

Bus Operator Workstation Design

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1

Summarizes work from the TCRP Project G-17

**Assessing Lifecycle and Human Costs of Bus
Operator Workstation Design and Components**

<https://rip.trb.org/View/1442152>

2



Primary Research Area:
Design for Human Variability

3

We conduct research in the design of artifacts, tasks, and environments that are robust to the variability in users.

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cars
trucks
airplanes
medical devices
implants
prosthetics
manufacturing
office furniture

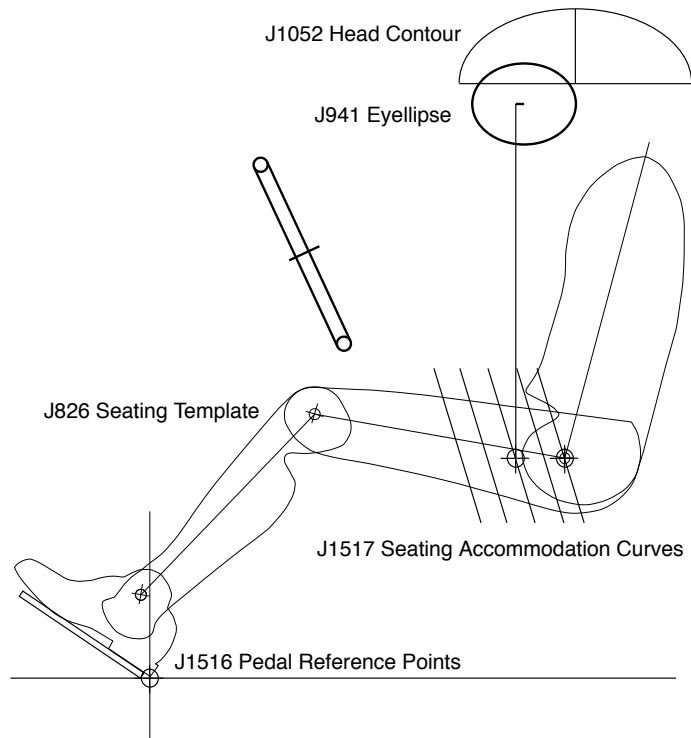
design practice and tools
global anthropometry
data synthesis

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**Objective: Improve bus packaging to
make them safer and more comfortable.**

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Vehicle packaging usually considers a single measure at a time (e.g., SAE J-tools).



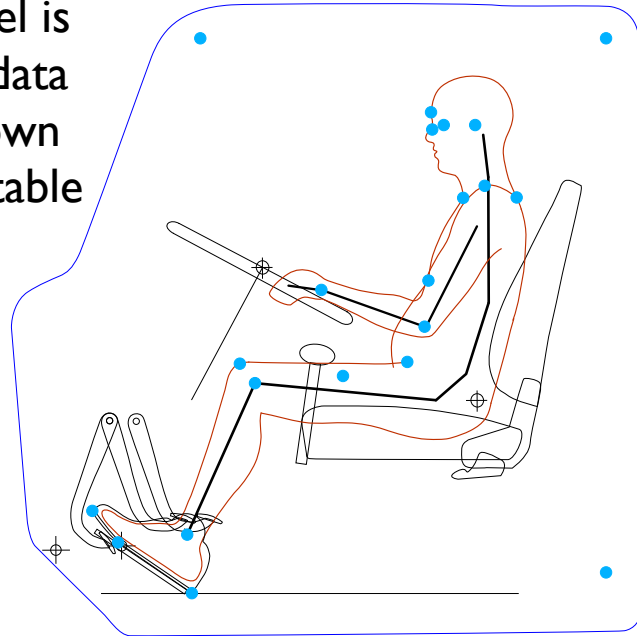
7

We need to simultaneously consider all aspects of design (body dimensions and preference).

Anthropometry in the Design of the Driver's Workspace
McFarland, R.A., Damon, A., and Stoudts, H.W. Jr. (1958)

8

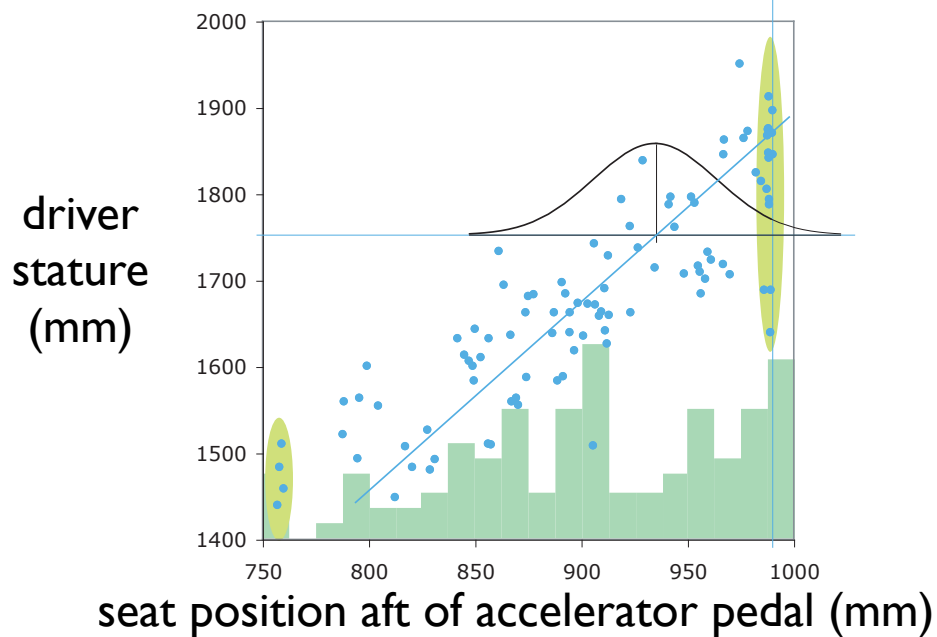
The UMTRI Cascading Posture Prediction Model is based on experimental data of participants in their own cabs and in a very adjustable buck.



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Resulting models predict the preferred location of components as a function of body size and shape.

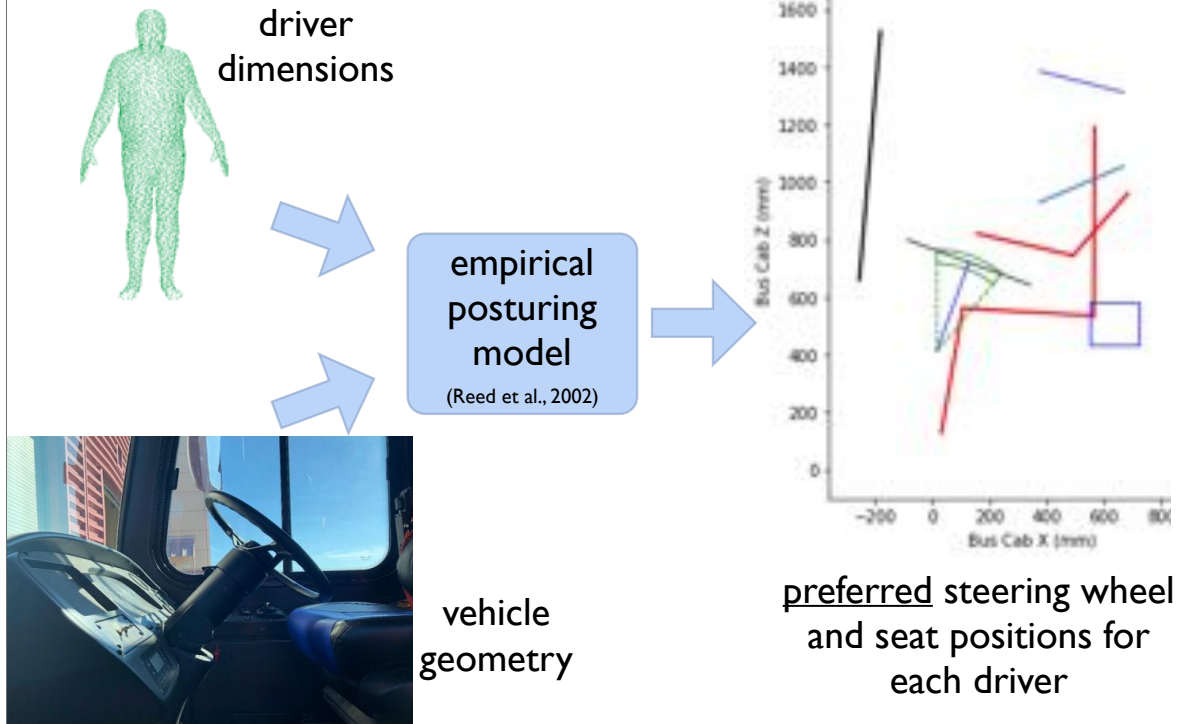
$$\text{Seat Position } X = a + b \text{ Stature} + c \text{ BMI} + d \text{ SWX}$$



(Manary et al., 1998)

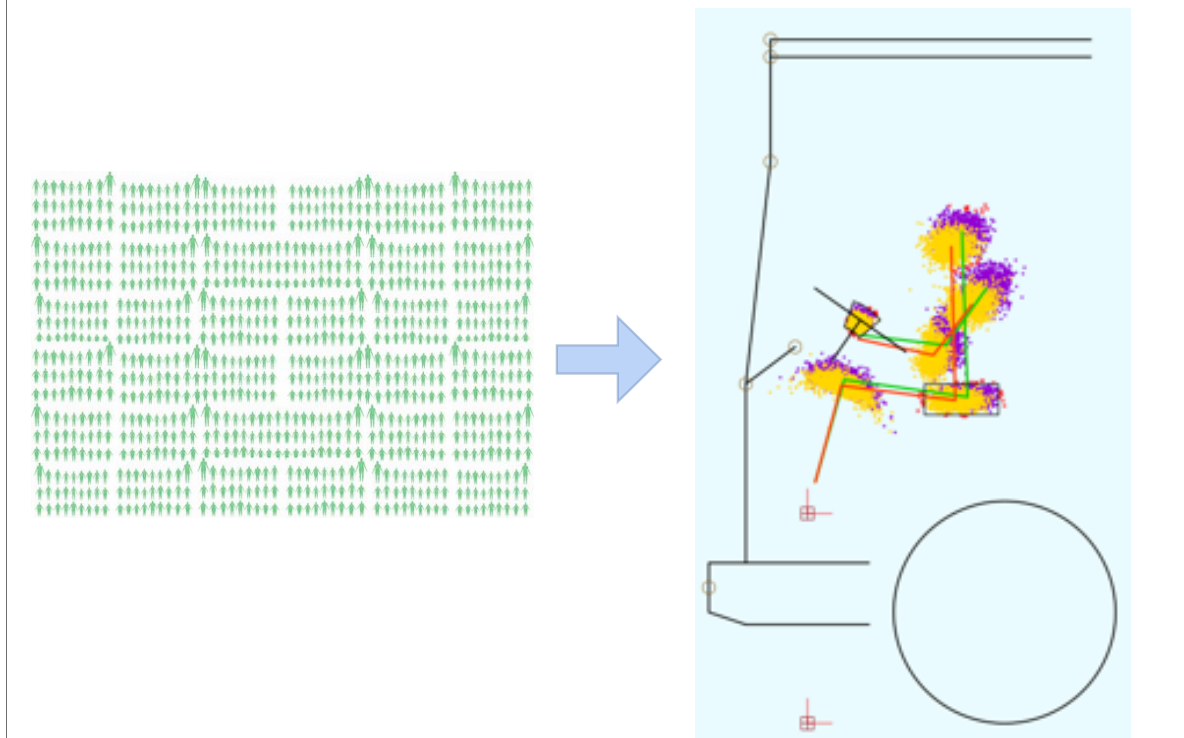
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Our packaging assessment tool combines these models with driver population data and vehicle geometry.



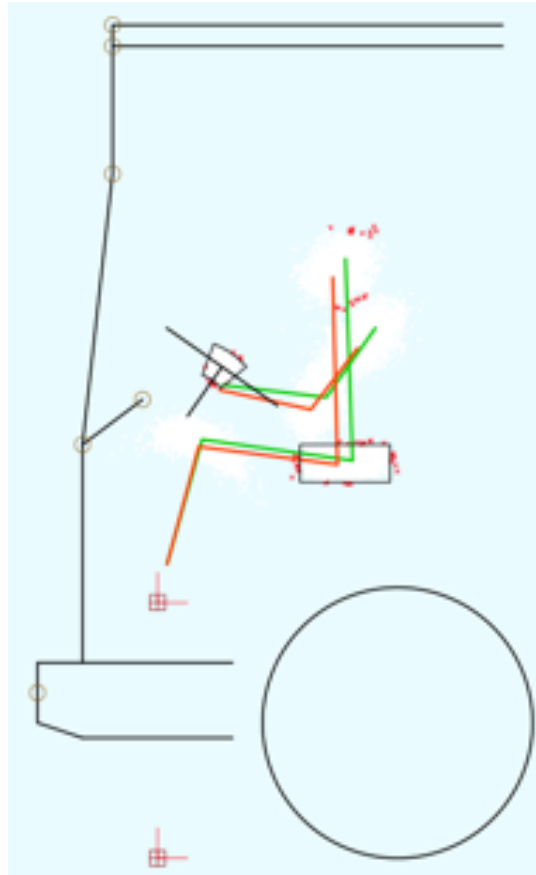
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We do this simulation for thousands of drivers representing the variability in the population.



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Users that are unable to achieve their preferred position/posture for a given vehicle configuration are considered disaccommodated.



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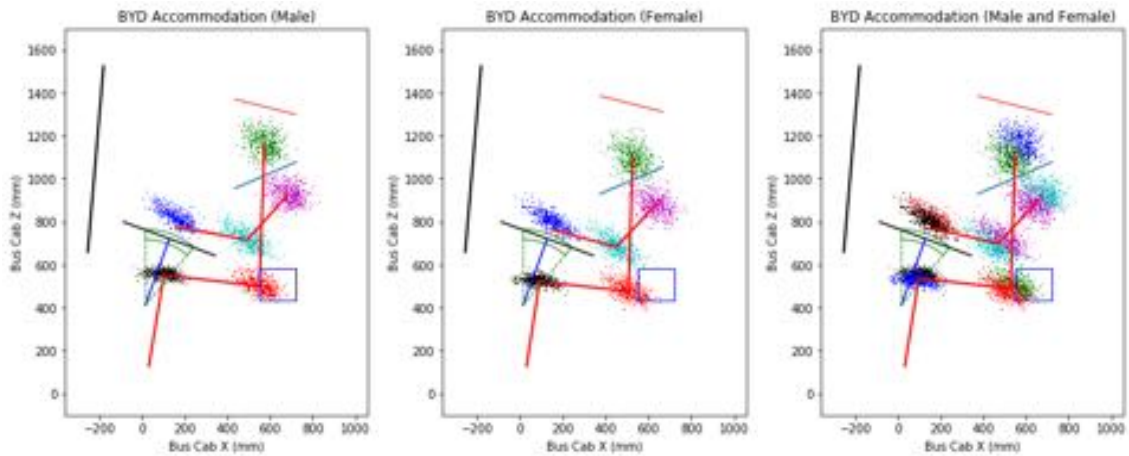
Designers and contracting agencies can use the tool to assess candidate designs.

14

VehicleClass	1	SteeringWheelAngleMin	0
SeatTrackFDFFX	551	SteeringWheelAngleMax	40
SeatTrackFDFFZ	432	SeatBackAngleMin	10
SeatTrackFDFRX	721	SeatBackAngleMax	30
SeatTrackFDFRZ	432	SeatBackAngleDesign	18
SeatTrackFUFFX	551	SeatInterferencePointX	200
SeatTrackFUFFZ	582	SeatInterferencePointZ	500
SeatTrackFUFRX	721	SeatBackPivotX	100
SeatTrackFUFRZ	582	SeatBackPivotZ	-100
SteeringWheelPivotX	15	AHPX	0
SteeringWheelPivotZ	410	AHPZ	838
SteeringWheelDiameter	457	CowlPointX	-254
TelescopeMin	307	CowlPointZ	1498
TelescopeMax	355	HoodPointX	-650
		HoodPointZ	650
		UpperDLOX	-280
		UpperDLOZ	2362
		RoofHeight	2819
		RoofThickness	0
		BackOfCabX	0



Many drivers are unable to achieve their desired locations—especially for the steering wheel.



The analysis results help us to understand where we need to modify our design.

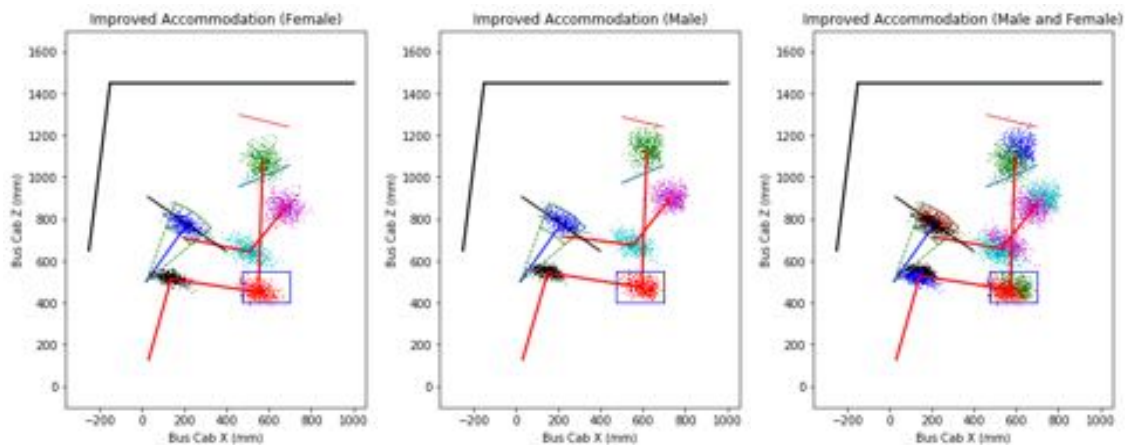
Accommodation Summary - Male					
Head Under Roof	Seat Track Range	Steering Wheel	Up Vision	Down Vision	Total
1.0	0.764	0.0	1.0	1.0	0.0

Accommodation Summary - Female					
Head Under Roof	Seat Track Range	Steering Wheel	Up Vision	Down Vision	Total
1.0	0.386	0.01	1.0	0.952	0.002

Accommodation Summary - Combined					
Head Under Roof	Seat Track Range	Steering Wheel	Up Vision	Down Vision	Total
1.0	0.575	0.005	1.0	0.976	0.001

17

The improved design repositions the steering wheel and seat track and adds some adjustability.



18

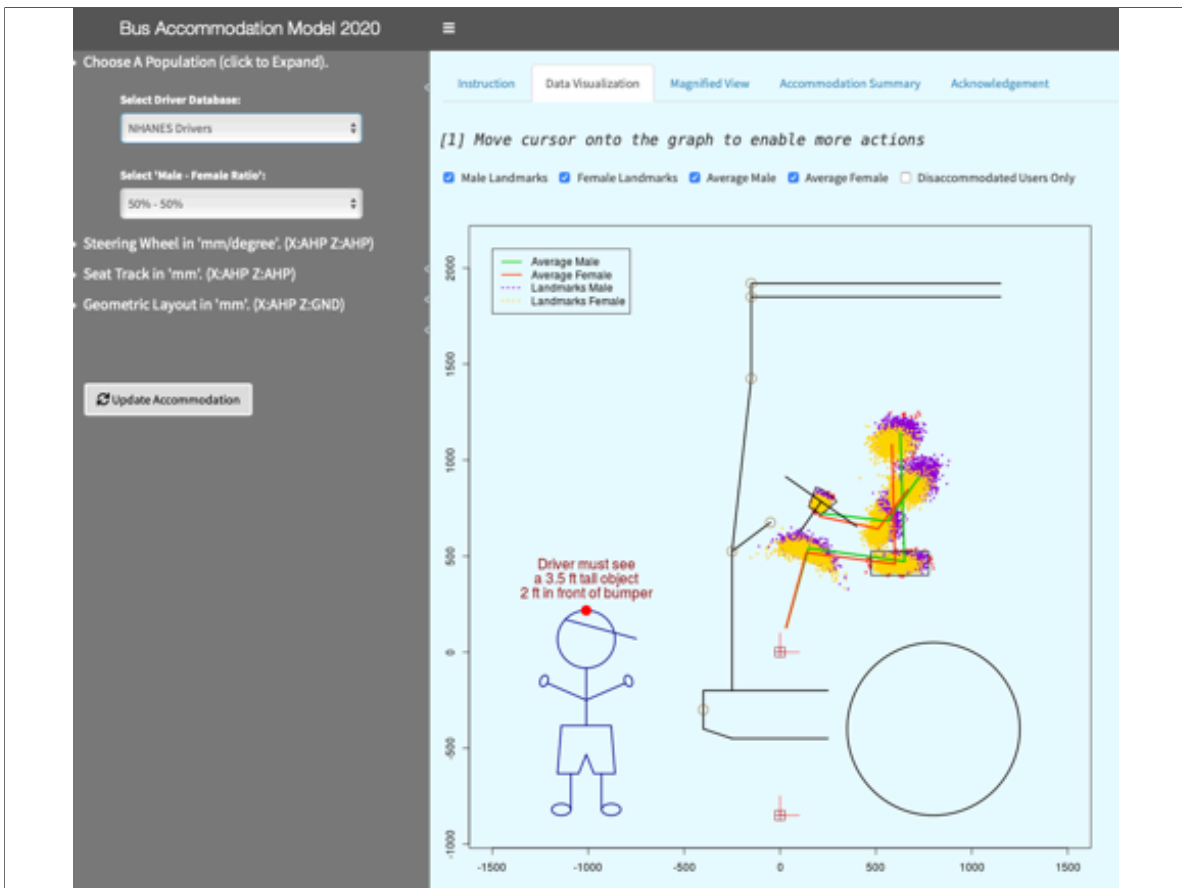
The improved design works better for both men and women.

Accommodation Summary - Male						
Head Under Roof	Seat Track Range	Steering Wheel	Up Vision	Down Vision	Total	
1.0	0.914	0.944	0.996	1.0	0.876	

Accommodation Summary - Female						
Head Under Roof	Seat Track Range	Steering Wheel	Up Vision	Down Vision	Total	
1.0	0.966	0.906	1.0	0.91	0.842	

Accommodation Summary - Combined						
Head Under Roof	Seat Track Range	Steering Wheel	Up Vision	Down Vision	Total	
1.0	0.94	0.925	0.998	0.955	0.859	

19



20



We conduct research in the application of rigorous design methods to the design of artifacts, tasks, and environments for people.

data
explore and download data for US civilians, global populations, NHANES, ANSUR, and ANSUR II

[download data](#)

design
make design decisions using our customizable design tools and data on body size and shape

[tools](#)

learn
learn from our how-to guides, research publications, primers, and other materials

[library](#)

Navigating the barriers to interdisciplinary design

Using Multivariate Analysis to Select Recommendations

search Search

openlab.psu.edu

thank you

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