

Ergonomic Design

By Doug Oswald

Why are there so many different seating designs on the market today – with such drastically different levels of comfort? Most transportation seating solutions are designed for unique purposes. But even within the same application, why does Company A’s seat “sit” differently than Company B’s seat?

The root reason is that all ergonomic design begins as an “art form.” But the designers of the art form must take into consideration the application, dimensional, structural and production design criteria that uniquely shape the seat. At the same time, the designer has to create an ergonomic contour that will fit the widest range of all sizes of people. Since each transit seat is generally a common size, the ergonomic guidelines are to meet the needs of 5th to 95th percentile users.

All ergonomic design starts as an art form and takes shape through the application of the design criteria, but most of the science occurs in the evaluation of comfort. The following explains the science of ergonomic seating design.

Materials and processes

The application of new technology in materials and processes has always provided a significant impact on the history of product and seating innovation. The key in maintaining an ergonomic design is not to allow the production technology to overshadow the ability to achieve a comfortable seat. Too much focus on materials and processes that limit the three-dimensional contours of the seat is a recipe for a lack of comfort. Figure 1 shows two drastically different centerline seat profiles designed for the same purpose and meeting the same design criteria.

Dimensional and structural requirements

All bus seats are required to meet certain dimensional and structural requirements, which impact the design of the seat. APTA guidelines specify certain dimensional standards in order to maintain seat sizes, angles and thicknesses, and each seat on the market generally complies. In addition, structural testing is done with static loading or dynamic force in order to prove structural properties for general durability and crash protection. While dimensional and structural requirements keep the seat design within



American Seating’s flagship product, **InSight**, was conceived, engineered, tested and tooled by American Seating to meet the needs of the North American heavy-duty transit market.

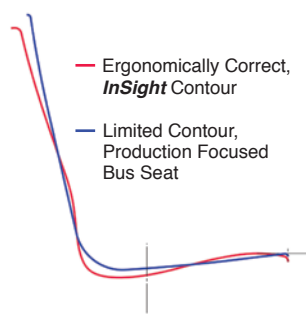


Figure 1

some specific parameters, there are no specific ergonomic criteria that define the shape or comfort of the seat.

People size

The North American population has been getting larger for decades. Providing a seat frame and back with a slim profile and using curvature to enhance hip-to-knee room are key to providing optimal comfort on a bus. Maximizing seat width is also critical to both comfort and personal space. Interior bus width and aisle space are set dimensions. Most seating manufacturers provide one size seat for all applications, but one company offers two seat-width options: a straight-sided 17-inch-wide seat and an 18-inch-wide seat with a tapered upper section (see Figure 2). This feature allows for maximum comfort while meeting industry dimensional standards.

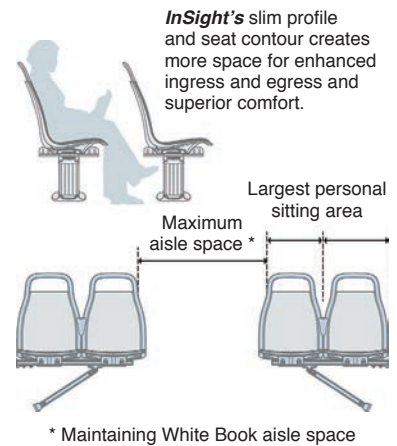



Figure 2

Art > Science

Although all ergonomic design begins as an art form, there is plenty of science that goes into a seat design. Once a look is established, understanding the physiology of comfort, and the science of how to create a comfortable seat, is critical. This is not to be trusted to designs from other continents, as body dimensions and comfort perceptions of the North American population are different than those of other countries. Utilizing a panel of people to evaluate how various body types interface with seating contours is part of solving the equation in ergonomic design development. This process is essentially trial and error until the optimal form is achieved.

In addition to the seat contour, the pitch and back angle of the seat play critical roles in comfort as well as retention in a moving vehicle. Digital pressure mapping is the latest technology to evaluate the comfort of a seat. While sitting upright on a flat surface, 75 percent of a person’s total body weight rests on two concentrated areas – technically referred to as “ischial tuberosities,” and known to most of us as the “sit bones.” In the Figure 3 images, cooler colors represent less pressure (absence of discomfort) while warmer colors represent more pressure (discomfort). This technology is commonly used by those specializing in the science of seating, but there is a simple way a transit authority also can evaluate comfort scientifically. It is highly recommended that seating decision-makers establish a user panel and perform a survey to evaluate comfort of various seating samples. 

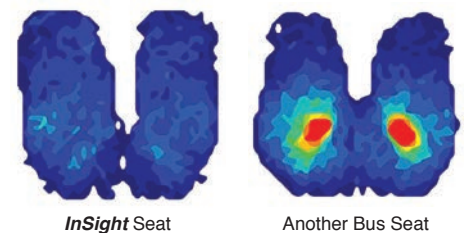


Figure 3

Doug Oswald serves as the director of marketing for American Seating’s Transportation Division and has over two decades’ experience in seating product development. Headquartered in Grand Rapids, MI, American Seating employs a U.S.-based workforce and takes pride in sourcing locally. American Seating has been listening to, designing for and investing in public transportation and related industries for 85 years. Flagship products **InSight**, **Vision**® and **Metropolitan**® were conceived, engineered, tested and tooled by American Seating to meet the needs of the North American heavy-duty transit market. Visit www.americanseating.com for additional information.