Mapping the space between buildings using Open Street Map

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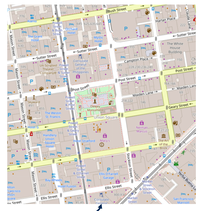
Defining Streets (a manifesto)

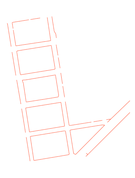
In urban areas buildings should be accessible by foot or wheelchair. The spaces between buildings should provide space and infrastructure suitable to these modes. Digital representations of this infrastructure should help indicate the extent to which this objective is met.

Function	Infrastructure	Mapping
Access Movement Public Realm	**The spaces 'between' buildings.**	Pavement Centre Lines: 'Sidewalks' Walking routes: 'Footways'



Buildings

Road Centre Line



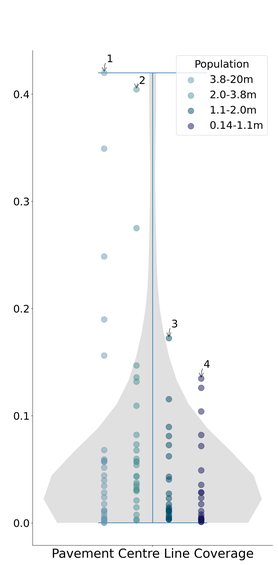
Pavement Centre Line

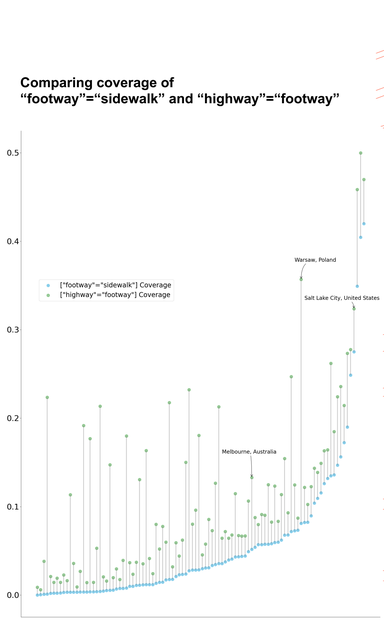
Streets and Sustainability

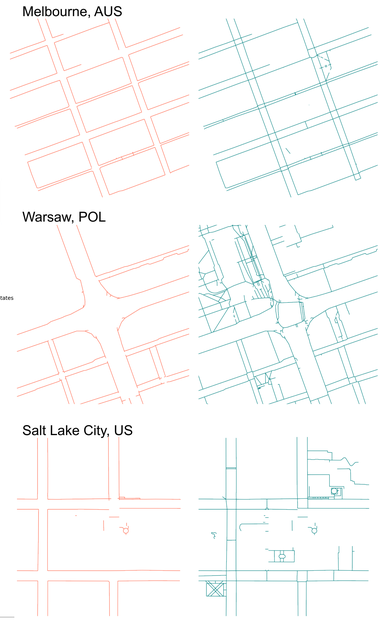
The sustainable mobility paradigm[1] creates demand for spatial information by emphasising the links between land use and transport planning. For example, the link and place function[2] categorisation of urban roads highlights the role of roads as places in themselves, increasing the need to understand public space design and features of the urban realm encompassed in the space "between buildings"[3].

Furthermore, emerging transport innovations are increasing the demand for diverse high-resolution geographic information. The introduction of single rider vehicles (micromobility) and increased transport network connectivity through mobility-as-a-services (MaaS) platforms exemplify such innovations. The resulting diversified use of streetspace creates competing demands, motivating the need to measure streetspace.

1. Banister, D. "The sustainable mobility paradigm." Transport policy 15.2 (2008)
2. Jones, P., Boujenko, N., & Marshall, S. (2007). "Link & Place—A guide to street planning and design" Landor.
3. Gehl, Jan. "Life between buildings". Vol. 23. New York: Van Nostrand Reinhold, 1987
4. Aderson, J et al. 'Corporate Editors in the Evolving Landscape of OpenStreetMap' ', ISPRS International Journal of Geo-Information, 8(5), p. 232







Streets in Open Street Map

OSM recommends a hierarchy for defining pedestrian routes. The overarching tag *"highway"="footway"* should be applied to all pedestrian specific routes. The more specific *"footway"="sidewalk"* tag identifies routes along sidewalks/pavements. Geometries with this tag map the 'pavement centre line'. Alternatively, road centre line geometries can be assigned the *"sidewalk"= "both|left|right|no"* tags, indicating the availability of pedestrian infrastructure without adding geometries to show its location.

Whilst a street can be represented by a one-dimensional road centre line geometry, understanding a 'place' effectively requires capturing activities across two and three dimensions. Furthermore, one-dimension representations are insufficient for assessing increasingly contested urban street space allocation. Only pavement centre line geometries, associated with the tag *"footway"="sidewalk",* extend the one-dimensional representation of streets by distinguishing between sides of the road.

We make an initial assessment of the availability of pavement centre line geometries in OSM using a sample of 99 cities worldwide and compare this to the coverage of all 'footways' and of road centre lines (RCL) with 'sidewalk' tags. For each city we calculate the coverage of footways and sidewalk tagged geometries by dividing the total length of these geometries by twice the total length of the walkable road network, also downloaded from OSM.

Walkable Road Centre Line Geometries	Pavement Centre Lines	Road Centre Lines with Sidewalks
["highway"]["area"!~"yes"] ["highway"!~"abandoned|bus_guideway|construction| cycleway|motor|planned|platform| proposed|raceway|pedestrian|footway"] ["footway"!~ "sidewalk"] ["foot"!~"no"]["service"!~"private"]	"footway"="sidewalk"	"sidewalk"= "both|left|right"]

Region	N Cities	Footways Coverage	Pavement Centre Line Coverage	Road Centre Line with Sidewalks Coverage
US + Canada	57	0.124	0.084	0.042
Europe	18	0.181	0.023	0.063
Brazil	10	0.026	0.004	0.016
Australia + New Zealand	9	0.082	0.001	0.010
China	5	0.037	0.008	0.004

Conclusions

Overall we find that OSM lacks data on pedestrian specific routes along streets as evidenced by the low coverage values. At best, the length of pavement centre line geometries mapped in OSM reaches around 40% of the mapping potential (assuming that both sides of every walkable road have a sidewalk), which we observe for San Jose, US and Vancouver, CA.

The figure to the left shows the large differences in coverage of *"footway"="sidewalk"* and *"highway"="footway"* features. This could be due to a lack of detailed tagging of geometries to distinguish between all pedestrian routes and those specifically on sidewalks, or the city having a large amount mapped of pedestrian only paths such as those through parks. While this distinction is not critical for routing purposes, assessing the competing demands on street space requires distinguishing pedestrian paths in pedestrian only spaces from those along city street shares with many other transport modes.

We observe a trend of greater pavement centre line coverage in North American cities which are known to be car-dominated. We hypothesise that this could be due to the participation of OSM 'corporate mappers' that aim to provide routing data for deliveries and logistics.[4]

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UCL

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UCL Colour palette – colour values and tints

	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
Dark Green	RGB: 85 80 37	102 97 59	119 115 81	136 132 102	153 150 124	170 167 146	187 185 168	204 202 190	221 220 211	238 237 233
Mid Green	RGB: 143 153 62	154 163 81	165 173 101	177 184 120	188 194 139	199 204 159	210 214 178	221 224 197	233 235 216	244 245 236
Bright Green	RGB: 181 189 0	188 196 25	196 202 51	203 209 77	211 215 102	218 222 128	225 229 153	233 235 179	240 242 204	248 248 230
Light Green	RGB: 187 197 146	194 203 157	201 209 168	207 214 179	214 220 190	221 226 201	228 238 222	235 238 222	241 243 233	248 249 244
Yellow	RGB: 246 190 0	247 197 25	248 203 51	249 210 77	250 216 102	251 223 128	251 229 153	252 236 179	253 242 204	254 249 230
Dark Red	RGB: 101 29 50	116 52 71	132 74 91	147 97 112	163 119 132	178 142 153	193 165 173	209 187 194	224 210 214	240 232 235
Mid Red	RGB: 147 39 44	158 61 65	169 82 86	179 104 107	190 125 128	201 147 150	212 169 171	223 190 192	233 212 213	244 233 234
Bright Red	RGB: 213 0 50	217 25 71	221 51 91	226 77 112	230 102 132	234 128 153	238 153 173	242 179 194	247 204 214	251 230 235
Light Red	RGB: 224 60 49	227 80 70	230 99 90	233 119 111	236 138 131	240 158 152	243 177 173	246 196 193	249 216 214	252 236 234
Orange	RGB: 234 118 0	236 132 25	238 145 51	140 159 77	242 173 102	244 187 128	247 200 153	249 214 179	251 228 204	253 241 230
Dark Purple	RGB: 75 56 76	93 76 94	11 96 112	129 116 130	147 136 148	165 156 166	183 175 183	201 195 201	219 215 219	237 235 237
Mid Purple	RGB: 80 7 120	98 32 133	115 57 147	133 81 161	150 106 174	168 131 188	185 156 201	203 181 214	220 205 228	238 230 242

	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
Bright Pink	RGB: 172 20 90	180 43 107	189 67 123	197 91 140	205 114 156	214 138 173	222 161 189	230 185 205	238 208 222	247 232 239
Light Purple	RGB: 198 176 188	204 184 195	209 192 201	215 200 208	221 208 215	227 216 227	232 223 228	238 231 235	244 239 242	249 247 248
Grey	RGB: 140 130 121	152 143 134	163 155 148	175 168 161	186 180 175	198 193 188	209 205 201	220 218 215	232 230 228	244 243 242
Dark Blue	RGB: 0 61 76	25 80 94	51 100 112	77 119 130	102 139 148	128 158 166	153 177 183	179 197 201	204 216 219	230 236 237
Mid Blue	RGB: 0 40 85	25 61 102	51 83 119	177 105 136	102 126 153	128 147 170	153 169 187	179 191 204	204 212 221	230 234 238
Bright Blue	RGB: 0 151 169	25 161 178	51 172 186	77 182 195	102 193 203	128 2030212	153 213 221	179 224 229	204 234 238	230 245 246
Light Blue	RGB: 141 185 202	152 192 207	164 199 213	175 206 218	187 213 223	198 220 228	209 227 234	221 234 239	232 241 244	244 248 250
Blue Celeste	RGB: 164 219 232	173 223 234	182 226 237	191 230 239	200 233 241	210 237 243	219 241 246	228 244 248	237 248 250	246 251 253
Stone	RGB: 214 210 196	218 215 202	222 219 208	226 224 214	230 228 220	235 233 226	239 237 231	234 242 237	247 246 243	251 251 249
Dark Brown	RGB: 78 54 41	96 74 62	113 94 84	131 114 105	149 134 127	167 155 148	184 175 169	202 195 191	220 215 212	237 235 234
Black	RGB: 0 0 0	25 25 25	51 51 51	77 77 77	102 102 102	128 128 128	15301530153	179 179 179	204 204 204	230 230 230
IOE Blue	RGB: 0 51 160	25 71 169	51 92 179	76 112 188	102 133 198	128 153 207	153 173 217	178 194 226	204 214 236	229 235 245