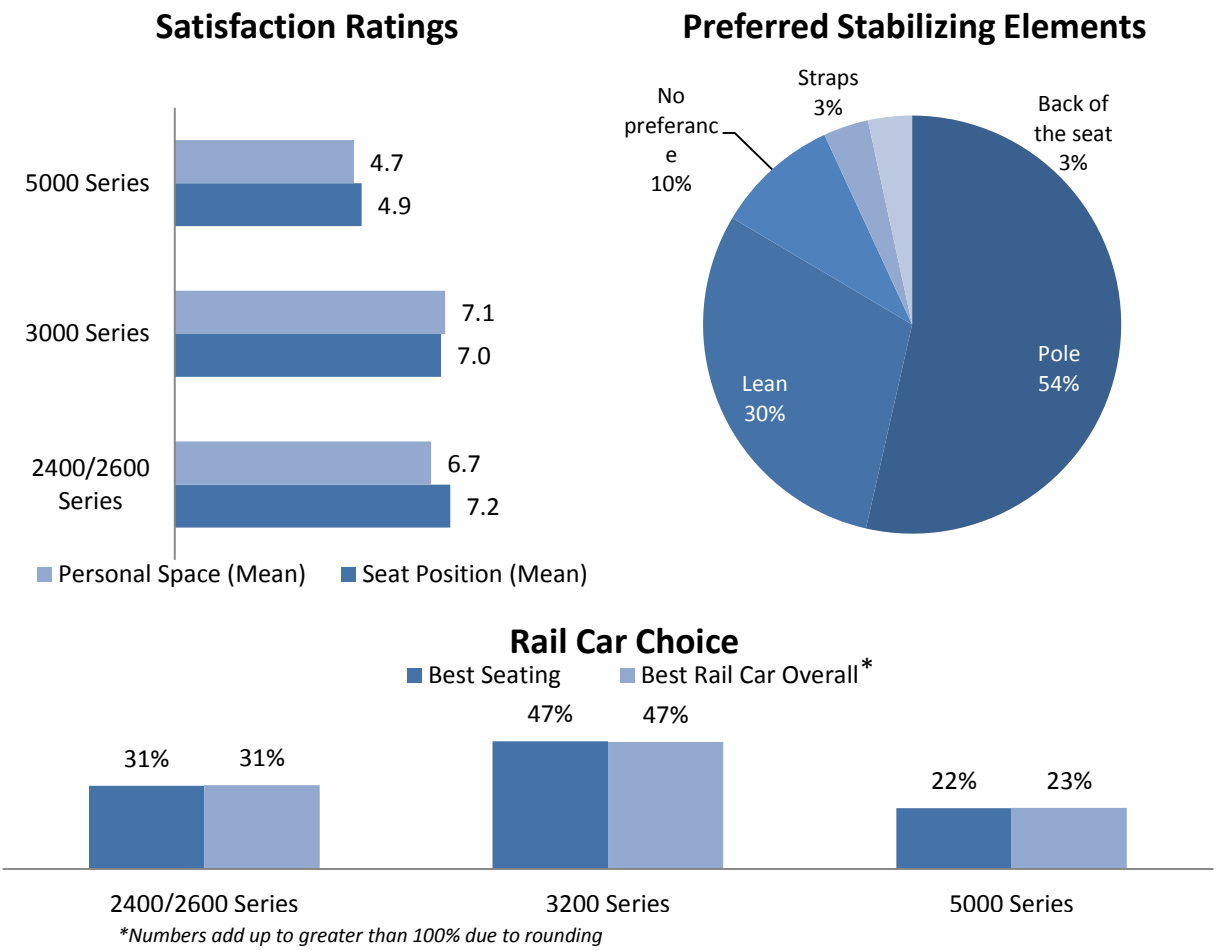
Figure 3: CTA Railcar Customer Survey Findings



Numbers add up to greater than 100% due to rounding

Each of the rail cars has different features that appeal to different customers. The customers were then shown the same three photographs side by side, and were asked to choose which of the rail cars they would most prefer to ride in, and which seating layout they liked best. The scores for seating layout and rail car preference were near identical, which is displayed in Figure 3.

Customers were asked to choose which seating design they liked best. They were also asked to state which rail car they preferred overall. Forty-seven percent of the customers said they liked the 3200 seating layout the best. This railcar type was also liked by 47 percent of respondents. They state that they like the chances of sitting by themselves in the single seats. Customers also mention the general spaciousness, standing space, and walking room of this car. Finally, customers say they appreciate the availability of a lot of poles as a reason for their choice. Just under one-third (31%) of customers chose the 2400/2600 series seat layout. When asked about which rail car the customers liked overall, 31% chose this car. These customers say they like the number of seats available in the car. These customers also state that these cars provide a chance for more privacy if they're able to find a seat. This was observed especially with customers who sit next to the window, where they are out of the way of others. Finally, 22% of the customers liked the 5000 series seat layout. Nearly one-quarter (23%) of the customers liked this car

overall. Customers state that these cars provide a feeling of safety from others. The fact that their backs were against the wall allows customers to watch others within the car, and can ride without the fear of burglary. Customers who prefer the 5000 series also state that it's easier to get on and off the train, and provides the greatest number of options for stabilization when standing.

Customer survey results indicate that narrow railcars like the CTA fleet benefit from a 2 x 1 transverse seating style, especially in the middle of the car. People taking shorter trips are more likely to move into the car if they have steady support infrastructure and if they are able to quickly make their way toward the doors in crowded conditions. Overall, transverse seating is strongly preferred over longitudinal seats, more so in the center of the car where an individual may have to sit between two people, creating discomfort.

MAJOR TAKEAWAYS AND LESSONS

Each component of this study assisted CTA planners to understand the most important features of different railcar types. Most customers prefer to sit in transverse seats and dislike taking a spot between two seats in the longitudinal seating arrangement. Standees prefer sturdy support structures such as vertical and horizontal poles to stabilize themselves. They are more willing to move into the center of the car if these stabilizing elements exist and they are able to move relatively easily in crowded conditions.

Passenger observations and capacity analysis helped connect the customer feedback with onboard activity during peak period.

- The 2400/2600 series cars provided few stabilizing options in the center aisle and fewer people were inclined to move inward if no seats were available. Crowded areas around the doors increased dwell times at stations. Even though the maximum capacity of the railcar was high, the car felt more crowded with fewer people onboard.
- In comparison, 3200 series cars provide more comfort and alternatives to standees at the cost of four seats. 2 x 1 staggered seating in the center aisle facilitates easier passenger flow and less crowded conditions near the doors. 3200 series cars also had the shortest dwell time at stations and reached maximum capacity loads similar to 2400/2600 series cars without feeling as crowded.
- 5000 series have two ADA spots at one end of the car with horizontal and vertical support structure not seen in the old trains. This area is able to hold a lot of standees more comfortably than other railcars. However, the center aisle's increased width is not utilized as anticipated and the long longitudinal seating is fully occupied on longer journeys. People taking short trips choose not to seat even if they would prefer a seat over standing. Overall, this railcar type had lower observed capacity when compared to the other types.

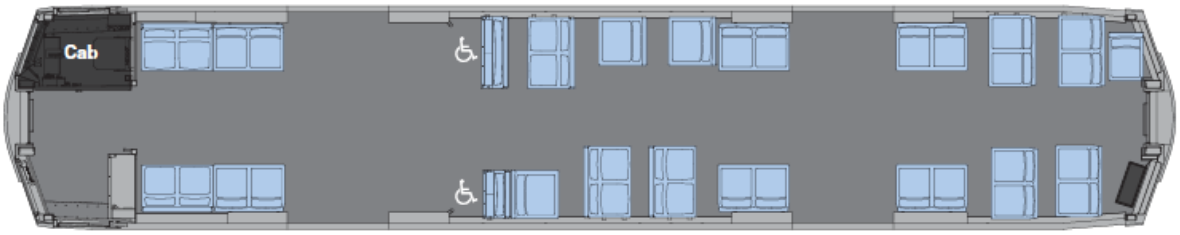
Railcar seating is dependent upon many design, safety, and mechanical factors. For example, some seats have to be longitudinal to accommodate equipment under them. It may not be possible to implement every suggestion or finding of this study, but the results help piece together a more efficient and comfortable railcar. The following suggestions were made to rail engineering for consideration:

- The 3200-series car should be the starting point for the center of the car. Seating should be asymmetrical with a mix of single seats and seat pairs. Pole locations should be offset

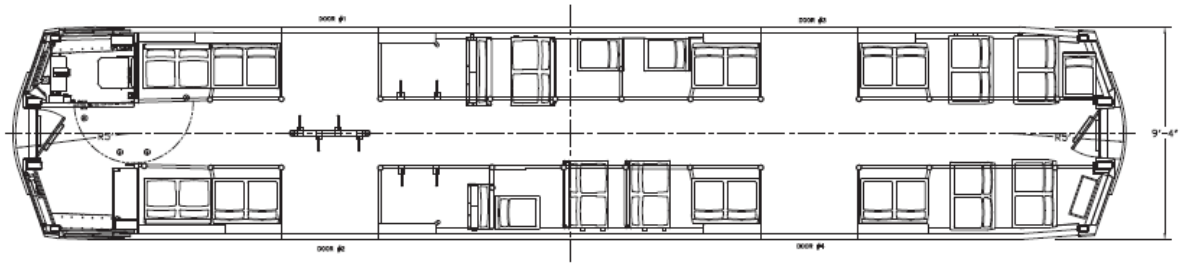
as well. The transverse seats are preferred by CTA customers while the asymmetrical seats and poles maximize capacity and enable effective passenger flow.

- The new 5000 series offer good support elements in open spots, such as the pole and strap setup found in the ADA area. This area showed better capacity and customer comfort in the 5000-series than the 3200-series which lacked stabilization mechanisms. Some ceiling mounted stabilization in the center of the ADA area should be added as well. This small area is currently lacking even in the 5000-series.
- More transverse seats in the non-cab side of the car are recommended with a 2 x 2 layout, as seen in the 2400/2600 series cars. This arrangement provides the maximum number of forward-facing seats in an area that will not impede passenger flow.
- The front end of the car near the cab is recommended with 4 x 4 longitudinal seats in the small section of the car. These seats will satisfy the customers that prefer them and the location will not impede passenger flow.

Figure 4: Proposed 7000 Series Railcar Configurations



"A" Car (odd-numbered car)
37 seats



Source: CTA IFB to Purchase Rapid Transit Cars Specification CTA 7000-12 Addendum 13 – Attachment G

CONCLUSION

Chicago Transit Authority studied customer behavior, analyzed dwell times, and sought customer feedback on seating arrangement to inform railcar design for the future 7000 series cars. A unique comparison between transverse and longitudinal seating was possible on the rail system as the new 5000 series rail cars feature longitudinal seats; a departure from the current transverse seating on 2400/2600 and 3200 railcars. The study aimed to compare the rail car interior on the basis of peak hour capacity, passenger flow, station dwell times, and customer feedback. Each rail car contains elements that prove beneficial to the customer experience and operational performance of the car.

The study suggests that the 7000 series railcars feature mainly transverse seats based on the 3200-series layout in the center of the car, which is currently most liked by the customers. Each

end of the car is recommended a layout similar to 5000-series in the front end and 2400/2600 series on the back end. A small number of longitudinal seats provide luggage space under the railcars, and gives an opportunity for customers who value these seats for safety reasons a comfortable place to sit. A 2x1 transverse layout in the center of the car facilitates movement and allows more people to stand away from the doors, reducing dwell times. The back end of the car with 2 x 2 seats maximizes seating, which customers like.

Since railcar design is garnering more attention as transit agencies seek to overhaul their aging equipment, this study has implications beyond Chicago. In context of previous work, it provides customer feedback and analysis that question whether longitudinal seating is able to achieve capacity gains promised by theoretical calculations. Each component of this study suggests there is no evidence that more standing room can necessarily increase railcar capacity. To the contrary, railcars with transverse seating achieved almost 8 percent more capacity during peak period. However, CTA rolling stock is constrained in its width and other agencies with different railcar dimensions are encouraged to conduct similar observed railcar capacity studies between different rail type configuration to further understand the effectiveness of seating layout on capacity, comfort and train operations.

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