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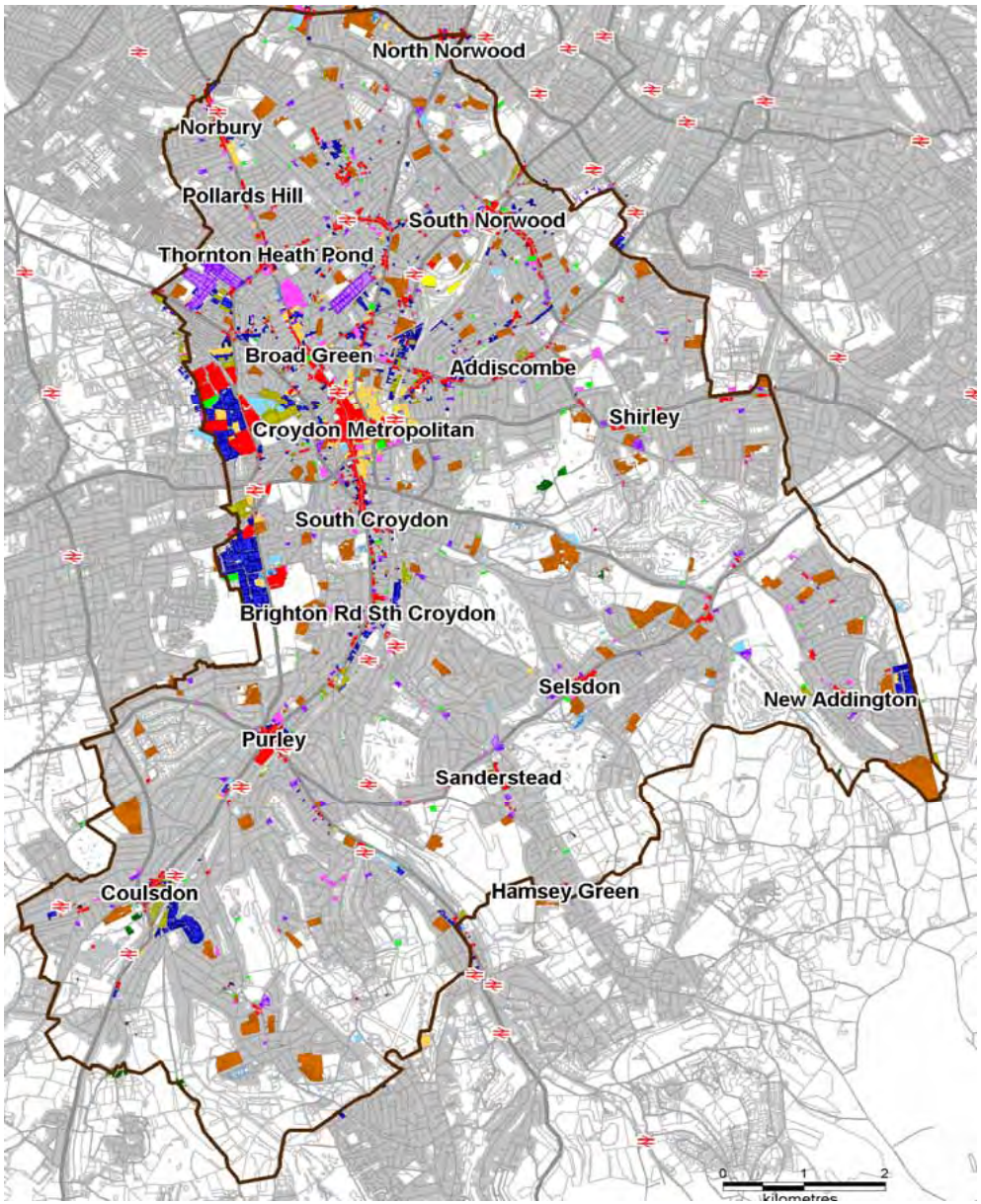
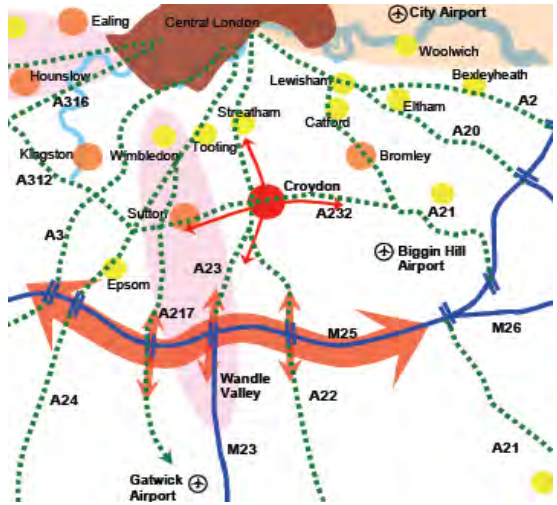


7th International Space Syntax Symposium



Thematic Seminar - Accessibility

Profiling land use location with Space Syntax

angular choice and multi metric radii

Outer South London – London Borough of Croydon

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Space Syntax

In this thematic discussion on accessibility, we thought it would be refreshing to show images of land use distribution of outer London (suburban) in conjunction with Space Syntax geometric analyses. This is a work in progress. As such it is a good support for this thematic discussion on accessibility. The focus is multi-scale accessibility i.e. multi-modal. The spatial extent is sub-regional. A preliminary conclusion is that Space Syntax angular analysis at multi metric radii seems a good tools to understand land use spatial distribution and transport logic.

We like to pose five questions that could expand our discussion and frame future research:

1. Accessibility for who? The distributional* effect question

- on the demand side, we know that income level, education, age, health have great impact on accessibility capability,

2. How land use type, the supply side, locates?

3. In what way land use type co-locate or not?

- i.e. what are benefit and disbenefit level of agglomeration?

4. At what range and for whom changing accessibility has the greater additional and distributional effect?**

5. In what way the accessibility indices are seamlessly usable from policy maker to spatial designer and monitoring?

*** Distributional effect: the concern for the distribution of accessibility benefit/disbenefit. How are they distributed across different social group; who gain more and who gain less, who pays more who pays less relative to resources, who contribute more or less in relationship to negative externalities (pollution, congestion etc.)**

**** Additionality: extent to which a new input adds to the existing inputs instead of replacing any of them and results in a greater aggregate**

London Borough of Croydon

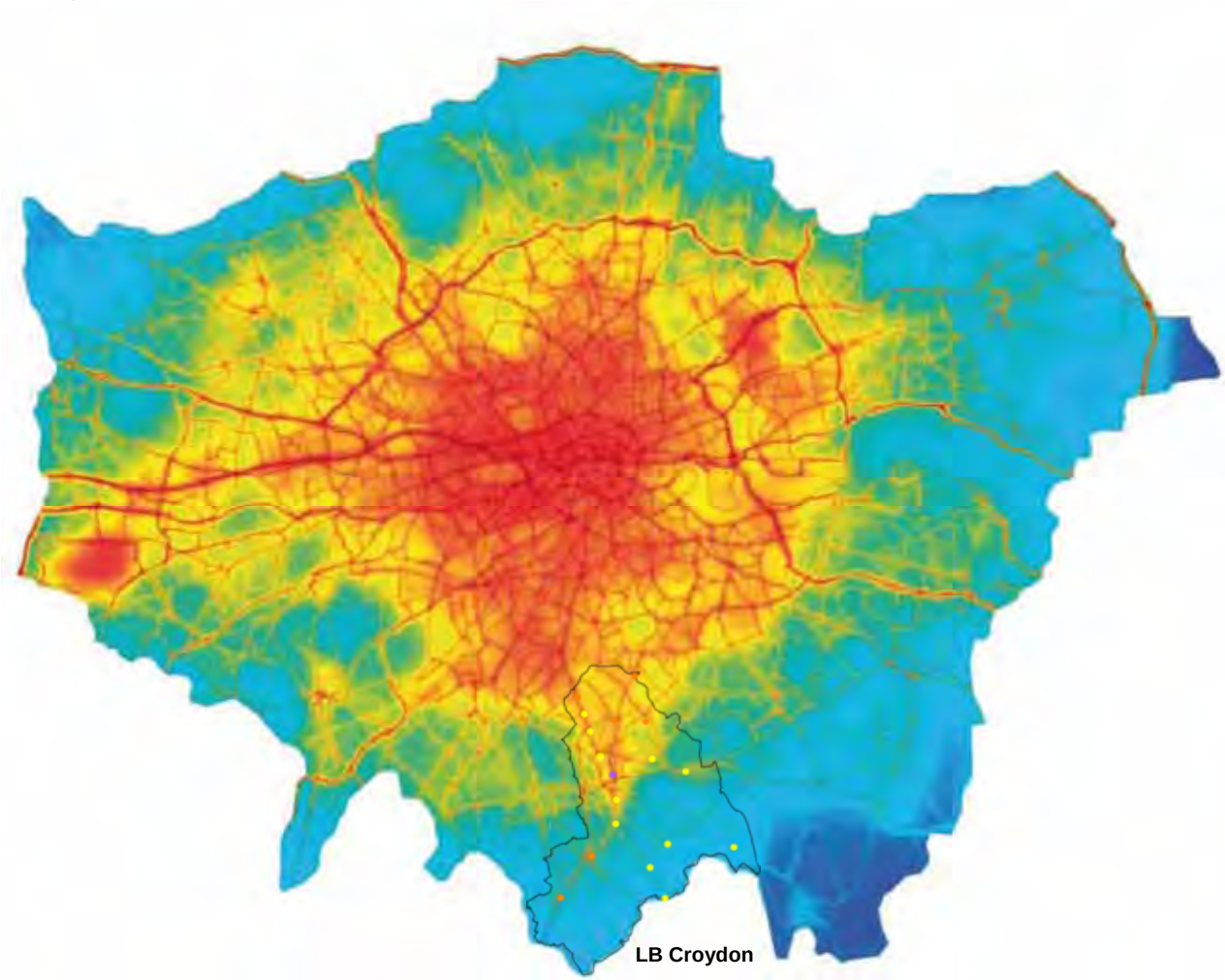
A quick portrait

population density

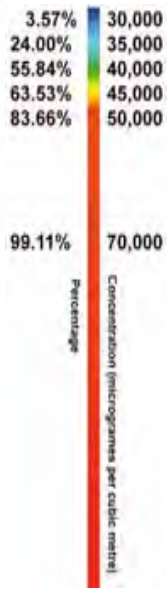
household weekly expenditure

Garden plot area

Greater London – London Borough of Croydon – outer london, mainly suburban



Annual mean nitrogen dioxide NO2 concentration (um-3) (2003)

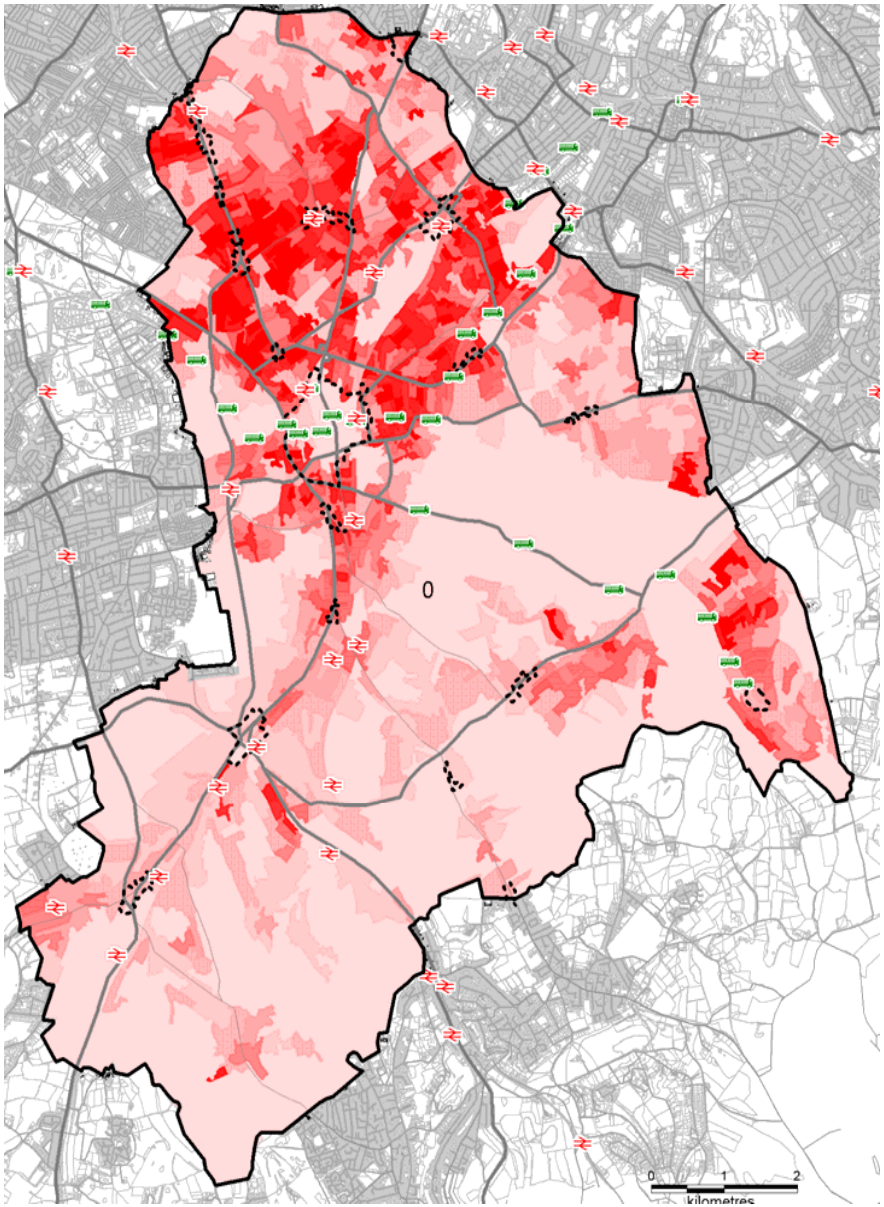


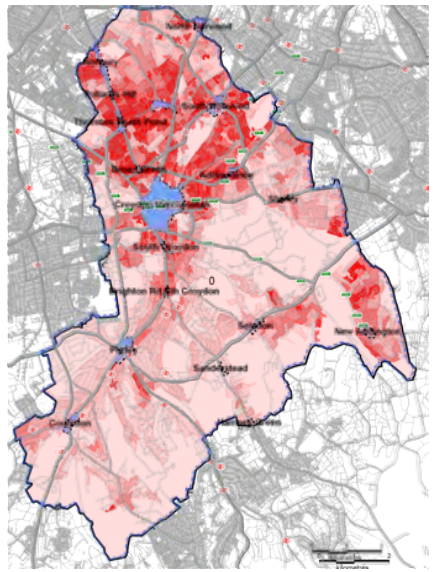
- Metropolitan
- District
- Neighbourhood

The Greater London map shows airborne pollution due to vehicular traffic (including buses). The map show that it is the area that has least level of car ownership and the highest residential densities that are most polluted. While the area that have the highest level of car ownership, the highest level of green space and largest family size are much less polluted (the area in dark, light blue, green shades)

Pollution Map (GLA, 2003)

Population Density - People per Ha





Rail

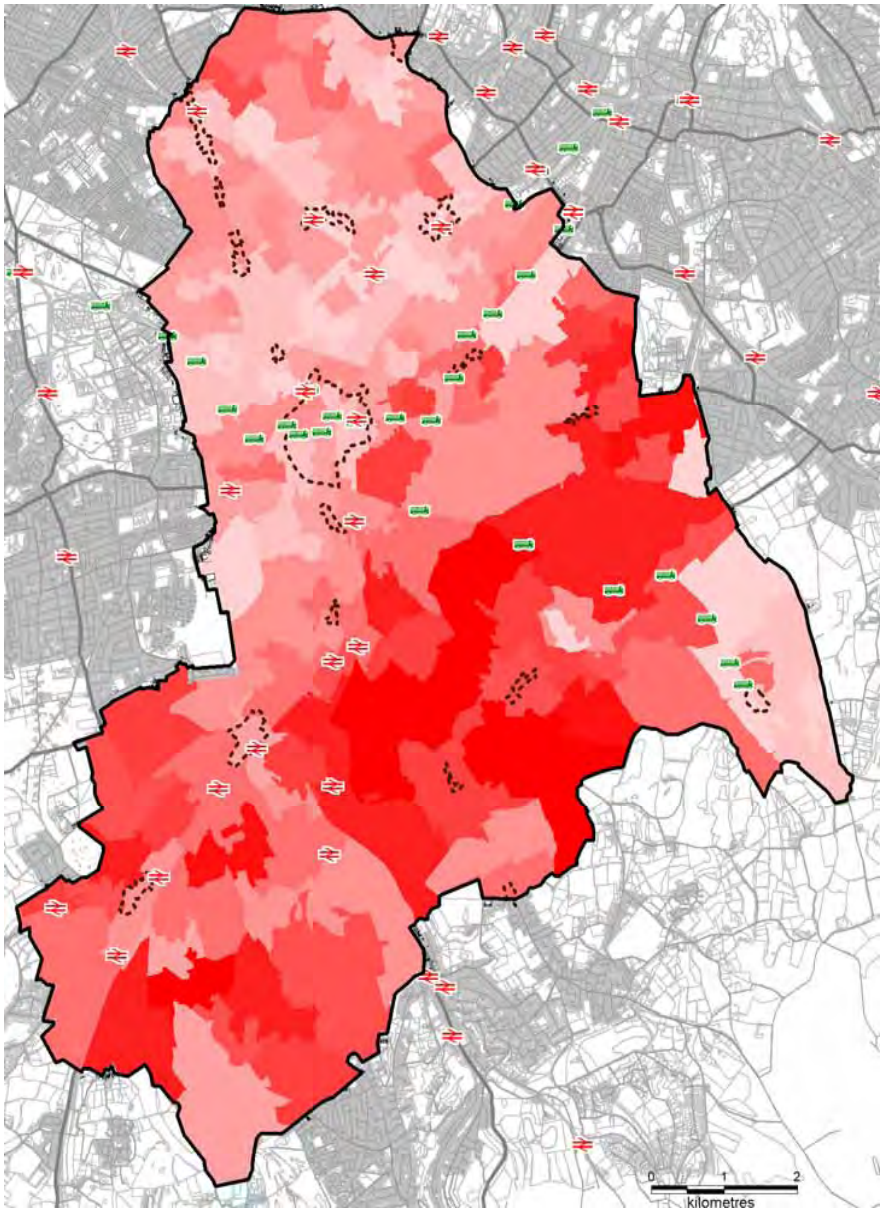
TRAM LINKS

Croydon CENTRES

Population Density km sq

122	to	386	(143)
106	to	122	(113)
93	to	106	(106)
80	to	93	(106)
70	to	80	(95)
58	to	70	(109)
47	to	58	(105)
35	to	47	(109)
23	to	35	(112)
3	to	23	(114)

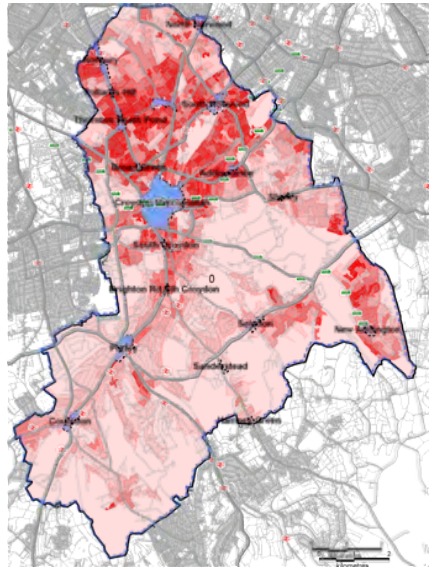
Average weekly household expenditure 2001 Census



people/ha

high

low

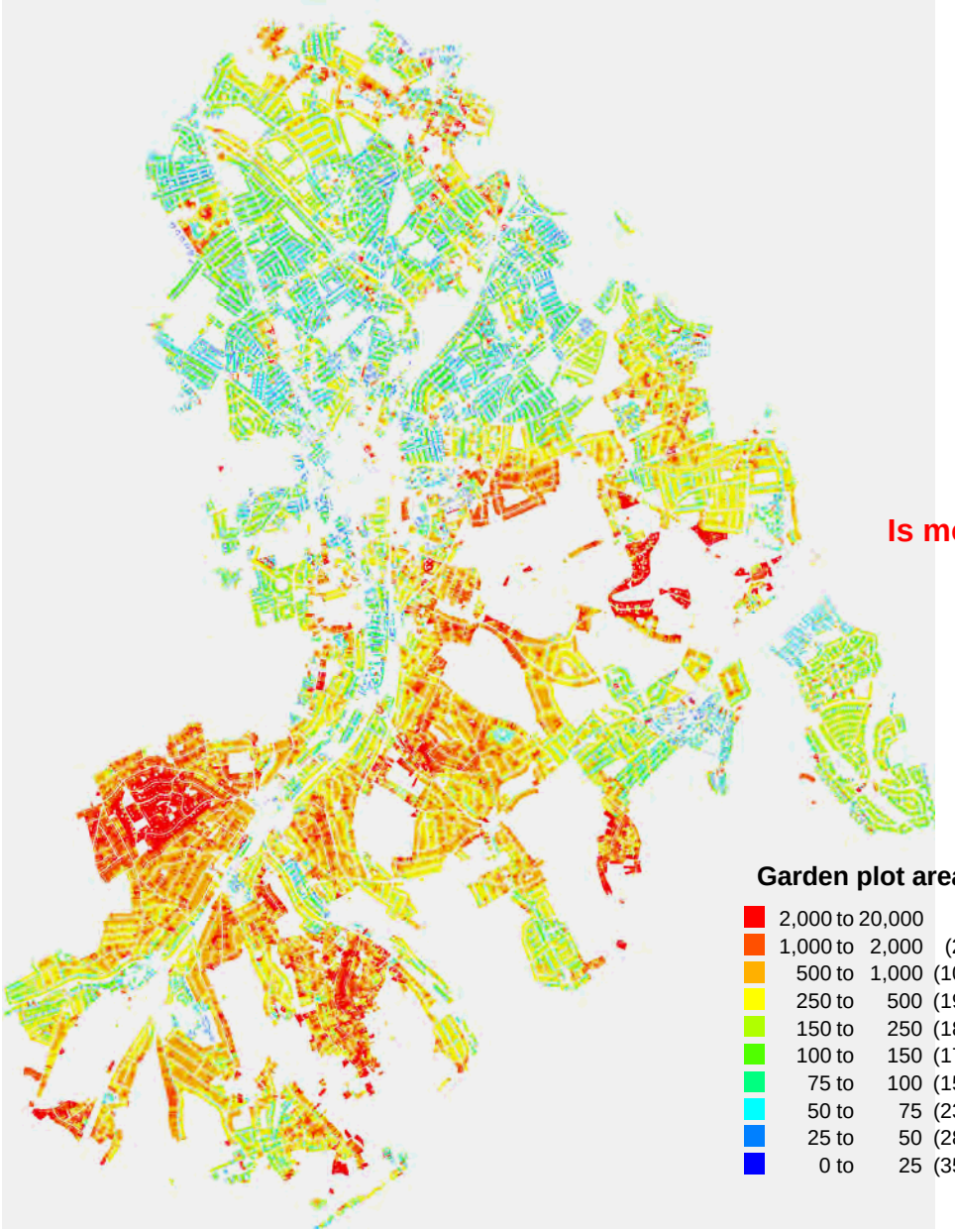


expenditure and density are inversely related

average weekly expenditure

93,129	to101,760	(32)
84,498	to 93,129	(18)
75,867	to 84,498	(43)
67,236	to 75,867	(75)
58,605	to 67,236	(67)
49,973	to 58,605	(131)
41,342	to 49,973	(215)
32,711	to 41,342	(203)
24,080	to 32,711	(189)
15,449	to 24,080	(139)

Garden plot area

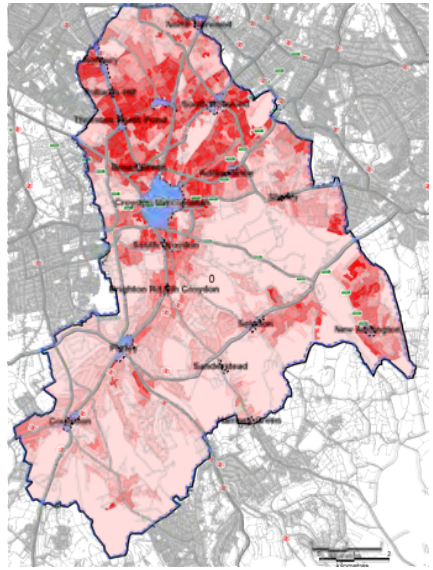


Is more garden space a substitute of accessibility?

people/ha

high

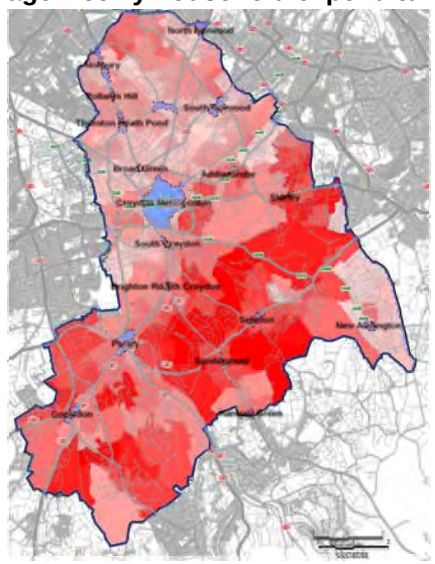
low



average weekly household expenditure

high

low



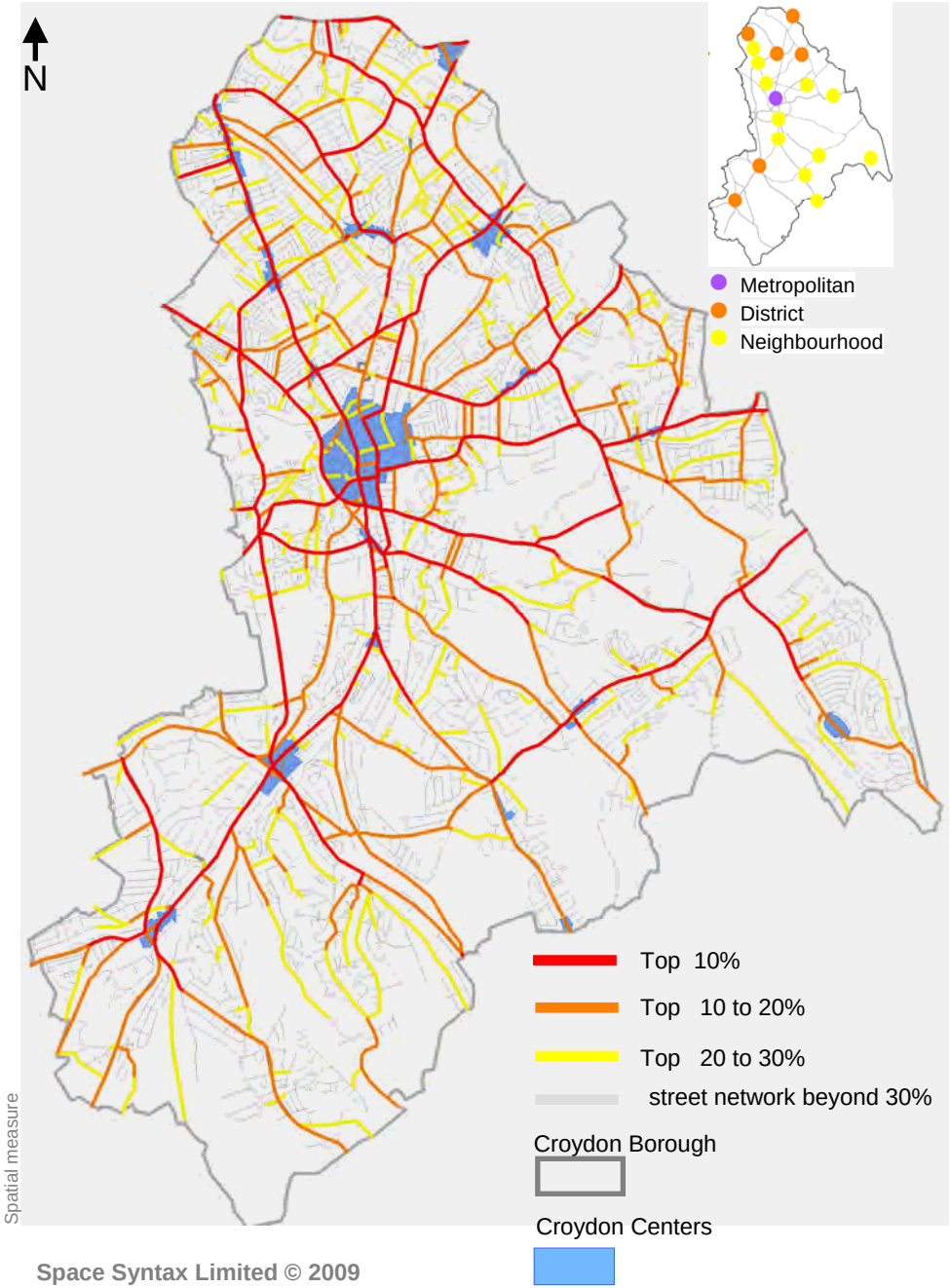
London Borough of Croydon

angular choice and centre

The following slides show space syntax angular choice analysis for the London Borough of Croydon at different metric radii global (10 km), mid level (5 & 2 km) and local (800 & 400 m).

The hierarchy of centre (metropolitan, district and local) is shown as underlay.

Spatial accessibility Top 30% angular choice, metric radius 10,000m



Centre

All centres are located on the top 10% (red) except New Addington to the East (10-20% in orange.

Trip

In London 48% of trip start and finish in Outer London.

Car

In Outer london 50% of trip were wholly by car (driver or passenger).

Inner London (25%)

Travel distance

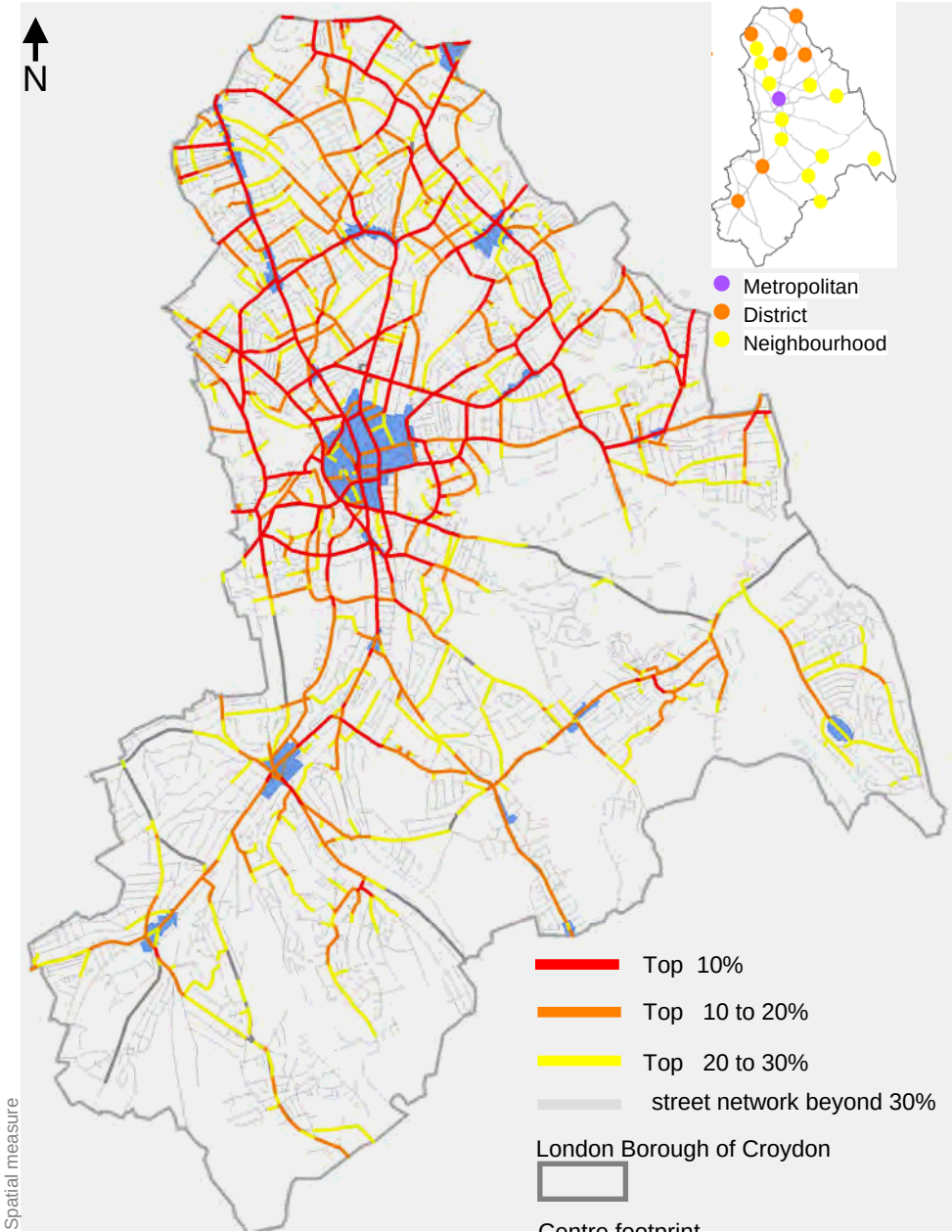
East Inner London – average 8 km/day average

West inner London – average 18 km/day

Outer London – 19 km/day average

Travel in London Report number 1 – TfL 2009

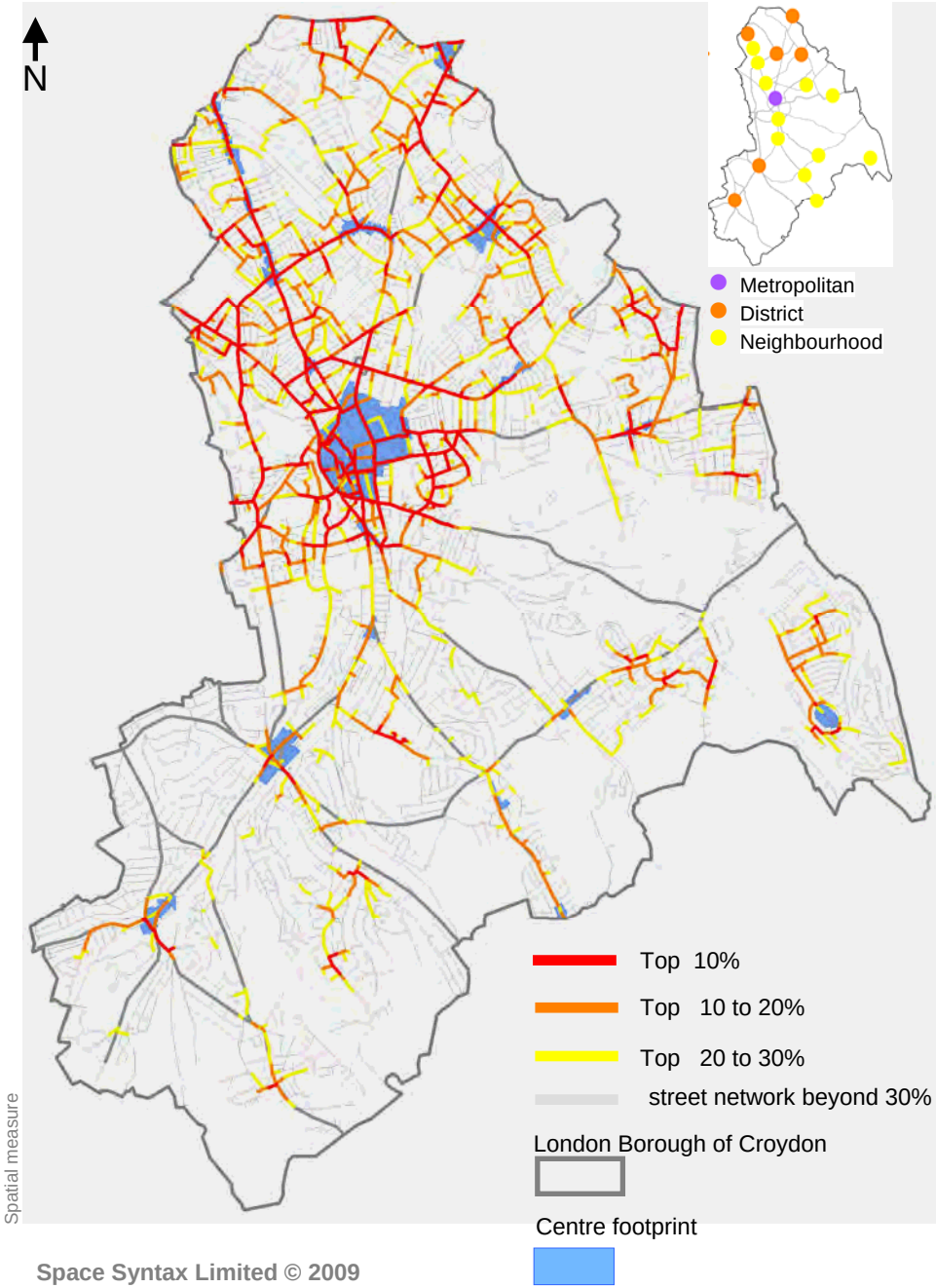
Spatial accessibility Top 30% angular choice, metric radius 2,000 m



Centre

All centres are located on the top 10 to 30% (red to yellow)

Spatial accessibility Top 30% angular choice, metric radius 800 m



Centre

Centres are supported by a variety of spatial attributes. Their growth is not dependent on a specific set of spatial advantages but can be generated by multiple and diverse combinations of local, intermediate and global accessibility and land use mix and intensity.

Most centres are locally accessible but not exclusively

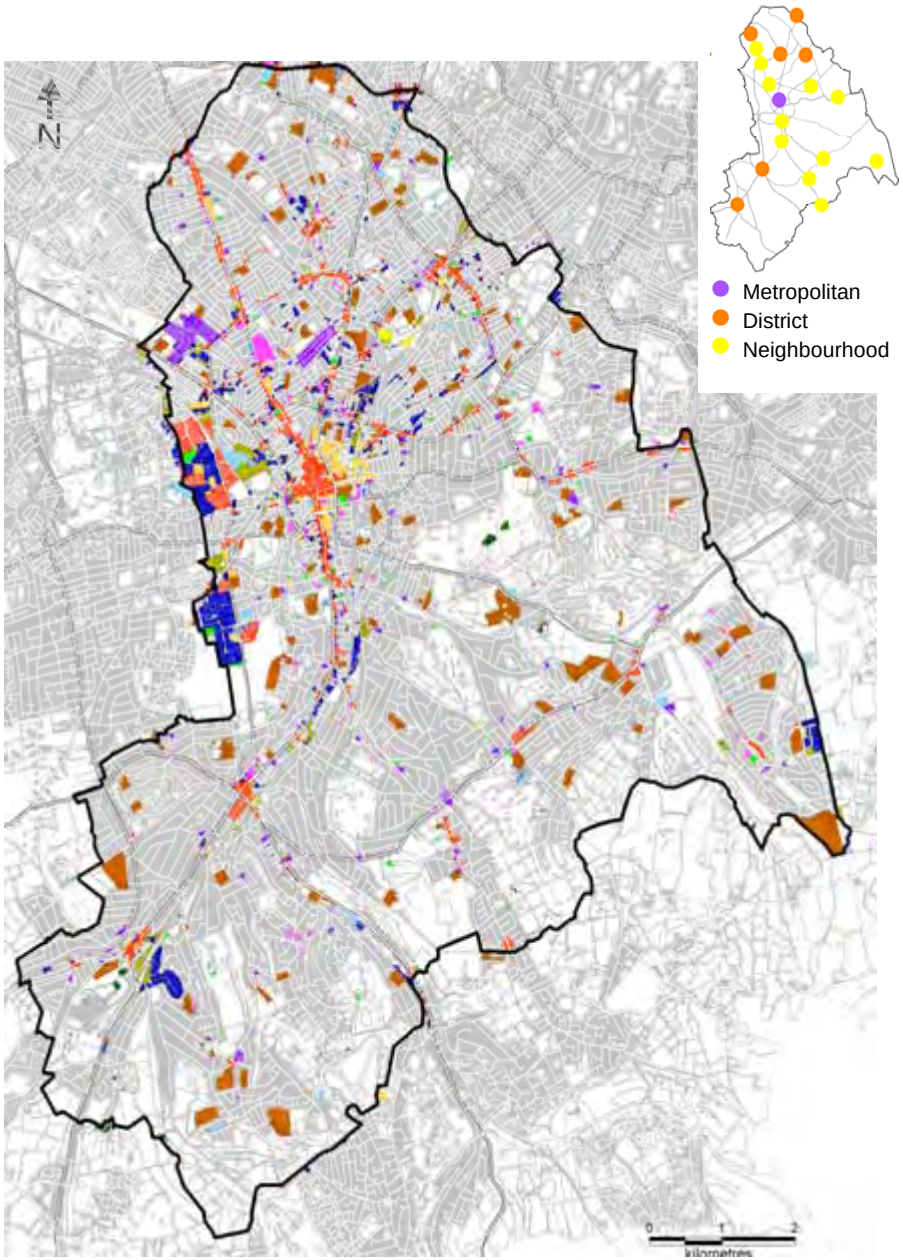
Centres can form from consistency of access across all scales or from extreme advantage within a select number of scales. This profile of spatial advantage has implications for the character of land use and urban quality within a centre.

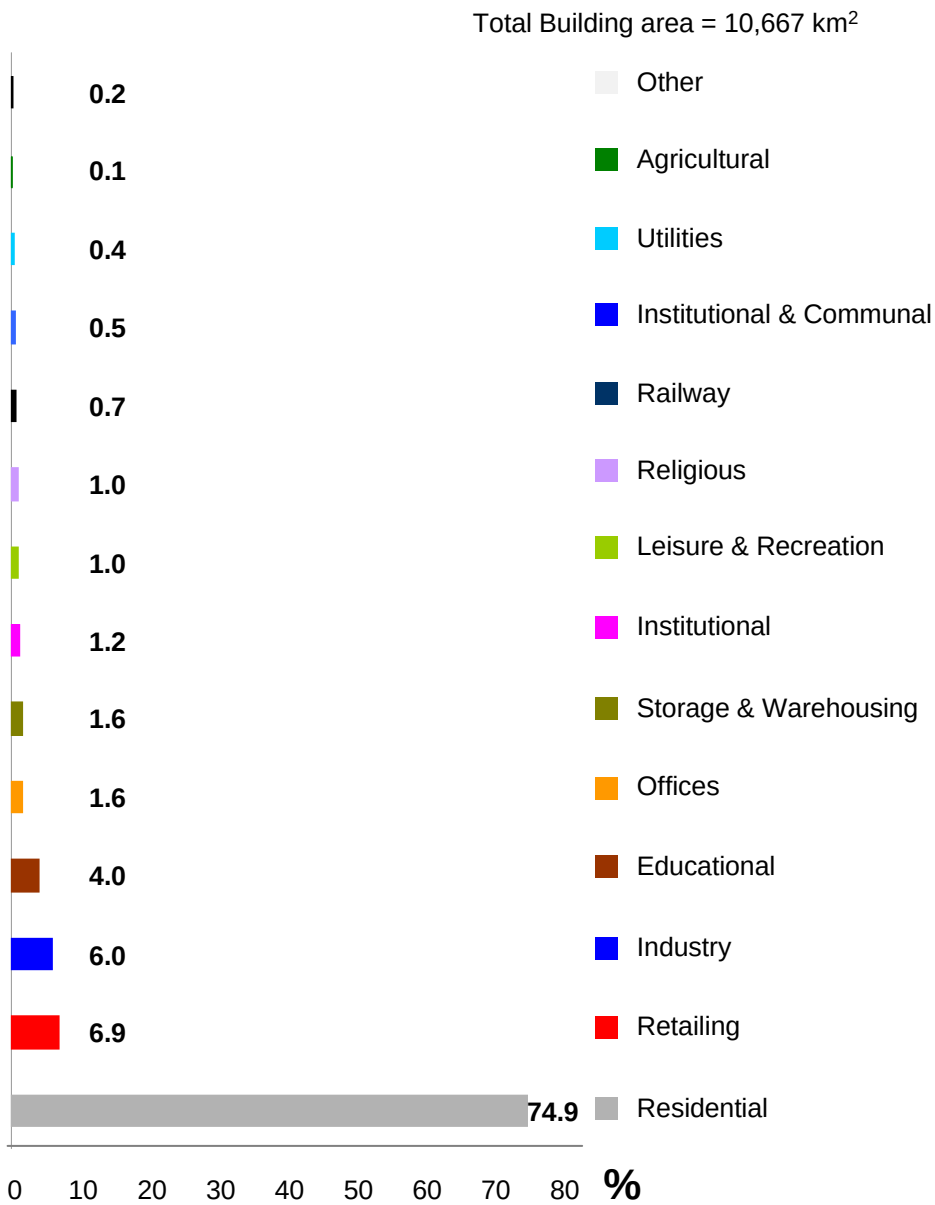
Local accessibility is co-produced from local population density, employment density, land use mix and layout. Their interaction is not fully understood.

Centre growth is limited by capacity and congestion

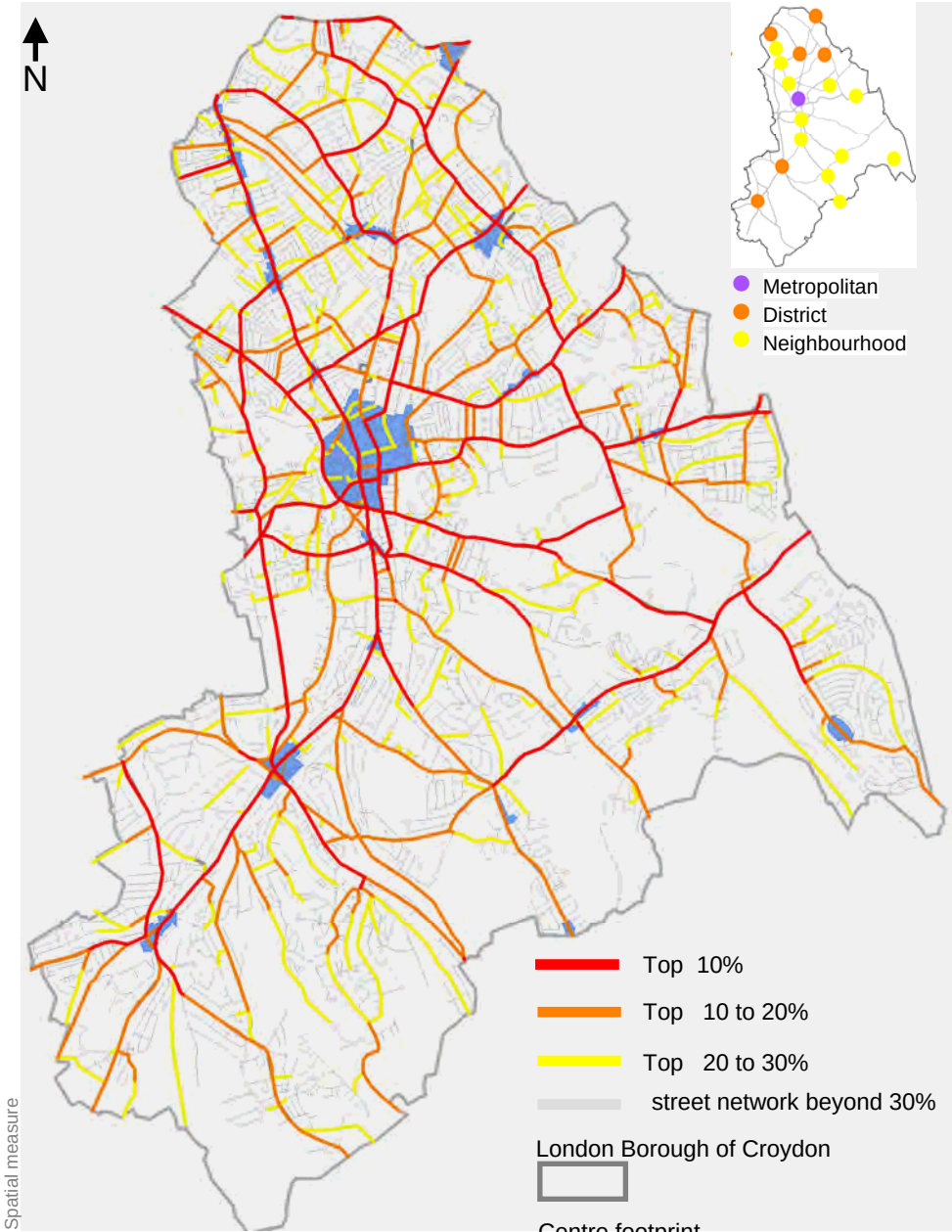
How do we account for centre spatial competition and taste for diversity?

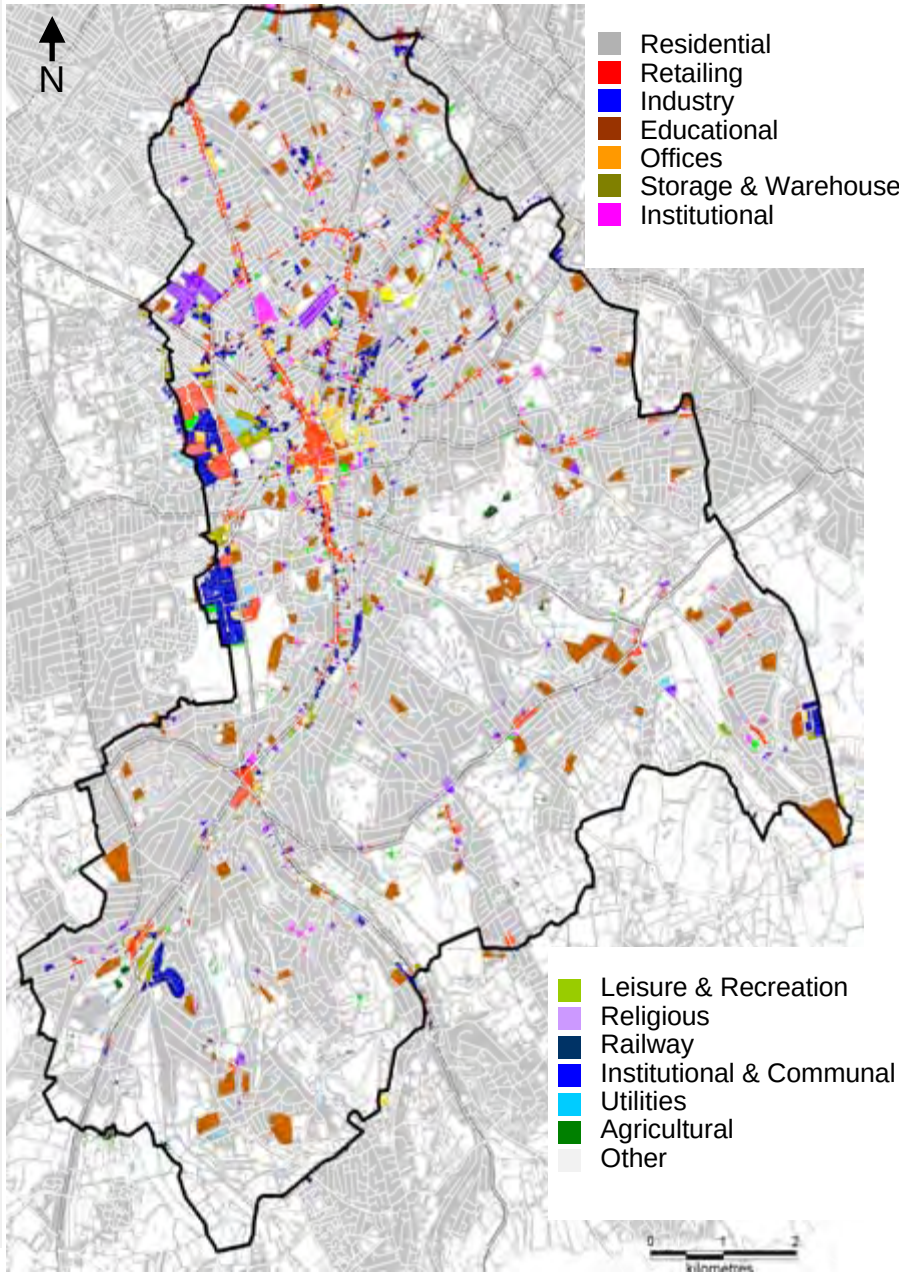
Land use footprint constitutes 12.11% of total land area





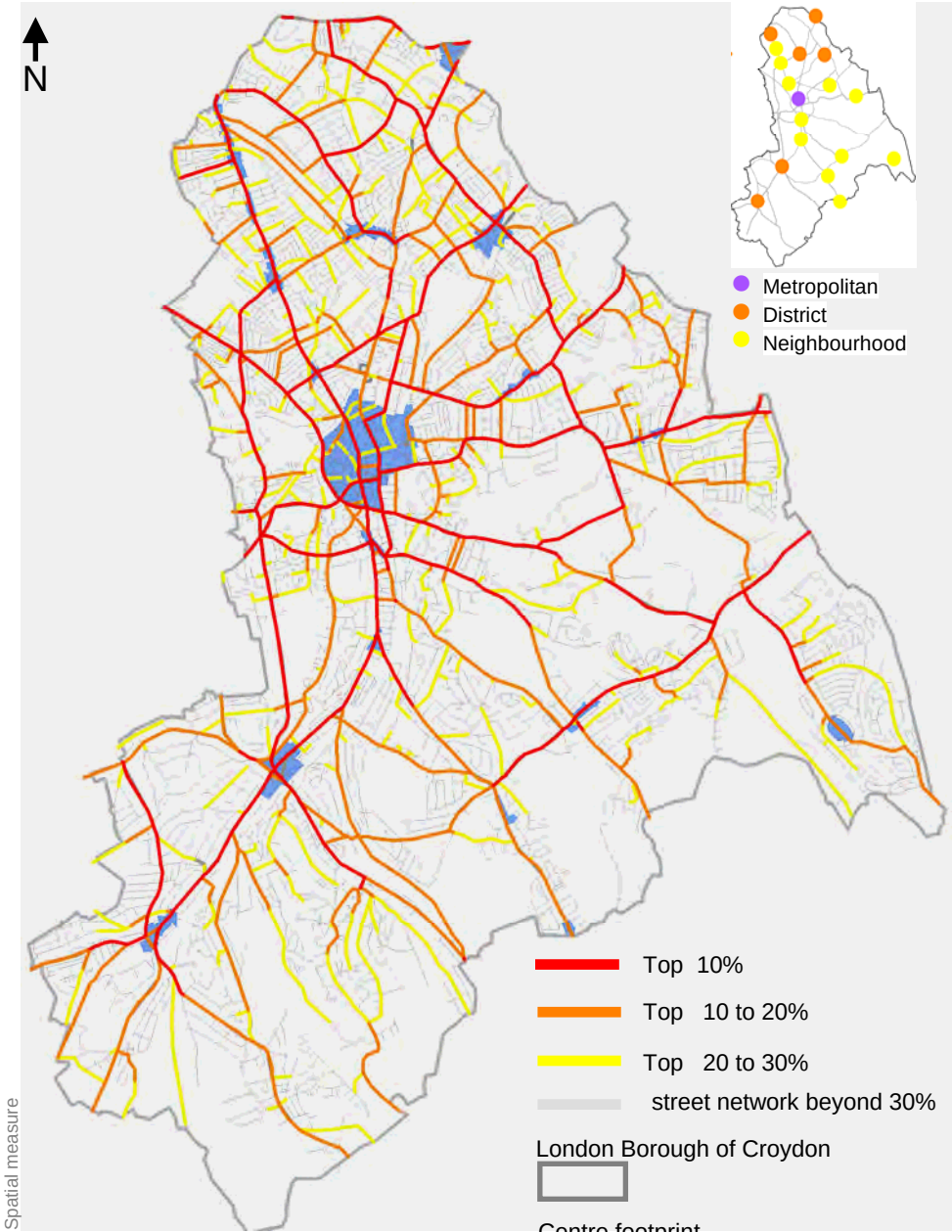
Spatial accessibility Top 30% angular choice, metric radius 10,000m – Land use

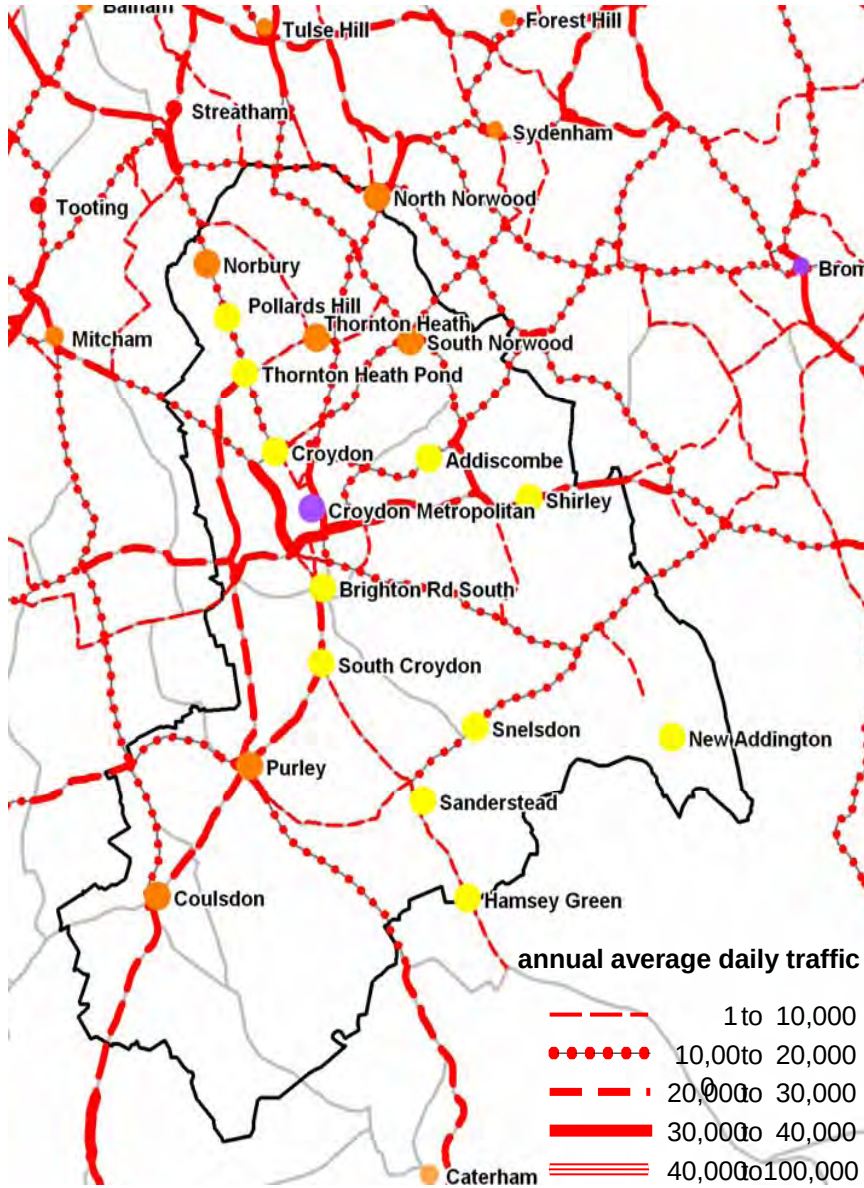




Spatial measure

Spatial accessibility Top 30% angular choice, metric radius 10,000m – Traffic - aadt

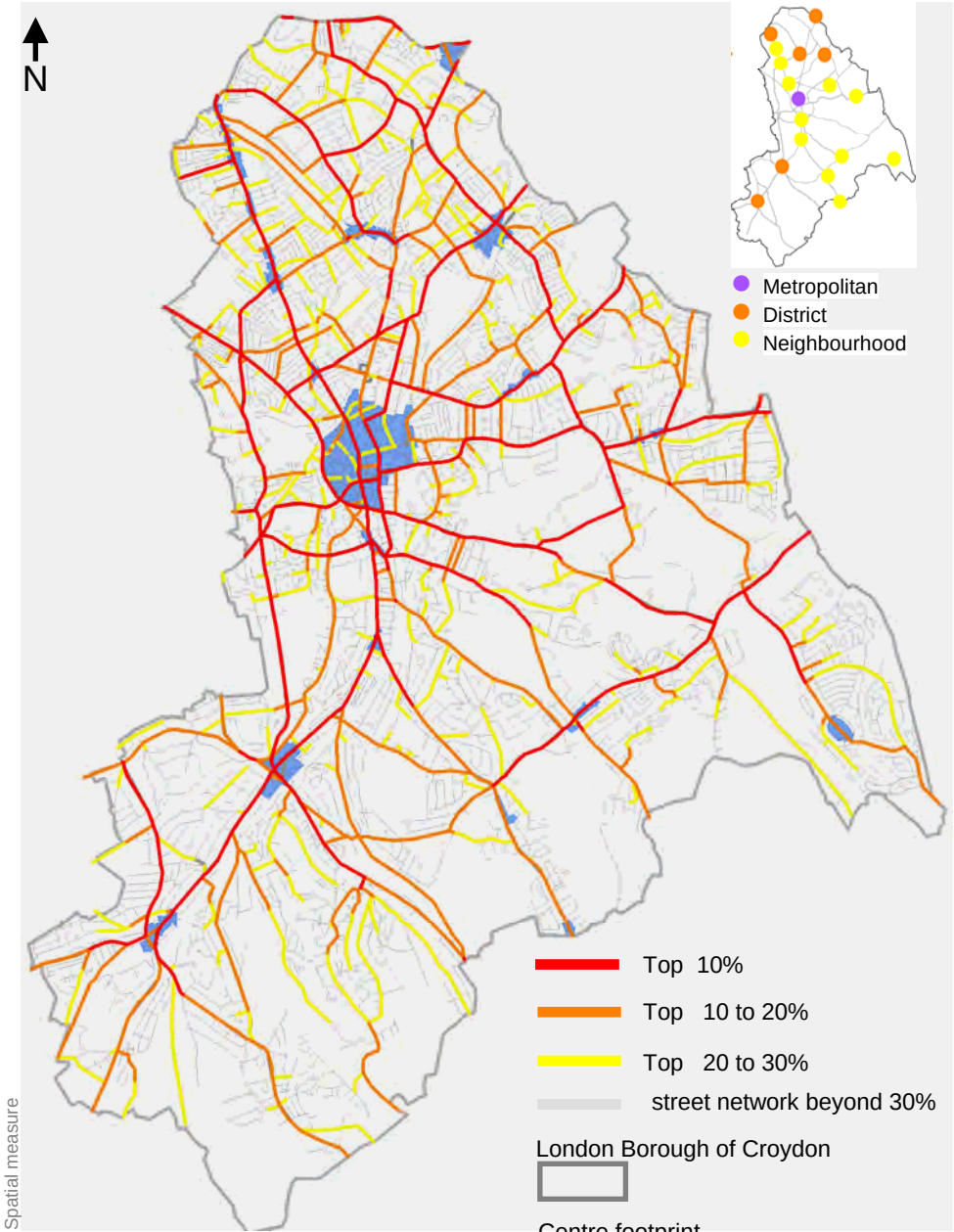




Spatial measure

UrbanBuzz i-Valul LB Croydon

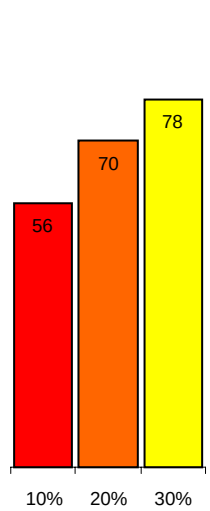
Spatial accessibility Top 30% angular choice, metric radius 10,000m – Traffic - aadt



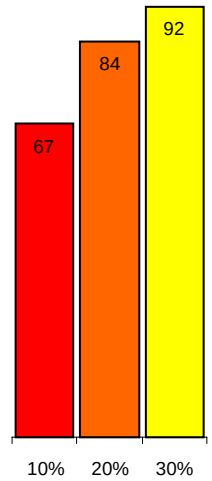
The bar charts below show the percentage of aatd according to top 10%, 10 to 20% and 20 to 30% angular choice metric radius 800 m, 2,000 m and 10,000m.

In LB Croydon, aadt data is collected on 11% of the road network

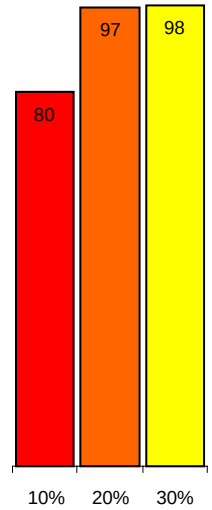
Total Car flow count is 1,868,472 annual average daily traffic



angular choice metric radius 800m

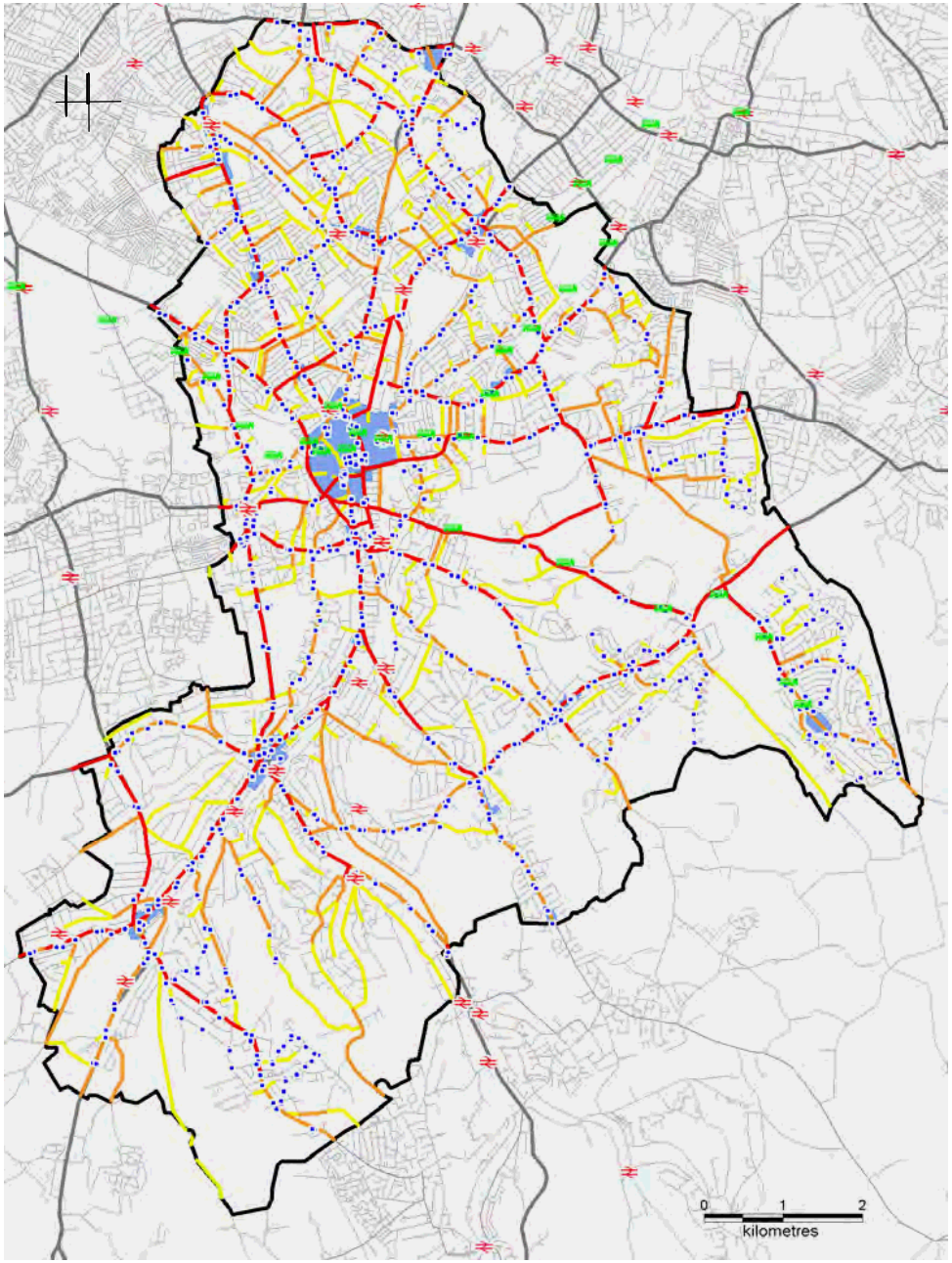


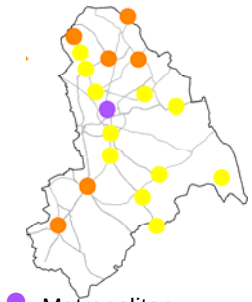
angular choice metric radius 2,000m



angular choice metric radius 10,000m

Top 30% angular choice, metric radius 10,000m – Public transport

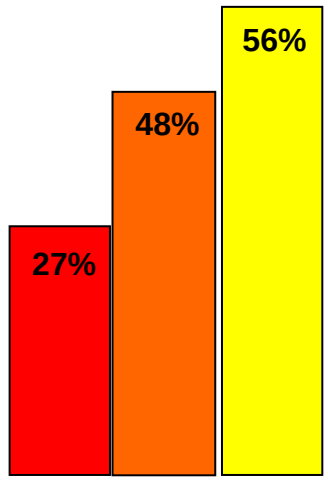




Metropolitan
District
Neighbourhood

Top 10%
Top 10 to 20%
Top 20 to 30%
ITN
Tram stop
Train station
Bus stop

Percentage of bus stop



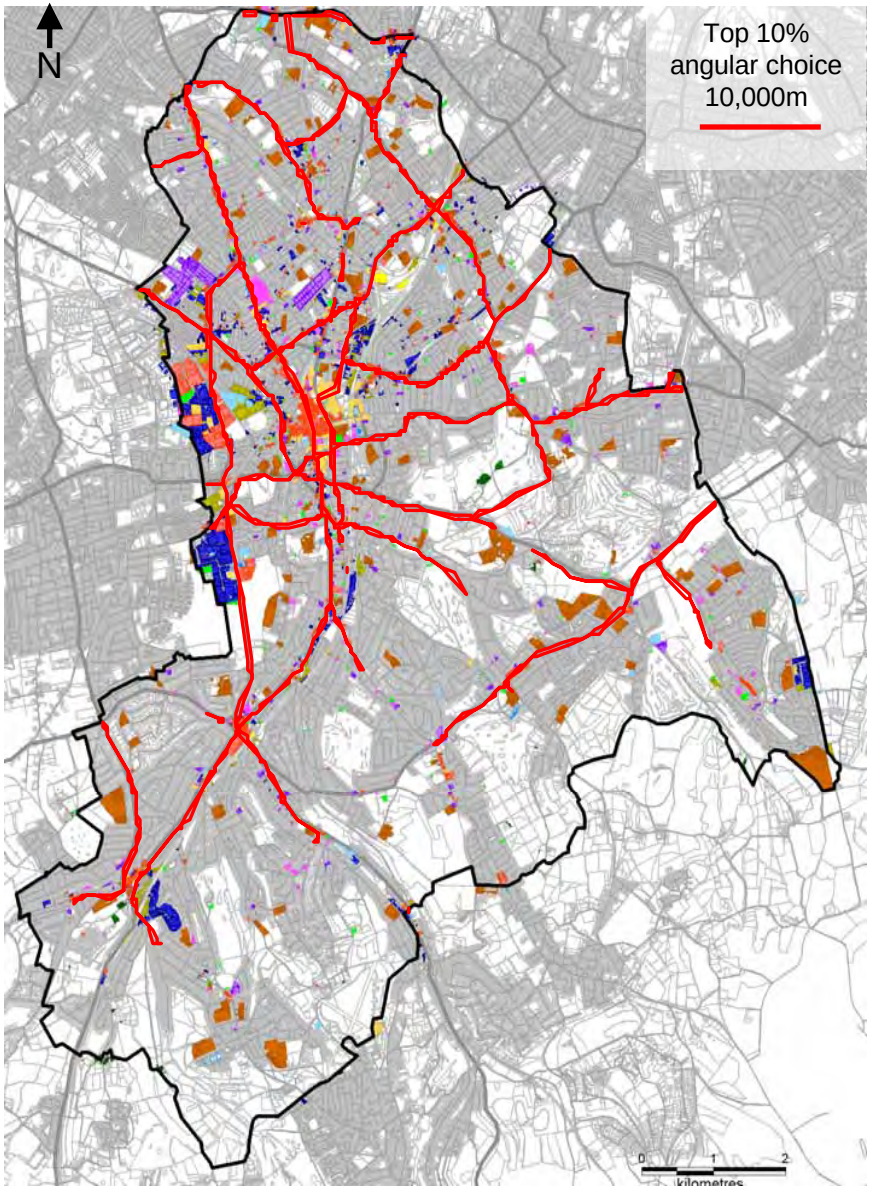
angular choice 10,000 m top 10% 10 to 20% 20 to 30%

London Borough of Croydon

angular choice multi radii
by land use type location

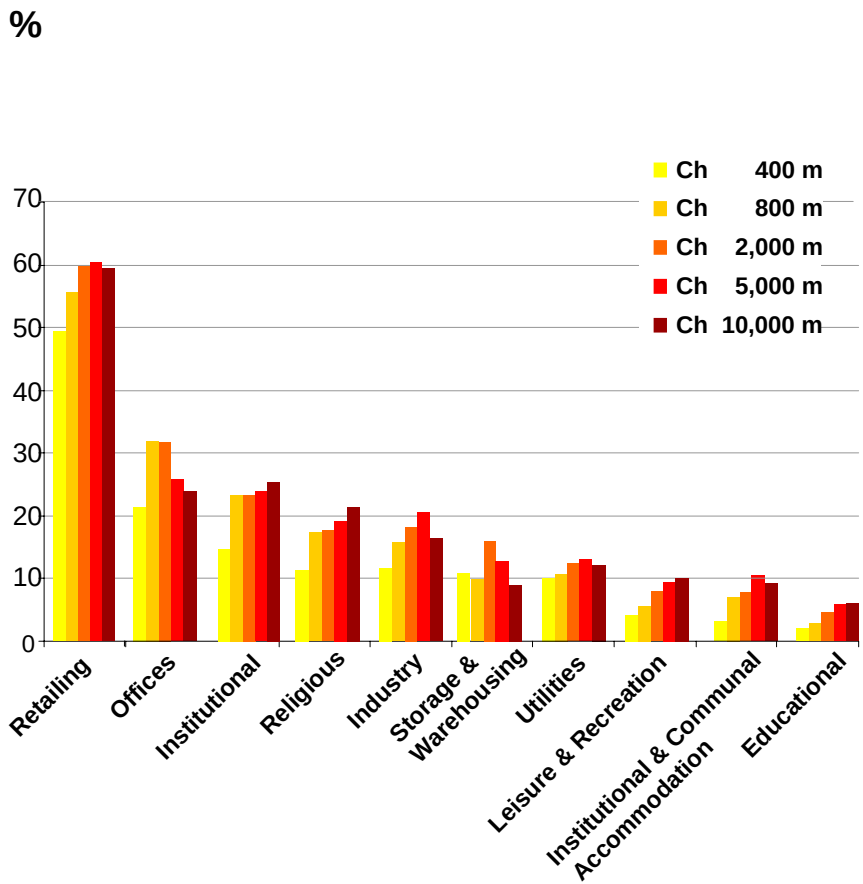
The following pages show the main land use groups which make up the Borough. The graphs have specific data selected in order to highlight particular values. A key observation is the higher the percentage the closer the land use type to the urban centre and Key movement routes.

top 10% angular choice – multi radii - % of LU occurrence

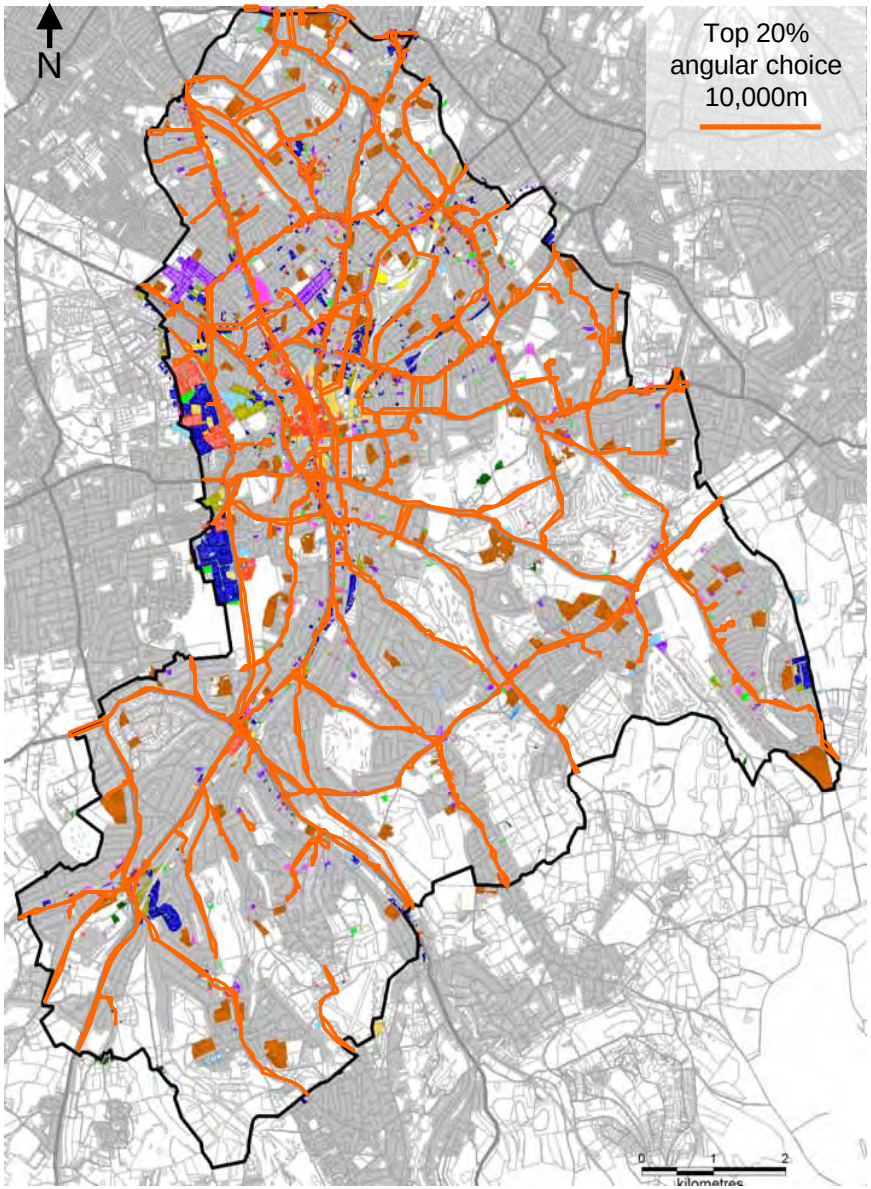


- The bar graph shows the percentage of LU type occurrence which are associated with the top 10% angular choice measure at 10,000, 5,000, 2,000, 800, 400 metric radii.

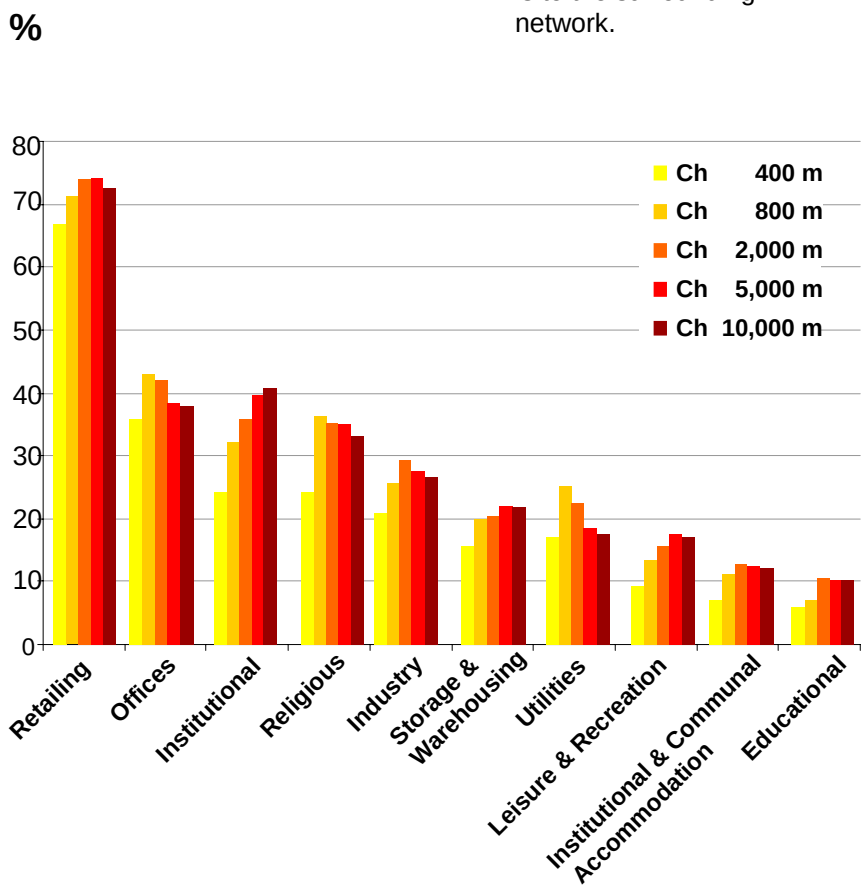
- The higher the percentage the more the land use type is related to spatial betweenness
- This bar graph gives angular choice trend of association with each land use type.



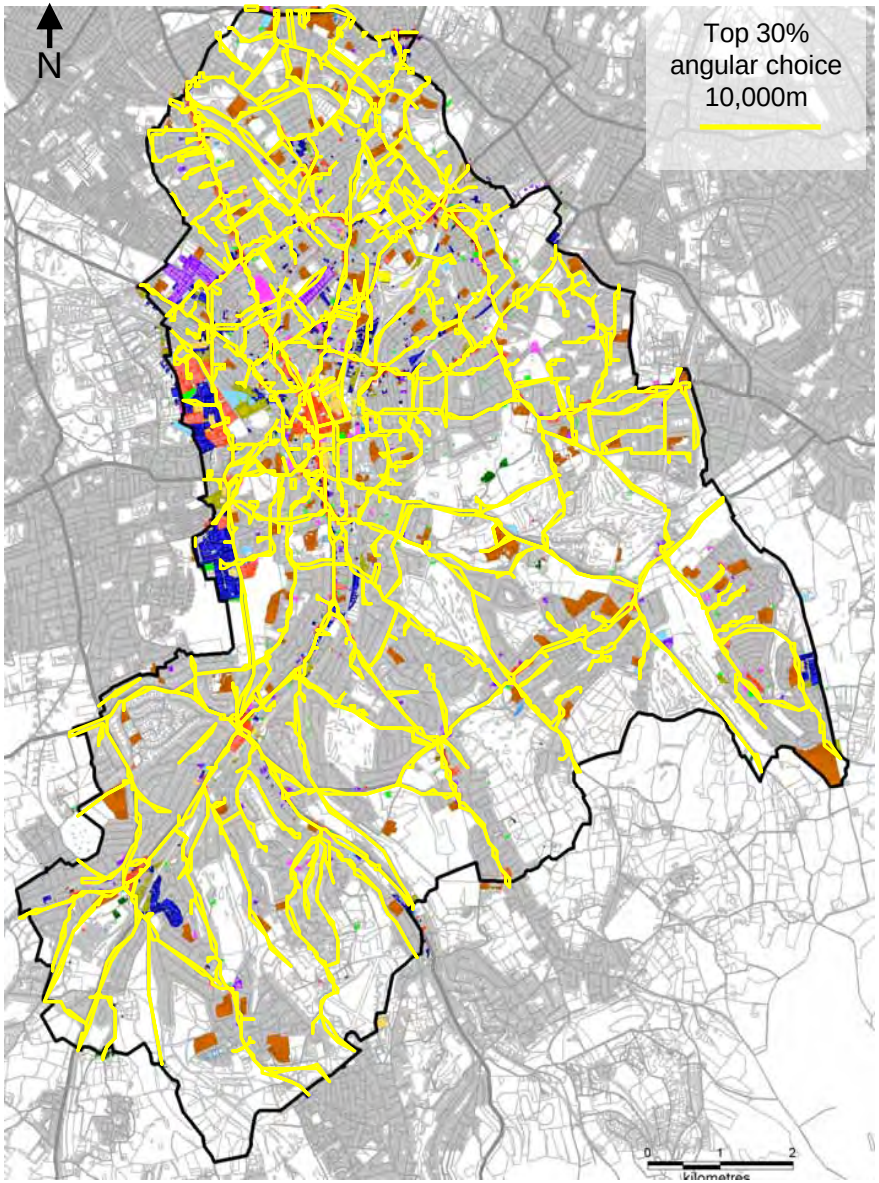
top 20% angular choice – multi radii - % of LU occurrence



- The graph shows the percentage of each building type captured by the top 20% route choice for each radii.
- The higher the percentage the more integrated the building type is to the surrounding network.



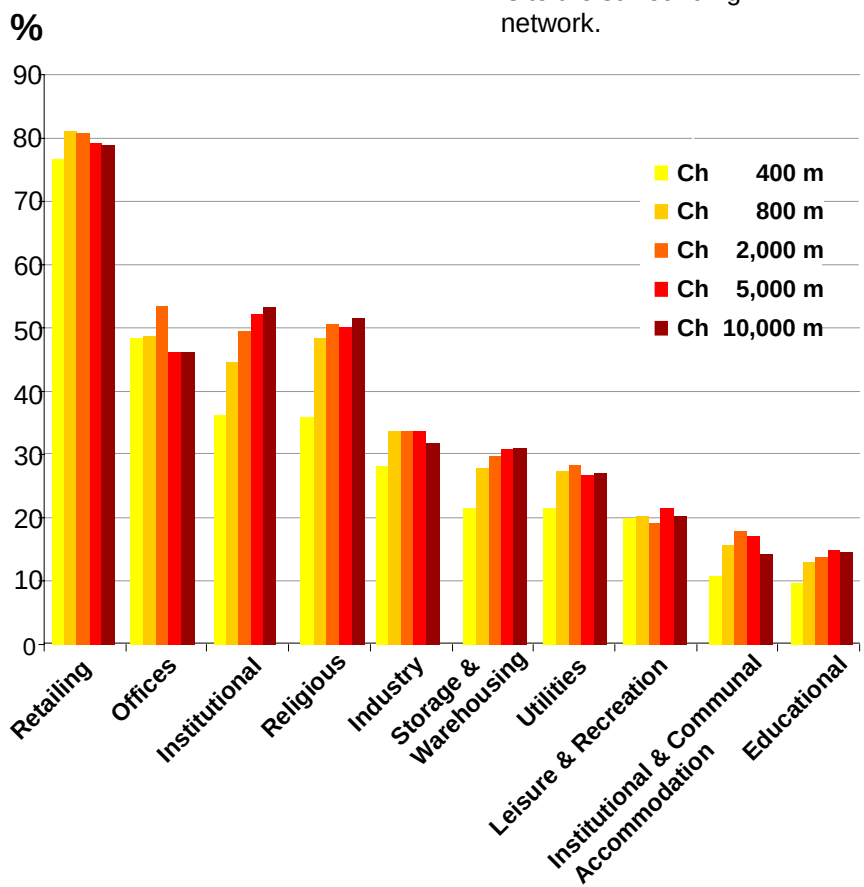
top 30% angular choice – multi radii - % of LU occurrence



- The Top 30% is the most accurate measure for defining a Land uses spatial attributes.

- The graph shows the percentage of each building type captured by the top 30% route choice for each radii.

- The higher the percentage the more integrated the building type is to the surrounding network.



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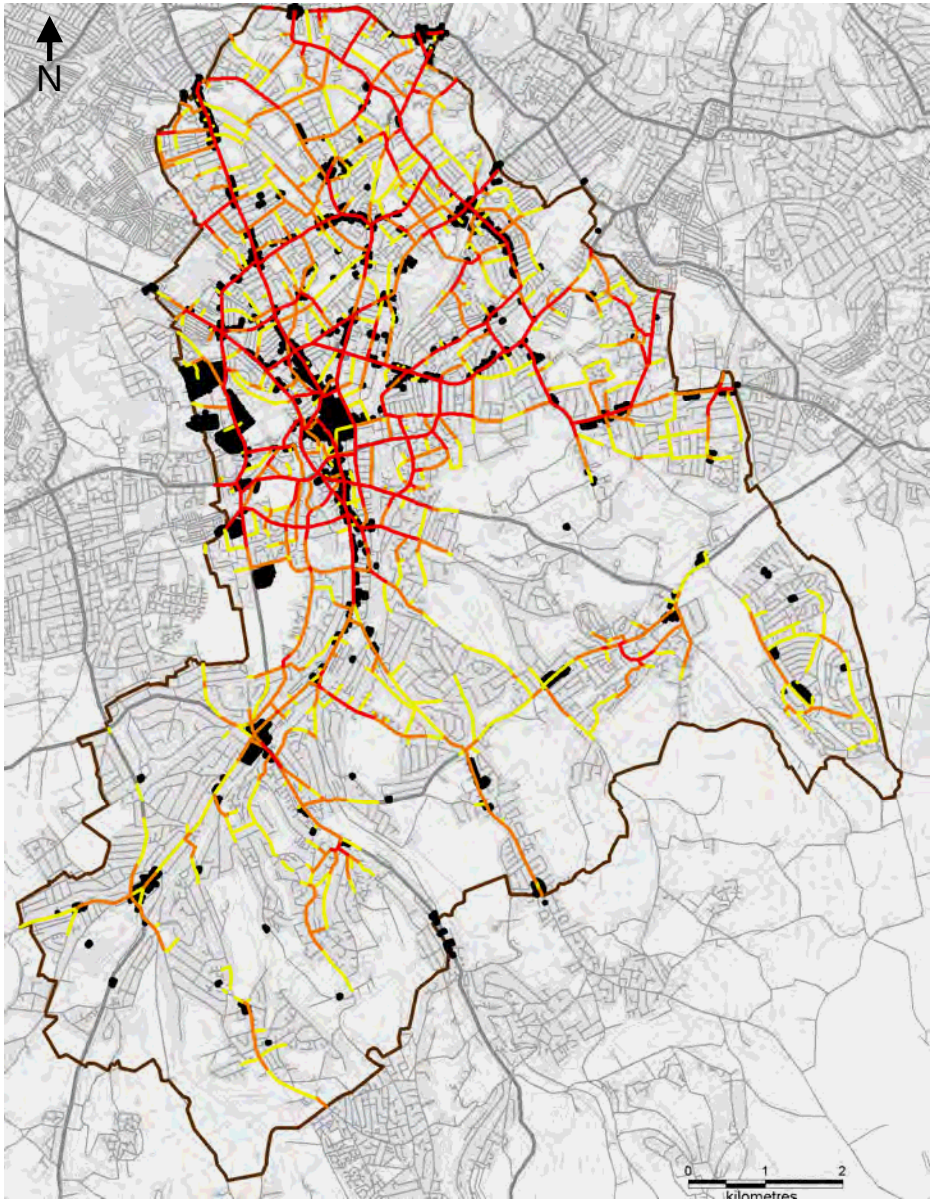
London Borough of Croydon

Land use type by angular choice multi radii

The following slides show each land use type percentage of association with space syntax 10%, 10 to 20%, 10 to 30% top value of angular choice analysis at different metric radii global (10 km), mid level (5, 2, 1.6 km) and local (800 & 400 m).

Retail by angular choice Top 10%, 10 to 20%, 10 to 30% – multi radii

angular choice metric radius 1,600 m



A, B and TLRN roads make up 12% of LBC road network.

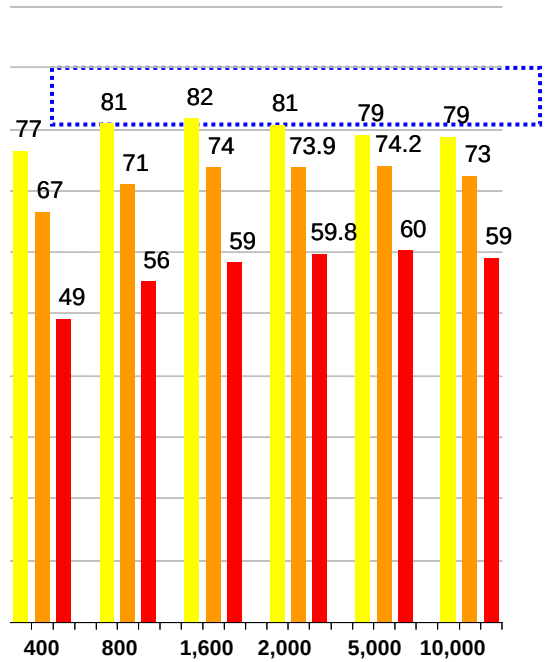
TLRN
A Road
B road
ITN Map
Tram Link
Station
Bus Stops
Croydon Borough

Top 10%
Top 20%
Top 30%
ITN Map

Spatial Accessibility

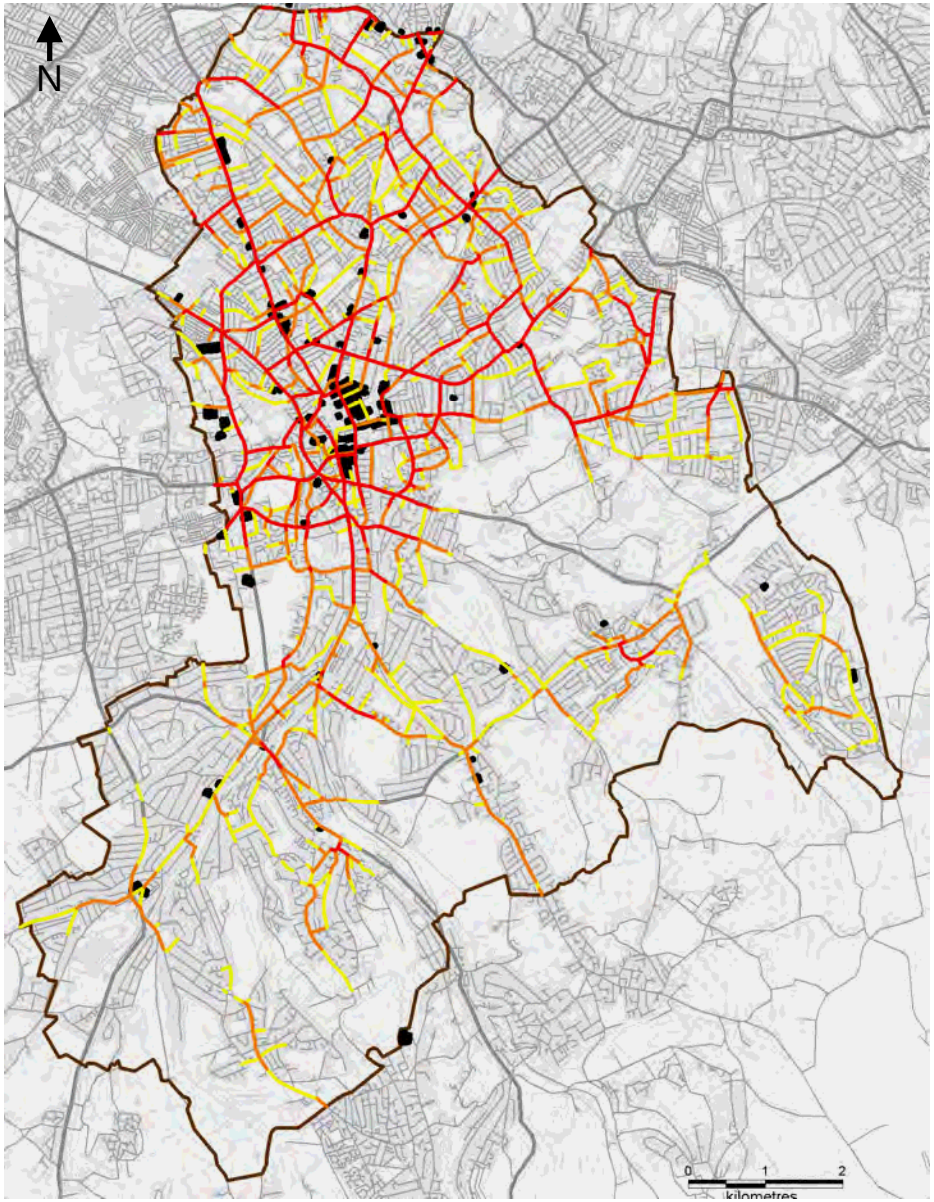
High choice

Low choice



Office by angular choice Top 10%, 10 to 20%, 10 to 30% – multi radii

angular choice metric radius 1,600 m



A, B and TLRN roads make up 12% of LBC road network.

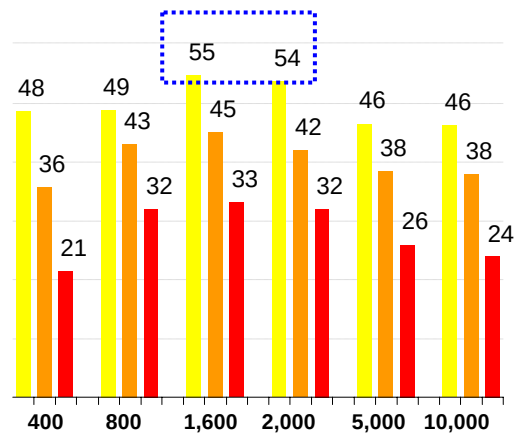
TLRN
A Road
B road
ITN Map
Tram Link
Station
Bus Stops
Croydon Borough

Top 10%
Top 20%
Top 30%
ITN Map

Spatial Accessibility

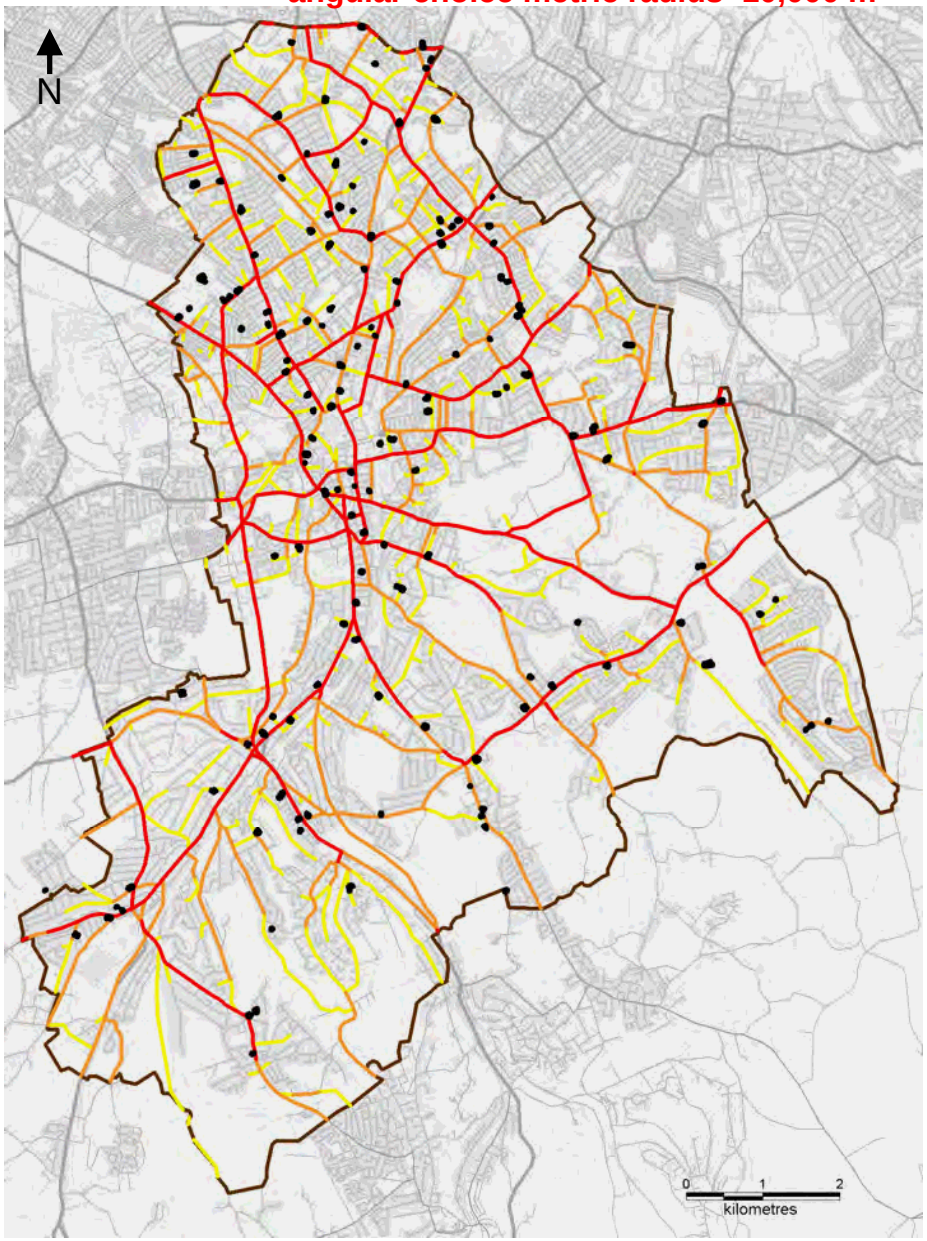
High choice

Low choice



Religious by angular choice Top 10%, 10 to 20%, 10 to 30% – multi radii

angular choice metric radius 10,000 m



A, B and TLRN roads make up 12% of LBC road network.

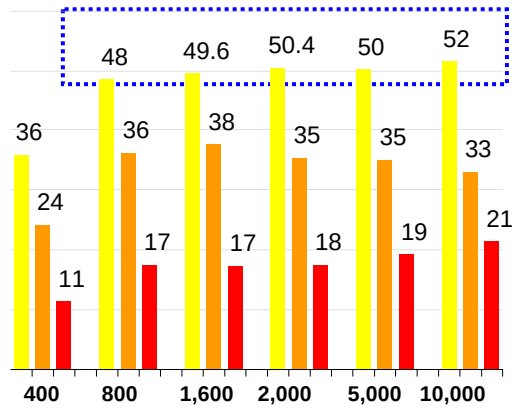
TLRN
A Road
B road
ITN Map
Tram Link
Station
Bus Stops
Croydon Borough

Top 10%
Top 20%
Top 30%
ITN Map

Spatial Accessibility

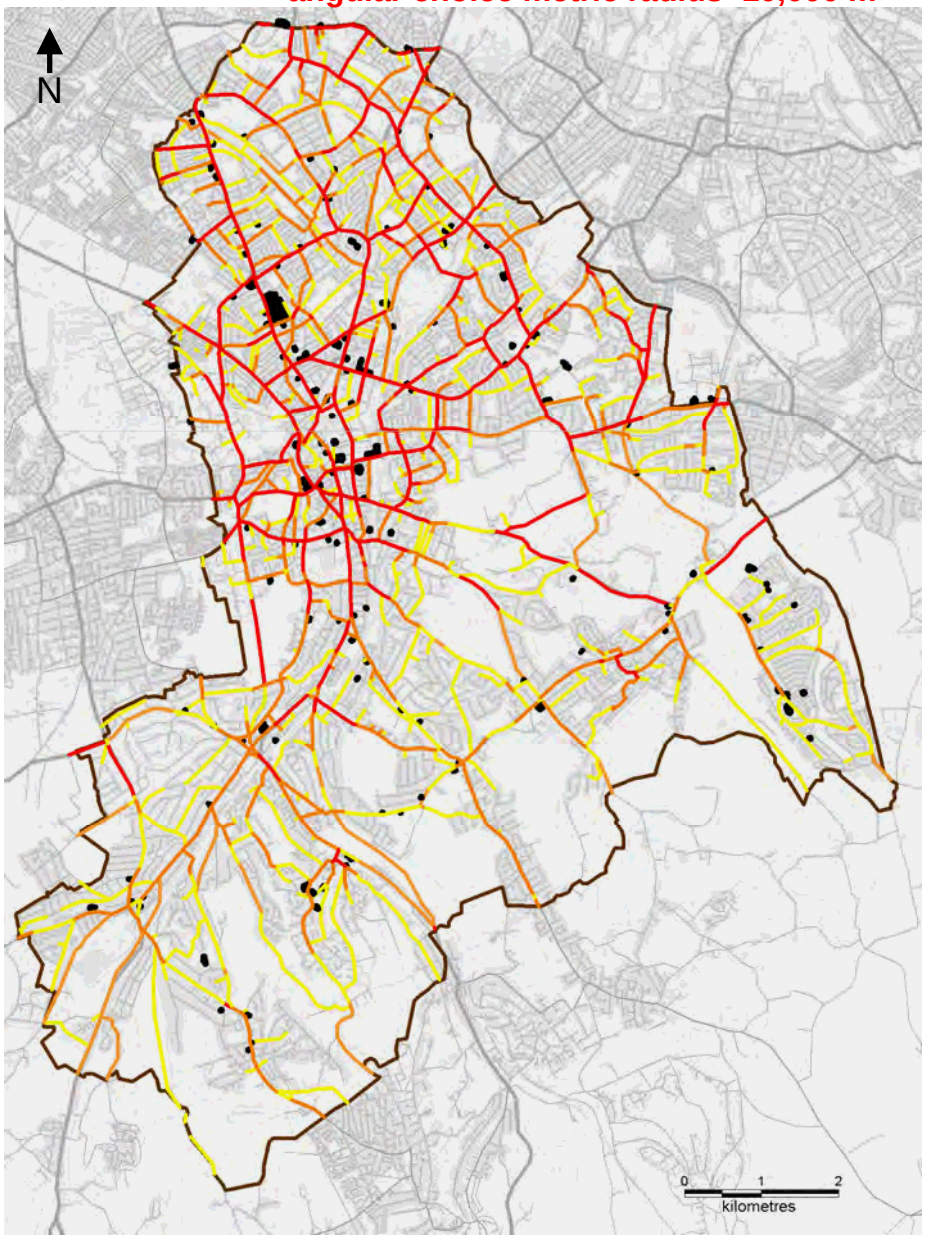
High choice

Low choice



Institutional by angular choice Top 10%, 10 to 20%, 10 to 30% – multi radii

angular choice metric radius 10,000 m



A, B and TLRN roads make up 12% of LBC road network.

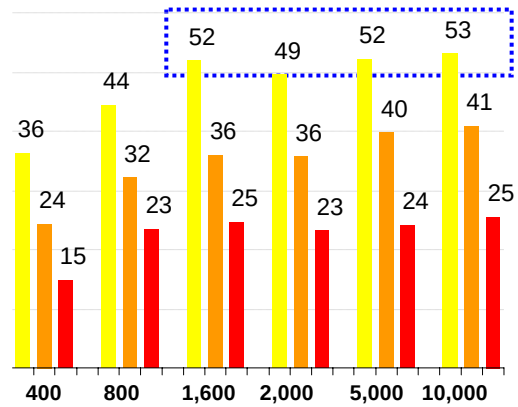
TLRN
A Road
B road
ITN Map
Tram Link
Station
Bus Stops
Croydon Borough

Top 10%
Top 20%
Top 30%
ITN Map

Spatial Accessibility

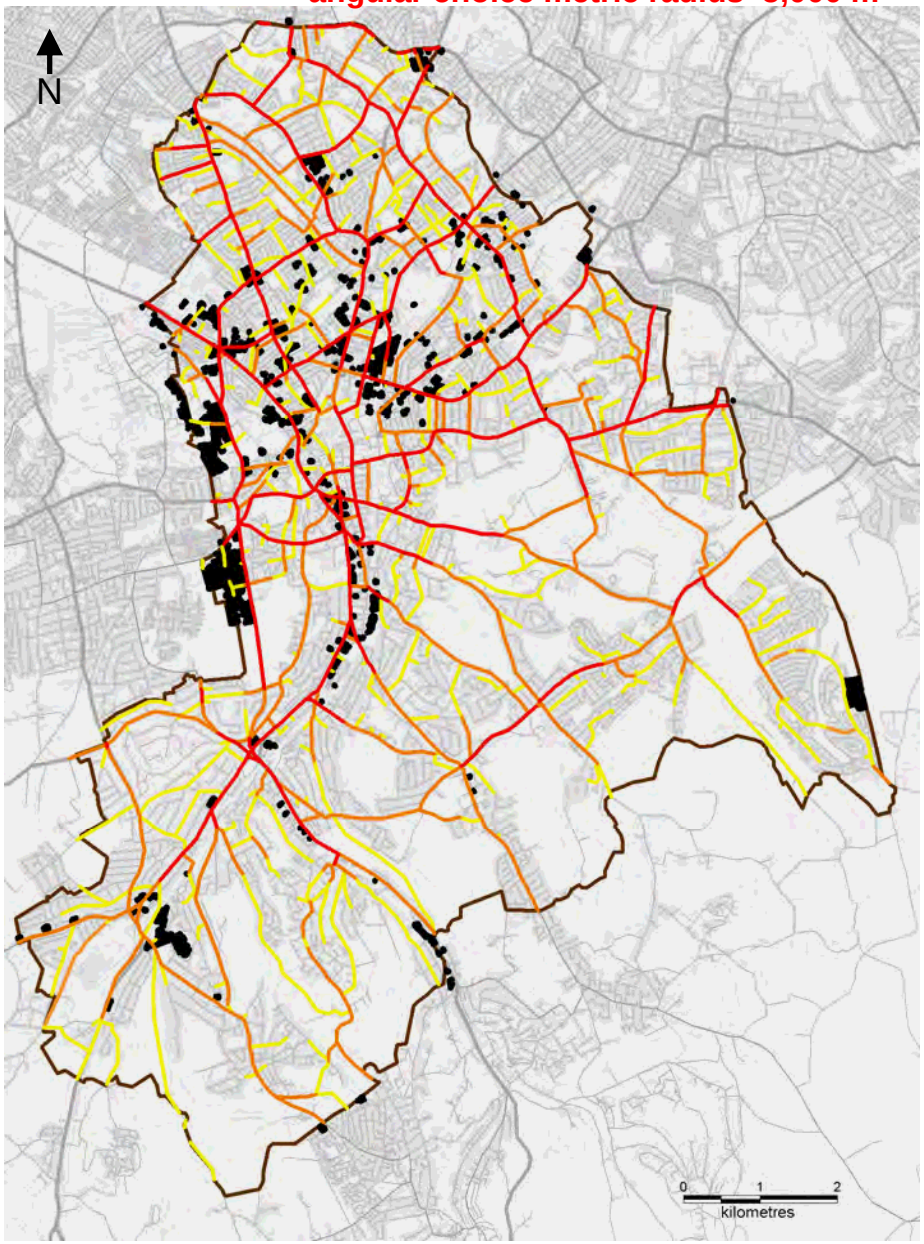
High choice

Low choice



Industry by angular choice Top 10%, 10 to 20%, 10 to 30% – multi radii

angular choice metric radius 5,000 m



A, B and TLRN roads make up 12% of LBC road network.

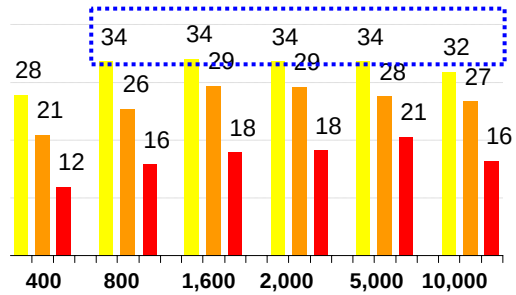
TLRN
A Road
B road
ITN Map
Tram Link
Station
Bus Stops
Croydon Borough

Top 10%
Top 20%
Top 30%
ITN Map

Spatial Accessibility

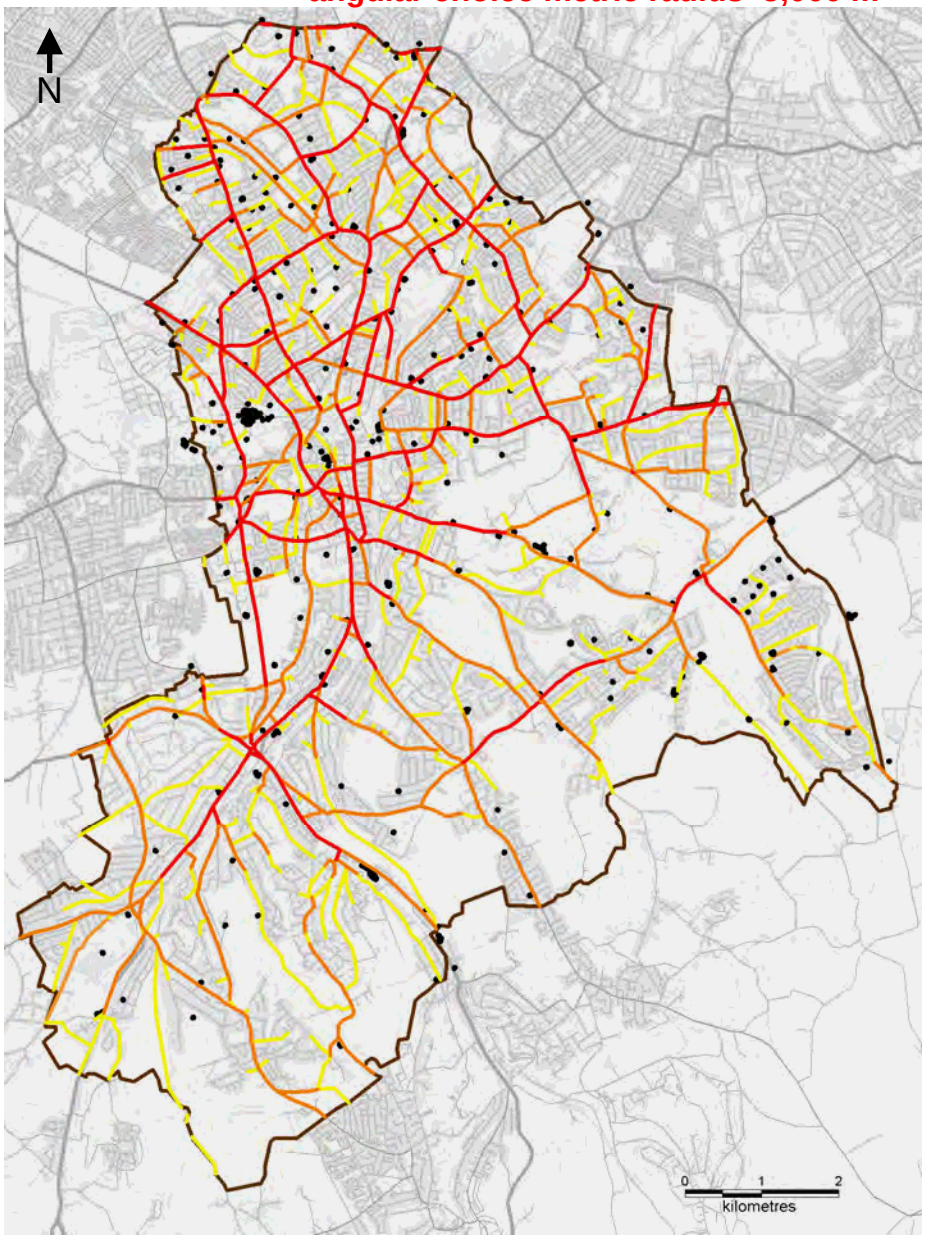
High choice

Low choice



Utilities by angular choice Top 10%, 10 to 20%, 10 to 30% – multi radii

angular choice metric radius 5,000 m



A, B and TLRN roads make up 12% of LBC road network.

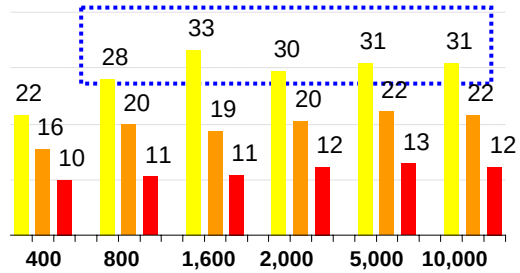
- TLRN
- A Road
- B road
- ITN Map
- Tram Link
- Station
- Bus Stops
- Croydon Borough

- Top 10%
- Top 20%
- Top 30%
- ITN Map

Spatial Accessibility

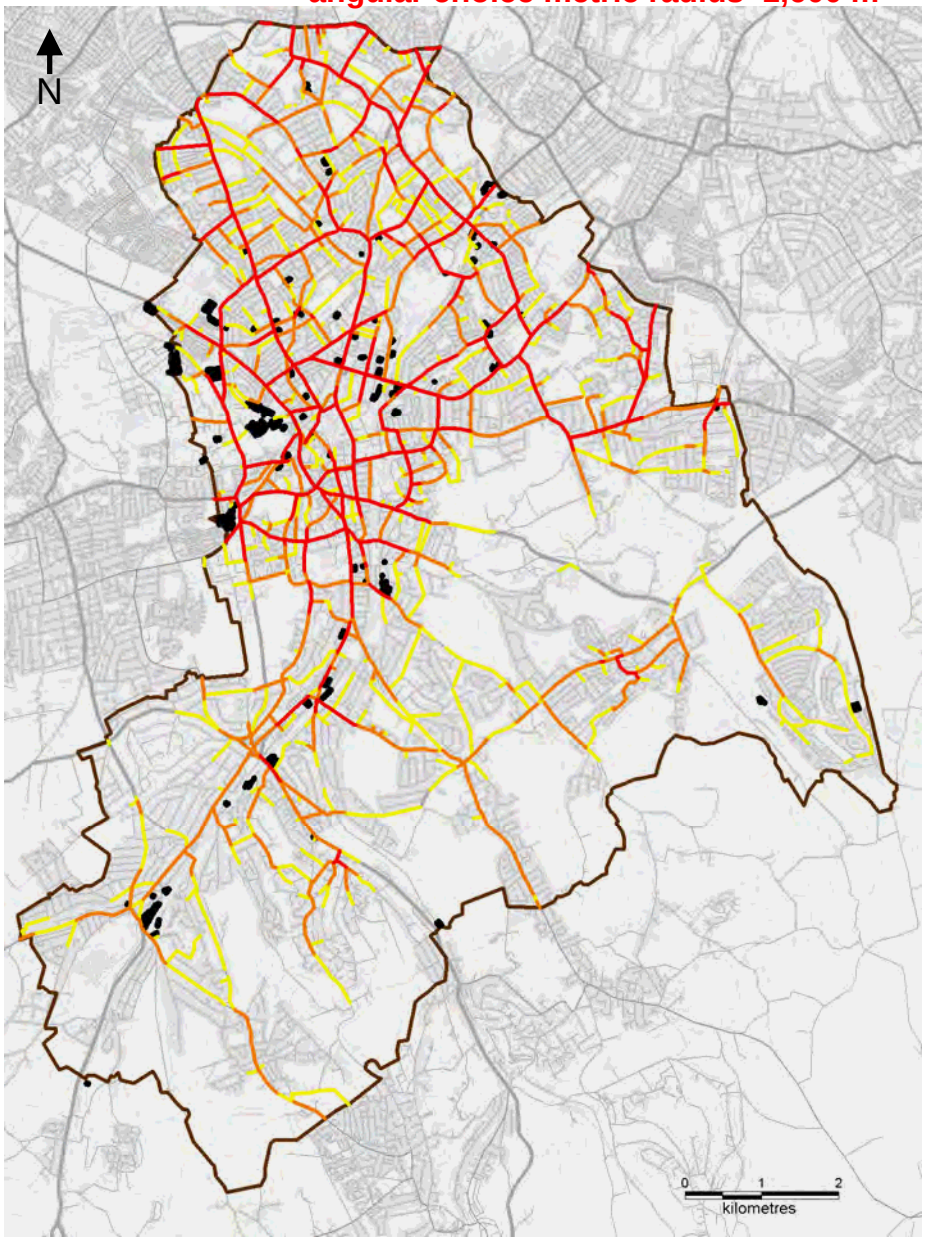
High choice

Low choice



Storage & Warehouse by angular choice Top 10%, 10 to 20%, 10 to 30% – multi radii

angular choice metric radius 1,600 m



A, B and TLRN roads make up 12% of LBC road network.

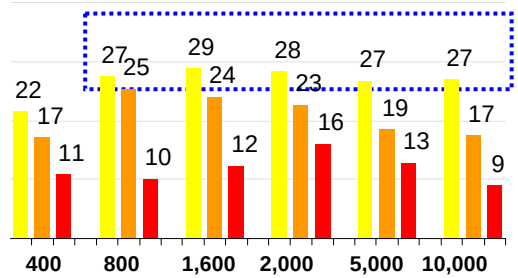
TLRN
A Road
B road
ITN Map
Tram Link
Station
Bus Stops
Croydon Borough

Top 10%
Top 20%
Top 30%
ITN Map

Spatial Accessibility

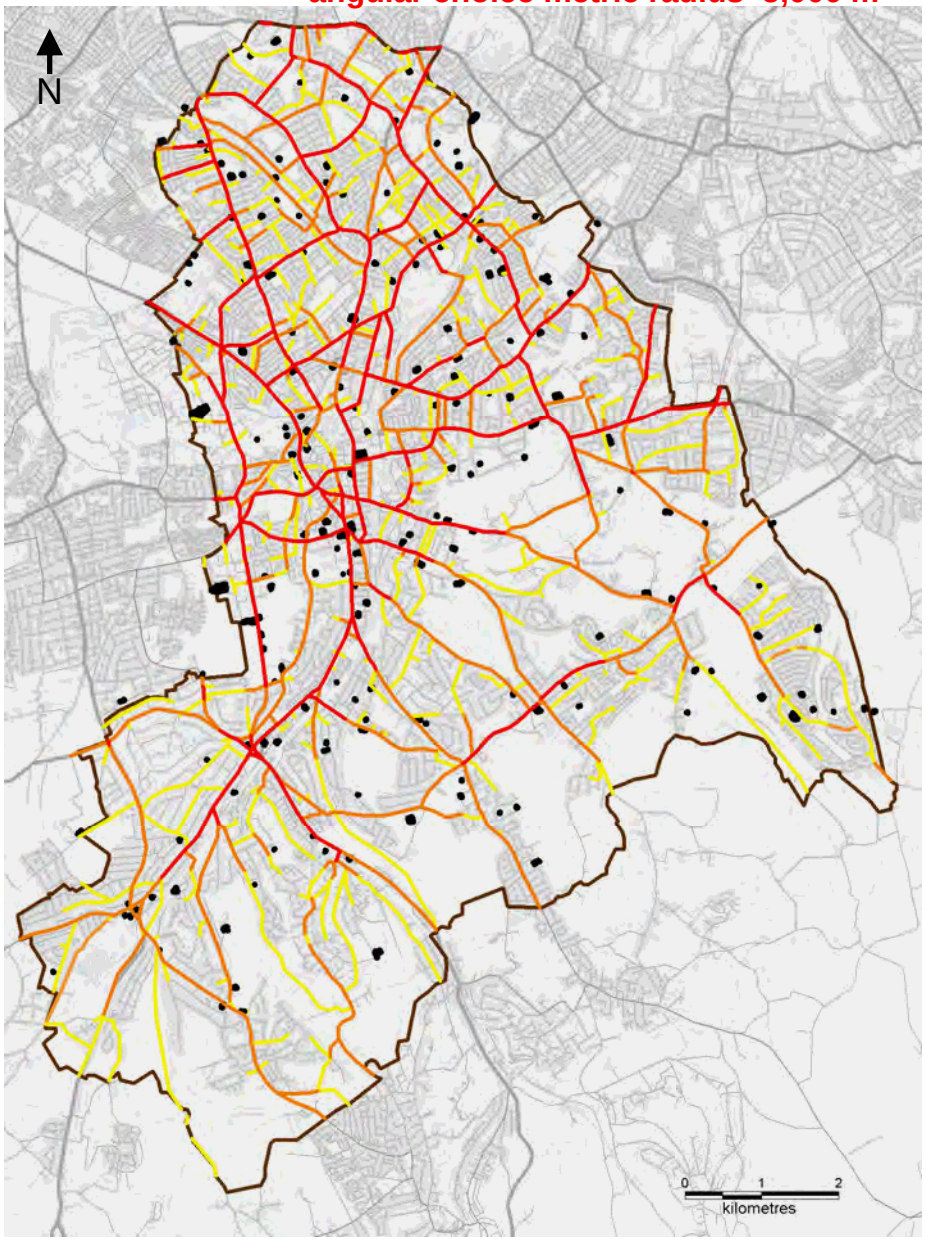
High choice

Low choice



Indoor Leisure & Recreation by angular choice Top 10%, 10 to 20%, 10 to 30% – multi radii

angular choice metric radius 5,000 m



A, B and TLRN roads make up 12% of LBC road network.

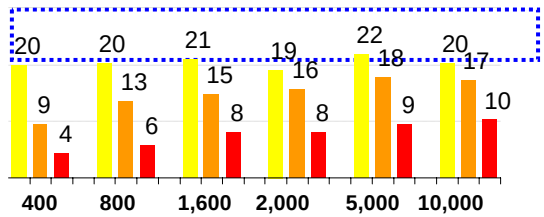
- TLRN
- A Road
- B road
- ITN Map
- Tram Link
- Station
- Bus Stops
- Croydon Borough

- Top 10%
- Top 20%
- Top 30%
- ITN Map

Spatial Accessibility

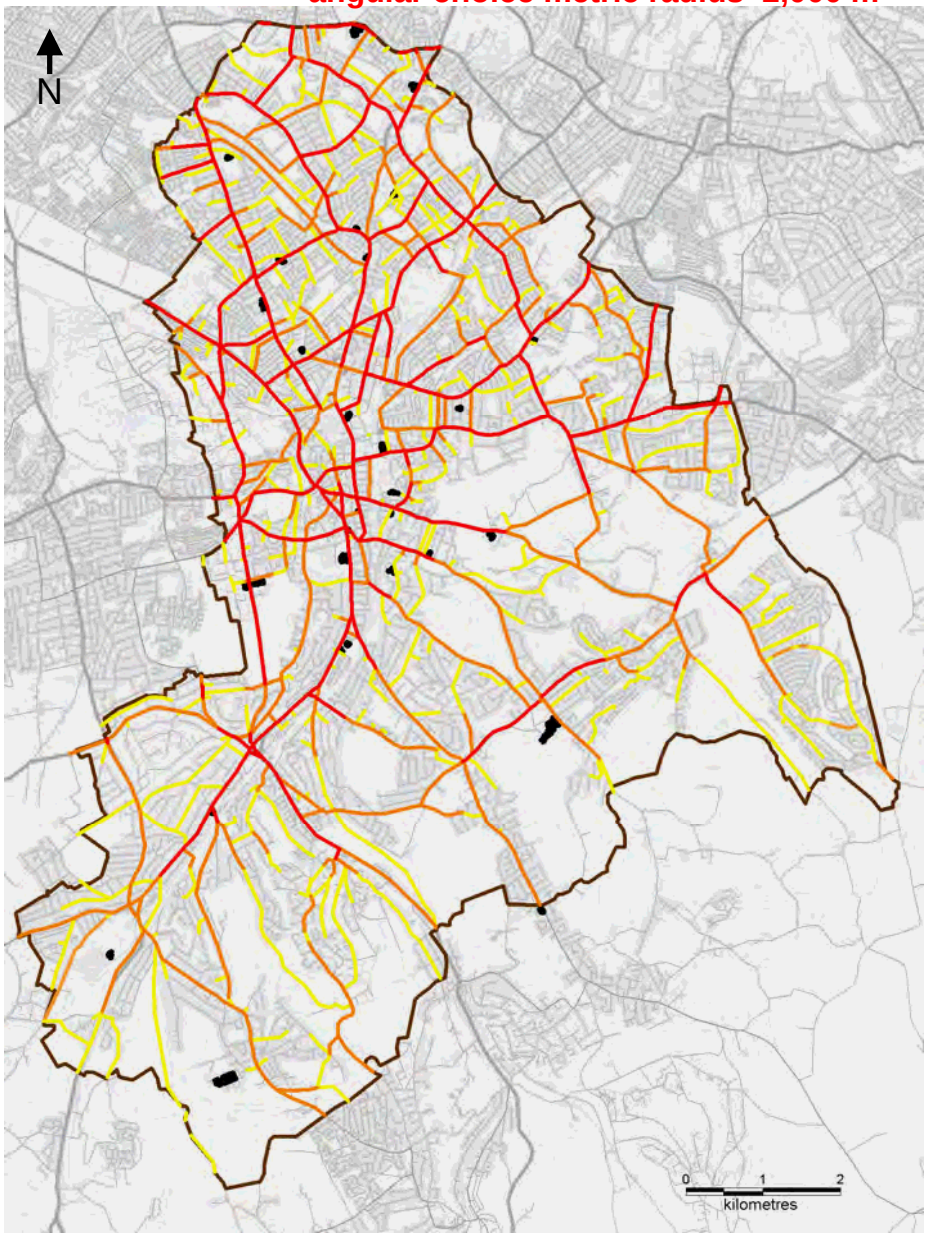
High choice

Low choice



Institutional & Communal Accommodation by angular choice Top 10%, 10 to 20%, 10 to 30% – multi radii

angular choice metric radius 2,000 m



A, B and TLRN roads make up 12% of LBC road network.

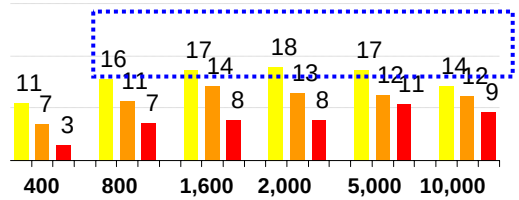
- TLRN
- A Road
- B road
- ITN Map
- Tram Link
- Station
- Bus Stops
- Croydon Borough

- Top 10%
- Top 20%
- Top 30%
- ITN Map

Spatial Accessibility

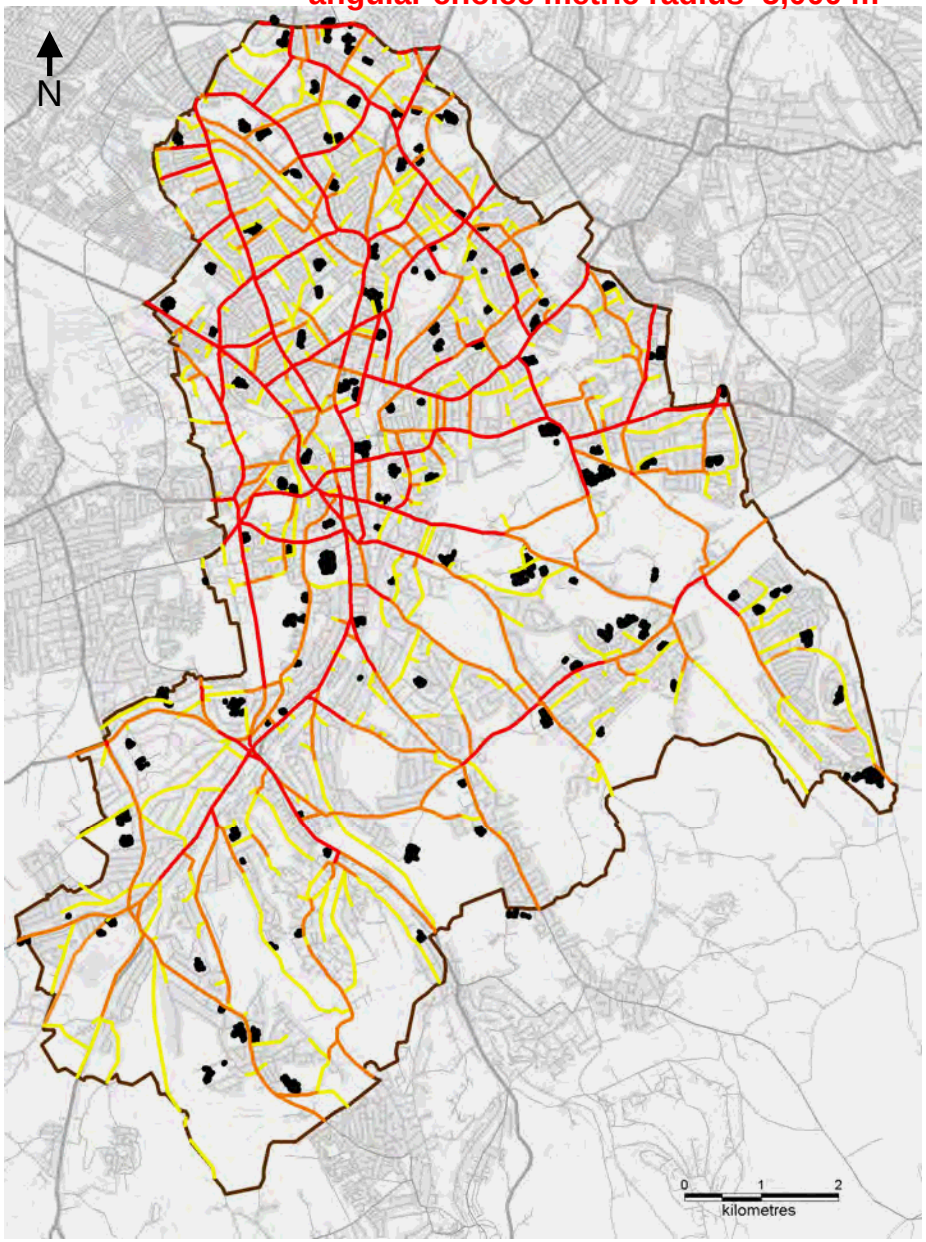
High choice

Low choice



Educational buildings by angular choice Top 10%, 10 to 20%, 10 to 30% – multi radii

angular choice metric radius 5,000 m



A, B and TLRN roads make up 12% of LBC road network.

- TLRN
- A Road
- B road
- ITN Map
- Tram Link
- Station
- Bus Stops
- Croydon Borough

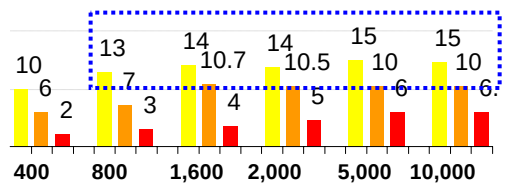
- Top 10%
- Top 20%
- Top 30%
- ITN Map

In the last fifty year, most education building have been rebuilt. They became larger with larger play ground. As such they have been build in remote location where land was cheap. They are accessible by motorised transport. This is reflected by a 20% drop in traffic level during school holyday.
In the London Borough of Croydon this is exacerbated by daily north south migrations of about 30,000 pupils.

Spatial Accessibility

High choice

Low choice



Appendix

Croydon angular choice radius 10,000m in context

Land use Occurrence %

Land use summary table – angular choice, metric multi radii

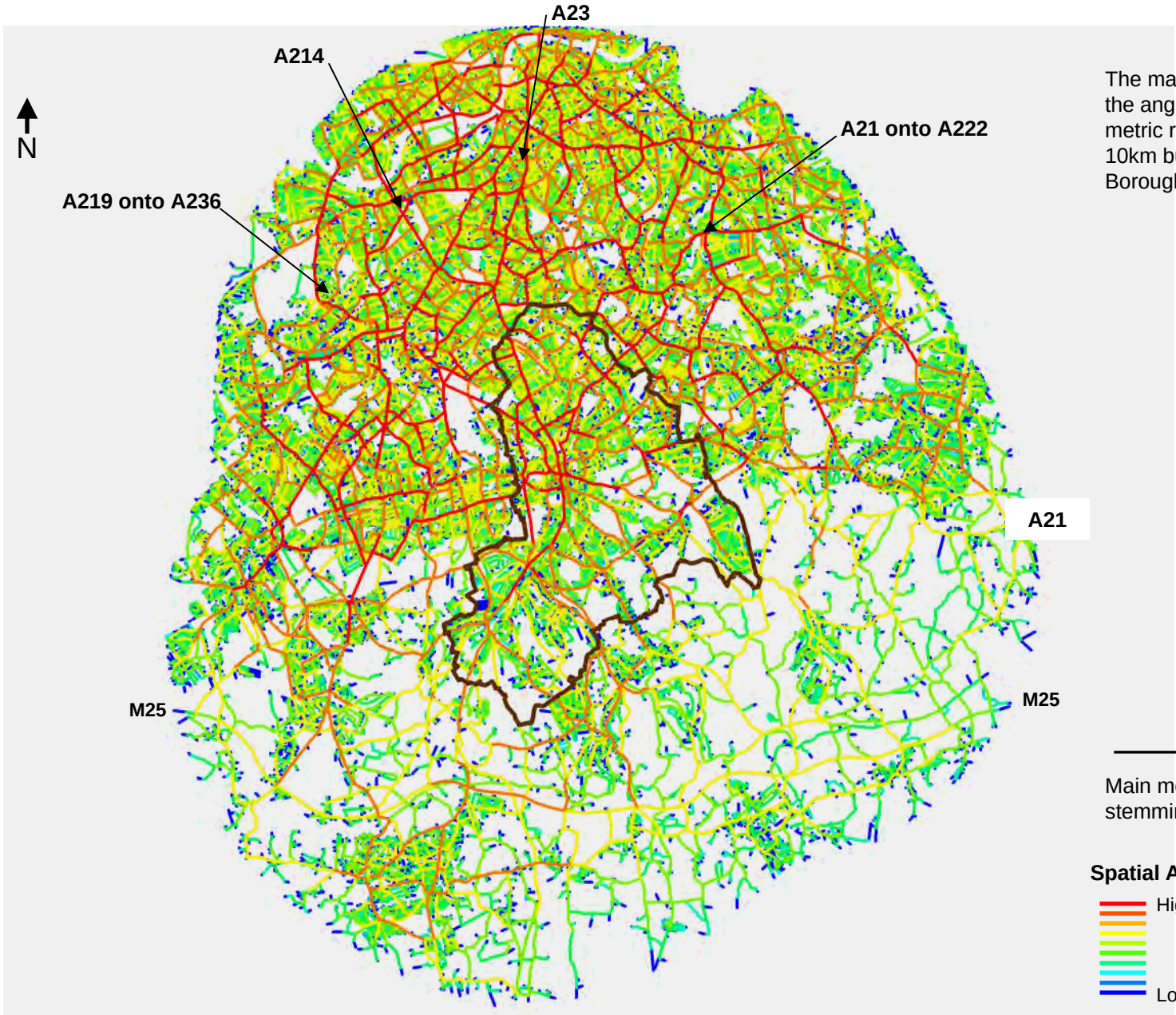
2006-2007 Rail entry and exit figures

mode of transport and visitors' spending in town centres

angular choice multi radii and spatial network covergae

distance travelled to work

Appendix - Spatial accessibility angular choice metric radius 10,000m in context



The map to the left shows the the angular choice 10,000 metric radius levels for a 10km buffer around London Borough of Croydon.

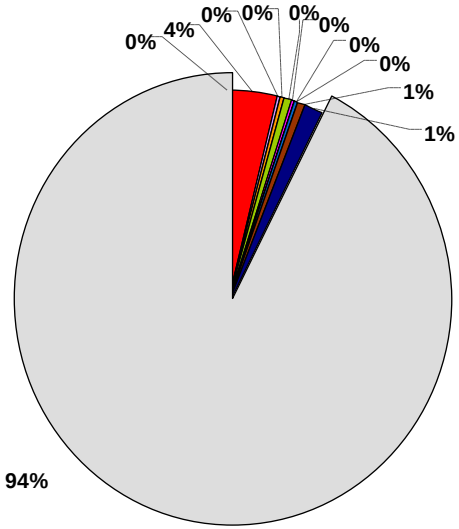
Main movement arteries stemming from Croydon.

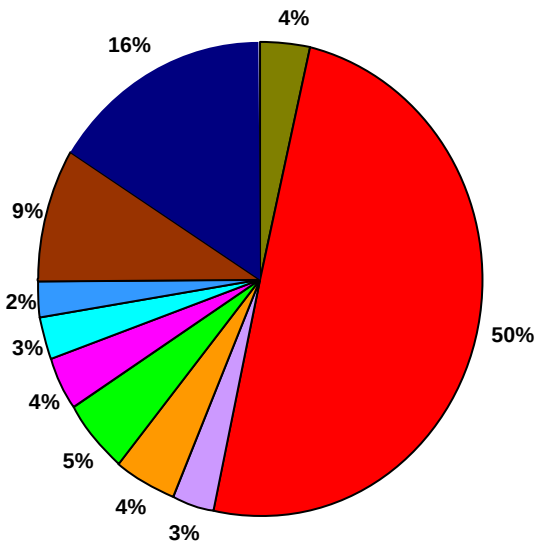
Spatial Accessibility

High choice

Low choice

Appendix - Land use Occurrence %



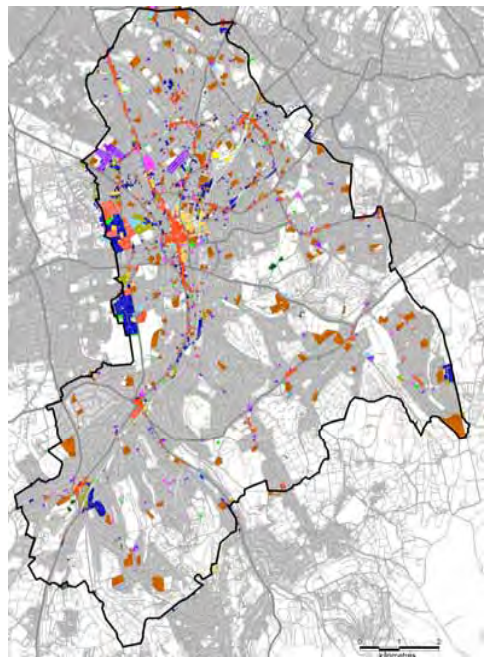


- Residential
- Utilities
- Institutional & Communal
- Religious
- Leisure & Recreation
- Institutional
- Storage & Warehousing
- Offices
- Educational
- Industry
- Retailing

The charts to the left show building type measured by quantity. Here the land of each property has been deducted to leave the building only.

By removing the connecting land a clearer definition is given to the direct location of each building type.

The chart on the top left contains residential data, the chart on the bottom left is without residential data.



Appendix - Land use summary table – angular choice, metric multi radii

The table below illustrates the movement economy for each building type headed at the top of the table.

The choice values listed on the left show the top 10%, 20% and 30% of movement potential for each radius.

This figure is taken from the Space Syntax mapping.

The values in each building type represent the % captured by the Space Syntax mapping at that radius.

Red = Top 10%

Orange = Top 20%

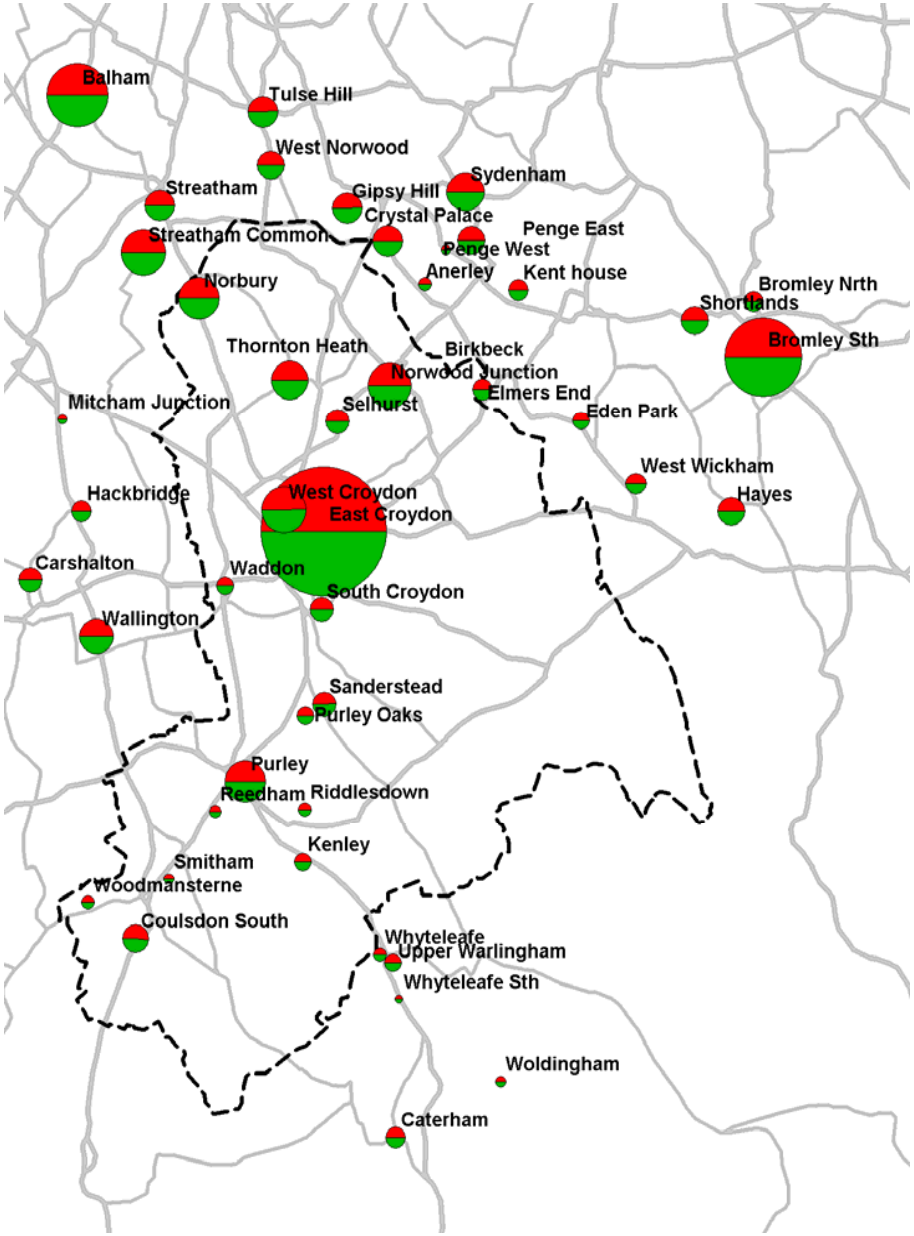
Yellow = Top 30%

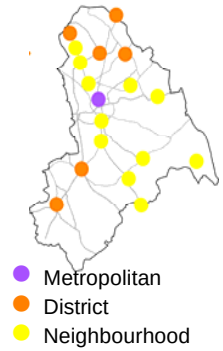
Each building type is identified to its spatial characteristics, accessibility requirements and layout preference.

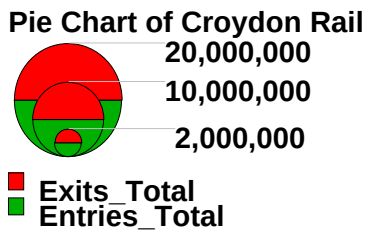
The results for each building type are explained further in the following pages.

Landuse Building type as a Percentage										
	Storage &Warehousing	Retailing	Religious	Offices	Leisure&Recreation	Institutional	Utilities	Institutional&Communal Accomadation	Educational	Industry
CH400 30%	22	77	36	48	20	36	22	11	10	28
CH400 20%	17	67	24	36	9	24	16	7	6	21
CH400 10%	11	49	11	21	4	15	10	3	2	12
CH800 30%	27	81	48	49	20	44	28	16	13	34
CH800 20%	25	71	36	43	13	32	20	11	7	26
CH800 10%	10	56	17	32	6	23	11	7	3	16
CH1600 30%	29	82	49.6	55	21	52	33	17	14	34
CH1600 20%	24	74	38	45	15	36	19	14	10.7	29
CH1600 10%	12	59	17	33	8	25	11	8	4	18
CH2000 30%	28	81	50.4	54	19	49	30	18	14	34
CH2000 20%	23	73.9	35	42	16	36	20	13	10.5	29
CH2000 10%	16	59.8	18	32	8	23	12	8	5	18
CH5000 30%	27	79	50	46	22	52	31	17	14.90	34
CH5000 20%	19	74.2	35	38	18	40	22	12	10.45	28
CH5000 10%	13	60	19	26	9	24	13	11	5.92	21
CH10000 30%	27	79	52	46	20	53	31	14	14.68	32
CH10000 20%	17	73	33	38	17	41	22	12	10.45	27
CH10000 10%	9	59	21	24	10	25	12	9	6.14	16
Total Landus	562	7480	482	650	425	542	469	321	1369	2448

Appendix - 2006-2007 Rail entry and exit figures







Spatial measure

Appendix - mode of transport and visitors' spending in town centres

angular choice multi radii and spatial network covergae

The mode of transport used to access town centres has an impact on the average spending of visitors, as suggested by research prepared for TfL Surface Transport in 2004.

Visitors' average spending per week by mode of transport

Walking	£91
Car	£64
Bus	£63
Tax/cycle/other	£56
Train/underground	£46

People who most contribute are those who walk. Their average spending per week exceeds that of people who use any other mode of transport. This group is followed by people who travel by car or bus.

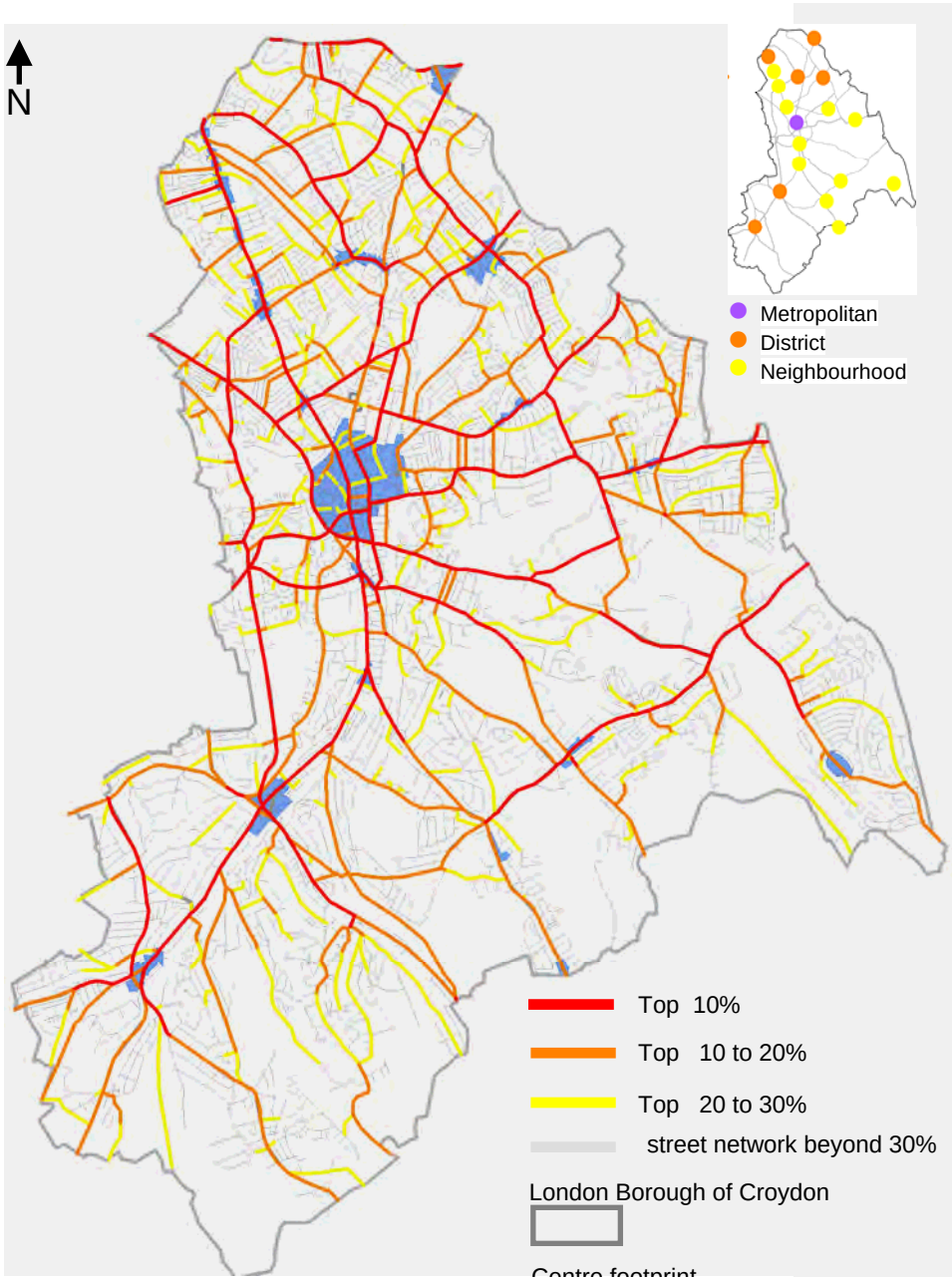
This implies that the way people move, dwell or stop within the public realm influences their spending or *'contribution to the economic health and viability of town centres across London.'*[5]

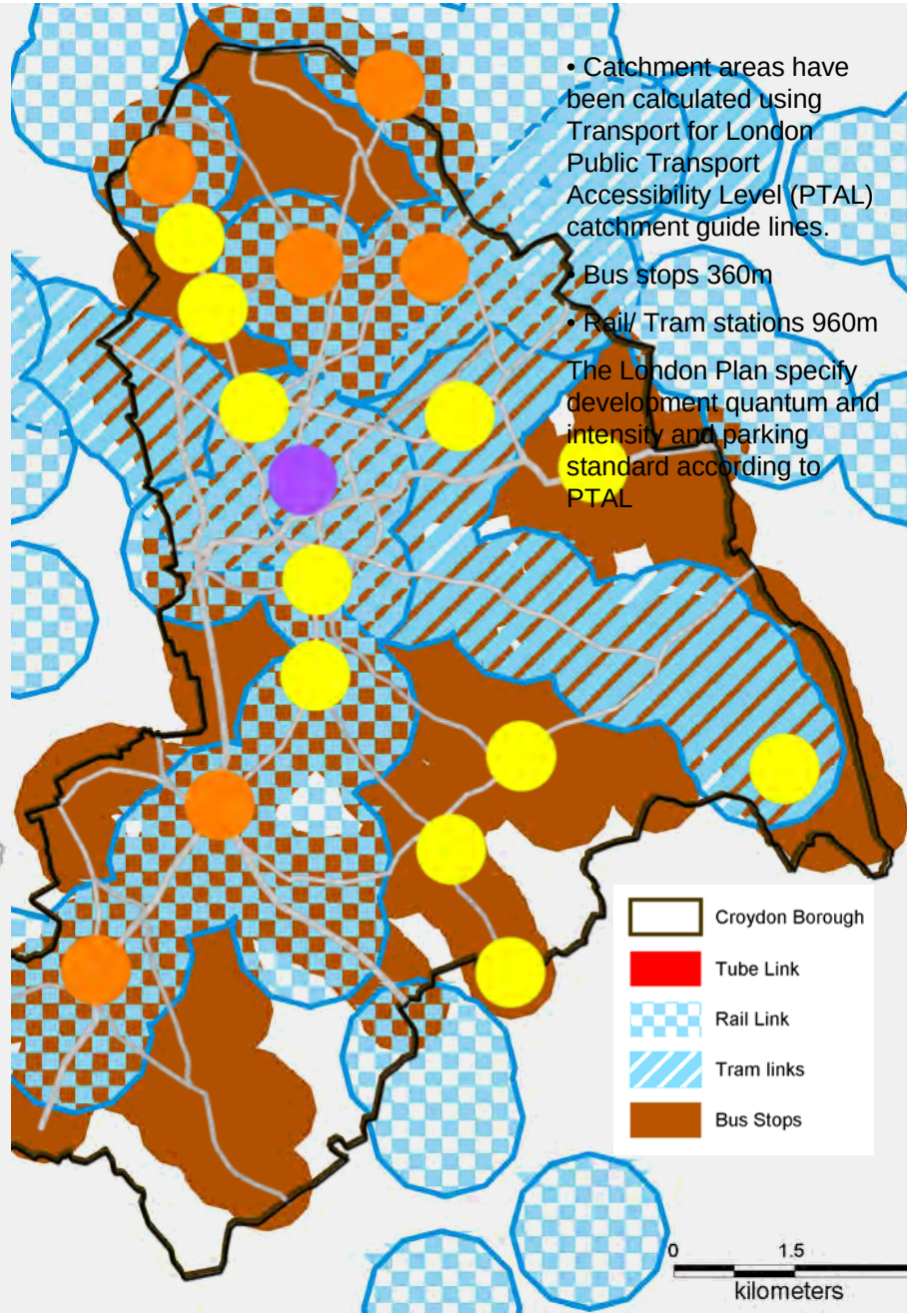
	% of the road network
Angular choice 10,000 m	
Top 10%	**10**
Top 10 t0 20%	**21**
Top 10 to 30%	**33**
Angular choice 2,000 m	
Top 10%	**8**
Top 10 t0 20%	**18**
Top 10 to 30%	**29**
Angular choice 800 m	
Top 10%	**7**
Top 10 t0 20%	**15**
Top 10 to 30%	**25**

References

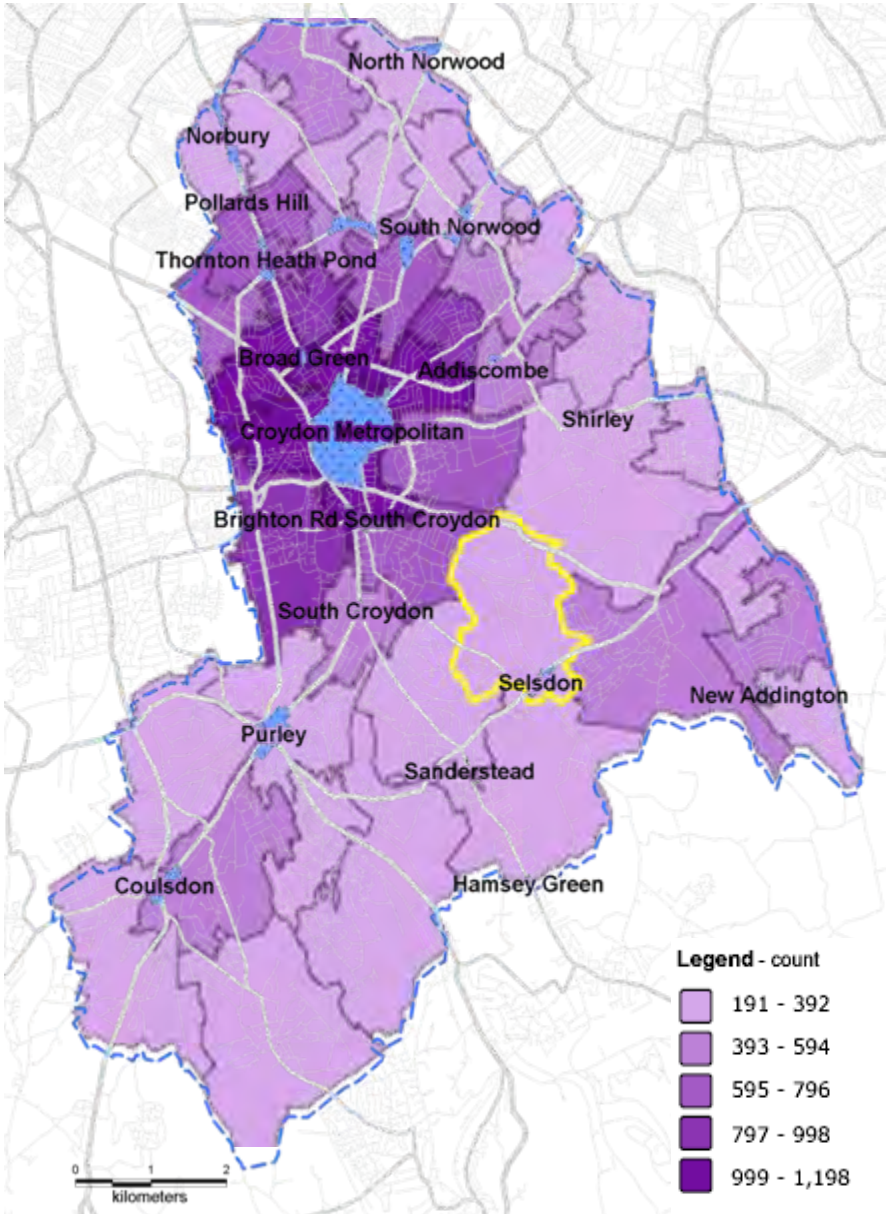
5 Town Centre Survey 2003-4: Summary Report. July 2004 by Accent Marketing Research for TfL Surface Transport. London

Spatial accessibility Top 30% angular choice, metric radius 10,000m – Public Transport



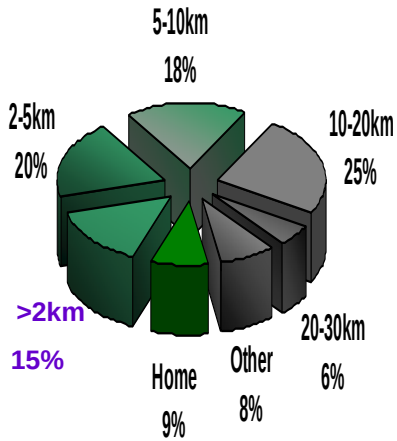


Distance travelled to work less than 2km -23,245

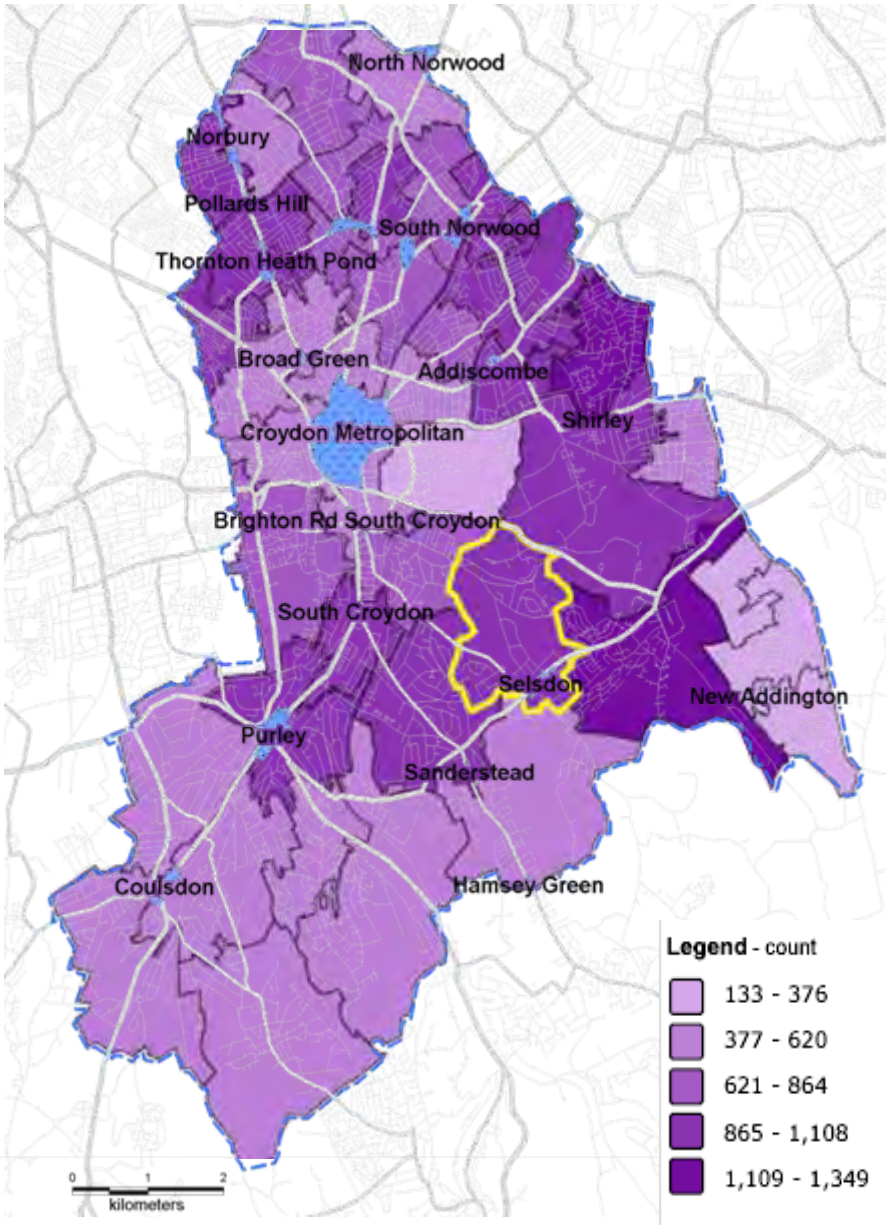


15% of Croydon's population travel less than 2km to work.

The diagram to the right shows that there is a high concentration of this type around Croydon's metropolitan centre.

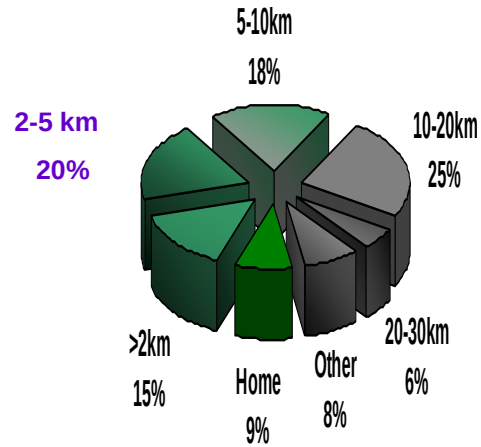


Distance travelled to work more than 2km less than 5km: 30,657

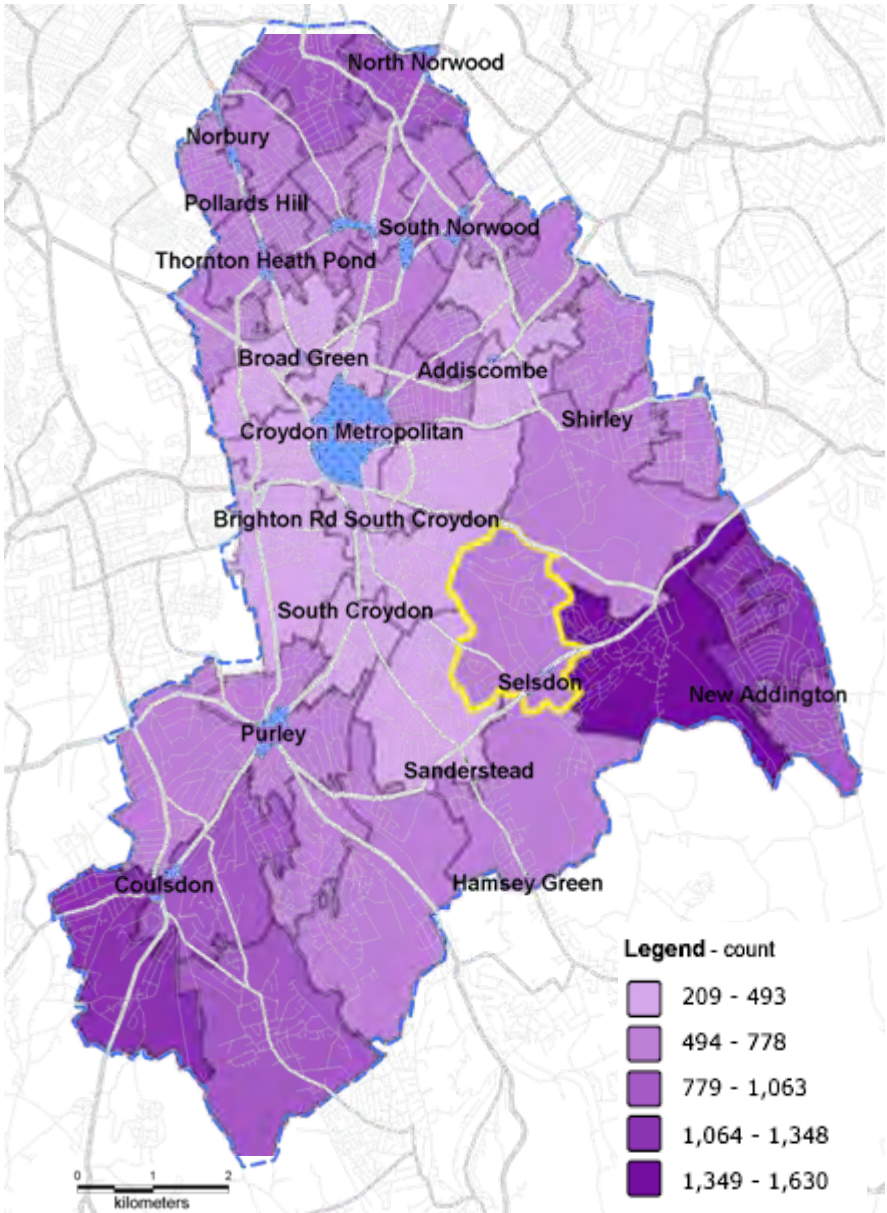


20% of Croydon's population travel between 2-5km to work.

The diagram to the right shows that this type has the highest concentration directly around Croydon's metropolitan centre.

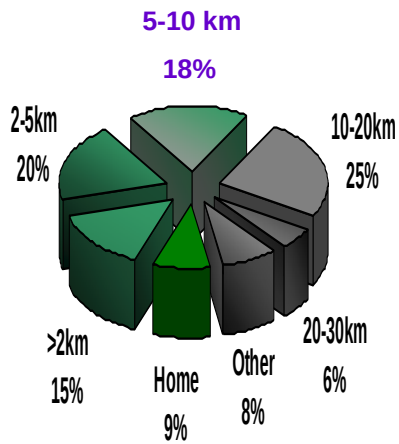


Distance travelled to work more than 5km less than 10km: 28,681

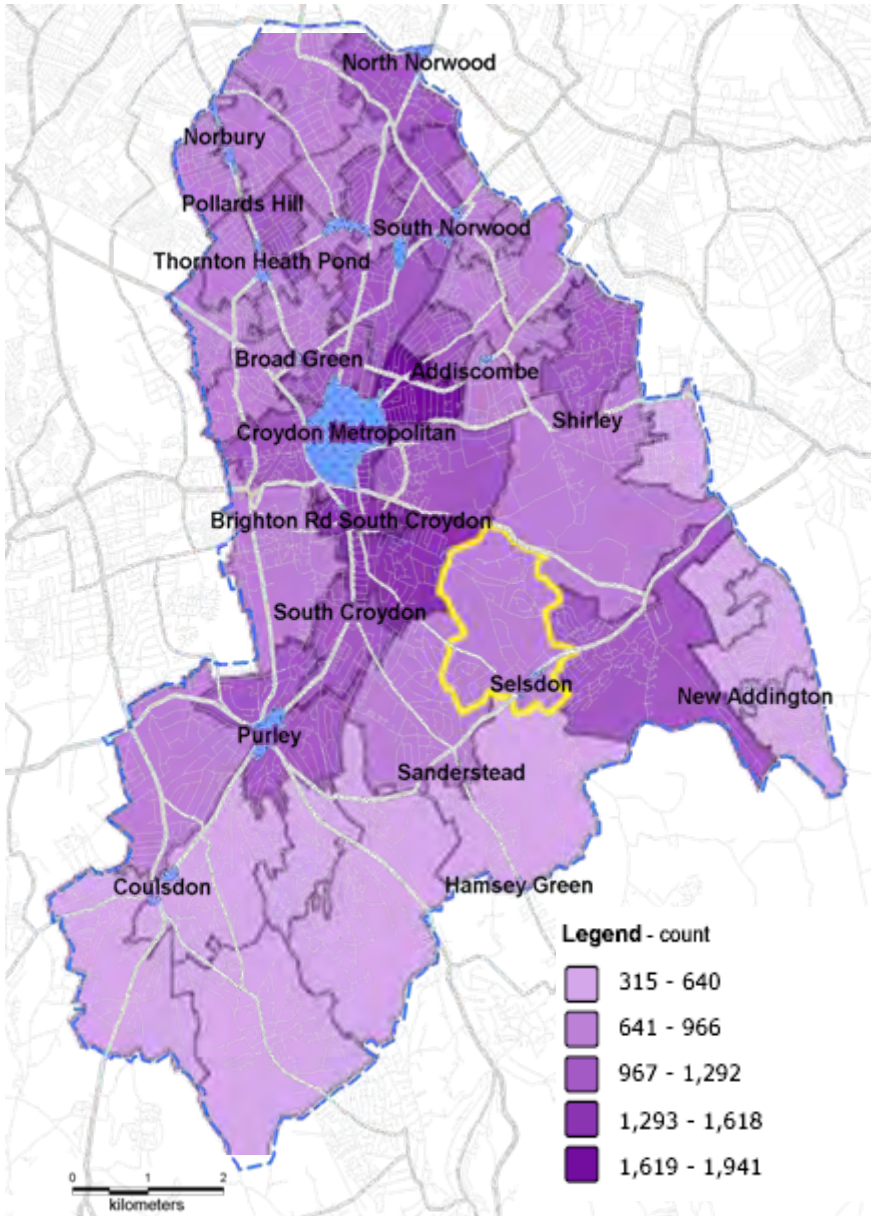


18% of Croydon's population travel less than 5-10km to work.

The diagram to the right shows that this type has the highest concentration in three areas, North Norwood, Coulsdon and between Selsdon and New Addington.

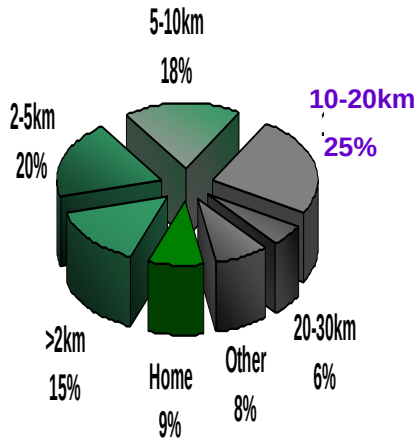


Distance travelled to work more than 10km less than 20km: 38,901

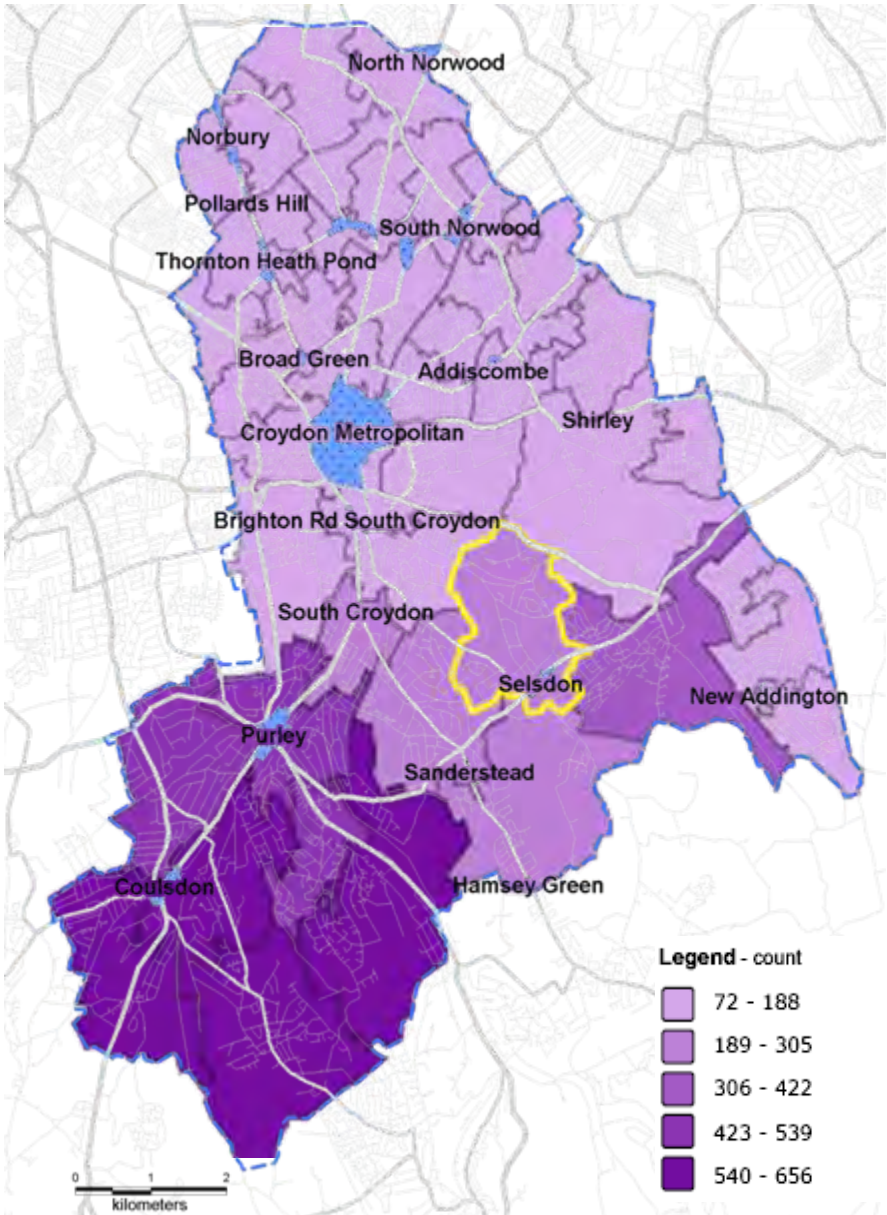


25% of Croydon's population travel less than 2-5km to work.

The diagram to the right shows that this type has the highest concentration directly around Croydon's metropolitan centre. The second highest level of concentration appears to follow the main network route A23 through the borough.

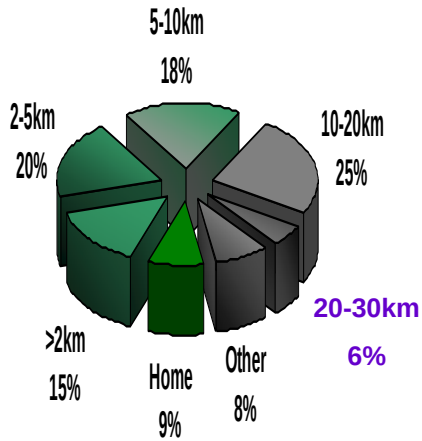


Distance travelled to work more than 20km less than 30km: 8,714

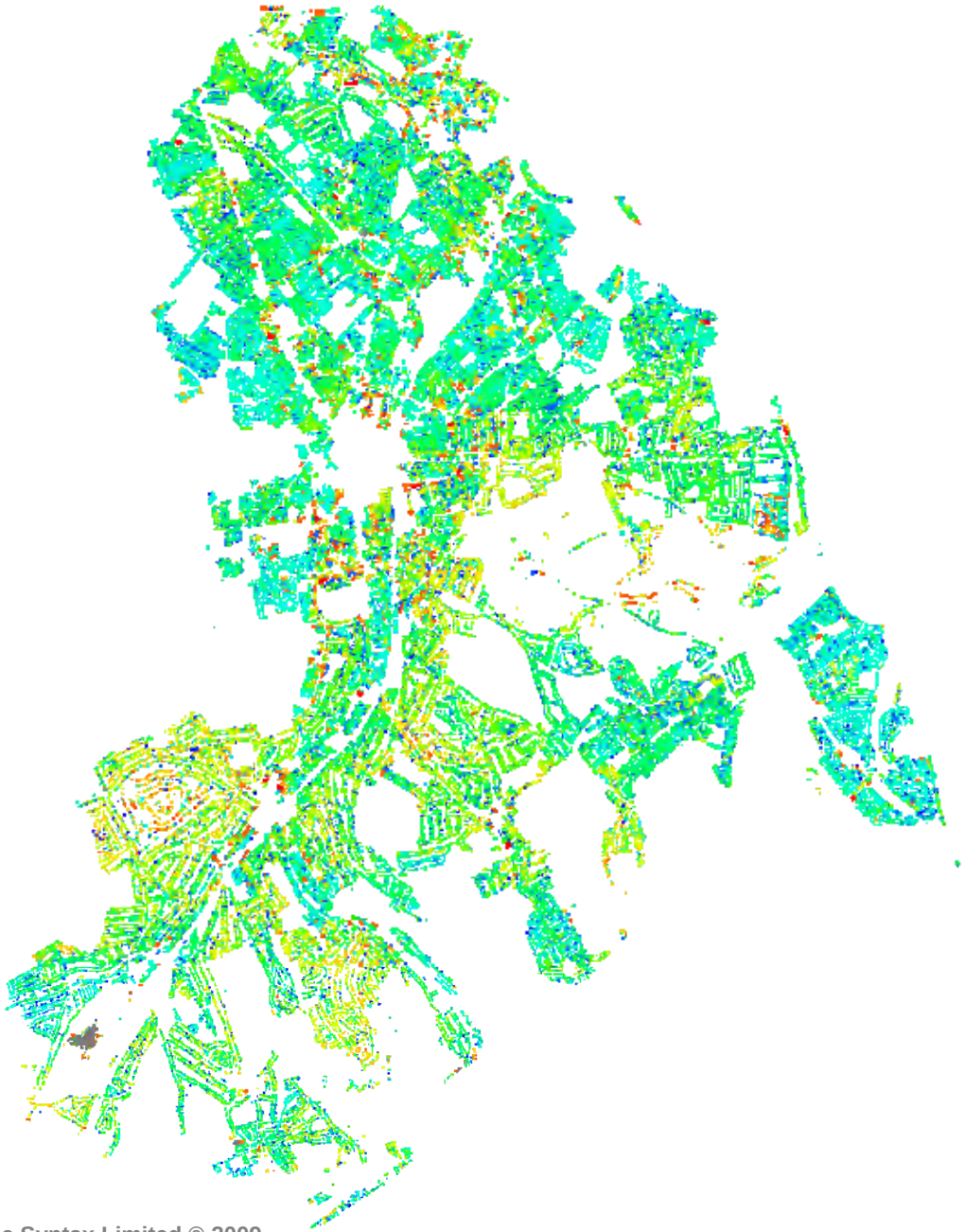


6% of Croydon's population travel between 20-30km to work.

The diagram to the right shows that this type has the highest concentration is around Coulsdon and Purley.



residential building footprint



Residential building footprint m2

1,000 to	2,000	(17)
250 to	1,000	(627)
150 to	250	(1885)
100 to	150	(7219)
75 to	100	(14062)
50 to	75	(42813)
30 to	50	(43083)
20 to	30	(5057)
10 to	20	(40646)