UK Biobank Built Environment Project - UKB Wales

MORPHOMETRIC ANALYSIS OF THE BUILT ENVIRONMENT IN UK BIOBANK: DATA ANALYSES AND SPECIFICATION MANUAL

Chinmoy Sarkar, John Gallacher, Chris Webster
Cardiff University
January 2014

1. INTRODUCTION

In the recent years, one of the primary emergent paradigms in the study of contextual health variations has been the influence of accessibility to health-promoting community resources upon an individual's health[1]. Accessibility in an urban activity space may be defined as the relative ease with which goods, services, activities and, generally destinations' or 'opportunities' can be reached from a given origin, essentially the dwelling location of an individual[2]. Several studies have highlighted the associations between health and access to health-promoting community resources, including: green spaces and recreational facilities[3-7]; retail[8-12]; transit stops[13-15]; supermarkets[16-18]; sports facilities[19,20]; community services[21,22]; and health care facilities[23,24]. Health effects of land use mix have also been highlighted[10,25-27]. Others have considered the health effects of street level physical accessibility[28] as well as combination of land use and street level physical accessibility in an urban space[29,30]. Inhibitory health effects of specific land use destinations have also been studies, including fast food outlets[31-33] the density of alcohol outlets[34,35].

Nonetheless in most built environment - health studies, robustness and reliability of the strength and significance of associations are limited by small sample size and cross sectional design. Lack of prospective health and built environment datasets imply that the impacts of sustained exposures to the built environment cannot be predicted with a significant degree of certainty. Unravelling causality may further be impeded by selective migration, lack of statistical power, limited ability to adjust for confounding variables as well as the confusion between mediating versus confounding effects[1,36,37]. Large-scale prospective gene-environment studies provide the most practical solution to such methodological constraints. They have the ability to produce more reliable assessment of the health-impacts of sustained environmental exposures, both in terms of significant increments in explanatory power as well as causal inference[38,39]. The UK Biobank is such a flagship epidemiology program collecting prospective data on individual health, lifestyle and behavioural for half a million participants, aged 40-69 years and residing in any of the 21 major cities of UK[40-42]. The aim of the UK Biobank Built Environment project is objective assessment of the built environment (OABE) around the immediate neighbourhood of 500,000 participants of the UK Biobank cohort. This will result in the modelling, compilation and linkage of corresponding longitudinal spatial database of built environment with the UK Biobank health datasets. The large-scale automation of such detailed and precise measures of individual-level built environment morphological metrics (morphometrics) will have the potential to unravel the *black box of causality*, the pathways through which built environment in conjunction with the social and natural environment act as one of fundamental determinants of individual behaviour, physical and mental health. OABE of UK Biobank can thus produce a comprehensive evidence-base on the impact of BE on lifestyle, behaviour and thereby health and hence, guide preventive intervention strategies as well as policy formulation.

2. BUILT ENVIRONMENT DATA SOURCE

2.1 UK Ordnance Survey dataset:

The Topography Layer and the Integrated Transport Network (ITN) Layer from the UK Ordnance Survey MasterMap (OSM) data as well as the UK Ordnance Survey Address Base Premium data constituted the base for the development of a series morphometrics. The OSM Topography Layer contains information on detailed surface features of the landscape categorized under nine themes (buildings, roads, tracks and paths, rail, water, terrain and height, heritage and antiques, structures and administrative boundaries). The Address Base Premium data provides the most detailed view of an address and its life cycle. It comprises of local authority, Ordnance Survey and Royal Mail addresses, current (approved) addresses, and alternatives for current addresses (reflecting differences in versions of addresses in current use), provisional addresses (proposed planning developments) and historic information for each address, where available, plus OWPAs and cross references to the OS MasterMap layer's TOIDs. The licence for the UK-wide Address Base Premium data procured from UK Ordnance survey comprised approximately 36 million valid address point features with an uncompressed file size of 29 GB. The component layers of the Address Base Premium data were joined together through the unique field – Unique Property Reference Number (UPRN). Thereafter, the geo-referenced grid coordinates; land use classifications and full address for each valid address points surveyed were extracted[43,44]. The same land use classification scheme as employed by the Ordnance Survey AddressBase Premium has been used in the present UK Biobank Built Environment project[45]. The polygon-based OSM Topography Layer and Address Base Premium were connected together through a spatial GIS queries. The OSM ITN Layer provides a topologically structured representation of the road network with respect to geometry of road links, road type (expressed in terms of motorway, A road, alleyway, etc.), junctions, grade separation, road names and numbers and information about the nature of road the link represents (for example single carriageway, dual carriageway or slip road). Geometric information consists of the length of the link as well as references to the node features at the ends of it. The OSM ITN Layer was subjected to network analysis techniques to evaluate the topological accessibility indices of the street network.

2.2 National Public Transport Access Nodes dataset:

Data on bus stops were obtained from the National Public Transport Access Nodes (NaPTAN) dataset[46]. NaPTAN forms a core component of the GB national transport information infrastructure and is used by a number of other UK standards and information systems. Every GB station, coach terminus, airport, ferry terminal, bus stop, etc., is allocated at least one identifier code.

2.3 Digital Terrain Model data:

5-metre resolution digital terrain model licensed by Blue Sky was procured from LandMap Services of MIMAS at The University of Manchester (www.landmap.ac.uk/index.php/Datasets/Bluesky-DTM/). The individual 100X100 KM^2 image chunks were mosaicked together and the coverage of study areas of interest were extracted. This formed the basis for the analysis of terrain slope.

2.4 Ariel photographs:

0.5-metre resolution Colour Infrared Image (CIR) licensed by Blue Sky was procured from LandMap Services of MIMAS at The University of Manchester (www.landmap.ac.uk/index.php/Datasets/Colour-Infrared/) . The imaged were captured using one of two instruments Vexel UltraCams, and ADS40 from Leica Geosystems GIS & Mapping, LLC. The individual 1X1 KM^2 image chunks were mosaicked together and the coverage of study areas of interest were extracted. CIR captures the solar reflectance in three wavelength bands, namely red, green and near infrared bands of the electromagnetic spectrum. CIR was employed to calculate the index of greenery.

2.5 Area-level deprivation data:

Data on Welsh Index of Multiple Deprivation (WIMD) scores of 2008 and 2011 releases measured at the level of lower super output areas were downloaded from the STATWALES website (https://statswales.wales.gov.uk/Catalogue/Community-Safety-and-Social_Inclusion/Welsh-Index-of-Multiple-Deprivation).

2.6 Building class data:

Cities Revealed building class dataset (version 6 for September 2012) comprising of information on residential dwelling types including the age of the dwelling and structural type was obtained in the form of 100X100 KM^2 from LandMap Services of MIMAS at The University of Manchester http://www.landmap.ac.uk/index.php/Datasets/Building_Class/Download-Building-Class-100km-x-100km.

3. GEOCODING INDIVIDUAL RESPONDENTS DWELLING ADDRESS

The UK Biobank Wales comprised of three assessment centres based in Cardiff, Swansea and Wrexham comprising of 20,816 active participants. The residential address of the participants were geocoded and X, Y coordinates were extracted by matching the Biobank address data with the UK Ordnance Survey address datasets. All spatial analyses in the study employed the British National Grid (i.e. OSBS1936) projection system. 96.81% of all Welsh Biobank addresses of participants from the three assessment centres could be geocoded by employing this process (N=20,152).

Deliverable file 1:

File Name (size)	Description
Wales_UKB.csv (1.75 MB)	UK Biobank addresses file with geocoded and X, Y coordinates in British National Grid appended to it.

Table 1: Description of variables used

Column No.	Variable	Description
1	**Encoded anonymised participant ID**	Unique ID
2	**Date of attending assessment centre**	
3	**UK Biobank assessment centre**	UKB assessment centre
4	**Address line 1**	Address fields provided by UK Biobank
5	**Address line 2**	
6	**Address line 3**	
7	**Address line 4**	
8	**Address line 5**	
9	**Postcode**	
10	**X_coordinate**	Geocoded and X coordinate in British National Grid
11	**Y_coordinate**	Geocoded and Y coordinate in British National Grid

4. BUILT ENVIRONMENT MORPHOMETRICS CONSTRUCTION

The built environment was measured within a pre-defined street network catchment buffers around an UK Biobank participant’s dwelling unit. The focus has been solely on objective measurements of built environment rather than on the individual’s perceptual information.

4.1 Land Use Morphometrics

4.1.1 Land use density

Given the epidemiological evidence of a significant relationship between density of health promoting/inhibiting land uses and multiple health outcomes, density was measured within 0.5, 1.0, 1.5, 2.0 kilometre street network catchments of UK Biobank respondent's dwelling as well as within the lower super output areas in which they resided. ArcGIS 10.2 Network Analyst was used to create street network catchment areas were created around the geocoded residences of UK Biobank participants. The UK Office of National Statistics has defined Lower Super Output Areas (LSOAs) as relatively stable, compact geographical units with reasonable degrees of homogeneity in shape and social composition and an average population of 1600 persons for Wales. This was also considered as one of the five definitions of neighbourhood. The LSOA boundaries for the present analysis were downloaded from the Office of National Statistics website. The 20,152 UK Biobank participants were distributed across 760 LSOAs of Wales. Density of more than 200 categories of land uses were calculated through a series of GIS queries from the from the AddressBase Premium dataset as the number of features of a specific land use category within a pre-defined neighbourhood and expressed as number of features per square kilometre of neighbourhood.

Deliverable files 2a-2e:

File Name (size)	**Description**
Wales_UKB_LU_Density_LSOAs.csv (13.6 MB)	Density of land uses within LSOA in which the UK Biobank participant resides
Wales_UKB_LU_Density_Netbuf500m.csv (11.9 MB)	Density of land uses within 500 metres street catchment area from the UK Biobank participant's residence
Wales_UKB_LU_Density_Netbuf1000m.csv (15.2 MB)	Density of land uses within 1000 metres street catchment area from the UK Biobank participant's residence
Wales_UKB_LU_Density_Netbuf1500m.csv (18.2 MB)	Density of land uses within 1500 metres street catchment area from the UK Biobank participant's residence
Wales_UKB_LU_Density_Netbuf2000m.csv (20.8 MB)	Density of land uses within 2000 metres street catchment area from the UK Biobank participant's residence

Header file name:

Wales_UKB_LU_Density_Header.csv (2.67 KB)

Table 2: Description of variables used for calculation of land use density

Column No.	Variable	Component AddressBase Premium land use description[45]									
		Land use code	Class Desc.	Primary Code	Secondary Code	Tertiary Code	Quaternary Code	Primary Desc.	Secondary Desc.	Tertiary Desc.	Quaternary Desc.
1	**Encoded anonymised participant ID**	-	-	-	-	-	-	-	-	-	-
2	**Buffer/LSOA area (sq Km)**	-	-	-	-	-	-	-	-	-	-
3	**Den_CA01**	CA01	Farm / Non-Residential Associated Building	C	A	1		Commercial	Agricultural	Farm / Non-Residential Associated Building	
4	**Den_CA02**	CA02	Fishery	C	A	2		Commercial	Agricultural	Fishery	
		CA02FF	Fish Farming	C	A	2	FF	Commercial	Agricultural	Fishery	Fish Farming
		CA02FH	Fish Hatchery	C	A	2	FH	Commercial	Agricultural	Fishery	Fish Hatchery
		CA02FP	Fish Processing	C	A	2	FP	Commercial	Agricultural	Fishery	Fish Processing
		CA02OY	Oyster / Mussel Bed	C	A	2	OY	Commercial	Agricultural	Fishery	Oyster / Mussel Bed
5	**Den_CA03**	CA03	Horticulture	C	A	3		Commercial	Agricultural	Horticulture	
		CA03SH	Smallholding	C	A	3	SH	Commercial	Agricultural	Horticulture	Smallholding
		CA03VY	Vineyard	C	A	3	VY	Commercial	Agricultural	Horticulture	Vineyard
		CA03WB	Watercress Bed	C	A	3	WB	Commercial	Agricultural	Horticulture	Watercress Bed
6	**Den_CA04**	CA04	Slaughter House / Abattoir	C	A	4		Commercial	Agricultural	Slaughter House / Abattoir	
7	**Den_CB**	CB	Ancillary Building	C	B			Commercial	Ancillary Building		
8	**Den_CC**	CC	Community Services	C	C			Commercial	Community Services		
9	**Den_ CC02**	CC02	Law Court	C	C	2		Commercial	Community Services	Law Court	
	Den_ CC03	CC03	Prison	C	C	3		Commercial	Community Services	Prison	
		CC03HD	HM Detention Centre	C	C	3	HD	Commercial	Community Services	Prison	HM Detention Centre
		CC03PR	HM Prison Service	C	C	3	PR	Commercial	Community Services	Prison	HM Prison Service

10		CC03SC	Secure Residential Accommodation	C	C	3	SC	Commercial	Community Services	Prison	Secure Residential Accommodation
11	**Den_ CC04**	CC04	Public / Village Hall / Other Community Facility	C	C	4		Commercial	Community Services	Public / Village Hall / Other Community Facility	
		CC04YR	Youth Recreational / Social Club	C	C	4	YR	Commercial	Community Services	Public / Village Hall / Other Community Facility	Youth Recreational / Social Club
12	**Den_ CC05**	CC05	Public Convenience	C	C	5		Commercial	Community Services	Public Convenience	
13	**Den_ CC06**	CC06	Cemetery / Crematorium / Graveyard. In Current Use.	C	C	6		Commercial	Community Services	Cemetery / Crematorium / Graveyard. In Current Use.	
		CC06CB	Columbarium	C	C	6	CB	Commercial	Community Services	Cemetery / Crematorium / Graveyard. In Current Use.	Columbarium
		CC06CR	Chapel Of Rest	C	C	6	CR	Commercial	Community Services	Cemetery / Crematorium / Graveyard. In Current Use.	Chapel Of Rest
		CC06CN	Crematorium	C	C	6	CN	Commercial	Community Services	Cemetery / Crematorium / Graveyard. In Current Use.	Crematorium
		CC06CY	Cemetery	C	C	6	CY	Commercial	Community Services	Cemetery / Crematorium / Graveyard. In Current Use.	Cemetery
		CC06MC	Military Cemetery	C	C	6	MC	Commercial	Community Services	Cemetery / Crematorium / Graveyard. In Current Use.	Military Cemetery
		CC06MY	Mortuary	C	C	6	MY	Commercial	Community Services	Cemetery / Crematorium / Graveyard. In Current Use.	Mortuary
14	**Den_ CC07**	CC07	Church Hall / Religious Meeting Place / Hall	C	C	7		Commercial	Community Services	Church Hall / Religious Meeting Place / Hall	

15	**Den_ CC08**	CC08	Community Service Centre / Office	C	C	8		Commercial	Community Services	Community Service Centre / Office	
16	**Den_ CC09**	CC09	Public Household Waste Recycling Centre (HWRC)	C	C	9		Commercial	Community Services	Public Household Waste Recycling Centre (HWRC)	
17	**Den_ CC10**	CC10	Recycling Site	C	C	10		Commercial	Community Services	Recycling Site	
18	**Den_ CC11**	CC11	CCTV	C	C	11		Commercial	Community Services	CCTV	
19	**Den_ CC12**	CC12	Job Centre	C	C	12		Commercial	Community Services	Job Centre	
20	**Den_ CE**	CE	Education	C	E			Commercial	Education		
21	**Den_ CE01**	CE01	College	C	E	1		Commercial	Education	College	
22	**Den_ CE01FE**	CE01FE	Further Education	C	E	1	FE	Commercial	Education	College	Further Education
23	**Den_ CE01HE**	CE01HE	Higher Education	C	E	1	HE	Commercial	Education	College	Higher Education
24	**Den_ CE02**	CE02	Children’s Nursery / Crèche	C	E	2		Commercial	Education	Children’s Nursery / Crèche	
25	**Den_ CE03**	CE03	Preparatory / First / Primary / Infant / Junior / Middle School	C	E	3		Commercial	Education	Preparatory / First / Primary / Infant / Junior / Middle School	
26	**Den_ CE03FS**	CE03FS	First School	C	E	3	FS	Commercial	Education	Preparatory / First / Primary / Infant / Junior / Middle School	First School
27	**Den_ CE03IS**	CE03IS	Infant School	C	E	3	IS	Commercial	Education	Preparatory / First / Primary / Infant / Junior / Middle School	Infant School
28	**Den_ CE03JS**	CE03JS	Junior School	C	E	3	JS	Commercial	Education	Preparatory / First / Primary / Infant / Junior / Middle School	Junior School
29	**Den_ CE03NP**	CE03NP	Non State Primary / Preparatory School	C	E	3	NP	Commercial	Education	Preparatory / First / Primary / Infant / Junior / Middle School	Non State Primary / Preparatory School
30	**Den_ CE03PS**	CE03PS	Primary School	C	E	3	PS	Commercial	Education	Preparatory / First / Primary / Infant / Junior / Middle School	Primary School

31	**Den_ CE04**	CE04	Secondary / High School	C	E	4		Commercial	Education	Secondary / High School	
32	**Den_ CE04SS**	CE04SS	Secondary School	C	E	4	SS	Commercial	Education	Secondary / High School	Secondary School
33	**Den_ CE05**	CE05	University	C	E	5		Commercial	Education	University	
34	**Den_ CE06**	CE06	Special Needs Establishment.	C	E	6		Commercial	Education	Special Needs Establishment.	
35	**Den_ CE07**	CE07	Other Educational Establishment	C	E	7		Commercial	Education	Other Educational Establishment	
36	**Den_ CH**	CH	Hotel / Motel / Boarding / Guest House	C	H			Commercial	Hotel / Motel / Boarding / Guest House		
37	**Den_ CH01**	CH01	Boarding / Guest House / Bed And Breakfast / Youth Hostel	C	H	1		Commercial	Hotel / Motel / Boarding / Guest House	Boarding / Guest House / Bed And Breakfast / Youth Hostel	
		CH01YH	Youth Hostel	C	H	1	YH	Commercial	Hotel / Motel / Boarding / Guest House	Boarding / Guest House / Bed And Breakfast / Youth Hostel	Youth Hostel
38	**Den_ CH02**	CH02	Holiday Let/Accomodati on/Short-Term Let Other Than CH01	C	H	2		Commercial	Hotel / Motel / Boarding / Guest House	Holiday Let/Accomodation/Short -Term Let Other Than CH01	
39	**Den_ CH03**	CH03	Hotel/Motel	C	H	3		Commercial	Hotel / Motel / Boarding / Guest House	Hotel/Motel	
40	**Den_ CI01**	CI01	Factory/Manufa cturing	C	I	1		Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	
		CI01AW	Aircraft Works	C	I	1	AW	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Aircraft Works
		CI01BB	Boat Building	C	I	1	BB	Commercial	Industrial Applicable	Factory/Manufacturing	Boat Building

									to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites		
		CI01BR	Brick Works	C	I	1	BR	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Brick Works
		CI01BW	Brewery	C	I	1	BW	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Brewery
	Den_ CI01	CI01CD	Cider Manufacture	C	I	1	CD	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Cider Manufacture
		CI01CM	Chemical Works	C	I	1	CM	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Chemical Works
		CI01CW	Cement Works	C	I	1	CW	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Cement Works
		CI01DA	Dairy Processing	C	I	1	DA	Commercial	Industrial Applicable to manufacturing, engineering, maintenance,	Factory/Manufacturing	Dairy Processing

									storage / wholesale distribution and extraction sites		
		CI01DY	Distillery	C	I	1	DY	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Distillery
		CI01FL	Flour Mill	C	I	1	FL	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Flour Mill
		CI01FO	Food Processing	C	I	1	FO	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Food Processing
	Den_ CI01	CI01GW	Glassworks	C	I	1	GW	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Glassworks
		CI01MG	Manufacturing	C	I	1	MG	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Manufacturing
		CI01OH	Oast House	C	I	1	OH	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Oast House

	Den_ CI01	CI01OR	Oil Refining	C	I	1	OR	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Oil Refining
		CI01PG	Pottery Manufacturing	C	I	1	PG	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Pottery Manufacturing
		CI01PM	Paper Mill	C	I	1	PM	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Paper Mill
		CI01PW	Printing Works	C	I	1	PW	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Printing Works
		CI01YD	Shipyard	C	I	1	YD	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Shipyard
		CI01SR	Sugar Refinery	C	I	1	SR	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Sugar Refinery
		CI01SW	Steel Works	C	I	1	SW	Commercial	Industrial Applicable to manufacturing, engineering,	Factory/Manufacturing	Steel Works

									maintenance, storage / wholesale distribution and extraction sites		
		CI01TL	Timber Mill	C	I	1	TL	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Timber Mill
	Den_ CI01	CI01WN	Winery	C	I	1	WN	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Factory/Manufacturing	Winery
41	**Den_ CI02**	CI02	Mineral / Ore Working / Quarry / Mine	C	I	2		Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Mineral / Ore Working / Quarry / Mine	
		CI02MA	Mineral Mining / Active	C	I	2	MA	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Mineral / Ore Working / Quarry / Mine	Mineral Mining / Active
		CI02MD	Mineral Distribution / Storage	C	I	2	MD	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Mineral / Ore Working / Quarry / Mine	Mineral Distribution / Storage
		CI02MP	Mineral Processing	C	I	2	MP	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and	Mineral / Ore Working / Quarry / Mine	Mineral Processing

									extraction sites		
	Den_ CI02	CI02OA	Oil / Gas Extraction / Active	C	I	2	OA	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Mineral / Ore Working / Quarry / Mine	Oil / Gas Extraction / Active
		CI02QA	Mineral Quarrying / Open Extraction / Active	C	I	2	QA	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Mineral / Ore Working / Quarry / Mine	Mineral Quarrying / Open Extraction / Active
42	Den_ CI03	CI03	Workshop / Light Industrial	C	I	3		Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Workshop / Light Industrial	
		CI03GA	Servicing Garage	C	I	3	GA	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Workshop / Light Industrial	Servicing Garage
43	Den_ CI04	CI04	Warehouse / Store / Storage Depot	C	I	4		Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Warehouse / Store / Storage Depot	
		CI04CS	Crop Handling / Storage	C	I	4	CS	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Warehouse / Store / Storage Depot	Crop Handling / Storage
		CI04PL	Postal Sorting / Distribution	C	I	4	PL	Commercial	Industrial Applicable to manufacturing,	Warehouse / Store / Storage Depot	Postal Sorting / Distribution

									engineering, maintenance, storage / wholesale distribution and extraction sites		
	Den_ CI04	CI04SO	Solid Fuel Storage	C	I	4	SO	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Warehouse / Store / Storage Depot	Solid Fuel Storage
		CI04TS	Timber Storage	C	I	4	TS	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Warehouse / Store / Storage Depot	Timber Storage
44	Den_ CI05	CI05	Wholesale Distribution	C	I	5		Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Wholesale Distribution	
		CI05SF	Solid Fuel Distribution	C	I	5	SF	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Wholesale Distribution	Solid Fuel Distribution
		CI05TD	Timber Distribution	C	I	5	TD	Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Wholesale Distribution	Timber Distribution
45	Den_ CI06	CI06	Recycling Plant	C	I	6		Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale	Recycling Plant	

									distribution and extraction sites		
46	**Den_ CI07**	CI07	Incinerator / Waste Transfer Station	C	I	7		Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Incinerator / Waste Transfer Station	
47	**Den_ CI08**	CI08	Maintenance Depot	C	I	8		Commercial	Industrial Applicable to manufacturing, engineering, maintenance, storage / wholesale distribution and extraction sites	Maintenance Depot	
48	**Den_ CL01**	CL01	Amusements	C	L	1		Commercial	Leisure - Applicable to recreational sites and enterprises	Amusements	
		CL01LP	Leisure Pier	C	L	1	LP	Commercial	Leisure - Applicable to recreational sites and enterprises	Amusements	Leisure Pier
49	**Den_ CL02**	CL02	Holiday / Campsite	C	L	2		Commercial	Leisure - Applicable to recreational sites and enterprises	Holiday / Campsite	
		CL02CG	Camping	C	L	2	CG	Commercial	Leisure - Applicable to recreational sites and enterprises	Holiday / Campsite	Camping
		CL02CV	Caravanning	C	L	2	CV	Commercial	Leisure - Applicable to recreational sites and enterprises	Holiday / Campsite	Caravanning
		CL02HA	Holiday Accommodatio n	C	L	2	HA	Commercial	Leisure - Applicable to recreational sites and enterprises	Holiday / Campsite	Holiday Accommodation
		CL02HO	Holiday Centre	C	L	2	HO	Commercial	Leisure - Applicable to recreational sites and enterprises	Holiday / Campsite	Holiday Centre
		CL02YC	Youth Organisation Camp	C	L	2	YC	Commercial	Leisure - Applicable to recreational sites and enterprises	Holiday / Campsite	Youth Organisation Camp
50	**Den_ CL03**	CL03	Library	C	L	3		Commercial	Leisure - Applicable to recreational sites and enterprises	Library	
		CL03RR	Reading Room	C	L	3	RR	Commercial	Leisure - Applicable to recreational sites	Library	Reading Room

									and enterprises		
51	**Den_ CL04**	CL04	Museum / Gallery	C	L	4		Commercial	Leisure - Applicable to recreational sites and enterprises	Museum / Gallery	
		CL04AC	Art Centre / Gallery	C	L	4	AC	Commercial	Leisure - Applicable to recreational sites and enterprises	Museum / Gallery	Art Centre / Gallery
		CL04AM	Aviation Museum	C	L	4	AM	Commercial	Leisure - Applicable to recreational sites and enterprises	Museum / Gallery	Aviation Museum
		CL04HG	Heritage Centre	C	L	4	HG	Commercial	Leisure - Applicable to recreational sites and enterprises	Museum / Gallery	Heritage Centre
		CL04IM	Industrial Museum	C	L	4	IM	Commercial	Leisure - Applicable to recreational sites and enterprises	Museum / Gallery	Industrial Museum
		CL04MM	Military Museum	C	L	4	MM	Commercial	Leisure - Applicable to recreational sites and enterprises	Museum / Gallery	Military Museum
		CL04SM	Science Museum	C	L	4	SM	Commercial	Leisure - Applicable to recreational sites and enterprises	Museum / Gallery	Science Museum
		CL04TM	Transport Museum	C	L	4	TM	Commercial	Leisure - Applicable to recreational sites and enterprises	Museum / Gallery	Transport Museum
		CL04NM	Maritime Museum	C	L	4	NM	Commercial	Leisure - Applicable to recreational sites and enterprises	Museum / Gallery	Maritime Museum
52	**Den_ CL06**	CL06	Indoor / Outdoor Leisure / Sporting Activity / Centre	C	L	6		Commercial	Leisure - Applicable to recreational sites and enterprises	Indoor / Outdoor Leisure / Sporting Activity / Centre	
53	**Den_ CL06BF**	CL06BF	Bowls Facility	C	L	6	BF	Commercial	Leisure - Applicable to recreational sites and enterprises	Indoor / Outdoor Leisure / Sporting Activity / Centre	Bowls Facility
54	**Den_ CL06CK**	CL06CK	Cricket Facility	C	L	6	CK	Commercial	Leisure - Applicable to recreational sites and enterprises	Indoor / Outdoor Leisure / Sporting Activity / Centre	Cricket Facility
55	**Den_ CL06DS**	CL06DS	Diving / Swimming Facility	C	L	6	DS	Commercial	Leisure - Applicable to recreational sites and enterprises	Indoor / Outdoor Leisure / Sporting Activity / Centre	Diving / Swimming Facility
	Den_ CL06EQ	CL06EQ	Equestrian Sports Facility	C	L	6	EQ	Commercial	Leisure - Applicable to recreational sites	Indoor / Outdoor Leisure / Sporting Activity /	Equestrian Sports Facility

56									and enterprises	Centre	
57	**Den_ CL06FB**	CL06FB	Football Facility	C	L	6	FB	Commercial	Leisure - Applicable to recreational sites and enterprises	Indoor / Outdoor Leisure / Sporting Activity / Centre	Football Facility
58	**Den_ CL06GF**	CL06GF	Golf Facility	C	L	6	GF	Commercial	Leisure - Applicable to recreational sites and enterprises	Indoor / Outdoor Leisure / Sporting Activity / Centre	Golf Facility
59	**Den_ CL06LS**	CL06LS	Activity / Leisure / Sports Centre	C	L	6	LS	Commercial	Leisure - Applicable to recreational sites and enterprises	Indoor / Outdoor Leisure / Sporting Activity / Centre	Activity / Leisure / Sports Centre
60	**Den_ CL06PF**	CL06PF	Playing Field	C	L	6	PF	Commercial	Leisure - Applicable to recreational sites and enterprises	Indoor / Outdoor Leisure / Sporting Activity / Centre	Playing Field
61	**Den_ CL06QS**	CL06QS	Racquet Sports Facility	C	L	6	QS	Commercial	Leisure - Applicable to recreational sites and enterprises	Indoor / Outdoor Leisure / Sporting Activity / Centre	Racquet Sports Facility
62	**Den_ CL06RF**	CL06RF	Rugby Facility	C	L	6	RF	Commercial	Leisure - Applicable to recreational sites and enterprises	Indoor / Outdoor Leisure / Sporting Activity / Centre	Rugby Facility
63	**Den_ CL06RG**	CL06RG	Recreation Ground	C	L	6	RG	Commercial	Leisure - Applicable to recreational sites and enterprises	Indoor / Outdoor Leisure / Sporting Activity / Centre	Recreation Ground
64	**Den_ CL06SK**	CL06SK	Skateboarding Facility	C	L	6	SK	Commercial	Leisure - Applicable to recreational sites and enterprises	Indoor / Outdoor Leisure / Sporting Activity / Centre	Skateboarding Facility
65	**Den_ CL06TB**	CL06TB	Tenpin Bowling Facility	C	L	6	TB	Commercial	Leisure - Applicable to recreational sites and enterprises	Indoor / Outdoor Leisure / Sporting Activity / Centre	Tenpin Bowling Facility
66	**Den_ CL06WA**	CL06WA	Water Sports Facility	C	L	6	WA	Commercial	Leisure - Applicable to recreational sites and enterprises	Indoor / Outdoor Leisure / Sporting Activity / Centre	Water Sports Facility
67	**Den_ CL06WP**	CL06WP	Winter Sports Facility	C	L	6	WP	Commercial	Leisure - Applicable to recreational sites and enterprises	Indoor / Outdoor Leisure / Sporting Activity / Centre	Winter Sports Facility
68	**Den_ CL07**	CL07	Bingo Hall / Cinema / Conference / Exhibition Centre / Theatre / Concert Hall	C	L	7		Commercial	Leisure - Applicable to recreational sites and enterprises	Bingo Hall / Cinema / Conference / Exhibition Centre / Theatre / Concert Hall	
		CL07TH	Theatre	C	L	7	TH	Commercial	Leisure - Applicable to recreational sites and enterprises	Bingo Hall / Cinema / Conference / Exhibition Centre / Theatre /	Theatre

										Concert Hall	
		CL07CI	Cinema	C	L	7	CI	Commercial	Leisure - Applicable to recreational sites and enterprises	Bingo Hall / Cinema / Conference / Exhibition Centre / Theatre / Concert Hall	Cinema
	Den_ CL07	CL07EN	Entertainment Complex	C	L	7	EN	Commercial	Leisure - Applicable to recreational sites and enterprises	Bingo Hall / Cinema / Conference / Exhibition Centre / Theatre / Concert Hall	Entertainment Complex
		CL07EX	Conference / Exhibition Centre	C	L	7	EX	Commercial	Leisure - Applicable to recreational sites and enterprises	Bingo Hall / Cinema / Conference / Exhibition Centre / Theatre / Concert Hall	Conference / Exhibition Centre
		CL08	Zoo / Theme Park	C	L	8		Commercial	Leisure - Applicable to recreational sites and enterprises	Zoo / Theme Park	
		CL08AK	Amusement Park	C	L	8	AK	Commercial	Leisure - Applicable to recreational sites and enterprises	Zoo / Theme Park	Amusement Park
69	**Den_ CL08**	CL08MX	Model Village Site	C	L	8	MX	Commercial	Leisure - Applicable to recreational sites and enterprises	Zoo / Theme Park	Model Village Site
		CL08WZ	Wildlife / Zoological Park	C	L	8	WZ	Commercial	Leisure - Applicable to recreational sites and enterprises	Zoo / Theme Park	Wildlife / Zoological Park
		CL08AQ	Aquatic Attraction	C	L	8	AQ	Commercial	Leisure - Applicable to recreational sites and enterprises	Zoo / Theme Park	Aquatic Attraction
70	**Den_ CL09**	CL09	Beach Hut (Recreational, Non-Residential Use Only)	C	L	9		Commercial	Leisure - Applicable to recreational sites and enterprises	Beach Hut (Recreational, Non-Residential Use Only)	
71	**Den_ CL10**	CL10	Licensed Private Members' Club	C	L	10		Commercial	Leisure - Applicable to recreational sites and enterprises	Licensed Private Members' Club	
		CL10RE	Recreational / Social Club	C	L	10	RE	Commercial	Leisure - Applicable to recreational sites and enterprises	Licensed Private Members' Club	Recreational / Social Club
72	**Den_ CL11**	CL11	Arena / Stadium	C	L	11		Commercial	Leisure - Applicable to recreational sites and enterprises	Arena / Stadium	

		CL11SD	Stadium	C	L	11	SD	Commercial	Leisure - Applicable to recreational sites and enterprises	Arena / Stadium	Stadium
		CL11SJ	Showground	C	L	11	SJ	Commercial	Leisure - Applicable to recreational sites and enterprises	Arena / Stadium	Showground
73	**Den_ CM**	CM	Medical	C	M			Commercial	Medical		
74	**Den_ CM01**	CM01	Dentist	C	M	1		Commercial	Medical	Dentist	
75	**Den_ CM02**	CM02	General Practice Surgery / Clinic	C	M	2		Commercial	Medical	General Practice Surgery / Clinic	
76	**Den_ CM02HL**	CM02HL	Health Care Services	C	M	2	HL	Commercial	Medical	General Practice Surgery / Clinic	Health Care Services
77	**Den_ CM02HC**	CM02HC	Health Centre	C	M	2	HC	Commercial	Medical	General Practice Surgery / Clinic	Health Centre
78	**Den_ CM03**	CM03	Hospital / Hospice	C	M	3		Commercial	Medical	Hospital / Hospice	
79	**Den_ CM03HI**	CM03HI	Hospice	C	M	3	HI	Commercial	Medical	Hospital / Hospice	Hospice
80	**Den_ CM03HP**	CM03HP	Hospital	C	M	3	HP	Commercial	Medical	Hospital / Hospice	Hospital
81	**Den_ CM04**	CM04	Medical / Testing / Research Laboratory	C	M	4		Commercial	Medical	Medical / Testing / Research Laboratory	
82	**Den_ CM05**	CM05	Professional Medical Service	C	M	5		Commercial	Medical	Professional Medical Service	
		CM05ZS	Assessment / Development Services	C	M	5	ZS	Commercial	Medical	Professional Medical Service	Assessment / Development Services
83	**Den_ CN**	CN	Animal Centre	C	N			Commercial	Animal Centre		
84	**Den_ CN01**	CN01	Cattery / Kennel	C	N	1		Commercial	Animal Centre	Cattery / Kennel	
85	**Den_ CN02**	CN02	Animal Services	C	N	2		Commercial	Animal Centre	Animal Services	
		CN02AX	Animal Quarantining	C	N	2	AX	Commercial	Animal Centre	Animal Services	Animal Quarantining
86	**Den_ CN03**	CN03	Equestrian	C	N	3		Commercial	Animal Centre	Equestrian	
		CN03HB	Horse Racing / Breeding Stable	C	N	3	HB	Commercial	Animal Centre	Equestrian	Horse Racing / Breeding Stable
		CN03SB	Commercial Stabling /	C	N	3	SB	Commercial	Animal Centre	Equestrian	Commercial Stabling / Riding

			Riding								
87	**Den_ CN04**	CN04	Vet / Animal Medical Treatment	C	N	4		Commercial	Animal Centre	Vet / Animal Medical Treatment	
88	**Den_ CN05**	CN05	Animal / Bird / Marine Sanctuary	C	N	5		Commercial	Animal Centre	Animal / Bird / Marine Sanctuary	
		CN05AN	Animal Sanctuary	C	N	5	AN	Commercial	Animal Centre	Animal / Bird / Marine Sanctuary	Animal Sanctuary
		CN05MR	Marine Sanctuary	C	N	5	MR	Commercial	Animal Centre	Animal / Bird / Marine Sanctuary	Marine Sanctuary
89	**Den_ CO01**	CO01	Office / Work Studio	C	O	1		Commercial	Office	Office / Work Studio	
		CO01EM	Embassy /, High Commission / Consulate	C	O	1	EM	Commercial	Office	Office / Work Studio	Embassy /, High Commission / Consulate
		CO01FM	Film Studio	C	O	1	FM	Commercial	Office	Office / Work Studio	Film Studio
		CO01GV	Central Government Service	C	O	1	GV	Commercial	Office	Office / Work Studio	Central Government Service
		CO01LG	Local Government Service	C	O	1	LG	Commercial	Office	Office / Work Studio	Local Government Service
90	**Den_ CO02**	CO02	Broadcasting (TV / Radio)	C	O	2		Commercial	Office	Broadcasting (TV / Radio)	
91	**Den_ CR01**	CR01	Bank / Financial Service	C	R	1		Commercial	Retail	Bank / Financial Service	
92	**Den_ CR02**	CR02	Retail Service Agent	C	R	2		Commercial	Retail	Retail Service Agent	
		CR02PO	Post Office	C	R	2	PO	Commercial	Retail	Retail Service Agent	Post Office
93	**Den_ CR04**	CR04	Market (Indoor / Outdoor)	C	R	4		Commercial	Retail	Market (Indoor / Outdoor)	
		CR04FK	Fish Market	C	R	4	FK	Commercial	Retail	Market (Indoor / Outdoor)	Fish Market
		CR04FV	Fruit / Vegetable Market	C	R	4	FV	Commercial	Retail	Market (Indoor / Outdoor)	Fruit / Vegetable Market
		CR04LV	Livestock Market	C	R	4	LV	Commercial	Retail	Market (Indoor / Outdoor)	Livestock Market
94	**Den_ CR05**	CR05	Petrol Filling Station	C	R	5		Commercial	Retail	Petrol Filling Station	
95	**Den_ CR06**	CR06	Public House / Bar / Nightclub	C	R	6		Commercial	Retail	Public House / Bar / Nightclub	

96	**Den_ CR07**	CR07	Restaurant / Cafeteria	C	R	7		Commercial	Retail	Restaurant / Cafeteria	
97	**Den_ CR08**	CR08	Shop / Showroom	C	R	8		Commercial	Retail	Shop / Showroom	
		CR08GC	Garden Centre	C	R	8	GC	Commercial	Retail	Shop / Showroom	Garden Centre
98	**Den_ CR09**	CR09	Other Licensed Premise / Vendor	C	R	9		Commercial	Retail	Other Licensed Premise / Vendor	
99	**Den_ CR10**	CR10	Fast Food Outlet / Takeaway (Hot / Cold)	C	R	10		Commercial	Retail	Fast Food Outlet / Takeaway (Hot / Cold)	
100	**Den_ CR11**	CR11	Automated Teller Machine (ATM)	C	R	11		Commercial	Retail	Automated Teller Machine (ATM)	
101	**Den_ CS**	CS	Storage Land	C	S			Commercial	Storage Land		
		CS01	General Storage Land	C	S	1		Commercial	Storage Land	General Storage Land	
		CS02	Builders' Yard	C	S	2		Commercial	Storage Land	Builders' Yard	
102	**Den_ CT**	CT	Transport	C	T			Commercial	Transport		
103	**Den_ CT01**	CT01	Airfield / Airstrip / Airport / Air Transport Infrastructure Facility	C	T	1		Commercial	Transport	Airfield / Airstrip / Airport / Air Transport Infrastructure Facility	
		CT01AF	Airfield	C	T	1	AF	Commercial	Transport	Airfield / Airstrip / Airport / Air Transport Infrastructure Facility	Airfield
		CT01AY	Air Passenger Terminal	C	T	1	AY	Commercial	Transport	Airfield / Airstrip / Airport / Air Transport Infrastructure Facility	Air Passenger Terminal
		CT01AI	Air Transport Infrastructure Services	C	T	1	AI	Commercial	Transport	Airfield / Airstrip / Airport / Air Transport Infrastructure Facility	Air Transport Infrastructure Services
		CT01AP	Airport	C	T	1	AP	Commercial	Transport	Airfield / Airstrip / Airport / Air Transport Infrastructure Facility	Airport
		CT01HS	Helicopter Station	C	T	1	HS	Commercial	Transport	Airfield / Airstrip / Airport / Air Transport Infrastructure Facility	Helicopter Station

		CT01HT	Heliport / Helipad	C	T	1	HT	Commercial	Transport	Airfield / Airstrip / Airport / Air Transport Infrastructure Facility	Heliport / Helipad
104	**Den_ CT02**	CT02	Bus Shelter	C	T	2		Commercial	Transport	Bus Shelter	
105	**Den_ CT03**	CT03	Car / Coach / Commercial Vehicle / Taxi Parking / Park And Ride Site	C	T	3		Commercial	Transport	Car / Coach / Commercial Vehicle / Taxi Parking / Park And Ride Site	
		CT03PK	Public Park And Ride	C	T	3	PK	Commercial	Transport	Car / Coach / Commercial Vehicle / Taxi Parking / Park And Ride Site	Public Park And Ride
		CT03PP	Public Car Parking	C	T	3	PP	Commercial	Transport	Car / Coach / Commercial Vehicle / Taxi Parking / Park And Ride Site	Public Car Parking
		CT03PU	Public Coach Parking	C	T	3	PU	Commercial	Transport	Car / Coach / Commercial Vehicle / Taxi Parking / Park And Ride Site	Public Coach Parking
		CT03VP	Public Commercial Vehicle Parking	C	T	3	VP	Commercial	Transport	Car / Coach / Commercial Vehicle / Taxi Parking / Park And Ride Site	Public Commercial Vehicle Parking
106	**Den_ CT04**	CT04	Goods Freight Handling / Terminal	C	T	4		Commercial	Transport	Goods Freight Handling / Terminal	
		CT04AE	Air Freight Terminal	C	T	4	AE	Commercial	Transport	Goods Freight Handling / Terminal	Air Freight Terminal
		CT04CF	Container Freight	C	T	4	CF	Commercial	Transport	Goods Freight Handling / Terminal	Container Freight
		CT04RH	Road Freight Transport	C	T	4	RH	Commercial	Transport	Goods Freight Handling / Terminal	Road Freight Transport
		CT04RT	Rail Freight Transport	C	T	4	RT	Commercial	Transport	Goods Freight Handling / Terminal	Rail Freight Transport
107	**Den_ CT05**	CT05	Marina	C	T	5		Commercial	Transport	Marina	
108	**Den_ CT06**	CT06	Mooring	C	T	6		Commercial	Transport	Mooring	
109	**Den_ CT07**	CT07	Railway Asset	C	T	7		Commercial	Transport	Railway Asset	
	Den_ CT08	CT08	Station /	C	T	8		Commercial	Transport	Station / Interchange /	

110			Interchange / Terminal / Halt							Terminal / Halt	
		CT08BC	Bus / Coach Station	C	T	8	BC	Commercial	Transport	Station / Interchange / Terminal / Halt	Bus / Coach Station
		CT08RS	Railway Station	C	T	8	RS	Commercial	Transport	Station / Interchange / Terminal / Halt	Railway Station
		CT08VH	Vehicular Rail Terminal	C	T	8	VH	Commercial	Transport	Station / Interchange / Terminal / Halt	Vehicular Rail Terminal
111	**Den_ CT09**	CT09	Transport Track / Way	C	T	9		Commercial	Transport	Transport Track / Way	
		CT09CL	Cliff Railway	C	T	9	CL	Commercial	Transport	Transport Track / Way	Cliff Railway
		CT09CX	Chair Lift / Cable Car / Ski Tow	C	T	9	CX	Commercial	Transport	Transport Track / Way	Chair Lift / Cable Car / Ski Tow
		CT09MO	Monorail	C	T	9	MO	Commercial	Transport	Transport Track / Way	Monorail
112	**Den_ CT10**	CT10	Vehicle Storage	C	T	10		Commercial	Transport	Vehicle Storage	
		CT10BG	Boat Storage	C	T	10	BG	Commercial	Transport	Vehicle Storage	Boat Storage
		CT10BU	Bus / Coach Depot	C	T	10	BU	Commercial	Transport	Vehicle Storage	Bus / Coach Depot
113	**Den_ CT11**	CT11	Transport Related Infrastructure	C	T	11		Commercial	Transport	Transport Related Infrastructure	
		CT11AD	Aqueduct	C	T	11	AD	Commercial	Transport	Transport Related Infrastructure	Aqueduct
		CT11LK	Lock	C	T	11	LK	Commercial	Transport	Transport Related Infrastructure	Lock
		CT11WE	Weir	C	T	11	WE	Commercial	Transport	Transport Related Infrastructure	Weir
		CT11WG	Weighbridge / Load Gauge	C	T	11	WG	Commercial	Transport	Transport Related Infrastructure	Weighbridge / Load Gauge
114	**Den_ CT12**	CT12	Overnight Lorry Park	C	T	12		Commercial	Transport	Overnight Lorry Park	
115	**Den_ CU**	CU	Utility	C	U			Commercial	Utility		
116	**Den_ CU01**	CU01	Electricity Sub-Station	C	U	1		Commercial	Utility	Electricity Sub-Station	
117	**Den_ CU02**	CU02	Landfill	C	U	2		Commercial	Utility	Landfill	
	Den_ CU03	CU03	Power Station / Energy Production	C	U	3		Commercial	Utility	Power Station / Energy Production	
		CU03ED	Electricity Distribution	C	U	3	ED	Commercial	Utility	Power Station / Energy Production	Electricity Distribution

			Facility								Facility
118		CU03EP	Electricity Production Facility	C	U	3	EP	Commercial	Utility	Power Station / Energy Production	Electricity Production Facility
		CU03WF	Wind Farm	C	U	3	WF	Commercial	Utility	Power Station / Energy Production	Wind Farm
		CU03WU	Wind Turbine	C	U	3	WU	Commercial	Utility	Power Station / Energy Production	Wind Turbine
119	**Den_ CU04**	CU04	Pump House / Pumping Station / Water Tower	C	U	4		Commercial	Utility	Pump House / Pumping Station / Water Tower	
		CU04WC	Water Controlling / Pumping	C	U	4	WC	Commercial	Utility	Pump House / Pumping Station / Water Tower	Water Controlling / Pumping
		CU04WD	Water Distribution / Pumping	C	U	4	WD	Commercial	Utility	Pump House / Pumping Station / Water Tower	Water Distribution / Pumping
		CU04W M	Water Quality Monitoring	C	U	4	WM	Commercial	Utility	Pump House / Pumping Station / Water Tower	Water Quality Monitoring
		CU04WS	Water Storage	C	U	4	WS	Commercial	Utility	Pump House / Pumping Station / Water Tower	Water Storage
		CU04W W	Waste Water Distribution / Pumping	C	U	4	WW	Commercial	Utility	Pump House / Pumping Station / Water Tower	Waste Water Distribution / Pumping
120	**Den_ CU06**	CU06	Telecommunica tion	C	U	6		Commercial	Utility	Telecommunication	
		CU06TE	Telecommunica tions Mast	C	U	6	TE	Commercial	Utility	Telecommunication	Telecommunicati ons Mast
		CU06TX	Telephone Exchange	C	U	6	TX	Commercial	Utility	Telecommunication	Telephone Exchange
121	**Den_ CU07**	CU07	Water / Waste Water / Sewage Treatment Works	C	U	7		Commercial	Utility	Water / Waste Water / Sewage Treatment Works	
		CU07WR	Waste Water Treatment	C	U	7	WR	Commercial	Utility	Water / Waste Water / Sewage Treatment Works	Waste Water Treatment
		CU07WT	Water Treatment	C	U	7	WT	Commercial	Utility	Water / Waste Water / Sewage Treatment Works	Water Treatment
	Den_ CU09	CU09	Other Utility Use	C	U	9		Commercial	Utility	Other Utility Use	
		CU09OV	Observatory	C	U	9	OV	Commercial	Utility	Other Utility Use	Observatory

122		CU09RA	Radar Station	C	U	9	RA	Commercial	Utility	Other Utility Use	Radar Station
		CU09SE	Satellite Earth Station	C	U	9	SE	Commercial	Utility	Other Utility Use	Satellite Earth Station
		CU09CQ	Cable Terminal Station	C	U	9	CQ	Commercial	Utility	Other Utility Use	Cable Terminal Station
123	**Den_ CU10**	CU10	Waste Management	C	U	10		Commercial	Utility	Waste Management	
124	**Den_ CU11**	CU11	Telephone Box	C	U	11		Commercial	Utility	Telephone Box	
		CU11OP	Other Public Telephones	C	U	11	OP	Commercial	Utility	Telephone Box	Other Public Telephones
		CU12	Dam	C	U	12		Commercial	Utility	Dam	
125	**Den_ CX**	CX	Emergency / Rescue Service	C	X			Commercial	Emergency / Rescue Service		
126	**Den_ CX01**	CX01	Police / Transport Police / Station	C	X	1		Commercial	Emergency / Rescue Service	Police / Transport Police / Station	
		CX01PT	Police Training	C	X	1	PT	Commercial	Emergency / Rescue Service	Police / Transport Police / Station	Police Training
127	**Den_ CX02**	CX02	Fire Station	C	X	2		Commercial	Emergency / Rescue Service	Fire Station	
		CX02FT	Fire Service Training	C	X	2	FT	Commercial	Emergency / Rescue Service	Fire Station	Fire Service Training
128	**Den_ CX02**	CX03	Ambulance Station	C	X	3		Commercial	Emergency / Rescue Service	Ambulance Station	
		CX03AA	Air Sea Rescue / Air Ambulance	C	X	3	AA	Commercial	Emergency / Rescue Service	Ambulance Station	Air Sea Rescue / Air Ambulance
129	**Den_ CX04**	CX04	Lifeboat Services / Station	C	X	4		Commercial	Emergency / Rescue Service	Lifeboat Services / Station	
130	**Den_ CX05**	CX05	Coastguard Rescue / Lookout / Station	C	X	5		Commercial	Emergency / Rescue Service	Coastguard Rescue / Lookout / Station	
131	**Den_ CX06**	CX06	Mountain Rescue Station	C	X	6		Commercial	Emergency / Rescue Service	Mountain Rescue Station	
132	**Den_ CX08**	CX08	Police Box / Kiosk	C	X	8		Commercial	Emergency / Rescue Service	Police Box / Kiosk	
133	**Den_ CZ**	CZ	Information	C	Z			Commercial	Information		
134	**Den_ CZ01**	CZ01	Advertising Hoarding	C	Z	1		Commercial	Information	Advertising Hoarding	
	Den_ CZ02	CZ02	Tourist Information	C	Z	2		Commercial	Information	Tourist Information Signage	

135			Signage								
		CZ02VI	Visitor Information	C	Z	2	VI	Commercial	Information	Tourist Information Signage	Visitor Information
136	**Den_ CZ03**	CZ03	Traffic Information Signage	C	Z	3		Commercial	Information	Traffic Information Signage	
137	**Den_LL**	LL	Allotment	L	L			Land	Allotment		
138	**Den_LM**	LM	Amenity - Open areas not attracting visitors	L	M			Land	Amenity - Open areas not attracting visitors		
139	**Den_LM01**	LM01	Landscaped Roundabout	L	M	1		Land	Amenity - Open areas not attracting visitors	Landscaped Roundabout	
140	**Den_LM02**	LM02	Verge / Central Reservation	L	M	2		Land	Amenity - Open areas not attracting visitors	Verge / Central Reservation	
		LM02NV	Natural Central Reservation	L	M	2	NV	Land	Amenity - Open areas not attracting visitors	Verge / Central Reservation	Natural Central Reservation
		LM02VE	Natural Verge	L	M	2	VE	Land	Amenity - Open areas not attracting visitors	Verge / Central Reservation	Natural Verge
141	**Den_LM03**	LM03	Maintained Amenity Land	L	M	3		Land	Amenity - Open areas not attracting visitors	Maintained Amenity Land	
142	**Den_LM04**	LM04	Maintained Surfaced Area	L	M	4		Land	Amenity - Open areas not attracting visitors	Maintained Surfaced Area	
		LM04MV	Made Central Reservation	L	M	4	MV	Land	Amenity - Open areas not attracting visitors	Maintained Surfaced Area	Made Central Reservation
		LM04PV	Pavement	L	M	4	PV	Land	Amenity - Open areas not attracting visitors	Maintained Surfaced Area	Pavement
143	**Den_LO**	LO	Open Space	L	O			Land	Open Space		
		LO01	Heath / Moorland	L	O	1		Land	Open Space	Heath / Moorland	
144	**Den_LP**	LP	Park	L	P			Land	Park		
145	**Den_LP01**	LP01	Public Park / Garden	L	P	1		Land	Park	Public Park / Garden	

146	**Den_LP02**	LP02	Public Open Space / Nature Reserve	L	P	2		Land	Park	Public Open Space / Nature Reserve	
147	**Den_LP03**	LP03	Playground	L	P	3		Land	Park	Playground	
		LP03PA	Play Area	L	P	3	PA	Land	Park	Playground	Play Area
		LP03PD	Paddling Pool	L	P	3	PD	Land	Park	Playground	Paddling Pool
148	**Den_LU**	LU	Unused Land	L	U			Land	Unused Land		
149	**Den_LU01**	LU01	Vacant / Derelict Land	L	U	1		Land	Unused Land	Vacant / Derelict Land	
150	**Den_LW**	LW	Water	L	W			Land	Water		
151	**Den_LW**	LW01	Lake / Reservoir	L	W	1		Land	Water	Lake / Reservoir	
		LW01BP	Balancing Pond	L	W	1	BP	Land	Water	Lake / Reservoir	Balancing Pond
		LW01BV	Buried Reservoir	L	W	1	BV	Land	Water	Lake / Reservoir	Buried Reservoir
152	**Den_LW02**	LW02	Named Pond	L	W	2		Land	Water	Named Pond	
		LW02DE	Dew Pond	L	W	2	DE	Land	Water	Named Pond	Dew Pond
		LW02DP	Decoy Pond	L	W	2	DP	Land	Water	Named Pond	Decoy Pond
		LW02IW	Static Water	L	W	2	IW	Land	Water	Named Pond	Static Water
153	**Den_ M**	M	Military	M				Military			
154	**Den_ MA**	MA	Army	M	A			Military	Army		
		MA99AR	Army Military Range	M	A	99	AR	Military	Army		Army Military Range
		MA99AS	Army Site	M	A	99	AS	Military	Army		Army Site
		MA99AT	Army Military Training	M	A	99	AT	Military	Army		Army Military Training
		MA99AG	Army Military Storage	M	A	99	AG	Military	Army		Army Military Storage
155	**Den_ MB**	MB	Ancillary Building	M	B			Military	Ancillary Building		
		MB99TG	Military Target	M	B	99	TG	Military	Ancillary Building		Military Target
156	**Den_ MF**	MF	Air Force	M	F			Military	Air Force		
		MF99UG	Air Force Military Storage	M	F	99	UG	Military	Air Force		Air Force Military Storage
		MF99UR	Air Force Military Range	M	F	99	UR	Military	Air Force		Air Force Military Range

		MF99US	Air Force Site	M	F	99	US	Military	Air Force		Air Force Site
		MF99UT	Air Force Military Training	M	F	99	UT	Military	Air Force		Air Force Military Training
157	**Den_ MG**	MG	Defence Estates	M	G			Military	Defence Estates		
158	**Den_ MN**	MN	Navy	M	N			Military	Navy		
		MN99VG	Naval Military Storage	M	N	99	VG	Military	Navy		Naval Military Storage
		MN99VR	Naval Military Range	M	N	99	VR	Military	Navy		Naval Military Range
		MN99VS	Naval Site	M	N	99	VS	Military	Navy		Naval Site
		MN99VT	Naval Military Training	M	N	99	VT	Military	Navy		Naval Military Training
159	**Den_ OG04**	OG04	Slurry Bed / Pit	O	G	4		Other (Ordnance Survey Only)	Agricultural Support Objects	Slurry Bed / Pit	
160	**Den_ OI**	OI	Industrial Support	O	I			Other (Ordnance Survey Only)	Industrial Support		
161	**Den_ OI02**	OI02	Caisson / Dry Dock / Grid	O	I	2		Other (Ordnance Survey Only)	Industrial Support	Caisson / Dry Dock / Grid	
162	**Den_ OI03**	OI03	Channel / Conveyor / Conduit / Pipe	O	I	3		Other (Ordnance Survey Only)	Industrial Support	Channel / Conveyor / Conduit / Pipe	
163	**Den_ OI04**	OI04	Chimney / Flue	O	I	4		Other (Ordnance Survey Only)	Industrial Support	Chimney / Flue	
164	**Den_ OI05**	OI05	Crane / Hoist / Winch / Material Elevator	O	I	5		Other (Ordnance Survey Only)	Industrial Support	Crane / Hoist / Winch / Material Elevator	
165	**Den_ OI06**	OI06	Flare Stack	O	I	6		Other (Ordnance Survey Only)	Industrial Support	Flare Stack	
166	**Den_ OI07**	OI07	Hopper / Silo / Cistern / Tank	O	I	7		Other (Ordnance Survey Only)	Industrial Support	Hopper / Silo / Cistern / Tank	
167	**Den_ OI08**	OI08	Grab / Skip / Other Industrial Waste Machinery / Discharging	O	I	8		Other (Ordnance Survey Only)	Industrial Support	Grab / Skip / Other Industrial Waste Machinery / Discharging	
168	**Den_ OI09**	OI09	Kiln / Oven / Smelter	O	I	9		Other (Ordnance Survey Only)	Industrial Support	Kiln / Oven / Smelter	
169	**Den_ OI10**	OI10	Manhole / Shaft	O	I	10		Other (Ordnance Survey Only)	Industrial Support	Manhole / Shaft	

170	**Den_ OI13**	OI13	Solar Panel / Waterwheel	O	I	13		Other (Ordnance Survey Only)	Industrial Support	Solar Panel / Waterwheel	
171	**Den_ OR01**	OR01	Postal Box	O	R	1		Other (Ordnance Survey Only)	Royal Mail Infrastructure	Postal Box	
172	**Den_ OR03**	OR03	PO Box	O	R	3		Other (Ordnance Survey Only)	Royal Mail Infrastructure	PO Box	
173	**Den_ R**	R	Residential	R				Residential			
174	**Den_ RB**	RB	Ancillary Building	R	B			Residential	Ancillary Building		
175	**Den_ RC01**	RC	Car Park Space	R	C			Residential	Car Park Space		
		RC01	Allocated Parking	R	C	1		Residential	Car Park Space	Allocated Parking	
176	**Den_ RD**	RD	Dwelling	R	D			Residential	Dwelling		
177	**Den_ RD01**	RD01	Caravan	R	D	1		Residential	Dwelling	Caravan	
178	**Den_ RD02**	RD02	Detached	R	D	2		Residential	Dwelling	Detached	
179	**Den_ RD03**	RD03	Semi-Detached	R	D	3		Residential	Dwelling	Semi-Detached	
180	**Den_ RD04**	RD04	Terraced	R	D	4		Residential	Dwelling	Terraced	
181	**Den_ RD06**	RD06	Self Contained Flat (Includes Maisonette / Apartment)	R	D	6		Residential	Dwelling	Self Contained Flat (Includes Maisonette / Apartment)	
182	**Den_ RD07**	RD07	House Boat	R	D	7		Residential	Dwelling	House Boat	
183	**Den_ RD08**	RD08	Sheltered Accommodatio n	R	D	8		Residential	Dwelling	Sheltered Accommodation	
184	**Den_ RD10**	RD10	Privately Owned Holiday Caravan / Chalet	R	D	10		Residential	Dwelling	Privately Owned Holiday Caravan / Chalet	
185	**Den_ RG**	RG	Garage	R	G			Residential	Garage		
186	**Den_ RG02**	RG02	Lock-Up Garage / Garage Court	R	G	2		Residential	Garage	Lock-Up Garage / Garage Court	
187	**Den_ RH**	RH	House In Multiple Occupation	R	H			Residential	House In Multiple Occupation		

188	**Den_ RH01**	RH01	HMO Parent	R	H	1		Residential	House In Multiple Occupation	HMO Parent	
189	**Den_ RH02**	RH02	HMO Bedsit / Other Non Self Contained Accommodatio n	R	H	2		Residential	House In Multiple Occupation	HMO Bedsit / Other Non Self Contained Accommodation	
190	**Den_ RH03**	RH03	HMO Not Further Divided	R	H	3		Residential	House In Multiple Occupation	HMO Not Further Divided	
191	**Den_ RI**	RI	Residential Institution	R	I			Residential	Residential Institution		
192	**Den_ RI01**	RI01	Care / Nursing Home	R	I	1		Residential	Residential Institution	Care / Nursing Home	
193	**Den_ RI02**	RI02	Communal Residence	R	I	2		Residential	Residential Institution	Communal Residence	
		RI02NC	Non-Commercial Lodgings	R	I	2	NC	Residential	Residential Institution	Communal Residence	Non-Commercial Lodgings
		RI02RC	Religious Community	R	I	2	RC	Residential	Residential Institution	Communal Residence	Religious Community
194	**Den_ RI03**	RI03	Residential Education	R	I	3		Residential	Residential Institution	Residential Education	
195	**Den_ Z**	Z	Object of Interest	Z				Object of Interest			
196	**Den_ ZA**	ZA	Archaeological Dig Site	Z	A			Object of Interest	Archaeological Dig Site		
197	**Den_ ZM**	ZM	Monument	Z	M			Object of Interest	Monument		
198	**Den_ ZM01**	ZM01	Obelisk / Milestone / Standing Stone	Z	M	1		Object of Interest	Monument	Obelisk / Milestone / Standing Stone	
		ZM01OB	Obelisk	Z	M	1	OB	Object of Interest	Monument	Obelisk / Milestone / Standing Stone	Obelisk
		ZM01ST	Standing Stone	Z	M	1	ST	Object of Interest	Monument	Obelisk / Milestone / Standing Stone	Standing Stone
199	**Den_ ZM02**	ZM02	Memorial / Market Cross	Z	M	2		Object of Interest	Monument	Memorial / Market Cross	
200	**Den_ ZM03**	ZM03	Statue	Z	M	3		Object of Interest	Monument	Statue	
201	**Den_ ZM04**	ZM04	Castle / Historic Ruin	Z	M	4		Object of Interest	Monument	Castle / Historic Ruin	
202	**Den_ ZM05**	ZM05	Other Structure	Z	M	5		Object of Interest	Monument	Other Structure	
		ZM05BS	Boundary Stone	Z	M	5	BS	Object of Interest	Monument	Other Structure	Boundary Stone

		ZM05PN	Permanent Art Display / Sculpture	Z	M	5	PN	Object of Interest	Monument	Other Structure	Permanent Art Display / Sculpture
		ZM05CE	Cascade / Fountain	Z	M	5	CE	Object of Interest	Monument	Other Structure	Cascade / Fountain
		ZM05WI	Windmill (Inactive)	Z	M	5	WI	Object of Interest	Monument	Other Structure	Windmill (Inactive)
203	**Den_ ZS**	ZS	Stately Home	Z	S			Object of Interest	Stately Home		
204	**Den_ ZU**	ZU	Underground Feature	Z	U			Object of Interest	Underground Feature		
205	**Den_ ZU01**	ZU01	Cave	Z	U	1		Object of Interest	Underground Feature	Cave	
206	**Den_ ZV**	ZV	Other Underground Feature	Z	V			Object of Interest	Other Underground Feature		
207	**Den_ ZV02**	ZV02	Disused Mine	Z	V	2		Object of Interest	Other Underground Feature	Disused Mine	
		ZV02MI	Mineral Mining / Inactive	Z	V	2	MI	Object of Interest	Other Underground Feature	Disused Mine	Mineral Mining / Inactive
		ZV02OI	Oil And / Gas Extraction/ Inactive	Z	V	2	OI	Object of Interest	Other Underground Feature	Disused Mine	Oil And / Gas Extraction/ Inactive
		ZV02QI	Mineral Quarrying And / Open Extraction / Inactive	Z	V	2	QI	Object of Interest	Other Underground Feature	Disused Mine	Mineral Quarrying And / Open Extraction / Inactive
208	**Den_ ZV03**	ZV03	Well / Spring	Z	V	3		Object of Interest	Other Underground Feature	Well / Spring	
		ZV03SG	Spring	Z	V	3	SG	Object of Interest	Other Underground Feature	Well / Spring	Spring
		ZV03WL	Well	Z	V	3	WL	Object of Interest	Other Underground Feature	Well / Spring	Well
209	**Den_ ZW**	ZW	Place Of Worship	Z	W			Object of Interest	Place Of Worship		
210	**Den_ ZW99CA**	ZW99CA	Cathedral	Z	W	99	CA	Object of Interest	Place Of Worship		Cathedral
211	**Den_ ZW99CH**	ZW99CH	Church	Z	W	99	CH	Object of Interest	Place Of Worship		Church
212	**Den_ ZW99CP**	ZW99CP	Chapel	Z	W	99	CP	Object of Interest	Place Of Worship		Chapel
213	**Den_ ZW99KH**	ZW99KH	Kingdom Hall	Z	W	99	KH	Object of Interest	Place Of Worship		Kingdom Hall
214	**Den_ ZW99MQ**	ZW99MQ	Mosque	Z	W	99	MQ	Object of Interest	Place Of Worship		Mosque

215	**Den_ ZW99SY**	ZW99SY	Synagogue	Z	W	99	SY	Object of Interest	Place Of Worship		Synagogue
216	**Den_ ZW99TP**	ZW99TP	Temple	Z	W	99	TP	Object of Interest	Place Of Worship		Temple
217	**Den_Bstops**	Density of bus stops calculated from NAPTAN database.									

4.1.2 Health specific destination accessibility

Walkable destinations having the propensity to influence health in a specific way were parameterized in the present study in the form of network distance from a respondent's dwelling to the nearest destination. Network proximity was used as opposed to the conventional Euclidean/airline distance, as it provides a more accurate behavioural measurement of accessibility. Street network distance (in metres) was calculated using 'closest facility analysis' in Network Analyst, ArcGIS 10.2. In the case of parks (land use code LP) which is a larger destination occupying a significant area, multiple entry points of access were manually digitized after overlaying it on the 0.5 meter resolution colour infrared image of the area of interest. However, in the case of building destinations, a single point was employed as the location of the facility. 39 different health promoting/inhibiting land use destinations were used in the present study.

***Deliverable file 3*:**

File Name (size)	Description
Wales_UKB_LU_ND.csv (9.08 MB)	Street network distance in metres of UK Biobank participant's residence from specific destinations.

Header file name: Wales_UKB_LU_ND_Header.csv (468 bytes)

Table 3: Description of variables used for calculation of destination accessibility

Column No.	Variable	Description of variable	
		Variable definition: Destination category for calculation of street network distance	**Included AddressBase Premium land use classes in the destination category**
1	**Encoded anonymised participant ID**	-	-
2	**ND_CC04**	Public/Village Hall/Other Community Facility	CC04, CC04YR
3	**ND_CC12**	Job Centre	CC12
4	**ND_CE01**	College	CE01, CE01FE, CE01HE
5	**ND_CE02**	Childrens Nursery/Creche	CE02
6	**ND_CE03**	Preparatory/First/Primary/Infant/Junior/Middle School	CE03, CE03FS, CE03IS, CE03JS, CE03MS, CE03NP, CE03PS
7	**ND_CE04**	Secondary/High School	CE04, CE04NS, CE04SS
8	**ND_CE05**	University	CE05
9	**ND_CI01**	Factory/Manufacturing	CI01, CI01AW, CI01BB, CI01BR, CI01BW, CI01CD, CI01CM, CI01CW, CI01DA, CI01DY, CI01FL, CI01FO, CI01GW, CI01MG, CI01OH, CI01OR, CI01PG, CI01PM, CI01PW, CI01YD, CI01SR, CI01SW, CI01TL, CI01WN
10	**ND_CI02**	Mineral/Ore Working/Quarry/Mine	CI02, CI02MA, CI02MD, CI02MP, CI02OA, CI02QA
11	**ND_CI03**	Workshop/Light Industrial	CI03, CI03GA
12	**ND_CI04**	Warehouse/Store/Storage Depot	CI04, CI04CS, CI04PL, CI04SO, CI04TS
13	**ND_OI04**	Industrial Support - Chimney/Flue	OI04
14	**ND_CL03**	Library	CL03, CL03RR
15	**ND_CL07**	Bingo Hall/Cinema/Conference/Exhibition Centre/Theatre/Concert Hall	CL07, CL07TH, CL07CI, CL07EN, CL07EX
16	**ND_CM01**	Dentist	CM01
17	**ND_CM02**	GP Practice Surgery/Clinic	CM02, CM02HL, CM02HC
18	**ND_CM03**	Hospital/Hospice	CM03, CM03HI, CM03HP
19	**ND_CO01**	Office/Work Studio	CO01
20	**ND_CO01GV**	Central Government Service	CO01GV

21	**ND_CO01LG**	Local Government Service	CO01LG
22	**ND_CR01**	Bank/Financial Service	CR01
23	**ND_CR02**	Retail Service Agent	CR02
24	**ND_CR02PO**	Post Office	CR02PO
25	**ND_CR06**	Public House/Bar/Night Club	CR06
26	**ND_CR07**	Restaurant/Cafeteria	CR07
27	**ND_CR10**	Fast Food Outlet/Takeaway (Hot/Cold)	CR10
28	**ND_Bstops**	Bus Stops	Bus stops (NAPTAN data)
29	**ND_CT03**	Car/Coach/Commercial Vehicle/Taxi Parking/Park and Ride Site	CT03, CT03PK, CT03PP, CT03PU, CT03VP
30	**ND_CT08**	Station/Interchange/Terminal/Halt	CT08, CT08BC, CT08RS, CT08VH
31	**ND_CU01**	Electricity Sub-station	CU01
32	**ND_CU02**	Landfill	CU02
33	**ND_CU03**	Power Station/Energy Production	CU03, CU03ED, CU03EP, CU03WF, CU03WU
34	**ND_CU07**	Water/Waste Water/Sewage Treatment Works	CU07, CU07WR, CU07WT
35	**ND_Recycling**	Recycling	CC09, CC10, CI06, CI07
36	**ND_CX01**	Police/Transport Police Station	CX01, CX01PT
37	**ND_CX02**	Fire Station	CX02, CX02FT
38	**ND_CX03**	Ambulance Station	CX03, CX03AA
39	**ND_ZW**	Places of Worship	ZW, ZW99AB, ZW99CA, ZW99CH, ZW99CP, ZW99GU, ZW99KH, ZW99MQ, ZW99MT, ZW99SU, ZW99SY, ZW99TP, ZW99LG, CC07
40	**ND_LP**	Parks	LP, LP01, LP02, LP03, LP03PA, LP03PD, LP04

4.2 Street network accessibility

spatial Design Network Analysis (sDNA) is a *state-of-the-art* technique of urban network analysis that have evolved from the conventional network analyses techniques like space syntax. Details on urban network analyses techniques employed in health research can be found elsewhere[1,47]. sDNA employs a technically improved network algorithm and has been developed by Cardiff University's School of Planning and Geography (http://www.cardiff.ac.uk/sdna). sDNA is able to overcome many of the inherent problems of conventional network analysis techniques, especially the representational problems and the modifiable link problem by its ability to function with off-the-shelf street centreline data such as Ordnance Survey ITN data, with minimum preparation.

The Ordnance Survey Mastermap Integrated Transport Network (ITN) layer for Wales with a 10 mile buffer was extracted. The sDNA Prepare tool was employed for automated cleaning of the ITN layer including the initial processes of removal of traffic islands as well as repairing of split links. sDNA standardizes the *network link* as the fundamental unit of computation. By using such industry-standard link representation, sDNA overcomes the modifiable link unit problem, as well as provides a better physical interpretation of road centreline data. In an urban space, several socio-economic processes such as density of residences, jobs, traffic flows, pedestrian movements and so on have been known to be correlated with the density of street network links. sDNA offers the analyst a diverse choice of refined graphical indices of accessibility, thereby enabling analyses of network centrality (in terms of closeness and betweenness centrality), network detour (in terms of sum of crow flight, mean diversion ratio and diversion ratio), network shape and efficiency (in terms of convex hull area, perimeter and bearing, and network shape index), link characteristics (in terms of length, angular curvature and connectivity) and radius-based indices (in terms of number of links, total network length, total angular distance, total and mean geodesic length and number of junctions within a defined catchment radius)[48]. Details of the twenty indices of physical street-level accessibility have been described in Table 4. sDNA provides the option of enumerating the centrality indices based on the notion of Euclidean or angular distance, with the choice of several weighting functions such as link weighting, link length weighting or other user-customized weighted indices. As in angular segment analysis, sDNA enumerates all the graphical accessibility indices within a specific user-defined catchment radius; nonetheless, sDNA provides the user with the option of *discrete or continuous space analysis*. In discrete space analysis, each link is considered as a discrete (whole) entity and, if a part of a link falls inside a given radius, the entire link is counted as being within the radius. On the other hand, in continuous space analysis, each link is treated as a continuous entity and only the fractional part of a link falling inside a given radius is counted, leading to fractional (proportional) link counts. The former is computationally faster, while the latter produces more accurate results. This study has employed continuous analysis throughout. sDNA has been tested and has successfully reproduced results equivalent to or better than those of predecessor space syntax methods. sDNA is also innovative in its class in providing a workflow that is fully automated. The UK Ordnance Survey (OS) Topography Layer, AddressBase Premium and Integrated Transport Network Layer linkages are cross-referenced through unique identifiers; the OS supports Digital National Framework identifiers, which facilitates integration and sharing of spatial information from diverse sources.

All the sDNA measured indices of accessibility were calculated for all the street links within the boundaries of the study area (Wales with a 10 kilometre buffer). Analyses were done at several spatial scales to take in to account the influence of physical accessibility at micro (neighbourhood), meso (city) and macro (regional) levels. Nineteen different catchment radii were employed in the present study for analysis: 400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000 metres. All the sDNA network metrics were subsequently linked to the dwelling location of the UK Biobank participant. Three types of linkages were used in the present study:

- Physical accessibility indices of the street network link *closest* to the UK Biobank respondent's dwelling location were linked together.
- Physical accessibility indices of the street network link *within a 25 metres buffer* of the UK Biobank respondent's dwelling location were linked together.
- Physical accessibility indices of the street network link *within a 50 metres buffer* of the UK Biobank respondent's dwelling location were linked together.

In the latter two cases mean, minimum, maximum and standard deviation in the accessibility indices of all the links within 25 and 50 metres of the UK Biobank respondent's dwelling location were enumerated.

Table 4: List of sDNA modelled street accessibility indices

sDNA modelled street accessibility index (acronym used*)	**Description**	**Spatial scale of measurement (catchment radius R in metres)**
Link characteristics: These measures describe the characteristics of individual links in the network and hence they are not network indices *per se.*		
Link Connectivity (*Link_Connectivity*)	The number of link ends that an individual link is connected to at its end points.	Measured for each link in the network.
Link Length (*Link_Length*)	Length of the individual link in the network.	Measured for each link in the network.
Link Angular Curvature (*Link_Ang_Curvature*)	The cumulative angular change while traversing the full length of a link in degrees.	Measured for each link in the network.
Centrality analysis: These set of measures owe their origin to the *graph theory*. The associations between urban morphology and the social phenomena dependent on it are essentially captured by indices of relationality in the graphs. The notion of accessibility captured by these measures acts to formally elucidate how network morphology influences individual activity behaviours and drives various socio-economic processes. They indicate the centrality of a vertex within a graph.		
Mean Angular Distance (*Mean_Ang_Dist_Wl_RXXXXXc*)	In graphical terminology, also called as the closeness centrality/accessibility. It is an indicator of the degree of difficulty, on average, of navigating to all possible destinations within a specified radius from each given link. This is weighted by the link length.	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000
Network Quantity Penalized for Distance (*NetQuantPD_Ang_Wl_XXXXXc*)	This is an improved measure of the conventional closeness centrality and takes in to account the effects of network quantity. For each link within a specified radius, it takes the network quantity (defined link length) and divides it by the difficulty of access (angular). This is weighted by the link length.	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000
	In graphical terminology, also called	400, 800, 1200, 1500,

Betweenness (*Betweenness_Ang_Wl_RXXXXXc*)	as the betweenness centrality or path overlap or through-movement potential. It is indicative of how often a given link is used for a journey within a defined radius. Measured as the sum of geodesics that pass through a link for a journey within a defined radius. This has been weighted by origin-destination link length.	2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000
Two Phase Betweenness (*TPBetweenness_Ang_Wl_RXXXXXc*)	This is betweenness weighted by a two-step floating catchment model. Measured as the sum of geodesics that pass through a link for a journey within a defined radius weighted by the proportion of network quantity accessible from geodesic origin that is represented by geodesic destination.	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000
Two Phase Destination assignment (*TPDestination_Ang_Wl_RXXXXXc*)	This is the total flow to each destination under the two phase betweenness model. In other words, it is similar to the two phase betweenness, but measured for the destination of each geodesic only.	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000
Simple radial measures: These measures pertain to the characteristics of the links within a specified network radius.		
Links (*Links_RXXXXXc*)	The number of network links within a specified network radius.	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000
Length (*Length_RXXXXXc*)	The total network length within a specified network radius.	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000
Angular Distance (*Ang_Dist_RXXXXXc*)	Sum of angular distance of each individual link within a specified radius.	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000,

		25000, 30000, 35000, 40000, 45000, 50000
Weight (*Weight_Wl_RXXXXXc*)	Total weight within a specified radius. Weights have been specified with respect unit of network length (in length weighted analysis).	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000
Mean Geometric Length (*MeanGeoLen_Ang_Wl_RXXXXXc*)	Mean of the angular geodesic Euclidean length within a specified radius. This has been weighted by the origin to destination link length.	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000
Network detour analysis: Measure the network severance by comparing the hypothetical crow fly distance to actual network distance. It is an indicator of the extent of deviation of the network from the most direct path.		
Mean Crow Flight Distance (*Mean_Crow_Flight_Wl_RXXXXXc*)	Mean of the crow flight distance between a link and all the links within a defined radius. This is weighted by the link length.	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000
Diversion Ratio (*Diversion_Ratio_Ang_Wl_RXXXXXc*)	Mean of the ratio of actual geodesic length to the crow flight distance for all geodesics within a defined radius. This is weighted by the link length. Indicative of the degree of deviation of the actual paths from the *crow flight* path.	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000
Network shape: Measure of network efficiency in terms of the spatial footprint of the street network in urban space.		
Convex Hull Area (*Convex_Hull_Area_RXXXXXc*)	Area of the convex hull containing all the origins and destinations within a defined radius. It is an indicator of the network footprint or the spatial spread of the street network in the	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000,

	urban space.	40000, 45000, 50000
Convex Hull Perimeter (*Convex_Hull_Perimeter_RXXXXXc*)	Length of perimeter of the convex hull containing all the origins and destinations within a defined radius.	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000
Convex Hull Maximum Radius (*Convex_Hull_Max_Radius_RXXXXXc*)	Maximum radius of the convex hull measured as the crow flight distance from the centre of the origin link to the furthest point on the convex hull of a defined radius.	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000
Convex Hull Bearing (*Convex_Hull_Bearing_RXXXXXc*)	Compass bearing of the line of maximum radius of convex hull of a defined radius, measured in degrees. It indicates the direction in which one can travel furthest from the origin link, while staying inside the network radius.	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000
Convex Hull Shape Index (*Convex_Hull_Shape_Index_RXXXXXc*)	Measures the degree of uniformity of the network in all directions. It is measured as the square of the hull perimeter divided by 4π times the hull area. Ranges from 1 in case of a circle to higher values, with higher indicating non-uniformity across all directions.	400, 800, 1200, 1500, 2000, 3000, 5000, 7500, 10000, 12500, 15000, 17500, 20000, 25000, 30000, 35000, 40000, 45000, 50000

* In each of the acronyms, the presence of:
Wl – Indicates that the analyses is weighted by origin – destination link length,
RXXXXX – Indicates the catchment radius at which the analysis was conducted; this can be R500 for radius of 500 metres or R50000 for radius of 50000 metres,
c – Indicates continuous space analysis.

Deliverable files 4a-4i:

File Name (size)	**Description**
UKB_Wales_sDNA_closest_link.csv (72.1 MB)	Physical accessibility indices of the street network link *closest* to the UK Biobank respondent's dwelling location.
UKB_Wales_sDNA_25m_mean.csv (66.8 MB)	Mean value of physical the accessibility indices of all the links lying within 25 metres of the UK Biobank respondent's dwelling location.
UKB_Wales_sDNA_25m_min.csv (66.4 MB)	Minimum value of physical the accessibility indices of all the links lying within 25 metres of the UK Biobank respondent's dwelling location.
UKB_Wales_sDNA_25m_max.csv (66.4 MB)	Maximum value of physical the accessibility indices of all the links lying within 25 metres of the UK Biobank respondent's dwelling location.
UKB_Wales_sDNA_25m_STD.csv (30.4 MB)	Standard deviation in physical the accessibility indices of all the links lying within 25 metres of the UK Biobank respondent's dwelling location.
UKB_Wales_sDNA_50m_mean.csv (72.4 MB)	Mean value of physical the accessibility indices of all the links lying within 50 metres of the UK Biobank respondent's dwelling location.
UKB_Wales_sDNA_50m_min.csv (72.1 MB)	Minimum value of physical the accessibility indices of all the links lying within 50 metres of the UK Biobank respondent's dwelling location.
UKB_Wales_sDNA_50m_max.csv (71.3 MB)	Maximum value of physical the accessibility indices of all the links lying within 50 metres of the UK Biobank respondent's dwelling location.
UKB_Wales_sDNA_50m_STD.csv (58.7 MB)	Standard deviation in physical the accessibility indices of all the links lying within 50 metres of the UK Biobank respondent's dwelling location.

Header file names:

UKB_Wales_sDNA_closest_link_header.csv (9.11 KB)
UKB_Wales_sDNA_25m_mean_header.csv (10.7 KB)
UKB_Wales_sDNA_25m_min_header.csv (10.3 KB)
UKB_Wales_sDNA_25m_max_header.csv (10.3 KB)
UKB_Wales_sDNA_25m_STD_header.csv (10.3 KB)
UKB_Wales_sDNA_50m_mean_header.csv (10.6 KB)
UKB_Wales_sDNA_50m_min_header.csv (10.3 KB)
UKB_Wales_sDNA_50m_max_header.csv (10.3 KB)
UKB_Wales_sDNA_50m_STD_header.csv (10.3 KB)

Table 5: Description of variables used for calculation of physical accessibility of street links

Table: *UKB_Wales_sDNA_closest_link.csv*		**Tables:** *UKB_Wales_sDNA_25m_mean.csv* *UKB_Wales_sDNA_50m_mean.csv*		**Tables:** *UKB_Wales_sDNA_25m_min.csv* *UKB_Wales_sDNA_50m_min.csv*		**Tables:** *UKB_Wales_sDNA_25m_max.csv* *UKB_Wales_sDNA_50m_max.csv*		**Tables:** *UKB_Wales_sDNA_25m_STD.csv* *UKB_Wales_sDNA_50m_STD.csv*	
Column No.	**Variable***	**Column No.**	**Variable***	**Column No.**	**Variable***	**Column No.**	**Variable***	**Column No.**	**Variable***
1	Encoded anonymised participant ID	1	Encoded anonymised participant ID	1	Encoded anonymised participant ID	1	Encoded anonymised participant ID	1	Encoded anonymised participant ID
2	Distance to closest link	2	Link_frequency	2	Link_frequency	2	Link_frequency	2	Link_frequency
3	Link_Connectivity	3	MEAN_Link_Connectivity	3	MIN_Link_Connectivity	3	MAX_Link_Connectivity	3	STD_Link_Connectivity
4	Link_Length	4	MEAN_Link_Length	4	MIN_Link_Length	4	MAX_Link_Length	4	STD_Link_Length
5	Link_Ang_Curvature	5	MEAN_Link_Ang_Curvature	5	MIN_Link_Ang_Curvature	5	MAX_Link_Ang_Curvature	5	STD_Link_Ang_Curvature
6	Mean_Ang_Dist_Wl_R400c	6	MEAN_Mean_Ang_Dist_Wl_R400c	6	MIN_Mean_Ang_Dist_Wl_R400c	6	MAX_Mean_Ang_Dist_Wl_R400c	6	STD_Mean_Ang_Dist_Wl_R400c
7	NetQuantPD_Ang_Wl_R400c	7	MEAN_NetQuantPD_Ang_Wl_R400c	7	MIN_NetQuantPD_Ang_Wl_R400c	7	MAX_NetQuantPD_Ang_Wl_R400c	7	STD_NetQuantPD_Ang_Wl_R400c
8	Betweenness_Ang_Wl_R400c	8	MEAN_Betweenness_Ang_Wl_R400c	8	MIN_Betweenness_Ang_Wl_R400c	8	MAX_Betweenness_Ang_Wl_R400c	8	STD_Betweenness_Ang_Wl_R400c
9	TPBetweenness_Ang_Wl_R400c	9	MEAN_TPBetweenness_Ang_Wl_R400c	9	MIN_TPBetweenness_Ang_Wl_R400c	9	MAX_TPBetweenness_Ang_Wl_R400c	9	STD_TPBetweenness_Ang_Wl_R400c
10	TPDestination_Ang_Wl_R400c	10	MEAN_TPDestination_Ang_Wl_R400c	10	MIN_TPDestination_Ang_Wl_R400c	10	MAX_TPDestination_Ang_Wl_R400c	10	STD_TPDestination_Ang_Wl_R400c
11	Links_R400c	11	MEAN_Links_R400c	11	MIN_Links_R400c	11	MAX_Links_R400c	11	STD_Links_R400c
12	Length_R400c	12	MEAN_Length_R400c	12	MIN_Length_R400c	12	MAX_Length_R400c	12	STD_Length_R400c
13	Ang_Dist_R400c	13	MEAN_Ang_Dist_R400c	13	MIN_Ang_Dist_R400c	13	MAX_Ang_Dist_R400c	13	STD_Ang_Dist_R400c
14	Weight_Wl_R400c	14	MEAN_Weight_Wl_R400c	14	MIN_Weight_Wl_R400c	14	MAX_Weight_Wl_R400c	14	STD_Weight_Wl_R400c
15	MeanGeoLen_Ang_Wl_R400c	15	MEAN_MeanGeoLen_Ang_Wl_R400c	15	MIN_MeanGeoLen_Ang_Wl_R400c	15	MAX_MeanGeoLen_Ang_Wl_R400c	15	STD_MeanGeoLen_Ang_Wl_R400c
16	Mean_Crow_Flight_Wl_R400c	16	MEAN_Mean_Crow_Flight_Wl_R400c	16	MIN_Mean_Crow_Flight_Wl_R400c	16	MAX_Mean_Crow_Flight_Wl_R400c	16	STD_Mean_Crow_Flight_Wl_R400c
17	Diversion_Ratio_Ang_Wl_R400c	17	MEAN_Diversion_Ratio_Ang_Wl_R400c	17	MIN_Diversion_Ratio_Ang_Wl_R400c	17	MAX_Diversion_Ratio_Ang_Wl_R400c	17	STD_Diversion_Ratio_Ang_Wl_R400c
18	Convex_Hull_Area_R400c	18	MEAN_Convex_Hull_Area_R400c	18	MIN_Convex_Hull_Area_R400c	18	MAX_Convex_Hull_Area_R400c	18	STD_Convex_Hull_Area_R400c
19	Convex_Hull_Perimeter_R400c	19	MEAN_Convex_Hull_Perimeter_R400c	19	MIN_Convex_Hull_Perimeter_R400c	19	MAX_Convex_Hull_Perimeter_R400c	19	STD_Convex_Hull_Perimeter_R400c
20	Convex_Hull_Max_Radius_R400c	20	MEAN_Convex_Hull_MEAN_Radius_R400c	20	MIN_Convex_Hull_Max_Radius_R400c	20	MAX_Convex_Hull_Max_Radius_R400c	20	STD_Convex_Hull_Max_Radius_R400c
21	Convex_Hull_Bearing_R400c	21	MEAN_Convex_Hull_Bearing_R400c	21	MIN_Convex_Hull_Bearing_R400c	21	MAX_Convex_Hull_Bearing_R400c	21	STD_Convex_Hull_Bearing_R400c

22	Convex_Hull_Shape_Index_R400c	22	MEAN_Convex_Hull_Shape_Index_R400c	22	MIN_Convex_Hull_Shape_Index_R400c	22	MAX_Convex_Hull_Shape_Index_R400c	22	STD_Convex_Hull_Shape_Index_R400c
23	Mean_Ang_Dist_Wl_R800c	23	MEAN_Mean_Ang_Dist_Wl_R800c	23	MIN_Mean_Ang_Dist_Wl_R800c	23	MAX_Mean_Ang_Dist_Wl_R800c	23	STD_Mean_Ang_Dist_Wl_R800c
24	NetQuantPD_Ang_Wl_R800c	24	MEAN_NetQuantPD_Ang_Wl_R800c	24	MIN_NetQuantPD_Ang_Wl_R800c	24	MAX_NetQuantPD_Ang_Wl_R800c	24	STD_NetQuantPD_Ang_Wl_R800c
25	Betweenness_Ang_Wl_R800c	25	MEAN_Betweenness_Ang_Wl_R800c	25	MIN_Betweenness_Ang_Wl_R800c	25	MAX_Betweenness_Ang_Wl_R800c	25	STD_Betweenness_Ang_Wl_R800c
26	TPBetweenness_Ang_Wl_R800c	26	MEAN_TPBetweenness_Ang_Wl_R800c	26	MIN_TPBetweenness_Ang_Wl_R800c	26	MAX_TPBetweenness_Ang_Wl_R800c	26	STD_TPBetweenness_Ang_Wl_R800c
27	TPDestination_Ang_Wl_R800c	27	MEAN_TPDestination_Ang_Wl_R800c	27	MIN_TPDestination_Ang_Wl_R800c	27	MAX_TPDestination_Ang_Wl_R800c	27	STD_TPDestination_Ang_Wl_R800c
28	Links_R800c	28	MEAN_Links_R800c	28	MIN_Links_R800c	28	MAX_Links_R800c	28	STD_Links_R800c
29	Length_R800c	29	MEAN_Length_R800c	29	MIN_Length_R800c	29	MAX_Length_R800c	29	STD_Length_R800c
30	Ang_Dist_R800c	30	MEAN_Ang_Dist_R800c	30	MIN_Ang_Dist_R800c	30	MAX_Ang_Dist_R800c	30	STD_Ang_Dist_R800c
31	Weight_Wl_R800c	31	MEAN_Weight_Wl_R800c	31	MIN_Weight_Wl_R800c	31	MAX_Weight_Wl_R800c	31	STD_Weight_Wl_R800c
32	MeanGeoLen_Ang_Wl_R800c	32	MEAN_MeanGeoLen_Ang_Wl_R800c	32	MIN_MeanGeoLen_Ang_Wl_R800c	32	MAX_MeanGeoLen_Ang_Wl_R800c	32	STD_MeanGeoLen_Ang_Wl_R800c
33	Mean_Crow_Flight_Wl_R800c	33	MEAN_Mean_Crow_Flight_Wl_R800c	33	MIN_Mean_Crow_Flight_Wl_R800c	33	MAX_Mean_Crow_Flight_Wl_R800c	33	STD_Mean_Crow_Flight_Wl_R800c
34	Diversion_Ratio_Ang_Wl_R800c	34	MEAN_Diversion_Ratio_Ang_Wl_R800c	34	MIN_Diversion_Ratio_Ang_Wl_R800c	34	MAX_Diversion_Ratio_Ang_Wl_R800c	34	STD_Diversion_Ratio_Ang_Wl_R800c
35	Convex_Hull_Area_R800c	35	MEAN_Convex_Hull_Area_R800c	35	MIN_Convex_Hull_Area_R800c	35	MAX_Convex_Hull_Area_R800c	35	STD_Convex_Hull_Area_R800c
36	Convex_Hull_Perimeter_R800c	36	MEAN_Convex_Hull_Perimeter_R800c	36	MIN_Convex_Hull_Perimeter_R800c	36	MAX_Convex_Hull_Perimeter_R800c	36	STD_Convex_Hull_Perimeter_R800c
37	Convex_Hull_Max_Radius_R800c	37	MEAN_Convex_Hull_MEAN_Radius_R800c	37	MIN_Convex_Hull_Max_Radius_R800c	37	MAX_Convex_Hull_Max_Radius_R800c	37	STD_Convex_Hull_Max_Radius_R800c
38	Convex_Hull_Bearing_R800c	38	MEAN_Convex_Hull_Bearing_R800c	38	MIN_Convex_Hull_Bearing_R800c	38	MAX_Convex_Hull_Bearing_R800c	38	STD_Convex_Hull_Bearing_R800c
39	Convex_Hull_Shape_Index_R800c	39	MEAN_Convex_Hull_Shape_Index_R800c	39	MIN_Convex_Hull_Shape_Index_R800c	39	MAX_Convex_Hull_Shape_Index_R800c	39	STD_Convex_Hull_Shape_Index_R800c
40	Mean_Ang_Dist_Wl_R1200c	40	MEAN_Mean_Ang_Dist_Wl_R1200c	40	MIN_Mean_Ang_Dist_Wl_R1200c	40	MAX_Mean_Ang_Dist_Wl_R1200c	40	STD_Mean_Ang_Dist_Wl_R1200c
41	NetQuantPD_Ang_Wl_R1200c	41	MEAN_NetQuantPD_Ang_Wl_R1200c	41	MIN_NetQuantPD_Ang_Wl_R1200c	41	MAX_NetQuantPD_Ang_Wl_R1200c	41	STD_NetQuantPD_Ang_Wl_R1200c
42	Betweenness_Ang_Wl_R1200c	42	MEAN_Betweenness_Ang_Wl_R1200c	42	MIN_Betweenness_Ang_Wl_R1200c	42	MAX_Betweenness_Ang_Wl_R1200c	42	STD_Betweenness_Ang_Wl_R1200c
43	TPBetweenness_Ang_Wl_R1200c	43	MEAN_TPBetweenness_Ang_Wl_R1200c	43	MIN_TPBetweenness_Ang_Wl_R1200c	43	MAX_TPBetweenness_Ang_Wl_R1200c	43	STD_TPBetweenness_Ang_Wl_R1200c
44	TPDestination_Ang_Wl_R1200c	44	MEAN_TPDestination_Ang_Wl_R1200c	44	MIN_TPDestination_Ang_Wl_R1200c	44	MAX_TPDestination_Ang_Wl_R1200c	44	STD_TPDestination_Ang_Wl_R1200c
45	Links_R1200c	45	MEAN_Links_R1200c	45	MIN_Links_R1200c	45	MAX_Links_R1200c	45	STD_Links_R1200c

46	Length_R1200c	46	MEAN_Length_R1200c	46	MIN_Length_R1200c	46	MAX_Length_R1200c	46	STD_Length_R1200c
47	Ang_Dist_R1200c	47	MEAN_Ang_Dist_R1200c	47	MIN_Ang_Dist_R1200c	47	MAX_Ang_Dist_R1200c	47	STD_Ang_Dist_R1200c
48	Weight_Wl_R1200c	48	MEAN_Weight_Wl_R1200c	48	MIN_Weight_Wl_R1200c	48	MAX_Weight_Wl_R1200c	48	STD_Weight_Wl_R1200c
49	MeanGeoLen_Ang_Wl_R1200c	49	MEAN_MeanGeoLen_Ang_Wl_R1200c	49	MIN_MeanGeoLen_Ang_Wl_R1200c	49	MAX_MeanGeoLen_Ang_Wl_R1200c	49	STD_MeanGeoLen_Ang_Wl_R1200c
50	Mean_Crow_Flight_Wl_R1200c	50	MEAN_Mean_Crow_Flight_Wl_R1200c	50	MIN_Mean_Crow_Flight_Wl_R1200c	50	MAX_Mean_Crow_Flight_Wl_R1200c	50	STD_Mean_Crow_Flight_Wl_R1200c
51	Diversion_Ratio_Ang_Wl_R1200c	51	MEAN_Diversion_Ratio_Ang_Wl_R1200c	51	MIN_Diversion_Ratio_Ang_Wl_R1200c	51	MAX_Diversion_Ratio_Ang_Wl_R1200c	51	STD_Diversion_Ratio_Ang_Wl_R1200c
52	Convex_Hull_Area_R1200c	52	MEAN_Convex_Hull_Area_R1200c	52	MIN_Convex_Hull_Area_R1200c	52	MAX_Convex_Hull_Area_R1200c	52	STD_Convex_Hull_Area_R1200c
53	Convex_Hull_Perimeter_R1200c	53	MEAN_Convex_Hull_Perimeter_R1200c	53	MIN_Convex_Hull_Perimeter_R1200c	53	MAX_Convex_Hull_Perimeter_R1200c	53	STD_Convex_Hull_Perimeter_R1200c
54	Convex_Hull_Max_Radius_R1200c	54	MEAN_Convex_Hull_MEAN_Radius_R1200c	54	MIN_Convex_Hull_Max_Radius_R1200c	54	MAX_Convex_Hull_Max_Radius_R1200c	54	STD_Convex_Hull_Max_Radius_R1200c
55	Convex_Hull_Bearing_R1200c	55	MEAN_Convex_Hull_Bearing_R1200c	55	MIN_Convex_Hull_Bearing_R1200c	55	MAX_Convex_Hull_Bearing_R1200c	55	STD_Convex_Hull_Bearing_R1200c
56	Convex_Hull_Shape_Index_R1200c	56	MEAN_Convex_Hull_Shape_Index_R1200c	56	MIN_Convex_Hull_Shape_Index_R1200c	56	MAX_Convex_Hull_Shape_Index_R1200c	56	STD_Convex_Hull_Shape_Index_R1200c
57	Mean_Ang_Dist_Wl_R1500c	57	MEAN_Mean_Ang_Dist_Wl_R1500c	57	MIN_Mean_Ang_Dist_Wl_R1500c	57	MAX_Mean_Ang_Dist_Wl_R1500c	57	STD_Mean_Ang_Dist_Wl_R1500c
58	NetQuantPD_Ang_Wl_R1500c	58	MEAN_NetQuantPD_Ang_Wl_R1500c	58	MIN_NetQuantPD_Ang_Wl_R1500c	58	MAX_NetQuantPD_Ang_Wl_R1500c	58	STD_NetQuantPD_Ang_Wl_R1500c
59	Betweenness_Ang_Wl_R1500c	59	MEAN_Betweenness_Ang_Wl_R1500c	59	MIN_Betweenness_Ang_Wl_R1500c	59	MAX_Betweenness_Ang_Wl_R1500c	59	STD_Betweenness_Ang_Wl_R1500c
60	TPBetweenness_Ang_Wl_R1500c	60	MEAN_TPBetweenness_Ang_Wl_R1500c	60	MIN_TPBetweenness_Ang_Wl_R1500c	60	MAX_TPBetweenness_Ang_Wl_R1500c	60	STD_TPBetweenness_Ang_Wl_R1500c
61	TPDestination_Ang_Wl_R1500c	61	MEAN_TPDestination_Ang_Wl_R1500c	61	MIN_TPDestination_Ang_Wl_R1500c	61	MAX_TPDestination_Ang_Wl_R1500c	61	STD_TPDestination_Ang_Wl_R1500c
62	Links_R1500c	62	MEAN_Links_R1500c	62	MIN_Links_R1500c	62	MAX_Links_R1500c	62	STD_Links_R1500c
63	Length_R1500c	63	MEAN_Length_R1500c	63	MIN_Length_R1500c	63	MAX_Length_R1500c	63	STD_Length_R1500c
64	Ang_Dist_R1500c	64	MEAN_Ang_Dist_R1500c	64	MIN_Ang_Dist_R1500c	64	MAX_Ang_Dist_R1500c	64	STD_Ang_Dist_R1500c
65	Weight_Wl_R1500c	65	MEAN_Weight_Wl_R1500c	65	MIN_Weight_Wl_R1500c	65	MAX_Weight_Wl_R1500c	65	STD_Weight_Wl_R1500c
66	MeanGeoLen_Ang_Wl_R1500c	66	MEAN_MeanGeoLen_Ang_Wl_R1500c	66	MIN_MeanGeoLen_Ang_Wl_R1500c	66	MAX_MeanGeoLen_Ang_Wl_R1500c	66	STD_MeanGeoLen_Ang_Wl_R1500c
67	Mean_Crow_Flight_Wl_R1500c	67	MEAN_Mean_Crow_Flight_Wl_R1500c	67	MIN_Mean_Crow_Flight_Wl_R1500c	67	MAX_Mean_Crow_Flight_Wl_R1500c	67	STD_Mean_Crow_Flight_Wl_R1500c
68	Diversion_Ratio_Ang_Wl_R1500c	68	MEAN_Diversion_Ratio_Ang_Wl_R1500c	68	MIN_Diversion_Ratio_Ang_Wl_R1500c	68	MAX_Diversion_Ratio_Ang_Wl_R1500c	68	STD_Diversion_Ratio_Ang_Wl_R1500c
69	Convex_Hull_Area_R1500c	69	MEAN_Convex_Hull_Area_R1500c	69	MIN_Convex_Hull_Area_R1500c	69	MAX_Convex_Hull_Area_R1500c	69	STD_Convex_Hull_Area_R1500c

70	Convex_Hull_Perimeter_R1500c	70	MEAN_Convex_Hull_Perimeter_R1500c	70	MIN_Convex_Hull_Perimeter_R1500c	70	MAX_Convex_Hull_Perimeter_R1500c	70	STD_Convex_Hull_Perimeter_R1500c
71	Convex_Hull_Max_Radius_R1500c	71	MEAN_Convex_Hull_MEAN_Radius_R1500c	71	MIN_Convex_Hull_Max_Radius_R1500c	71	MAX_Convex_Hull_Max_Radius_R1500c	71	STD_Convex_Hull_Max_Radius_R1500c
72	Convex_Hull_Bearing_R1500c	72	MEAN_Convex_Hull_Bearing_R1500c	72	MIN_Convex_Hull_Bearing_R1500c	72	MAX_Convex_Hull_Bearing_R1500c	72	STD_Convex_Hull_Bearing_R1500c
73	Convex_Hull_Shape_Index_R1500c	73	MEAN_Convex_Hull_Shape_Index_R1500c	73	MIN_Convex_Hull_Shape_Index_R1500c	73	MAX_Convex_Hull_Shape_Index_R1500c	73	STD_Convex_Hull_Shape_Index_R1500c
74	Mean_Ang_Dist_Wl_R2000c	74	MEAN_Mean_Ang_Dist_Wl_R2000c	74	MIN_Mean_Ang_Dist_Wl_R2000c	74	MAX_Mean_Ang_Dist_Wl_R2000c	74	STD_Mean_Ang_Dist_Wl_R2000c
75	NetQuantPD_Ang_Wl_R2000c	75	MEAN_NetQuantPD_Ang_Wl_R2000c	75	MIN_NetQuantPD_Ang_Wl_R2000c	75	MAX_NetQuantPD_Ang_Wl_R2000c	75	STD_NetQuantPD_Ang_Wl_R2000c
76	Betweenness_Ang_Wl_R2000c	76	MEAN_Betweenness_Ang_Wl_R2000c	76	MIN_Betweenness_Ang_Wl_R2000c	76	MAX_Betweenness_Ang_Wl_R2000c	76	STD_Betweenness_Ang_Wl_R2000c
77	TPBetweenness_Ang_Wl_R2000c	77	MEAN_TPBetweenness_Ang_Wl_R2000c	77	MIN_TPBetweenness_Ang_Wl_R2000c	77	MAX_TPBetweenness_Ang_Wl_R2000c	77	STD_TPBetweenness_Ang_Wl_R2000c
78	TPDestination_Ang_Wl_R2000c	78	MEAN_TPDestination_Ang_Wl_R2000c	78	MIN_TPDestination_Ang_Wl_R2000c	78	MAX_TPDestination_Ang_Wl_R2000c	78	STD_TPDestination_Ang_Wl_R2000c
79	Links_R2000c	79	MEAN_Links_R2000c	79	MIN_Links_R2000c	79	MAX_Links_R2000c	79	STD_Links_R2000c
80	Length_R2000c	80	MEAN_Length_R2000c	80	MIN_Length_R2000c	80	MAX_Length_R2000c	80	STD_Length_R2000c
81	Ang_Dist_R2000c	81	MEAN_Ang_Dist_R2000c	81	MIN_Ang_Dist_R2000c	81	MAX_Ang_Dist_R2000c	81	STD_Ang_Dist_R2000c
82	Weight_Wl_R2000c	82	MEAN_Weight_Wl_R2000c	82	MIN_Weight_Wl_R2000c	82	MAX_Weight_Wl_R2000c	82	STD_Weight_Wl_R2000c
83	MeanGeoLen_Ang_Wl_R2000c	83	MEAN_MeanGeoLen_Ang_Wl_R2000c	83	MIN_MeanGeoLen_Ang_Wl_R2000c	83	MAX_MeanGeoLen_Ang_Wl_R2000c	83	STD_MeanGeoLen_Ang_Wl_R2000c
84	Mean_Crow_Flight_Wl_R2000c	84	MEAN_Mean_Crow_Flight_Wl_R2000c	84	MIN_Mean_Crow_Flight_Wl_R2000c	84	MAX_Mean_Crow_Flight_Wl_R2000c	84	STD_Mean_Crow_Flight_Wl_R2000c
85	Diversion_Ratio_Ang_Wl_R2000c	85	MEAN_Diversion_Ratio_Ang_Wl_R2000c	85	MIN_Diversion_Ratio_Ang_Wl_R2000c	85	MAX_Diversion_Ratio_Ang_Wl_R2000c	85	STD_Diversion_Ratio_Ang_Wl_R2000c
86	Convex_Hull_Area_R2000c	86	MEAN_Convex_Hull_Area_R2000c	86	MIN_Convex_Hull_Area_R2000c	86	MAX_Convex_Hull_Area_R2000c	86	STD_Convex_Hull_Area_R2000c
87	Convex_Hull_Perimeter_R2000c	87	MEAN_Convex_Hull_Perimeter_R2000c	87	MIN_Convex_Hull_Perimeter_R2000c	87	MAX_Convex_Hull_Perimeter_R2000c	87	STD_Convex_Hull_Perimeter_R2000c
88	Convex_Hull_Max_Radius_R2000c	88	MEAN_Convex_Hull_MEAN_Radius_R2000c	88	MIN_Convex_Hull_Max_Radius_R2000c	88	MAX_Convex_Hull_Max_Radius_R2000c	88	STD_Convex_Hull_Max_Radius_R2000c
89	Convex_Hull_Bearing_R2000c	89	MEAN_Convex_Hull_Bearing_R2000c	89	MIN_Convex_Hull_Bearing_R2000c	89	MAX_Convex_Hull_Bearing_R2000c	89	STD_Convex_Hull_Bearing_R2000c
90	Convex_Hull_Shape_Index_R2000c	90	MEAN_Convex_Hull_Shape_Index_R2000c	90	MIN_Convex_Hull_Shape_Index_R2000c	90	MAX_Convex_Hull_Shape_Index_R2000c	90	STD_Convex_Hull_Shape_Index_R2000c
91	Mean_Ang_Dist_Wl_R3000c	91	MEAN_Mean_Ang_Dist_Wl_R3000c	91	MIN_Mean_Ang_Dist_Wl_R3000c	91	MAX_Mean_Ang_Dist_Wl_R3000c	91	STD_Mean_Ang_Dist_Wl_R3000c
92	NetQuantPD_Ang_Wl_R3000c	92	MEAN_NetQuantPD_Ang_Wl_R3000c	92	MIN_NetQuantPD_Ang_Wl_R3000c	92	MAX_NetQuantPD_Ang_Wl_R3000c	92	STD_NetQuantPD_Ang_Wl_R3000c

93	Betweenness_Ang_Wl_R3000c	93	MEAN_Betweenness_Ang_Wl_R3000c	93	MIN_Betweenness_Ang_Wl_R3000c	93	MAX_Betweenness_Ang_Wl_R3000c	93	STD_Betweenness_Ang_Wl_R3000c
94	TPBetweenness_Ang_Wl_R3000c	94	MEAN_TPBetweenness_Ang_Wl_R3000c	94	MIN_TPBetweenness_Ang_Wl_R3000c	94	MAX_TPBetweenness_Ang_Wl_R3000c	94	STD_TPBetweenness_Ang_Wl_R3000c
95	TPDestination_Ang_Wl_R3000c	95	MEAN_TPDestination_Ang_Wl_R3000c	95	MIN_TPDestination_Ang_Wl_R3000c	95	MAX_TPDestination_Ang_Wl_R3000c	95	STD_TPDestination_Ang_Wl_R3000c
96	Links_R3000c	96	MEAN_Links_R3000c	96	MIN_Links_R3000c	96	MAX_Links_R3000c	96	STD_Links_R3000c
97	Length_R3000c	97	MEAN_Length_R3000c	97	MIN_Length_R3000c	97	MAX_Length_R3000c	97	STD_Length_R3000c
98	Ang_Dist_R3000c	98	MEAN_Ang_Dist_R3000c	98	MIN_Ang_Dist_R3000c	98	MAX_Ang_Dist_R3000c	98	STD_Ang_Dist_R3000c
99	Weight_Wl_R3000c	99	MEAN_Weight_Wl_R3000c	99	MIN_Weight_Wl_R3000c	99	MAX_Weight_Wl_R3000c	99	STD_Weight_Wl_R3000c
100	MeanGeoLen_Ang_Wl_R3000c	100	MEAN_MeanGeoLen_Ang_Wl_R3000c	100	MIN_MeanGeoLen_Ang_Wl_R3000c	100	MAX_MeanGeoLen_Ang_Wl_R3000c	100	STD_MeanGeoLen_Ang_Wl_R3000c
101	Mean_Crow_Flight_Wl_R3000c	101	MEAN_Mean_Crow_Flight_Wl_R3000c	101	MIN_Mean_Crow_Flight_Wl_R3000c	101	MAX_Mean_Crow_Flight_Wl_R3000c	101	STD_Mean_Crow_Flight_Wl_R3000c
102	Diversion_Ratio_Ang_Wl_R3000c	102	MEAN_Diversion_Ratio_Ang_Wl_R3000c	102	MIN_Diversion_Ratio_Ang_Wl_R3000c	102	MAX_Diversion_Ratio_Ang_Wl_R3000c	102	STD_Diversion_Ratio_Ang_Wl_R3000c
103	Convex_Hull_Area_R3000c	103	MEAN_Convex_Hull_Area_R3000c	103	MIN_Convex_Hull_Area_R3000c	103	MAX_Convex_Hull_Area_R3000c	103	STD_Convex_Hull_Area_R3000c
104	Convex_Hull_Perimeter_R3000c	104	MEAN_Convex_Hull_Perimeter_R3000c	104	MIN_Convex_Hull_Perimeter_R3000c	104	MAX_Convex_Hull_Perimeter_R3000c	104	STD_Convex_Hull_Perimeter_R3000c
105	Convex_Hull_Max_Radius_R3000c	105	MEAN_Convex_Hull_MEAN_Radius_R3000c	105	MIN_Convex_Hull_Max_Radius_R3000c	105	MAX_Convex_Hull_Max_Radius_R3000c	105	STD_Convex_Hull_Max_Radius_R3000c
106	Convex_Hull_Bearing_R3000c	106	MEAN_Convex_Hull_Bearing_R3000c	106	MIN_Convex_Hull_Bearing_R3000c	106	MAX_Convex_Hull_Bearing_R3000c	106	STD_Convex_Hull_Bearing_R3000c
107	Convex_Hull_Shape_Index_R3000c	107	MEAN_Convex_Hull_Shape_Index_R3000c	107	MIN_Convex_Hull_Shape_Index_R3000c	107	MAX_Convex_Hull_Shape_Index_R3000c	107	STD_Convex_Hull_Shape_Index_R3000c
108	Mean_Ang_Dist_Wl_R5000c	108	MEAN_Mean_Ang_Dist_Wl_R5000c	108	MIN_Mean_Ang_Dist_Wl_R5000c	108	MAX_Mean_Ang_Dist_Wl_R5000c	108	STD_Mean_Ang_Dist_Wl_R5000c
109	NetQuantPD_Ang_Wl_R5000c	109	MEAN_NetQuantPD_Ang_Wl_R5000c	109	MIN_NetQuantPD_Ang_Wl_R5000c	109	MAX_NetQuantPD_Ang_Wl_R5000c	109	STD_NetQuantPD_Ang_Wl_R5000c
110	Betweenness_Ang_Wl_R5000c	110	MEAN_Betweenness_Ang_Wl_R5000c	110	MIN_Betweenness_Ang_Wl_R5000c	110	MAX_Betweenness_Ang_Wl_R5000c	110	STD_Betweenness_Ang_Wl_R5000c
111	TPBetweenness_Ang_Wl_R5000c	111	MEAN_TPBetweenness_Ang_Wl_R5000c	111	MIN_TPBetweenness_Ang_Wl_R5000c	111	MAX_TPBetweenness_Ang_Wl_R5000c	111	STD_TPBetweenness_Ang_Wl_R5000c
112	TPDestination_Ang_Wl_R5000c	112	MEAN_TPDestination_Ang_Wl_R5000c	112	MIN_TPDestination_Ang_Wl_R5000c	112	MAX_TPDestination_Ang_Wl_R5000c	112	STD_TPDestination_Ang_Wl_R5000c
113	Links_R5000c	113	MEAN_Links_R5000c	113	MIN_Links_R5000c	113	MAX_Links_R5000c	113	STD_Links_R5000c
114	Length_R5000c	114	MEAN_Length_R5000c	114	MIN_Length_R5000c	114	MAX_Length_R5000c	114	STD_Length_R5000c
115	Ang_Dist_R5000c	115	MEAN_Ang_Dist_R5000c	115	MIN_Ang_Dist_R5000c	115	MAX_Ang_Dist_R5000c	115	STD_Ang_Dist_R5000c
116	Weight_Wl_R5000c	116	MEAN_Weight_Wl_R5000c	116	MIN_Weight_Wl_R5000c	116	MAX_Weight_Wl_R5000c	116	STD_Weight_Wl_R5000c

117	MeanGeoLen_Ang_Wl_R5000c	117	MEAN_MeanGeoLen_Ang_Wl_R5000c	117	MIN_MeanGeoLen_Ang_Wl_R5000c	117	MAX_MeanGeoLen_Ang_Wl_R5000c	117	STD_MeanGeoLen_Ang_Wl_R5000c
118	Mean_Crow_Flight_Wl_R5000c	118	MEAN_Mean_Crow_Flight_Wl_R5000c	118	MIN_Mean_Crow_Flight_Wl_R5000c	118	MAX_Mean_Crow_Flight_Wl_R5000c	118	STD_Mean_Crow_Flight_Wl_R5000c
119	Diversion_Ratio_Ang_Wl_R5000c	119	MEAN_Diversion_Ratio_Ang_Wl_R5000c	119	MIN_Diversion_Ratio_Ang_Wl_R5000c	119	MAX_Diversion_Ratio_Ang_Wl_R5000c	119	STD_Diversion_Ratio_Ang_Wl_R5000c
120	Convex_Hull_Area_R5000c	120	MEAN_Convex_Hull_Area_R5000c	120	MIN_Convex_Hull_Area_R5000c	120	MAX_Convex_Hull_Area_R5000c	120	STD_Convex_Hull_Area_R5000c
121	Convex_Hull_Perimeter_R5000c	121	MEAN_Convex_Hull_Perimeter_R5000c	121	MIN_Convex_Hull_Perimeter_R5000c	121	MAX_Convex_Hull_Perimeter_R5000c	121	STD_Convex_Hull_Perimeter_R5000c
122	Convex_Hull_Max_Radius_R5000c	122	MEAN_Convex_Hull_MEAN_Radius_R5000c	122	MIN_Convex_Hull_Max_Radius_R5000c	122	MAX_Convex_Hull_Max_Radius_R5000c	122	STD_Convex_Hull_Max_Radius_R5000c
123	Convex_Hull_Bearing_R5000c	123	MEAN_Convex_Hull_Bearing_R5000c	123	MIN_Convex_Hull_Bearing_R5000c	123	MAX_Convex_Hull_Bearing_R5000c	123	STD_Convex_Hull_Bearing_R5000c
124	Convex_Hull_Shape_Index_R5000c	124	MEAN_Convex_Hull_Shape_Index_R5000c	124	MIN_Convex_Hull_Shape_Index_R5000c	124	MAX_Convex_Hull_Shape_Index_R5000c	124	STD_Convex_Hull_Shape_Index_R5000c
125	Mean_Ang_Dist_Wl_R7500c	125	MEAN_Mean_Ang_Dist_Wl_R7500c	125	MIN_Mean_Ang_Dist_Wl_R7500c	125	MAX_Mean_Ang_Dist_Wl_R7500c	125	STD_Mean_Ang_Dist_Wl_R7500c
126	NetQuantPD_Ang_Wl_R7500c	126	MEAN_NetQuantPD_Ang_Wl_R7500c	126	MIN_NetQuantPD_Ang_Wl_R7500c	126	MAX_NetQuantPD_Ang_Wl_R7500c	126	STD_NetQuantPD_Ang_Wl_R7500c
127	Betweenness_Ang_Wl_R7500c	127	MEAN_Betweenness_Ang_Wl_R7500c	127	MIN_Betweenness_Ang_Wl_R7500c	127	MAX_Betweenness_Ang_Wl_R7500c	127	STD_Betweenness_Ang_Wl_R7500c
128	TPBetweenness_Ang_Wl_R7500c	128	MEAN_TPBetweenness_Ang_Wl_R7500c	128	MIN_TPBetweenness_Ang_Wl_R7500c	128	MAX_TPBetweenness_Ang_Wl_R7500c	128	STD_TPBetweenness_Ang_Wl_R7500c
129	TPDestination_Ang_Wl_R7500c	129	MEAN_TPDestination_Ang_Wl_R7500c	129	MIN_TPDestination_Ang_Wl_R7500c	129	MAX_TPDestination_Ang_Wl_R7500c	129	STD_TPDestination_Ang_Wl_R7500c
130	Links_R7500c	130	MEAN_Links_R7500c	130	MIN_Links_R7500c	130	MAX_Links_R7500c	130	STD_Links_R7500c
131	Length_R7500c	131	MEAN_Length_R7500c	131	MIN_Length_R7500c	131	MAX_Length_R7500c	131	STD_Length_R7500c
132	Ang_Dist_R7500c	132	MEAN_Ang_Dist_R7500c	132	MIN_Ang_Dist_R7500c	132	MAX_Ang_Dist_R7500c	132	STD_Ang_Dist_R7500c
133	Weight_Wl_R7500c	133	MEAN_Weight_Wl_R7500c	133	MIN_Weight_Wl_R7500c	133	MAX_Weight_Wl_R7500c	133	STD_Weight_Wl_R7500c
134	MeanGeoLen_Ang_Wl_R7500c	134	MEAN_MeanGeoLen_Ang_Wl_R7500c	134	MIN_MeanGeoLen_Ang_Wl_R7500c	134	MAX_MeanGeoLen_Ang_Wl_R7500c	134	STD_MeanGeoLen_Ang_Wl_R7500c
135	Mean_Crow_Flight_Wl_R7500c	135	MEAN_Mean_Crow_Flight_Wl_R7500c	135	MIN_Mean_Crow_Flight_Wl_R7500c	135	MAX_Mean_Crow_Flight_Wl_R7500c	135	STD_Mean_Crow_Flight_Wl_R7500c
136	Diversion_Ratio_Ang_Wl_R7500c	136	MEAN_Diversion_Ratio_Ang_Wl_R7500c	136	MIN_Diversion_Ratio_Ang_Wl_R7500c	136	MAX_Diversion_Ratio_Ang_Wl_R7500c	136	STD_Diversion_Ratio_Ang_Wl_R7500c
137	Convex_Hull_Area_R7500c	137	MEAN_Convex_Hull_Area_R7500c	137	MIN_Convex_Hull_Area_R7500c	137	MAX_Convex_Hull_Area_R7500c	137	STD_Convex_Hull_Area_R7500c
138	Convex_Hull_Perimeter_R7500c	138	MEAN_Convex_Hull_Perimeter_R7500c	138	MIN_Convex_Hull_Perimeter_R7500c	138	MAX_Convex_Hull_Perimeter_R7500c	138	STD_Convex_Hull_Perimeter_R7500c
139	Convex_Hull_Max_Radius_R7500c	139	MEAN_Convex_Hull_MEAN_Radius_R7500c	139	MIN_Convex_Hull_Max_Radius_R7500c	139	MAX_Convex_Hull_Max_Radius_R7500c	139	STD_Convex_Hull_Max_Radius_R7500c

140	Convex_Hull_Bearing_R7500c	140	MEAN_Convex_Hull_Bearing_R7500c	140	MIN_Convex_Hull_Bearing_R7500c	140	MAX_Convex_Hull_Bearing_R7500c	140	STD_Convex_Hull_Bearing_R7500c
141	Convex_Hull_Shape_Index_R7500c	141	MEAN_Convex_Hull_Shape_Index_R7500c	141	MIN_Convex_Hull_Shape_Index_R7500c	141	MAX_Convex_Hull_Shape_Index_R7500c	141	STD_Convex_Hull_Shape_Index_R7500c
142	Mean_Ang_Dist_Wl_R10000c	142	MEAN_Mean_Ang_Dist_Wl_R10000c	142	MIN_Mean_Ang_Dist_Wl_R10000c	142	MAX_Mean_Ang_Dist_Wl_R10000c	142	STD_Mean_Ang_Dist_Wl_R10000c
143	NetQuantPD_Ang_Wl_R10000c	143	MEAN_NetQuantPD_Ang_Wl_R10000c	143	MIN_NetQuantPD_Ang_Wl_R10000c	143	MAX_NetQuantPD_Ang_Wl_R10000c	143	STD_NetQuantPD_Ang_Wl_R10000c
144	Betweenness_Ang_Wl_R10000c	144	MEAN_Betweenness_Ang_Wl_R10000c	144	MIN_Betweenness_Ang_Wl_R10000c	144	MAX_Betweenness_Ang_Wl_R10000c	144	STD_Betweenness_Ang_Wl_R10000c
145	TPBetweenness_Ang_Wl_R10000c	145	MEAN_TPBetweenness_Ang_Wl_R10000c	145	MIN_TPBetweenness_Ang_Wl_R10000c	145	MAX_TPBetweenness_Ang_Wl_R10000c	145	STD_TPBetweenness_Ang_Wl_R10000c
146	TPDestination_Ang_Wl_R10000c	146	MEAN_TPDestination_Ang_Wl_R10000c	146	MIN_TPDestination_Ang_Wl_R10000c	146	MAX_TPDestination_Ang_Wl_R10000c	146	STD_TPDestination_Ang_Wl_R10000c
147	Links_R10000c	147	MEAN_Links_R10000c	147	MIN_Links_R10000c	147	MAX_Links_R10000c	147	STD_Links_R10000c
148	Length_R10000c	148	MEAN_Length_R10000c	148	MIN_Length_R10000c	148	MAX_Length_R10000c	148	STD_Length_R10000c
149	Ang_Dist_R10000c	149	MEAN_Ang_Dist_R10000c	149	MIN_Ang_Dist_R10000c	149	MAX_Ang_Dist_R10000c	149	STD_Ang_Dist_R10000c
150	Weight_Wl_R10000c	150	MEAN_Weight_Wl_R10000c	150	MIN_Weight_Wl_R10000c	150	MAX_Weight_Wl_R10000c	150	STD_Weight_Wl_R10000c
151	MeanGeoLen_Ang_Wl_R10000c	151	MEAN_MeanGeoLen_Ang_Wl_R10000c	151	MIN_MeanGeoLen_Ang_Wl_R10000c	151	MAX_MeanGeoLen_Ang_Wl_R10000c	151	STD_MeanGeoLen_Ang_Wl_R10000c
152	Mean_Crow_Flight_Wl_R10000c	152	MEAN_Mean_Crow_Flight_Wl_R10000c	152	MIN_Mean_Crow_Flight_Wl_R10000c	152	MAX_Mean_Crow_Flight_Wl_R10000c	152	STD_Mean_Crow_Flight_Wl_R10000c
153	Diversion_Ratio_Ang_Wl_R10000c	153	MEAN_Diversion_Ratio_Ang_Wl_R10000c	153	MIN_Diversion_Ratio_Ang_Wl_R10000c	153	MAX_Diversion_Ratio_Ang_Wl_R10000c	153	STD_Diversion_Ratio_Ang_Wl_R10000c
154	Convex_Hull_Area_R10000c	154	MEAN_Convex_Hull_Area_R10000c	154	MIN_Convex_Hull_Area_R10000c	154	MAX_Convex_Hull_Area_R10000c	154	STD_Convex_Hull_Area_R10000c
155	Convex_Hull_Perimeter_R10000c	155	MEAN_Convex_Hull_Perimeter_R10000c	155	MIN_Convex_Hull_Perimeter_R10000c	155	MAX_Convex_Hull_Perimeter_R10000c	155	STD_Convex_Hull_Perimeter_R10000c
156	Convex_Hull_Max_Radius_R10000c	156	MEAN_Convex_Hull_MEAN_Radius_R10000c	156	MIN_Convex_Hull_Max_Radius_R10000c	156	MAX_Convex_Hull_Max_Radius_R10000c	156	STD_Convex_Hull_Max_Radius_R10000c
157	Convex_Hull_Bearing_R10000c	157	MEAN_Convex_Hull_Bearing_R10000c	157	MIN_Convex_Hull_Bearing_R10000c	157	MAX_Convex_Hull_Bearing_R10000c	157	STD_Convex_Hull_Bearing_R10000c
158	Convex_Hull_Shape_Index_R10000c	158	MEAN_Convex_Hull_Shape_Index_R10000c	158	MIN_Convex_Hull_Shape_Index_R10000c	158	MAX_Convex_Hull_Shape_Index_R10000c	158	STD_Convex_Hull_Shape_Index_R10000c
159	Mean_Ang_Dist_Wl_R12500c	159	MEAN_Mean_Ang_Dist_Wl_R12500c	159	MIN_Mean_Ang_Dist_Wl_R12500c	159	MAX_Mean_Ang_Dist_Wl_R12500c	159	STD_Mean_Ang_Dist_Wl_R12500c
160	NetQuantPD_Ang_Wl_R12500c	160	MEAN_NetQuantPD_Ang_Wl_R12500c	160	MIN_NetQuantPD_Ang_Wl_R12500c	160	MAX_NetQuantPD_Ang_Wl_R12500c	160	STD_NetQuantPD_Ang_Wl_R12500c
161	Betweenness_Ang_Wl_R12500c	161	MEAN_Betweenness_Ang_Wl_R12500c	161	MIN_Betweenness_Ang_Wl_R12500c	161	MAX_Betweenness_Ang_Wl_R12500c	161	STD_Betweenness_Ang_Wl_R12500c
162	TPBetweenness_Ang_Wl_R12500c	162	MEAN_TPBetweenness_Ang_Wl_R12500c	162	MIN_TPBetweenness_Ang_Wl_R12500c	162	MAX_TPBetweenness_Ang_Wl_R12500c	162	STD_TPBetweenness_Ang_Wl_R12500c

163	TPDestination_Ang_Wl_R12500c	163	MEAN_TPDestination_Ang_Wl_R12500c	163	MIN_TPDestination_Ang_Wl_R12500c	163	MAX_TPDestination_Ang_Wl_R12500c	163	STD_TPDestination_Ang_Wl_R12500c
164	Links_R12500c	164	MEAN_Links_R12500c	164	MIN_Links_R12500c	164	MAX_Links_R12500c	164	STD_Links_R12500c
165	Length_R12500c	165	MEAN_Length_R12500c	165	MIN_Length_R12500c	165	MAX_Length_R12500c	165	STD_Length_R12500c
166	Ang_Dist_R12500c	166	MEAN_Ang_Dist_R12500c	166	MIN_Ang_Dist_R12500c	166	MAX_Ang_Dist_R12500c	166	STD_Ang_Dist_R12500c
167	Weight_Wl_R12500c	167	MEAN_Weight_Wl_R12500c	167	MIN_Weight_Wl_R12500c	167	MAX_Weight_Wl_R12500c	167	STD_Weight_Wl_R12500c
168	MeanGeoLen_Ang_Wl_R12500c	168	MEAN_MeanGeoLen_Ang_Wl_R12500c	168	MIN_MeanGeoLen_Ang_Wl_R12500c	168	MAX_MeanGeoLen_Ang_Wl_R12500c	168	STD_MeanGeoLen_Ang_Wl_R12500c
169	Mean_Crow_Flight_Wl_R12500c	169	MEAN_Mean_Crow_Flight_Wl_R12500c	169	MIN_Mean_Crow_Flight_Wl_R12500c	169	MAX_Mean_Crow_Flight_Wl_R12500c	169	STD_Mean_Crow_Flight_Wl_R12500c
170	Diversion_Ratio_Ang_Wl_R12500c	170	MEAN_Diversion_Ratio_Ang_Wl_R12500c	170	MIN_Diversion_Ratio_Ang_Wl_R12500c	170	MAX_Diversion_Ratio_Ang_Wl_R12500c	170	STD_Diversion_Ratio_Ang_Wl_R12500c
171	Convex_Hull_Area_R12500c	171	MEAN_Convex_Hull_Area_R12500c	171	MIN_Convex_Hull_Area_R12500c	171	MAX_Convex_Hull_Area_R12500c	171	STD_Convex_Hull_Area_R12500c
172	Convex_Hull_Perimeter_R12500c	172	MEAN_Convex_Hull_Perimeter_R12500c	172	MIN_Convex_Hull_Perimeter_R12500c	172	MAX_Convex_Hull_Perimeter_R12500c	172	STD_Convex_Hull_Perimeter_R12500c
173	Convex_Hull_Max_Radius_R12500c	173	MEAN_Convex_Hull_MEAN_Radius_R12500c	173	MIN_Convex_Hull_Max_Radius_R12500c	173	MAX_Convex_Hull_Max_Radius_R12500c	173	STD_Convex_Hull_Max_Radius_R12500c
174	Convex_Hull_Bearing_R12500c	174	MEAN_Convex_Hull_Bearing_R12500c	174	MIN_Convex_Hull_Bearing_R12500c	174	MAX_Convex_Hull_Bearing_R12500c	174	STD_Convex_Hull_Bearing_R12500c
175	Convex_Hull_Shape_Index_R12500c	175	MEAN_Convex_Hull_Shape_Index_R12500c	175	MIN_Convex_Hull_Shape_Index_R12500c	175	MAX_Convex_Hull_Shape_Index_R12500c	175	STD_Convex_Hull_Shape_Index_R12500c
176	Mean_Ang_Dist_Wl_R15000c	176	MEAN_Mean_Ang_Dist_Wl_R15000c	176	MIN_Mean_Ang_Dist_Wl_R15000c	176	MAX_Mean_Ang_Dist_Wl_R15000c	176	STD_Mean_Ang_Dist_Wl_R15000c
177	NetQuantPD_Ang_Wl_R15000c	177	MEAN_NetQuantPD_Ang_Wl_R15000c	177	MIN_NetQuantPD_Ang_Wl_R15000c	177	MAX_NetQuantPD_Ang_Wl_R15000c	177	STD_NetQuantPD_Ang_Wl_R15000c
178	Betweenness_Ang_Wl_R15000c	178	MEAN_Betweenness_Ang_Wl_R15000c	178	MIN_Betweenness_Ang_Wl_R15000c	178	MAX_Betweenness_Ang_Wl_R15000c	178	STD_Betweenness_Ang_Wl_R15000c
179	TPBetweenness_Ang_Wl_R15000c	179	MEAN_TPBetweenness_Ang_Wl_R15000c	179	MIN_TPBetweenness_Ang_Wl_R15000c	179	MAX_TPBetweenness_Ang_Wl_R15000c	179	STD_TPBetweenness_Ang_Wl_R15000c
180	TPDestination_Ang_Wl_R15000c	180	MEAN_TPDestination_Ang_Wl_R15000c	180	MIN_TPDestination_Ang_Wl_R15000c	180	MAX_TPDestination_Ang_Wl_R15000c	180	STD_TPDestination_Ang_Wl_R15000c
181	Links_R15000c	181	MEAN_Links_R15000c	181	MIN_Links_R15000c	181	MAX_Links_R15000c	181	STD_Links_R15000c
182	Length_R15000c	182	MEAN_Length_R15000c	182	MIN_Length_R15000c	182	MAX_Length_R15000c	182	STD_Length_R15000c
183	Ang_Dist_R15000c	183	MEAN_Ang_Dist_R15000c	183	MIN_Ang_Dist_R15000c	183	MAX_Ang_Dist_R15000c	183	STD_Ang_Dist_R15000c
184	Weight_Wl_R15000c	184	MEAN_Weight_Wl_R15000c	184	MIN_Weight_Wl_R15000c	184	MAX_Weight_Wl_R15000c	184	STD_Weight_Wl_R15000c
185	MeanGeoLen_Ang_Wl_R15000c	185	MEAN_MeanGeoLen_Ang_Wl_R15000c	185	MIN_MeanGeoLen_Ang_Wl_R15000c	185	MAX_MeanGeoLen_Ang_Wl_R15000c	185	STD_MeanGeoLen_Ang_Wl_R15000c
186	Mean_Crow_Flight_Wl_R15000c	186	MEAN_Mean_Crow_Flight_Wl_R15000c	186	MIN_Mean_Crow_Flight_Wl_R15000c	186	MAX_Mean_Crow_Flight_Wl_R15000c	186	STD_Mean_Crow_Flight_Wl_R15000c

187	Diversion_Ratio_Ang_Wl_R15000c	187	MEAN_Diversion_Ratio_Ang_Wl_R15000c	187	MIN_Diversion_Ratio_Ang_Wl_R15000c	187	MAX_Diversion_Ratio_Ang_Wl_R15000c	187	STD_Diversion_Ratio_Ang_Wl_R15000c
188	Convex_Hull_Area_R15000c	188	MEAN_Convex_Hull_Area_R15000c	188	MIN_Convex_Hull_Area_R15000c	188	MAX_Convex_Hull_Area_R15000c	188	STD_Convex_Hull_Area_R15000c
189	Convex_Hull_Perimeter_R15000c	189	MEAN_Convex_Hull_Perimeter_R15000c	189	MIN_Convex_Hull_Perimeter_R15000c	189	MAX_Convex_Hull_Perimeter_R15000c	189	STD_Convex_Hull_Perimeter_R15000c
190	Convex_Hull_Max_Radius_R15000c	190	MEAN_Convex_Hull_MEAN_Radius_R15000c	190	MIN_Convex_Hull_Max_Radius_R15000c	190	MAX_Convex_Hull_Max_Radius_R15000c	190	STD_Convex_Hull_Max_Radius_R15000c
191	Convex_Hull_Bearing_R15000c	191	MEAN_Convex_Hull_Bearing_R15000c	191	MIN_Convex_Hull_Bearing_R15000c	191	MAX_Convex_Hull_Bearing_R15000c	191	STD_Convex_Hull_Bearing_R15000c
192	Convex_Hull_Shape_Index_R15000c	192	MEAN_Convex_Hull_Shape_Index_R15000c	192	MIN_Convex_Hull_Shape_Index_R15000c	192	MAX_Convex_Hull_Shape_Index_R15000c	192	STD_Convex_Hull_Shape_Index_R15000c
193	Mean_Ang_Dist_Wl_R17500c	193	MEAN_Mean_Ang_Dist_Wl_R17500c	193	MIN_Mean_Ang_Dist_Wl_R17500c	193	MAX_Mean_Ang_Dist_Wl_R17500c	193	STD_Mean_Ang_Dist_Wl_R17500c
194	NetQuantPD_Ang_Wl_R17500c	194	MEAN_NetQuantPD_Ang_Wl_R17500c	194	MIN_NetQuantPD_Ang_Wl_R17500c	194	MAX_NetQuantPD_Ang_Wl_R17500c	194	STD_NetQuantPD_Ang_Wl_R17500c
195	Betweenness_Ang_Wl_R17500c	195	MEAN_Betweenness_Ang_Wl_R17500c	195	MIN_Betweenness_Ang_Wl_R17500c	195	MAX_Betweenness_Ang_Wl_R17500c	195	STD_Betweenness_Ang_Wl_R17500c
196	TPBetweenness_Ang_Wl_R17500c	196	MEAN_TPBetweenness_Ang_Wl_R17500c	196	MIN_TPBetweenness_Ang_Wl_R17500c	196	MAX_TPBetweenness_Ang_Wl_R17500c	196	STD_TPBetweenness_Ang_Wl_R17500c
197	TPDestination_Ang_Wl_R17500c	197	MEAN_TPDestination_Ang_Wl_R17500c	197	MIN_TPDestination_Ang_Wl_R17500c	197	MAX_TPDestination_Ang_Wl_R17500c	197	STD_TPDestination_Ang_Wl_R17500c
198	Links_R17500c	198	MEAN_Links_R17500c	198	MIN_Links_R17500c	198	MAX_Links_R17500c	198	STD_Links_R17500c
199	Length_R17500c	199	MEAN_Length_R17500c	199	MIN_Length_R17500c	199	MAX_Length_R17500c	199	STD_Length_R17500c
200	Ang_Dist_R17500c	200	MEAN_Ang_Dist_R17500c	200	MIN_Ang_Dist_R17500c	200	MAX_Ang_Dist_R17500c	200	STD_Ang_Dist_R17500c
201	Weight_Wl_R17500c	201	MEAN_Weight_Wl_R17500c	201	MIN_Weight_Wl_R17500c	201	MAX_Weight_Wl_R17500c	201	STD_Weight_Wl_R17500c
202	MeanGeoLen_Ang_Wl_R17500c	202	MEAN_MeanGeoLen_Ang_Wl_R17500c	202	MIN_MeanGeoLen_Ang_Wl_R17500c	202	MAX_MeanGeoLen_Ang_Wl_R17500c	202	STD_MeanGeoLen_Ang_Wl_R17500c
203	Mean_Crow_Flight_Wl_R17500c	203	MEAN_Mean_Crow_Flight_Wl_R17500c	203	MIN_Mean_Crow_Flight_Wl_R17500c	203	MAX_Mean_Crow_Flight_Wl_R17500c	203	STD_Mean_Crow_Flight_Wl_R17500c
204	Diversion_Ratio_Ang_Wl_R17500c	204	MEAN_Diversion_Ratio_Ang_Wl_R17500c	204	MIN_Diversion_Ratio_Ang_Wl_R17500c	204	MAX_Diversion_Ratio_Ang_Wl_R17500c	204	STD_Diversion_Ratio_Ang_Wl_R17500c
205	Convex_Hull_Area_R17500c	205	MEAN_Convex_Hull_Area_R17500c	205	MIN_Convex_Hull_Area_R17500c	205	MAX_Convex_Hull_Area_R17500c	205	STD_Convex_Hull_Area_R17500c
206	Convex_Hull_Perimeter_R17500c	206	MEAN_Convex_Hull_Perimeter_R17500c	206	MIN_Convex_Hull_Perimeter_R17500c	206	MAX_Convex_Hull_Perimeter_R17500c	206	STD_Convex_Hull_Perimeter_R17500c
207	Convex_Hull_Max_Radius_R17500c	207	MEAN_Convex_Hull_MEAN_Radius_R17500c	207	MIN_Convex_Hull_Max_Radius_R17500c	207	MAX_Convex_Hull_Max_Radius_R17500c	207	STD_Convex_Hull_Max_Radius_R17500c
208	Convex_Hull_Bearing_R17500c	208	MEAN_Convex_Hull_Bearing_R17500c	208	MIN_Convex_Hull_Bearing_R17500c	208	MAX_Convex_Hull_Bearing_R17500c	208	STD_Convex_Hull_Bearing_R17500c
209	Convex_Hull_Shape_Index_R17500c	209	MEAN_Convex_Hull_Shape_Index_R17500c	209	MIN_Convex_Hull_Shape_Index_R17500c	209	MAX_Convex_Hull_Shape_Index_R17500c	209	STD_Convex_Hull_Shape_Index_R17500c

210	Mean_Ang_Dist_Wl_R20000c	210	MEAN_Mean_Ang_Dist_Wl_R20000c	210	MIN_Mean_Ang_Dist_Wl_R20000c	210	MAX_Mean_Ang_Dist_Wl_R20000c	210	STD_Mean_Ang_Dist_Wl_R20000c
211	NetQuantPD_Ang_Wl_R20000c	211	MEAN_NetQuantPD_Ang_Wl_R20000c	211	MIN_NetQuantPD_Ang_Wl_R20000c	211	MAX_NetQuantPD_Ang_Wl_R20000c	211	STD_NetQuantPD_Ang_Wl_R20000c
212	Betweenness_Ang_Wl_R20000c	212	MEAN_Betweenness_Ang_Wl_R20000c	212	MIN_Betweenness_Ang_Wl_R20000c	212	MAX_Betweenness_Ang_Wl_R20000c	212	STD_Betweenness_Ang_Wl_R20000c
213	TPBetweenness_Ang_Wl_R20000c	213	MEAN_TPBetweenness_Ang_Wl_R20000c	213	MIN_TPBetweenness_Ang_Wl_R20000c	213	MAX_TPBetweenness_Ang_Wl_R20000c	213	STD_TPBetweenness_Ang_Wl_R20000c
214	TPDestination_Ang_Wl_R20000c	214	MEAN_TPDestination_Ang_Wl_R20000c	214	MIN_TPDestination_Ang_Wl_R20000c	214	MAX_TPDestination_Ang_Wl_R20000c	214	STD_TPDestination_Ang_Wl_R20000c
215	Links_R20000c	215	MEAN_Links_R20000c	215	MIN_Links_R20000c	215	MAX_Links_R20000c	215	STD_Links_R20000c
216	Length_R20000c	216	MEAN_Length_R20000c	216	MIN_Length_R20000c	216	MAX_Length_R20000c	216	STD_Length_R20000c
217	Ang_Dist_R20000c	217	MEAN_Ang_Dist_R20000c	217	MIN_Ang_Dist_R20000c	217	MAX_Ang_Dist_R20000c	217	STD_Ang_Dist_R20000c
218	Weight_Wl_R20000c	218	MEAN_Weight_Wl_R20000c	218	MIN_Weight_Wl_R20000c	218	MAX_Weight_Wl_R20000c	218	STD_Weight_Wl_R20000c
219	MeanGeoLen_Ang_Wl_R20000c	219	MEAN_MeanGeoLen_Ang_Wl_R20000c	219	MIN_MeanGeoLen_Ang_Wl_R20000c	219	MAX_MeanGeoLen_Ang_Wl_R20000c	219	STD_MeanGeoLen_Ang_Wl_R20000c
220	Mean_Crow_Flight_Wl_R20000c	220	MEAN_Mean_Crow_Flight_Wl_R20000c	220	MIN_Mean_Crow_Flight_Wl_R20000c	220	MAX_Mean_Crow_Flight_Wl_R20000c	220	STD_Mean_Crow_Flight_Wl_R20000c
221	Diversion_Ratio_Ang_Wl_R20000c	221	MEAN_Diversion_Ratio_Ang_Wl_R20000c	221	MIN_Diversion_Ratio_Ang_Wl_R20000c	221	MAX_Diversion_Ratio_Ang_Wl_R20000c	221	STD_Diversion_Ratio_Ang_Wl_R20000c
222	Convex_Hull_Area_R20000c	222	MEAN_Convex_Hull_Area_R20000c	222	MIN_Convex_Hull_Area_R20000c	222	MAX_Convex_Hull_Area_R20000c	222	STD_Convex_Hull_Area_R20000c
223	Convex_Hull_Perimeter_R20000c	223	MEAN_Convex_Hull_Perimeter_R20000c	223	MIN_Convex_Hull_Perimeter_R20000c	223	MAX_Convex_Hull_Perimeter_R20000c	223	STD_Convex_Hull_Perimeter_R20000c
224	Convex_Hull_Max_Radius_R20000c	224	MEAN_Convex_Hull_MEAN_Radius_R20000c	224	MIN_Convex_Hull_Max_Radius_R20000c	224	MAX_Convex_Hull_Max_Radius_R20000c	224	STD_Convex_Hull_Max_Radius_R20000c
225	Convex_Hull_Bearing_R20000c	225	MEAN_Convex_Hull_Bearing_R20000c	225	MIN_Convex_Hull_Bearing_R20000c	225	MAX_Convex_Hull_Bearing_R20000c	225	STD_Convex_Hull_Bearing_R20000c
226	Convex_Hull_Shape_Index_R20000c	226	MEAN_Convex_Hull_Shape_Index_R20000c	226	MIN_Convex_Hull_Shape_Index_R20000c	226	MAX_Convex_Hull_Shape_Index_R20000c	226	STD_Convex_Hull_Shape_Index_R20000c
227	Mean_Ang_Dist_Wl_R25000c	227	MEAN_Mean_Ang_Dist_Wl_R25000c	227	MIN_Mean_Ang_Dist_Wl_R25000c	227	MAX_Mean_Ang_Dist_Wl_R25000c	227	STD_Mean_Ang_Dist_Wl_R25000c
228	NetQuantPD_Ang_Wl_R25000c	228	MEAN_NetQuantPD_Ang_Wl_R25000c	228	MIN_NetQuantPD_Ang_Wl_R25000c	228	MAX_NetQuantPD_Ang_Wl_R25000c	228	STD_NetQuantPD_Ang_Wl_R25000c
229	Betweenness_Ang_Wl_R25000c	229	MEAN_Betweenness_Ang_Wl_R25000c	229	MIN_Betweenness_Ang_Wl_R25000c	229	MAX_Betweenness_Ang_Wl_R25000c	229	STD_Betweenness_Ang_Wl_R25000c
230	TPBetweenness_Ang_Wl_R25000c	230	MEAN_TPBetweenness_Ang_Wl_R25000c	230	MIN_TPBetweenness_Ang_Wl_R25000c	230	MAX_TPBetweenness_Ang_Wl_R25000c	230	STD_TPBetweenness_Ang_Wl_R25000c
231	TPDestination_Ang_Wl_R25000c	231	MEAN_TPDestination_Ang_Wl_R25000c	231	MIN_TPDestination_Ang_Wl_R25000c	231	MAX_TPDestination_Ang_Wl_R25000c	231	STD_TPDestination_Ang_Wl_R25000c
232	Links_R25000c	232	MEAN_Links_R25000c	232	MIN_Links_R25000c	232	MAX_Links_R25000c	232	STD_Links_R25000c
233	Length_R25000c	233	MEAN_Length_R25000c	233	MIN_Length_R25000c	233	MAX_Length_R25000c	233	STD_Length_R25000c

234	Ang_Dist_R25000c	234	MEAN_Ang_Dist_R25000c	234	MIN_Ang_Dist_R25000c	234	MAX_Ang_Dist_R25000c	234	STD_Ang_Dist_R25000c
235	Weight_Wl_R25000c	235	MEAN_Weight_Wl_R25000c	235	MIN_Weight_Wl_R25000c	235	MAX_Weight_Wl_R25000c	235	STD_Weight_Wl_R25000c
236	MeanGeoLen_Ang_Wl_R25000c	236	MEAN_MeanGeoLen_Ang_Wl_R25000c	236	MIN_MeanGeoLen_Ang_Wl_R25000c	236	MAX_MeanGeoLen_Ang_Wl_R25000c	236	STD_MeanGeoLen_Ang_Wl_R25000c
237	Mean_Crow_Flight_Wl_R25000c	237	MEAN_Mean_Crow_Flight_Wl_R25000c	237	MIN_Mean_Crow_Flight_Wl_R25000c	237	MAX_Mean_Crow_Flight_Wl_R25000c	237	STD_Mean_Crow_Flight_Wl_R25000c
238	Diversion_Ratio_Ang_Wl_R25000c	238	MEAN_Diversion_Ratio_Ang_Wl_R25000c	238	MIN_Diversion_Ratio_Ang_Wl_R25000c	238	MAX_Diversion_Ratio_Ang_Wl_R25000c	238	STD_Diversion_Ratio_Ang_Wl_R25000c
239	Convex_Hull_Area_R25000c	239	MEAN_Convex_Hull_Area_R25000c	239	MIN_Convex_Hull_Area_R25000c	239	MAX_Convex_Hull_Area_R25000c	239	STD_Convex_Hull_Area_R25000c
240	Convex_Hull_Perimeter_R25000c	240	MEAN_Convex_Hull_Perimeter_R25000c	240	MIN_Convex_Hull_Perimeter_R25000c	240	MAX_Convex_Hull_Perimeter_R25000c	240	STD_Convex_Hull_Perimeter_R25000c
241	Convex_Hull_Max_Radius_R25000c	241	MEAN_Convex_Hull_MEAN_Radius_R25000c	241	MIN_Convex_Hull_Max_Radius_R25000c	241	MAX_Convex_Hull_Max_Radius_R25000c	241	STD_Convex_Hull_Max_Radius_R25000c
242	Convex_Hull_Bearing_R25000c	242	MEAN_Convex_Hull_Bearing_R25000c	242	MIN_Convex_Hull_Bearing_R25000c	242	MAX_Convex_Hull_Bearing_R25000c	242	STD_Convex_Hull_Bearing_R25000c
243	Convex_Hull_Shape_Index_R25000c	243	MEAN_Convex_Hull_Shape_Index_R25000c	243	MIN_Convex_Hull_Shape_Index_R25000c	243	MAX_Convex_Hull_Shape_Index_R25000c	243	STD_Convex_Hull_Shape_Index_R25000c
244	Mean_Ang_Dist_Wl_R30000c	244	MEAN_Mean_Ang_Dist_Wl_R30000c	244	MIN_Mean_Ang_Dist_Wl_R30000c	244	MAX_Mean_Ang_Dist_Wl_R30000c	244	STD_Mean_Ang_Dist_Wl_R30000c
245	NetQuantPD_Ang_Wl_R30000c	245	MEAN_NetQuantPD_Ang_Wl_R30000c	245	MIN_NetQuantPD_Ang_Wl_R30000c	245	MAX_NetQuantPD_Ang_Wl_R30000c	245	STD_NetQuantPD_Ang_Wl_R30000c
246	Betweenness_Ang_Wl_R30000c	246	MEAN_Betweenness_Ang_Wl_R30000c	246	MIN_Betweenness_Ang_Wl_R30000c	246	MAX_Betweenness_Ang_Wl_R30000c	246	STD_Betweenness_Ang_Wl_R30000c
247	TPBetweenness_Ang_Wl_R30000c	247	MEAN_TPBetweenness_Ang_Wl_R30000c	247	MIN_TPBetweenness_Ang_Wl_R30000c	247	MAX_TPBetweenness_Ang_Wl_R30000c	247	STD_TPBetweenness_Ang_Wl_R30000c
248	TPDestination_Ang_Wl_R30000c	248	MEAN_TPDestination_Ang_Wl_R30000c	248	MIN_TPDestination_Ang_Wl_R30000c	248	MAX_TPDestination_Ang_Wl_R30000c	248	STD_TPDestination_Ang_Wl_R30000c
249	Links_R30000c	249	MEAN_Links_R30000c	249	MIN_Links_R30000c	249	MAX_Links_R30000c	249	STD_Links_R30000c
250	Length_R30000c	250	MEAN_Length_R30000c	250	MIN_Length_R30000c	250	MAX_Length_R30000c	250	STD_Length_R30000c
251	Ang_Dist_R30000c	251	MEAN_Ang_Dist_R30000c	251	MIN_Ang_Dist_R30000c	251	MAX_Ang_Dist_R30000c	251	STD_Ang_Dist_R30000c
252	Weight_Wl_R30000c	252	MEAN_Weight_Wl_R30000c	252	MIN_Weight_Wl_R30000c	252	MAX_Weight_Wl_R30000c	252	STD_Weight_Wl_R30000c
253	MeanGeoLen_Ang_Wl_R30000c	253	MEAN_MeanGeoLen_Ang_Wl_R30000c	253	MIN_MeanGeoLen_Ang_Wl_R30000c	253	MAX_MeanGeoLen_Ang_Wl_R30000c	253	STD_MeanGeoLen_Ang_Wl_R30000c
254	Mean_Crow_Flight_Wl_R30000c	254	MEAN_Mean_Crow_Flight_Wl_R30000c	254	MIN_Mean_Crow_Flight_Wl_R30000c	254	MAX_Mean_Crow_Flight_Wl_R30000c	254	STD_Mean_Crow_Flight_Wl_R30000c
255	Diversion_Ratio_Ang_Wl_R30000c	255	MEAN_Diversion_Ratio_Ang_Wl_R30000c	255	MIN_Diversion_Ratio_Ang_Wl_R30000c	255	MAX_Diversion_Ratio_Ang_Wl_R30000c	255	STD_Diversion_Ratio_Ang_Wl_R30000c
256	Convex_Hull_Area_R30000c	256	MEAN_Convex_Hull_Area_R30000c	256	MIN_Convex_Hull_Area_R30000c	256	MAX_Convex_Hull_Area_R30000c	256	STD_Convex_Hull_Area_R30000c
257	Convex_Hull_Perimeter_R30000c	257	MEAN_Convex_Hull_Perimeter_R30000c	257	MIN_Convex_Hull_Perimeter_R30000c	257	MAX_Convex_Hull_Perimeter_R30000c	257	STD_Convex_Hull_Perimeter_R30000c

258	Convex_Hull_Max_Radius_R30000c	258	MEAN_Convex_Hull_MEAN_Radius_R30000c	258	MIN_Convex_Hull_Max_Radius_R30000c	258	MAX_Convex_Hull_Max_Radius_R30000c	258	STD_Convex_Hull_Max_Radius_R30000c
259	Convex_Hull_Bearing_R30000c	259	MEAN_Convex_Hull_Bearing_R30000c	259	MIN_Convex_Hull_Bearing_R30000c	259	MAX_Convex_Hull_Bearing_R30000c	259	STD_Convex_Hull_Bearing_R30000c
260	Convex_Hull_Shape_Index_R30000c	260	MEAN_Convex_Hull_Shape_Index_R30000c	260	MIN_Convex_Hull_Shape_Index_R30000c	260	MAX_Convex_Hull_Shape_Index_R30000c	260	STD_Convex_Hull_Shape_Index_R30000c
261	Mean_Ang_Dist_Wl_R35000c	261	MEAN_Mean_Ang_Dist_Wl_R35000c	261	MIN_Mean_Ang_Dist_Wl_R35000c	261	MAX_Mean_Ang_Dist_Wl_R35000c	261	STD_Mean_Ang_Dist_Wl_R35000c
262	NetQuantPD_Ang_Wl_R35000c	262	MEAN_NetQuantPD_Ang_Wl_R35000c	262	MIN_NetQuantPD_Ang_Wl_R35000c	262	MAX_NetQuantPD_Ang_Wl_R35000c	262	STD_NetQuantPD_Ang_Wl_R35000c
263	Betweenness_Ang_Wl_R35000c	263	MEAN_Betweenness_Ang_Wl_R35000c	263	MIN_Betweenness_Ang_Wl_R35000c	263	MAX_Betweenness_Ang_Wl_R35000c	263	STD_Betweenness_Ang_Wl_R35000c
264	TPBetweenness_Ang_Wl_R35000c	264	MEAN_TPBetweenness_Ang_Wl_R35000c	264	MIN_TPBetweenness_Ang_Wl_R35000c	264	MAX_TPBetweenness_Ang_Wl_R35000c	264	STD_TPBetweenness_Ang_Wl_R35000c
265	TPDestination_Ang_Wl_R35000c	265	MEAN_TPDestination_Ang_Wl_R35000c	265	MIN_TPDestination_Ang_Wl_R35000c	265	MAX_TPDestination_Ang_Wl_R35000c	265	STD_TPDestination_Ang_Wl_R35000c
266	Links_R35000c	266	MEAN_Links_R35000c	266	MIN_Links_R35000c	266	MAX_Links_R35000c	266	STD_Links_R35000c
267	Length_R35000c	267	MEAN_Length_R35000c	267	MIN_Length_R35000c	267	MAX_Length_R35000c	267	STD_Length_R35000c
268	Ang_Dist_R35000c	268	MEAN_Ang_Dist_R35000c	268	MIN_Ang_Dist_R35000c	268	MAX_Ang_Dist_R35000c	268	STD_Ang_Dist_R35000c
269	Weight_Wl_R35000c	269	MEAN_Weight_Wl_R35000c	269	MIN_Weight_Wl_R35000c	269	MAX_Weight_Wl_R35000c	269	STD_Weight_Wl_R35000c
270	MeanGeoLen_Ang_Wl_R35000c	270	MEAN_MeanGeoLen_Ang_Wl_R35000c	270	MIN_MeanGeoLen_Ang_Wl_R35000c	270	MAX_MeanGeoLen_Ang_Wl_R35000c	270	STD_MeanGeoLen_Ang_Wl_R35000c
271	Mean_Crow_Flight_Wl_R35000c	271	MEAN_Mean_Crow_Flight_Wl_R35000c	271	MIN_Mean_Crow_Flight_Wl_R35000c	271	MAX_Mean_Crow_Flight_Wl_R35000c	271	STD_Mean_Crow_Flight_Wl_R35000c
272	Diversion_Ratio_Ang_Wl_R35000c	272	MEAN_Diversion_Ratio_Ang_Wl_R35000c	272	MIN_Diversion_Ratio_Ang_Wl_R35000c	272	MAX_Diversion_Ratio_Ang_Wl_R35000c	272	STD_Diversion_Ratio_Ang_Wl_R35000c
273	Convex_Hull_Area_R35000c	273	MEAN_Convex_Hull_Area_R35000c	273	MIN_Convex_Hull_Area_R35000c	273	MAX_Convex_Hull_Area_R35000c	273	STD_Convex_Hull_Area_R35000c
274	Convex_Hull_Perimeter_R35000c	274	MEAN_Convex_Hull_Perimeter_R35000c	274	MIN_Convex_Hull_Perimeter_R35000c	274	MAX_Convex_Hull_Perimeter_R35000c	274	STD_Convex_Hull_Perimeter_R35000c
275	Convex_Hull_Max_Radius_R35000c	275	MEAN_Convex_Hull_MEAN_Radius_R35000c	275	MIN_Convex_Hull_Max_Radius_R35000c	275	MAX_Convex_Hull_Max_Radius_R35000c	275	STD_Convex_Hull_Max_Radius_R35000c
276	Convex_Hull_Bearing_R35000c	276	MEAN_Convex_Hull_Bearing_R35000c	276	MIN_Convex_Hull_Bearing_R35000c	276	MAX_Convex_Hull_Bearing_R35000c	276	STD_Convex_Hull_Bearing_R35000c
277	Convex_Hull_Shape_Index_R35000c	277	MEAN_Convex_Hull_Shape_Index_R35000c	277	MIN_Convex_Hull_Shape_Index_R35000c	277	MAX_Convex_Hull_Shape_Index_R35000c	277	STD_Convex_Hull_Shape_Index_R35000c
278	Mean_Ang_Dist_Wl_R40000c	278	MEAN_Mean_Ang_Dist_Wl_R40000c	278	MIN_Mean_Ang_Dist_Wl_R40000c	278	MAX_Mean_Ang_Dist_Wl_R40000c	278	STD_Mean_Ang_Dist_Wl_R40000c
279	NetQuantPD_Ang_Wl_R40000c	279	MEAN_NetQuantPD_Ang_Wl_R40000c	279	MIN_NetQuantPD_Ang_Wl_R40000c	279	MAX_NetQuantPD_Ang_Wl_R40000c	279	STD_NetQuantPD_Ang_Wl_R40000c
280	Betweenness_Ang_Wl_R40000c	280	MEAN_Betweenness_Ang_Wl_R40000c	280	MIN_Betweenness_Ang_Wl_R40000c	280	MAX_Betweenness_Ang_Wl_R40000c	280	STD_Betweenness_Ang_Wl_R40000c

281	TPBetweenness_Ang_Wl_R40000c	281	MEAN_TPBetweenness_Ang_Wl_R40000c	281	MIN_TPBetweenness_Ang_Wl_R40000c	281	MAX_TPBetweenness_Ang_Wl_R40000c	281	STD_TPBetweenness_Ang_Wl_R40000c
282	TPDestination_Ang_Wl_R40000c	282	MEAN_TPDestination_Ang_Wl_R40000c	282	MIN_TPDestination_Ang_Wl_R40000c	282	MAX_TPDestination_Ang_Wl_R40000c	282	STD_TPDestination_Ang_Wl_R40000c
283	Links_R40000c	283	MEAN_Links_R40000c	283	MIN_Links_R40000c	283	MAX_Links_R40000c	283	STD_Links_R40000c
284	Length_R40000c	284	MEAN_Length_R40000c	284	MIN_Length_R40000c	284	MAX_Length_R40000c	284	STD_Length_R40000c
285	Ang_Dist_R40000c	285	MEAN_Ang_Dist_R40000c	285	MIN_Ang_Dist_R40000c	285	MAX_Ang_Dist_R40000c	285	STD_Ang_Dist_R40000c
286	Weight_Wl_R40000c	286	MEAN_Weight_Wl_R40000c	286	MIN_Weight_Wl_R40000c	286	MAX_Weight_Wl_R40000c	286	STD_Weight_Wl_R40000c
287	MeanGeoLen_Ang_Wl_R40000c	287	MEAN_MeanGeoLen_Ang_Wl_R40000c	287	MIN_MeanGeoLen_Ang_Wl_R40000c	287	MAX_MeanGeoLen_Ang_Wl_R40000c	287	STD_MeanGeoLen_Ang_Wl_R40000c
288	Mean_Crow_Flight_Wl_R40000c	288	MEAN_Mean_Crow_Flight_Wl_R40000c	288	MIN_Mean_Crow_Flight_Wl_R40000c	288	MAX_Mean_Crow_Flight_Wl_R40000c	288	STD_Mean_Crow_Flight_Wl_R40000c
289	Diversion_Ratio_Ang_Wl_R40000c	289	MEAN_Diversion_Ratio_Ang_Wl_R40000c	289	MIN_Diversion_Ratio_Ang_Wl_R40000c	289	MAX_Diversion_Ratio_Ang_Wl_R40000c	289	STD_Diversion_Ratio_Ang_Wl_R40000c
290	Convex_Hull_Area_R40000c	290	MEAN_Convex_Hull_Area_R40000c	290	MIN_Convex_Hull_Area_R40000c	290	MAX_Convex_Hull_Area_R40000c	290	STD_Convex_Hull_Area_R40000c
291	Convex_Hull_Perimeter_R40000c	291	MEAN_Convex_Hull_Perimeter_R40000c	291	MIN_Convex_Hull_Perimeter_R40000c	291	MAX_Convex_Hull_Perimeter_R40000c	291	STD_Convex_Hull_Perimeter_R40000c
292	Convex_Hull_Max_Radius_R40000c	292	MEAN_Convex_Hull_MEAN_Radius_R40000c	292	MIN_Convex_Hull_Max_Radius_R40000c	292	MAX_Convex_Hull_Max_Radius_R40000c	292	STD_Convex_Hull_Max_Radius_R40000c
293	Convex_Hull_Bearing_R40000c	293	MEAN_Convex_Hull_Bearing_R40000c	293	MIN_Convex_Hull_Bearing_R40000c	293	MAX_Convex_Hull_Bearing_R40000c	293	STD_Convex_Hull_Bearing_R40000c
294	Convex_Hull_Shape_Index_R40000c	294	MEAN_Convex_Hull_Shape_Index_R40000c	294	MIN_Convex_Hull_Shape_Index_R40000c	294	MAX_Convex_Hull_Shape_Index_R40000c	294	STD_Convex_Hull_Shape_Index_R40000c
295	Mean_Ang_Dist_Wl_R45000c	295	MEAN_Mean_Ang_Dist_Wl_R45000c	295	MIN_Mean_Ang_Dist_Wl_R45000c	295	MAX_Mean_Ang_Dist_Wl_R45000c	295	STD_Mean_Ang_Dist_Wl_R45000c
296	NetQuantPD_Ang_Wl_R45000c	296	MEAN_NetQuantPD_Ang_Wl_R45000c	296	MIN_NetQuantPD_Ang_Wl_R45000c	296	MAX_NetQuantPD_Ang_Wl_R45000c	296	STD_NetQuantPD_Ang_Wl_R45000c
297	Betweenness_Ang_Wl_R45000c	297	MEAN_Betweenness_Ang_Wl_R45000c	297	MIN_Betweenness_Ang_Wl_R45000c	297	MAX_Betweenness_Ang_Wl_R45000c	297	STD_Betweenness_Ang_Wl_R45000c
298	TPBetweenness_Ang_Wl_R45000c	298	MEAN_TPBetweenness_Ang_Wl_R45000c	298	MIN_TPBetweenness_Ang_Wl_R45000c	298	MAX_TPBetweenness_Ang_Wl_R45000c	298	STD_TPBetweenness_Ang_Wl_R45000c
299	TPDestination_Ang_Wl_R45000c	299	MEAN_TPDestination_Ang_Wl_R45000c	299	MIN_TPDestination_Ang_Wl_R45000c	299	MAX_TPDestination_Ang_Wl_R45000c	299	STD_TPDestination_Ang_Wl_R45000c
300	Links_R45000c	300	MEAN_Links_R45000c	300	MIN_Links_R45000c	300	MAX_Links_R45000c	300	STD_Links_R45000c
301	Length_R45000c	301	Length_R45000c	301	Length_R45000c	301	Length_R45000c	301	Length_R45000c
302	Ang_Dist_R45000c	302	MEAN_Ang_Dist_R45000c	302	MIN_Ang_Dist_R45000c	302	MAX_Ang_Dist_R45000c	302	STD_Ang_Dist_R45000c
303	Weight_Wl_R45000c	303	MEAN_Weight_Wl_R45000c	303	MIN_Weight_Wl_R45000c	303	MAX_Weight_Wl_R45000c	303	STD_Weight_Wl_R45000c
304	MeanGeoLen_Ang_Wl_R45000c	304	MEAN_MeanGeoLen_Ang_Wl_R45000c	304	MIN_MeanGeoLen_Ang_Wl_R45000c	304	MAX_MeanGeoLen_Ang_Wl_R45000c	304	STD_MeanGeoLen_Ang_Wl_R45000c

305	Mean_Crow_Flight_Wl_R45000c	305	MEAN_Mean_Crow_Flight_Wl_R45000c	305	MIN_Mean_Crow_Flight_Wl_R45000c	305	MAX_Mean_Crow_Flight_Wl_R45000c	305	STD_Mean_Crow_Flight_Wl_R45000c
306	Diversion_Ratio_Ang_Wl_R45000c	306	MEAN_Diversion_Ratio_Ang_Wl_R45000c	306	MIN_Diversion_Ratio_Ang_Wl_R45000c	306	MAX_Diversion_Ratio_Ang_Wl_R45000c	306	STD_Diversion_Ratio_Ang_Wl_R45000c
307	Convex_Hull_Area_R45000c	307	MEAN_Convex_Hull_Area_R45000c	307	MIN_Convex_Hull_Area_R45000c	307	MAX_Convex_Hull_Area_R45000c	307	STD_Convex_Hull_Area_R45000c
308	Convex_Hull_Perimeter_R45000c	308	MEAN_Convex_Hull_Perimeter_R45000c	308	MIN_Convex_Hull_Perimeter_R45000c	308	MAX_Convex_Hull_Perimeter_R45000c	308	STD_Convex_Hull_Perimeter_R45000c
309	Convex_Hull_Max_Radius_R45000c	309	MEAN_Convex_Hull_MEAN_Radius_R45000c	309	MIN_Convex_Hull_Max_Radius_R45000c	309	MAX_Convex_Hull_Max_Radius_R45000c	309	STD_Convex_Hull_Max_Radius_R45000c
310	Convex_Hull_Bearing_R45000c	310	MEAN_Convex_Hull_Bearing_R45000c	310	MIN_Convex_Hull_Bearing_R45000c	310	MAX_Convex_Hull_Bearing_R45000c	310	STD_Convex_Hull_Bearing_R45000c
311	Convex_Hull_Shape_Index_R45000c	311	MEAN_Convex_Hull_Shape_Index_R45000c	311	MIN_Convex_Hull_Shape_Index_R45000c	311	MAX_Convex_Hull_Shape_Index_R45000c	311	STD_Convex_Hull_Shape_Index_R45000c
312	Mean_Ang_Dist_Wl_R50000c	312	MEAN_Mean_Ang_Dist_Wl_R50000c	312	MIN_Mean_Ang_Dist_Wl_R50000c	312	MAX_Mean_Ang_Dist_Wl_R50000c	312	STD_Mean_Ang_Dist_Wl_R50000c
313	NetQuantPD_Ang_Wl_R50000c	313	MEAN_NetQuantPD_Ang_Wl_R50000c	313	MIN_NetQuantPD_Ang_Wl_R50000c	313	MAX_NetQuantPD_Ang_Wl_R50000c	313	STD_NetQuantPD_Ang_Wl_R50000c
314	Betweenness_Ang_Wl_R50000c	314	MEAN_Betweenness_Ang_Wl_R50000c	314	MIN_Betweenness_Ang_Wl_R50000c	314	MAX_Betweenness_Ang_Wl_R50000c	314	STD_Betweenness_Ang_Wl_R50000c
315	TPBetweenness_Ang_Wl_R50000c	315	MEAN_TPBetweenness_Ang_Wl_R50000c	315	MIN_TPBetweenness_Ang_Wl_R50000c	315	MAX_TPBetweenness_Ang_Wl_R50000c	315	STD_TPBetweenness_Ang_Wl_R50000c
316	TPDestination_Ang_Wl_R50000c	316	MEAN_TPDestination_Ang_Wl_R50000c	316	MIN_TPDestination_Ang_Wl_R50000c	316	MAX_TPDestination_Ang_Wl_R50000c	316	STD_TPDestination_Ang_Wl_R50000c
317	Links_R50000c	317	MEAN_Links_R50000c	317	MIN_Links_R50000c	317	MAX_Links_R50000c	317	STD_Links_R50000c
318	Length_R50000c	318	MEAN_Length_R50000c	318	MIN_Length_R50000c	318	MAX_Length_R50000c	318	STD_Length_R50000c
319	Ang_Dist_R50000c	319	MEAN_Ang_Dist_R50000c	319	MIN_Ang_Dist_R50000c	319	MAX_Ang_Dist_R50000c	319	STD_Ang_Dist_R50000c
320	Weight_Wl_R50000c	320	MEAN_Weight_Wl_R50000c	320	MIN_Weight_Wl_R50000c	320	MAX_Weight_Wl_R50000c	320	STD_Weight_Wl_R50000c
321	MeanGeoLen_Ang_Wl_R50000c	321	MEAN_MeanGeoLen_Ang_Wl_R50000c	321	MIN_MeanGeoLen_Ang_Wl_R50000c	321	MAX_MeanGeoLen_Ang_Wl_R50000c	321	STD_MeanGeoLen_Ang_Wl_R50000c
322	Mean_Crow_Flight_Wl_R50000c	322	MEAN_Mean_Crow_Flight_Wl_R50000c	322	MIN_Mean_Crow_Flight_Wl_R50000c	322	MAX_Mean_Crow_Flight_Wl_R50000c	322	STD_Mean_Crow_Flight_Wl_R50000c
323	Diversion_Ratio_Ang_Wl_R50000c	323	MEAN_Diversion_Ratio_Ang_Wl_R50000c	323	MIN_Diversion_Ratio_Ang_Wl_R50000c	323	MAX_Diversion_Ratio_Ang_Wl_R50000c	323	STD_Diversion_Ratio_Ang_Wl_R50000c
324	Convex_Hull_Area_R50000c	324	MEAN_Convex_Hull_Area_R50000c	324	MIN_Convex_Hull_Area_R50000c	324	MAX_Convex_Hull_Area_R50000c	324	STD_Convex_Hull_Area_R50000c
325	Convex_Hull_Perimeter_R50000c	325	MEAN_Convex_Hull_Perimeter_R50000c	325	MIN_Convex_Hull_Perimeter_R50000c	325	MAX_Convex_Hull_Perimeter_R50000c	325	STD_Convex_Hull_Perimeter_R50000c
326	Convex_Hull_Max_Radius_R50000c	326	MEAN_Convex_Hull_MEAN_Radius_R50000c	326	MIN_Convex_Hull_Max_Radius_R50000c	326	MAX_Convex_Hull_Max_Radius_R50000c	326	STD_Convex_Hull_Max_Radius_R50000c
327	Convex_Hull_Bearing_R50000c	327	MEAN_Convex_Hull_Bearing_R50000c	327	MIN_Convex_Hull_Bearing_R50000c	327	MAX_Convex_Hull_Bearing_R50000c	327	STD_Convex_Hull_Bearing_R50000c

328	Convex_Hull_Shape_Index_R50000c	328	MEAN_Convex_Hull_Shape_Index_R50000c	328	MIN_Convex_Hull_Shape_Index_R50000c	328	MAX_Convex_Hull_Shape_Index_R50000c	328	STD_Convex_Hull_Shape_Index_R50000c

***** For meaning of each acronym used in the variable column and their description, please see Table 3.

4.3 Greenness

Normalized Difference Vegetation Index (NDVI) has been employed as an objective measure of greenness. The NDVI is a unitless index calculated from the reflectance measures in satellite data, comparing the amount of energy absorbed by the chlorophyll in the red portion and the amount scattered by the internal structure of the leaves in the near-infrared region. This contrast has been employed as an estimate for vegetation greenness, as indicated by the following formula:

$$NDVI = \frac{(NIR - RED)}{(NIR + RED)}$$

where RED and NIR stand for the spectral reflectance measurements acquired in the visible (red) and near-infrared regions, respectively. The index ranges between −1 and +1, with higher values reflective of healthy green vegetation and vice versa. A collection 0.50 metre resolution Colour Infrared (CIR) imagery data collected by Blue Sky were merged together, area of interest extracted and employed in the calculation of NDVI index in Raster Calculator – Spatial Analyst, ArcGIS 10.2. The CIR band 2, 630–690 nm, was used as the red region of the electromagnetic spectrum, while band 1, 760–900 nm, acted as the infrared region, so that the formulae used was NDVI = (Band 1 − Band 2) / (Band 1 + Band 2). Neighbourhoods of 0.5 and 1.0 kilometre Euclidean buffers around each UK Biobank participant's residence were defined and the greenness was calculated in terms of mean, minimum, maximum and standard deviation in the NDVI values within the defined 0.5 and 1.0 kilometre circular buffers.

***Deliverable file 5*:**

File Name (1.33 MB)	Description
Wales_UKB_NDVI.csv	Normalized Difference Vegetation Index greenness within pre-defined Euclidean buffers (0.5 Km, 1.0 Km) of UK Biobank participant's residence.

Header file name: Wales_UKB_NDVI_Header.csv (172 bytes)

Table 6: Description of variables used

Column No.	Variable	Description
1	**Encoded anonymised participant ID**	-
2	**NDVI_500m_mean**	Mean NDVI within 0.5 Km Euclidean buffer of UK Biobank participant's residence
3	**NDVI_500m_min**	Minimum value of NDVI within 0.5 Km Euclidean buffer of UK Biobank participant's residence
4	**NDVI_500m_max**	Maximum value of NDVI within 0.5 Km Euclidean buffer of UK Biobank participant's residence
5	**NDVI_500m_STD**	Standard deviation in NDVI within 0.5 Km Euclidean buffer of UK Biobank participant's residence
6	**NDVI_1000m_mean**	Mean NDVI within 1.0 Km Euclidean buffer of UK Biobank participant's residence
7	**NDVI_1000m_min**	Minimum value of NDVI within 1.0 Km Euclidean buffer of UK Biobank participant's residence
8	**NDVI_1000m_max**	Maximum value of NDVI within 1.0 Km Euclidean buffer of UK Biobank participant's residence
9	**NDVI_1000m_STD**	Standard deviation in NDVI within 1.0 Km Euclidean buffer of UK Biobank participant's residence

4.4 Terrain (slope)

A series of 5 metre resolution Bluesky digital terrain model were mosaicked together and the area of interest extracted. Slope analysis was conducted in Spatial Analyst, ArcGIS 10.2. As in the case of greenness, neighbourhoods of 0.5 and 1.0 kilometre Euclidean buffers around each UK Biobank participant's residence were defined and slope (in degrees) within an individual's home range was operationalized in terms of mean, minimum, maximum and standard deviation in the values within the defined 0.5 and 1.0 kilometre circular buffers.

Deliverable file 6:

File Name (size)	**Description**
UKB_Wales_slope.csv (1.62 MB)	Terrain (slope in degrees) within pre-defined Euclidean buffers (0.5 Km, 1.0 Km) of UK Biobank participant's residence.

Header file name: UKB_Wales_slope_Header.csv (188 bytes)

Table 7: Description of variables used

Column No.	**Variable**	**Description**
1	**Encoded anonymised participant ID**	-
2	**Slope500m_Mean**	Mean slope within 0.5 Km Euclidean buffer of UK Biobank participant's residence
3	**Slope500m_Minimum**	Minimum value of slope within 0.5 Km Euclidean buffer of UK Biobank participant's residence
4	**Slope500m_Maximum**	Maximum value of slope within 0.5 Km Euclidean buffer of UK Biobank participant's residence
5	**Slope500m_STD**	Standard deviation in slope within 0.5 Km Euclidean buffer of UK Biobank participant's residence
6	**Slope1000m_Mean**	Mean slope within 1.0 Km Euclidean buffer of UK Biobank participant's residence
7	**Slope1000m_Minimum**	Minimum value of slope within 1.0 Km Euclidean buffer of UK Biobank participant's residence
8	**Slope1000m_Maximum**	Maximum value of slope within 1.0 Km Euclidean buffer of UK Biobank participant's residence
9	**Slope1000m_STD**	Standard deviation in slope within 1.0 Km Euclidean buffer of UK Biobank participant's residence

4.5 Welsh index of multiple deprivation (area-level deprivation)

The Welsh index of multiple deprivation (WIMD) scores, measured at the level of lower super output areas (LSOA) census areas have been employed as indicators of neighbourhood deprivation. WIMD 2008 and 2011 have been employed in the present study. The composite WIMD score originates from eight unitless indicators of disadvantage (so-called *domain indices*) for income, employment, health, education, access to services, community safety, physical environment and housing having domain weights of 23.5%, 23.5%, 14%, 14%, 10%, 5%, 5% and 5% respectively[49]. Thus, each geocoded UK respondent's address was associated with the WIMD (2008 and 2011) scores of the LSOA in which it's spatially located.

***Deliverable file 7*:**

File Name (size)	**Description**
UKB_Wales_WIMD.csv (2.16 MB)	WIMD 2008 and 2011 scores of the LSOAs within which UK Biobank participant resides.

Header file name: UKB_Wales_WIMD_Header.csv (528 bytes)

Table 8: Description of variables used

Column No.	**Variables**	**Description**
1	**Encoded anonymised participant ID**	-
2	**LSOA_2011_code**	2011 lower super output area code
3	**LSOA_2011_name**	2011 lower super output area code
4	**Income_2008_score**	WIMD 2008 income domain
5	**Employment_2008_score**	WIMD 2008 employment domain
6	**Health_2008_score**	WIMD 2008 health domain
7	**Education_2008_score**	WIMD 2008 education domain
8	**Access_to_services_2008_score**	WIMD 2008 access to services domain
9	**Housing_2008_score**	WIMD 2008 housing domain
10	**Physical_environment_2008_score**	WIMD 2008 physical environment domain
11	**Community_safety_2008_score**	WIMD 2008 community safety domain
12	**WIMD_2008_score**	WIMD 2008 overall score
13	**Income_2011_score**	WIMD 2011 income domain
14	**Employment_2011_score**	WIMD 2011 employment domain
15	**Health_2011_score**	WIMD 2011 health domain
16	**Education_2011_score**	WIMD 2011 education domain
17	**Access_to_services_2011_score**	WIMD 2011 access to services domain
18	**Housing_2011_score**	WIMD 2011 housing domain
19	**Physical_environment_2011_score**	WIMD 2011 physical environment domain
20	**Community_safety_2011_score**	WIMD 2011 community safety domain
21	**WIMD_2011_score**	WIMD 2011 overall score

4.6 Building class

The building class GIS datasets were extracted for the area of interest. The building footprints were subsequently linked with the geocoded UK Biobank participants' residences through a spatial query. After taking in to account the missing data, linkages could be obtained for N=15,470 Biobank respondents. There are 9 age categories and 19 type categories in this dataset. However, age categories 1, 2 and 8 as well as type categories of 3, 5 and 15 have been removed from the latest release (indicated by DNU; see Fig. 1). The age and type codes are combined together to form the building class code of each dwelling.

Deliverable file 8:

File Name (size)	Description
Wales_UKB_Building_Class.csv (587 KB)	Building class of the dwelling within which UK Biobank participant resides.

Header file name: Wales_UKB_Building_Class_Header.csv (111 bytes)

Table 9: Building class quality code used[50]

Class code	Definition
A	▪ Very experienced PI compiled the dataset ▪ The imagery used was 12.5cm resolution or better ▪ The imagery was of very good or better quality with high definition of building features ▪ Field verification was undertaken with fieldwork photos available ▪ Some local knowledge was available or gained during the field visit.
B	▪ Experienced PI compiled the dataset ▪ The imagery used was 25cm resolution or better ▪ The imagery was of good or better quality with reasonable definition of building features ▪ Field verification was undertaken ▪ Some local knowledge was available or gained during the field visit
C	▪ Less experienced PI compiled the dataset ▪ The imagery used was 50cm resolution or better ▪ The imagery was often of a poor quality with poor definition of building features ▪ Only limited field verification was undertaken ▪ Little local knowledge was available or gained during the field visit.

Version 6
September 2012

IMAGE TO INFORMATION
BUILDING CLASS REFERENCE SHEET

TYPE	AGE	Historic to end Georgian -1837	Early and Middle Victorian 1837-1870	Late Victorian/ Edwardian 1870-1914	World War 1 - World War 2 1914-1945	Post war regeneration 1945-1964	Sixties/ seventies 1964-1979	Modern 1979-1999	Recent years 2000-photo date*	Unknown date
		3			4	5	6	7	8	0
Very Tall Flats (point blocks)	1					55	74	93	(113) DNU	
Tall flats 6-15 storeys (slabs)	2					56	75	94	(114) DNU	
Medium height flats 5-6 storeys	3			(25) DNU	(40) DNU	(57) DNU	(76) DNU	(95) DNU	(115) DNU	
Lower 3-4 storey and smaller flats, detached and linked	4			26	41	58	77	96	(116) DNU	
Tall terraces 3-4 storeys	5	(2) DNU	(13) DNU	(27) DNU	(42) DNU	(59) DNU	(78) DNU	(97) DNU	(117) DNU	
Low terraces, 2 storeys with large T-rear extension	6	(3) DNU	(14) DNU	28	43	60	79	98	(118) DNU	
Low terraces, small	5	(4) DNU	(15) DNU	29	44	61	80	99	(119) DNU	
Linked and step linked houses, 2-3 or mixed 2 and 3 storeys	8					62	81	100	(120) DNU	
Planned balanced-mixed estates	9					63	82	101	121	
Standard size semis	10	(5) DNU	(16) DNU	30	45	64	83	102	(122) DNU	
Semi type house in multiples of 4,6,8 etc.	11			31	46	65	84	103	(123) DNU	
Large property semis	12	(6) DNU	(17) DNU	32	47	66	85	104	(124) DNU	
Smaller detached houses	13	(7) DNU	(18) DNU	33	48	67	86	105	(125) DNU	
Large detached houses	14	(8) DNU	(19) DNU	34	49	68	87	106	(126) DNU	
Very large detached houses, sometimes converted to flats		(9) DNU	(20) DNU	(35) DNU	(50) DNU	(69) DNU	(88) DNU	(107) DNU	(127) DNU	
Mixed housing in small settlements	16									108
Non residential building	17									132
Probably Residential building - Unknown classification	18									333
Address point unreliable - no classification	19									999

* Age Class to be added in 2012 based on review of recent development

Fig. 2 Building class codes[51]

Table 10: Description of variables used

Column No.	Variables	Description
1	**Encoded anonymised participant ID**	-
2	**Building_Class_code**	Refer fig. 2
3	**Age_code**	Refer fig. 2
4	**Type_code**	Refer fig. 2
5	**Quality_code**	Refer Table 9
6	**Class_Name**	Categorized as public and non-public buildings

5. References:

1. Sarkar, C., Webster, C. and Gallacher, J. (2014) Healthy Cities: Public Health through Urban Planning. Cheltenham, UK: Edward Elgar Publishing Limited. (*In press, due April 2014*).

2. Litman, T. (2003) Measuring transportation: traffic, mobility and accessibility, ITE Journal (Institute of Transportation Engineers), 73, 28–32.

3. Norman, G.J., Nutter, S.K., Ryan, S., Sallis, J.F., Calfas, K.J. and Patrick, K. (2006) Community design and access to recreational facilities as correlates of adolescent physical activity and body-mass index. Journal of Physical Activity and Health, 3, S118–28.

4. Diez Roux, A.V., Evenson, K.R., McGinn, A.P., Brown, D.G., Moore, L., Brines, S. and Jacobs, D.R., Jr (2007) Availability of recreational resources and physical activity in adults. American Journal of Public Health, 97, 493–9.

5. Nielsen, T.S., Hansen, K.B., 2007. Do green areas affect health? Results from a Danish survey on the use of green areas and health indicators. Health and Place 13, 839–850.

6. Björk, J., Albin, M., Grahn, P., Jacobsson, H., Ardö, J., Wadbro, J. and Ostergren, P.O. (2008) Recreational values of the natural environment in relation to neighbourhood satisfaction, physical activity, obesity and wellbeing. Journal of Epidemiology and Community Health, 62.

7. Wolch, J., Jerrett, M., Reynolds, K., McConnell, R., Chang, R., Dahmann, N., Brady, K., Gilliland, F., Su, J.G., Berhane, K., 2011. Childhood obesity and proximity to urban parks and recreational resources: a longitudinal cohort study. Health and Place 17, 207–214.

8. Handy, S., Cao, X. and Mokhtarian, P.L. (2006) Self-selection in the relationship between the built environment and walking: empirical evidence from Northern California. Journal of the American Planning Association, 72, 55–74.

9. Cerin, E., Leslie, E., Toit, L., Owen, N. and Frank, L.D. (2007) Destinations that matter: associations with walking for transport. Health and Place, 13, 713–24.

10. Saarloos, D., Alfonso, H., Giles-Corti, B., Middleton, N. and Almeida, O.P. (2011) The built environment and depression in later life: the Health in Men Study. American Journal of Geriatric Psychiatry, 19, 461–70.

11. Sallis, J.F., Bowles, H.R., Bauman, A., Ainsworth, B.E., Bull, F.C., Craig, C.L., Sjöström, M., De Bourdeaudhuij, I., Lefevre, J., Matsudo, V., Matsudo, S., Macfarlane, D.J., Gomez, L.F., Inoue, S., Murase, N., Volbekiene, V., McLean, G., Carr, H., Heggebo, L.K., Tomten, H. and Bergman, P. (2009) Neighborhood environments and physical activity among adults in 11 countries. American Journal of Preventive Medicine, 36, 484–90.

12. Wood, L., Frank, L.D. and Giles-Corti, B. (2010) Sense of community and its relationship with walking and neighborhood design. Social Science and Medicine, 70, 1381–90.

13. Bassett, D.R., Jr, Pucher, J., Buehler, R., Thompson, D.L. and Crouter, S.E. (2008) Walking, cycling, and obesity rates in Europe, North America and Australia. Journal of Physical Activity and Health, 5, 795–814.

14. Brown, B.B. and Werner, C.M. (2008) Before and after a new light rail stop: resident attitudes, travel behavior, and obesity. Journal of the American Planning Association, 75, 5–12.

15. Edwards, R.D. (2008) Public transit, obesity, and medical costs: assessing the magnitudes. Preventive Medicine, 46, 14–21.

16. Inagami, S., Cohen, D.A., Finch, B.K. and Asch, S.M. (2006) You are where you shop: grocery store locations, weight, and neighborhoods. American Journal of Preventive Medicine, 31, 10–17.

17. Morland, K., Diez Roux, A.V. and Wing, S. (2006) Supermarkets, other food stores, and obesity: the Atherosclerosis Risk in Communities Study. American Journal of Preventive Medicine, 30, 333–9.

18. Black, J.L., Macinko, J., Dixon, L.B. and Fryer, J.G.E. (2010) Neighborhoods and obesity in New York City. Health and Place, 16, 489–99.

19. Giles-Corti, B., Macintyre, S., Clarkson, J.P., Pikora, T. and Donovan, R.J. (2003) Environmental and lifestyle factors associated with overweight and obesity in Perth, Australia. American Journal of Health Promotion, 18, 93–102.

20. Rutt, C.D., Coleman, K.J., 2005. Examining the relationships among built environment, physical activity, and body mass index in El Paso, TX. Preventive Medicine 40, 831–841.

21. Field, A., Witten, K., Robinson, E. and Pledger, M. (2004) Who gets to what? Access to community resources in two New Zealand cities. Urban Policy and Research, 22, 189–205.

22. Pearce, J., Witten, K., Bartie, P., 2006. Neighbourhoods and health: a GIS approach to measuring community resource accessibility. Journal of Epidemiology and Community Health 60, 389–395.

23. Lovett, A., Haynes, R., Sünnenberg, G. and Gale, S. (2002) Car travel time and accessibility by bus to general practitioner services: a study using patient registers and GIS. Social Science and Medicine, 55, 97–111.

24. Luo, W. and Wang, F. (2003) Measures of spatial accessibility to health care in a GIS environment: synthesis and a case study in the Chicago region. Environment and Planning B: Planning and Design, 30, 865–84.

25. Frank, L.D., Andresen, M.A. and Schmid, T.L. (2004) Obesity relationships with community design, physical activity, and time spent in cars. American Journal of Preventive Medicine, 27, 87–96.

26. Li, F., Harmer, P.A., Cardinal, B.J., Bosworth, M., Acock, A., Johnson-Shelton, D. and Moore, J.M. (2008) Built environment, adiposity, and physical activity in adults aged 50–75. American Journal of Preventive Medicine, 35, 38–46.

27. Troped, P.J., Wilson, J.S., Matthews, C.E., Cromley, E.K. and Melly, S.J. (2010) The built environment and location-based physical activity. American Journal of Preventive Medicine, 38, 429–38.

28. Ball, K., Lamb, K., Travaglini, N. and Ellaway, A. (2012) Street connectivity and obesity in Glasgow, Scotland: impact of age, sex and socioeconomic position. Health and Place, 18, 1307–13.

29. Sarkar, C., Gallacher, J. and Webster, C. (2013) Built environment configuration and change in body mass index: the Caerphilly Prospective Study (CaPS). Health and Place, 19, 33–44.

30. Sarkar, C., Gallacher, J. and Webster, C. (2013) Urban built environment configuration and psychological distress in older men: Results from the Caerphilly study. BMC Public Health, 13, 695.

31. Mehta, N.K. and Chang, V.W. (2008) Weight status and restaurant availability: a multilevel analysis. American Journal of Preventive Medicine, 34, 127.

32. Dengel, D.R., Hearst, M.O., Harmon, J.H., Forsyth, A. and Lytle, L.A. (2009) Does the built environment relate to the metabolic syndrome in adolescents? Health and Place, 15, 946–51.

33. Burgoine, T., Alvanides, S. and Lake, A.A. (2011) Assessing the obesogenic environment of North East England. Health and Place, 17, 738–47.

34. Huckle, T., Huakau, J., Sweetsur, P., Huisman, O., Casswell, S. 92008) Density of alcohol outlets and teenage drinking: Living in an alcogenic environment is associated with higher consumption in a metropolitan setting. Addiction, 103, 1614-1621.

35. Fone, D., Dunstan, F., White, J., Webster, C., Rodgers, S., Lee, S., Shiode, N., Orford, S., Weightman, A. and Brennan, I. (2012) Change in alcohol outlet density and alcohol-related harm to population health (CHALICE). BMC Public Health, 12, 428.

36. Diez Roux, A. V. (2004) Estimating neighborhood health effects: The challenges of causal inference in a complex world. Social Science and Medicine, 58, 1953-1960.

37. Diez Roux, A. V. (2004) The study of group-level factors in epidemiology: rethinking variables, study designs, and analytical approaches. Epidemiologic Reviews, 26, 104-111.

38. Manolio, T. A. & Collins, R. (2010) Enhancing the feasibility of large cohort studies. The Journal of the American Medical Association, 304, 2290-2291.

39. Manolio, T. A., Weis, B. K., Cowie, C. C., Hoover, R. N., Hudson, K., Kramer, B. S., Berg, C., Collins, R., Ewart, W. & Gaziano, J. M. 2012. New models for large prospective studies: Is there a better way? American Journal of Epidemiology, 175, 859-866.

40. Gallacher, J.E.J. (2007) The case for large scale fungible cohorts. European Journal of Public Health, 17, 548–549.

41. UK Biobank (2007) UK Biobank: Protocol for a large-scale prospective epidemiological resource. http://www.ukbiobank.ac.uk/wp-content/uploads/2011/11/UK-Biobank-Protocol.pdf.

42. Collins, R. (2012) What makes UK Biobank special? The Lancet, 379, 1173-1174.

43. Ordnance Survey UK (2012) AddressBase Products: Getting started guide, available at: http://www.ordnancesurvey.co.uk/docs/user-guides/addressbase-products-getting-started-guide.pdf.

44. Ordnance Survey UK (2013) AddressBase Products: User Guide, v1.3 – 06/2013, available at: http://www.ordnancesurvey.co.uk/docs/user-guides/addressbase-products-user-guide.pdf.

45. Ordnance Survey UK (2012) AddressBase Products: Classification scheme, v 1.1 – 04/2012, available at: http://www.ordnancesurvey.co.uk/docs/user-guides/addressbase-plus-premium-classification-codes.zip.

46. Department of Transport (2012) NPTG and NaPTAN Schema Guide, 2.4-v0.57, available at: http://www.dft.gov.uk/naptan/schema/schemas.htm#2.4guide.

47. Hillier, B. (1996) Space is the machine: A configurational theory of architecture. Cambridge: Cambridge University Press.

48. Chiaradia, A.J., Webster, C. and Crispin, C. (2013) sDNA: A software for spatial design network analysis. Specifications, available at: http://www.cardiff.ac.uk/sdna/.

49. Welsh Government (2011) Welsh Index of Multiple Deprivation 2011: Summary Report, available at: http://wales.gov.uk/docs/statistics/2011/110831wimd11summaryen.pdf.

50. GeoInformation Group (2012) Cities Revealed building class datasets: Note to users, available at: http://www.landmap.ac.uk/images/stories/datasets/building_class100/Building_Class_Notes_2012.pdf.

51. GeoInformation Group (2012) Image to information: Building class reference sheet, available at: http://www.landmap.ac.uk/images/stories/datasets/building_class100/Building_Class_Reference_Sheet_v6_Sep_12.pdf.