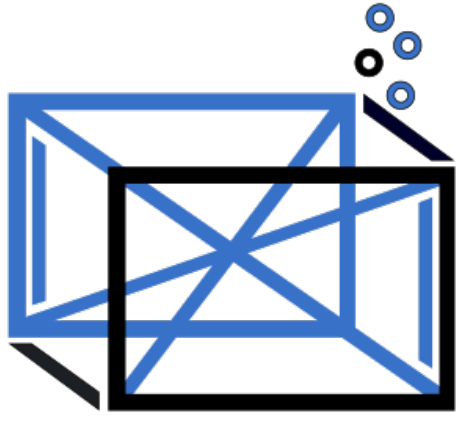
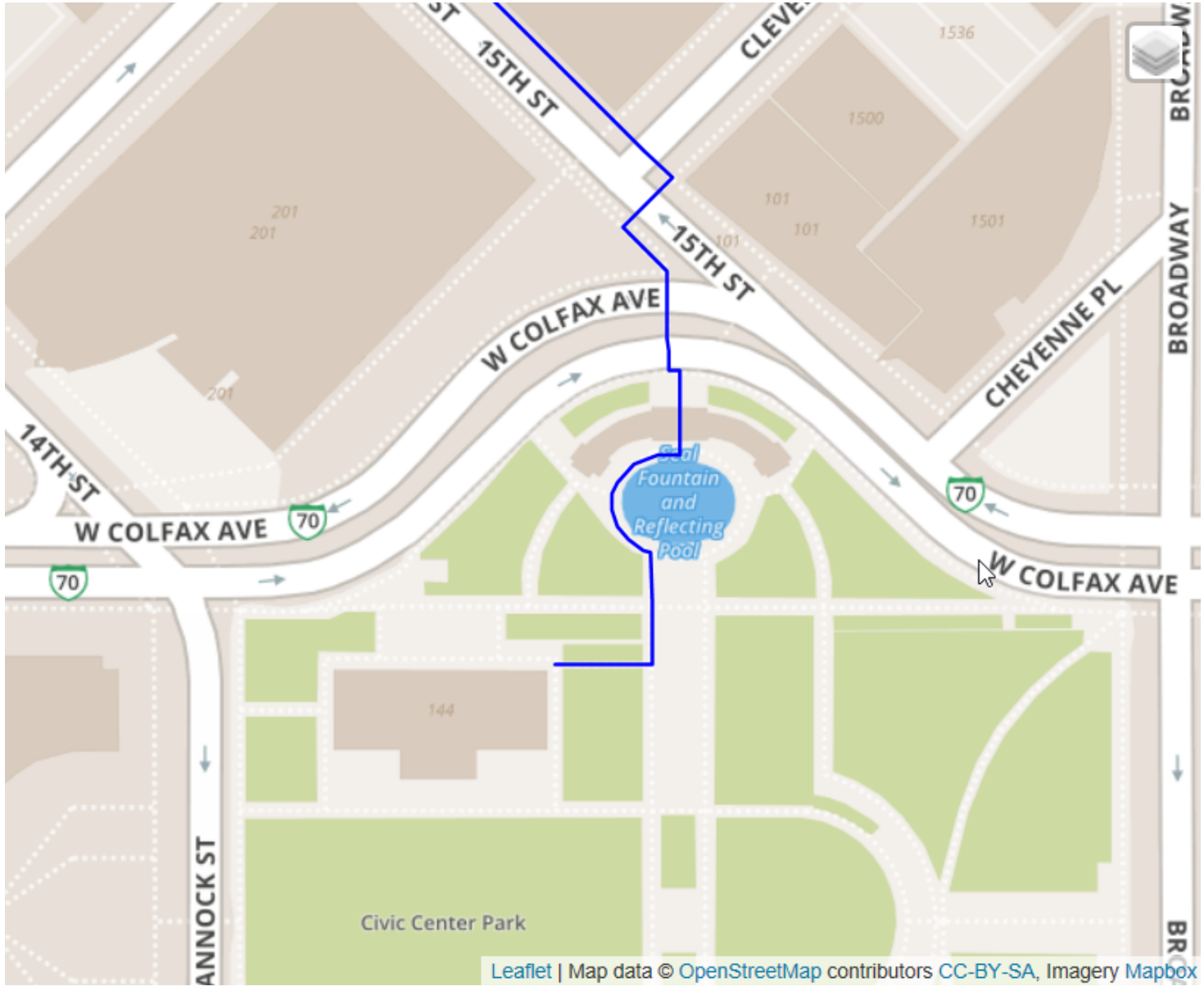
Routing and Motion

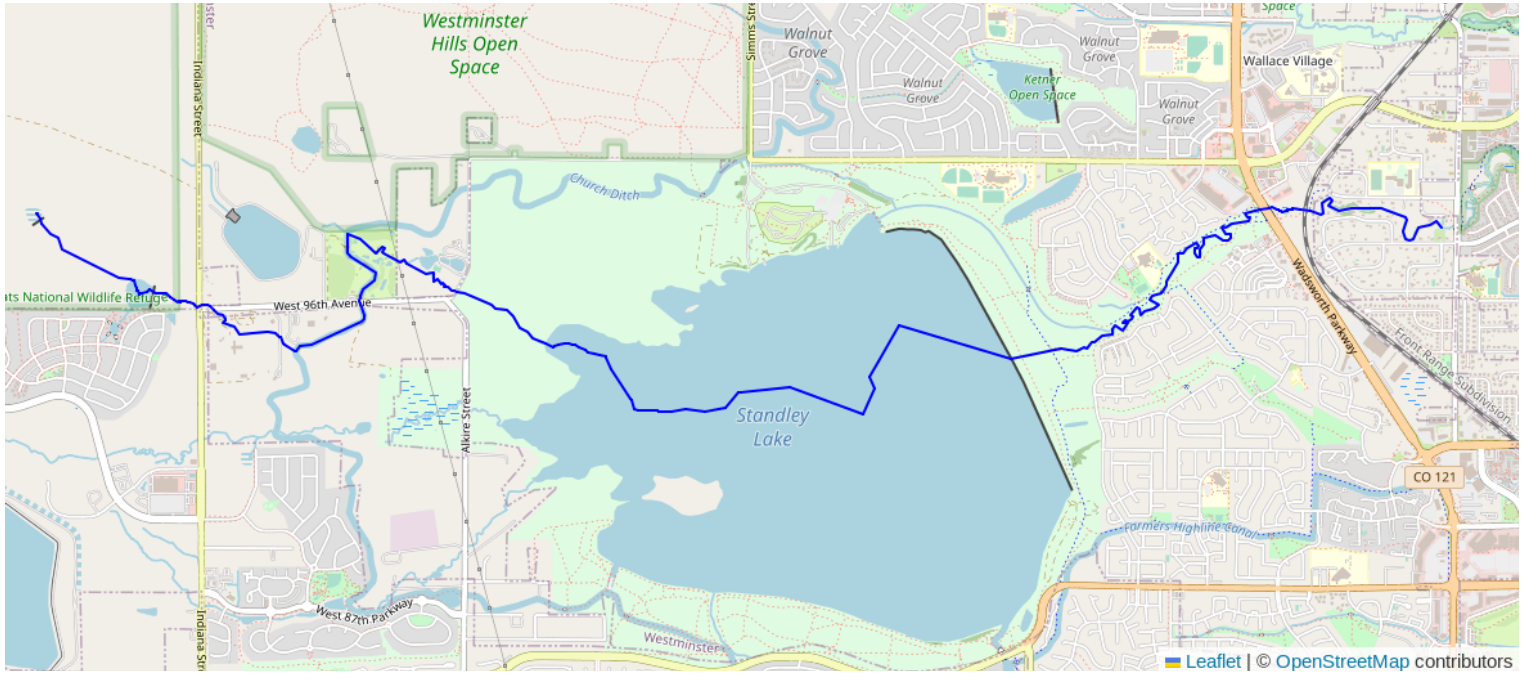


RustProof Labs

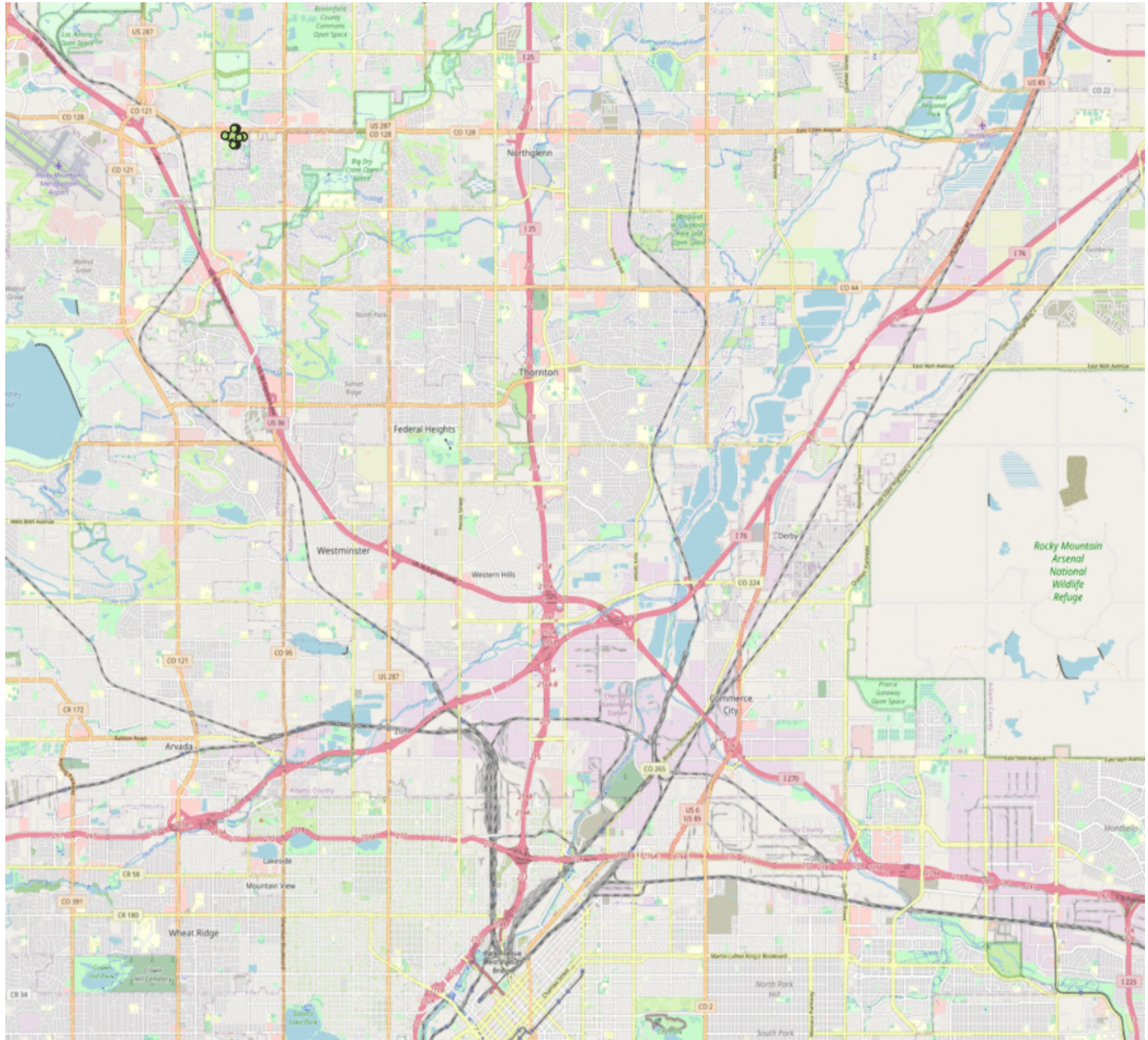
bringing you data



Route 2: Union Station to Civic Center Park, foot traffic only



Source: https://blog.rustprooflabs.com/2022/10/pgrouting-lines-through-polygons


Northglenn
Thornton
Federal Heights
Westminster
Western Hills
Derby
Commerce City
Arvada
Lakeside
Mountain View
Wheat Ridge
Rocky Mountain Arsenal National Wildlife Refuge
Montbello
North Park Hill
South Park
US 287
CO 128
CO 121
I 25
US 85
CO 22
I 76
CO 44
US 36
CO 95
CO 224
CO 265
I 270
US 6
CR 172
CR 58
CO 391
CR 180
CR 34
CO 2
I 225

Routing is like Painting a Room

Routing is like Painting a Room

With many doors, windows, odd angles, lights, and cupboards

Routing is like Painting a Room

With many doors, windows, odd angles, lights, and cupboards

> *It's all about the preparation*

Routing Preparation

- Limit your input size
- Clean data
- Deal with imperfections
- Persist results?

Routing Preparation

- Limit your input size
- Clean data
- Deal with imperfections
- Persist results?

Critical Thinking is Necessary!

Routing Challenges

- Polygons
- Layers / Levels
- Access Controls
- Long lines, `MULTILINESTRING`

Routing through Polygons

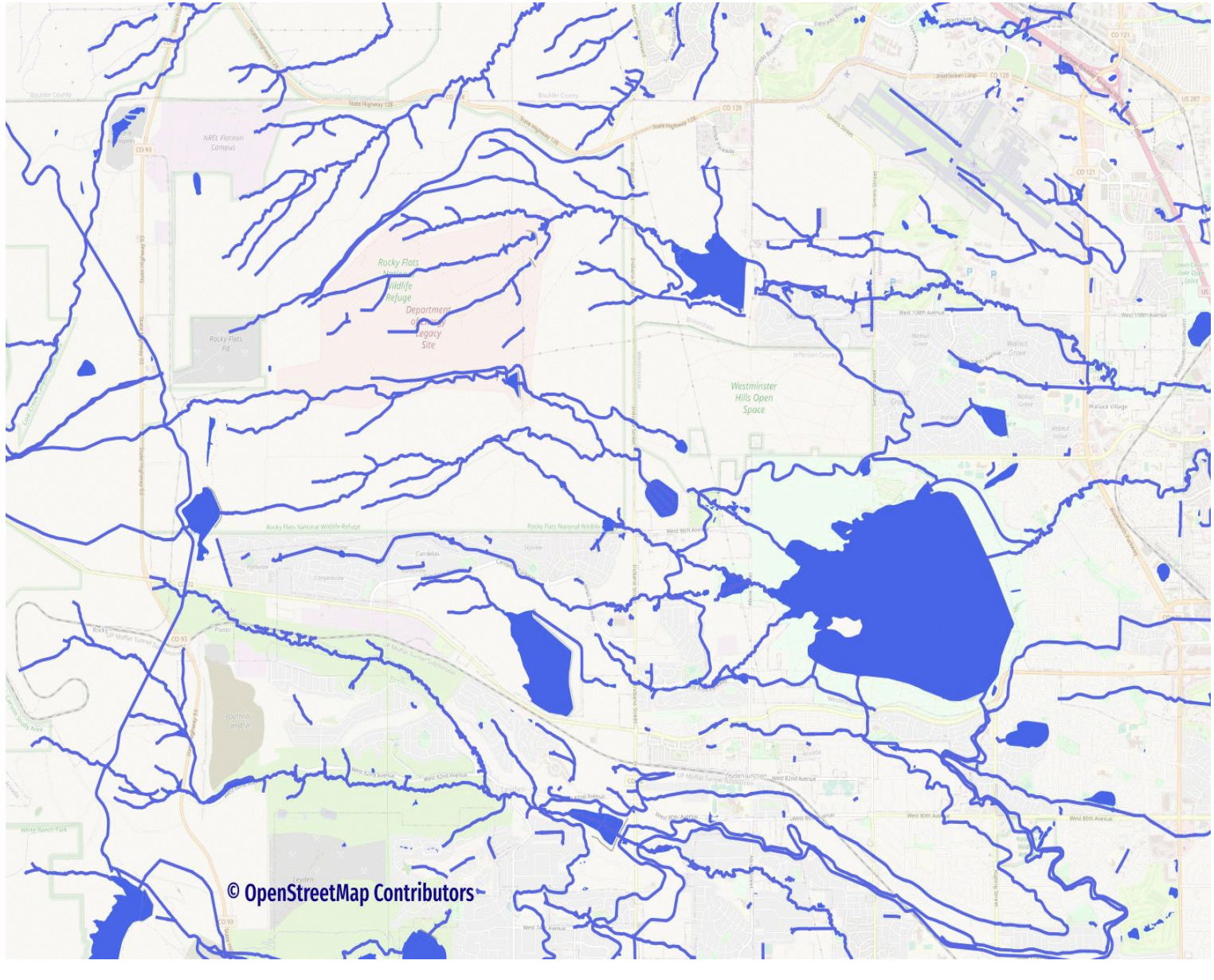
Why was the route through the lake a challenge?

Why was the route through the lake a challenge?

Routing Challenge: Polygons

- `pgRouting` uses "edges" and "nodes" created from lines
- Polygons are not routeable
- Polygons are common in waterway and pedestrian networks

Routing through Polygons

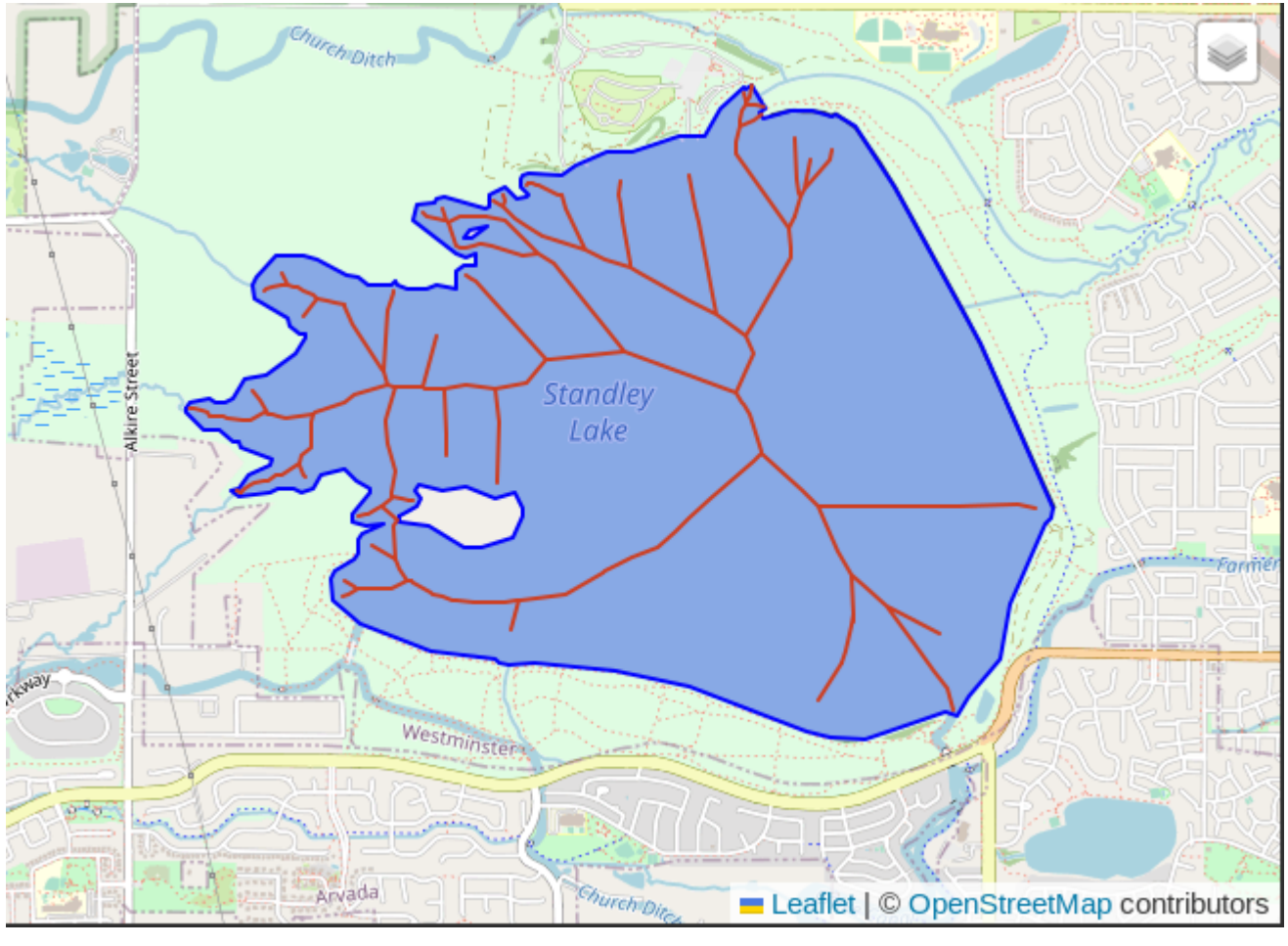


Functions Used to Route Through Lakes

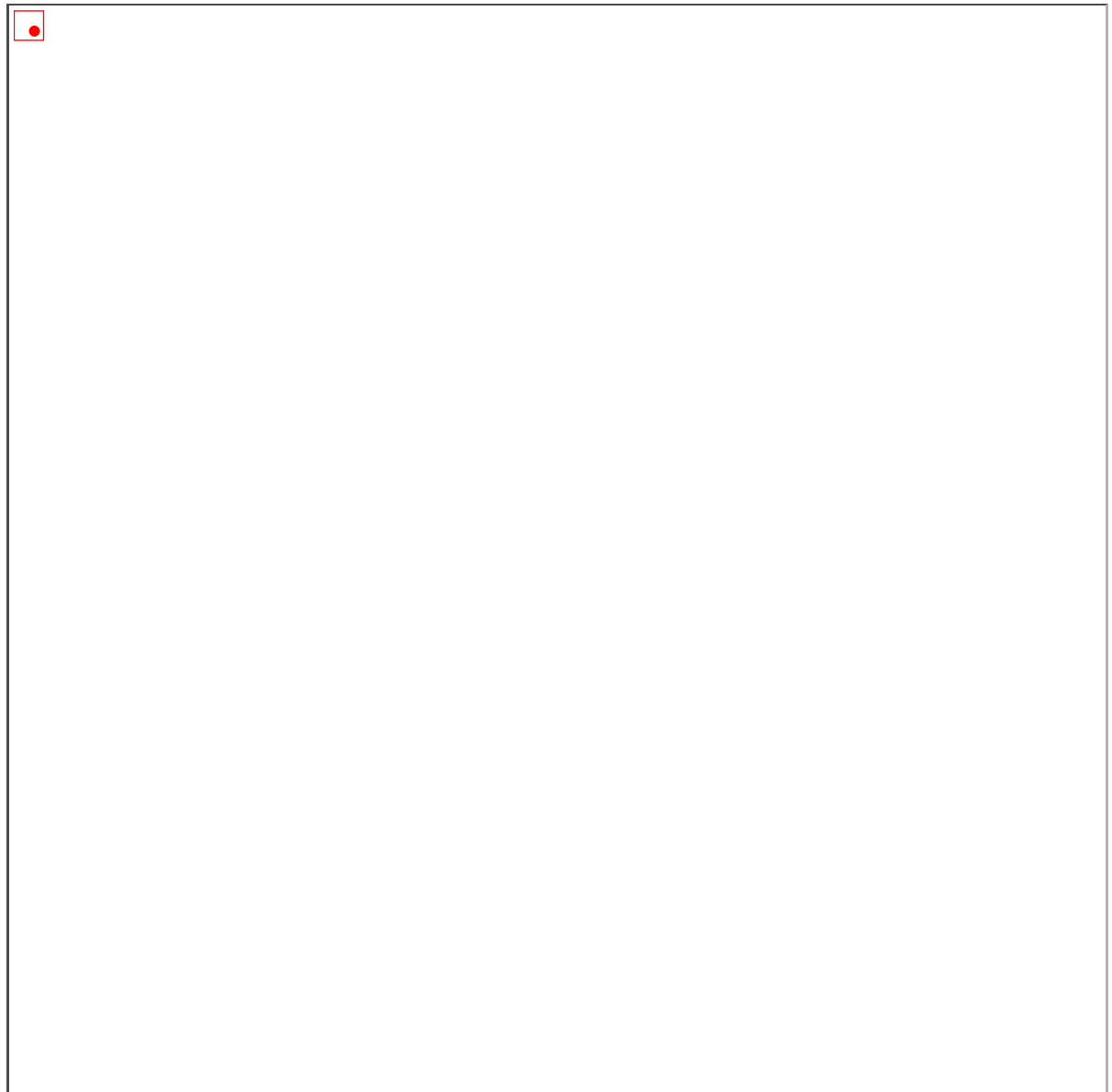
- `ST_ApproximateMedialAxis()`
- `ST_NPoints()`
- `ST_PointN()`
- `ST_ClosestPoint()`
- `ST_Dump()`
- `ST_LineMerge()`
- `ST_Collect()`

https://blog.rustprooflabs.com/2022/10/pgrouting-lines-through-polygons

ST_ApproximateMedialAxis()



Routing through Buildings



Routing through Buildings

Talk @ PostGIS Day 2022

https://blog.rustprooflabs.com/2022/11/route-the-interesting-things-postgis-day2022

https://www.youtube.com/watch?v=uydAoMaReos

Routing Challenge: Layers / Levels

OpenStreetMap has Layers

OpenStreetMap Layers v Levels

- Layers: Outside
- Levels: Inside

"When editing, the `layer=*` tag is used to describe vertical relationships between crossing or overlapping elements, e.g. a bridge over a street. For describing different floors within a building or multilevel parking decks use `level=*`."

https://wiki.openstreetmap.org/wiki/Layer

Routing Challenge: Layers

Examples

- Tunnels
- Bridges
- Multi-story buildings

Routing Challenge: Layers

OpenStreetMap `layer` data is messy

- `1`
- `2`
- `2;3`
- `-2--1`
- `1.5`
- `'C'`

Routing with OpenStreetMap

https://pgosm-flex.com/routing.html

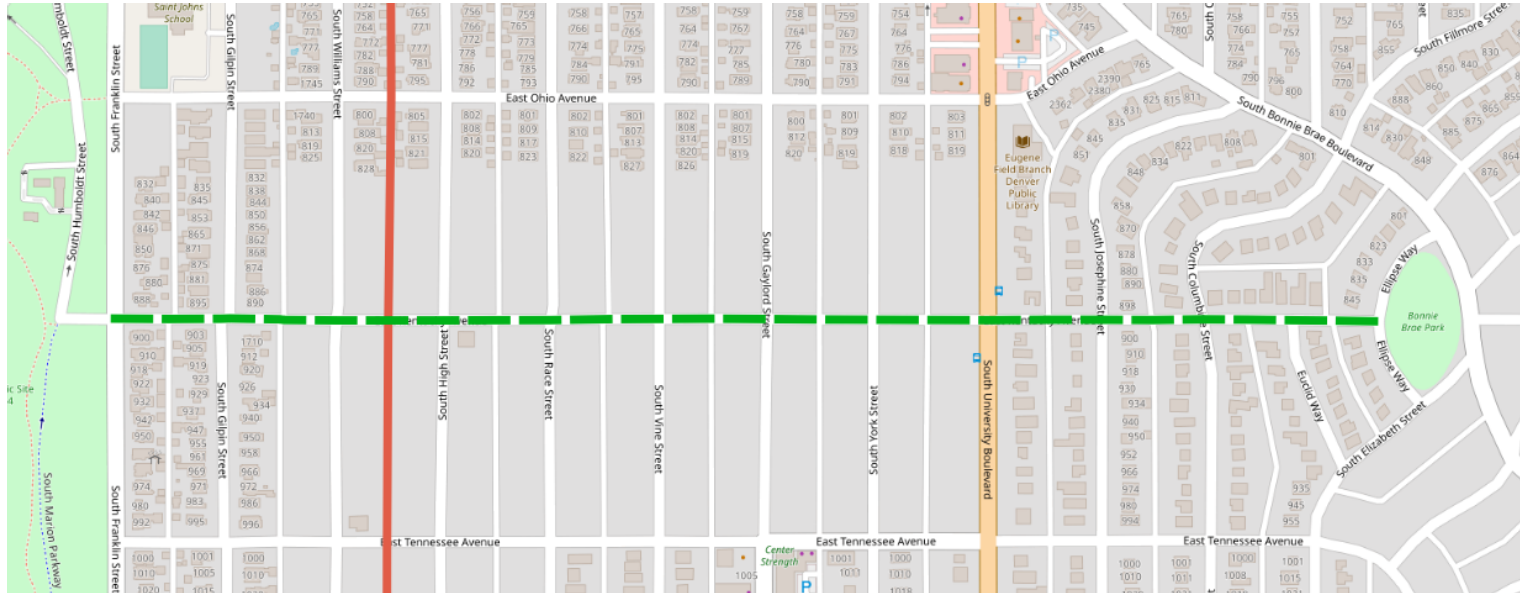
Routing with OpenStreetMap

> *Shameless plug: 4 of 18 chapters of Mastering PostGIS and OpenStreetMap are about routing!*

- Discount Code: PASS2023
- 25% off

https://postgis-osm.com

Challenge: Long Lines



Mastering PostGIS and OpenStreetMap, Figure 14.5 Roads that intersect in the middle cannot be routed

Challenge: Long Lines

- pgRouting has a solution!
- `pgr_NodeNetwork()` splits lines

Challenge: Long Lines

- pgRouting has a solution!
- `pgr_NodeNetwork()` splits lines
- Creates false intersections

pgRouting Preparation

pgRouting Preparation

- Limit rows
- `MULTILINESTRING` --> `LINESTRING`
- Split long lines for proper routing
- Remove false positives (level/layer)
- Build routing network

Brain Break: 3 - 5 minute

Routing Performance Tips

- Use less data!
- Filter Early, Filter Often
- Temp tables, side tables... Index them!

Node selection for routing

- Tricky
- Custom Functions save the day

PostGIS Trajectories

- `ST_MakePointM()` https://postgis.net/docs/ST_MakePointM.html
- `ST_DistanceCPA()` https://postgis.net/docs/ST_DistanceCPA.html
- `twCentroid()` https://docs.mobilitydb.com/MobilityDB/develop/ch05s12.html#twCentroid

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https://blog.rustprooflabs.com/2020/11/postgis-trajectory-intro

Mobility DB

- `|=|` (smallest distance)
- `nearestApproachInstant()`

https://mobilitydb.com/

https://blog.rustprooflabs.com/2023/08/postgis-mobility-db

Questions?