

The effect of external lighting conditions on pedestrian flows in London

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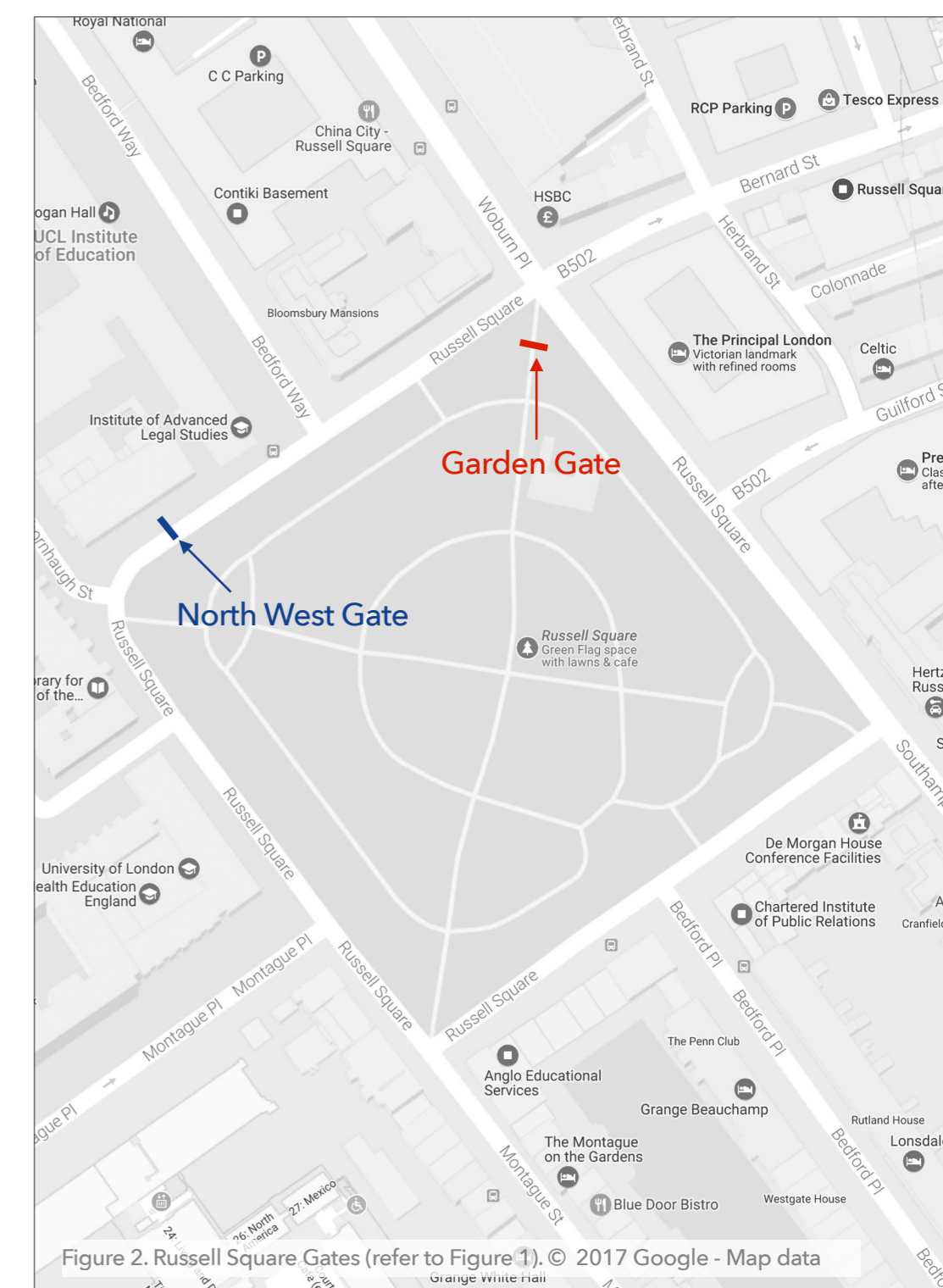
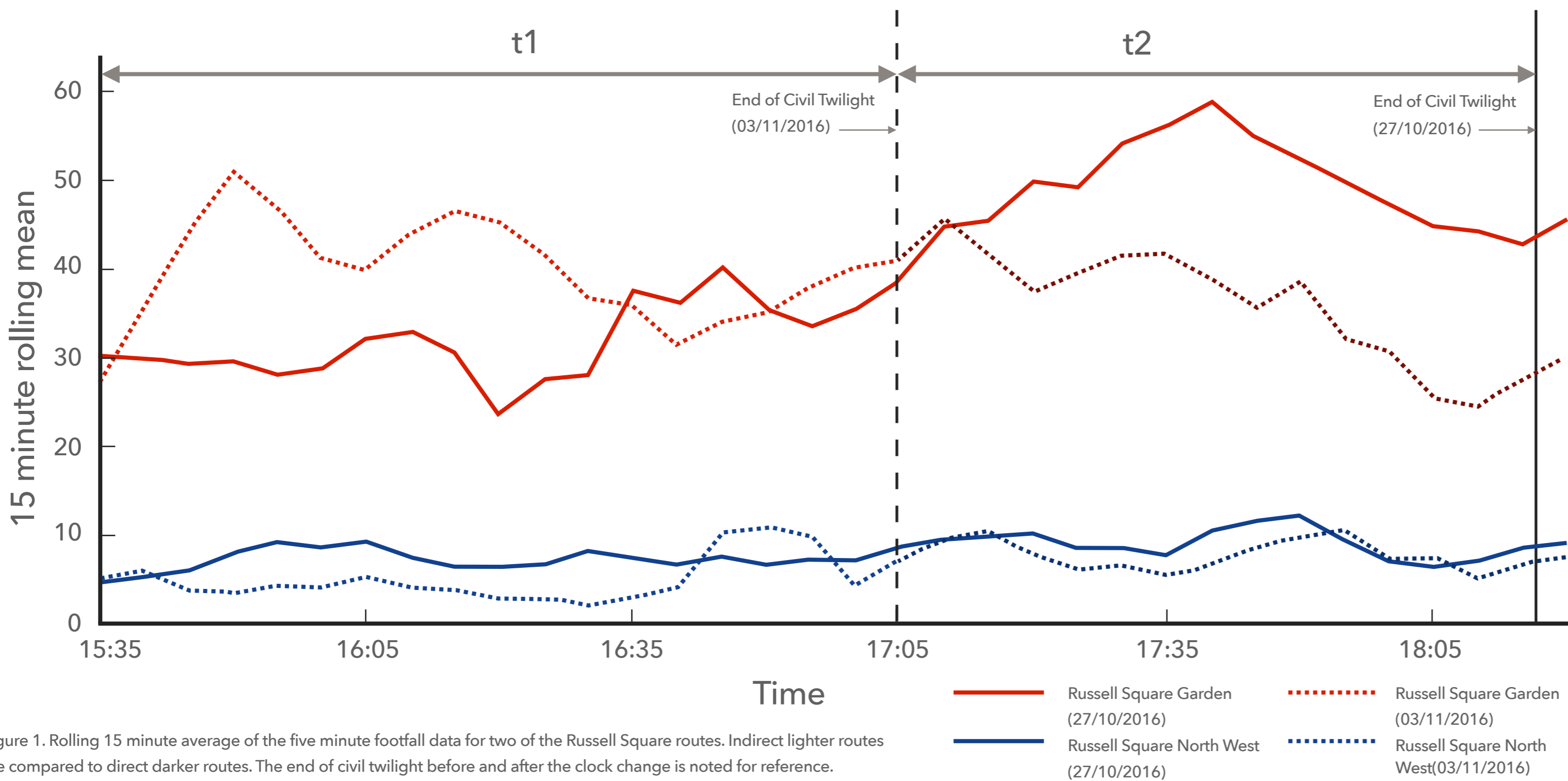


Figure 1. Rolling 15 minute average of the five minute footfall data for two of the Russell Square routes. Indirect lighter routes are compared to direct darker routes. The end of civil twilight before and after the clock change is noted for reference.

Figure 2. Russell Square Gates (refer to Figure 1). © 2017 Google - Map data

Background

The night-time appearance of major cities across the world is changing as existing street lighting stock is replaced. The question of whether this could affect street usage is asked. Comfortable street environments are accessible, promoting activity and therefore health. It is important to know whether external illumination conditions can influence pedestrian movement patterns because this information can be used to inform lighting design at an urban scale.

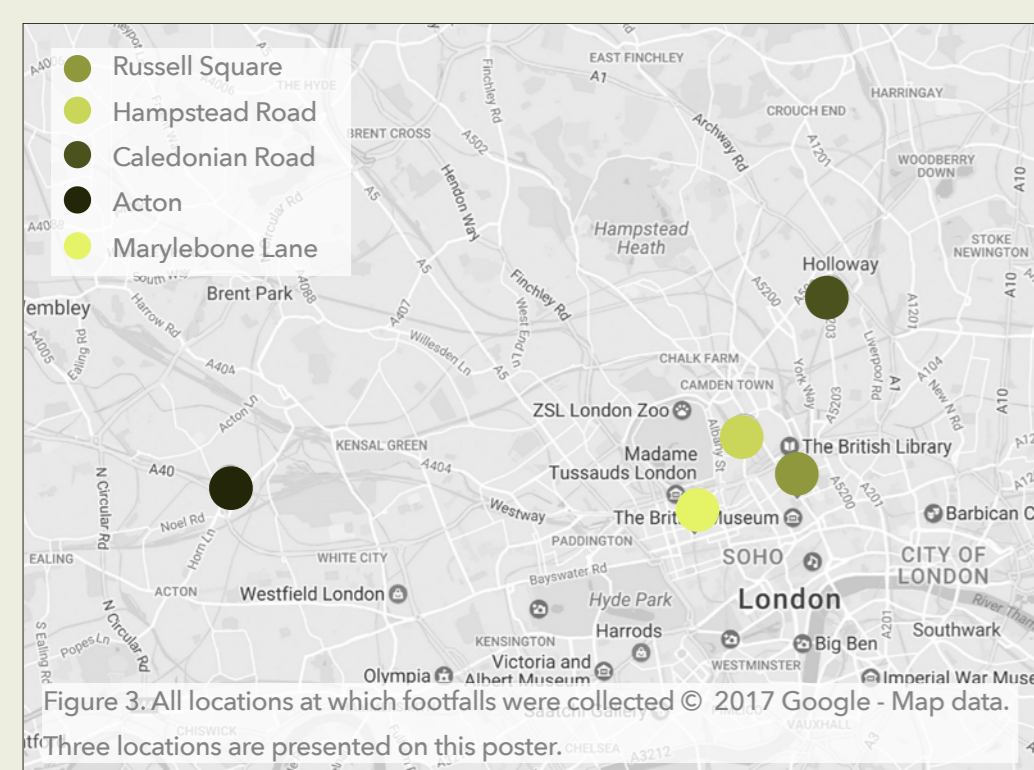


Figure 3. All locations at which footfalls were collected. © 2017 Google - Map data. Three locations are presented on this poster.

Method

Pedestrian movement flow is recorded by counting pedestrians passing through twelve "gates" at five locations in London.

The footfall (i.e. the number of pedestrians including cyclists passing through each gate) was recorded during five minute intervals.

The surveys were completed either side of the clock change in Autumn 2016, so that different lighting conditions at the same time of day could be compared.

Footfall sites are sampled on the basis of relative illumination conditions and whether they provide direct or indirect routes to a destination.

Two lighting conditions are compared. (1) Individual sites before and after the clock change and (2) pairs of sites with a variation in lighting condition.

Table 1. Metadata regarding the locations and routes under study.

Location	Route/site information	Sky angle (openness)	Day of week	Dates (before & after clock change)	Weather (before & after clock change)
Russell Square Garden (south)	Direct & darker	85°	Wednesday	26/10/2016 02/11/2016	16/14 °C - dry, passing clouds 10/6 °C - dry, passing clouds
Russell Square South East	Indirect & lighter	156°			
Russell Square North West	Indirect & lighter	121°	Thursday	27/10/2016 03/11/2016	16/14 °C - mostly cloudy 11/9 °C - mostly cloudy
Russell Square North East	Indirect & lighter	155°			
Russell Square Garden (north)	Direct & darker	80°			
Hampstead Road	Direct & darker	59°			
Caledonian Road Indirect	Indirect & lighter	56°	Friday	21/10/2016 04/11/2016	13/12 °C - mostly cloudy 9/7 °C - light rain
Caledonian Road Direct	Direct & darker	42°			
Marylebone Lane	Indirect & lighter	19°	Wednesday	26/10/2016 02/11/2016	16/14 °C - passing clouds 10/6 °C - passing clouds
Jason Court	Direct & darker	7°			
North Acton - Western Ave	Indirect & lighter	93°	Tuesday	25/10/2016 01/11/2016	13/12 °C - mostly cloudy 12/10 °C - mostly cloudy
North Acton - Portal Way	Direct & darker	106°			

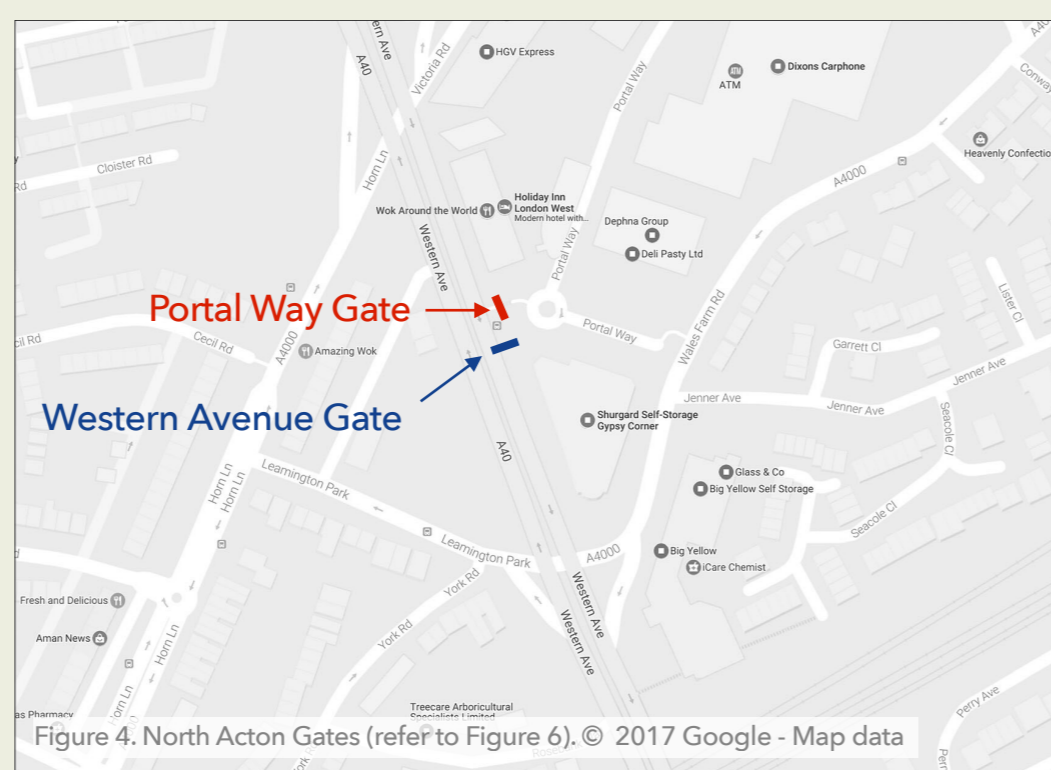


Figure 4. North Acton Gates (refer to Figure 6). © 2017 Google - Map data

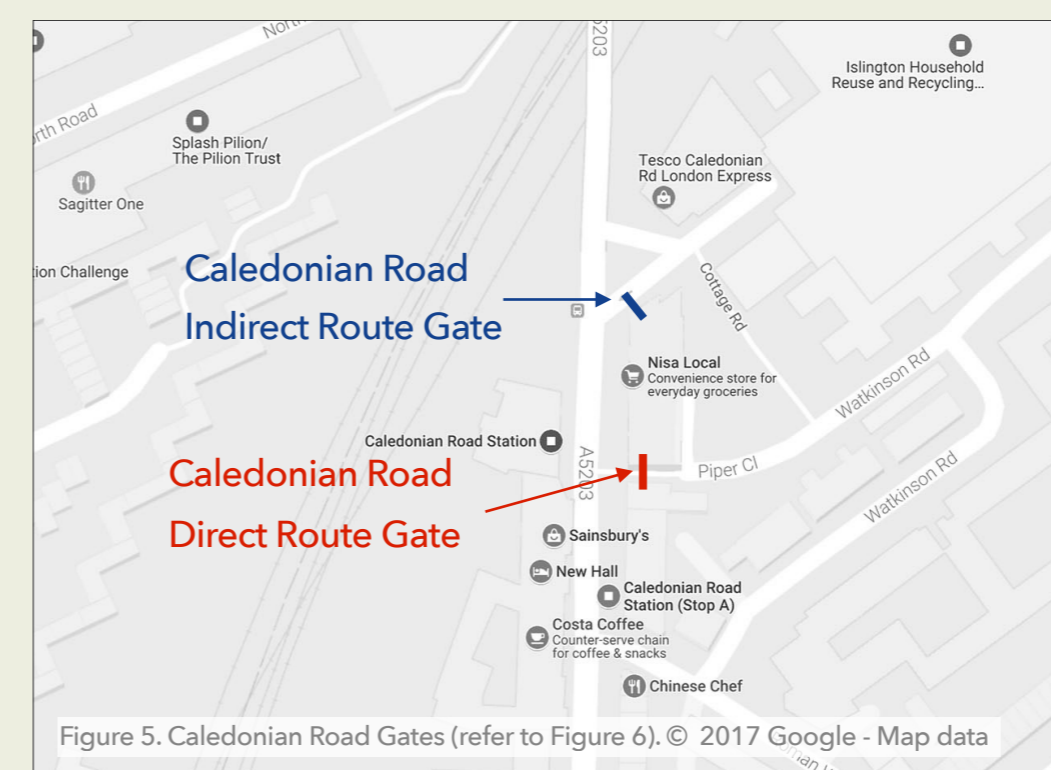


Figure 5. Caledonian Road Gates (refer to Figure 6). © 2017 Google - Map data

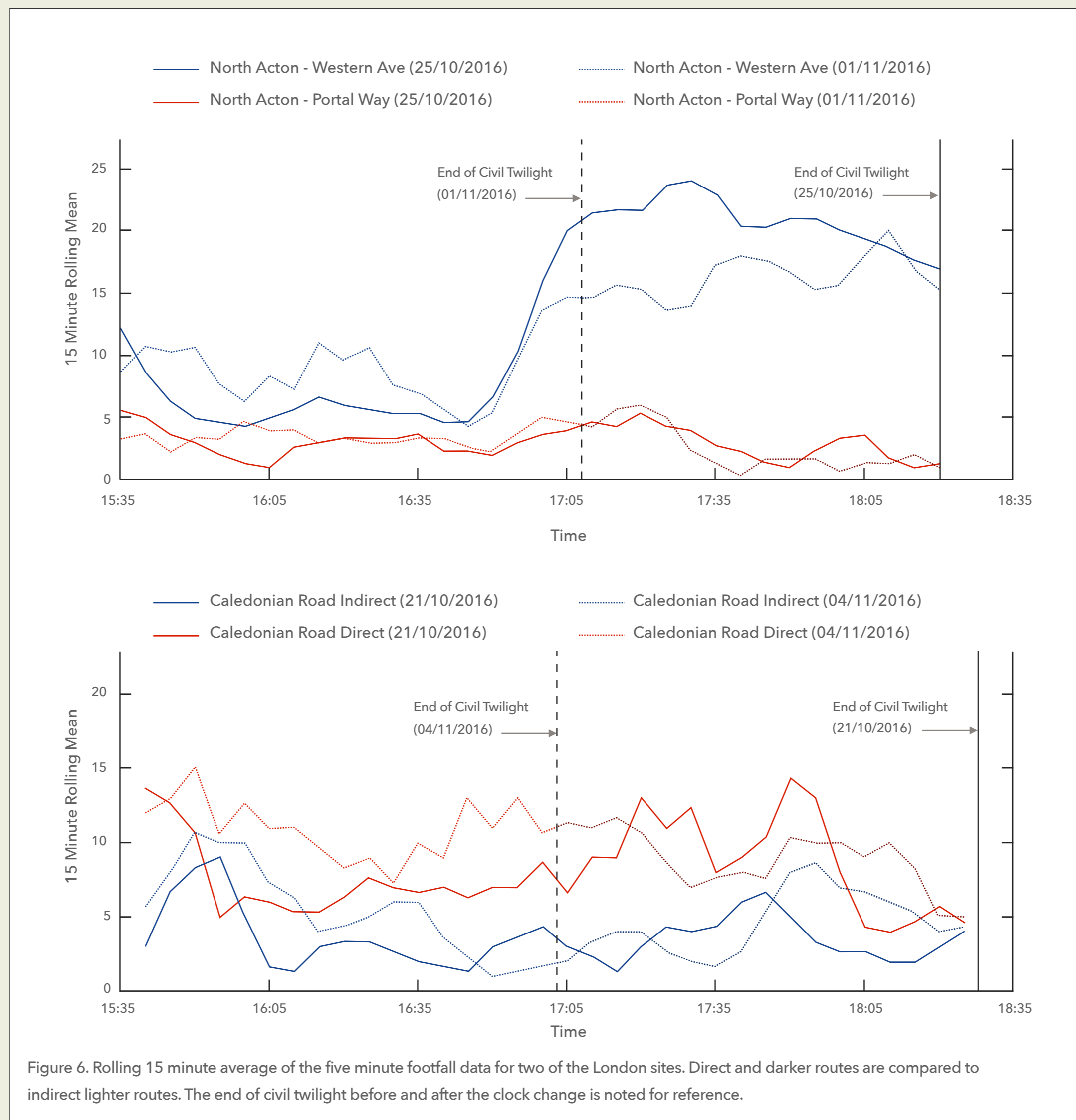


Figure 6. Rolling 15 minute average of the five minute footfall data for two of the London sites. Direct and darker routes are compared to indirect lighter routes. The end of civil twilight before and after the clock change is noted for reference.

Summary of Findings

In general, there were lower footfalls in the period of darkness (i.e. t2 post clock change). The percentage changes were largest around Russell Square.

(1) Individual sites before and after the clock change.

On eight of twelve sites there was an increase in footfalls after the clock change for the total time period of counts (t1 and t2). Three of the four remaining sites had a total footfall percentage decrease of more than 10% after the clock change. These were also the quietest routes with overall footfalls of no more than 111 per hour. Footfalls on the other routes ranged from 294 to 3203 per hour.

On nine of twelve routes* the percentage decrease in footfalls after the clock change was greater in t2 compared to t1, showing the possible influence of the change of end of civil twilight time. This means that relative footfalls (t1 compared to t2) may be influenced by a decrease in illumination conditions. On five** of these nine routes, the percentage change was positive (higher footfalls after the clock change) in t1 and negative (lower footfalls after the clock change) in t2. In these locations this could demonstrate a change in route taking behaviour or that people change their commute (leave work earlier) after the clock change.

(2) Pairs of sites with a variation in lighting condition

On closer examination of the ratio of people taking the direct (darker) to indirect (lighter) route in t1 and t2 there is a trend for a relative increase in people taking the indirect lighter routes in t2 after the clock change (in 4 of 6 street pairs***).

*The three routes on which this was not the case were all sides of Russell Square.

**Russell square garden, Drummond Street, Marylebone Lane and Western Avenue and Portal Way in North Acton.

***The two exceptions were an example of dense sites (sky angle less than 20°, compared to other sites which had a sky angle of 40°-150°) and an out of city centre location in North Acton.

Table 2. Total footfall counts within time periods t1 and t2 pre- and post- the autumn clock change. t2 post clock change is the only dark time period.

Site/route	t1			t2		
	pre	post	% change	pre	post	% change
Russell Square Garden (south)	861	616	-28	1047	679	-35
Russell Square South East	487	415	-15	601	576	-4
Russell Square North West	87	62	-29	115	97	-16
Russell Square North East	84	47	-44	94	69	-27
Russell Square Garden (north)	380	468	23	619	453	-27
Hampstead Road	55	56	2	46	33	-28
Caledonian Road Indirect	45	65	44	42	55	31
Caledonian Road Direct	93	132	42	105	106	1
Marylebone Lane	392	513	31	538	499	-7
Jason Court	235	313	33	271	319	18
North Acton - Western Ave	97	112	15	258	199	-23
North Acton - Portal Way	40	43	8	35	31	-11

Limitations

London is a busy environment and the "gates" captured many people taking different routes which may not have been direct/indirect depending on their destination.

Other factors may have been at play, i.e. some measurements taken over half term, the weather could have influenced the results, etc...

Lighter/darker judgements were made by visual assessments only. This is an exploratory study therefore photometric measurements were not made.

Further work

Further work should investigate whether illumination conditions influence a pedestrian's decision to take a quieter street after the clock change and the impact of the street geometry and the night time economy on route taking decisions.

It would be useful for Local Authorities to know whether there is an absolute level of darkness below which pedestrians will avoid a route, even if the area is urban with high footfalls.

Acknowledgements

Current students studying for MSc Light & Lighting collected all the data presented as part of a research exercise in Module BENVG63.

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