

27•04•2017

INVESTIGATION INTO RELIABILITY: LONDON UNDERGROUND JUBILEE LINE

BY: JACK AGOLLI,
MARIANNA BAILEY,
BERWIN JAYAPURNA,
YIANNIS KAPAROS



WPI

cpc

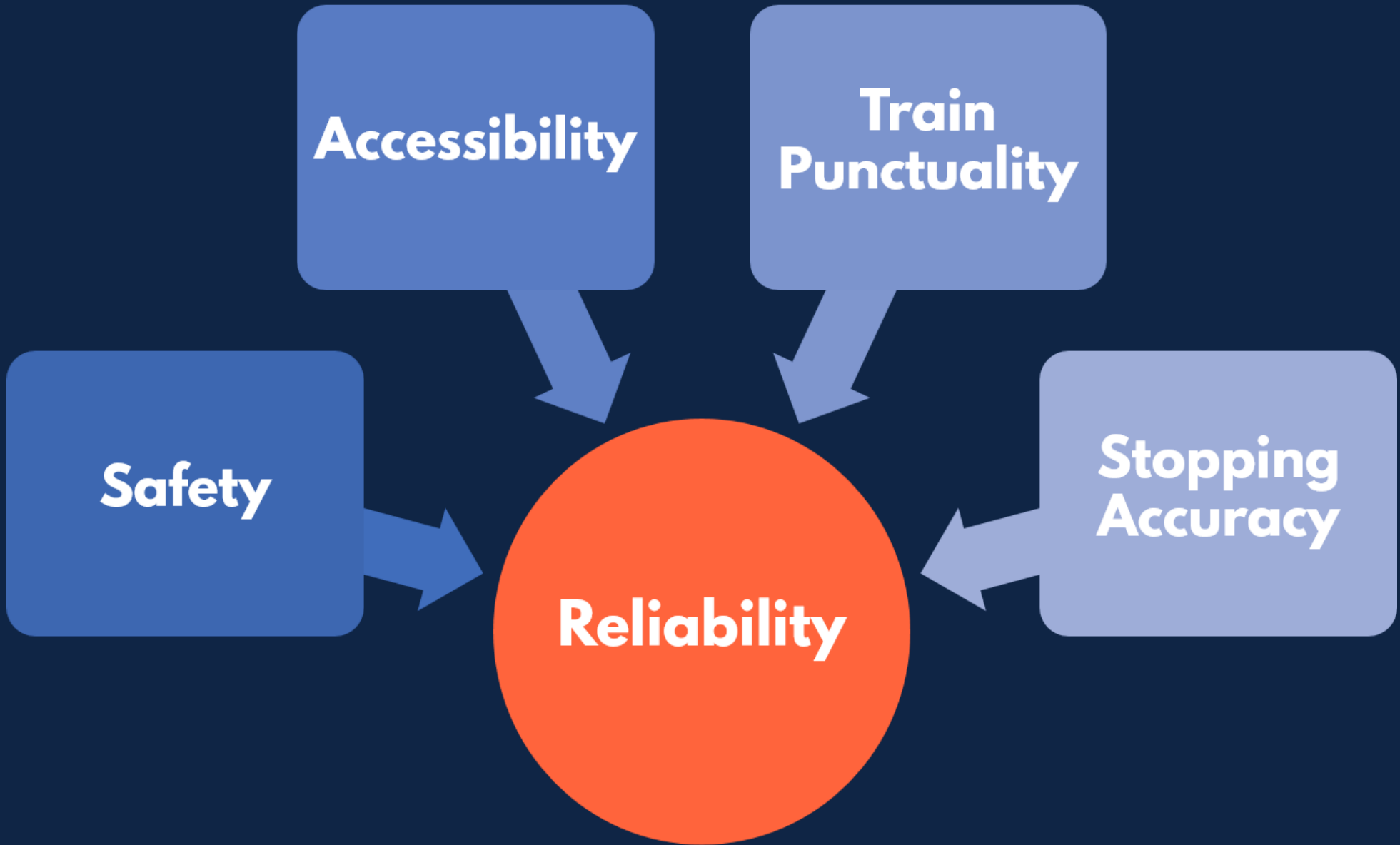


Project Goal

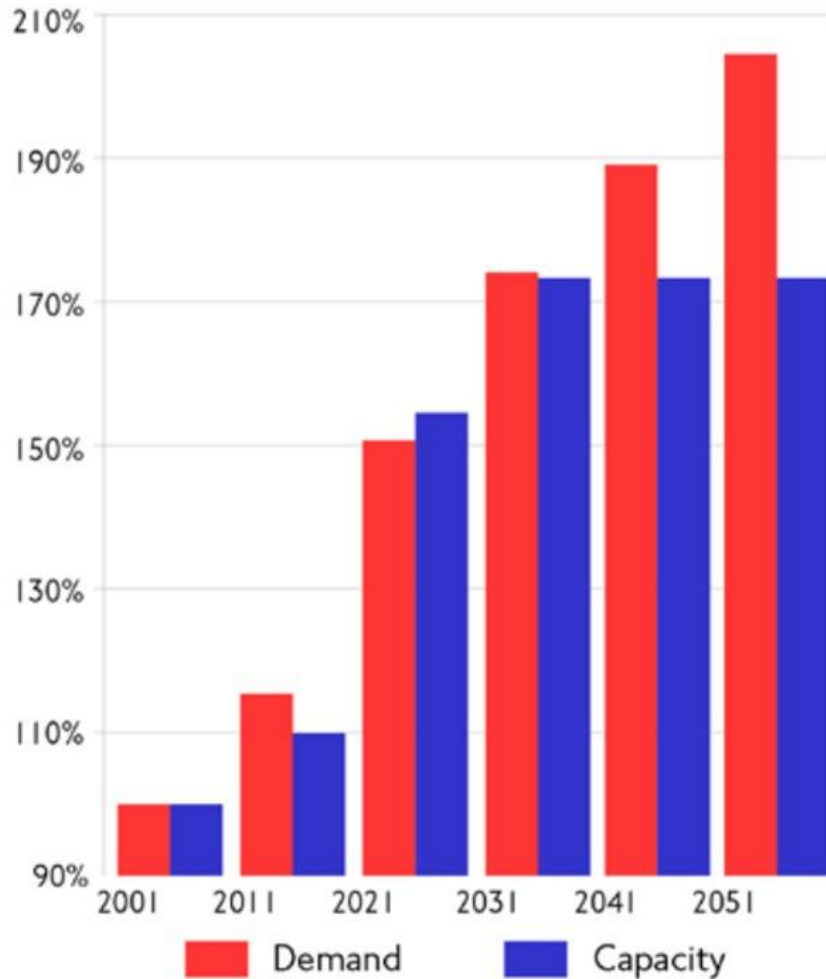
**INVESTIGATE
RELIABILITY**



Objectives



Public transport demand versus capacity
2001 to 2051



LONDON IS GROWING BY

**9 residents
every hour**

An effective and modern public transportation system is necessary to facilitate this rapid growth.

Of all stations in the London Underground,

**26% have
step-free
access.**

London Underground's motto,

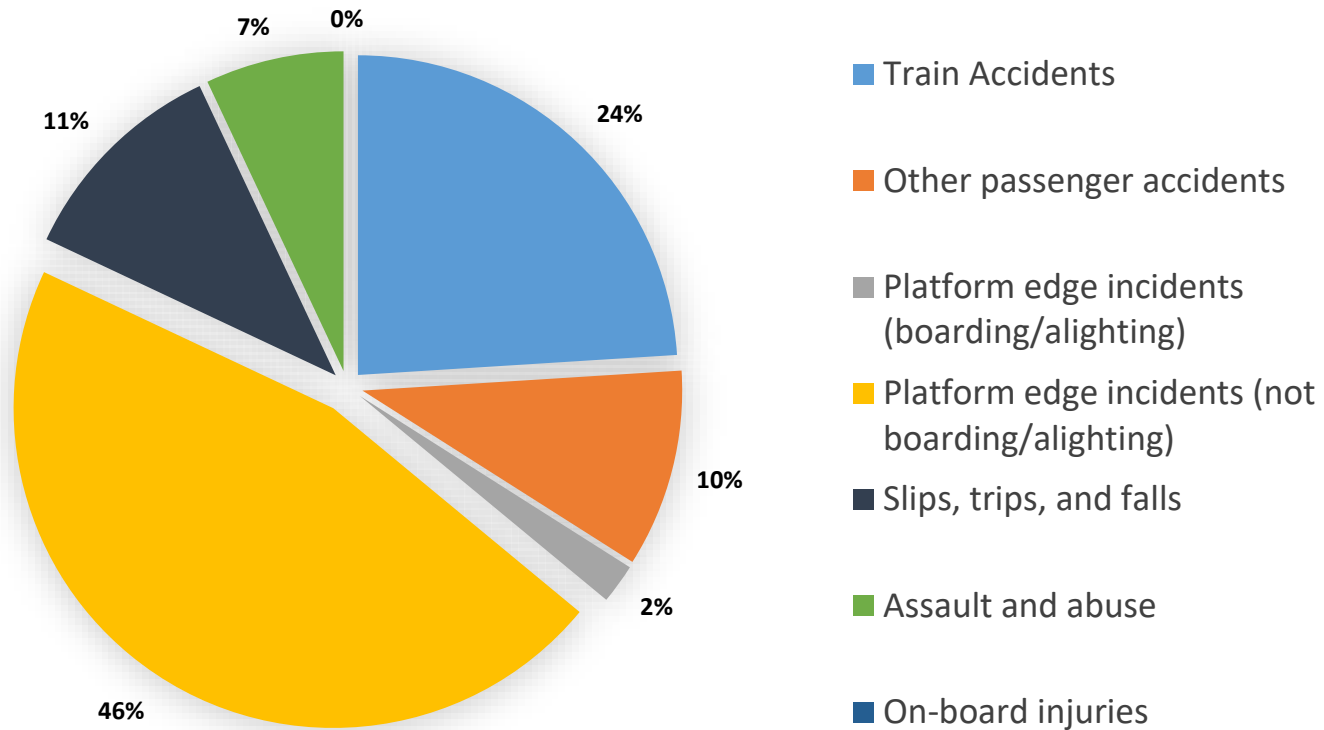
**Every Journey
Matters,**

applies to all riders.

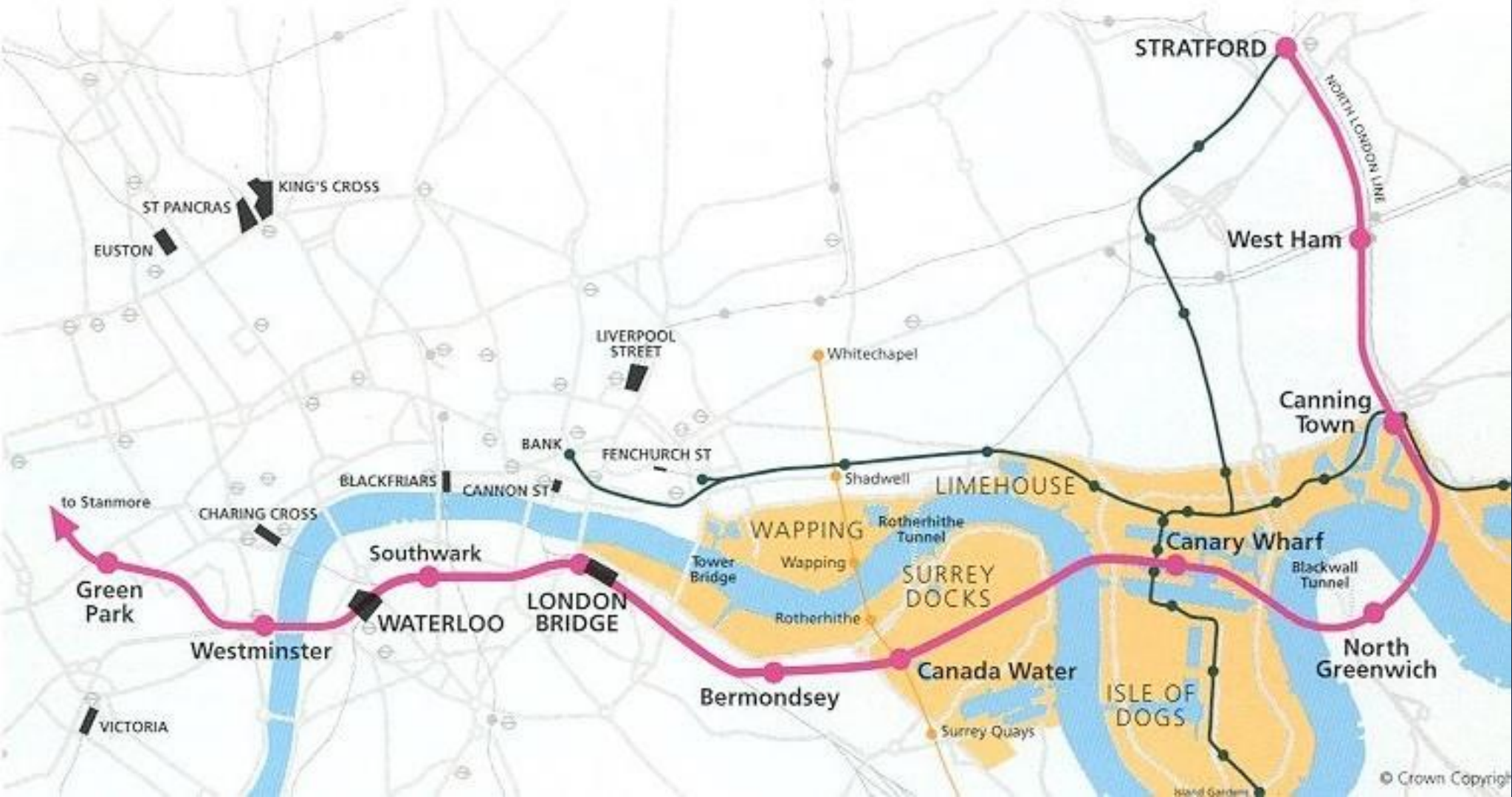


Safety in the Underground

Passenger Fatality Risk



The Jubilee Line



Methods



PASSENGER SURVEYS



INTERVIEWS

- Drivers
- Duty Reliability Managers
- Senior Jubilee Line Managers



OBSERVATIONS

- Platform Train Interface
- Passenger Behavior
- Accessibility



STOPPING ACCURACY MEASUREMENTS

- Manual Measurements
- VCC
- VOBC

RESULTS

Safety

74%

of passengers felt safer with PEDs.

Only

15%

of passengers have had bad experience with PEDs

All

six drivers were in favor of PEDs and ATC because of safety benefits.



Customer Behavior

326

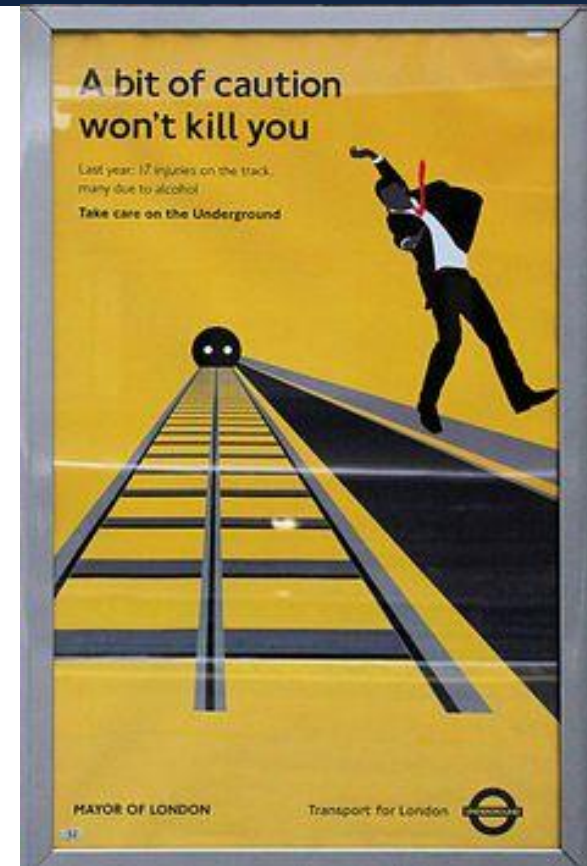
people were caught in the doors over an 11-year period

72%

of passengers said they were satisfied with the provision of signs, but

Both

senior staff members said customers pose the biggest threat to safety



Accessibility

67% of passengers felt that Jubilee Line is **more accessible** than other lines in the Underground

46% of passengers who needed assistance said the JL was their favorite line



Level Access

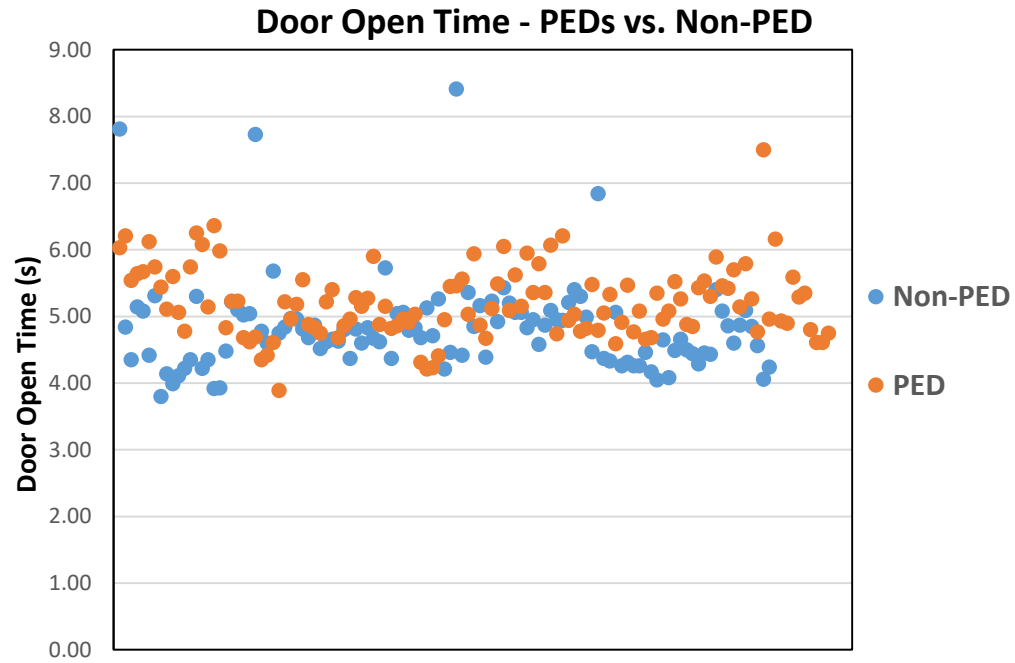
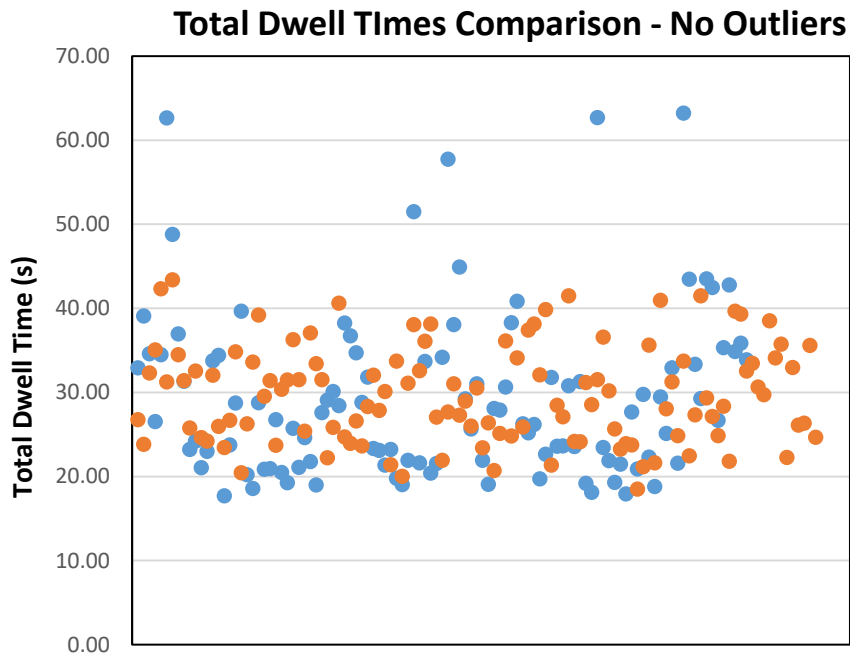


Platform Humps



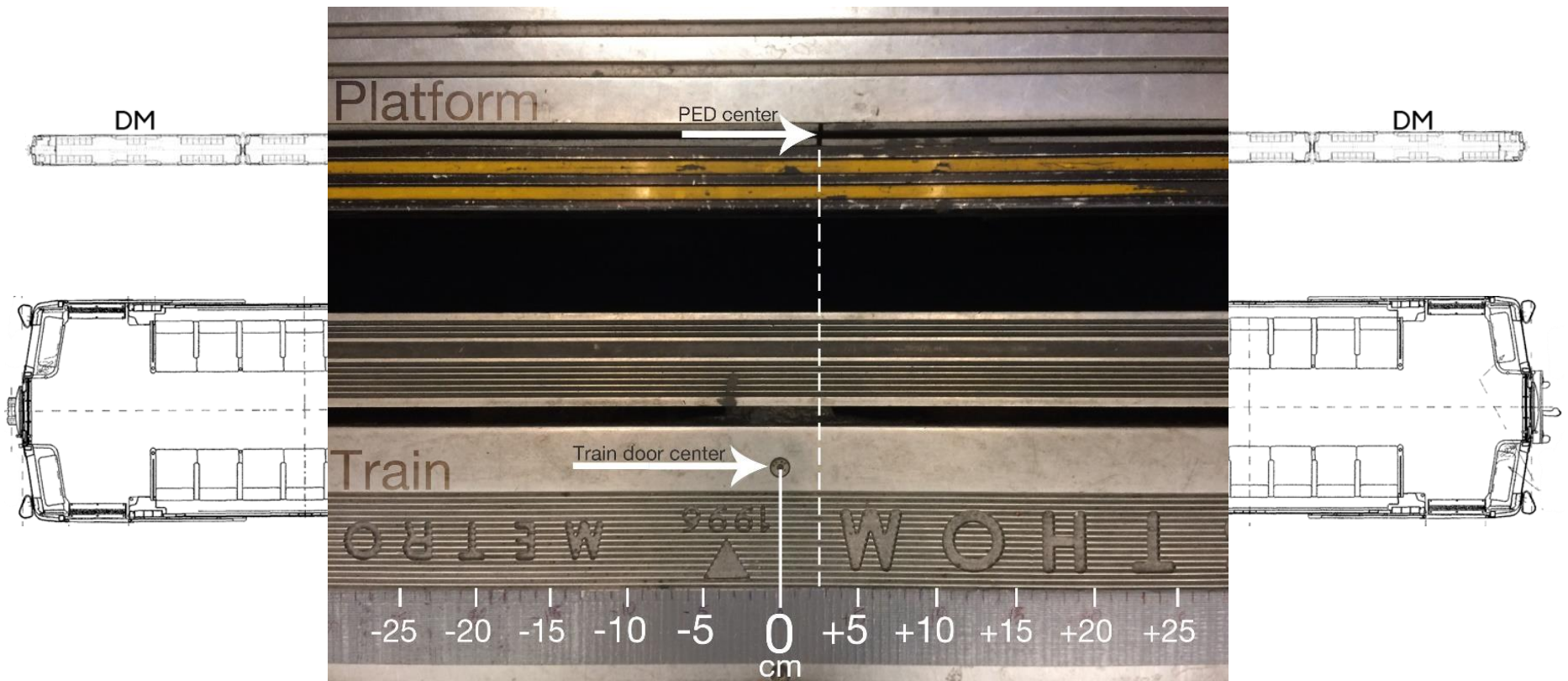
Train Punctuality

30-40% of **delays** are a result of **customer's lack of "awareness and understanding of the system"**



Stopping Accuracy

Stopping accuracy is one of the most significant measurements of an Automatic Train Operation (ATO) system's efficiency

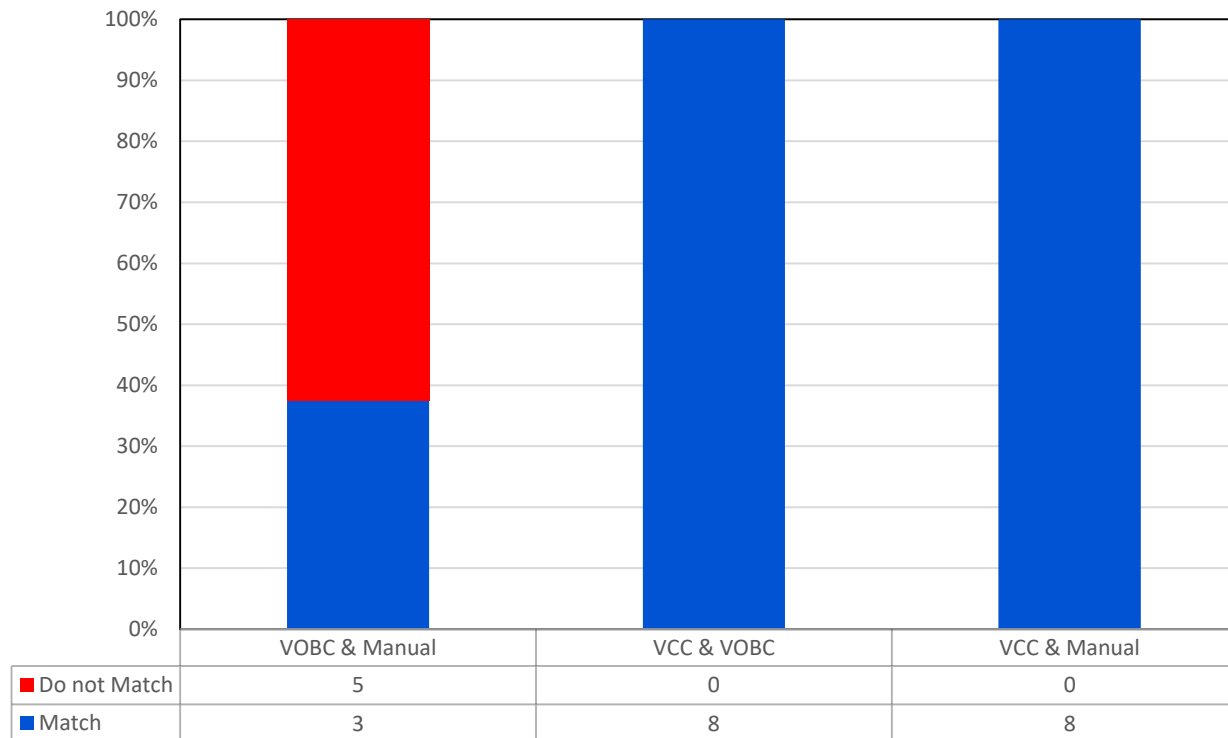


Stopping Accuracy

The **VCC data matched** our manual measurements in over **96%** of cases

In March of 2017, the VCC data revealed that in **over 96%** of cases in the JL the trains stop **within 20cm**

Train 96081 Stopping Accuracy Data Comparison



RECOMMENDATIONS

TRIPLE POLE

Triple poles consist of three bars protruding from the central pole, spaced equally from one another.



PLATFORM MARKINGS

Platform markings, as visualized at Stratford station on the right, will allow more effective boarding and alighting on non-PED platforms and minimize obstructions.



METAL RAILINGS

Metal railings would be placed along the platforms in the areas between the train doors, and serve as a more cost-effective safety barrier and indicator of where the train will stop than PEDs.



CONNECTED CARS

Connected train cars, like those currently used in the train stock on the Metropolitan, Circle, District, and Hammersmith & City lines, would allow accessibility across the entire train.



MECHANICAL GAP FILLERS

Mechanical gap fillers bridge the gap at the PTI. as they are extended from the train upon stopping at stations, and prevent people from falling into or getting trapped in the PTI



DOOR OBSTRUCTION FEE



A fee is proposed for passengers who prohibit train doors from closing on time. Implementation of this could be chip based or camera based and linked to the passenger's Oyster Card.

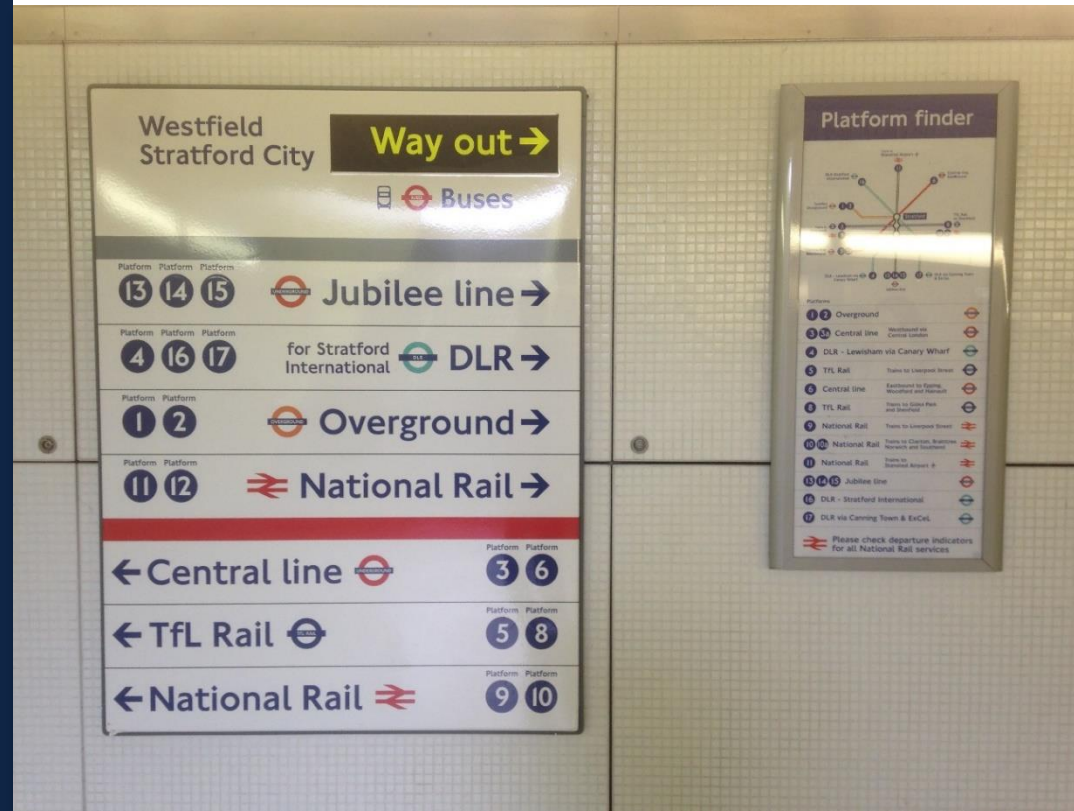
ACCESSIBILITY CARD

An accessibility card would be available for riders with disabilities (visible or nonvisible) that require assistance to navigate around the Underground, and would notify station staff when the rider enters the station.



INVESTIGATION INTO SIGNAGE

A focused study into optimized sign design and placement is recommended based on our findings of how important influencing customer behavior is for reliability.





Moving Forward

**MODERNIZATION &
CUSTOMER BEHAVIOR**



THANK YOU!

CONTACT US AT
CPC17@WPI.EDU

Joshua Rosenstock, our advisor
Adrienne Hall-Phillips, our co-advisor
Sarah Crowne, our ID 2050 professor
Malcolm Dobell, our sponsor, non-executive director at CPC Project Services
Gareth Davies, systems engineer at CPC Project Services
Mehmet Narin, systems engineer at CPC Project Services
James Goff and Charlotte Hughes, project managers at CPC Project Services
Fernando Soler, service control manager on the Jubilee Line
Phil O'Hare, general manager on the Jubilee Line,
Steve Walling and Eric Wright, former and current sponsors for London projects with TfL

Questions?

Contact us at CPC17@wpi.edu