



The Passenger Experience Study

Daylight comfort drives airport satisfaction

Executive Summary

Designing for comfort designs for satisfaction. As major airports invest in upgrading facilities to provide travelers with a more pleasant travel experience, prioritizing features that most impact passenger satisfaction is crucial. The current thinking is that amenities such as electrical outlets and concessions are the key drivers of traveler satisfaction, but new research at Charlotte Douglas International Airport (CLT) suggests that daylight comfort plays an important role in how passengers rate their overall gate experience.

Key Findings

68% more likely to be very satisfied

Up to **33%** more modern, efficient, bright, comfortable

15°F cooler surface temperatures

Key Findings

An airport concourse with View Smart Windows provides a more comfortable physical environment for passengers, a benefit that drives their overall satisfaction.

- **68%** more likely to be very satisfied
- Up to **33%** more modern, efficient, bright and comfortable
- **15°F** cooler surface temperatures

Results

Passenger comfort. Passengers in the concourse with View Smart Windows reported significantly greater comfort with daylight conditions and with performing a variety of activities: reading, using a personal device and eating at their seat. The gates with View Smart Windows were also measured to have 15°F cooler surface temperatures, indicating a more comfortable thermal environment.

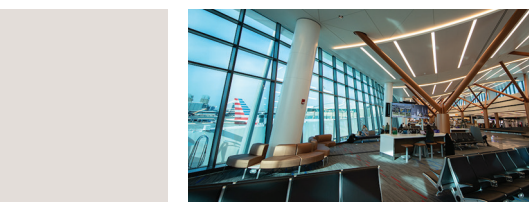
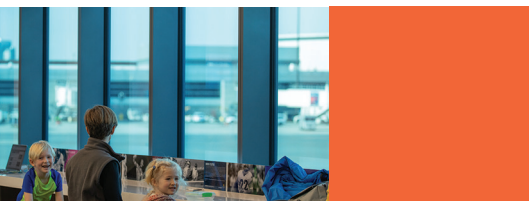
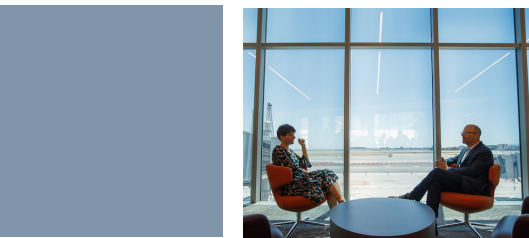
Passenger satisfaction. The study revealed that passengers in the concourse with View Smart Windows were 68% more likely to be very satisfied with their overall gate experience. Furthermore, passengers rated the concourse up to 33% more modern, efficient, bright, and comfortable compared to passengers in the concourse with traditional windows.

Research Methods

To better understand the impact of daylight and views in the airport setting on passenger comfort and satisfaction, Dr. Alan Hedge of Cornell University conducted a comparative study of 573 passengers in CLT Airport, half of whom were surveyed from a concourse with traditional windows and half of whom were surveyed from a concourse with electrochromic glass (View Smart Windows), which intelligently optimizes daylight and views to the outdoors.

Conclusions

Improving the physical airport environment by enhancing daylight and thermal conditions drives an increase in passenger overall satisfaction. By investing in design features that optimizes these conditions, airports have the opportunity to positively impact the travel experience of the millions of passengers they greet every year.



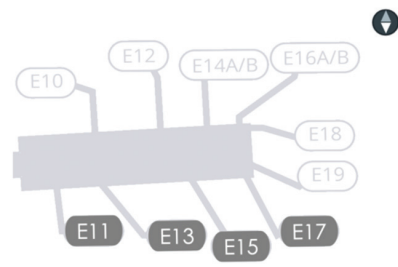
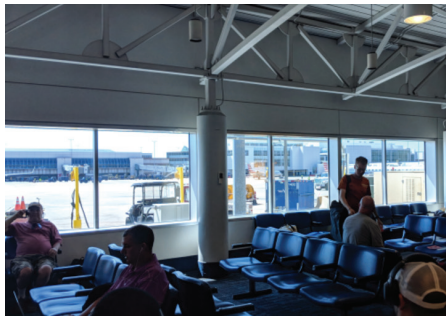
Cornell University

Hedge, A., MacNaughton, P., Woo, M., Guglielmetti, R., Tinianov, B. Airport Passenger Experiences in Concourses with either Electrochromic or Low-e Glass Windows. International Journal of Aviation Management. Vol. 5, No. 1, 2021.

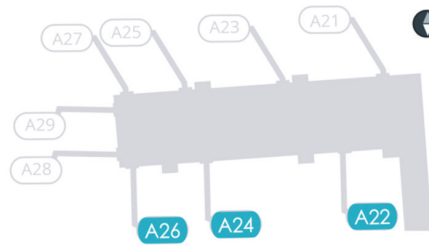
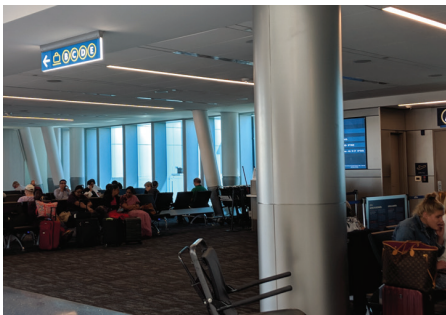
Methods

The Passenger Experience Study was conducted in two concourses in Charlotte Douglas International (CLT) Airport in fall of 2019: Concourse A Expansion, which was fitted with electrochromic glass (View Smart Windows), and Concourse E, which was fitted with traditional low-E glass. The concourses and their respective gates were selected for comparison due to their similar South-facing orientation, allowing for comparison of passenger reactions under similar solar exposures throughout the study.

573 passengers across the two concourses, 290 from Concourse A Expansion and 283 from Concourse E, completed a survey regarding their comfort, perceptions and satisfaction at their gate. All respondents were surveyed between 9:00 AM and 5:00 PM over the course of six clear weather days, with alternated order of sampling to balance the number of passengers surveyed in the mornings and afternoons. Infrared (thermal) imaging was also taken to measure temperature differences.



Concourse E - Low-E glass



Concourse A Expansion - View Smart Glass



*Dr. Alan Hedge
Professor Emeritus of the Department
of Design and Environmental Analysis
Cornell University*

The Expert

Dr. Alan Hedge is a Professor Emeritus of the Department of Design and Environmental Analysis at Cornell University. He directed the Human Factors and Ergonomics teaching and research programs at Cornell University and his expertise lies in the impact of design and workplace ergonomics, including office lighting conditions, on the health, comfort, and productivity of workers.

Dr. Hedge has authored over 50 book chapters and 250 articles on the subject of human factors.

Results

Passenger Comfort

Modern airports often feature large floor-to-ceiling windows to provide passengers with ample natural lighting and views of the outdoors. However, when daylight penetration is uncontrolled, this can lead to glare reflected off of surfaces such as laptop and phone screens, which can cause significant visual discomfort for the passengers attempting to use their devices near the windows. Electrochromic glass, by tinting when sun penetration is harshest, presents a practical solution that prioritizes passengers' visual comfort while maintaining the benefits of plentiful natural light and access to views.

Passengers in the concourse with View Smart Windows reported significantly greater comfort with the daylight conditions at their gates: 75% reported the daylight conditions to be 'very comfortable', compared to 63% of passengers in the concourse with low-E glass.

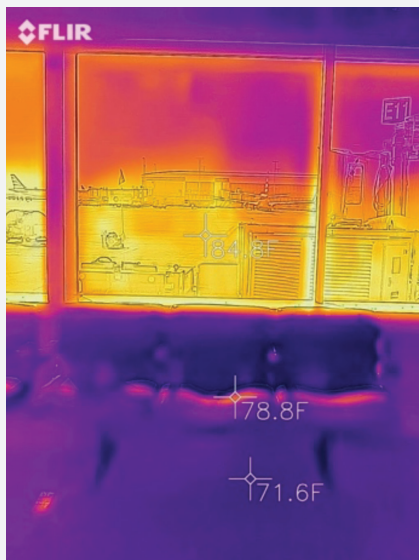
A significantly higher proportion of respondents in the concourse with View Smart Windows also reported being very comfortable taking part in a variety of activities: reading a book or magazine; using a laptop, tablet, or cell phone; and eating at their seat. As travelers become increasingly connected to their devices, particularly in airport settings to retrieve flight information or engage in work, providing passengers with an environment that fosters visual comfort and productivity is key.

These survey results support observations made in a previous study, where passengers in a gate with View Smart Windows were observed to comfortably use their devices near the windows and spend 83% more time in the seats near the windows, whereas those in a gate with traditional low-E glass were observed to frequently engage in behaviors indicating visual discomfort such as wearing sunglasses indoors or shielding their devices from glare¹.

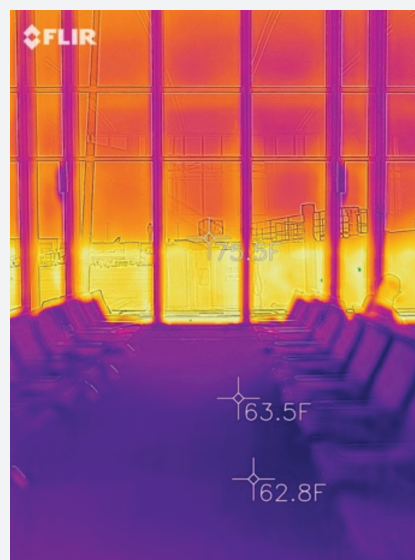
Comfort



- Daylight conditions
- Using laptop, tablet, phone
- Reading a book or magazine
- Eating



Concourse E
Low-E Glass



Concourse A Expansion
View Smart Glass

Cooler temperatures

In addition to reducing visual discomfort by minimizing harsh sun penetration, electrochromic glass technology also reduces solar heat gain. The study found that surface temperatures in the gates with View Smart Windows were approximately 15°F (9° C) cooler, a factor that improves passenger thermal comfort given previous research indicating passengers' dominant preference for cooler temperature conditions².

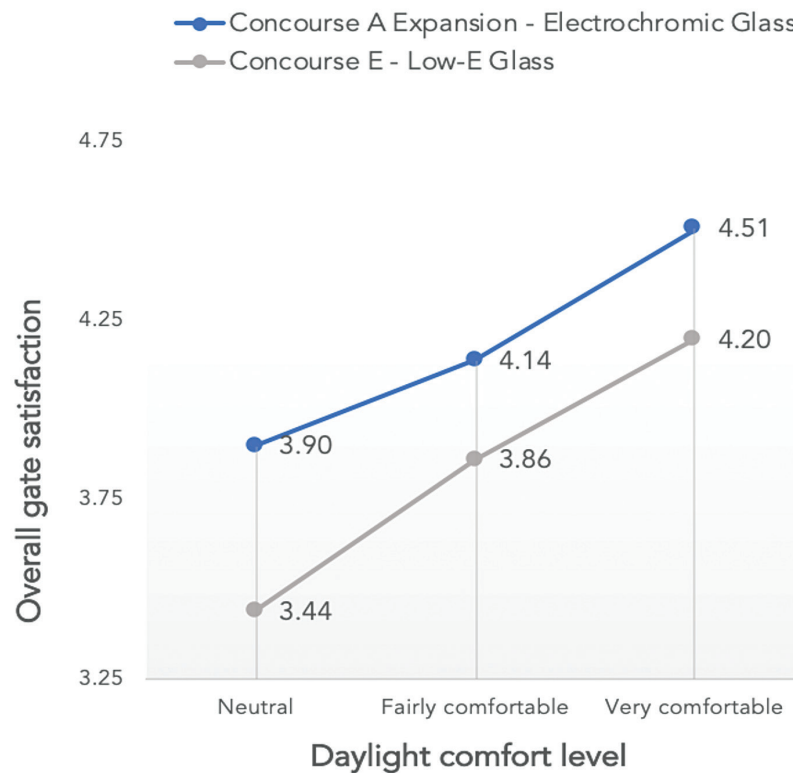
1 Hedge A, Nou D, and Horton R. Electrochromic Glass Enhances the Passenger Experience in Airports. Ergonomics International Journal. 2018, 2(6):000162.
2 Kotopoulos A and Nikolopoulou M. Evaluation of comfort conditions in airport terminal buildings. Building and Environment. 2018. 130: 162-178.

Passenger Satisfaction

The difference in passenger comfort across the two concourses was also reflected in differences in overall experience ratings. Passengers in the concourse with View Smart Windows were found to be 68% more likely to be very satisfied with their overall gate experience. When translated to a satisfaction score on a 1 to 5 scale (from very unsatisfied to very satisfied), the average score among responses collected in the concourse with low-E glass was 4.05, whereas the score among responses collected in the concourse with View Smart Windows was 4.41.

Furthermore, passengers in the concourse with View Smart Windows had higher positive impressions of the space, reporting 33% higher ratings for modernity, 23% higher ratings for efficiency, 10% higher ratings for brightness and 20% higher ratings for comfort than passengers in the concourse with traditional windows.

An analysis of all passengers revealed that passengers reported higher gate satisfaction when they were more comfortable with the daylight conditions, regardless of what gate they were in. Passengers were 3.3 times more likely to report being 'very satisfied' with the gate experience if they found the daylight conditions to be 'very comfortable'. These results demonstrate that daylight comfort is a key driver of gate satisfaction and suggest that prioritizing design features that enhance visual comfort by optimizing for natural light can significantly improve the passenger experience.



Conclusions

Enhancing daylight, views and thermal conditions in an airport drives passenger satisfaction by providing a more comfortable environment. These findings unlock a significant potential for airports to improve upon their performance as they consider which design elements or amenities would benefit their customers the most. By investing in features that optimize for the physical airport environment, airports have the opportunity to improve the travel experience for the millions of passengers they greet every year.