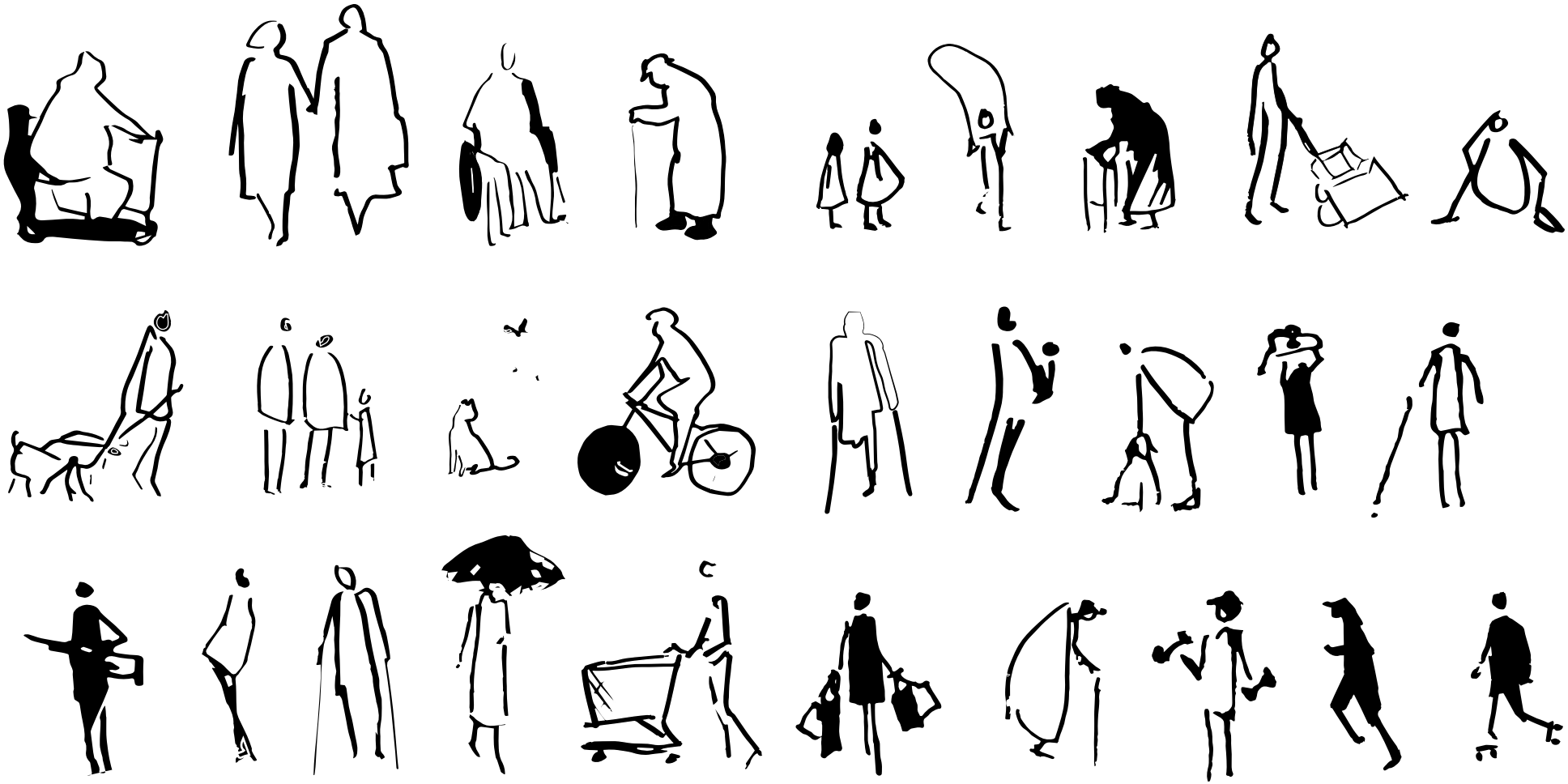
Tactile Map Tile

working towards inclusive cartography

Jess Hamilton 2017



Everyone brings a unique experience to the public realm.

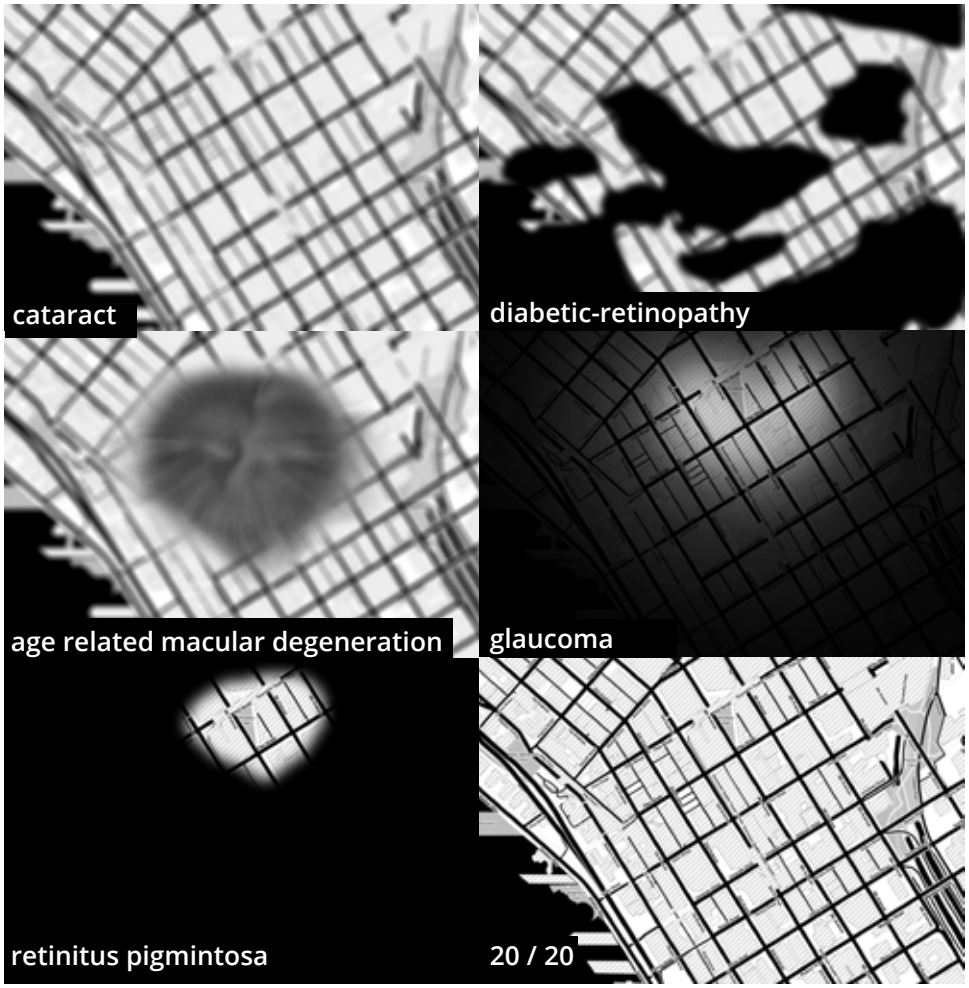
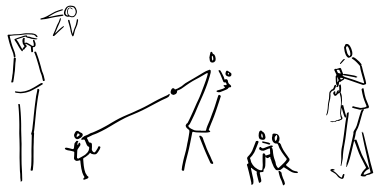
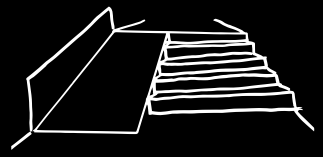


Photo by Oakenroad via Flickr / CC BY 2.0



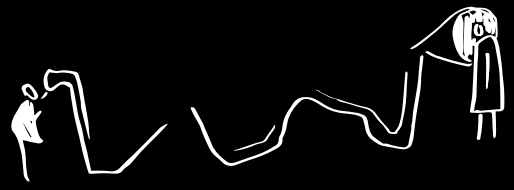
© Snapchat Spectacles

Included in these is a range of visual experiences, from permanent conditions to situational low vision experienced when pedestrian may not be engaged with their surroundings.



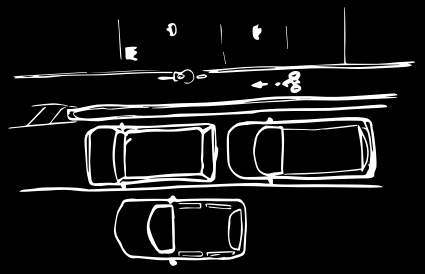
1. equitable use

2. flexibility in use

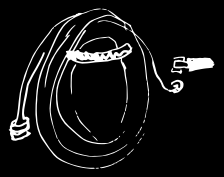


3. simple and intuitive use

4. perceptible information



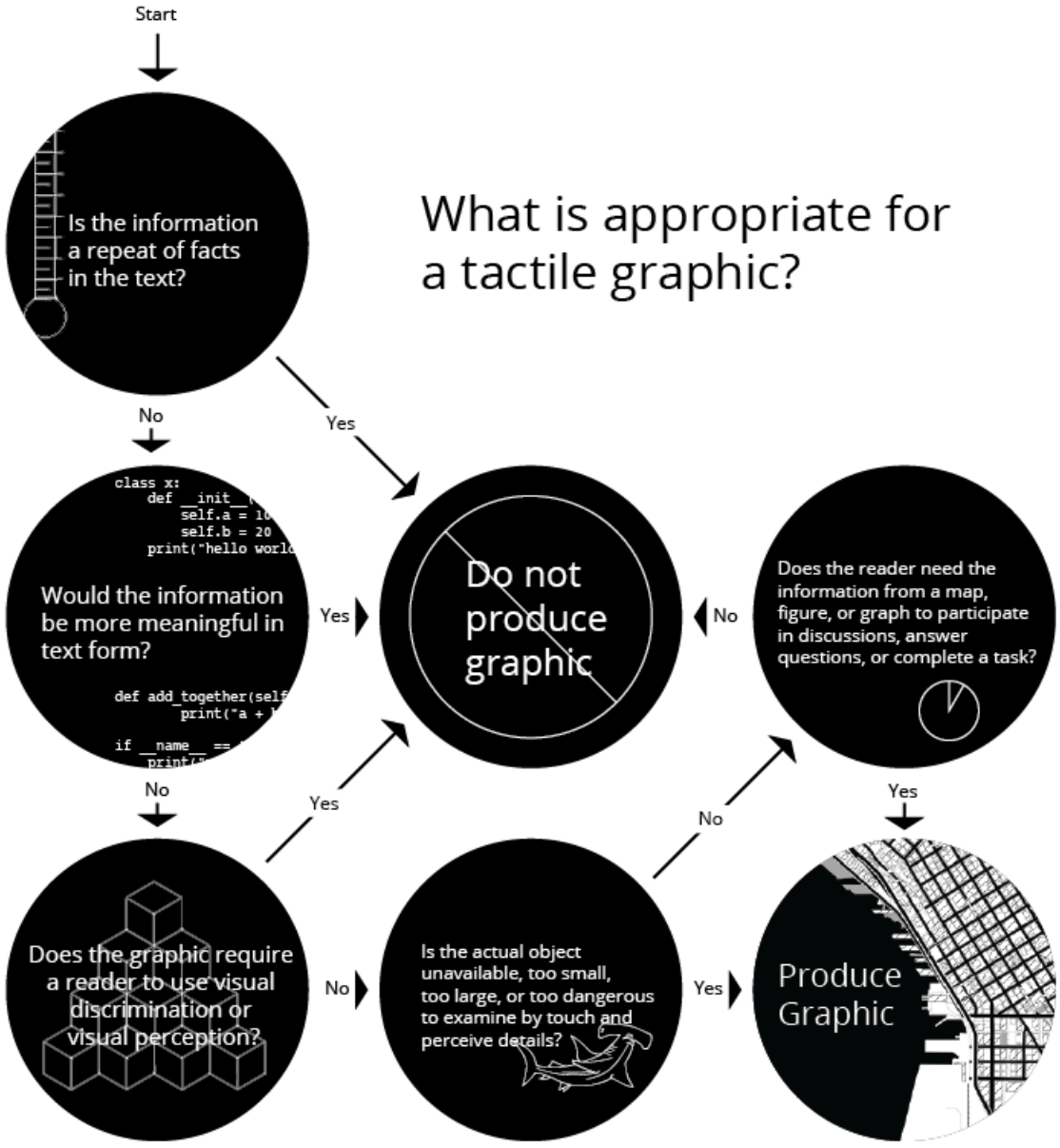
5. tolerance for error



6. low physical effort

7. size and space for approach and use

Landscape architecture's discourse surrounding inclusive and accessible design is largely centered on the Universal Design Principals established at North Carolina State's Center for Universal Design. A lack of critical engagement with these and related ideas has left significant room for improvement when it comes to equitable design.



Adapted from the American Foundation for the Blind from Ike Presley and Lucia Hasty *Techniques for Creating and Instructing with Tactile Graphics*

This project uses the development of tactile graphics as both a means of better understanding the pedestrian experience for people with low vision and blindness, as well as a step towards developing way-finding tools that can be used by people with range of visual experiences

Point Features

Modifiers

- flexible
- elevation change

Intersection Features

- no traffic control
- 4-way traffic control
- one-way control (following cl)
- one-way control (following cl)

Passageway Features

- general passageway
- underpass or tunnel
- overpass or bridge

Other

- challenging feature
- vegetation
- entrance
- entrance w/ stairs or ramp-up
- entrance w/ stairs or ramp-down

Area Features

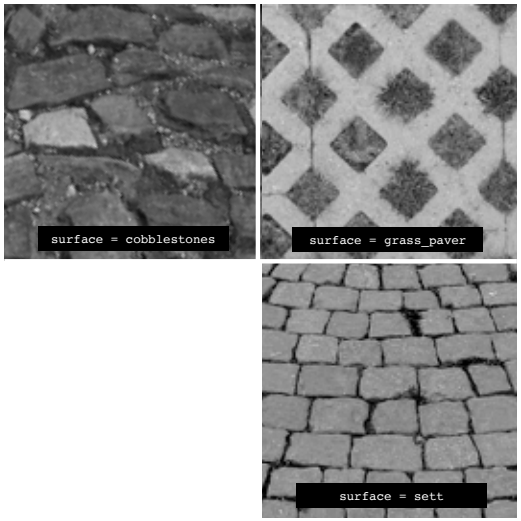
- parking lot
- ground
- building
- water
- flexible
- park

Line Features

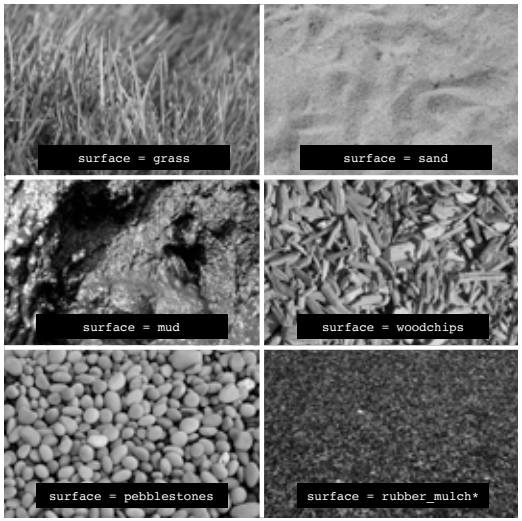
- streets
- one-way street
- one-way street
- water
- fence
- railroad
- sidewalk
- stairs or ramp in sidewalk

Existing symbology recommended by the North American Braille Authority was developed with braille embossing and micro-capsule paper in mind. Newer 3D printing technologies allow for variable relief heights, which enables a greater range of symbols and extends opportunities for representation.

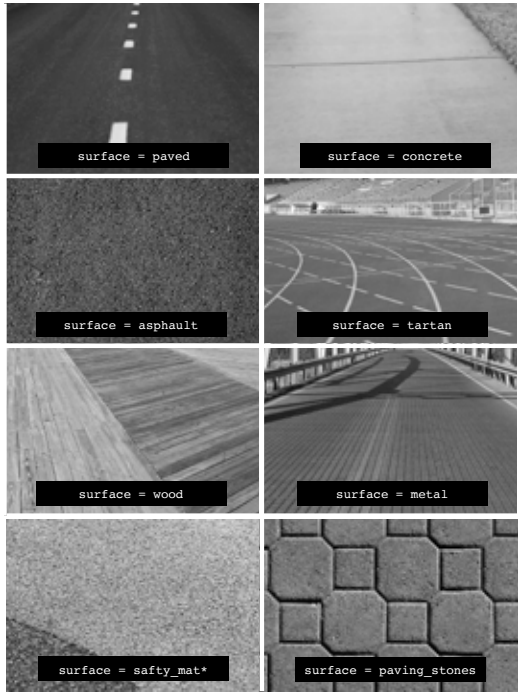
heat ● ● ●
noise ● ●
traction ● ●
evenness ● ●
infiltration ● ●
smoothness ●



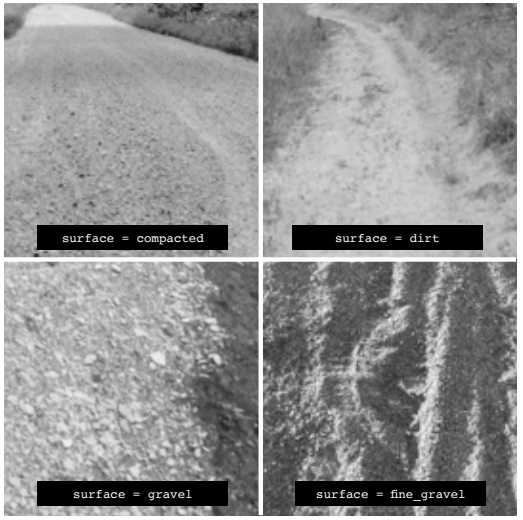
heat ●
noise ● ●
traction ● ● ● ● ●
evenness
infiltration ● ● ● ● ●
smoothness



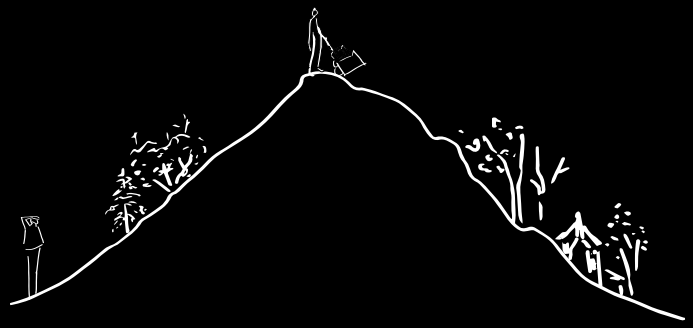
heat ● ● ● ● ●
noise ● ● ●
traction ● ● ●
evenness ● ● ● ● ●
infiltration
smoothness ● ● ● ● ●

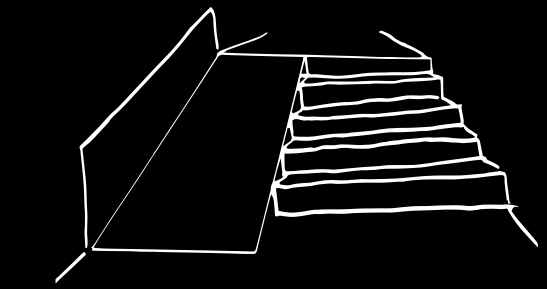


heat ● ●
noise ● ● ● ●
traction ● ● ● ● ●
evenness ● ●
infiltration ● ●
smoothness ●



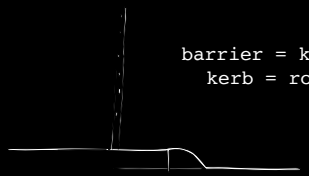
Features of the pedestrian environment were evaluated for inclusion on the maps. Surfaces were grouped according to similar traits in order to reduce the number of symbols required.





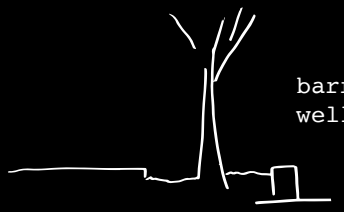
highway = steps
steps = ramp

highway = steps



barrier = kerb
kerb = rolled

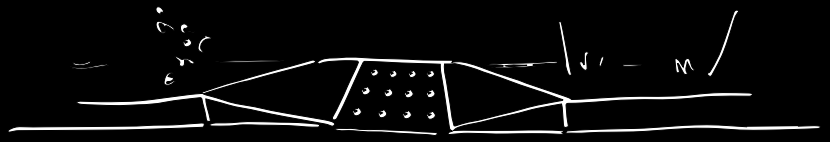
barrier = kerb
kerb = raised



barrier = tree_
well*

leisure = garden
garden:type = rain*

waterway = runnel*



barrier = kerb
kerb = lowered
wheelchair = yes
tactile paving = yes

Topography was considered at multiple scales: macro-topography characterizing street or district level grade changes, transitional features such as stairs and ramps, and micro topography changes such as curb heights and tree well depths.

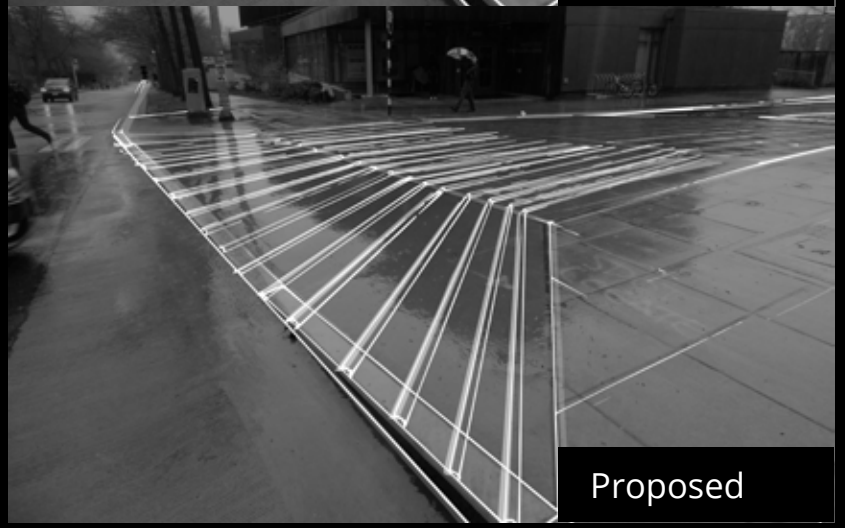
Broadway + Olive

Existing

Proposed

40th + Brooklyn

Existing



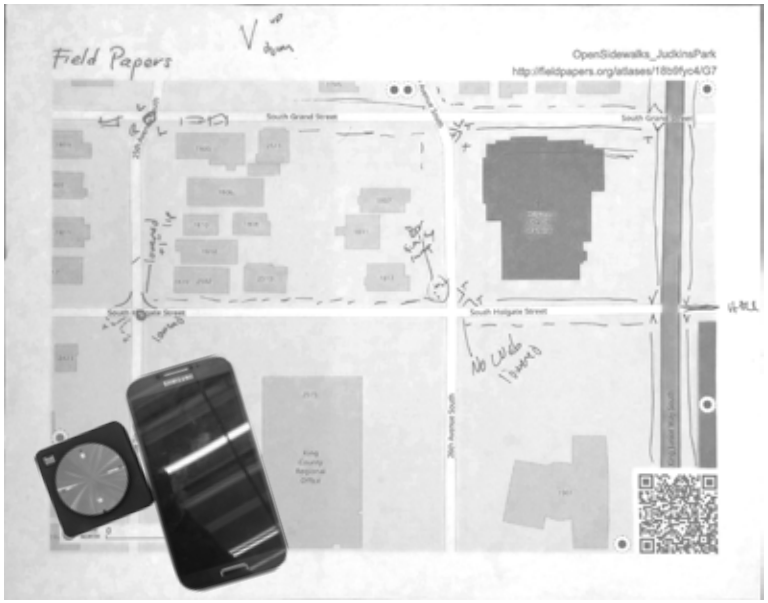
Proposed

Street interfaces are a critical area for all pedestrians. Curb ramps, with tactile paving suggest transitions and direct heading. Surface, contrast, and grade change all indicate entrance into a car dominant area, and a variety of signal types are used, some more detectable than others.

SDOT Sidewalks

OpenStreetMap

Much like our cities, digital maps have been built around street networks. Rather than infrastructure in and of their own right, sidewalks are often treated as an addendum to the streets, resulting in inaccurate and incomplete datasets.



Pedestrian Ways

```
highway =  living_street
           pedestrian
           footway
           path

highway = *
      sidewalk = both/left/right/no

highway = footway
      footway = sidewalk
```

attributes:

lit = yes/no
kerb=*
incline=*
wheelchair=*
smoothness=*
surface=*
tactile_paving=*
width=* / est_width=*

Crossings

highway = crossing
highway = mini_roundabout
railway = crossing

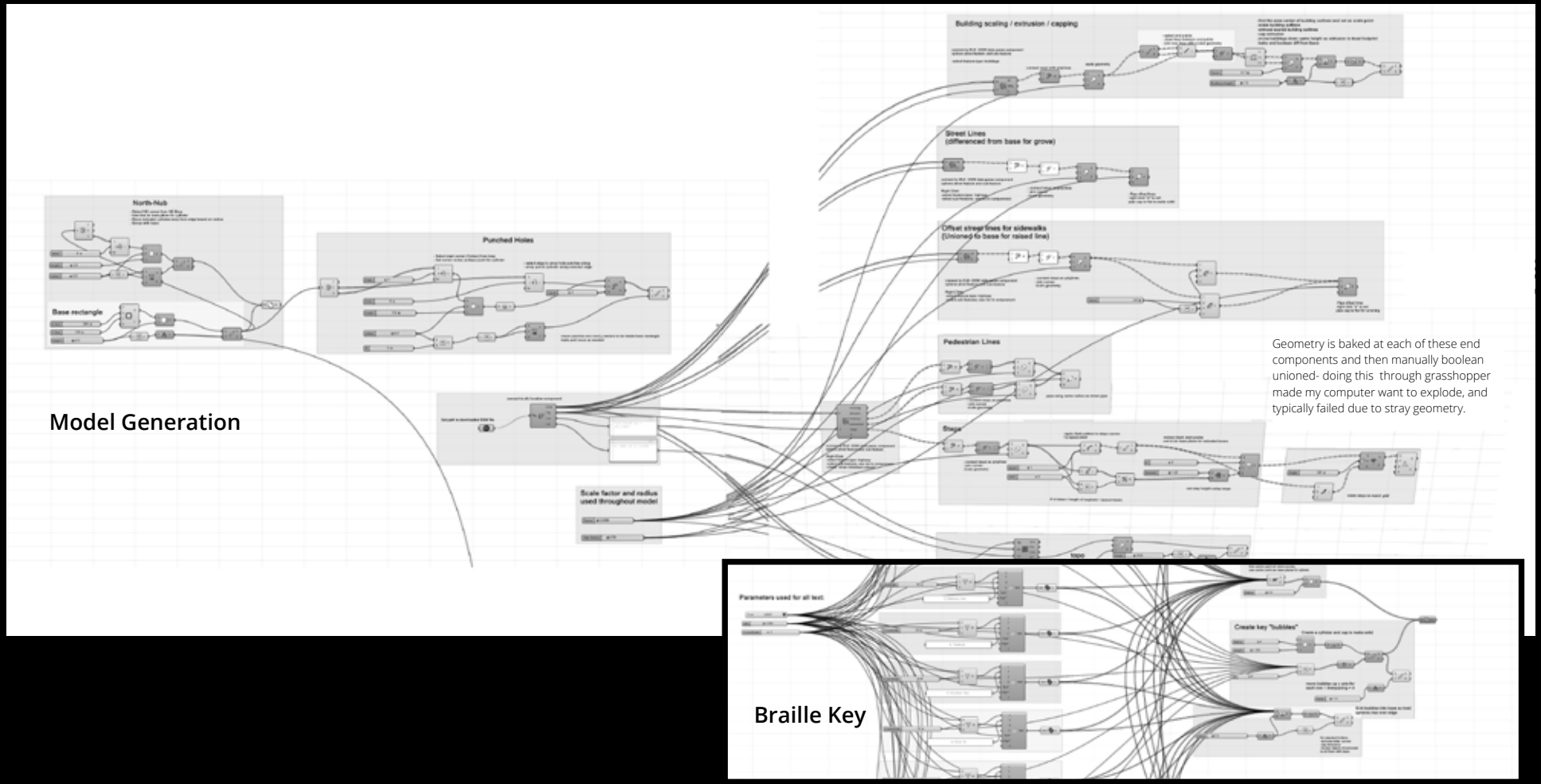
crossing = traffic_signals
button_operated = yes/no
traffic_signals:sound = yes/no
traffic_signals:vibration = yes/no
traffic_signals:arrow = yes/no
traffic_signals:minimap = yes/no
traffic_signals:floor_vibration = yes/no
traffic_calming = table

Public Transportation

public_transport = stop_position
platform
station
stop_area

route = bus
ferry
fitness_trail
hiking
light_rail
railway
running
train
tram

To fill in the data gaps for the area of interest, base maps were printed from fieldpapers.org and manually annotated. After, they were scanned to the OpenSidewalks iD editor and digitally mapped. Passive data collection techniques were also tested.



Using the Elk plug-in, OpenStreetMap data is pulled in to Grasshopper to create parametrically designed maps which allow for user feedback, and ever changing open-data sets to be quickly incorporated.

Begin with OpenStreetMap data.

Elk an open-source plug-in for grasshopper is used to read the .osm file, providing easy access to OSM's point and line geometry through the associated key tag pairs.

OSM2World is a small Java application that translates OSM point and line data into mesh surfaces on designated layers in an .obj file.

Rhino is a proprietary 3D modeling software, developed for professional design applications , including architectural, mechanical and automotive design work.

Blender is a free and open-source 3D modeling program, well suited for video and game modeling.

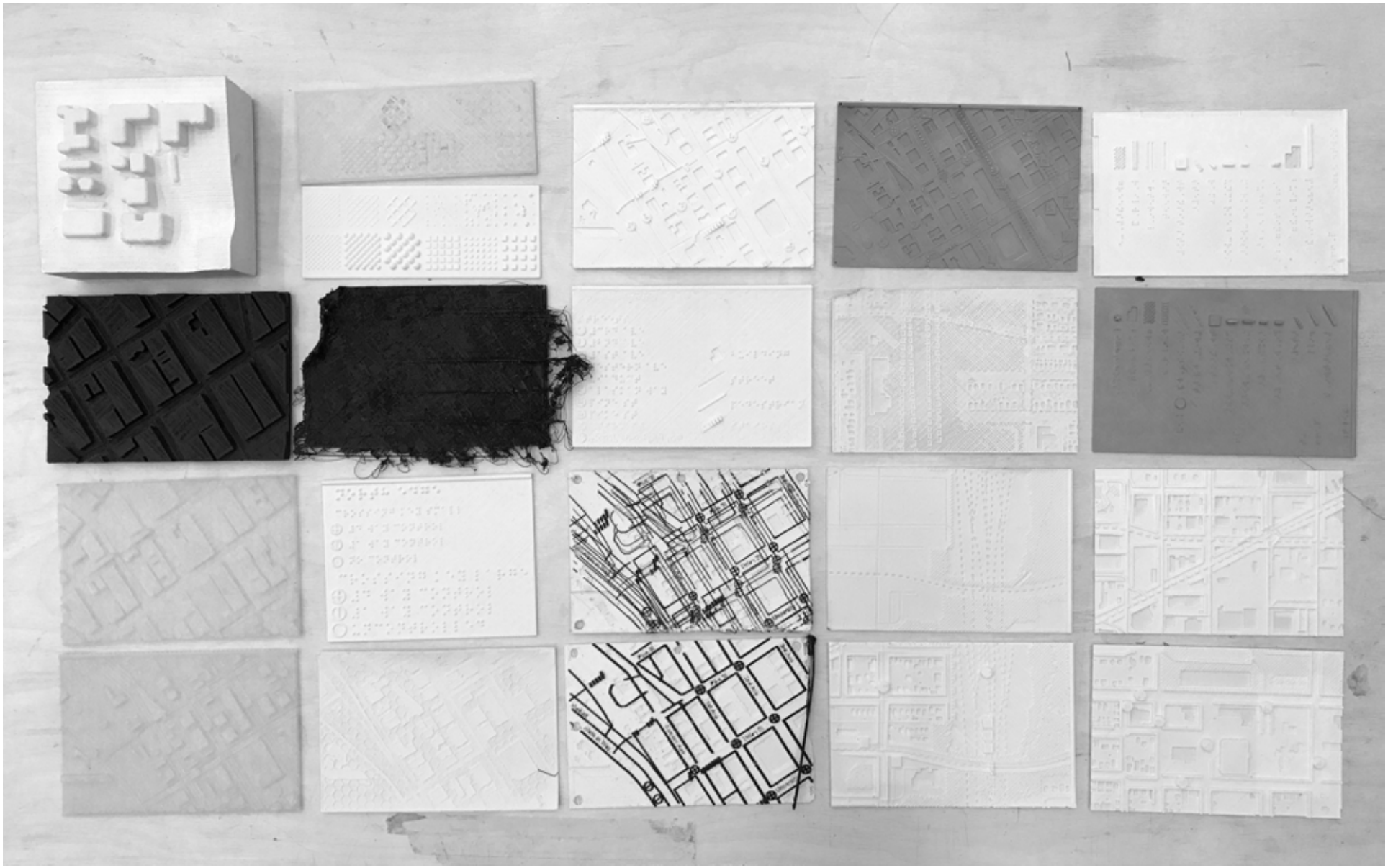
Grasshopper, an open-source visual scripting Rhino add-on, uses components to apply design rules to designated geometry defined by OSM key pairs, extracted in Elk.

Python, a general use programming language is used to script the surface mesh manipulations using the Blender API.

Compared to traditional tactile graphic production methods, 3D printing allows for a greater range of symbols and textures, and is more widely available at a lower cost.

Forked from the TouchMapper project Tactile MapTile is a screen reader accessible web application that automatically generates a .stl file of a designated area ready to be 3D printed

In collaboration with an undergraduate computer science capstone group, an open source pipeline for this workflow was established so that customizable maps could eventually be made available through an accessible web application.



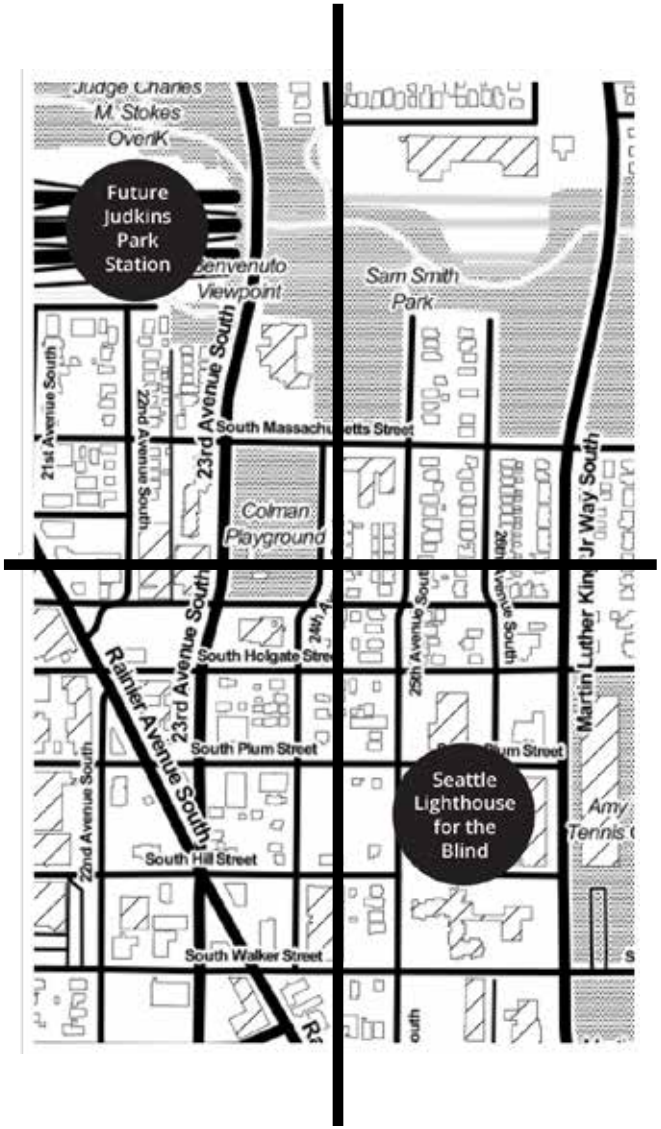
Prototypes were printed throughout the process to test legibility with expert users and to better understand the technical and material constraints associated with 3D printing.

North Edge

Sidewalk
Hill
Steps
Vibrating Ped Signal
Audible Ped Signal
Pedestrian Signal
Marked Crossing
Transit Stop
Primary St
Secondary St
Railway
Greenspace
Buildings
Lighthouse for the Blind

500 ft

Key



Streets

A I 90
B S Massachusetts
C S Grand
D S Holgate
E S Plum
F S Hill
G S Walker
H Rainier
I S 23rd
J S25th
K MLK Way S

As with any cartographic tool, it is important to include a key, cardinal direction and a scale for clarity. The above graphic keys and map relate to the final area mapped, and braille keys produced.

Ultimately the maps were printed using a Wood PLA and sandblasted to achieve a softer texture. A custom folder was bound to organize the map tiles, so they could be used at home prior to a journey, or folded and taken en route.

References

All black and white base maps from Stamen Design, under CC BY 3.0 Data by OpenStreetMap, under CC BY SA

p.2 Based on simulations from the National Eye Institute, National Institutes of Health https://commons.wikimedia.org/wiki/File:Eye_disease_simulation,_retinitis_pigmentosa.jpg

p.3 Adapted from the American Foundation for the Blind from Ike Presley and Lucia Hasty Techniques for Creating and Instructing with Tactile Graphics

p. 7: Lobben, A. and M. Lawrence (2012). "The Use of Environmental Features on
Tactile Maps by Navigators Who Are Blind." Professional Geographer 64(1)

p.8 Surfaces All photos public domain or Creative Commons

Sett https://commons.wikimedia.org/wiki/File:Palace_Square_setts_(SPb,_Russia).JPG

cobble stones https://upload.wikimedia.org/wikipedia/commons/d/d8/Havlickuv_Brod_Cobblestone.jpg

paving stones http://www.publicdomainpictures.net/view-image.php?image=123610&picture=octagon-bricks

grass paver https://commons.wikimedia.org/wiki/File:Grass_paver_paving.jpg

mud https://upload.wikimedia.org/wikipedia/commons/thumb/0/0c/Snapping_turtle_in_Mud.JPG/1280px-Snapping_turtle_in_Mud.JPG

grass https://commons.wikimedia.org/wiki/File:Green_Grass.JPG

sand https://upload.wikimedia.org/wikipedia/commons/b/b0/A_scene_of_river_sand.JPG

pebble-stone https://en.wikipedia.org/wiki/Cobble_(geology)

cobble-stone https://en.wikipedia.org/wiki/Pebble#/media/File:Pebbleswithquarzite.jpg

rubber mulch https://upload.wikimedia.org/wikipedia/commons/9/98/Rubber_mulch.jpg

paved https://static.pexels.com/photos/4033/road-mountains-nature-street.jpeg

asphalt http://www.publicdomainpictures.net/pictures/100000/velka/background-1411379004Euy.jpg

concrete https://commons.wikimedia.org/wiki/File:Sidewalk_and_road_after_rain.jpg

tartan track https://upload.wikimedia.org/wikipedia/commons/5/5f/Rosenau2.JPG

safety mat http://maxpixel.freegreatpicture.com/Ground-Rubber-Texture-Surface-Playground-Tire-1100560

wood https://upload.wikimedia.org/wikipedia/commons/c/cf/Asbury_Park_Boardwalk_NJ3.jpg

metal https://c1.staticflickr.com/4/3230/3083970065_c750727503_b.jpg

compacted http://wiki.openstreetmap.org/wiki/File:Surface_gravel.jpg

dirt https://commons.wikimedia.org/wiki/File:Seven-Islands-dirt-path-tn1.jpg

fine gravel https://commons.wikimedia.org/wiki/File:Decomposed_granite_path.jpg

urbanalytics

Support provided by the Taskar Center for Accessible Technology and the UW Urbanalytics Studio