Procedural Bike Planning
(aka First Principles)

Computational Bike Planning and Dutch Design Concepts

Who am I?

- David Edmondson, AICP, PMP
- Principal of *Edmondson Planning and Design*
- Transportation Planner for the City of Frederick
- The Greater Marin on Twitter

In this presentation…

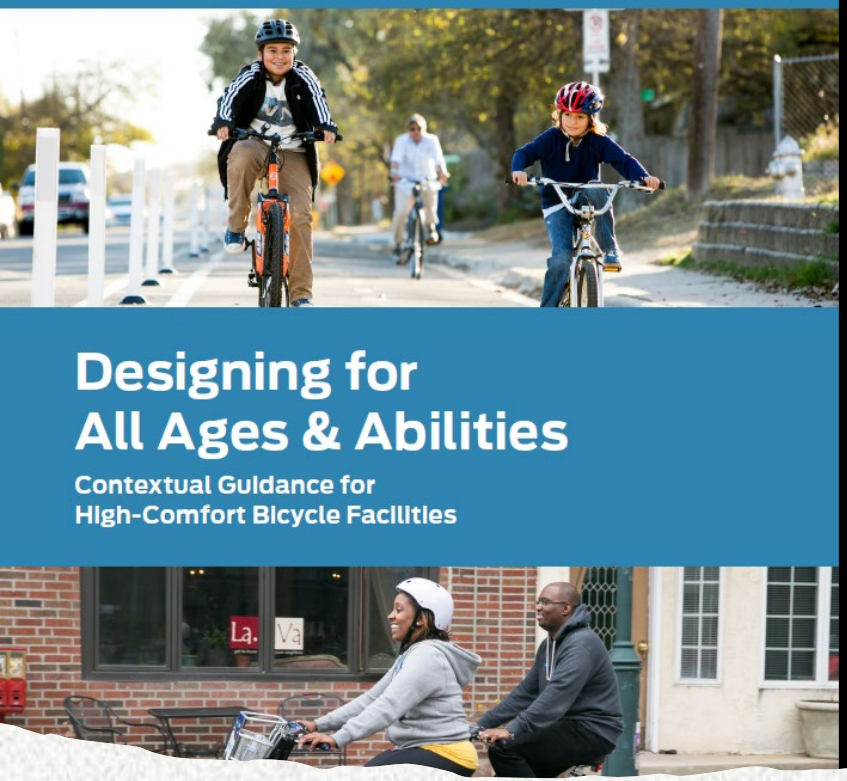
- Converting traffic data into a digital bike map
- The basics of the Dutch planning method
- Using GIS to help with the Dutch method
- Combining the digital bike map into a prioritization scheme
- Questions

What you'll learn

- The pieces needed to make a computer-aided bicycle map
- How to use Dutch planning to prioritize your system

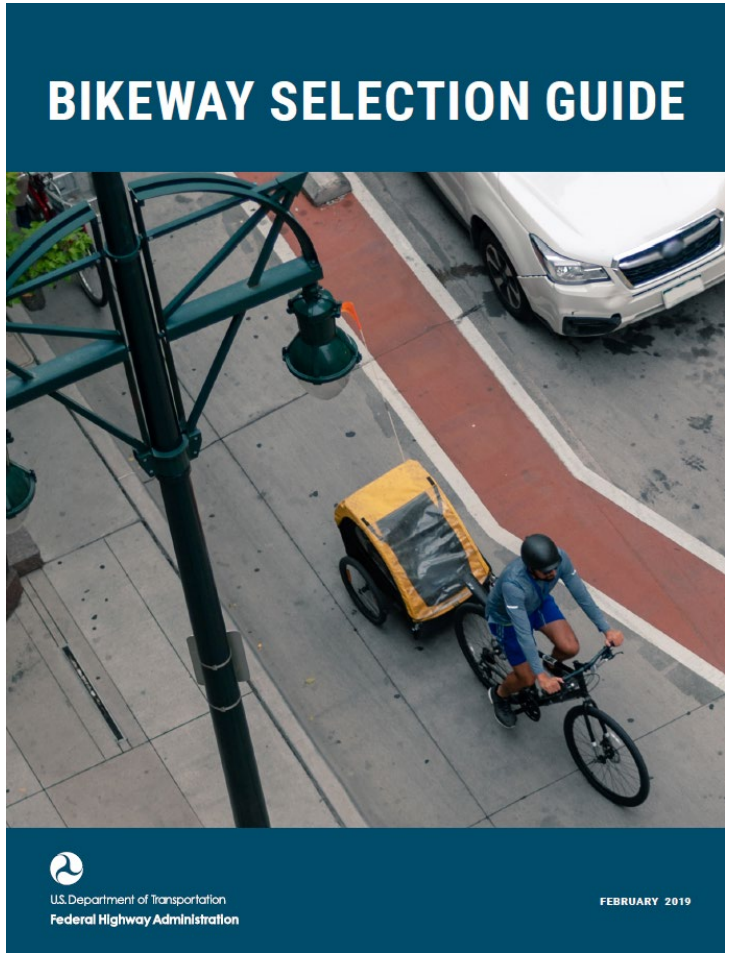
Part 1: Algorithmic Planning

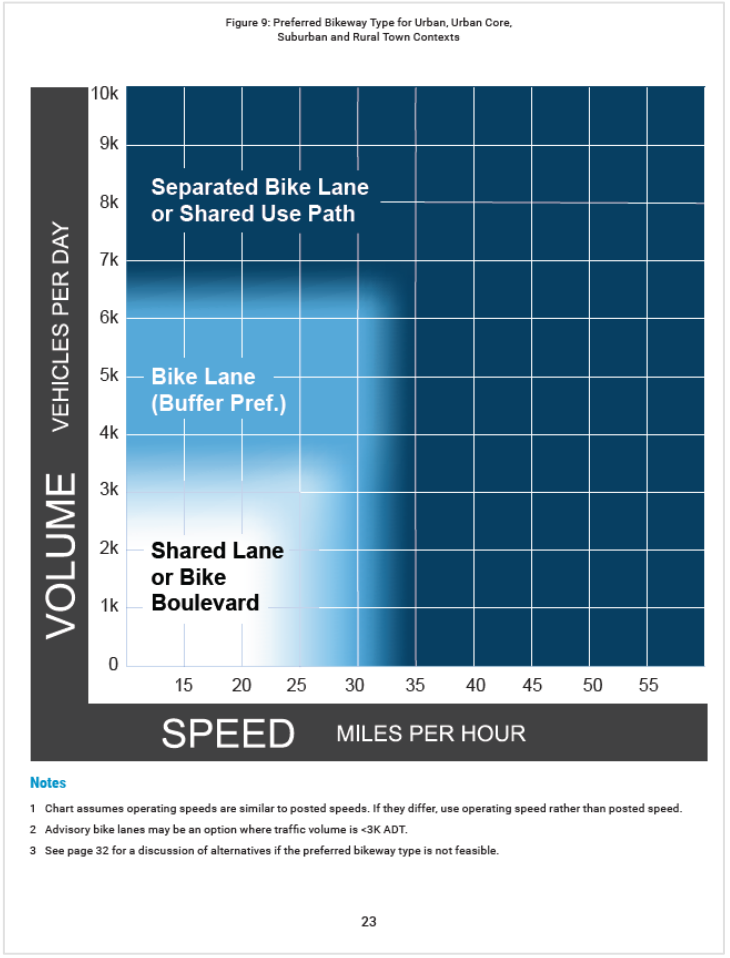
Or: What bike lane should go on which road?



Step 1: Choosing your schema

FHWA Bikeway Selection Guide





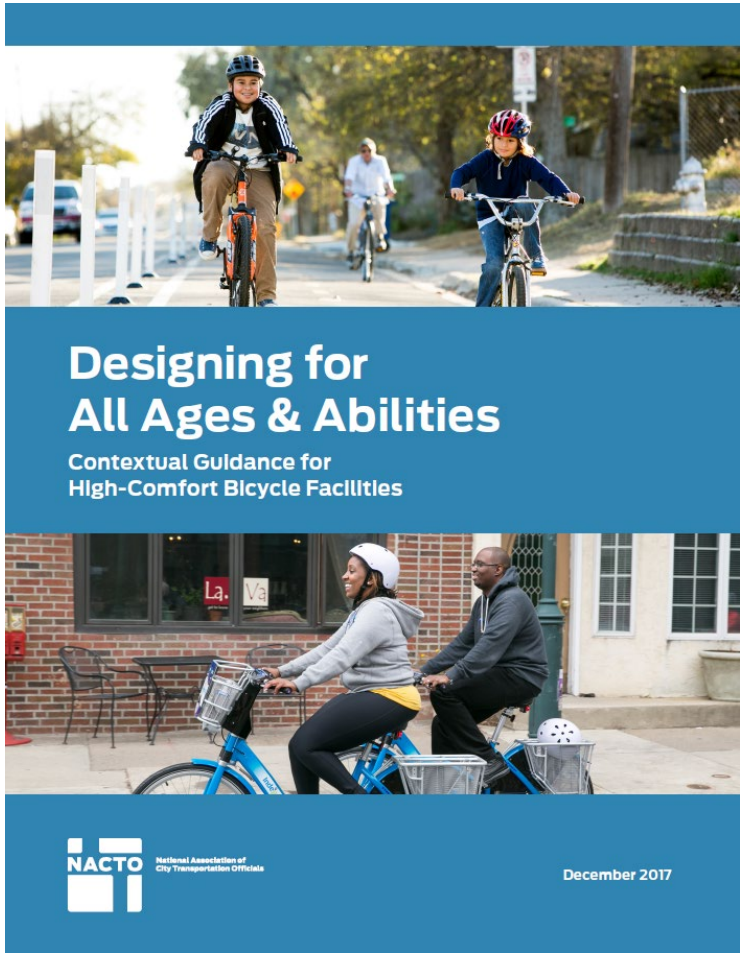
- Detailed and excellent qualitative guidance
- Fuzzy rather than hard boundaries
- Not very stringent

CROW Design Manual for Bicycle Traffic

- Everyone should buy it (just €142 for the English version!)
- Assumes bicycle awareness and competency by drivers
- Optimized for Dutch standards, which does not include protected bicycle lanes

Road category	Speed limit motorized traffic (km/h)		Volume of motorized traffic (PCU / 24-hour period)	Cycle Network Category: Basic structure ($I_{bicycle}$ < 750 / 24-hour period)	Cycle Network Category: Main cycle network ($I_{bicycle}$ = 500-2,500 / 24-hour period)	Cycle Network Category: Bicycle highway ($I_{bicycle}$ > 2,000 / 24-hour period)
Residential road	Walking pace or 30 km/h		< 2,500	Mixed traffic	Mixed traffic or bicycle street	Bicycle street (with right of way)
			2,000-5,000		Mixed traffic or cycle lane	Cycle path or cycle lane (with right of way)
			> 4,000	Cycle lane or cycle path		
Distributor road	50	2x1 lane	Not relevant		Cycle path	
		2x2 traffic lanes				
	70			Cycle/moped path		

NACTO Designing for All Ages and Abilities



Contextual Guidance for Selecting All Ages & Abilities Bikeways

Roadway Context				All Ages & Abilities Bicycle Facility
Target Motor Vehicle Speed*	Target Max. Motor Vehicle Volume (ADT)	Motor Vehicle Lanes	Key Operational Considerations	
Any		*Any*	*Any of the following:* high curbside activity, frequent buses, motor vehicle congestion, or turning conflicts‡	**Protected Bicycle Lane**
< 10 mph	Less relevant	No centerline, or single lane one-way	Pedestrians share the roadway	**Shared Street**
≤ 20 mph	≤ 1,000 – 2,000		< 50 motor vehicles per hour in the peak direction at peak hour	**Bicycle Boulevard**
≤ 25 mph	≤ 500 – 1,500			
	≤ 1,500 – 3,000	Single lane each direction, or single lane one-way	Low curbside activity, or low congestion pressure	**Conventional or Buffered Bicycle Lane, or Protected Bicycle Lane**
	≤ 3,000 – 6,000			**Buffered or Protected Bicycle Lane**
	Greater than 6,000			**Protected Bicycle Lane**
	Any	Multiple lanes per direction		
Greater than 26 mph†	≤ 6,000	Single lane each direction	Low curbside activity, or low congestion pressure	**Protected Bicycle Lane, or Reduce Speed**
		Multiple lanes per direction		**Protected Bicycle Lane, or Reduce to Single Lane & Reduce Speed**
	Greater than 6,000	*Any*	*Any*	**Protected Bicycle Lane, or Bicycle Path**
High-speed limited access roadways, natural corridors, or geographic edge conditions with limited conflicts		*Any*	High pedestrian volume	**Bike Path with Separate Walkway or Protected Bicycle Lane**
			Low pedestrian volume	**Shared-Use Path or Protected Bicycle Lane**

- High-quality quantitative and qualitative design guidance
- Uses the common NACTO designs
- Prescriptive, so it's easy to fall back on the guidance

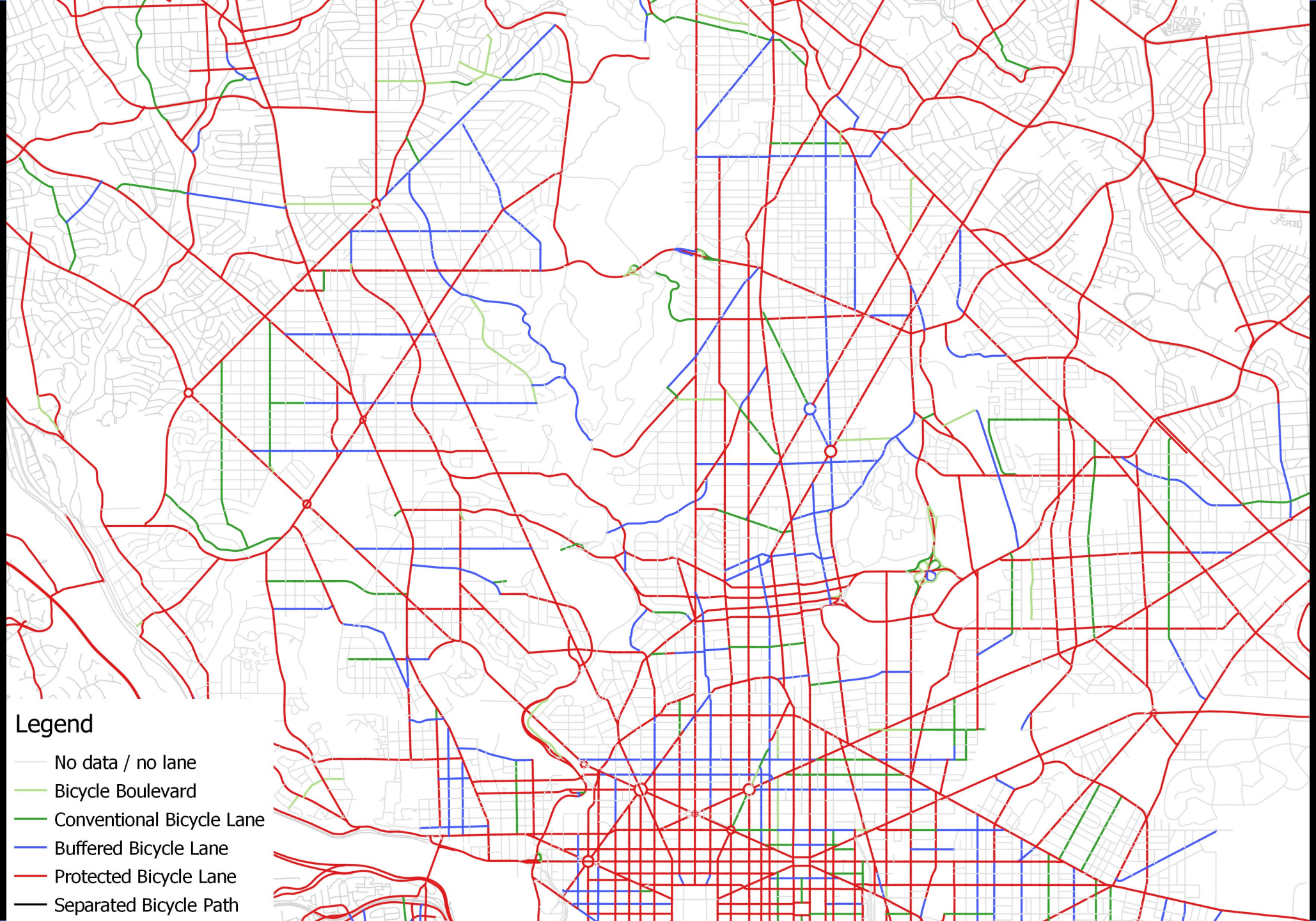
Step 2: Finding & processing your data

Speed limit

Traffic volumes

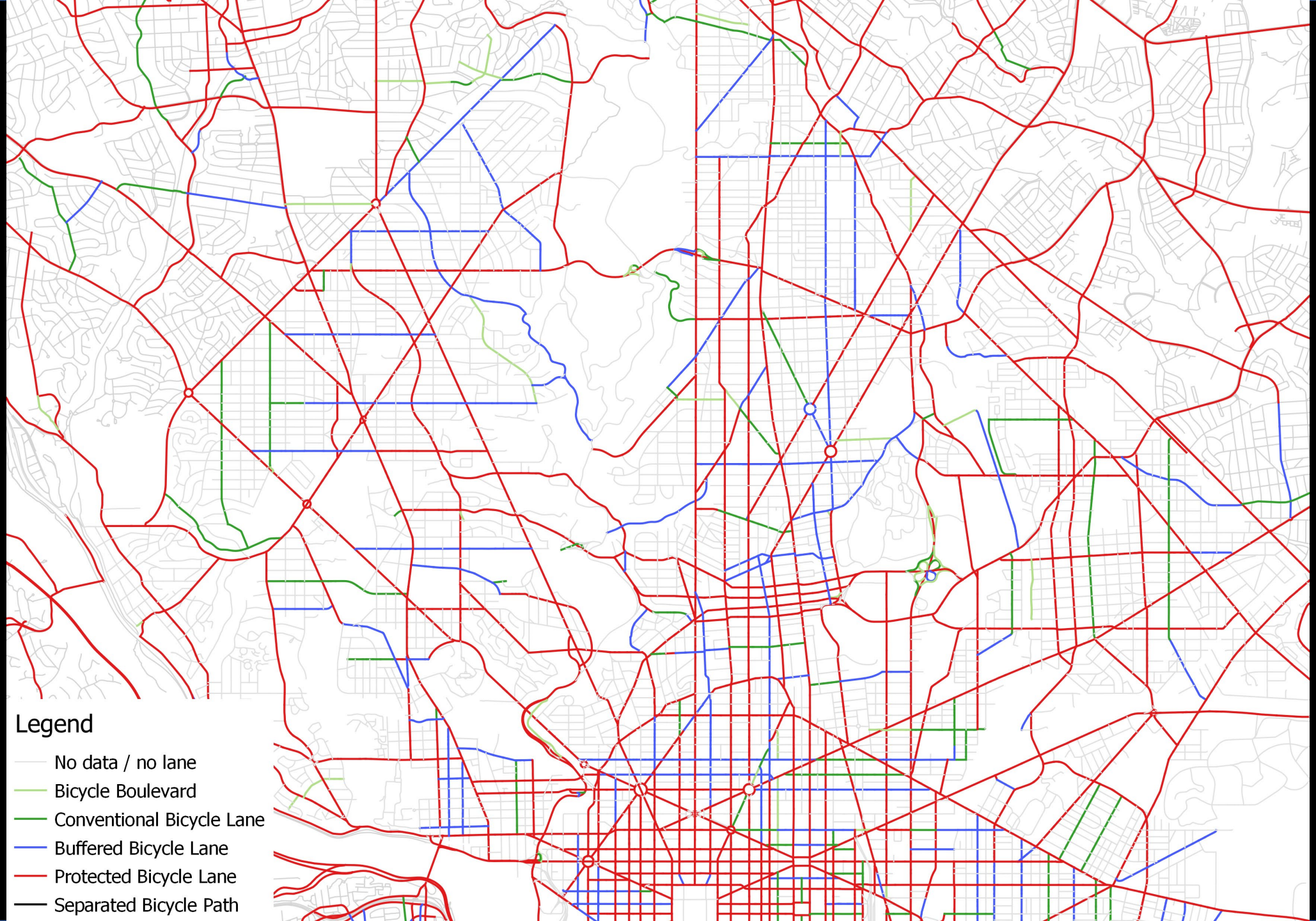
Lanes per direction (your striping pattern)

Step 3: Getting your output


Legend
No data / no lane
Bicycle Boulevard
Conventional Bicycle Lane
Buffered Bicycle Lane
Protected Bicycle Lane
Separated Bicycle Path

Cleaning

- Proof-check your map
  - Rural roads might need bicycle paths instead of protected bike lanes
  - I-495 bike lanes = bad idea
  - Etc.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No data / no lane
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Nice-to-have: Places for off-street paths

- Easements (like sewer or water)
- Rights-of-way (like railroads, power lines)
- Areas (parks, government-owned property)

Part 2: Dutch Planning

Or: How to prioritize

Dutch Planning Sketch

1. Identify your origins
2. Identify your destinations
3. Draw lines between them

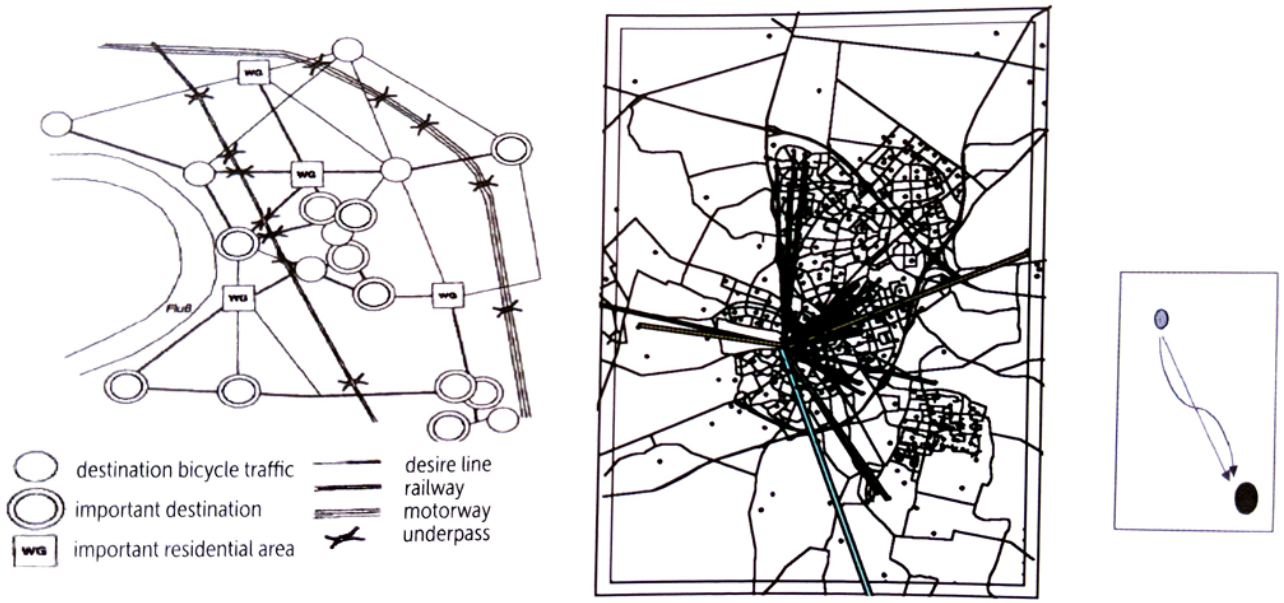
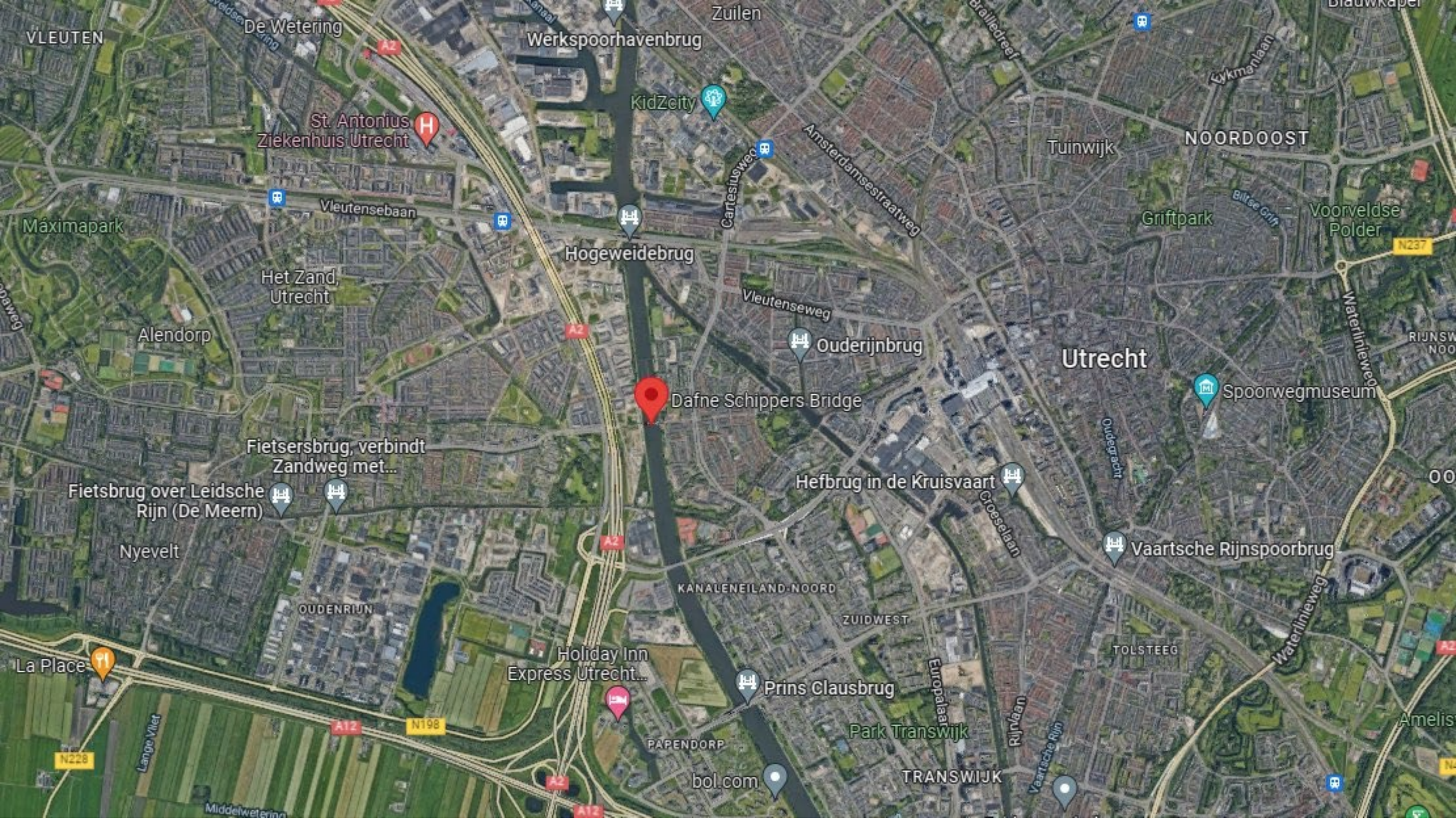


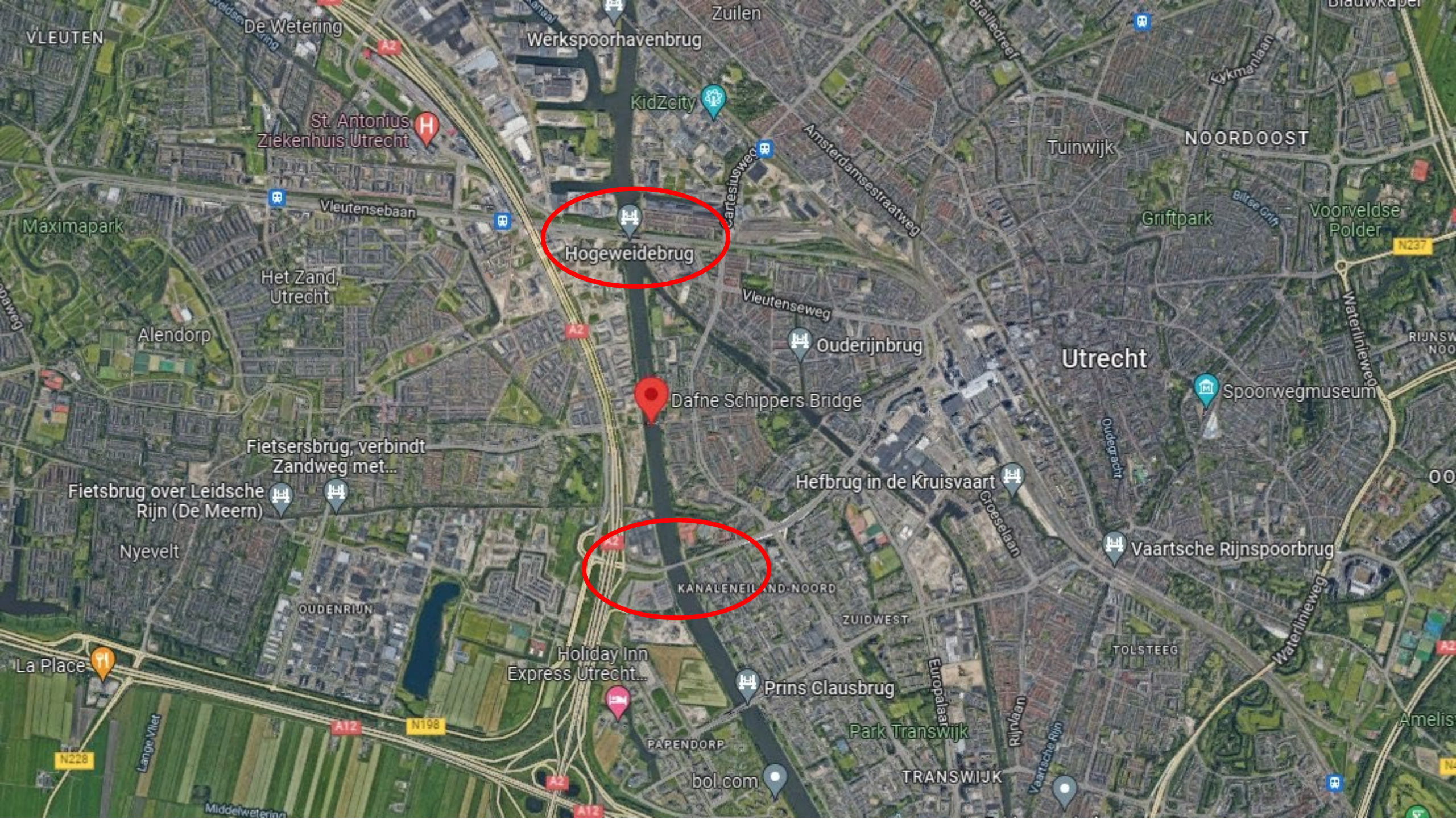
Figure 4-2. Examples of desire lines between destinations

Why?

- Straight paths are usually better
- Identifies critical barriers to making straight paths

Example: Dafne Schippers Bridge


VLEUTEN
De Wetering
Zuilen
Werkspoorhavenbrug
KidZcity
St. Antonius Ziekenhuis Utrecht
Tuinwijk
NOORDOOST
Amsterdamsestraatweg
Cartesiusweg
Vleutensebaan
Máximapark
Hogeweidebrug
Griftpark
Voorveldse Polder
Het Zand, Utrecht
Vleutenseweg
Alendorp
Ouderijnbrug
Utrecht
Dafne Schippers Bridge
Spoorwegmuseum
Fietsersbrug, verbindt Zandweg met...
Fietsbrug over Leidsche Rijn (De Meern)
Hefbrug in de Kruisvaart
Croeselaan
Vaartsche Rijnspoorbrug
Nyevelt
KANALENEILAND-NOORD
OUDENRIJN
ZUIDWEST
TOLSTEEG
La Place
Holiday Inn Express Utrecht...
Prins Clausbrug
Europalaan
Park Transwijk
PAPENDORP
bol.com
TRANSWIJK
A2
A12
N198
N228
N237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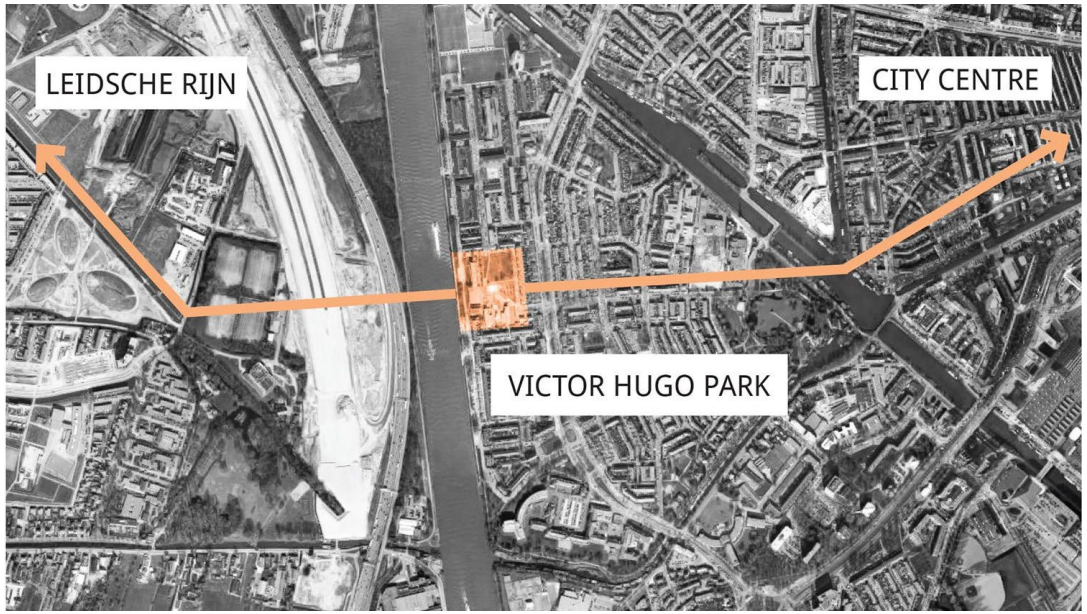
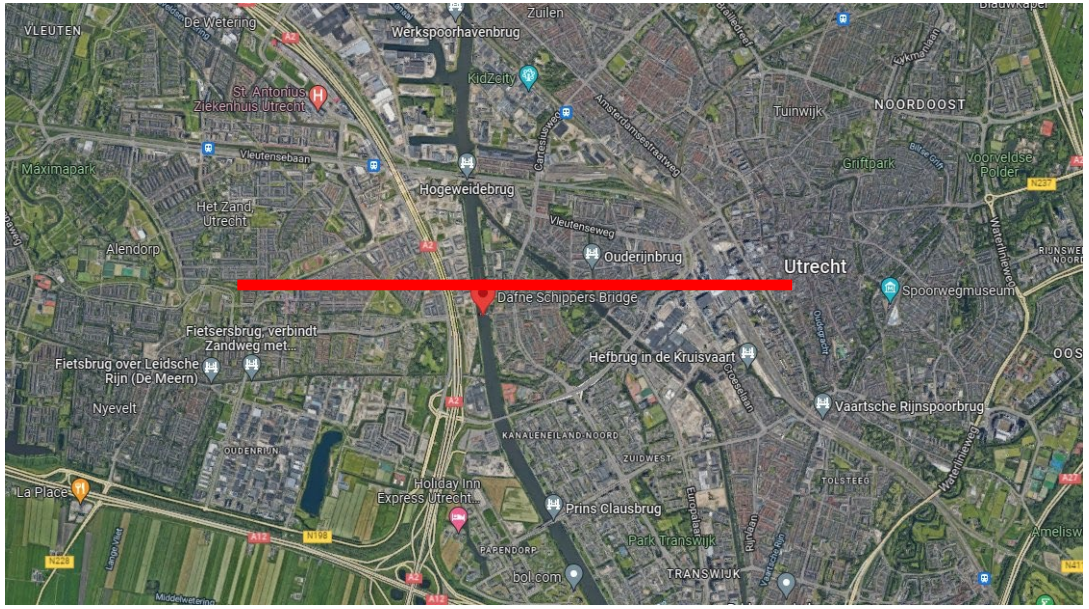
Gelebrug (north)

De Meernbrug (south)


LEIDSCHE RIJN
CITY CENTRE
VICTOR HUGO PARK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bol.com
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Computer-aided design

- Get your data:
  - Use OnTheMap data to identify workplaces and shopping areas
  - Use Census data to identify population concentrations
  - Use local sources to identify schools and school districts
- Draw your blobs by hand
- Draw your lines by hand or with GIS tools (hub-and-spoke tools)
- Eyeball or use line density computation to identify major and minor corridors
- Identify barriers along the lines

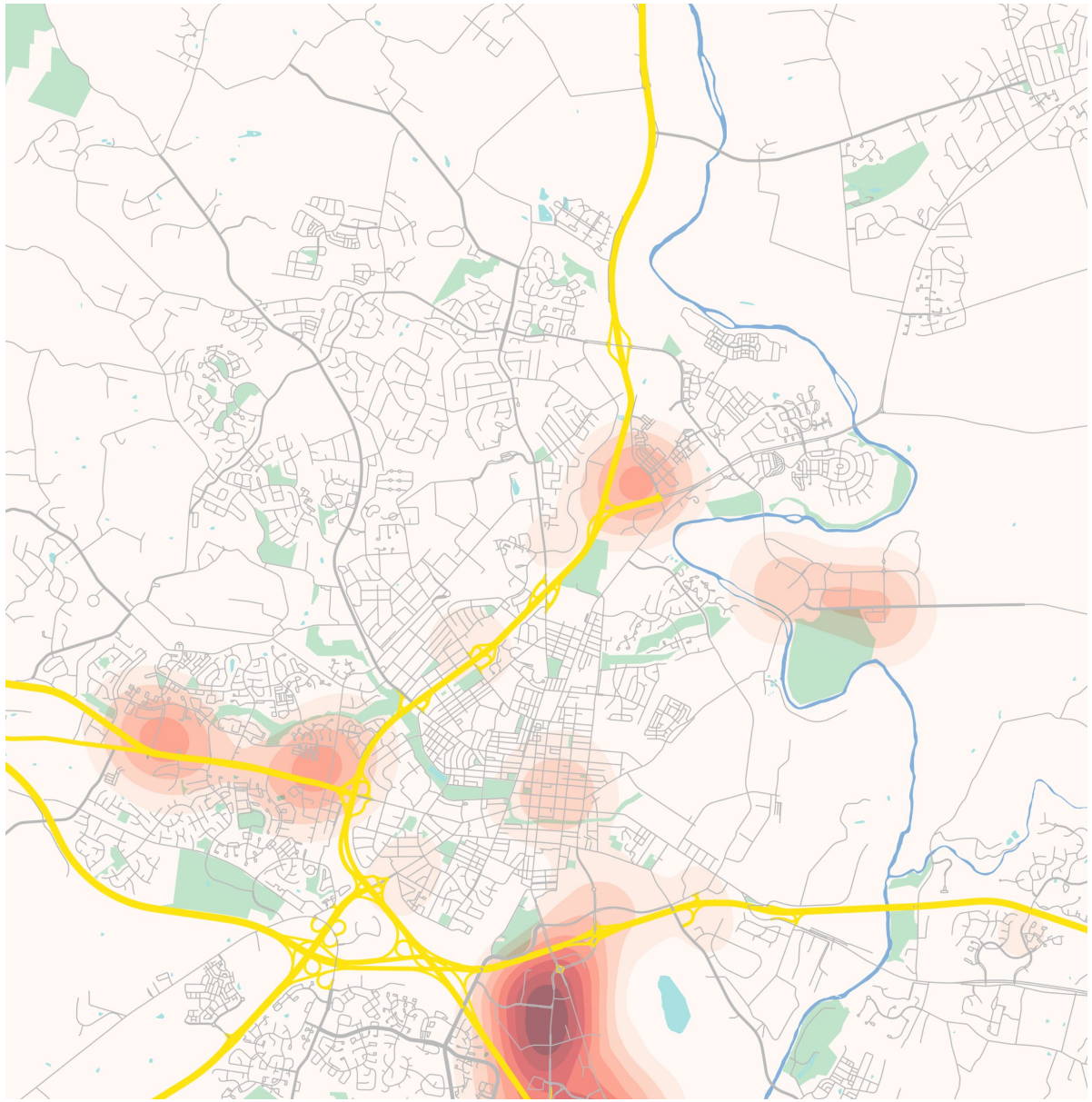
Overlay and Plan

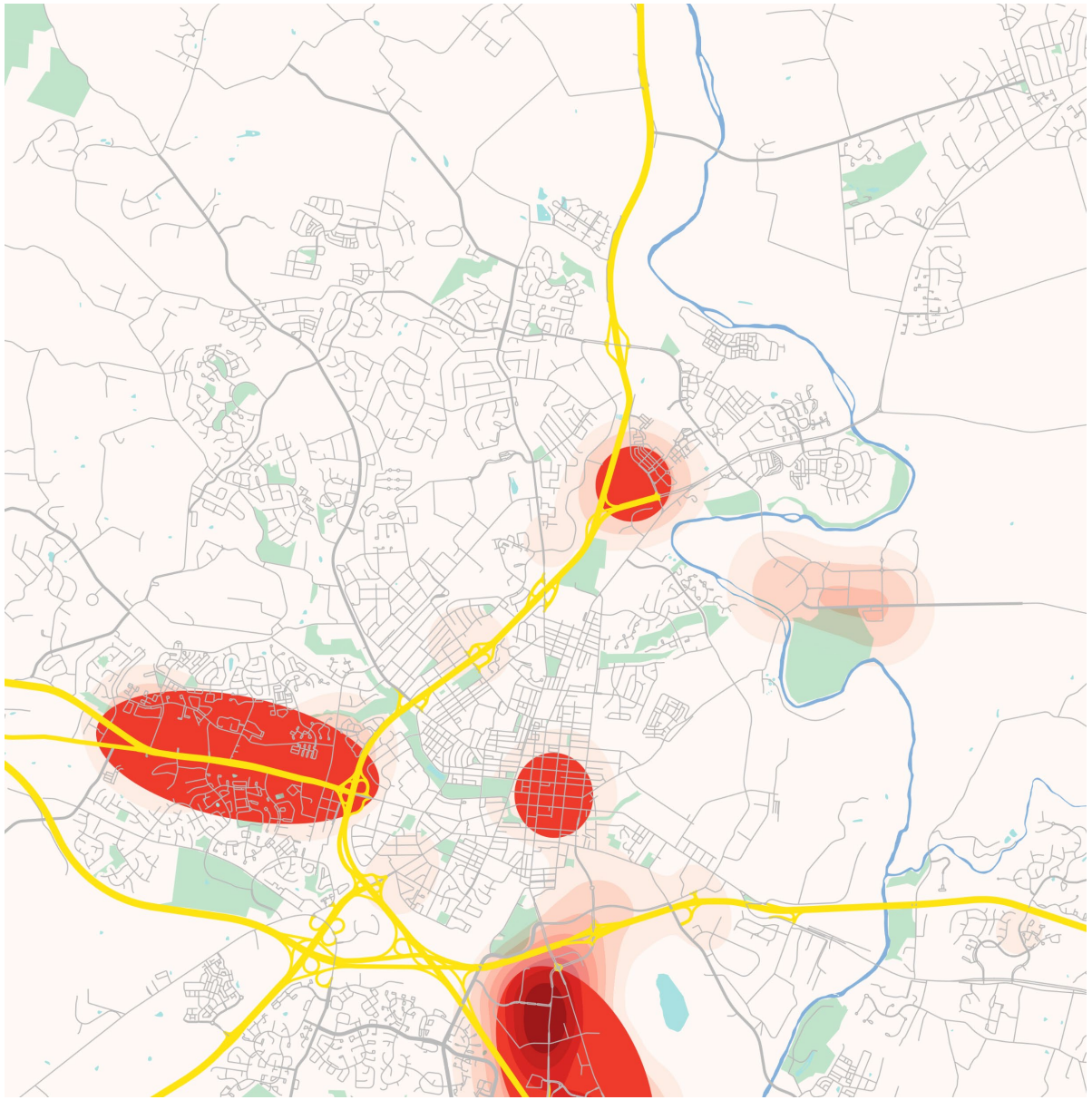
1. Finish existing corridors
2. Plan new ones along major identified routes
3. Use windfalls to tackle critical barriers

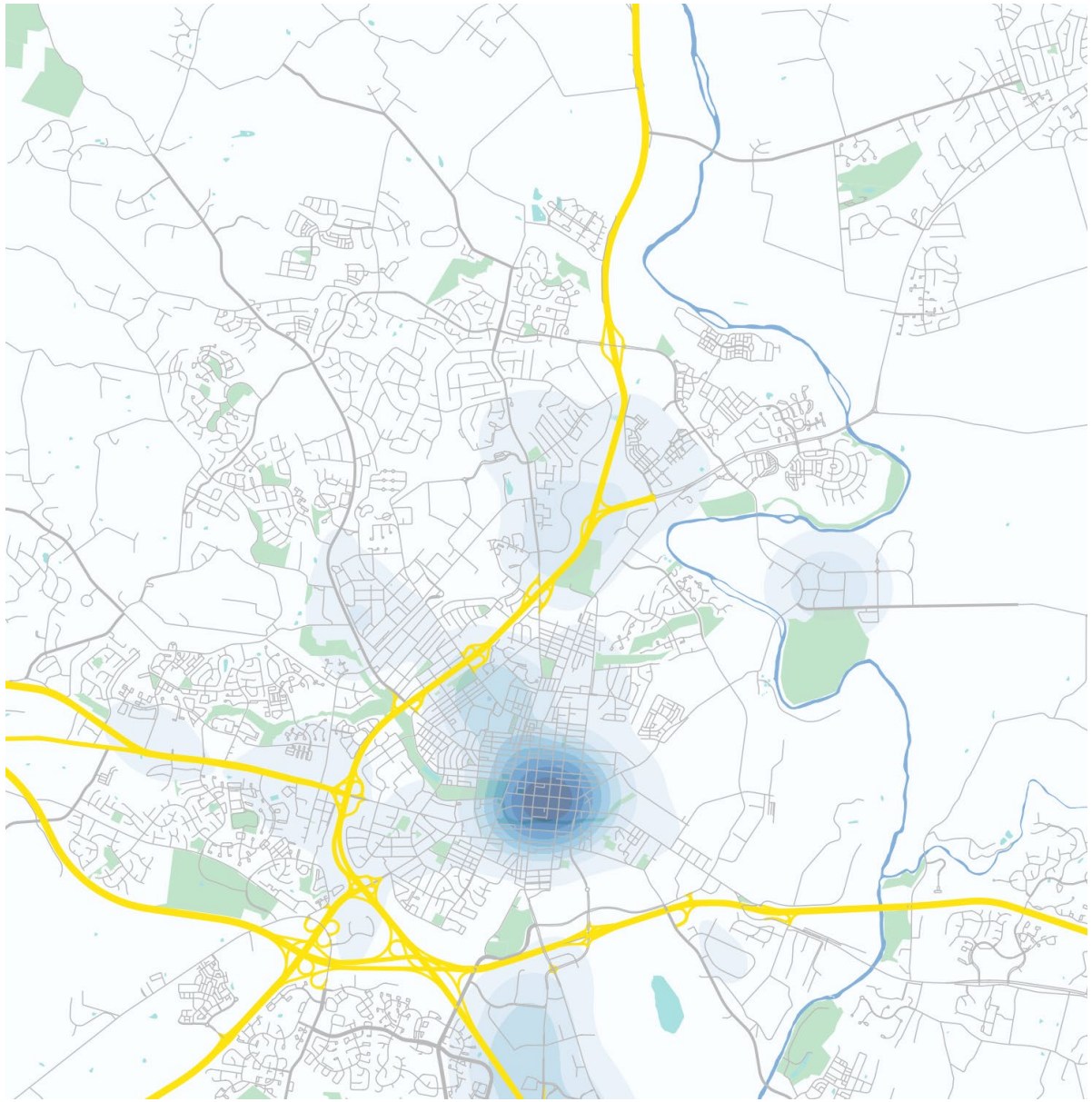
Part 3: How This Looks

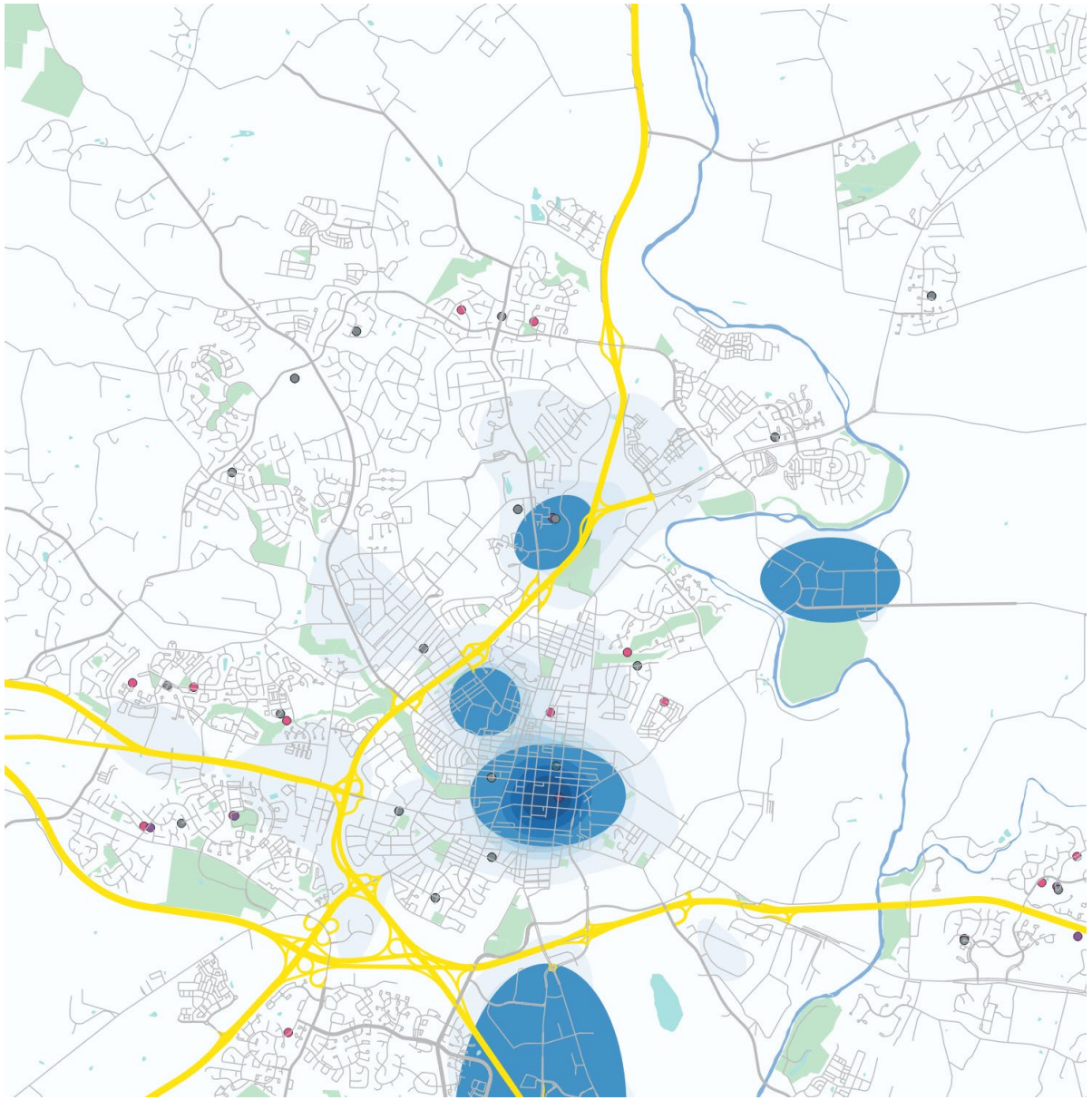
Photo: Diane Bentley Raymond/E+/Getty Images

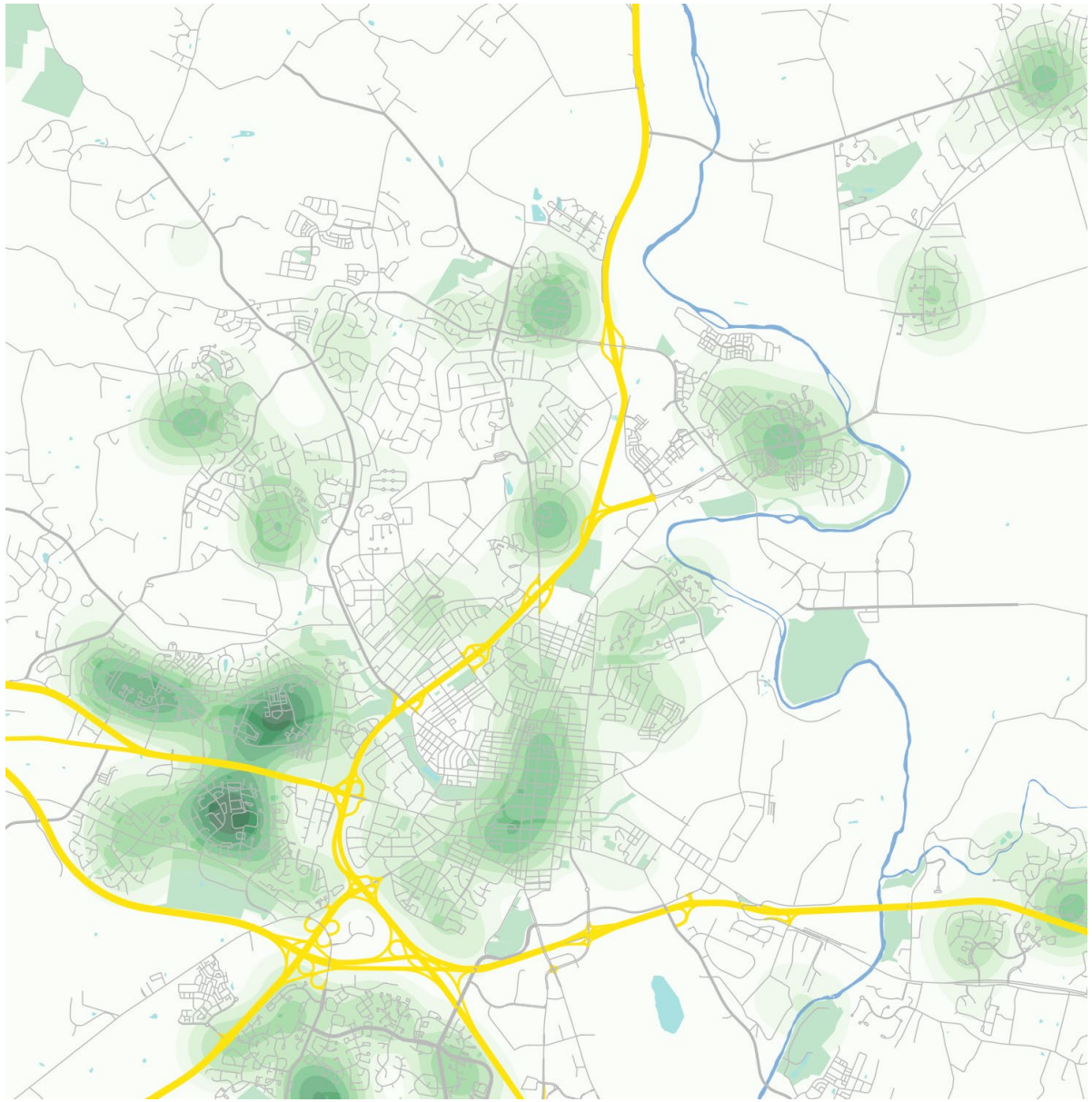
Frederick, MD

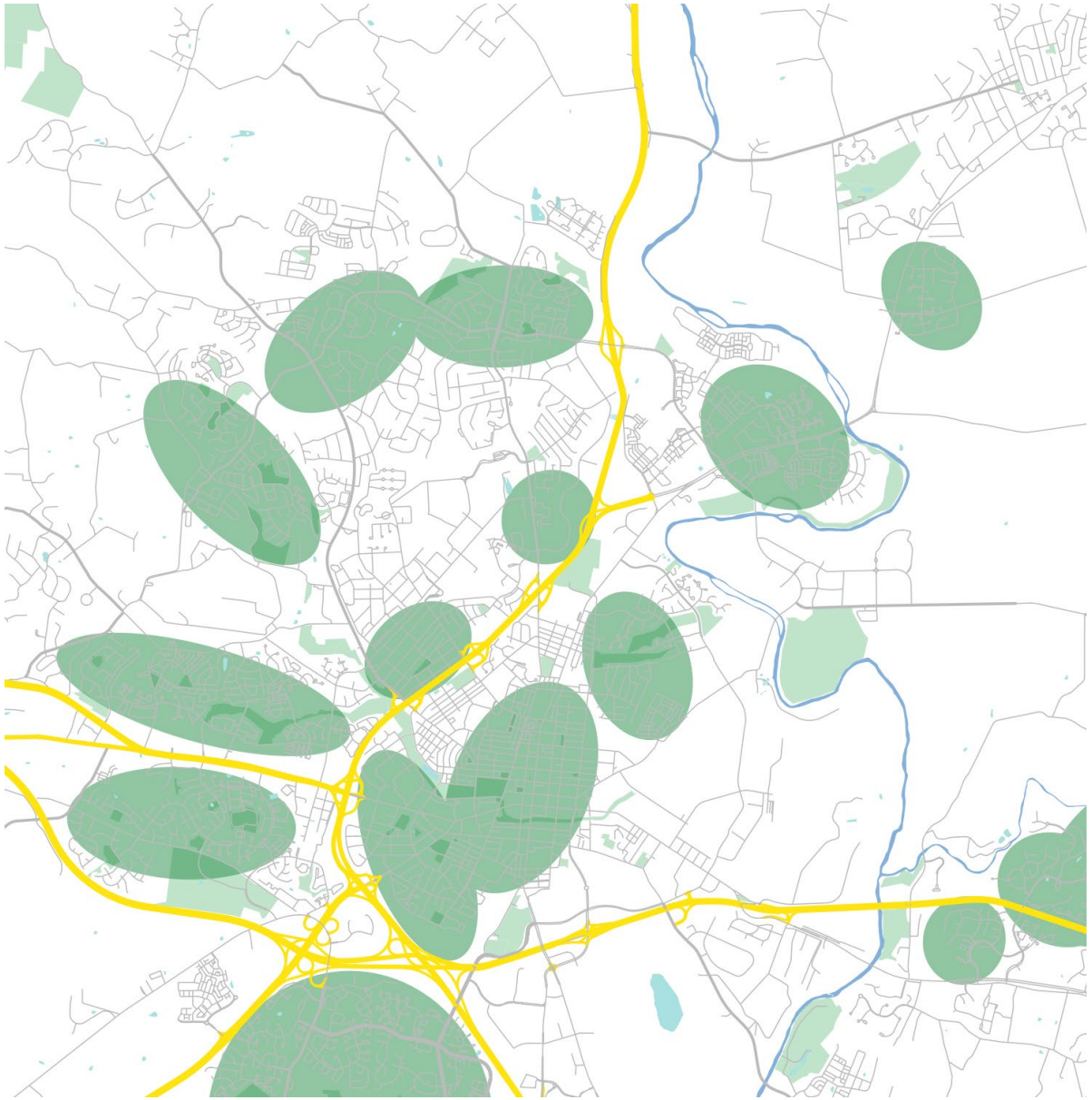


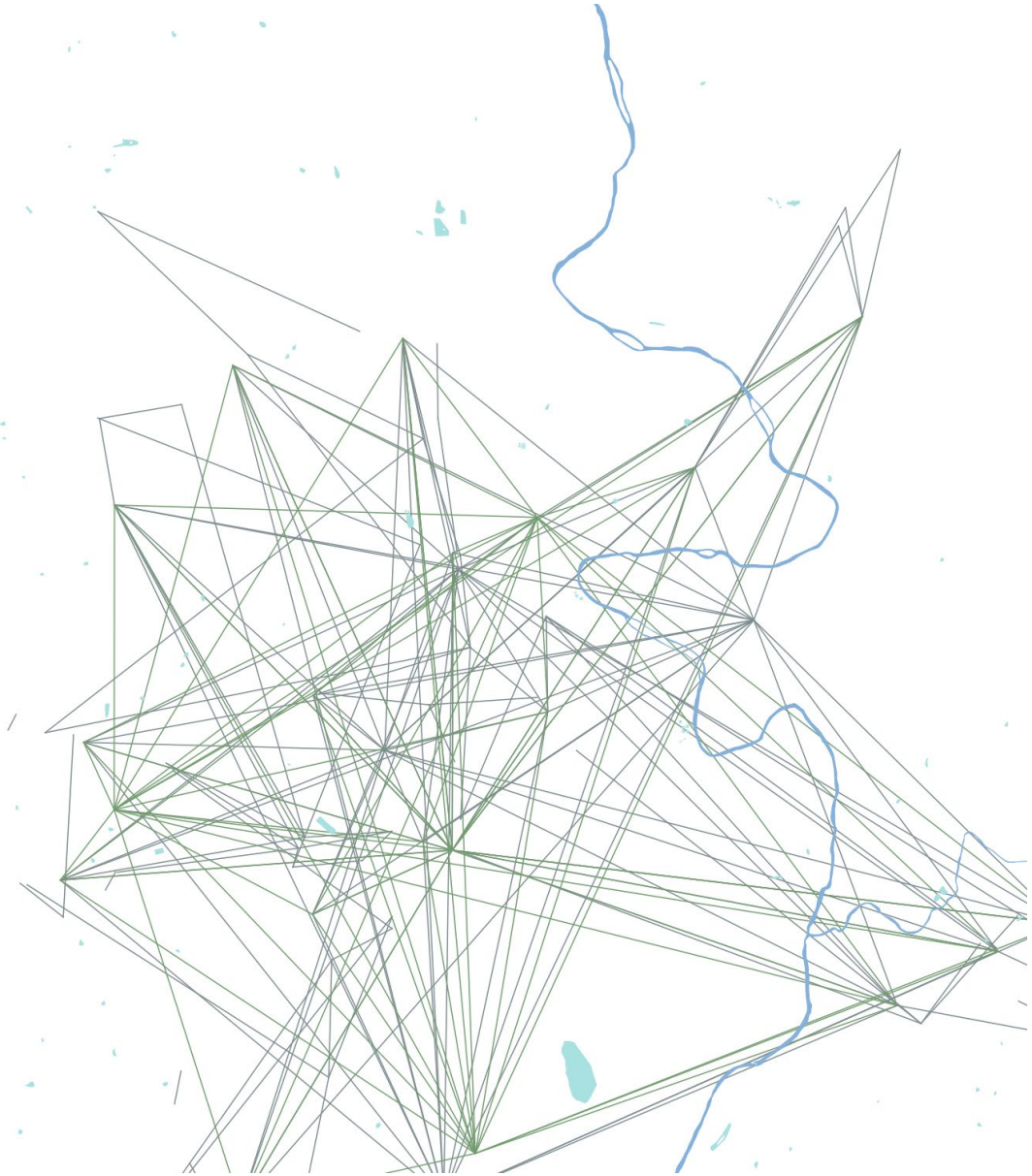


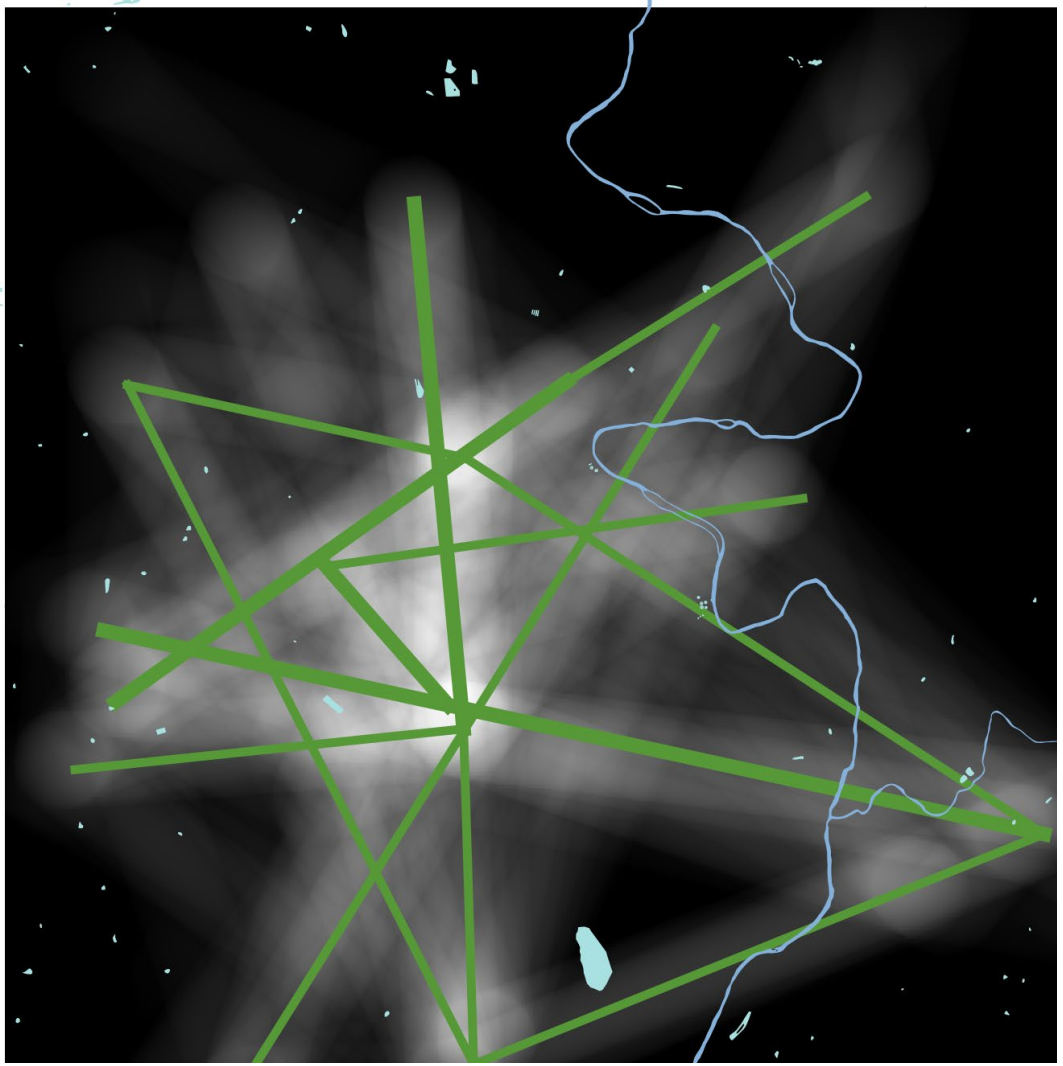


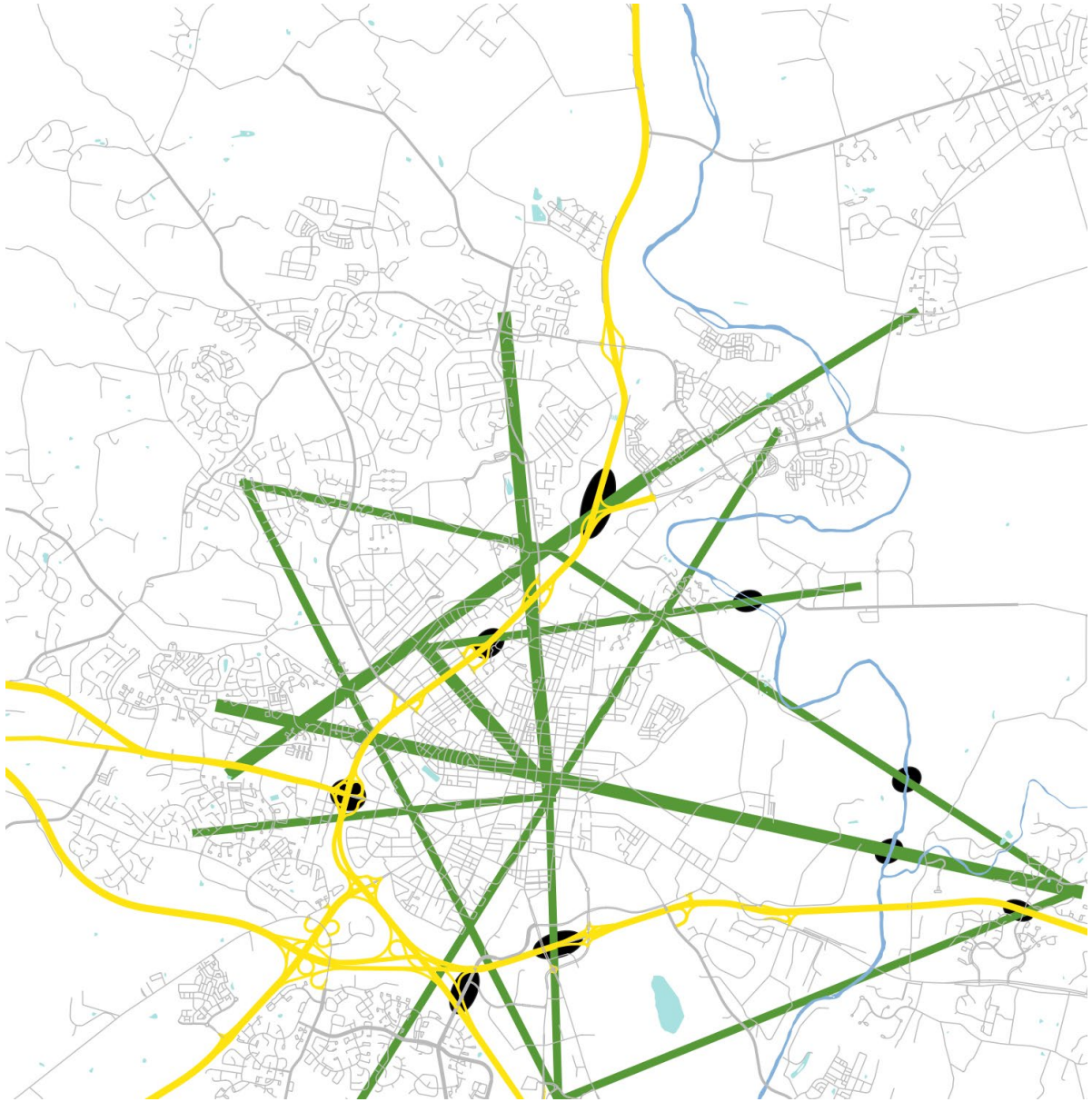












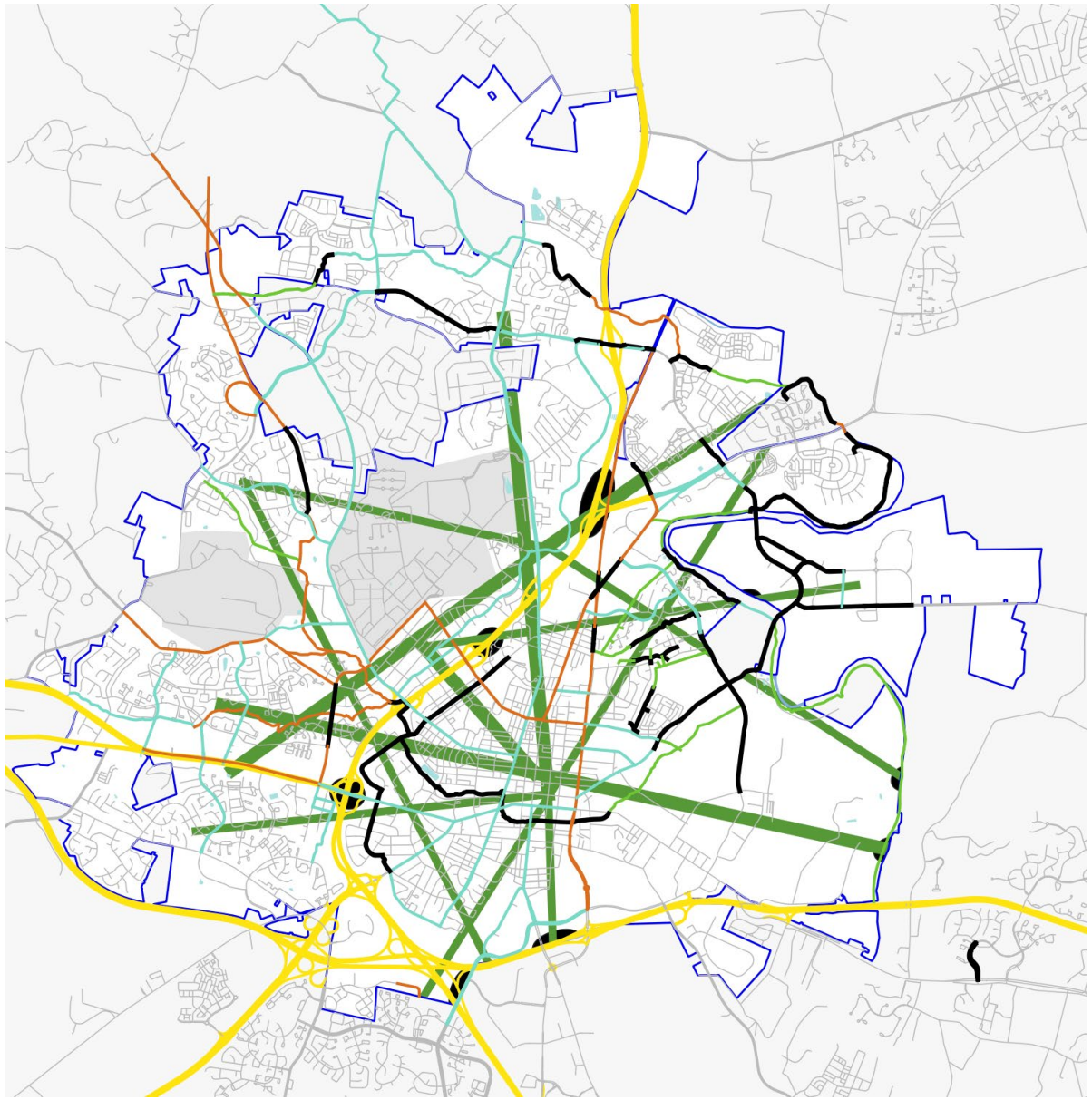
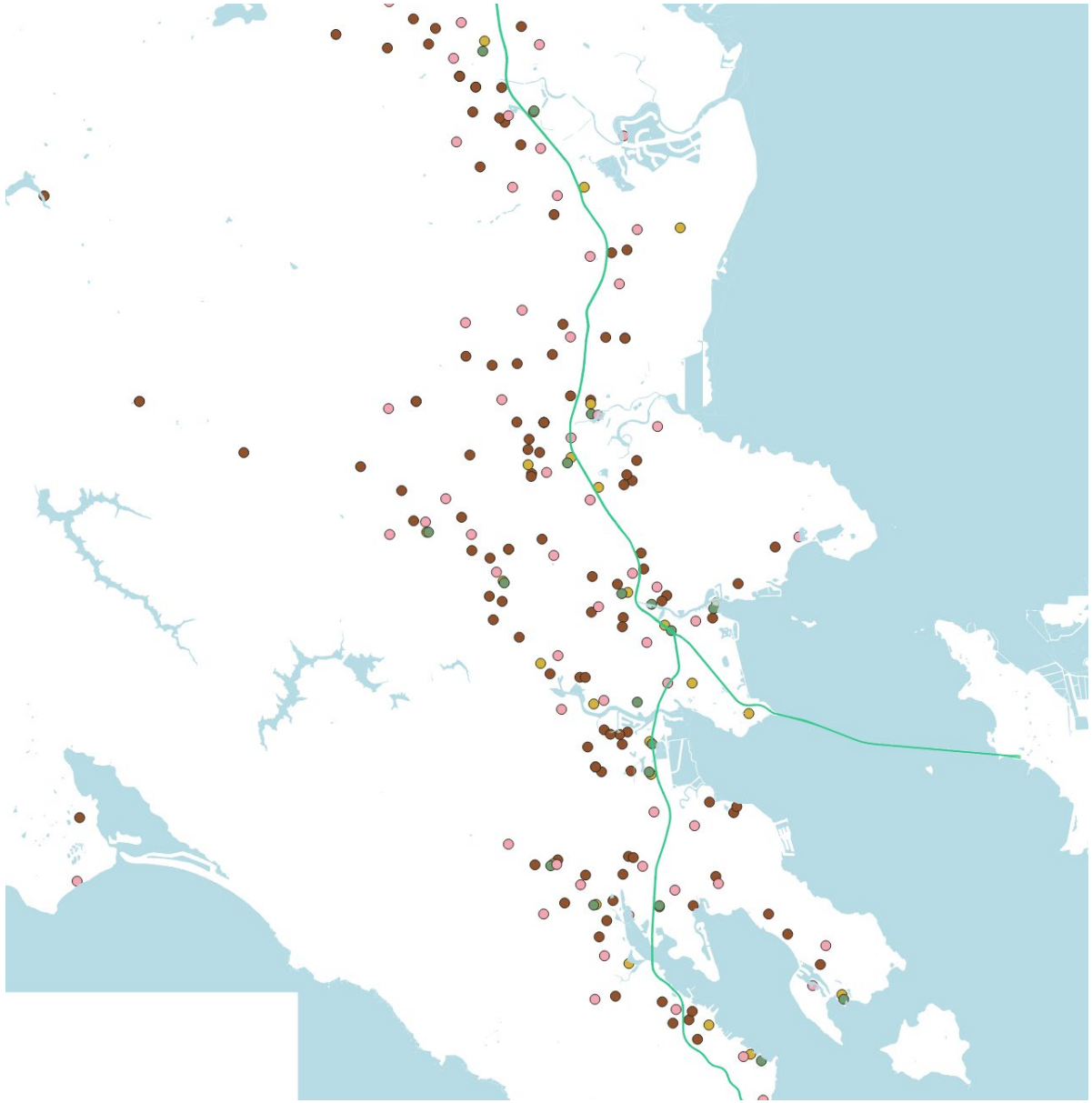
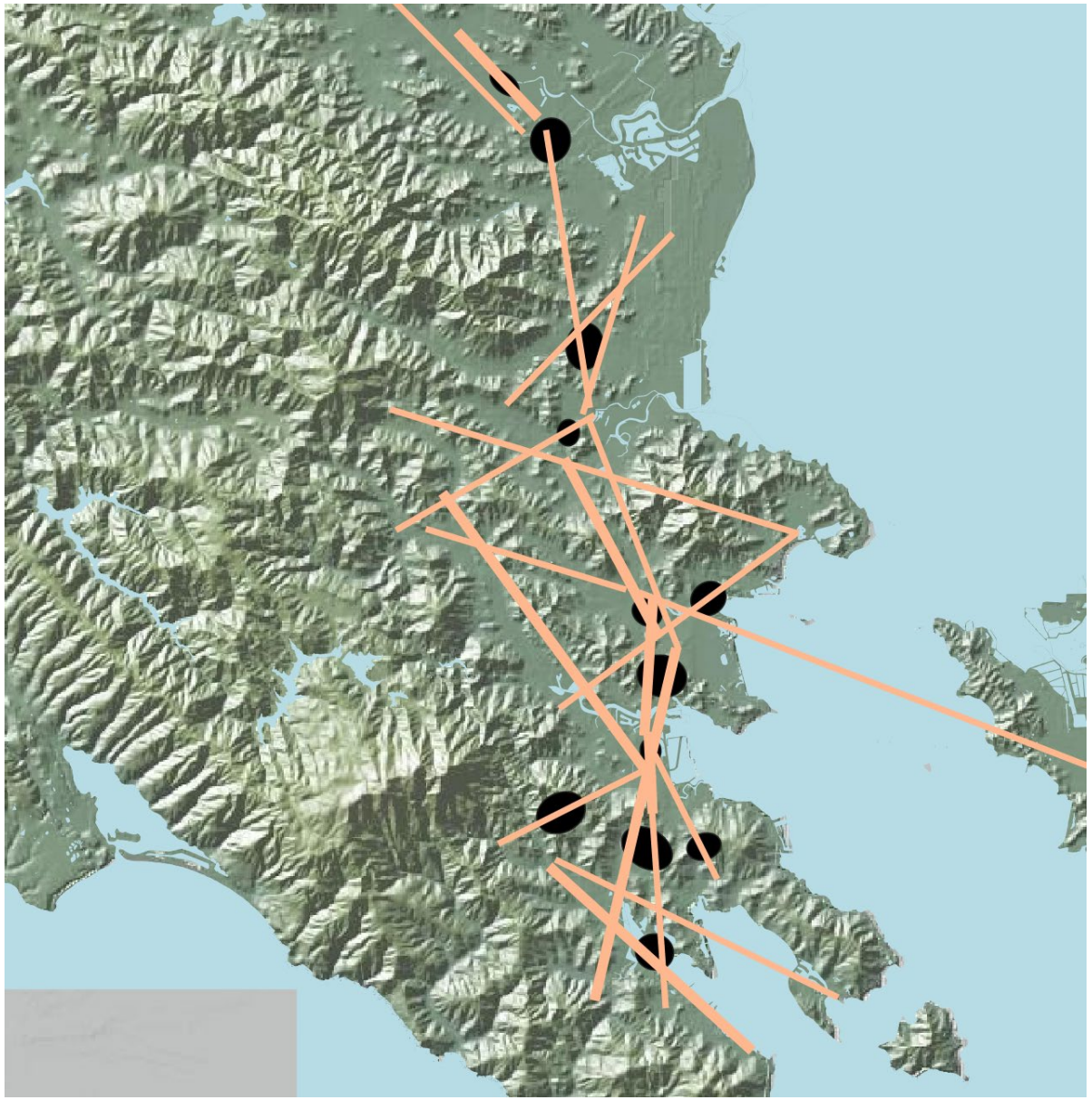


Photo: Diane Bentley Raymond/E+/Getty Images

Marin County, California





Questions?

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david@edmondsonplanning.com

@theGreaterMarin