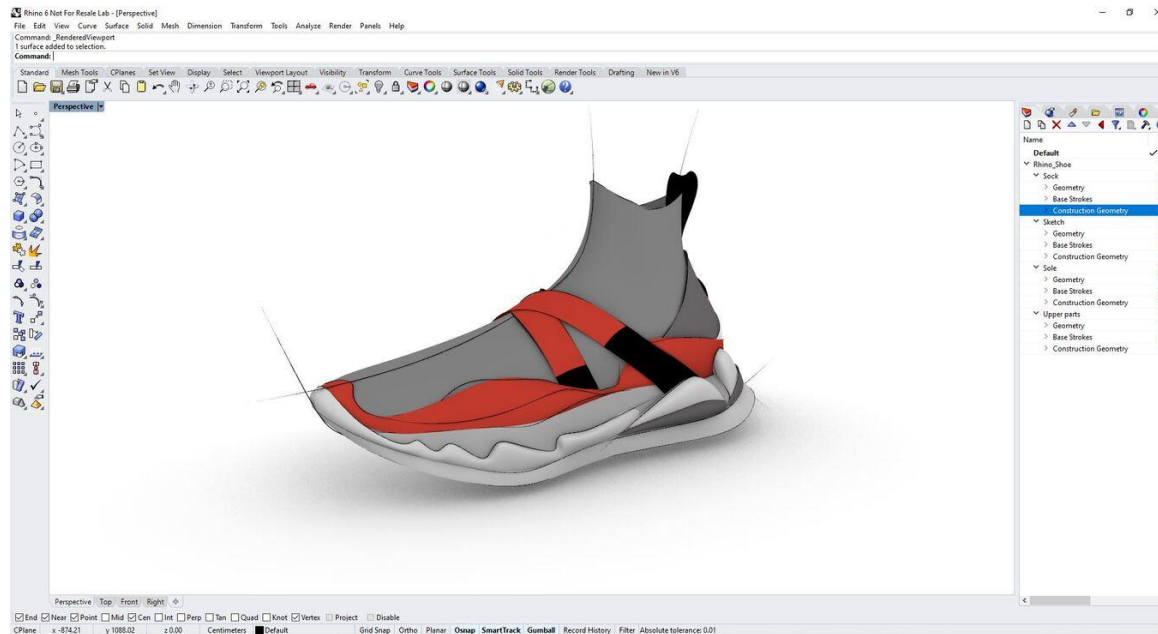
What Is Visual Prototyping of Outsoles?

- It's the process of digitally designing and rendering the outsole of a shoe—its bottom layer that contacts the ground—using 3D modeling and simulation tools. This helps designers test tread patterns, flexibility, and aesthetics without manufacturing a physical sample.



Tools & Techniques

- **Gravity Sketch:** A popular platform for creating 3D printable outsole designs. Designers sketch the form, define wall thickness, and prepare models for FDM (fused deposition modeling) printing.



Tools & Techniques

- **Dual-Material 3D Printing:** TPU (for flexibility) and PLA (for support structures) are often used together to print complex outsole geometries. This method allows for realistic testing of grip and structure.

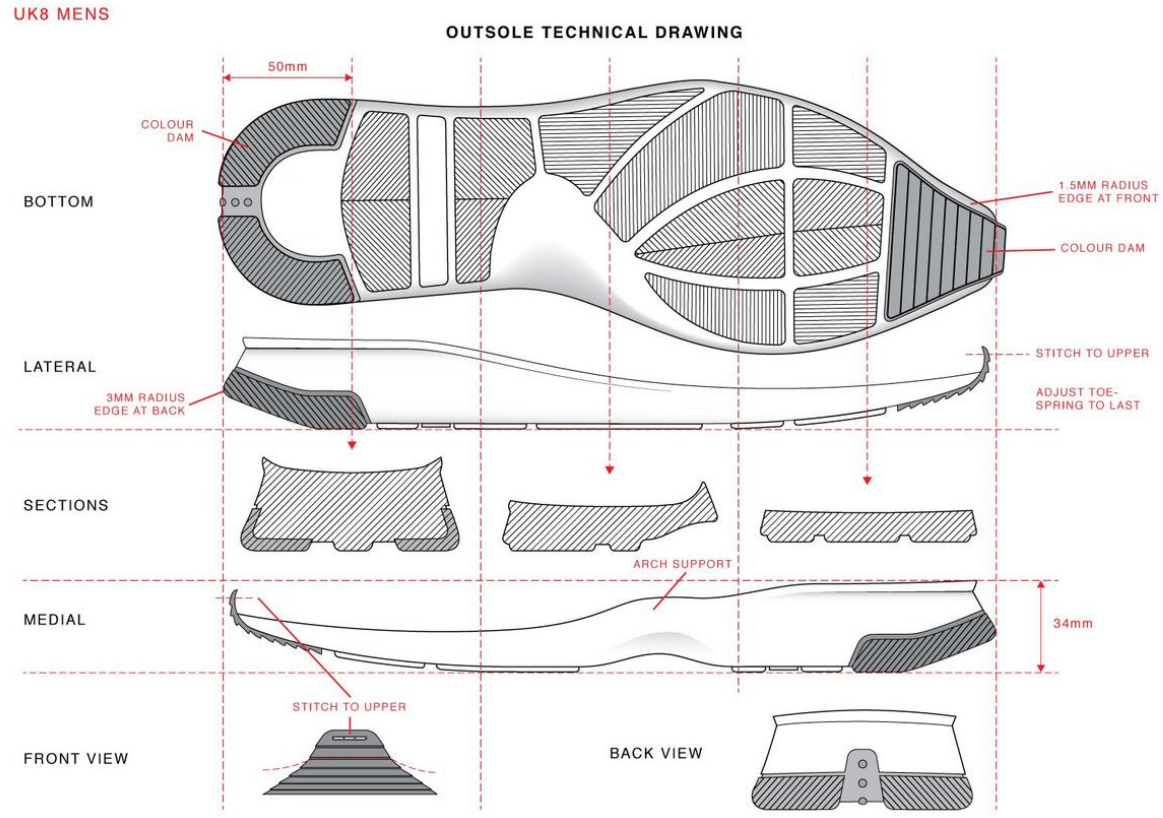


Tools & Techniques

- **CAD**

- Software:**

- Programs like Rhino, SolidWorks, and Fusion 360 help sculpt intricate tread patterns and sole contours.



Tools & Techniques

- **Rendering Engines:**

KeyShot and Blender simulate lighting, textures, and wear to visualize how the outsole will look and perform.



Benefits

- Reduces cost and waste from failed physical prototypes
- Accelerates Design Iteration
- Improves Performance Optimization
- Supports Customization and Branding
- Enables Early Stakeholder Feedback
- Enhances collaboration between designers and engineers



Industry Insight

- 3D printing is revolutionizing outsole prototyping by reducing lead times and enabling complex designs that traditional methods struggle to replicate. Brands are increasingly using hybrid approaches—combining digital modeling with physical testing—to optimize both speed and quality.
- Outsole design is one of the most technically demanding and costly parts of footwear development. It affects comfort, durability, and style—and visual prototyping helps balance performance with tooling efficiency.