Design experiments in metropolitan carriage interior configuration to improve boarding, alighting, passenger dispersal and dwell time stability



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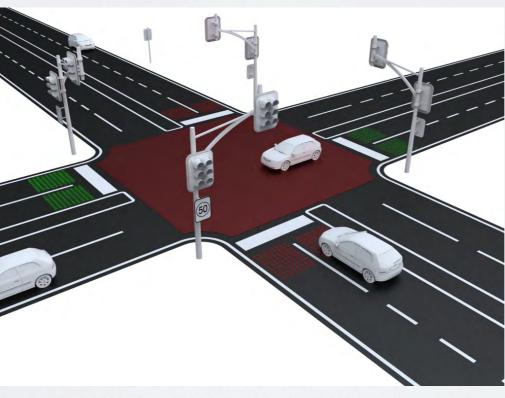














industrial design The research problem

Current state of the proposed solution

The research method

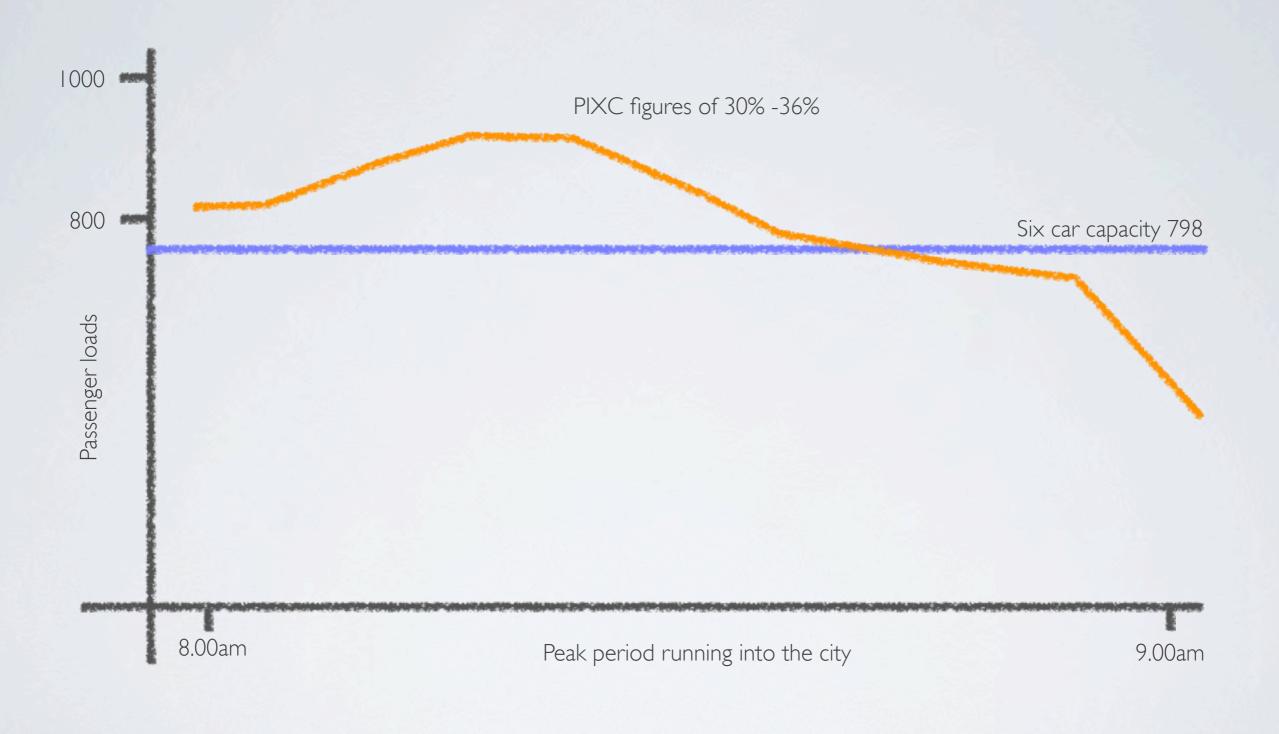
Conclusions

Rail Patronage

Punctuality - Network capacity



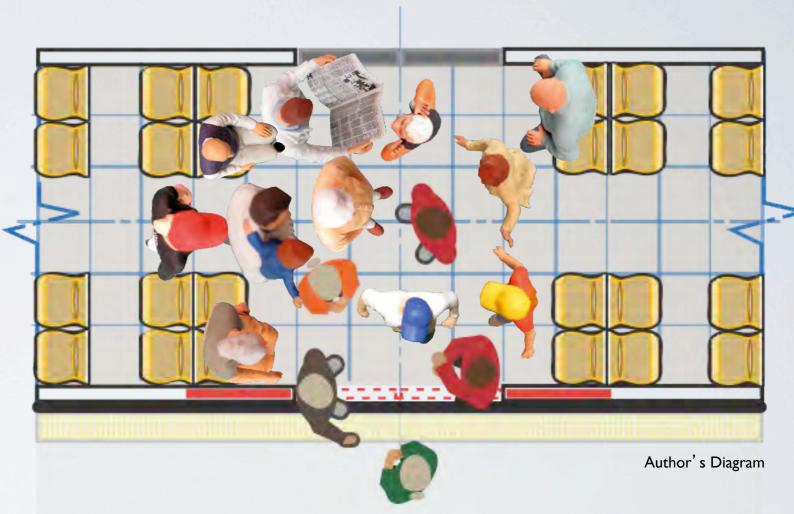




Doorway occlusion

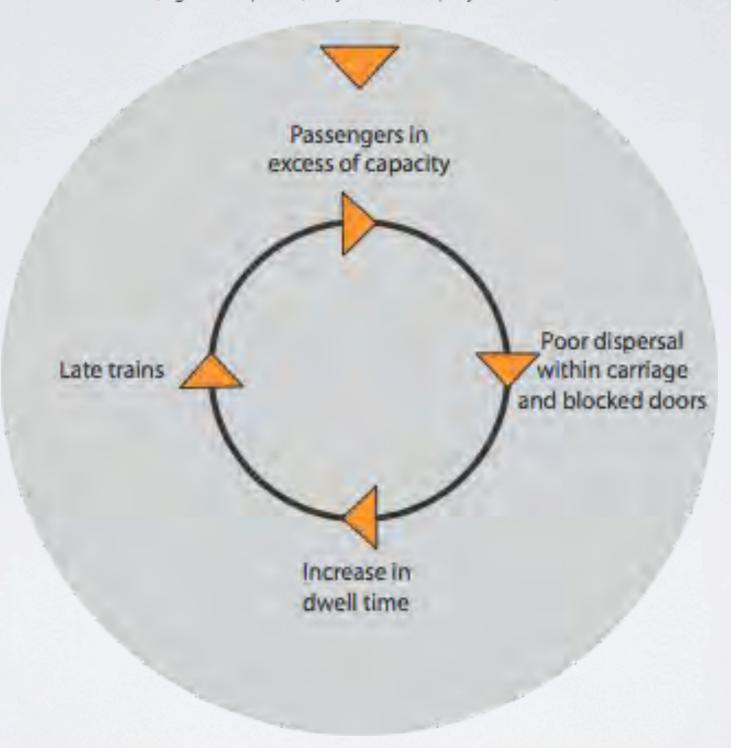


Image: Age Newspaper Online Archive



The Problem Space

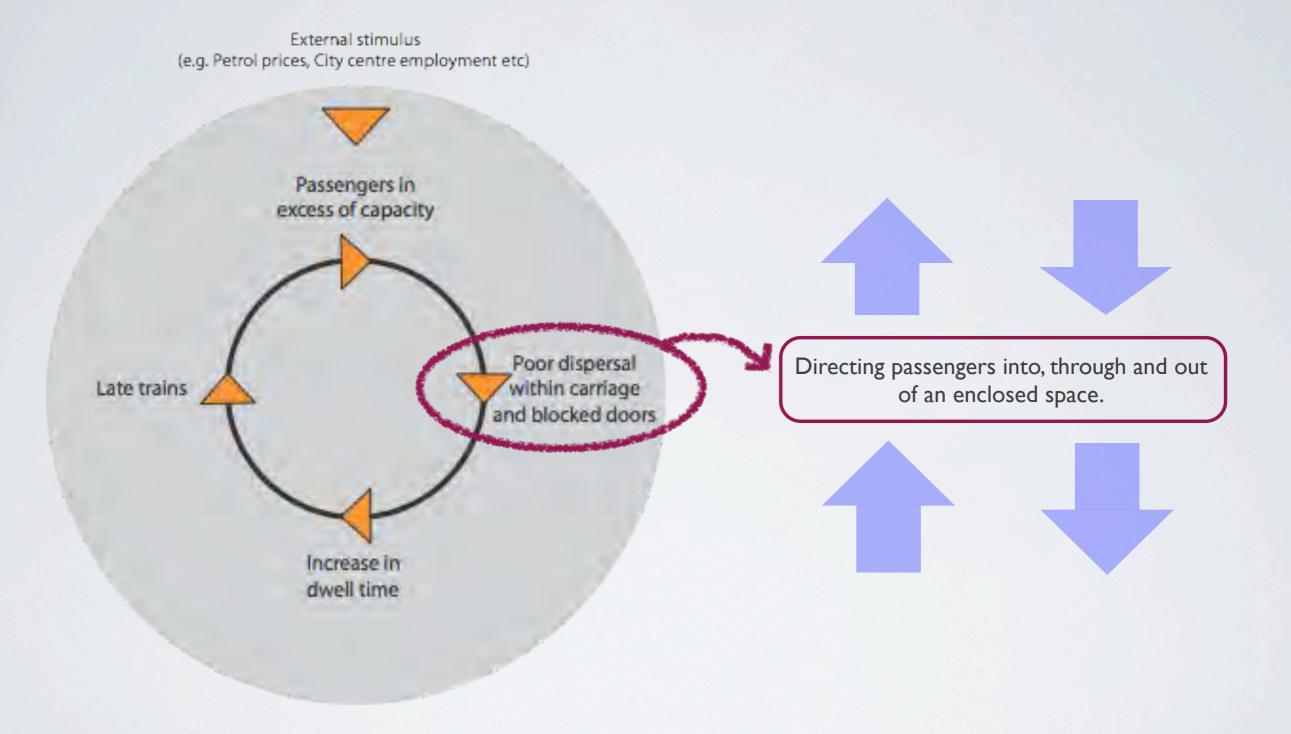
External stimulus (e.g. Petrol prices, City centre employment etc)



Current methods to ameliorate the problem

- Add more carriages
- Increase service frequency
- Fewer seats
- Wider doors / More doors
- Signpost desired behaviors
- Seat configuration
- Double deck carriages
- Track amplification

The Design Intervention



Alighting

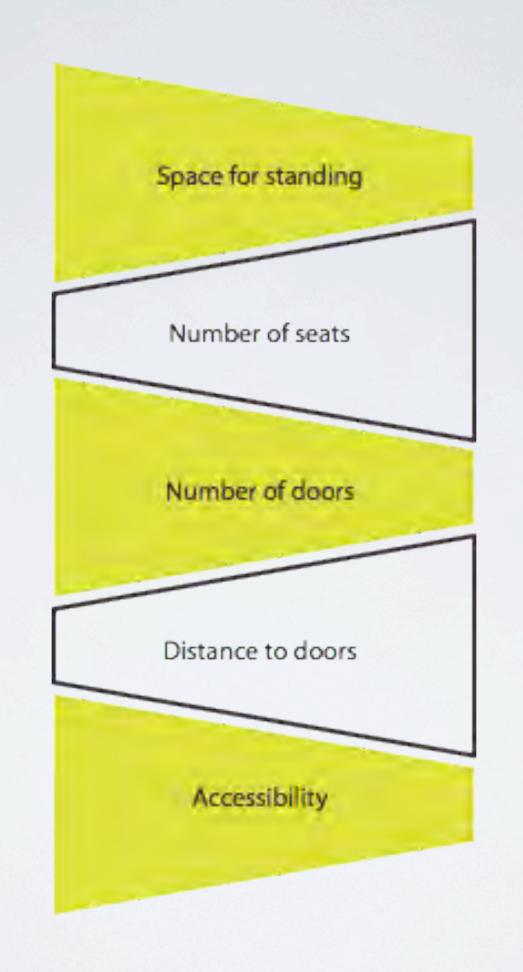
Boarding

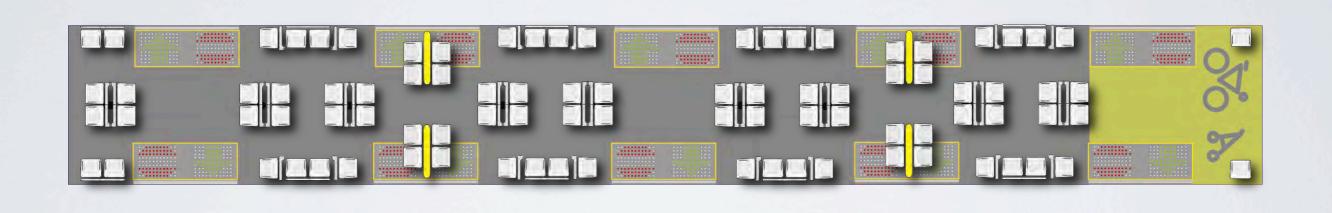
Emergence onto platform Preparation to alight Dispersal along Coverage from → Extent of patronage → weather elements platform Awareness of location Queueing behaviour Δ Time of day Δ Time pressure Access to exit Cultural behaviour

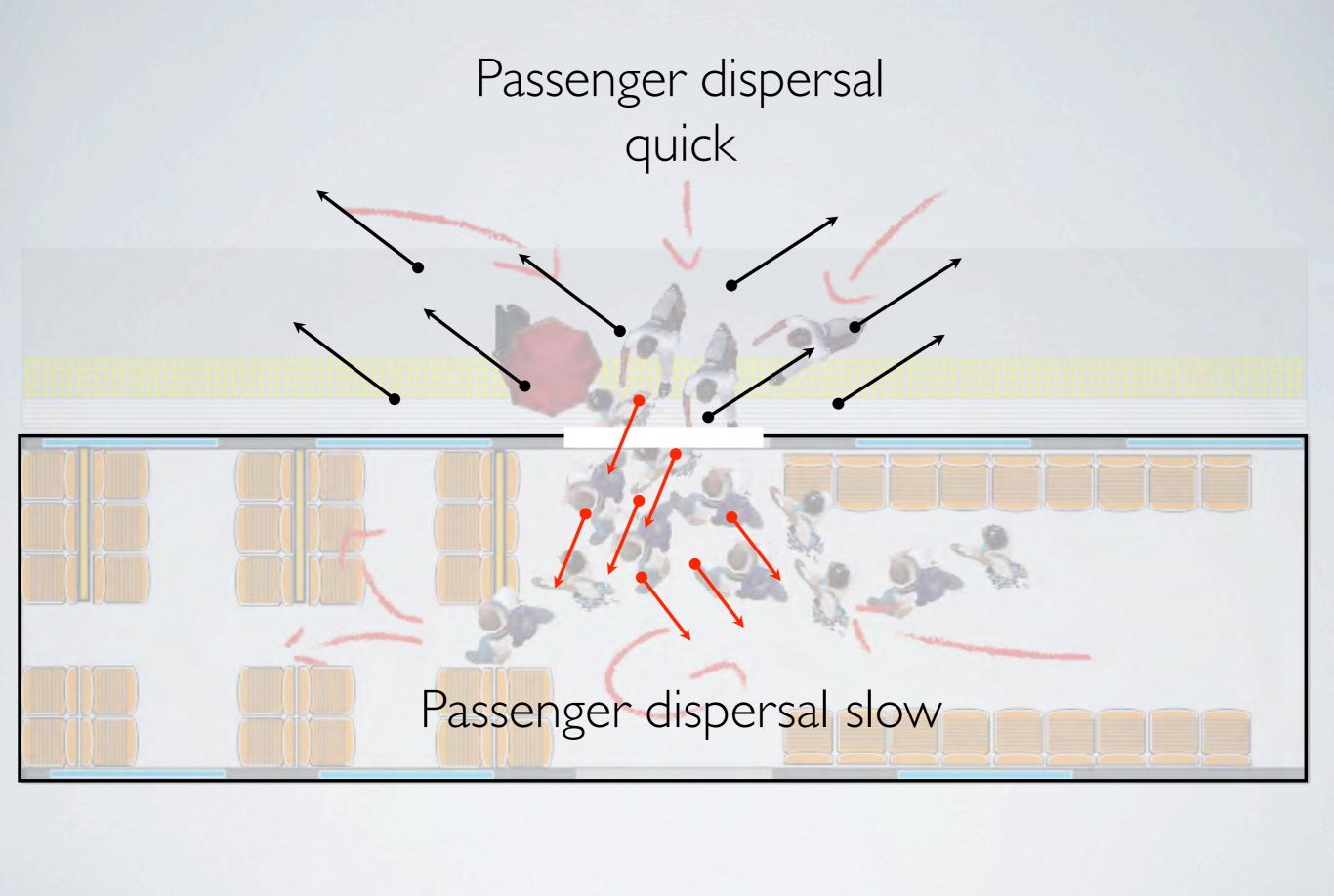
Negotiating passing other passengers Locating door to carriage Doorway configuration \(\rightarrow \text{Ingress / Egress} \) Physical ability \(\sum \) Disability \(\sum \) Age \(\sum \) Gender Doorway configuration Threshold Step(s) Gap between platform and train \(\triangle \) Holding of doors Negotiating passing other passengers \(\triangle \) Cultural behavior Personal belongings \(\sum \) Carried / Stowed Dispersal within carriage / out onto platform

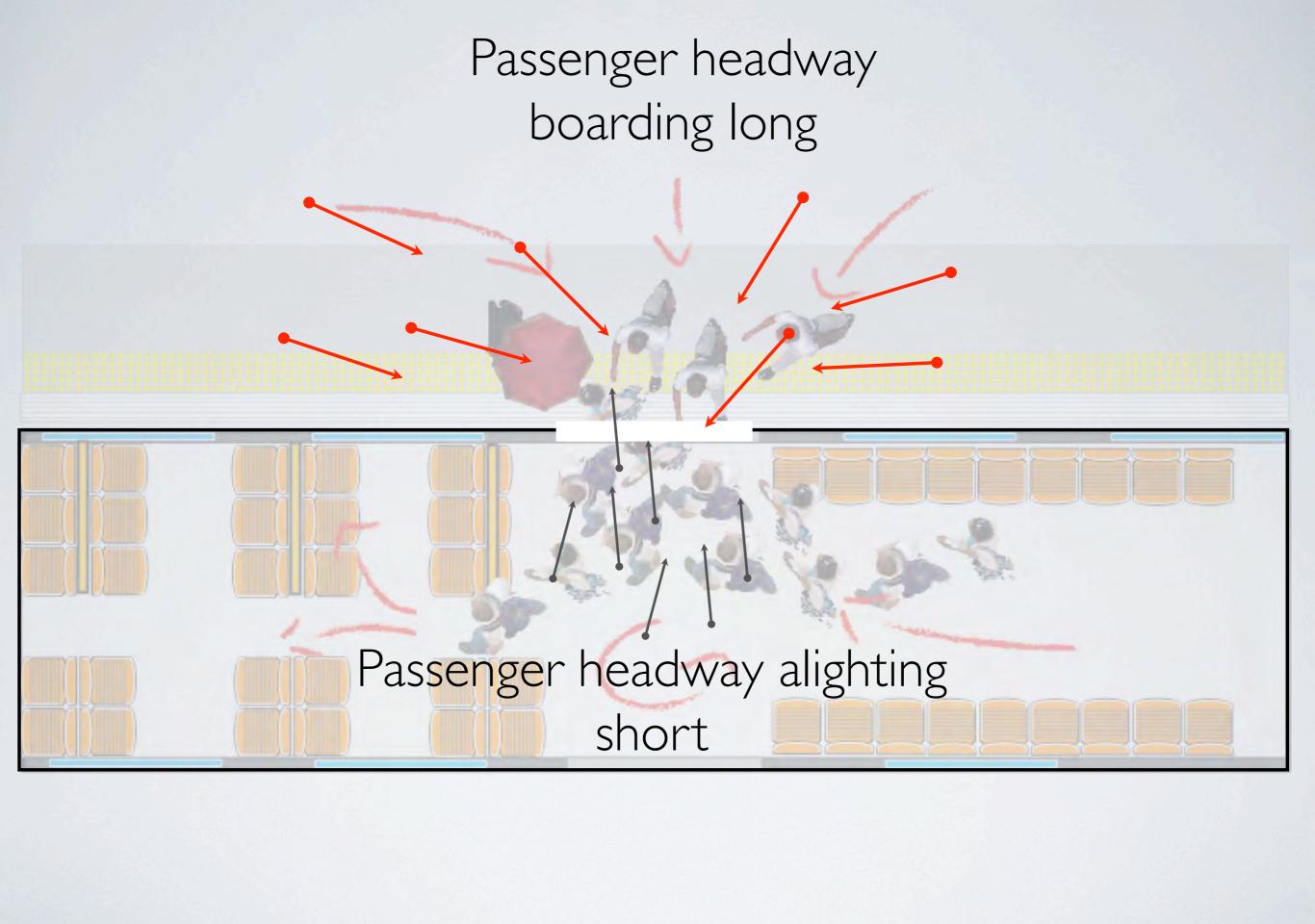


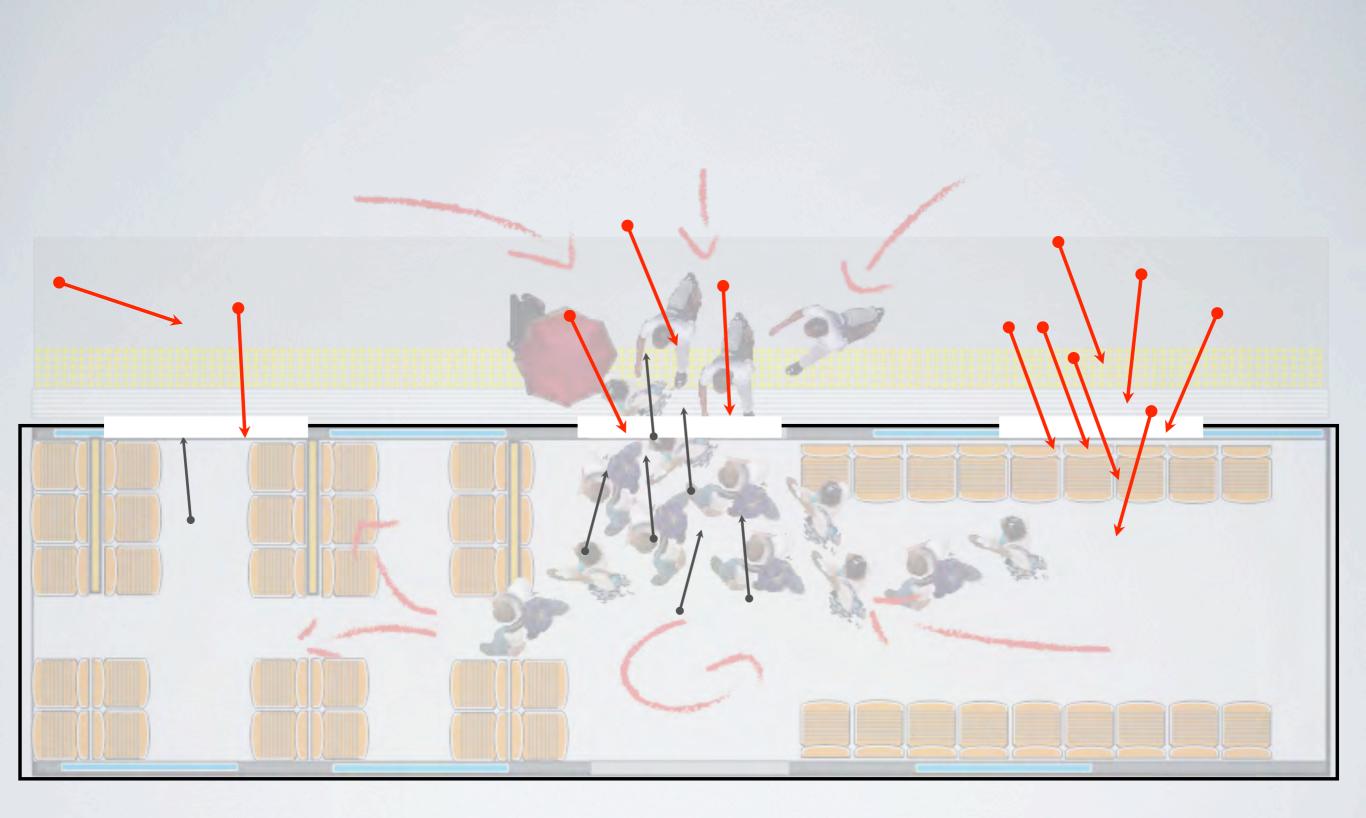








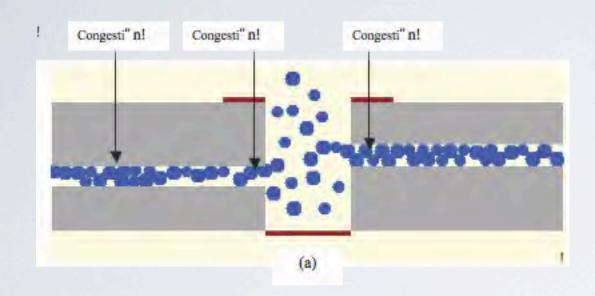


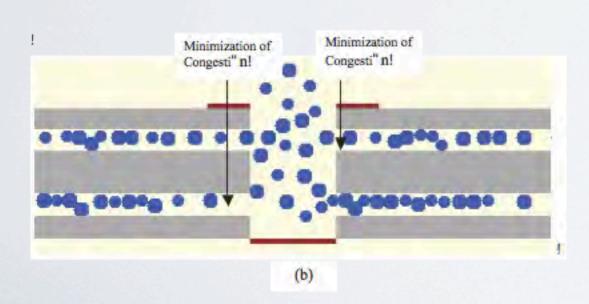


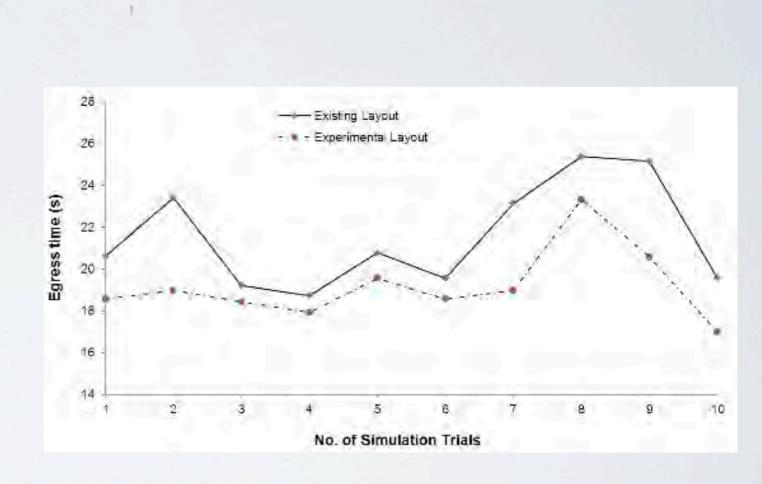
Variable loading on doors

Door with the highest load controls the dwell

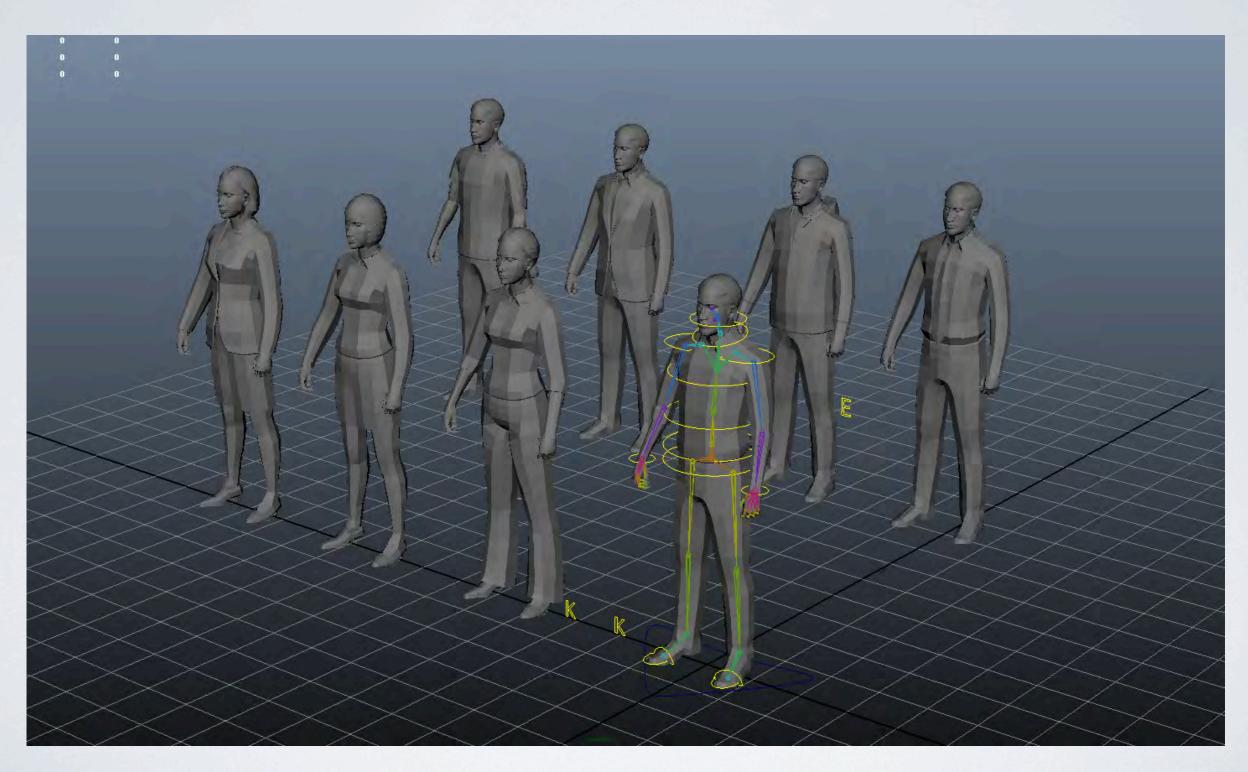
Evaluation through computer simulation

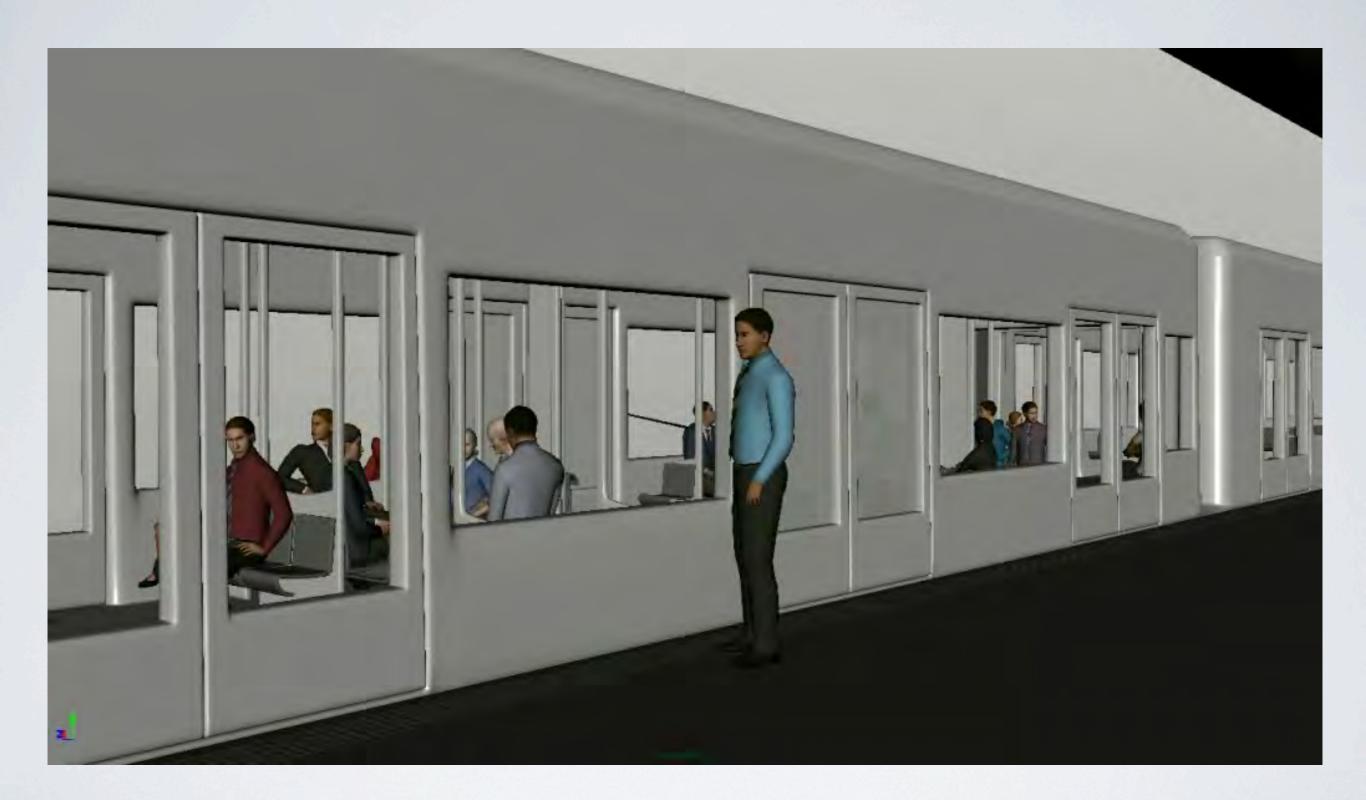




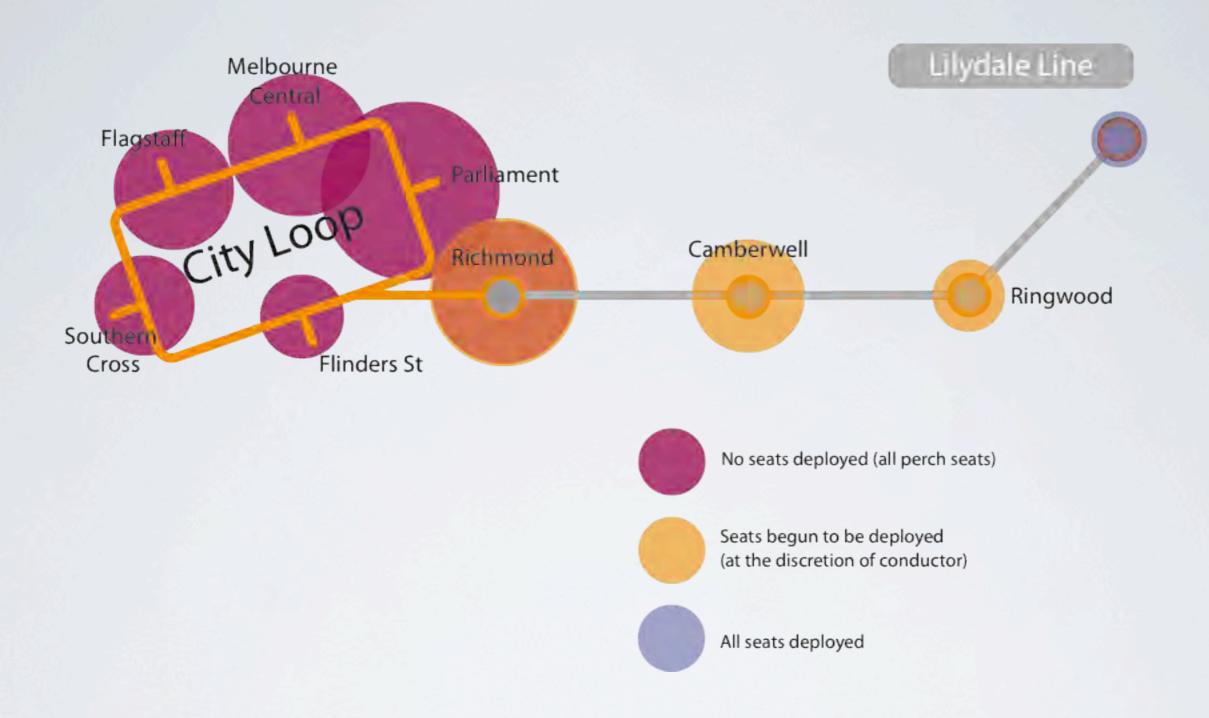


Creating passenger archetypes



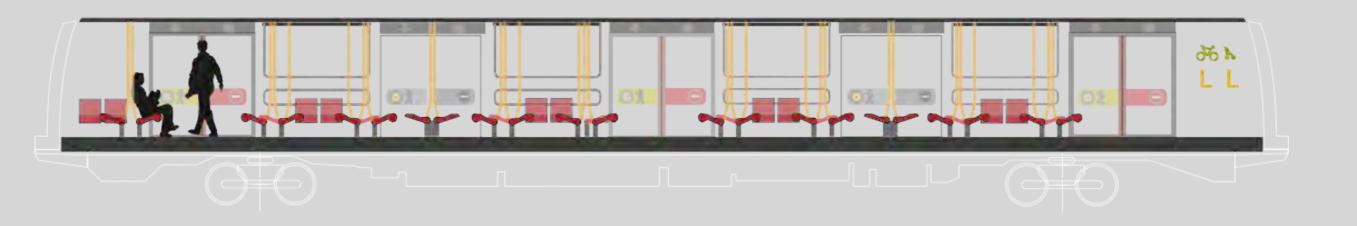


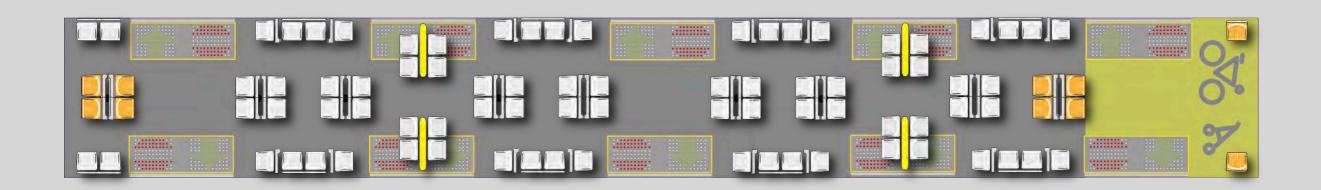




Seat deployment during afternoon peak

(defined as being at the point where patronage is within 5% of desired maximum load i.e 798 people per 6 car train at 4.30pm - 6.30pm.)

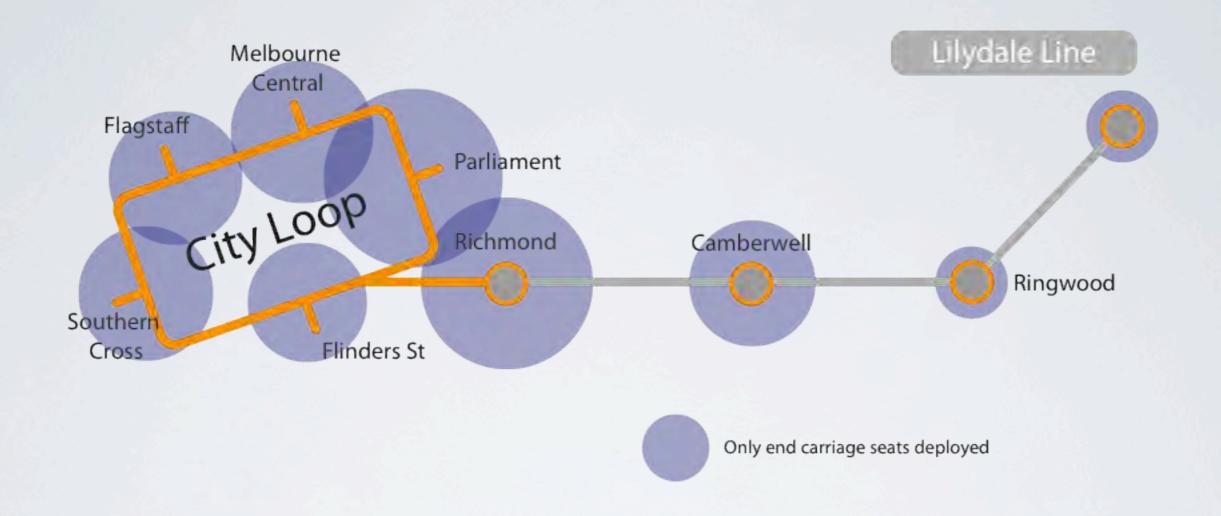




Perch seat to full seat deployment







Seat deployment during morning peak

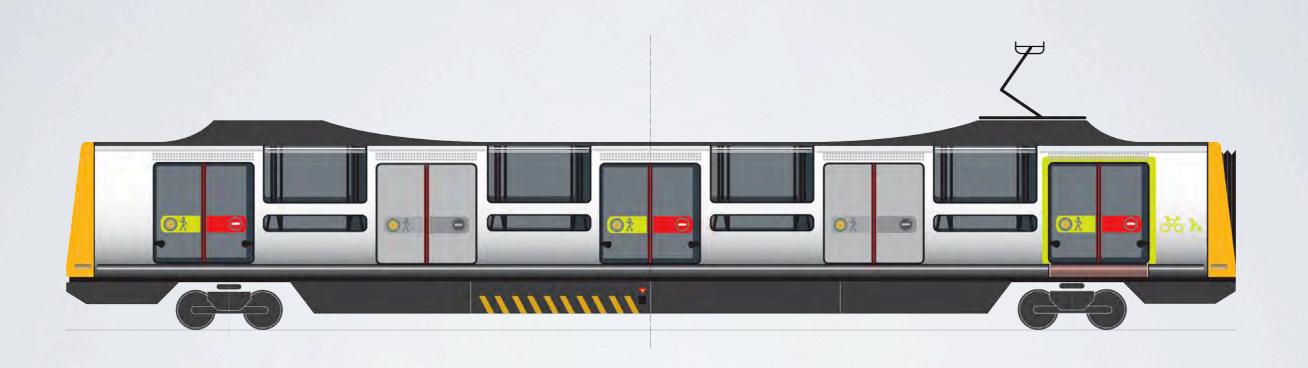
(defined as being at the point where patronage is within 5% of desired maximum load i.e 798 people per 6 car train at 7.30am - 9.30am.)

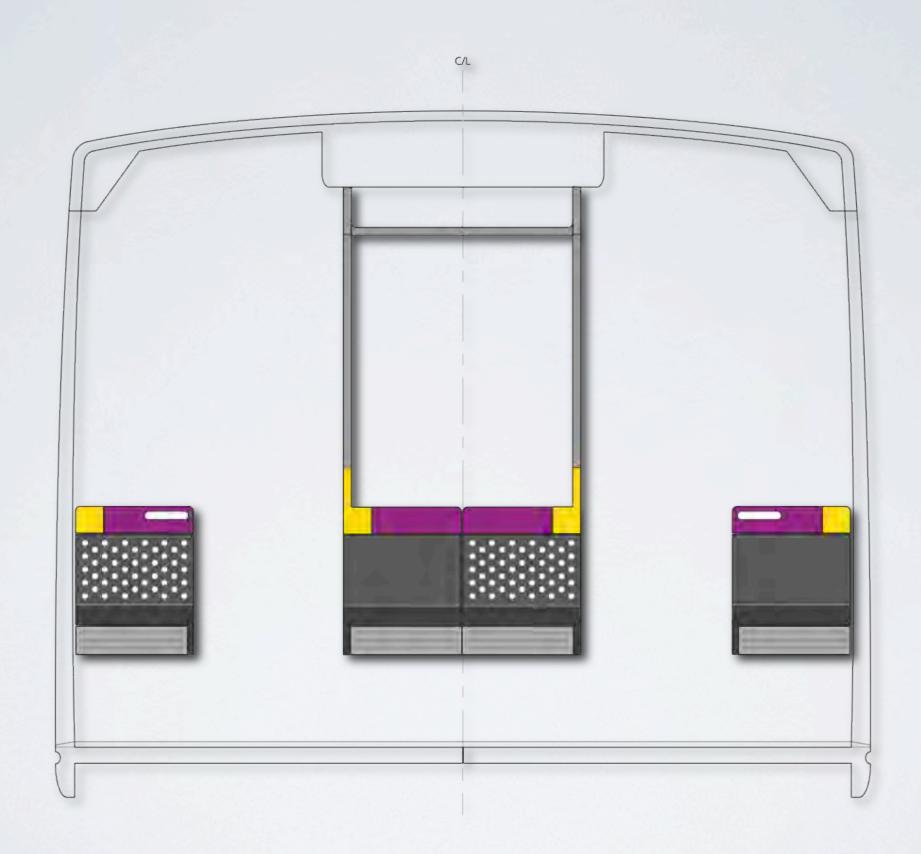
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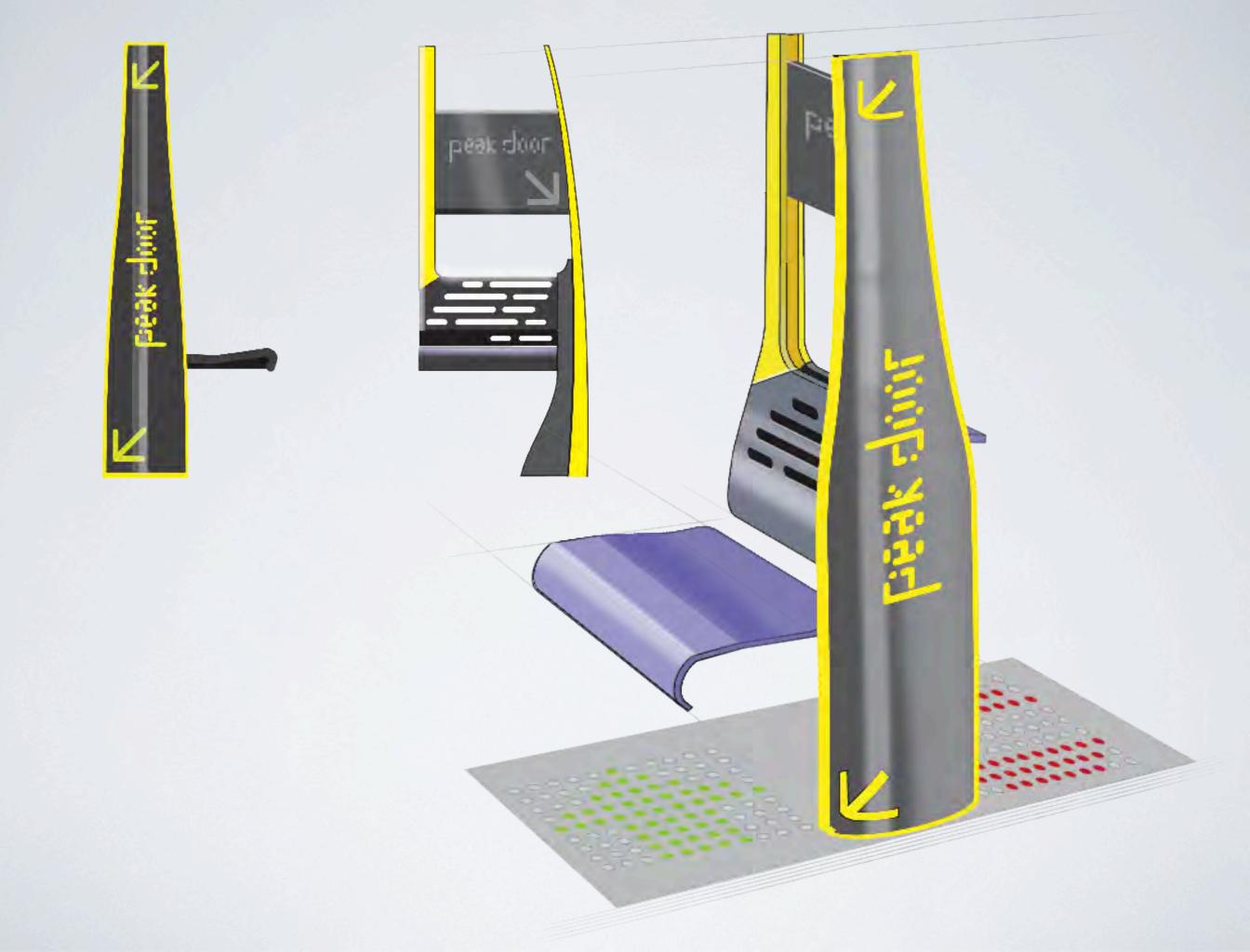
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Conclusions to the study

ABM modelling of the design concept suggests that for peak periods; multiple doors, dual corridor and a two way split boarding reduces dwell time.

But......this has come at the cost of fewer seats overall and considerable culture change amongst patrons and operators alike.

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