



# Adient Seating: Experts in Occupant Comfort

Improving the experience of a world in motion.



# Adient Comfort Lab™

 25<sup>th</sup>  
ANNIVERSARY

1998 • 2023



# We're pioneers in automotive seating comfort.



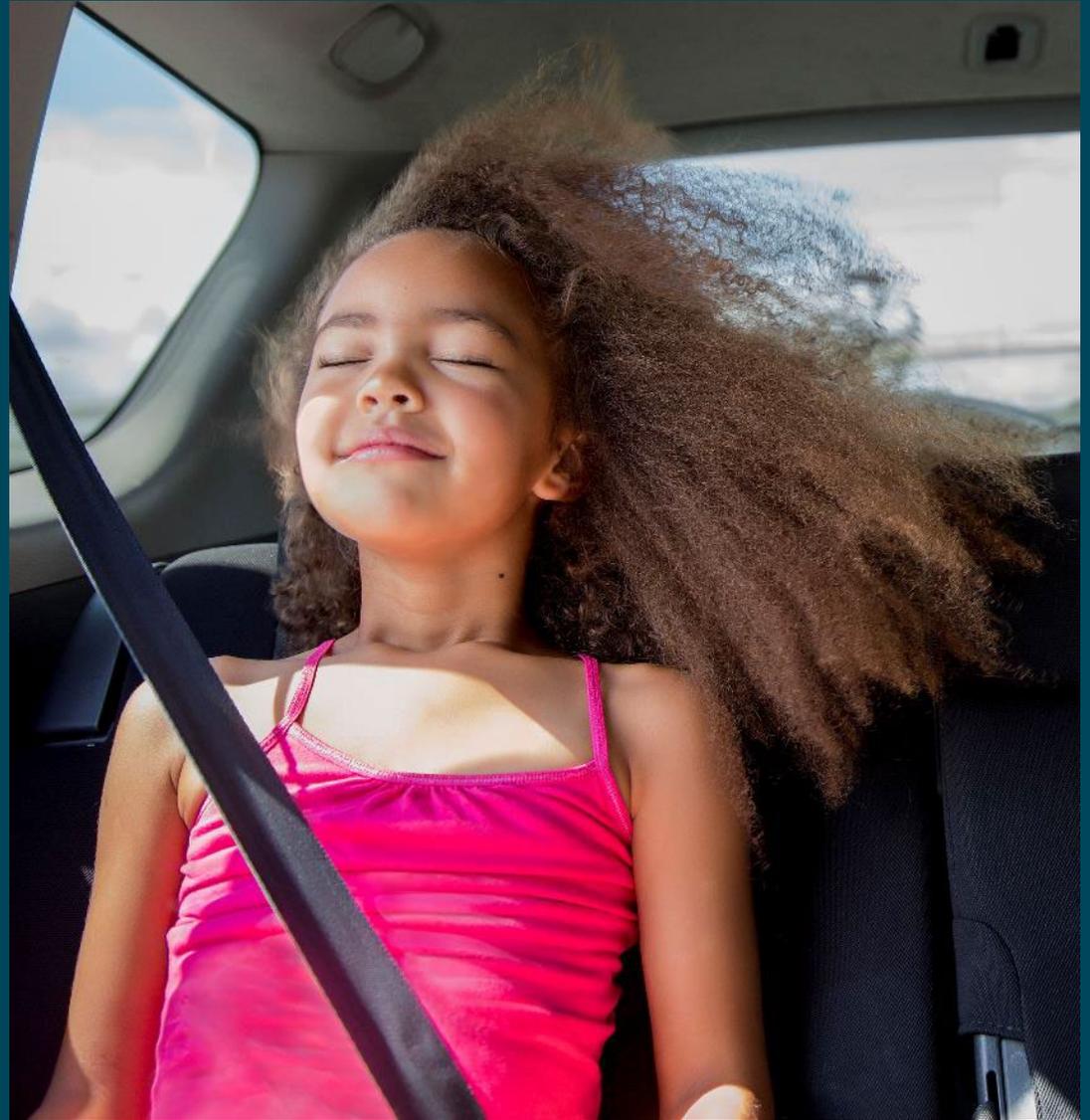
At Adient, we make real seats for real people.

When we established the industry's first comfort lab in 1998, we set the bar in automotive seating comfort. Today, we leverage our unparalleled knowledge, proprietary data and cutting-edge technologies to bake comfort into our award-winning products — from the design phase through production.

Our comfort team includes experts in ergonomics, biomechanics, technology and seating design who work with our customers to create innovative solutions that meet their stringent requirements for quality, design, craftsmanship and value.



# Defining Comfort



# Comfort is highly subjective. It's *personal*.



Generally, comfort is a **positive subjective impression** of liking something while at the same time **not experiencing physical suffering**.

In other words, it's both **psychological** (e.g., "This seat is attractive and stylish") and **biomechanical** (e.g., "This seat forms well to my body").

Comfort is also a **critical** part of the consumer vehicle **purchase decision**.



# Multiple factors affect seating comfort, some of which we control.



## Demographic

- Age
- Race
- Ethnicity
- Gender

## Physical

- Height
- Weight
- Body Shape
- Ability

## Environmental

- Vehicle Type
- Interior Ergonomics
- Packaging

## Experiential

- 'Look and Feel'
- Posture
- Thermal
- Vibration



**Out of Adient's control**



**Within Adient's control**

# We focus on the factors we can influence.



There are three components to — and opportunities to optimize — the overall Seating Experience:



## See

- Overall Appearance
- Initial Impressions
- Safety & Robustness
- Accommodation



## Sit

- Surface Feel / Cushioning
- Fitting / Posture
- Pressure Distribution
- Positioning / Intuitive Adjustment



## Ride

- Vibration & Dampening
- Holding
- Fatigue
- Thermal Management

# Our Philosophy of Comfort guides us.



To meet our customers' needs — and our own stringent internal requirements — our philosophy is to follow an *occupant-centered approach* that encompasses all three stages of the seating experience.

We accomplish this through our **Comfort Development Process**.



Adient's Comfort  
Development Process



# Our Comfort Development Process drives us forward.



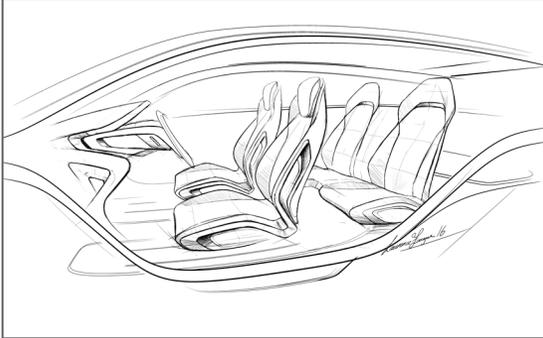
## Research

Drive seat design by focusing on the needs of the consumer. Draw on our extensive comfort benchmarking database, proprietary data and market analyses to provide design direction based on emerging trends.



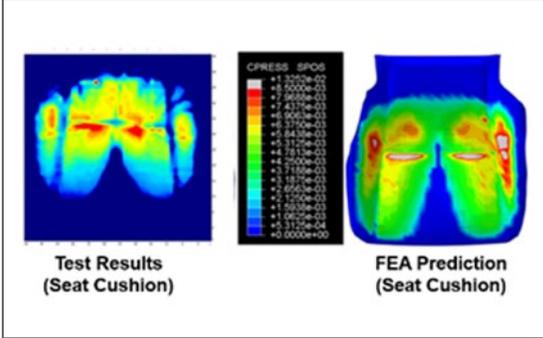
## Align

Collaborate with our customers to identify targets and expectations. Apply comfort guidelines to early seat contour during product development feasibility reviews.



## Develop

Apply our vast comfort knowledge, guidelines, experience and tools to enhance our products and drive optimal comfort performance.



## Evaluate

Use our comprehensive in-house testing capabilities to assess and optimize prototype comfort performance.

See the [appendix](#) for a more detailed overview.

# Our comfort capabilities set us apart from the rest.

Adient created the **industry's first Comfort Lab™** in 1998. Our comfort capabilities include:

- > **Industry Leader in Predictive Comfort, FEA simulation** (CASIMIR) — Virtual validation
- > **H-point, head restraint measurements** (IIHS/202a) — Safety and comfort trade-offs
- > **3D Surface laser scanning** — How well prototype meets design intent (shape)
- > **Pressure distribution** — How the seat supports the occupant
- > **Occupant Posture Assessment** — How well the occupant fits in the seat
- > **Robotic Seat system Load / Deflection** — Understand foam/material properties under occupant loading
- > **Simulated road vibration / transmissibility** (man-rated 6-axis shaker) — Assess dynamic comfort (real world)
- > **Trained Comfort Expert Panel (CEP) for subjective assessments and clinics** — Understanding the voice of the customer
- > **Thermal comfort** — Assess thermal performance of trim and features (EU specific)



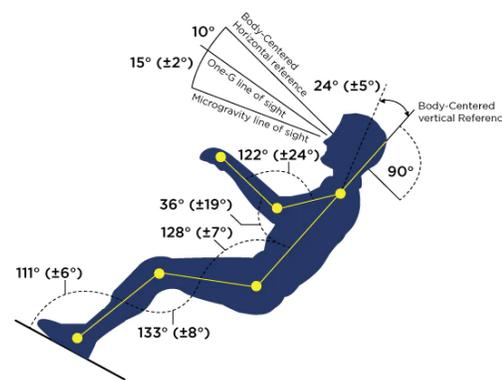
# Our expertise is unmatched in the industry.



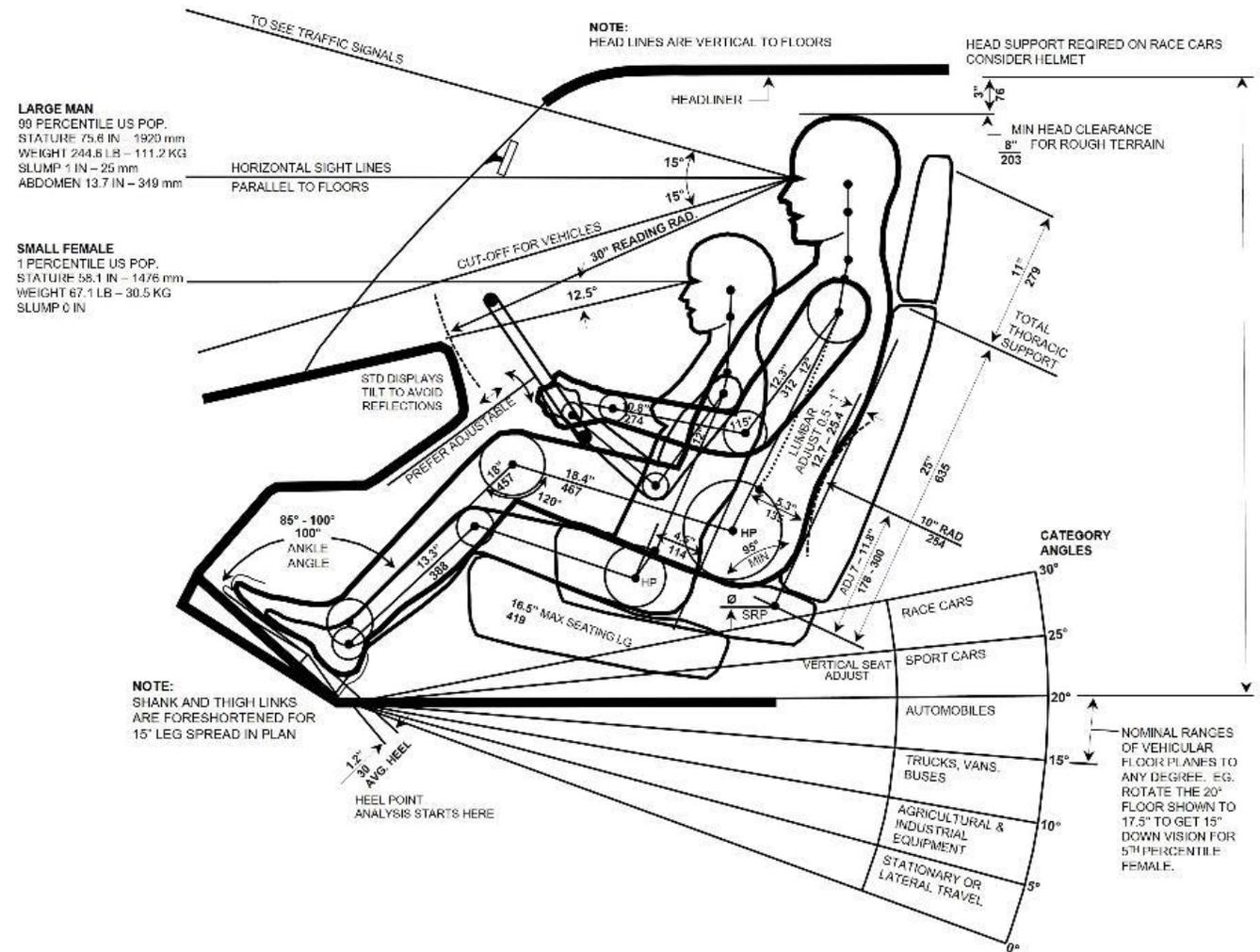
Adient's internal **Comfort Design Guidelines** incorporate **objective** and **subjective** comfort measures with a high confidence and correlation level to JD Power and other consumer analytics.

- > Developed over the last 25 years of seat design
- > Include a '100-point' SMTE checklist
- > Based on subject demographics, percentile (5<sup>th</sup> to 95<sup>th</sup>), anthropometry and ergonomics
- > Applicable for non-standard seating positions:
  - "Zero-G"
  - Deep Recline

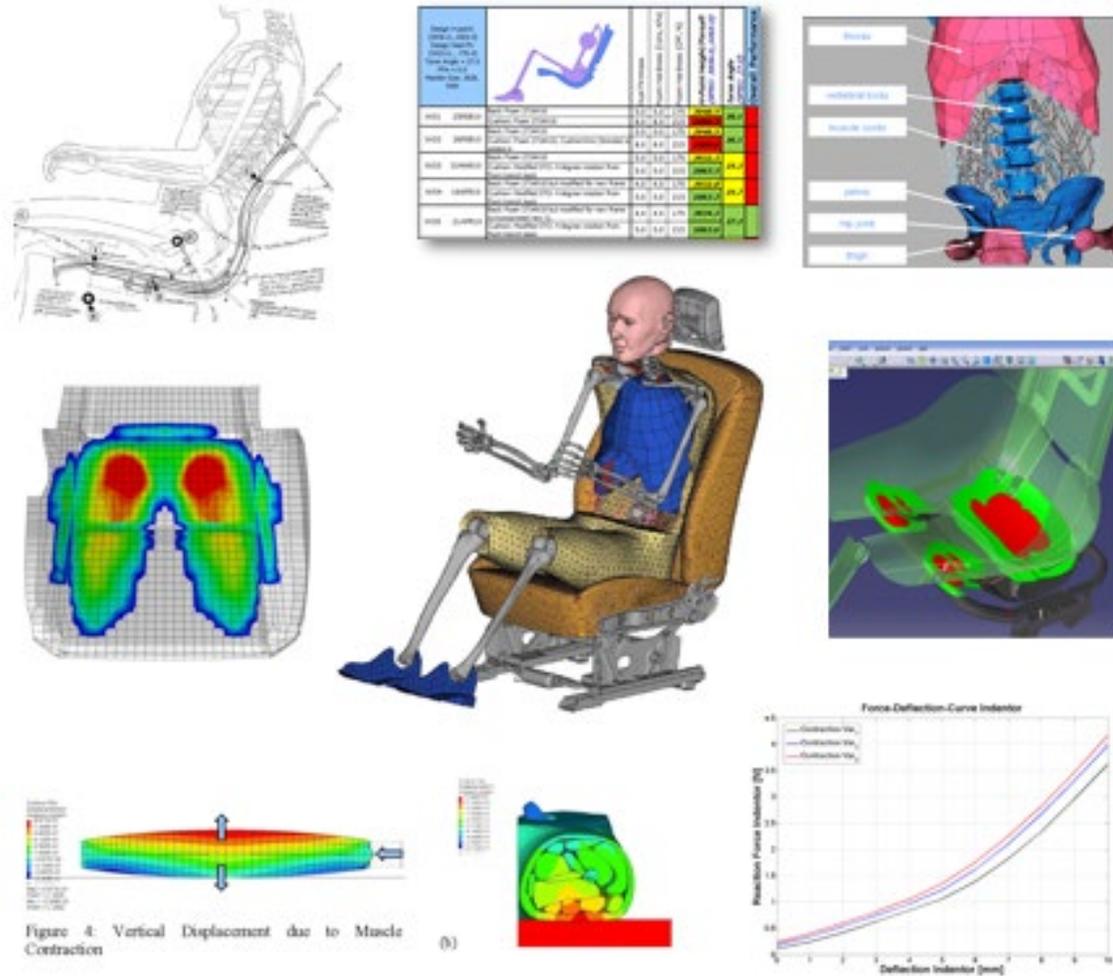
## ZERO GRAVITY POSITION



Zero Gravity + Pressure relief = **COMFORT**



# Our comfort knowledge is expansive and unrivaled.



Our extensive **Comfort Benchmarking Database** contains subjective and objective measurements on comfort indicators, including:

- > Occupant pressure distribution (cushion & back)
- > Seat surface dimensional measures (heights/widths, etc.)
- > Subjective comfort assessment (survey results)
- > Seat content and features, etc.

We maintain a **vast library** of papers on comfort, human physiology, anthropometry and ergonomics and have **partnered with universities** to conduct research and **comfort studies**:

- > UMTRI studies (Matt Reed)
- > MSU (Tammy Bush)

# We apply our comfort knowledge to our newest innovations.



## Example: Adient Aerospace (left)

- > Non-standard seating positions; Zero-G (deep recline) and lay flat (bed)
- > Applied our extensive comfort knowledge, processes and capabilities to develop a Business Class pod for the aerospace industry (Boeing)

## Example: Adient's award-winning UltraThin™ seat (right)

- > Applied our extensive comfort knowledge, processes and capabilities to develop the UltraThin™ concept
- > Currently have multiple concepts for our customers in development
- > View the UltraThin™ product sheet in the [Appendix](#) of this presentation



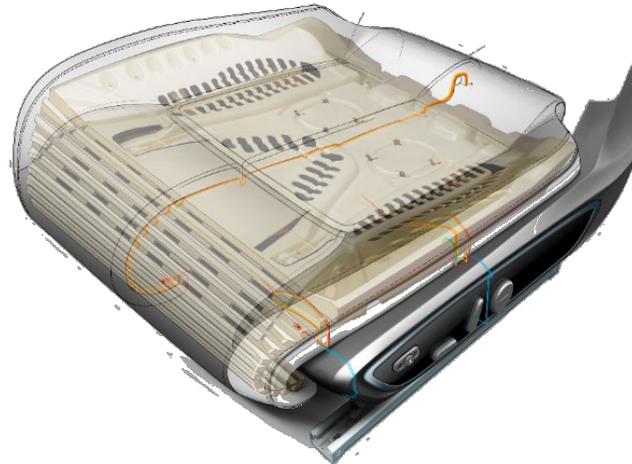


## UltraThin



- > Developed using a Generative Design Process incorporating Comfort FEA inputs (virtual occupant pressure)
- > Panel shape designed to accommodate all occupant anthropometries (5<sup>th</sup> to 95<sup>th</sup> percentile)

## UltraThin Cushion Length Extender



- > Ergonomic cushion length support for all occupant anthropometries (5<sup>th</sup> to 95<sup>th</sup> %tile)
- > Design eliminates need for trim construction that impacts occupant comfort (i.e. trench)

## Molded A-Surface



- > Concave seat shape accommodates all occupant anthropometries (5<sup>th</sup> to 95<sup>th</sup> %tile)
- > Design eliminates need for trim construction that impacts occupant comfort



# Appendix



# Adient Comfort Development Process



## Automotive Seating Comfort Development Process



### Research

- Competitive market analysis
- Vehicle content assessment
- Customer quote support
- Comfort activity definition

Research tools and reports including J.D. Power and Consumer Reports.

### Alignment

- Review product layout/CAD model
- Reverse engineering/lessons learned
- Apply lessons learned

Alignment diagrams and PLUS Action Plan.

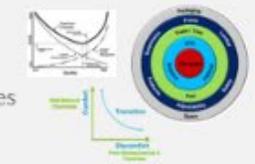
### Tactical Planning & Customer Process Alignment

- Establish customer engagement
- Align customer process with PLUS
- Identify opportunities for improvement

Logos of FCA, GM, Toyota, Ford, and Nissan.

### Develop

- Understand and apply trade-off curves
- Identify gaps between benchmark & guidelines
- Apply comfort SMTE best practices



### Property Build & Design Assessment

- Occupant, structure and feature packaging
- Contour development
- Foam & trim design
- Performance simulation

Images of seat components and simulation.

### Evaluate

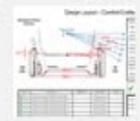
- Expert panel evaluation
- Objective comfort data measured
- Customer evaluation & support

Evaluation methods including expert panels and customer testing.

### Capture Knowledge (SMTE)

- Lessons learned captured
- Reflection log updated

### Final Prod. Rel.



**Vision:** Provide comfort engineering expertise globally for all Adient products

# Ultrathin – Overview

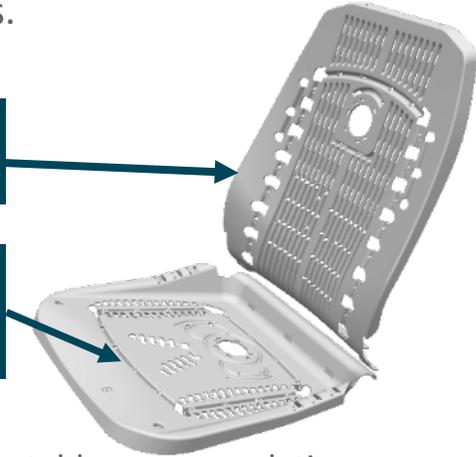
A unique seat construction that offers a high level of comfort and support while offering opportunities for significant space savings, component consolidation and overall mass reductions.

- 30% Overall STO Volume Reduction
- 45mm Block Height Reduction
- 14% Overall Mass Reduction
- 5% JIT Labor Reduction
- Premium BIC Comfort in a Thin Package
- 10% Reduction in Overall Seat Part Count

➤ The supportive Ultrathin panel conforms to the occupant's posture, size and weight comfortably accommodating all different size occupants

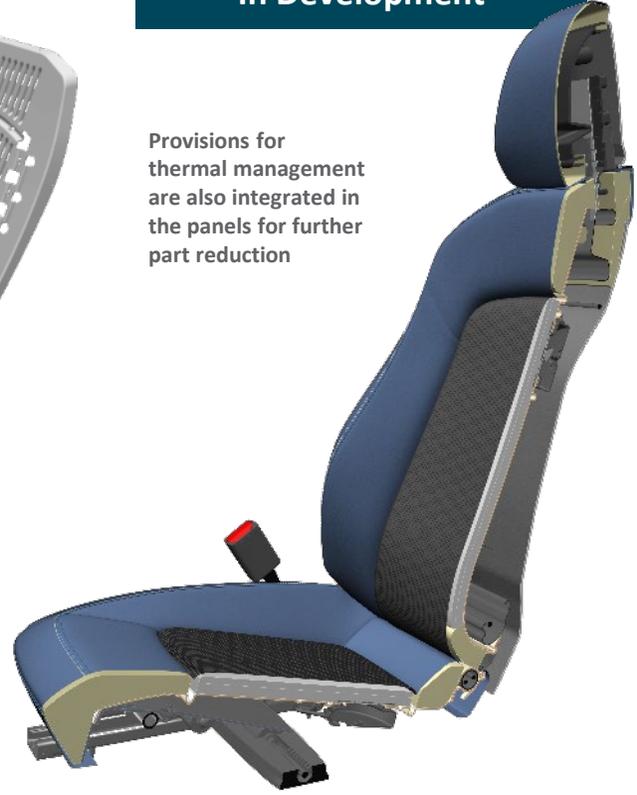
Design and engineered thermoplastic suspension substrates utilizing our most advanced comfort FEA toolset

Trim tiedown clips have been integrated directly into the suspension panels, eliminating the need for wires, clips and Velcro in the foam pad.

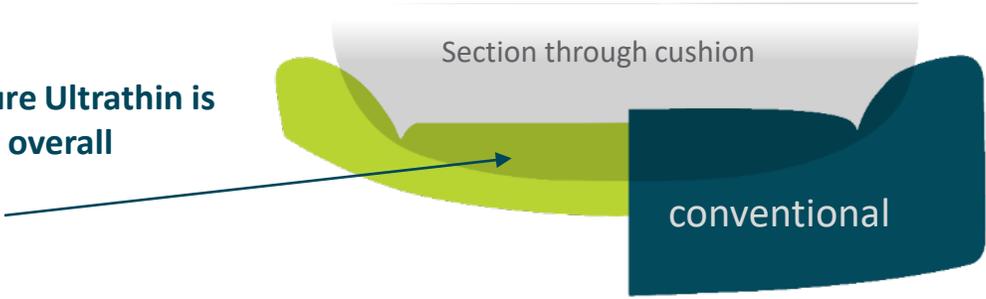


**In Development**

Provisions for thermal management are also integrated in the panels for further part reduction



When optimized with the structure Ultrathin is saving an average of 40-60mm in overall package thickness



UltraThin is a 2022 winner of the Altair Enlighten Award



## Trend Attributes

Power train electrification	Slim appearance & comfort	Sustainability	Cost & complexity reduction	Connectivity	Integration	Shorter cycle times	Scenario Based Reconfiguration	Safety
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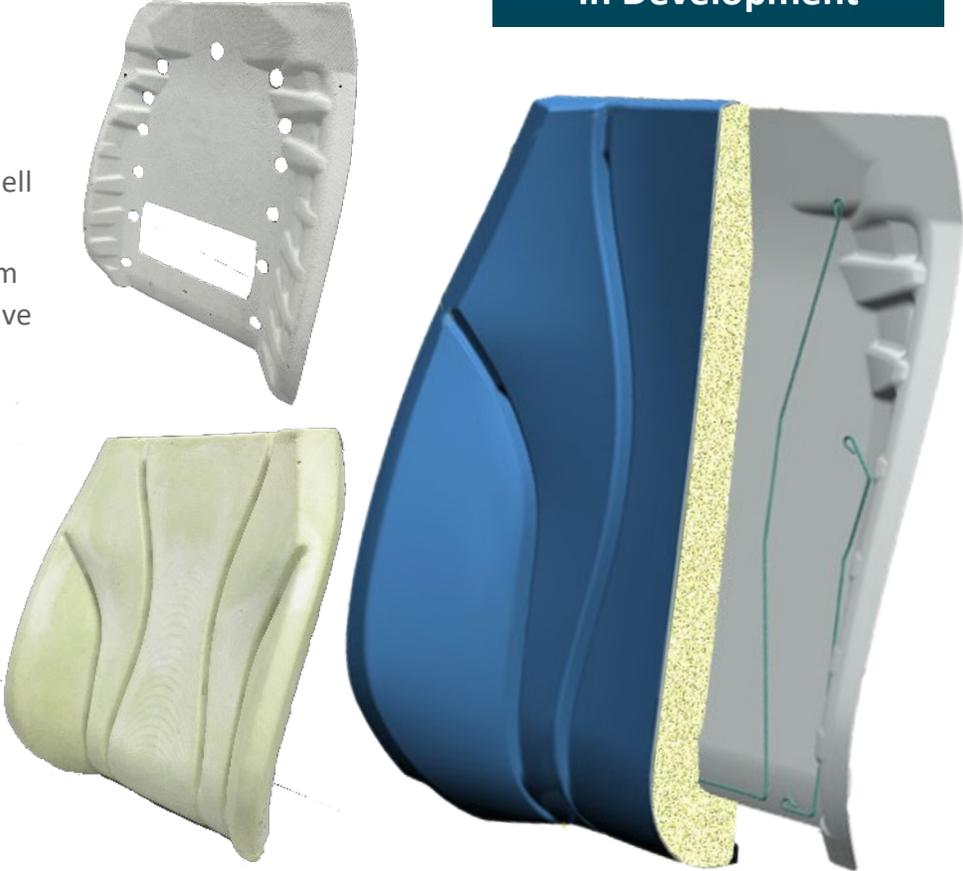
## Adient is ready to answer the call for slim and lightweight seating solutions used in micro cars and electric vehicles

### Why It Matters

With increasing demands towards lighter and slimmer seats, Adient has developed an innovative solution called shell foam which can offer more interior space without compromising on comfort. Shell Foam™ is much thinner but more rigid than traditional foam which allows for thinner seats enhancing legroom space in a vehicle. From a design perspective, the more rigid character can offer customers more fancy and attractive seat shapes.

### The Details

- > **Slim:** The foam product is up to 50% thinner than traditional foam products
- > **Rigidity:** It allows fancy styles and shapes without compromising on seating comfort
- > **Sustainable:** Lower carbon footprint compared to standard foam
- > **Supportive:** Shell foam provides stiffness on demand
- > **Flexible:** Its structure allows for additions to the complete seat, including ventilators and spacers



### Trend Attributes

Power train electrification	Slim appearance & comfort	Sustainability	Cost & complexity reduction	Connectivity	Integration	Shorter cycle times	Scenario Based Reconfiguration	Safety
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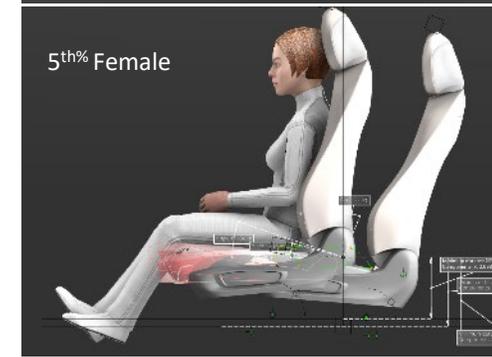
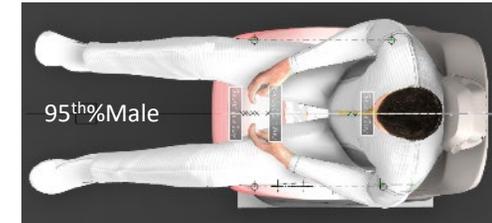
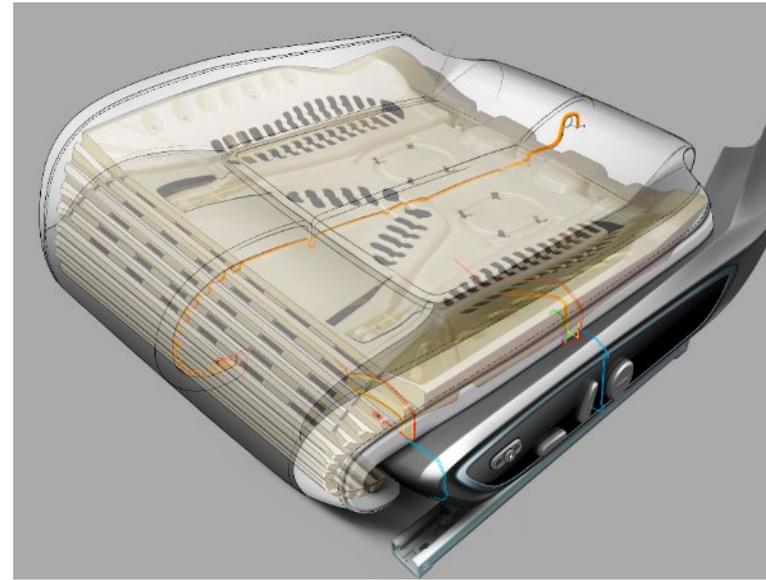
# Cushion Length Adjustment Integration with Ultrathin

## Why It Matters

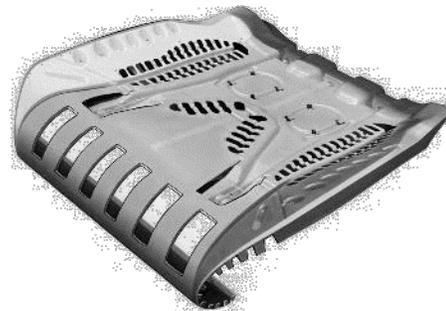
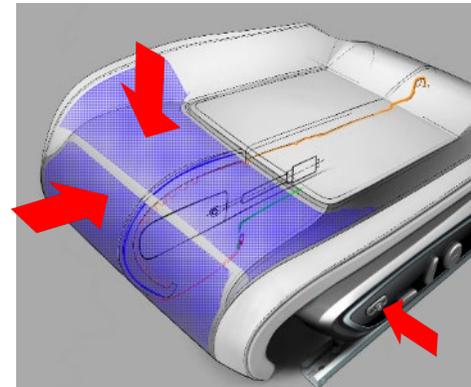
Thigh support features enhance comfort and can enable support for different driving positions and different size people. Cushion Length Extension using the Ultra Thin Panel technology can provide simple and unique execution with improved functionality and ergonomics.

## The Details

- > **Design Differentiation and Experience:** Flexible Support Membrane allows for effective CLE function while maintaining STO theme
- > **Full width adjustment:** without need for functional separation between insert and bolsters.
- > **Function & Flexibility:** Flexible Support Membrane with horizontal corrugations provides support and resizing by curling the front end of the cushion underneath.
- > **Optional Self adjusting feature:** Deployment or retraction is automatically adjusted based on pressure detected by sensing material under trim cover. Different-sized occupants can obtain customized thigh support in a fully-automated manner.



pressure-sensitive activation



# Sculpted Soft Trim

Sculped A surface trim cover that offers fresh aesthetics and new design opportunities leveraging Adient's Soft Back Panel technology as a base layer

## Why It Matters

- > Enables design freedom for the seat cover shape, offering concavity and unique trim tie down look
- > Enables product differentiation between brands and product offerings
- > Can be executed with fabric, vinyl, and leather

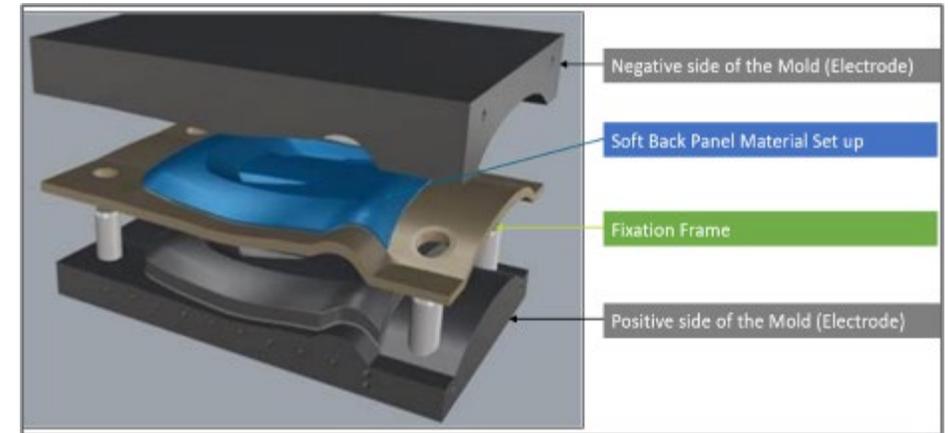
## Details

- > **Leverages our Proven HF Welding Process:** Builds on our Soft Back Panel capability
- > **Easy to Clean:** Compared to traditional trimming where crumbs and dust can collect
- > **Modular:** Seat components can be integrated, trim can be quickly replaced
- > **Differentiated:** Provides the capability to differentiate brands and trim levels based on aesthetics, content or service needs
- > **Reduced Build Times:** Can reduce the necessary components and labor
- > **Two versions:** Single piece cover or pre-sewn cover (incorporates sew lines)
- > **Well-Crafted Appearance:** Consistent parts from the tool, every time
- > **Thinner Packaging:** Package savings vs traditional foam and trim when paired with our Ultrathin panel



In Development

Latest parts are very promising, with a very good balance of soft feel and shape stability. Parts are using a spec'd Tenowo carrier with no laminate and a perforated cover



## Trend Attributes

Power train electrification	Slim appearance & comfort	Sustainability	Cost & complexity reduction	Connectivity	Integration	Shorter cycle times	Scenario Based Reconfiguration	Safety
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# Soft Back Panel



## Why It Matters

Adient's Soft Back Panel improves knee clearance, enhances comfort, and improves quality through reduced buzz, squeak and rattle (BSR) and enhanced soft touch. The unique seat back panel allows for greater seat design flexibility, improved packaging and incorporation of a variety of cover materials.

## The Details

- Lightweight: Estimated mass reduction of up to **2kg per car set**.
- Design: Designed to be an optimized replacement for injection-molded plastic back panels.
- Shore hardness values up to **80 shore-A**.
- Comfortable: Enhances second-row space by increasing knee clearance
- Soft: Features an improved luxury feel (soft haptic)
- Versatile: Creates design enhancement opportunities by integrating unique technologies like embossing
- Modular: Suitable for all cover materials (incl. fabric, vinyl and leather without the need to change tooling)
- Efficient: Cost-competitive compared with competitors' laminated hard and soft back panels
- Sustainability: Carrier material from 70% recycled PET; sustainable materials feasible for the A-side



## Key Attributes

Cost Efficiency	Lightweight	Safety	Function & Flexibility	Sustainability	Comfort & Convenience	Design Differentiation & Experience	New Mobility
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# ES<sup>3</sup> — Evolution of Seating Systems Sustainability leverages available knowledge and addresses key trends to create value for our customers



## Key trends

	Power train electrification
	Integrated appearance and comfort
	Sustainability
	Cost and complexity reduction
	Shared mobility
	Integration
	Shorter cycle times
	Autonomous driving & Safety



## Available knowledge

	JD Power Results
	Market Research
	VAVE Workshops
	Innovation Portfolio
	Warranty Analysis
	Benchmarking
	IIHS Rating

