



7th International Conference on Evidence-Based Policing



Randomised Controlled Trial on the London Buses *Operation Menas*

Barak Ariel

With

Henry Partridge (UCL), Tim Herbert (TfL), Homre Varley (MPS) and Ben Linton (MPS and Cambridge University)

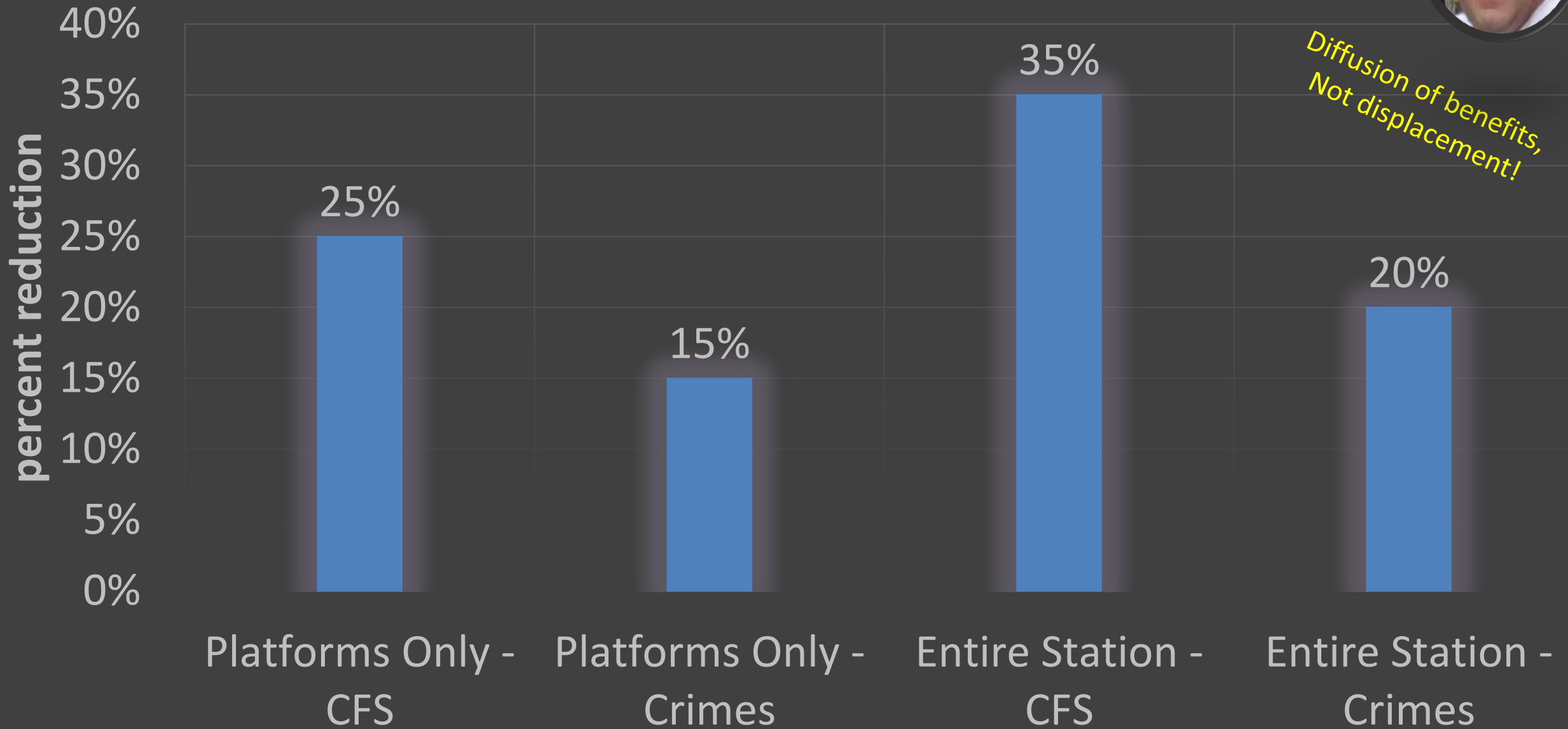
Bus Crime → Background

- **CRIME PATTERN THEORY** suggests that bus stops and mass transit systems more broadly present crime opportunities
 - Brantingham and Brantingham 1993
- Mass transit is often **THOUGHT TO BE DANGEROUS**, “eliciting concerns for personal security” when waiting for and traveling on mass transit
 - Yu et al 2009
- Bus stops are ‘**NODES**’ = departure/arrival points, while bus routes can be considered ‘**PATHS**’ = journeys between nodes
 - Tilley 2013:636
- Research evidence points to bus stops as being **CRIME ATTRACTORS/GENERATORS**
 - Brantingham and Brantingham 1997; Block and Block 2000; Liggett et al 2001; Loukaitou-Sideris 1999; Newton 2004
- Bus stops are more likely than any other activity node to be found across dominant situational profiles of robbery
 - Hart and Miethe 2014
- **FEAR OF CRIME** plays a strong role in making travel decisions

Policing Mass Transit Systems

- As already discussed today, hotspot policing research generally supports the practice (Braga, Papachristos & Hureau 2012)
 - “City centres” (e.g., Peterborough)
 - “Neighbourhood hotspots” (e.g., Birmingham)
- Yet the mass transit system as the unit of analysis has largely escaped the hotspot policing literature, despite the importance it is given as crime generator/attractor
 - (*cf. Ariel and Sherman 2014*)

Op Beck Results - Calls for Service + Crimes - Reductions Compared to Control Hotspots



What about the Bus Network?



Designing an Experiment for a Mass Transit System

- When we consider a hotspot-policing RCT for the London Bus System, what *exactly* do we mean? What is the **unit of analysis**?
 - crime **at** bus stops?
 - **On** buses?
 - **At** Bus depots?
 - Corridors of bus routes?
- The answer to this practical question largely drives what the intervention should be, although it is still grounded in sociological theory:
 - Where does the ‘crime cycle’ start/end?
 - Is there an ecological attribute to the bus itself that *causes* crime?
 - Are there management / interagency collaboration implications that are at stake?
- The Dosage Question / CBA
 - How much time should be spent at hotspots, and “can we deliver”?
 - How many visits should be made to each hotspot, and “can we deliver”?
 - **CAN WE ACCURATELY TRACK THE DOSAGE?**

Designing an Experiment for the Mass Transit System: Measurement challenges

- Baseline analyses quickly revealed handicapped crime / CFS recording systems
- CRIS and CAD systems used by the Met are technologically immature: spatiotemporal accuracy of crime in relation to the bus system is largely low or fundamentally qualitative and therefore annoying
- More importantly, figures are lower than “expected” and compared to US cities:
 - Under-reporting?
 - “Transit Crime” is in fact lower in London than comparable sites elsewhere?
 - Crime severity is low and does reach the level of a crime event?

Designing an Experiment for the Mass Transit System: Resourcing Challenges

- When designing police experiments, there is a fine balance between statistical power requirements and practicalities:
 - On the one hand, we ought not to design studies that are “doomed to failure”
 - Small samples make it difficult to interpret when the results are n.s.
 - Small samples leave little room to conduct further subgroup analyses
 - On the other hand:
 - How many officers can be seconded?
 - What is the travelling distance between hotspots?
 - How often do buses arrive?
 - When do officers start their patrol journey? When do they debrief?

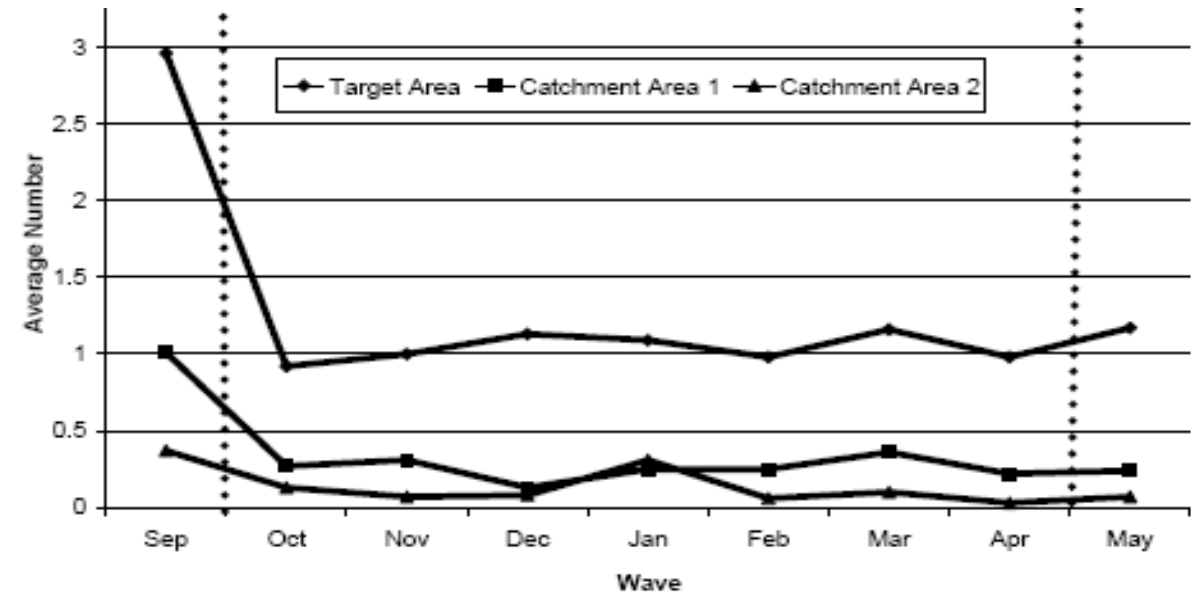
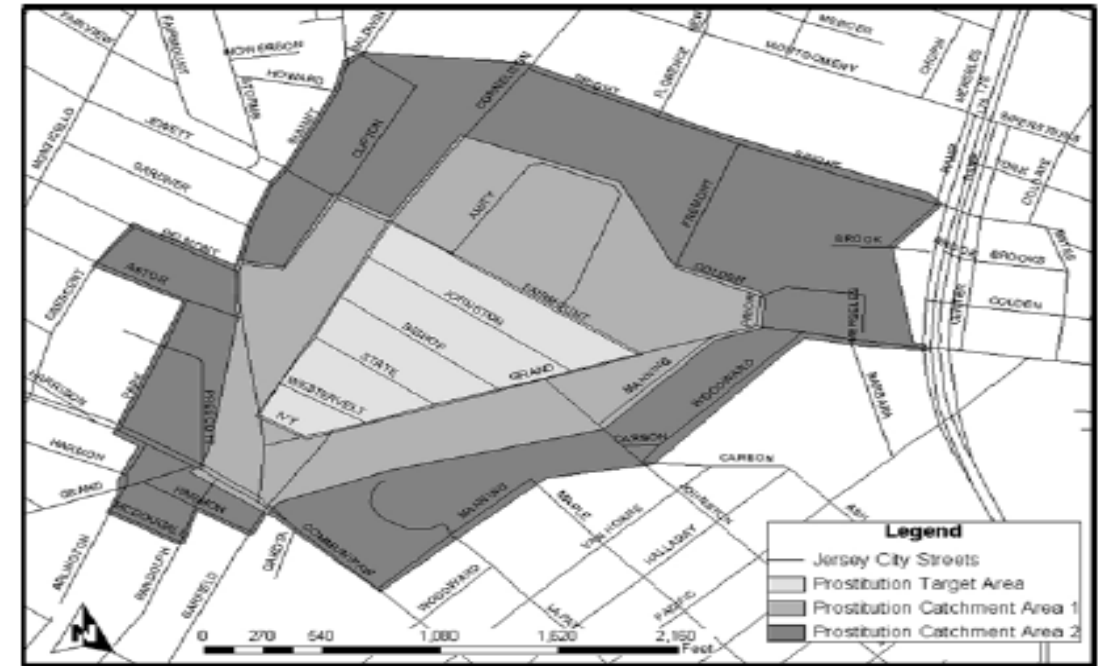
The Unique Environment of Buses – Ideal Settings for Testing Displacement Directly

Displacement v. Diffusion of Benefits

Assumptions:

1. Any bus route can be divided into “hot segments” with more crime compared to other segments
2. Bus crimes occur in hot segments *because* of the unique environment of the bus
3. Targeting the hot bus routes with prevention initiatives can either:
 - Displace the crime to other segments on the bus route
 - Diffuse the benefits of targeting to other segments on the bus route

Figure 1. Map of the Prostitution Site Target and Catchment Areas

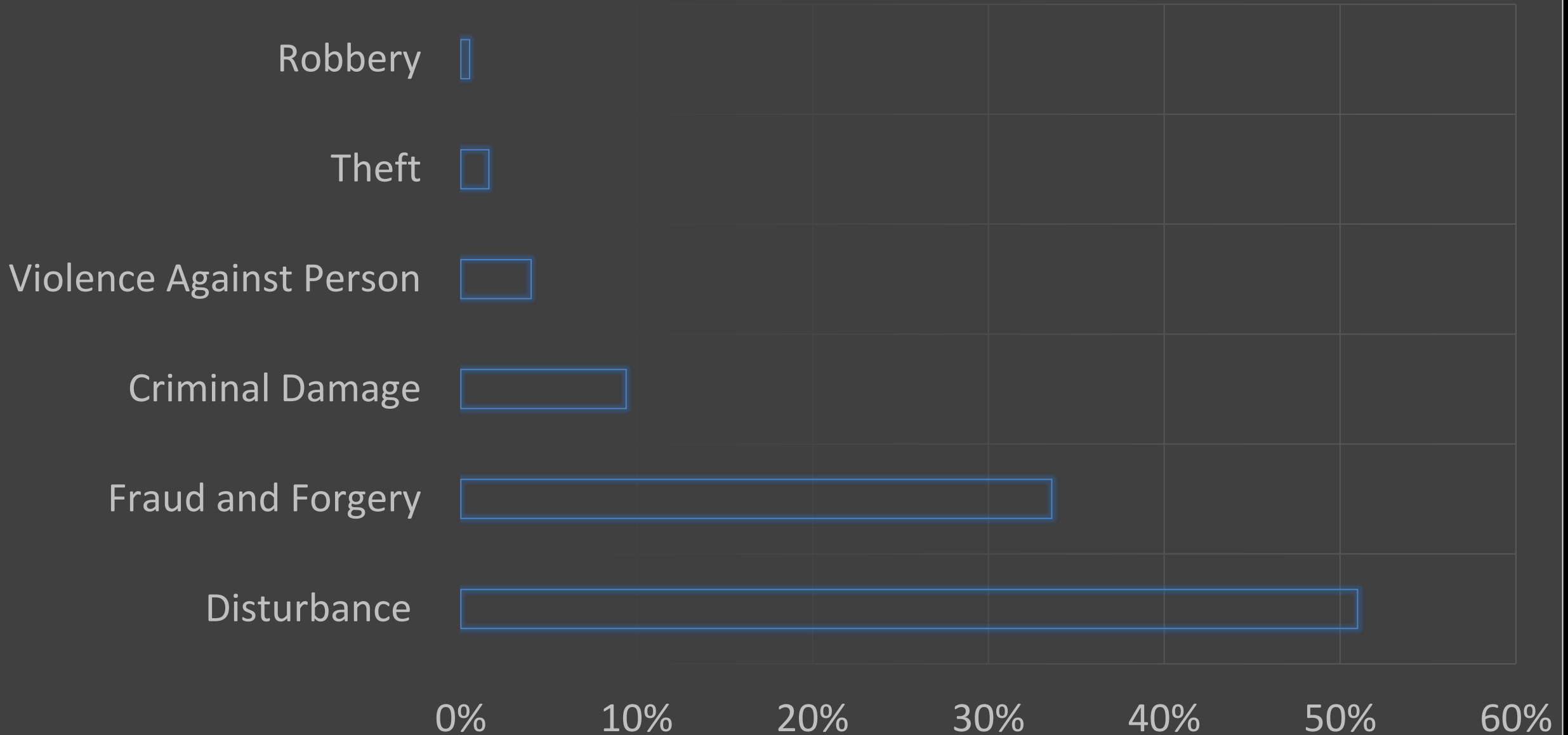




Baseline Analyses for a Mass Transit RCT:

1. Bus Routes
2. Bus Stops

DIR Crime Categories (5 1/2 years 2008-2013)



1. Spatiotemporal concentrations = Routes

Bus Routes:

- 5% of bus routes (33 out of 673) are responsible for 25% of crime events
- 18% of bus routes responsible for 50% of crime events

The Bus Route Segment:

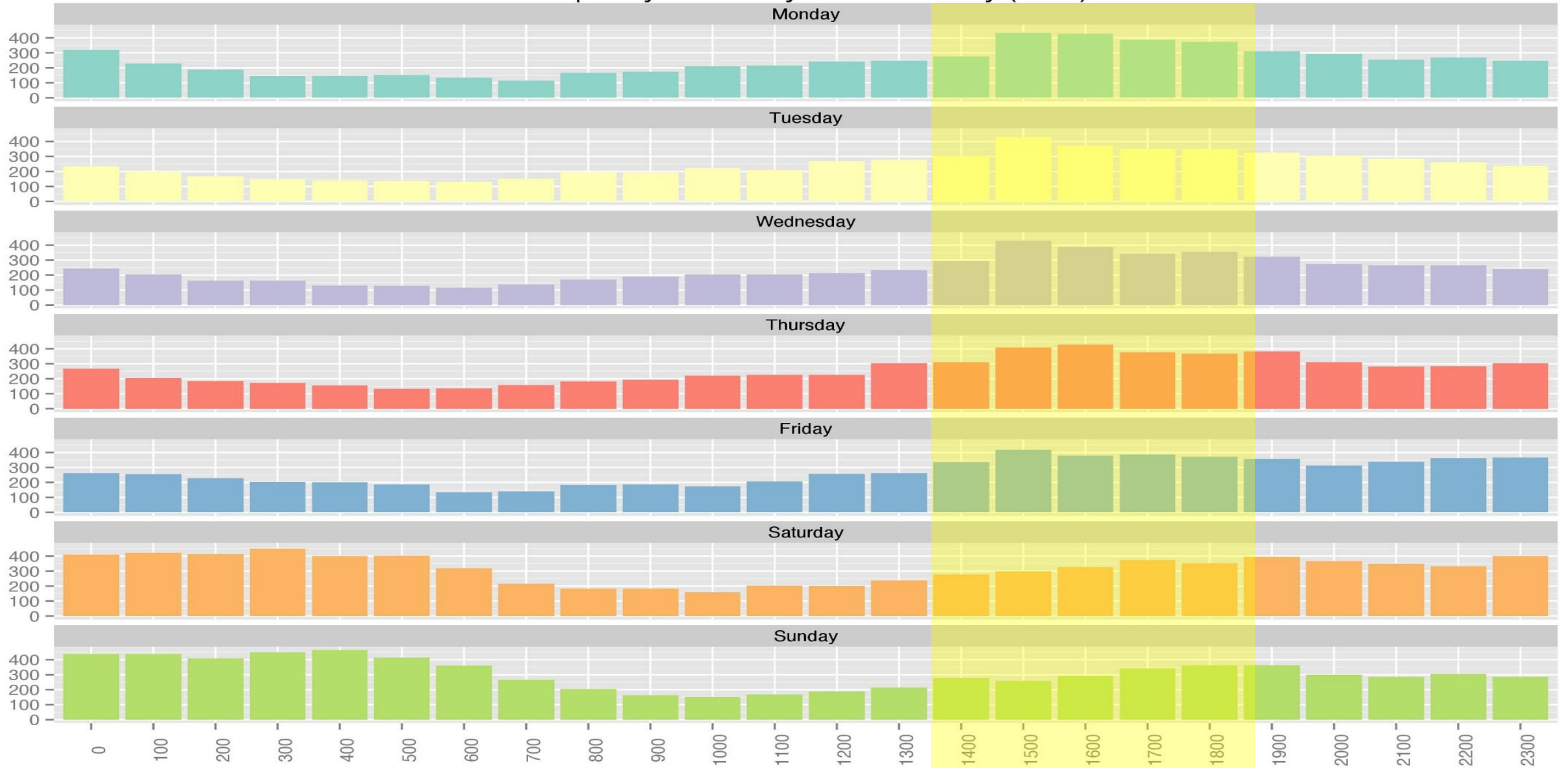
- We define a segment as a piece of the route between two bus stops
- 7.1% of route segments responsible for 40.8% crime events

Time:

- On “Hot Bus Routes”, 6 hours (00:00-05:59) - accounted for over 37% of on-bus events per day
- On “Cooler Bus Routes”, a different 6 hours (15:00-20:59) accounted for over 39% of on-bus events per day

“When? 3-8PM, Mon-Sat”

Frequency of DIRs by hour of the day (2013)



2. Spatiotemporal concentrations = Bus Stops

- While the 19,000 bus stops across London do not move, they are tricky to conceptualise in terms of crime
- It is not entirely clear what they are, in terms of crime:
 - Crime attractors?
 - Crime generators?
 - Crime neutral?
- Should police treatment be assigned to the hot bus stops across London, what is the “size” of the treatment area? → **DIRECT MEASUREMENT IMPLICATIONS**
 - Right on the bus stop?
 - 50 metres around? 100? 150? “as far as the eye can see”?
- Should additional ecological attributes of the area be taken into consideration?



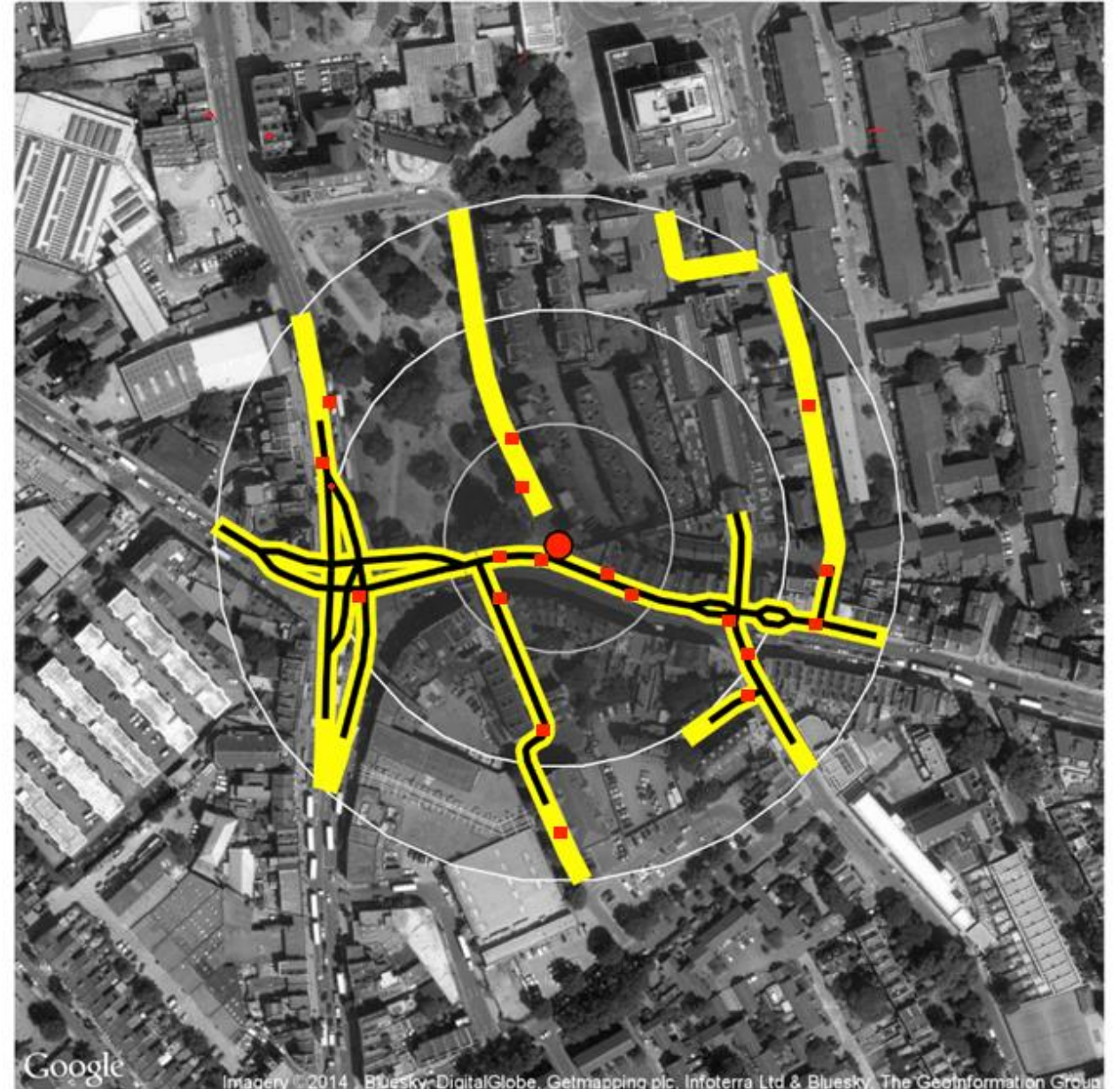
Measures: Euclidean Out, Networks In

- Most forces (still) use ordinary polygons, or simple circles around epicentres of hotspots
- These are largely misleading
- Since Weisburd et al and the “street segments movements”, more focus is given to the actual layout and topography of the terrain

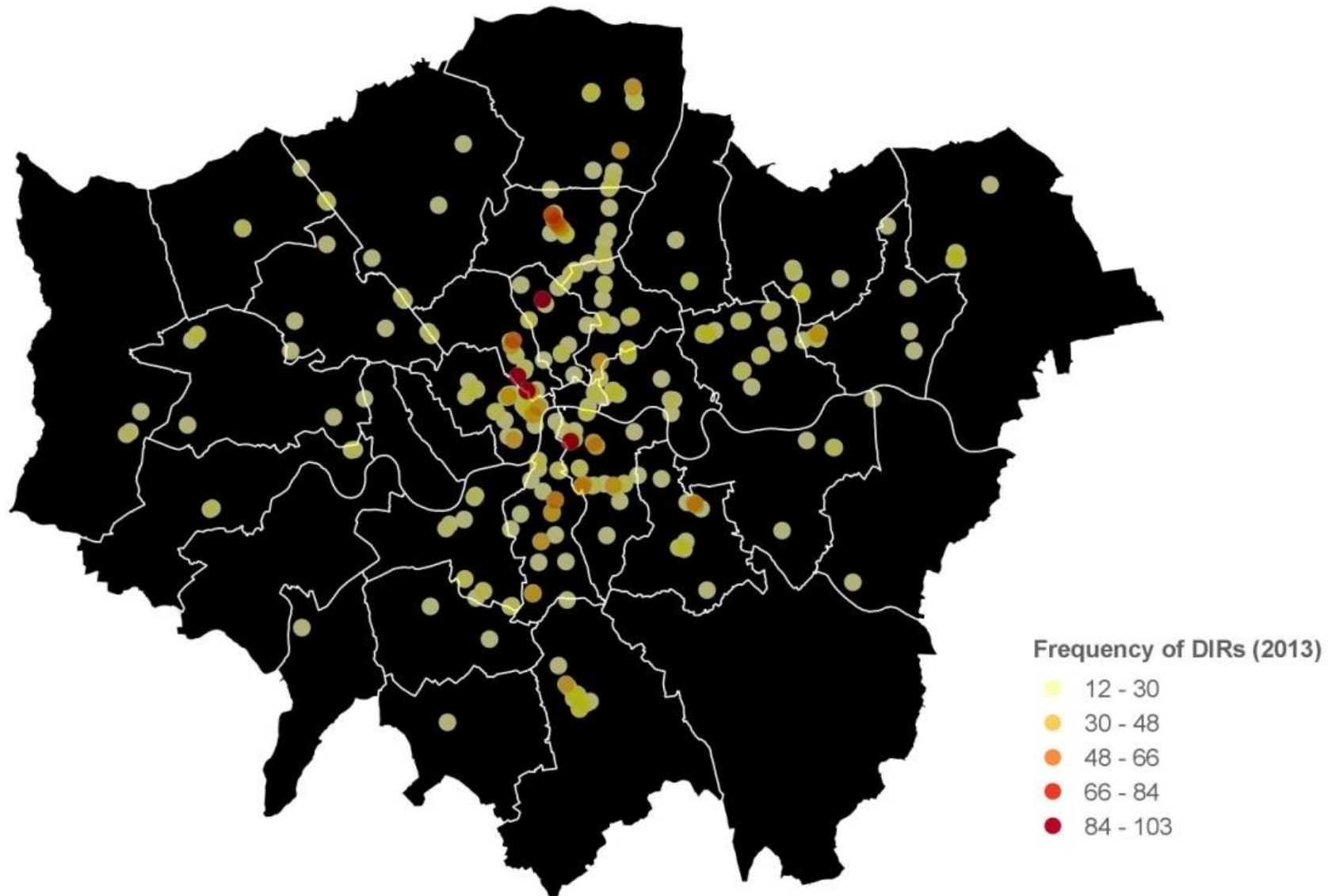
Roads within euclidean (yellow) and network (black) buffers

Concentric ring buffers at 50m, 100m and 150m from a bus stop

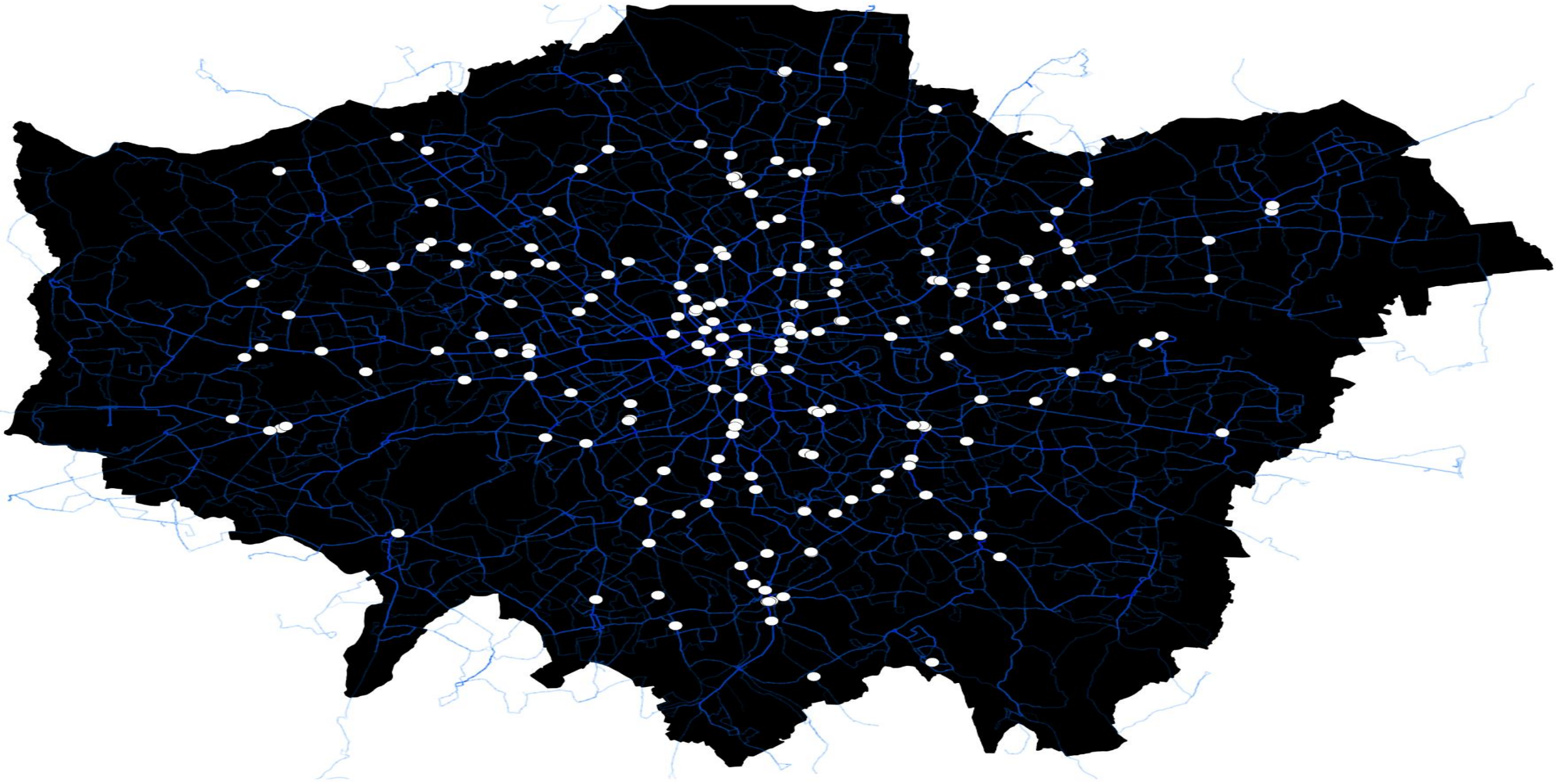
Created using ArcGIS and ggmap in R



Bus-related crime and disorder at bus stops



London's hottest 100 bus stops



Op Menas

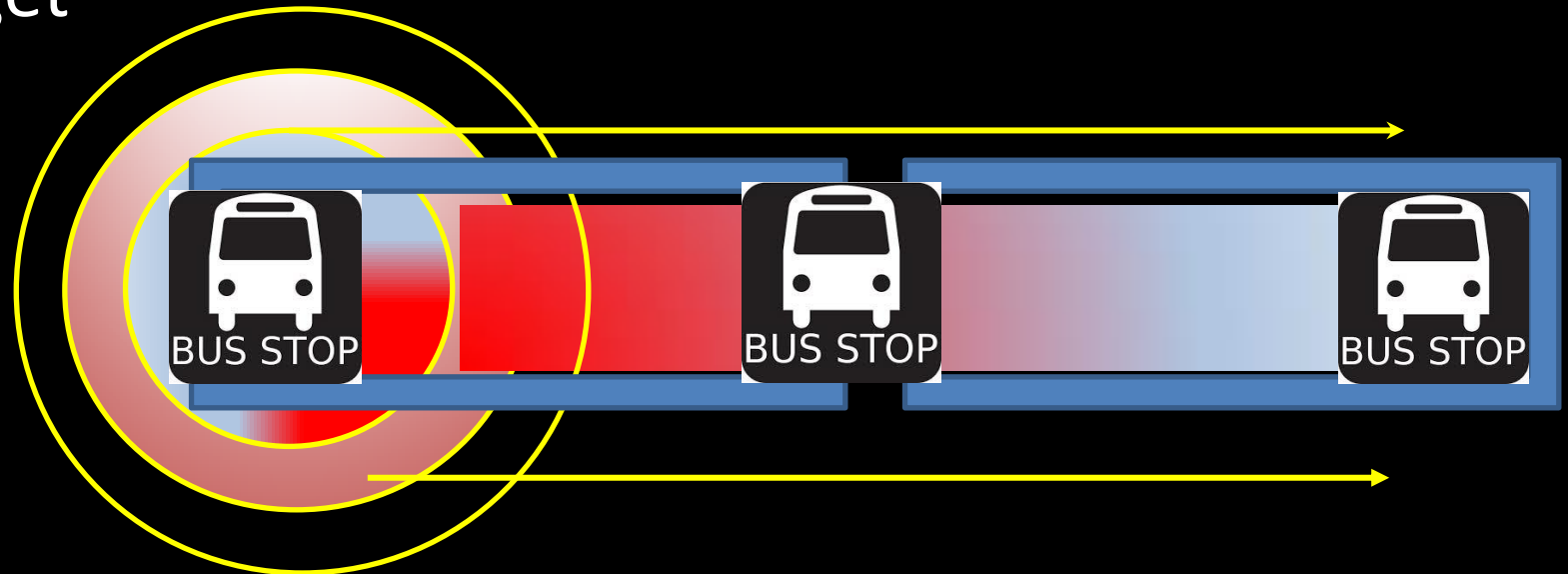
Two RCTs Nested in One

- Cambridge University with UCL and TFL designed an experiment that addresses these concerns

- **First key finding of the study:**
 - Hottest bus stops are associated with hottest bus routes segments

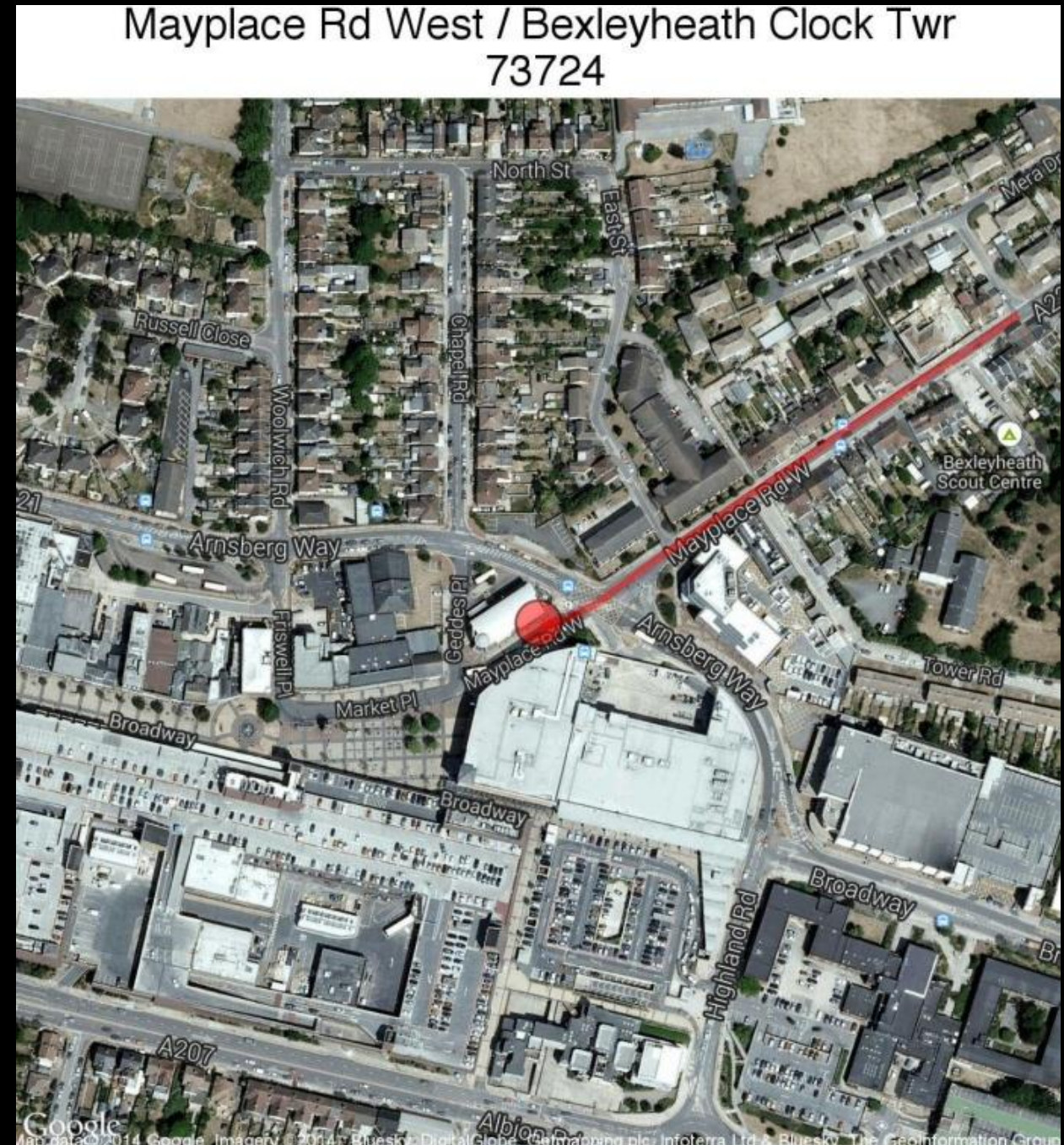
- In fact, there are two target areas within one design:

- Tackling on-bus crime: “moving hotspots”
- Dealing with high-crime bus stops across London =



Concept

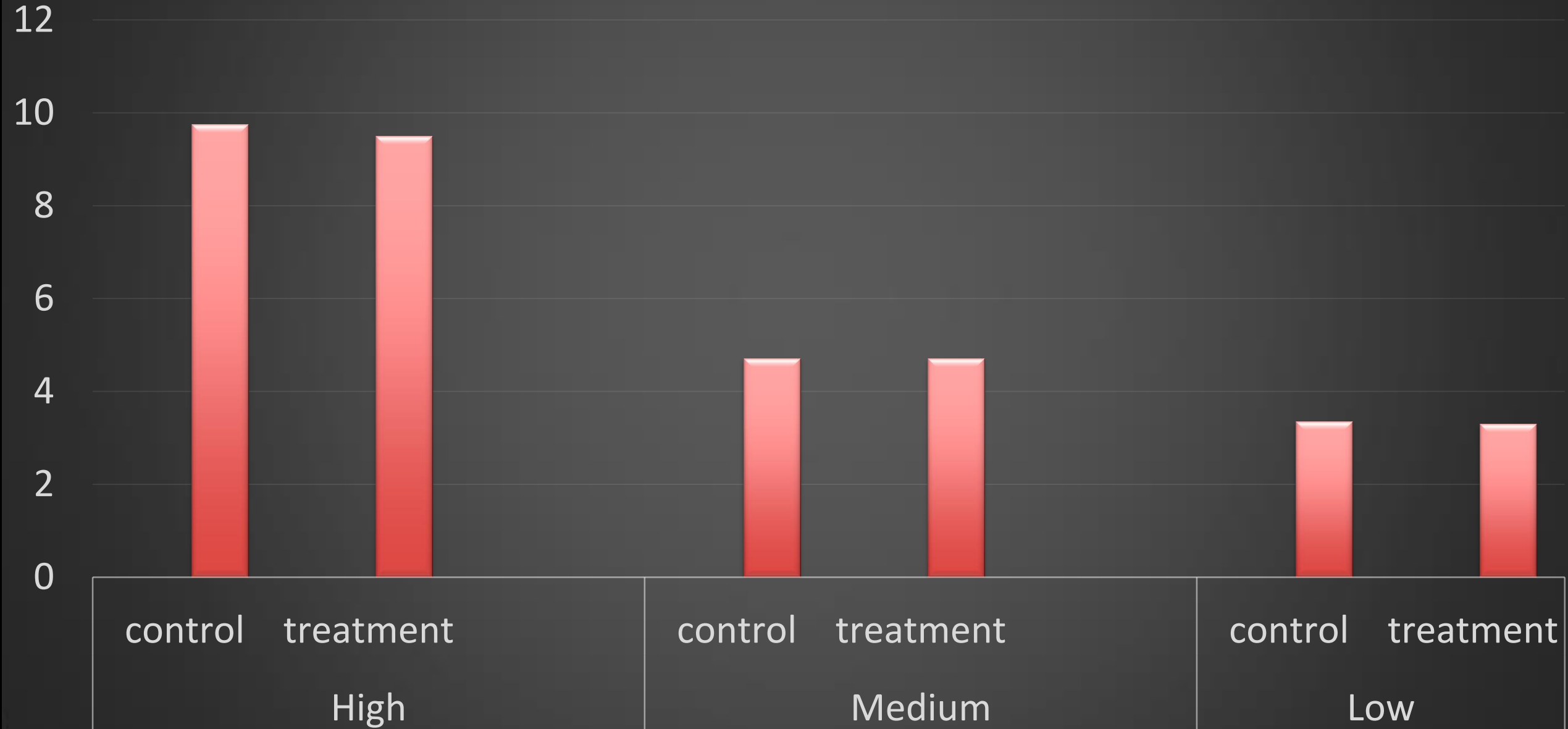
1. Visible directed patrol in 50% of the HOTTEST BUS STOPS to prevent crime and disorder
2. 15-Minute visits RIGHT ON the bus stop, 3 times per day
3. Hop on the hottest bus line associated with this bus stop until the hot segment finishes

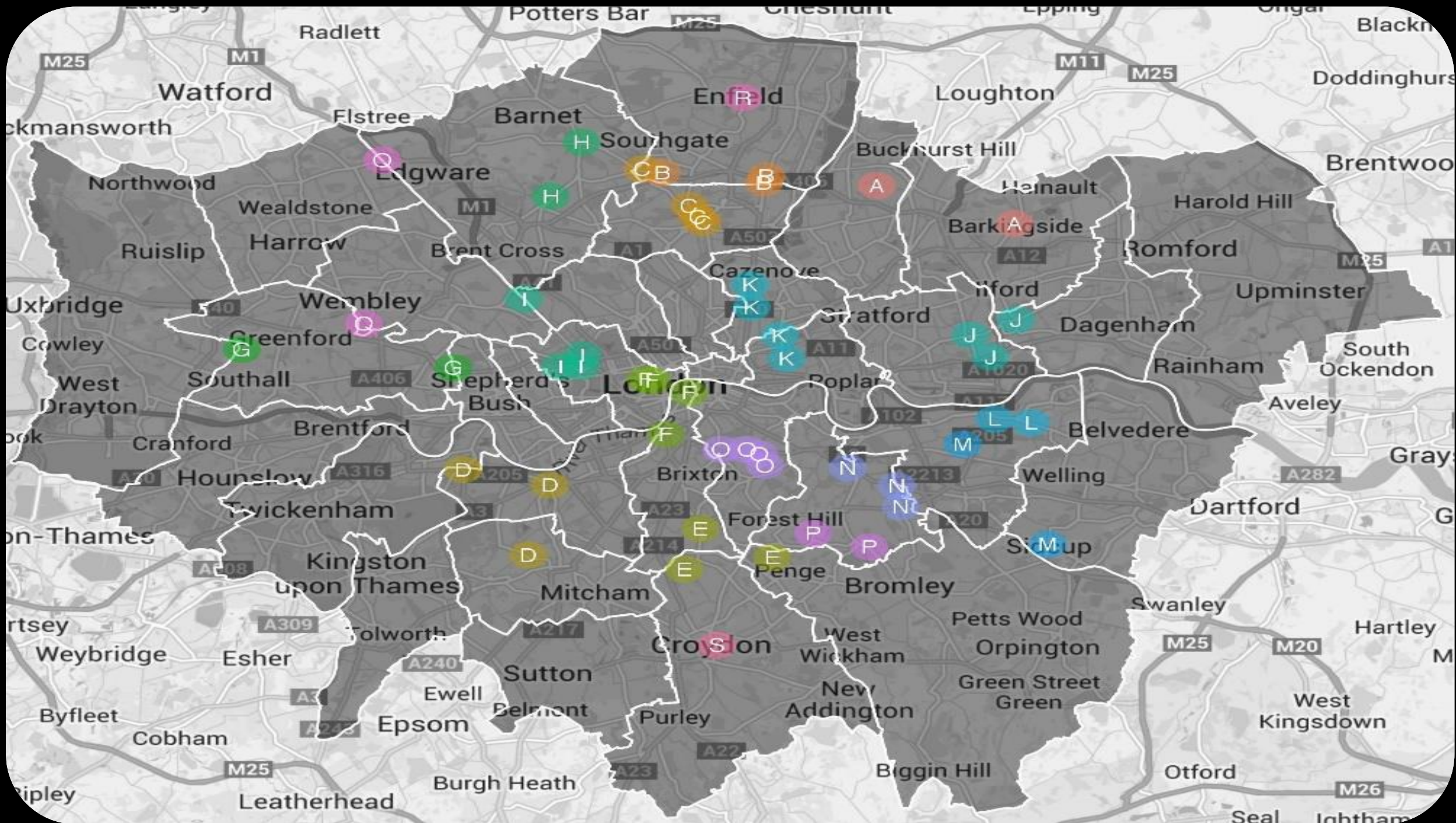


Random Assignment

- We randomly assigned 100 bus stops across London to Treatment and Control Conditions
- Assignment was conducted within 3 statistical blocks with discrete levels of DIR
 - $F(98,2)=127.170; p<.0001$

Pre-RA Mean DIR per Bus Stop (2013) Within 3 statistical blocks





Treatment

What to do?

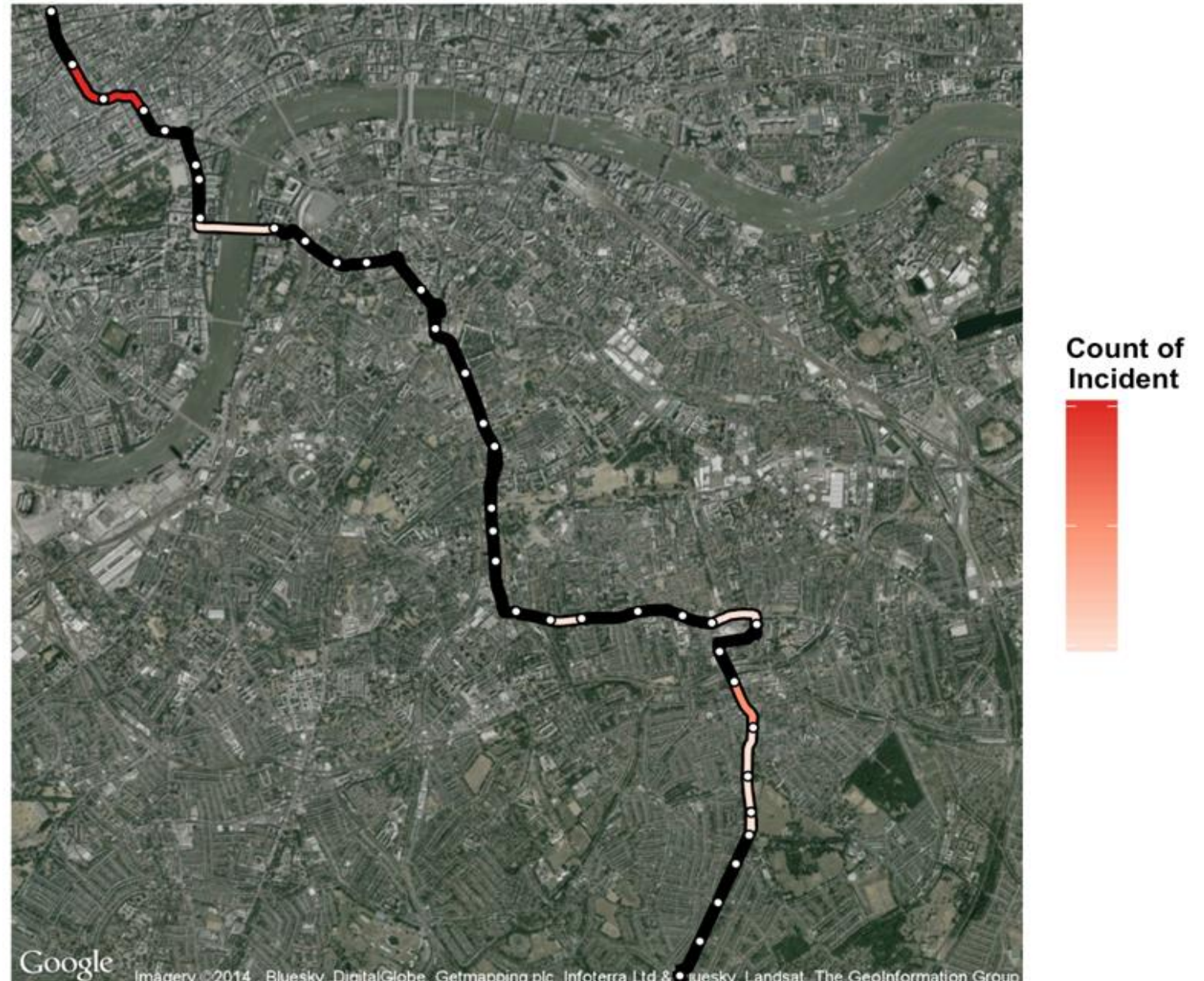
1. Start patrol at the hot bus stop (15 minutes)
2. Hop on hot bus route and ride it until the hot route ends *
3. Intervention delivered by pairs of PCs and PCSOs
4. Repeat 3 times in random order during the shift

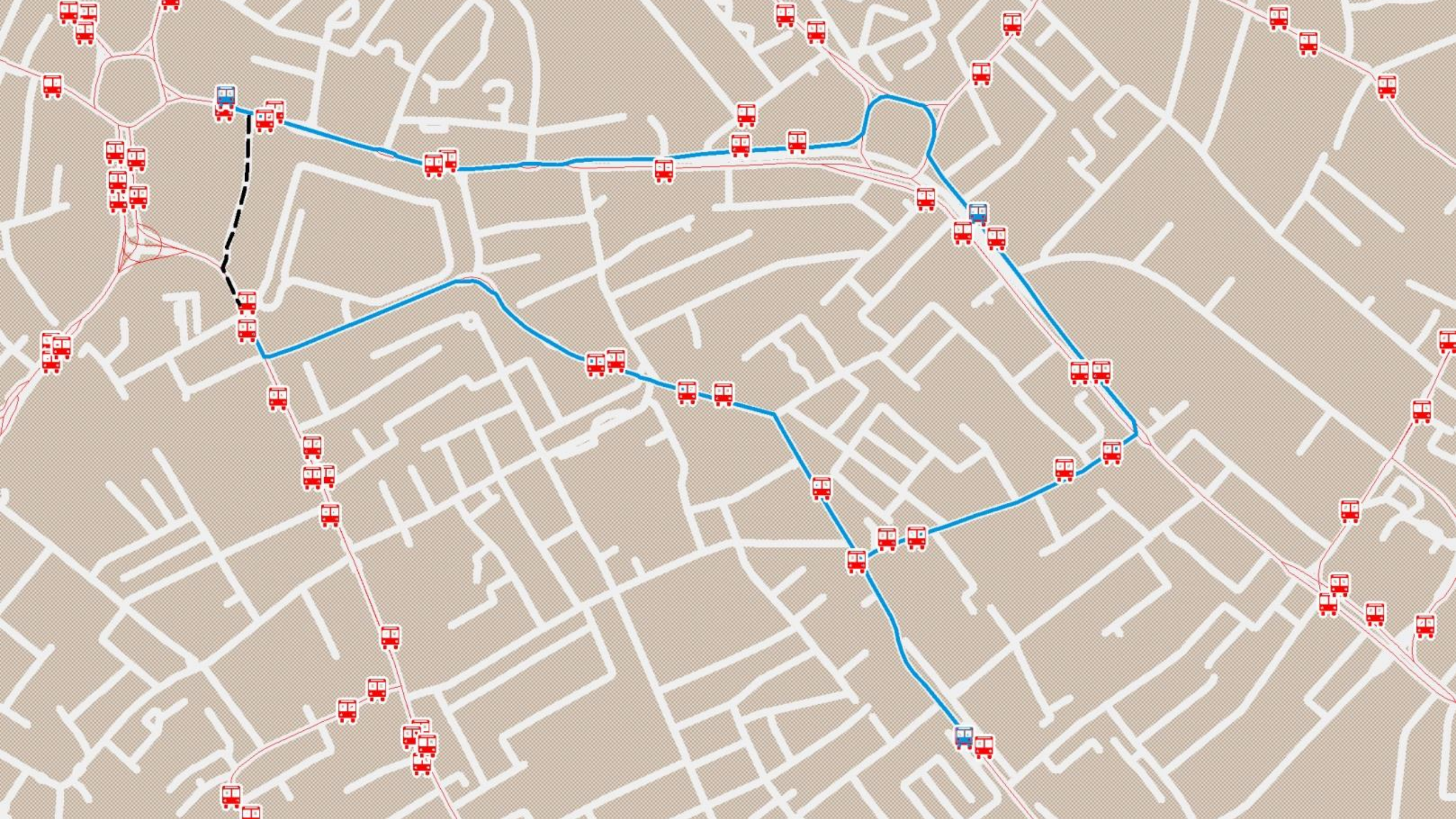
*could be more than 2 aligned on the same bus line

per route run segment

Route 12 towards Peckham

Created using ggmap in R





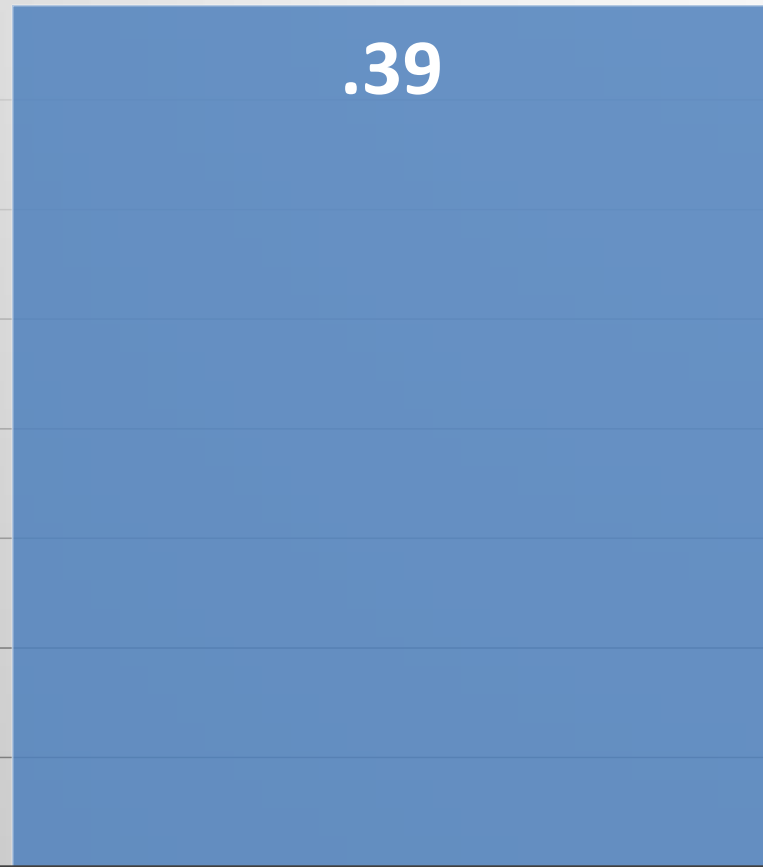
Leadership: Supervision, Monitoring and Motivation

- 1 day-out with all participating officers prior to RCT
- 1 Inspector, 2 sergeants
- GPS devices issued to each pair of officers
- Detailed patrol patterns
- Weekly briefings

Preliminary Findings (3 months) and only for the
effect on buses

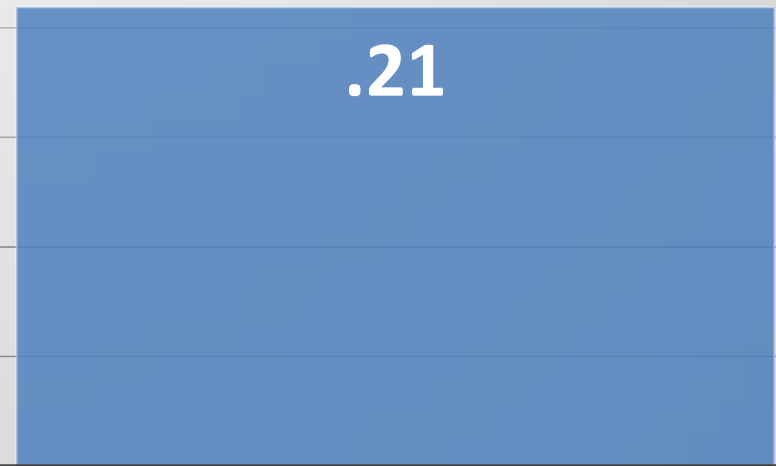
Mean DIR per Hotspot - 3-Month Report

= 46% reduction (p=0.69)



.39

CONTROL



.21

TREATMENT

The Most Interesting Findings Are Yet To Come...

- Displacement vs. diffusion of the benefits for on route bus crime
- Predicting treatment outcomes based on dosage-per-visit
- Effect of policing the bus stops using Network-based hotspots



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