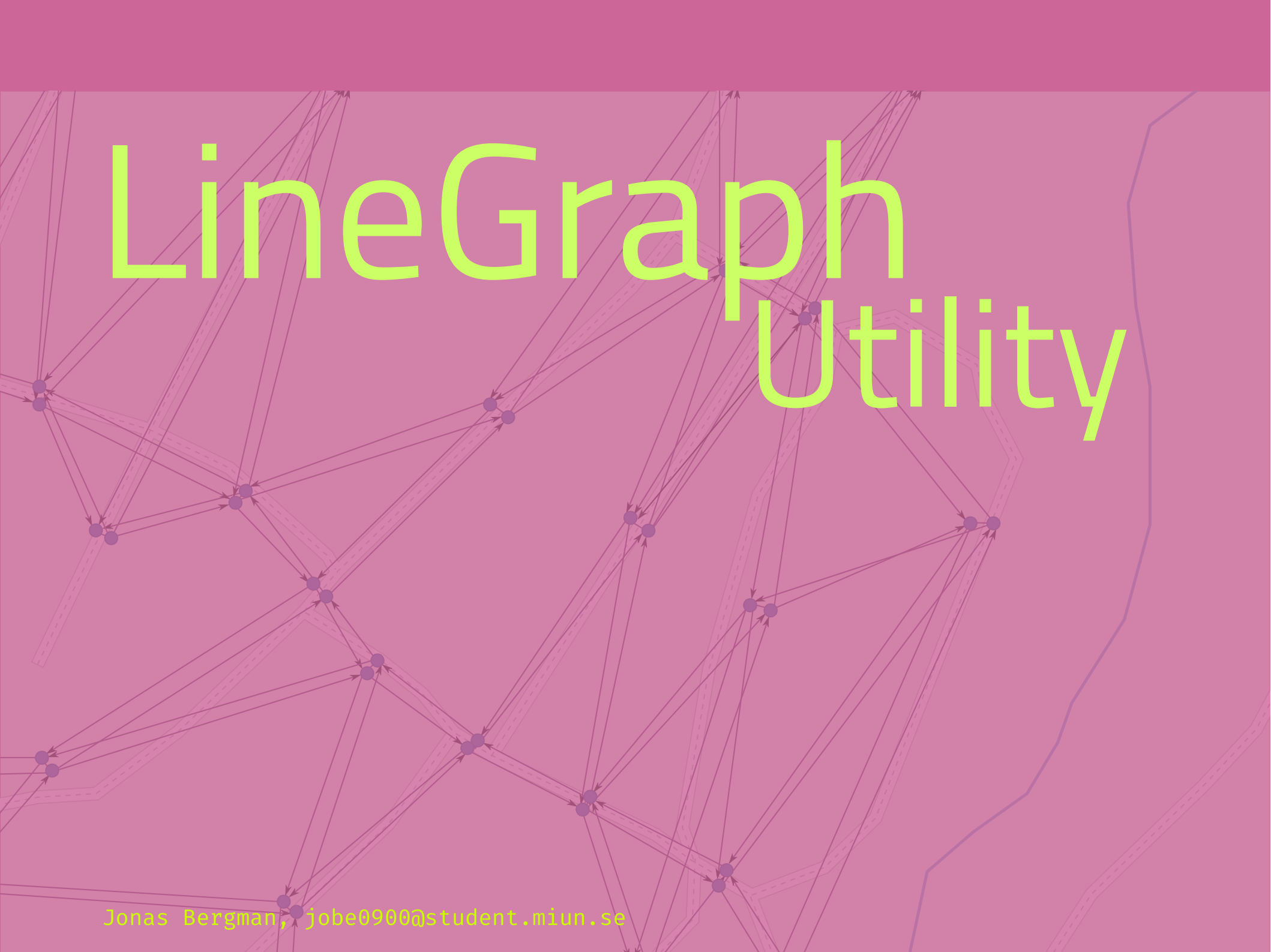
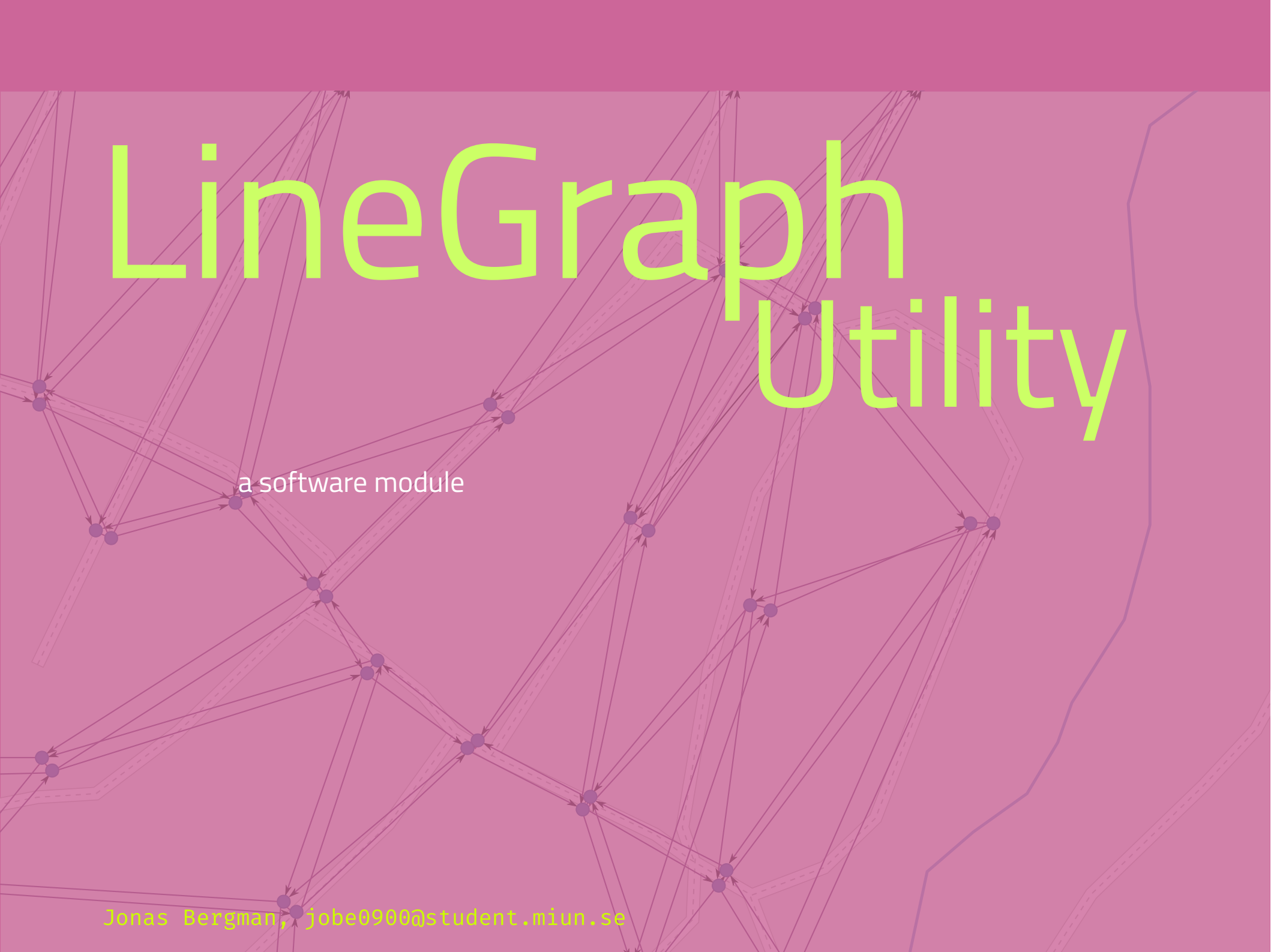


LineGraph Utility

The background of the slide features a light purple map of a road network. Overlaid on this map is a complex graph structure. The graph consists of numerous small, dark purple circular nodes. These nodes are interconnected by a dense web of thin, dark purple lines representing edges. The nodes are positioned at various points along the road network, often at intersections or along straight segments. The edges connect these nodes in a way that suggests a flow or relationship between different parts of the network. The overall aesthetic is technical and data-oriented.

LineGraph Utility

The background of the slide features a complex directed graph. Nodes are represented by small purple circles, and edges are thin black lines with arrowheads indicating direction. The graph is dense and interconnected, with some nodes having multiple incoming and outgoing edges. The overall aesthetic is technical and network-oriented.

a software module

LineGraph Utility

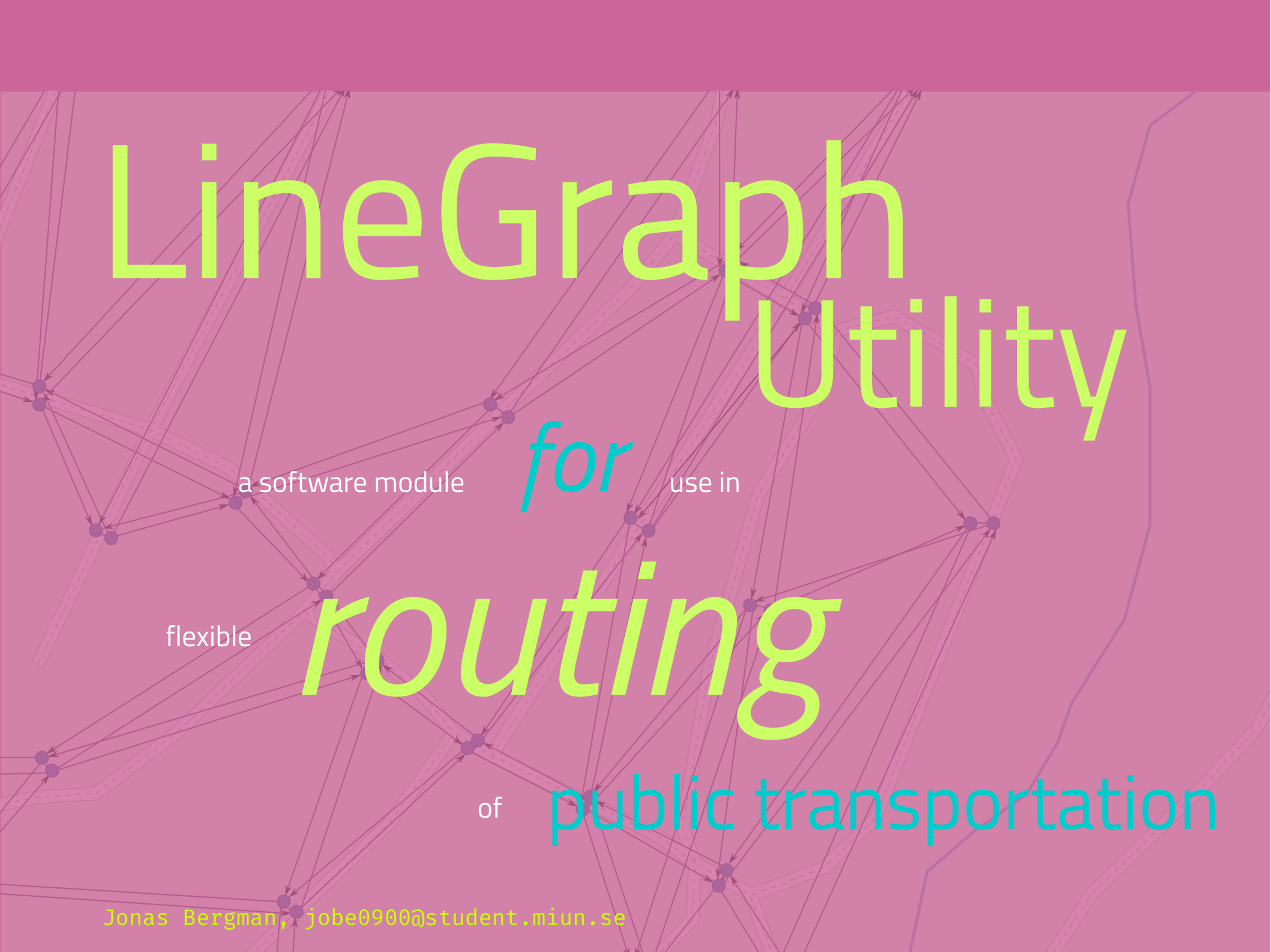
a software module

for

use in

flexible

routing



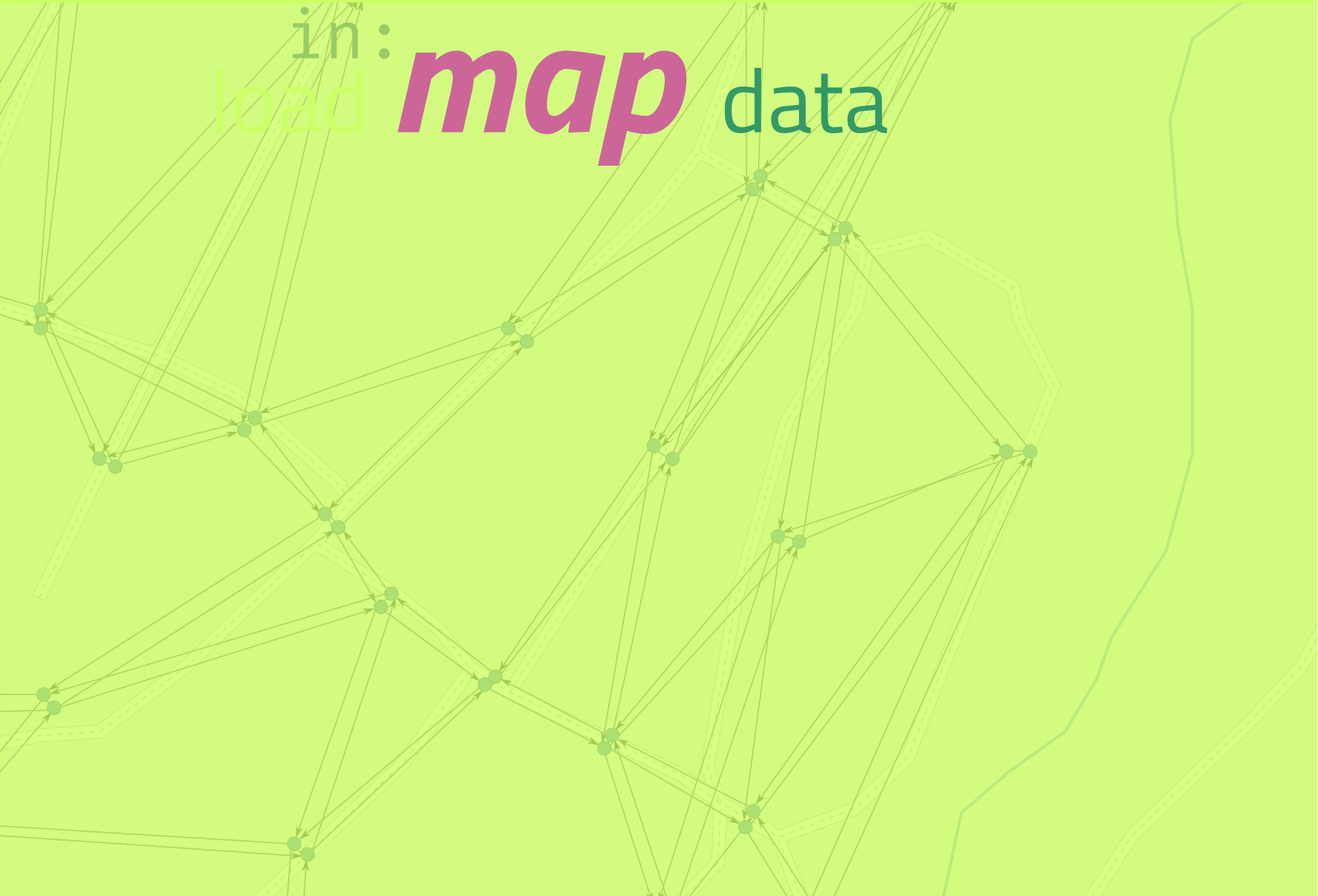
LineGraph Utility *for* *routing* of public transportation

a software module use in
flexible

requirements



in:
load *map* data



in:
load *map* data

out:
build *line graph*

1 load *map* data

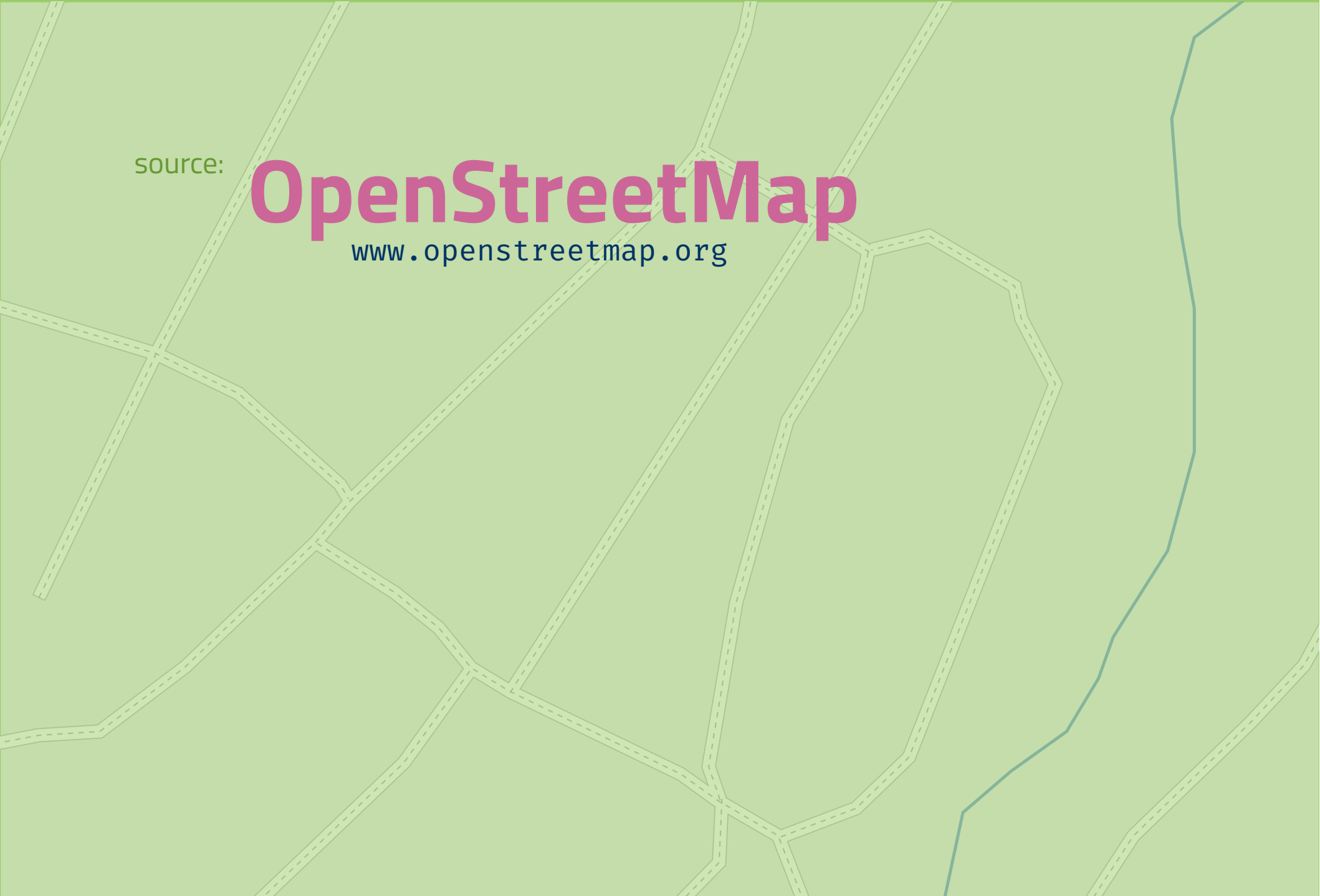
1. map



1. map

source:

OpenStreetMap
www.openstreetmap.org



1. map

source:

OpenStreetMap

www.openstreetmap.org

store:

PostGIS

www.postgis.net

1. map

source:

OpenStreetMap

www.openstreetmap.org

store:

PostGIS

PostgreSQL + spatial data extension

www.postgis.net

1. map

source:

OpenStreetMap

www.openstreetmap.org

load:

```
$ osm2pgsql
```

store:

PostGIS

www.postgis.net

PostgreSQL + spatial data extension

1. map

source:

OpenStreetMap

www.openstreetmap.org

load:

```
$ osm2pgsql -U user -d map_db -s -k mapdata.osm
```

store:

PostGIS

www.postgis.net

PostgreSQL + spatial data extension

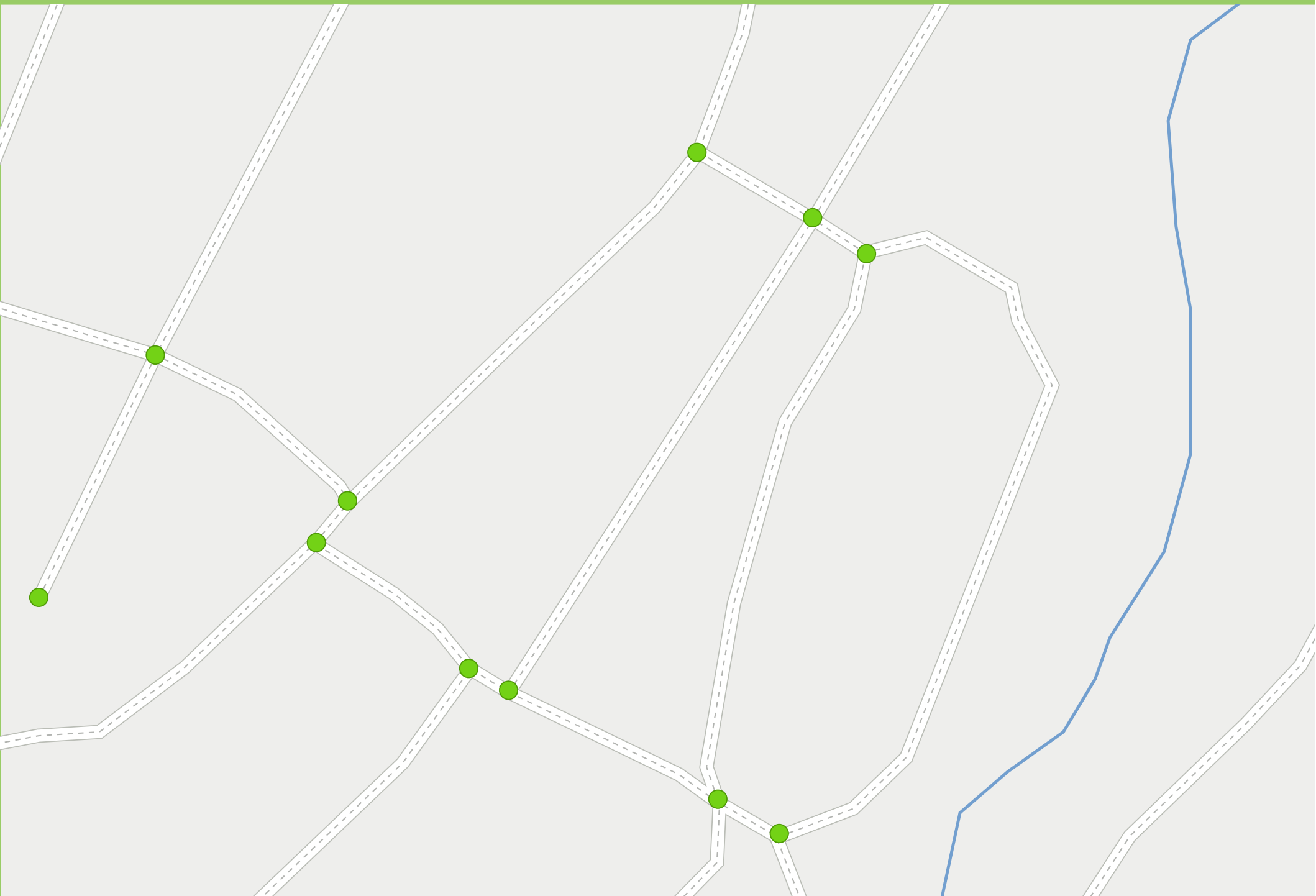
1 load *map* data

2 build *topology*

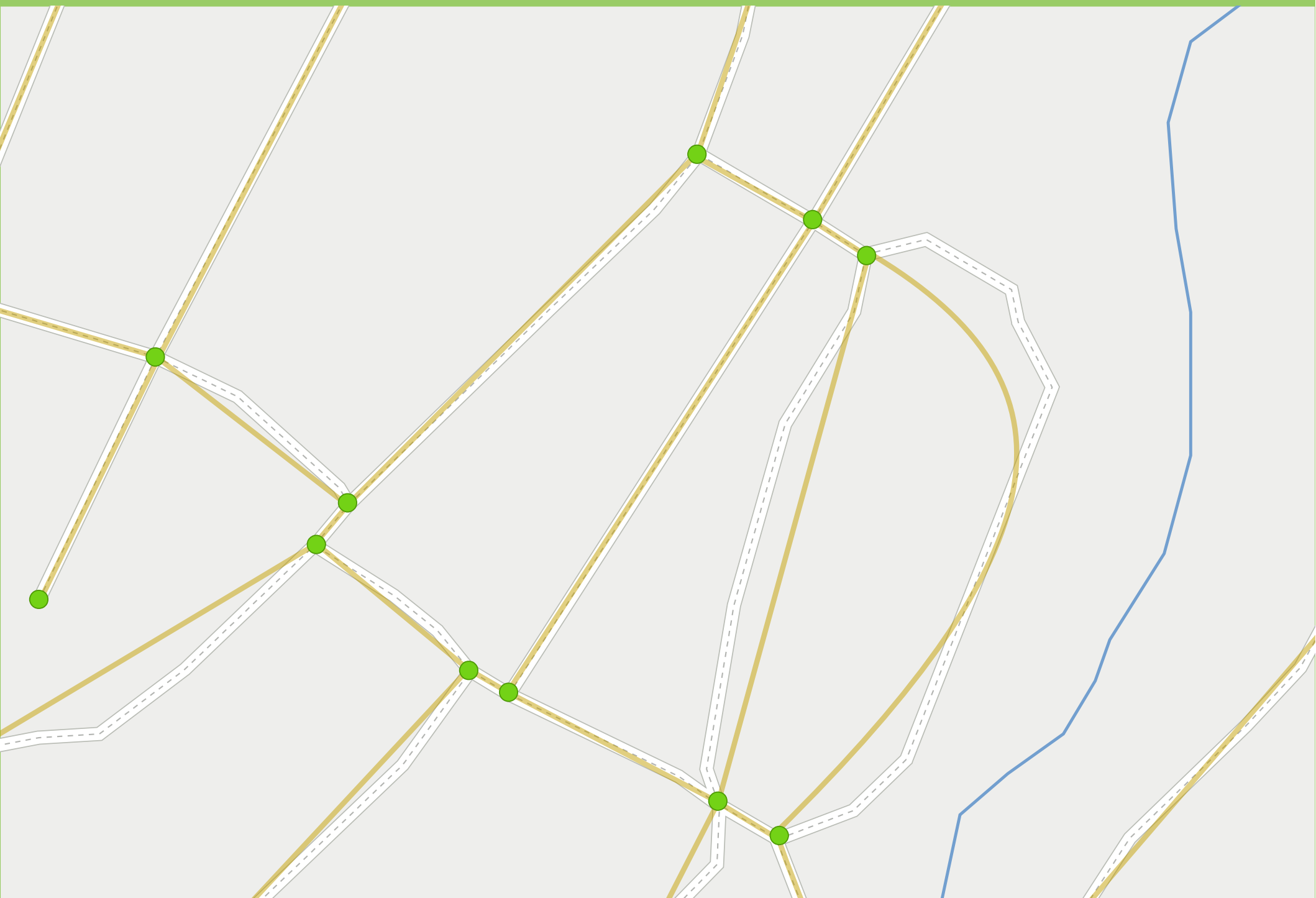
2. topology



2. topology



2. topology



2. topology



2. topology



2. topology



2. topology

tool:

postgis_topology



1 load *map* data

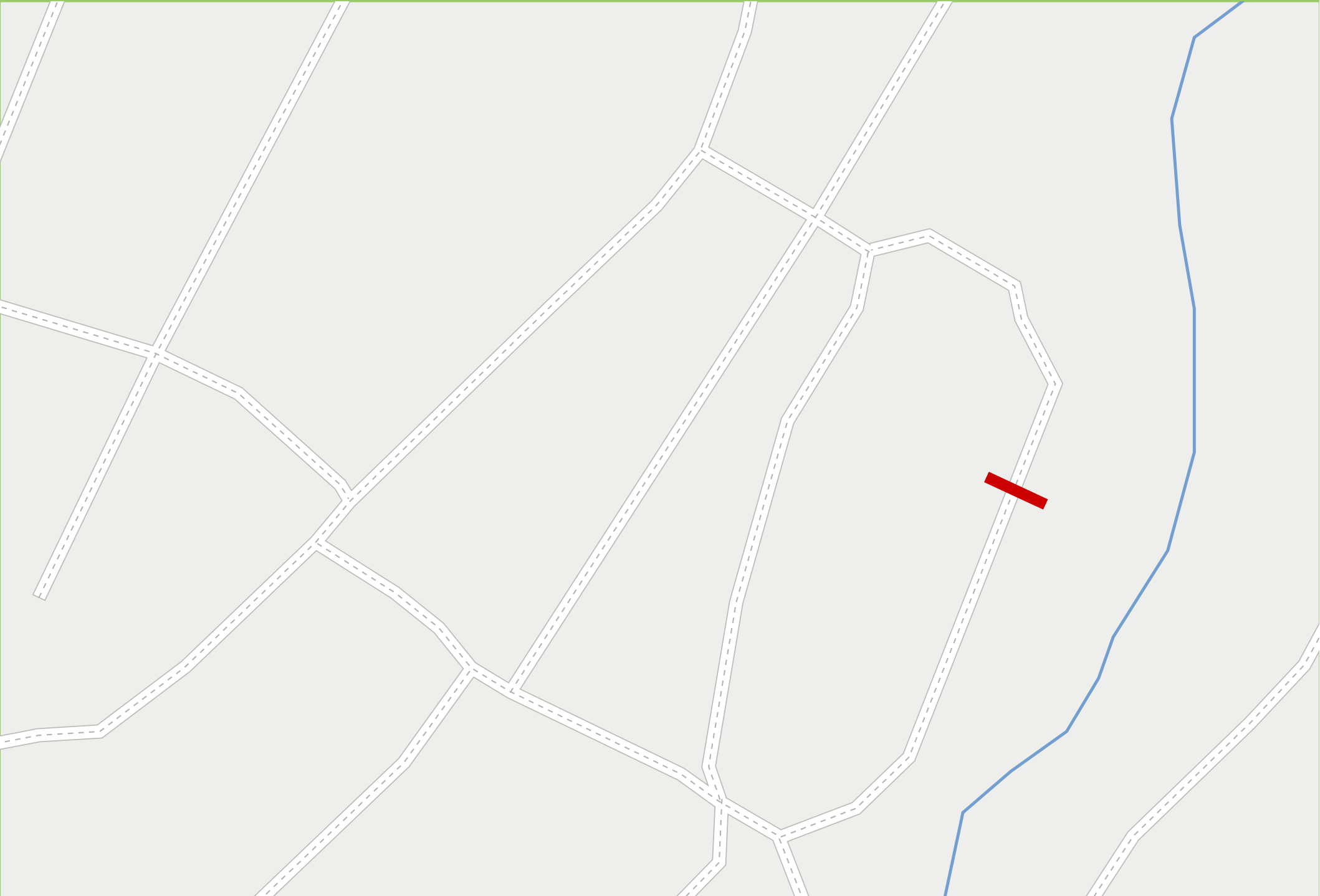
2 build *topology*

3 apply *restrictions*

3. restrictions



3. restrictions



3. restrictions



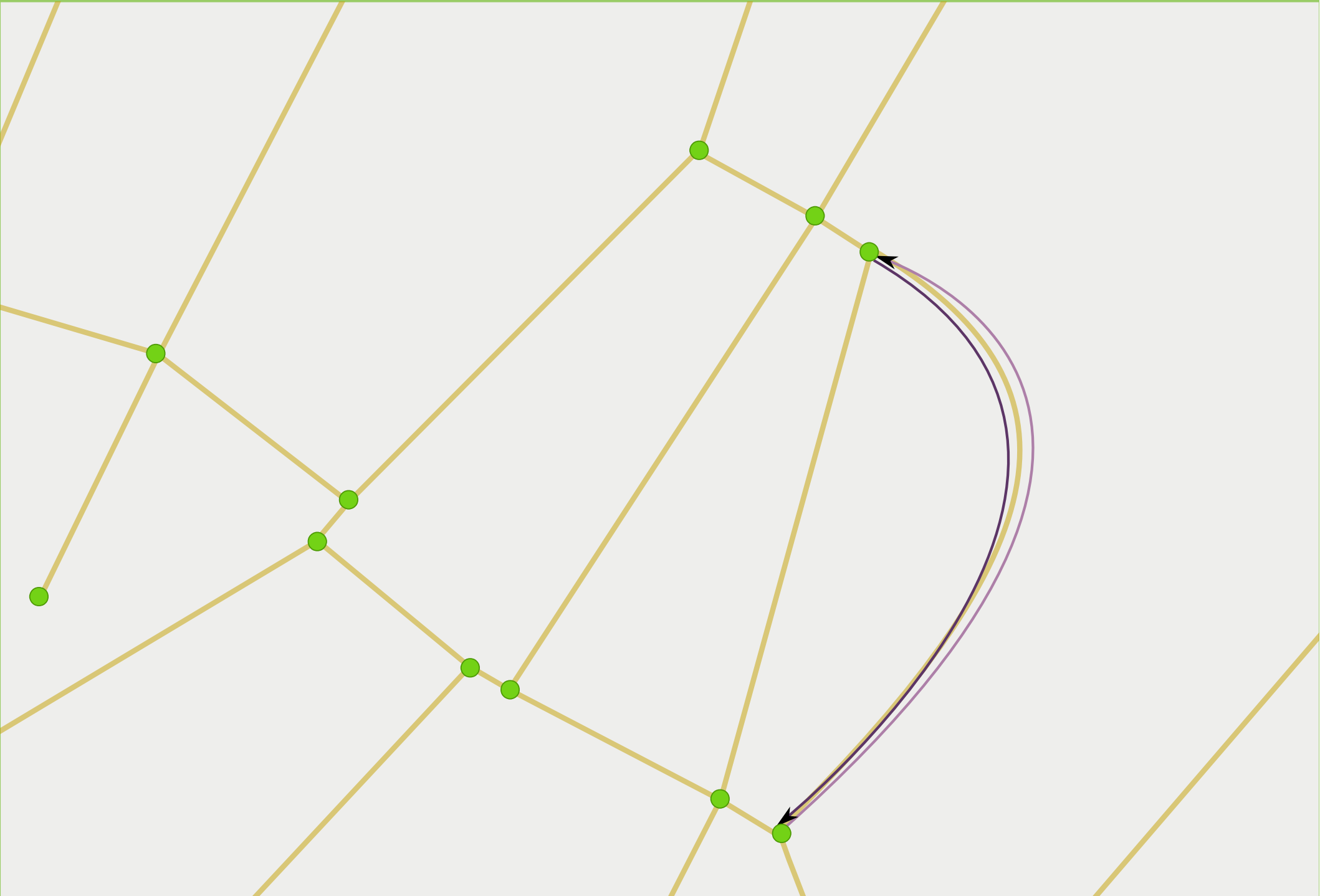
3. restrictions (directed graph)



3. restrictions (directed graph)



3. restrictions (directed graph)



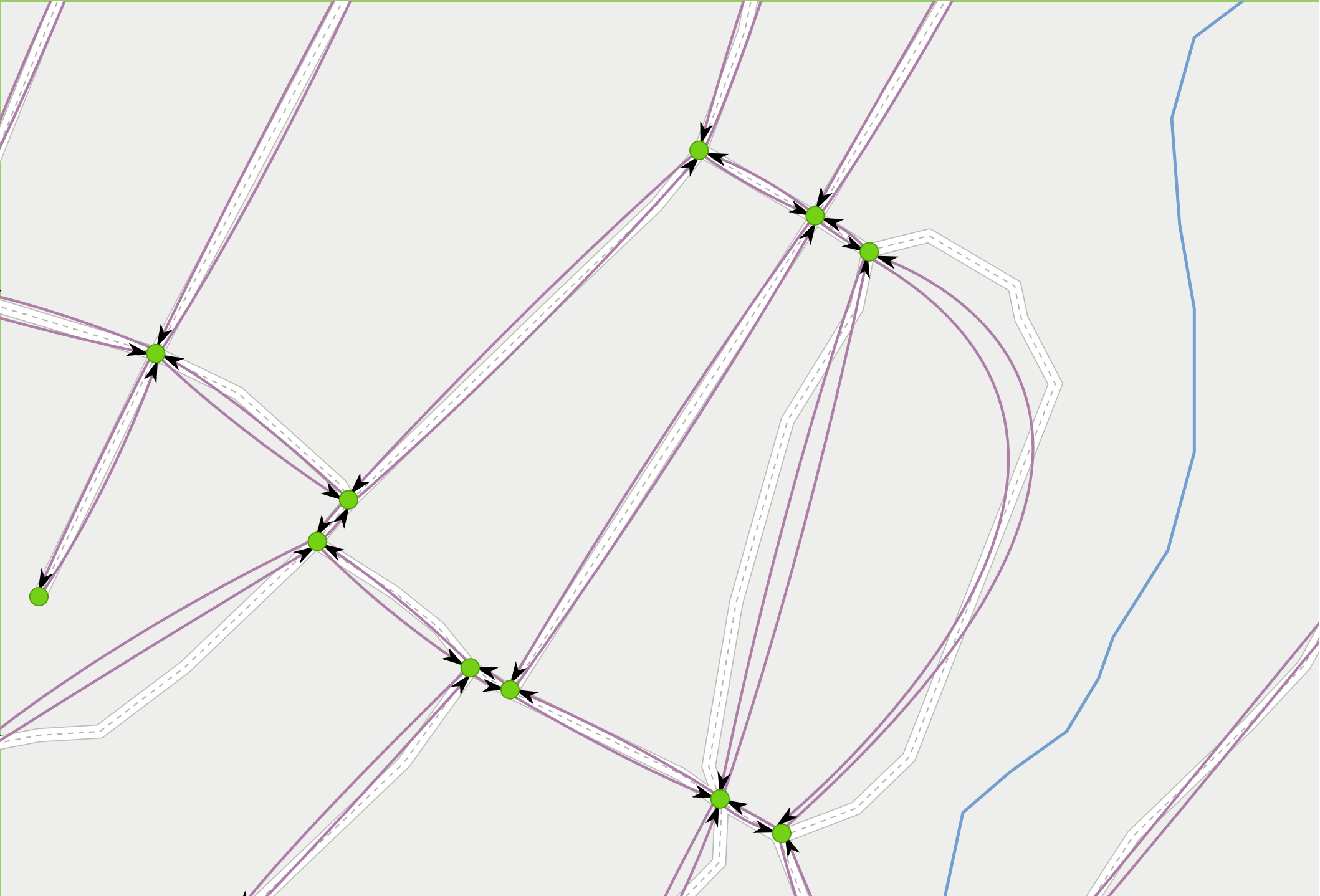
3. restrictions (directed graph)



3. restrictions (directed graph)



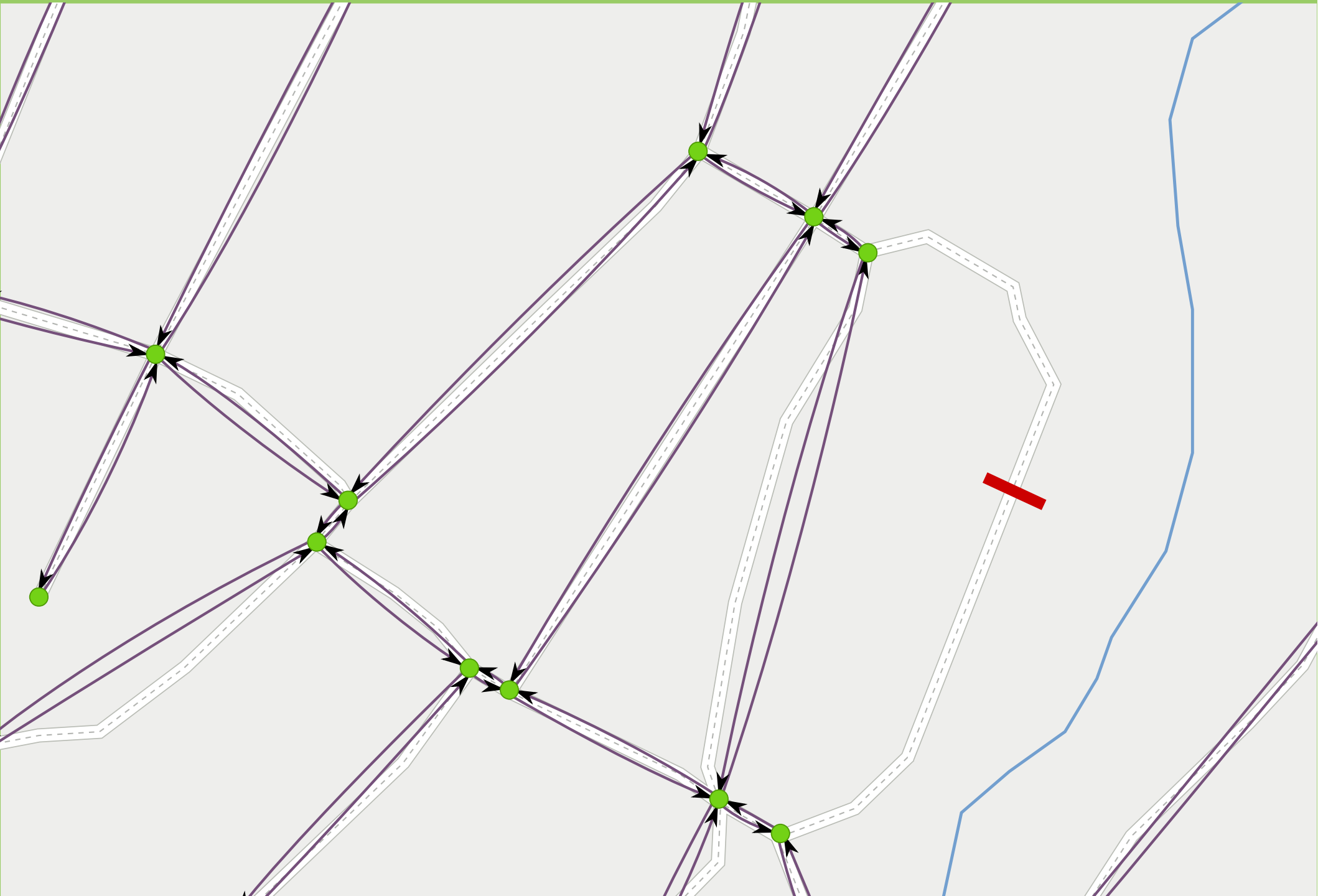
3. restrictions (directed graph)



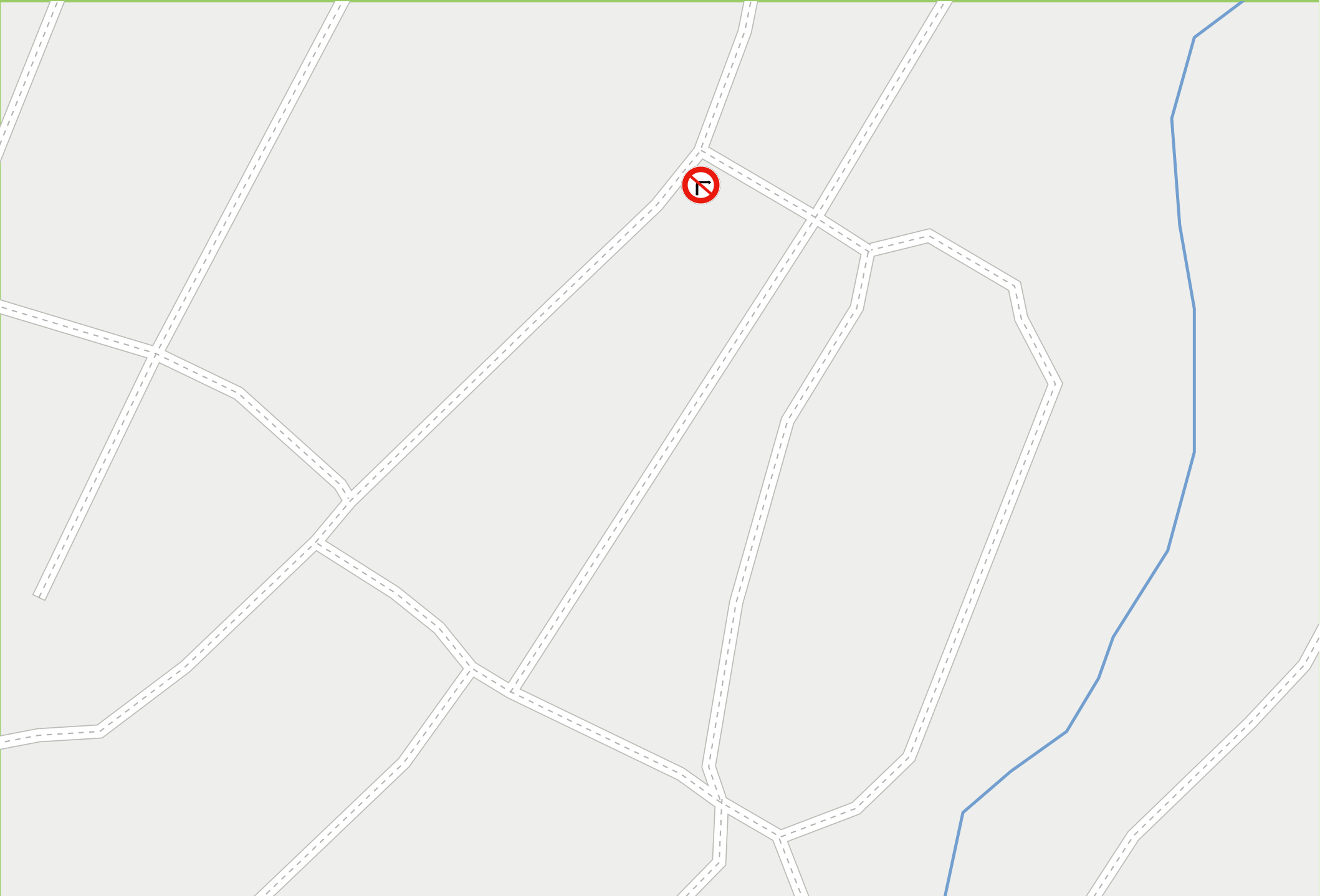
3. restrictions



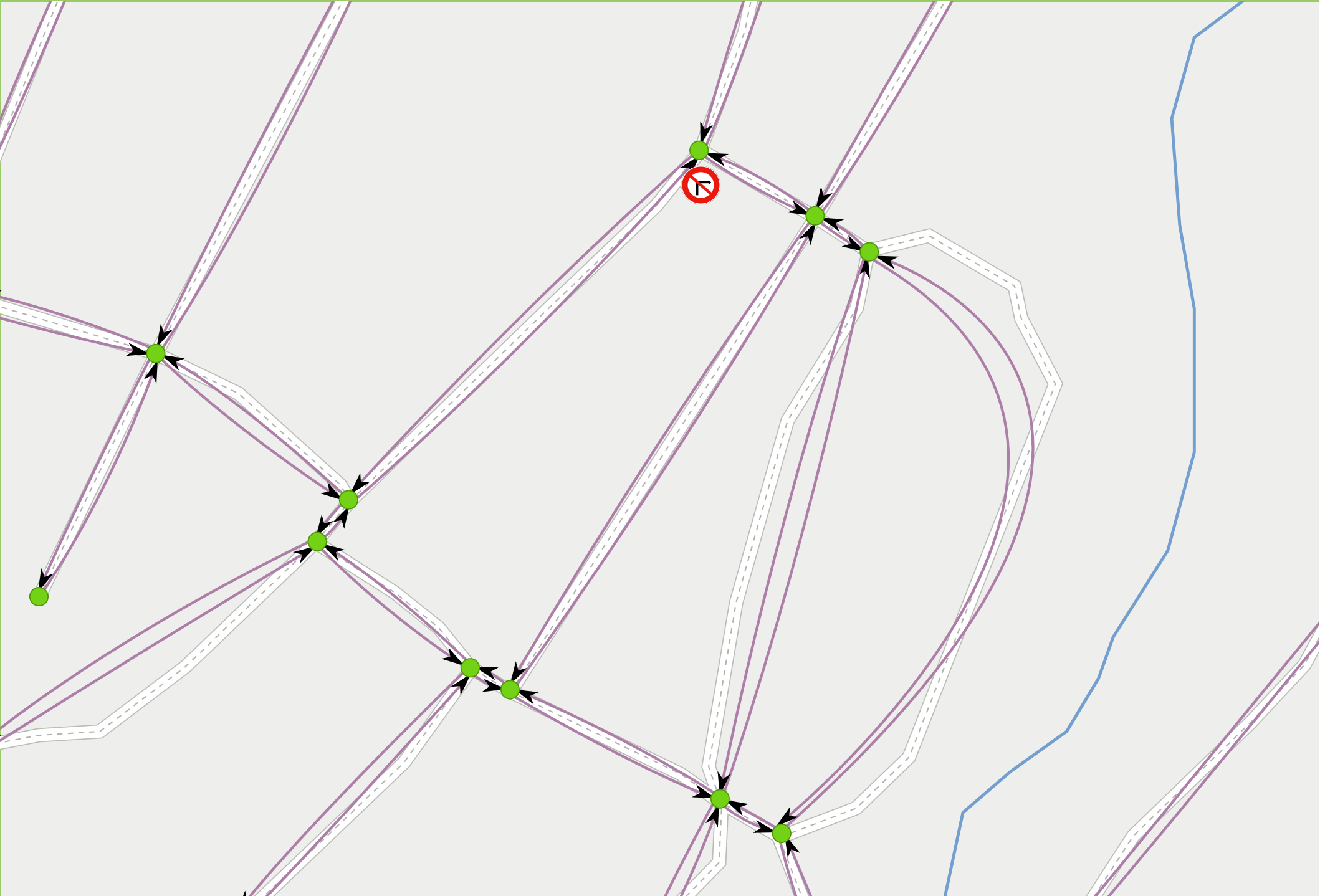
3. restrictions



3. restrictions



3. restrictions



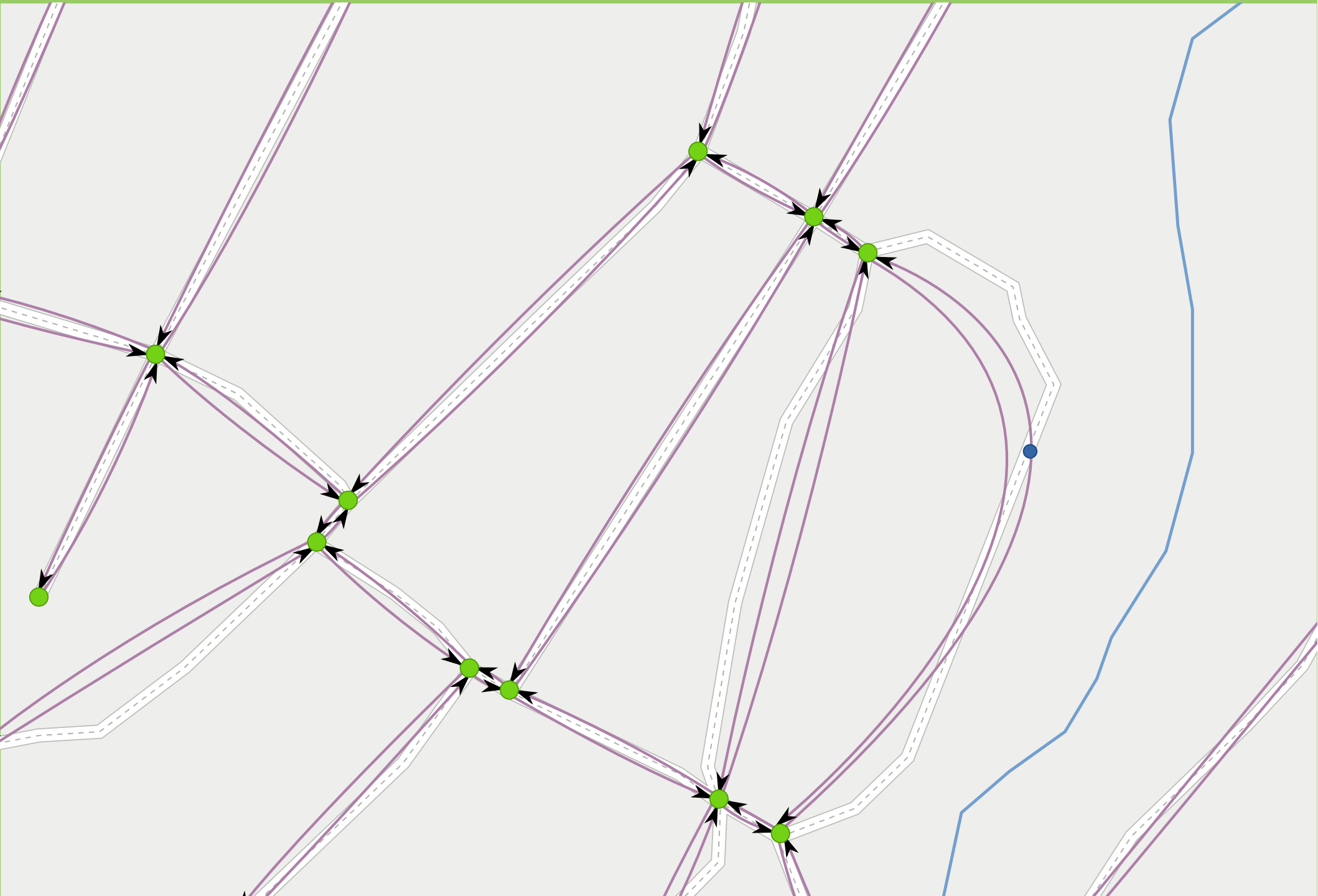
1 load *map* data

2 build *topology*

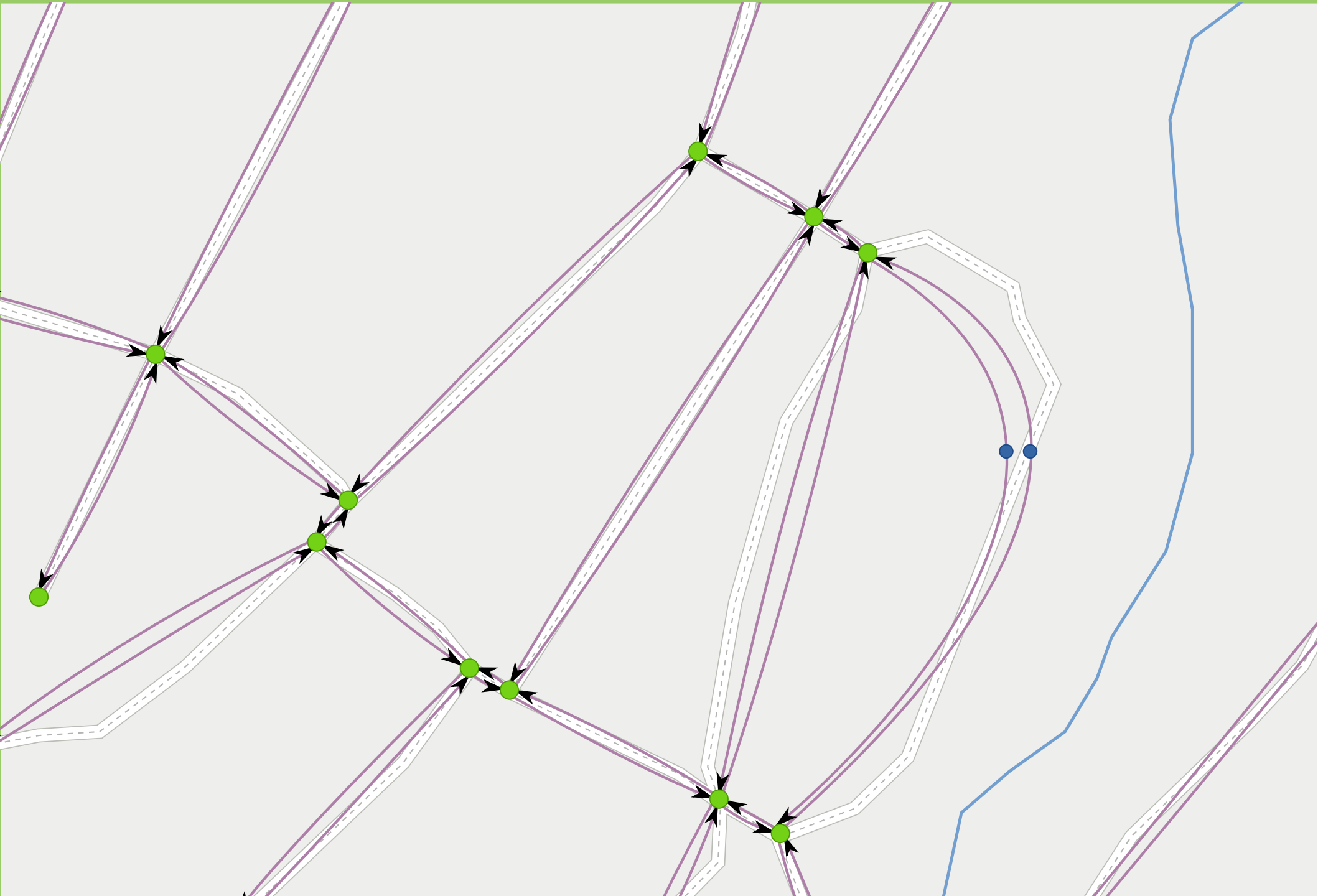
3 apply *restrictions*

4 build *line graph*

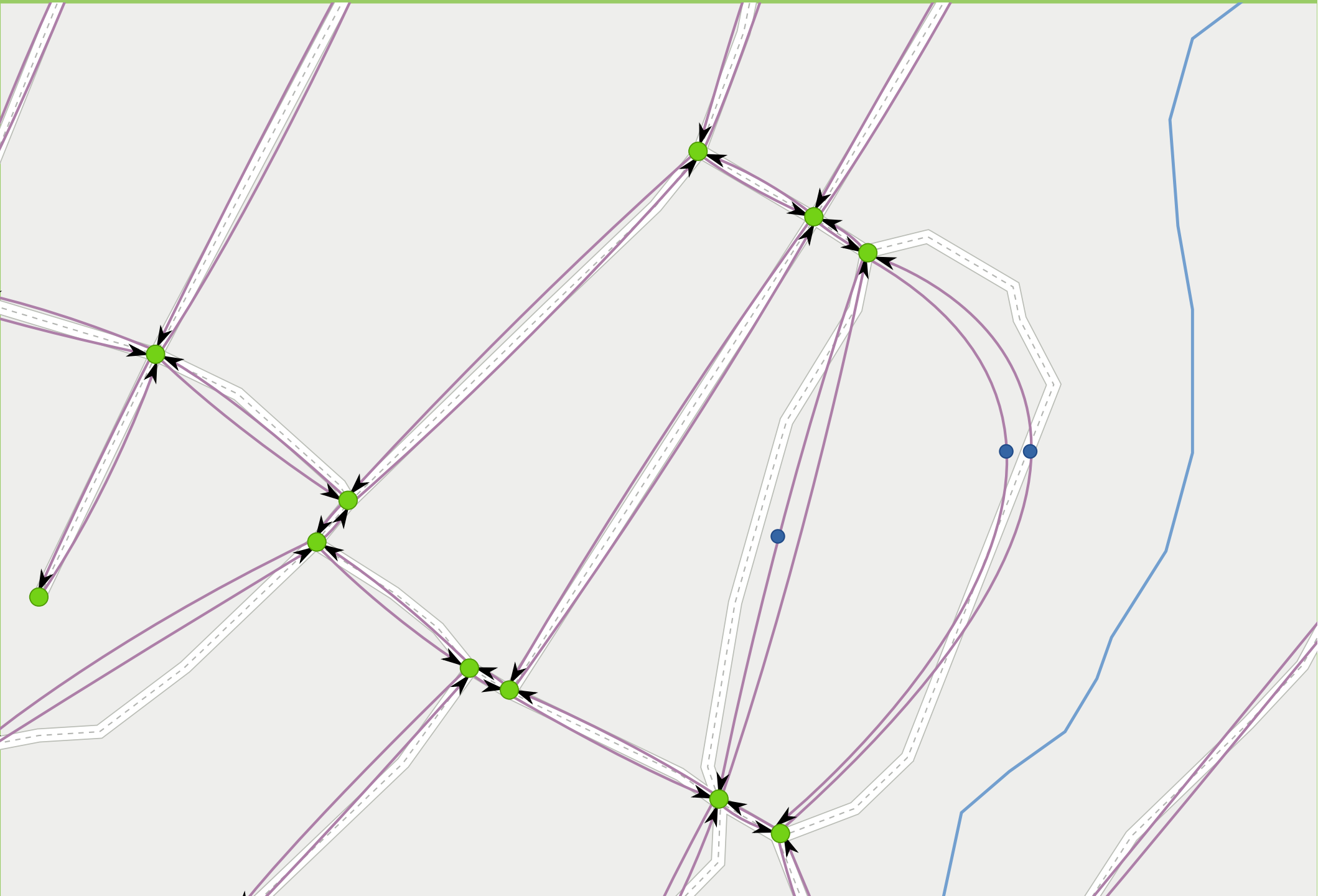
4. line graph



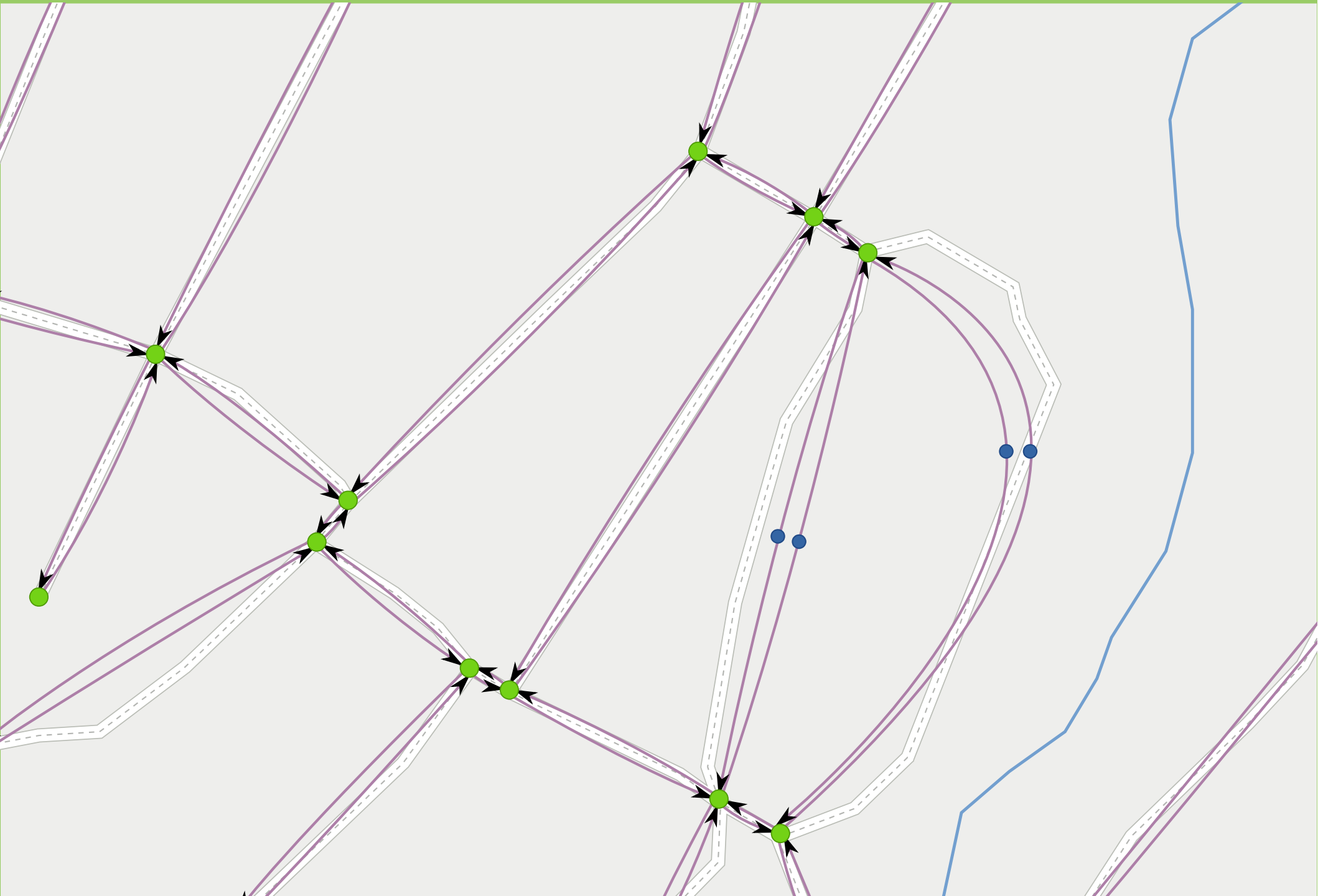
4. line graph



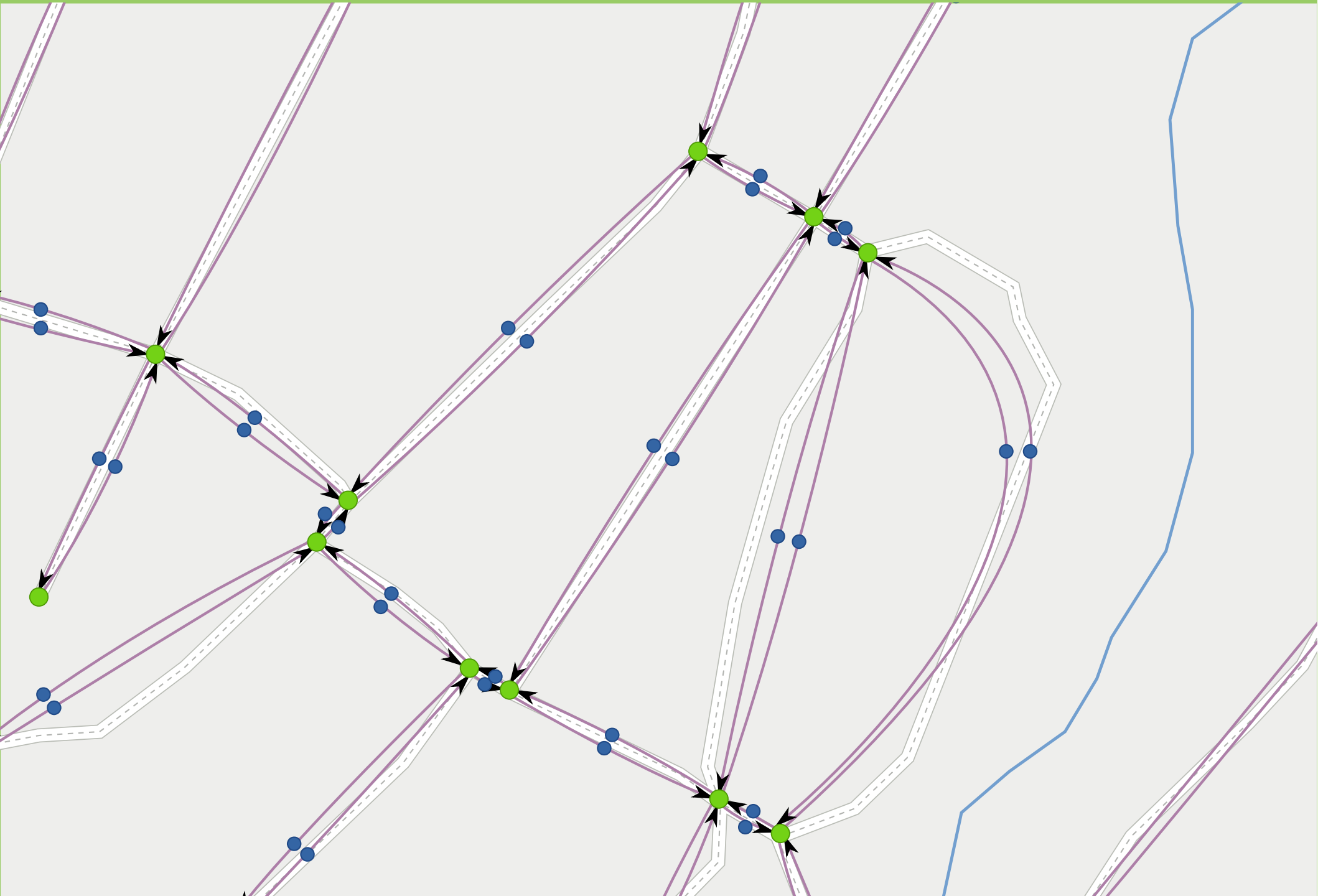
4. line graph



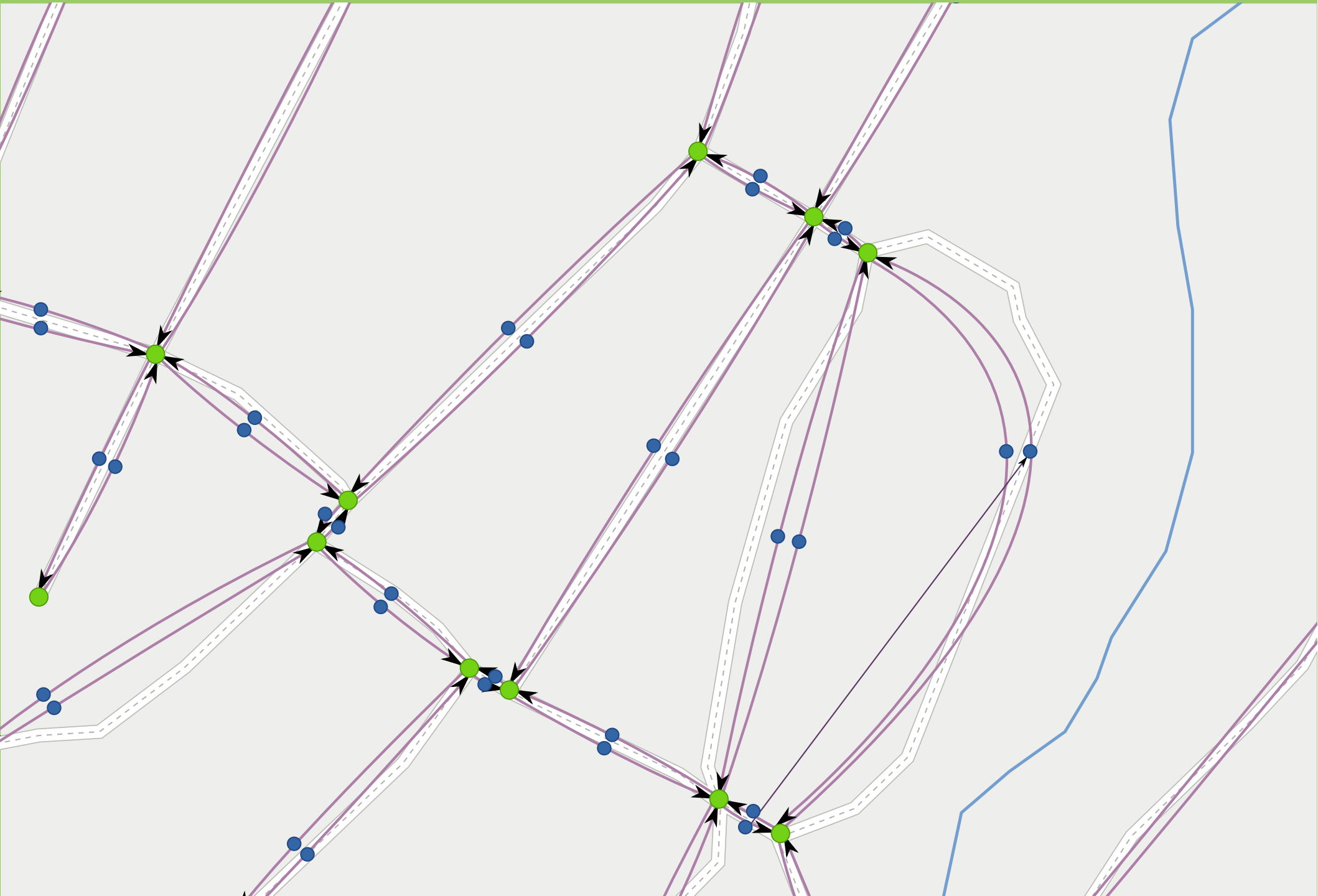
4. line graph



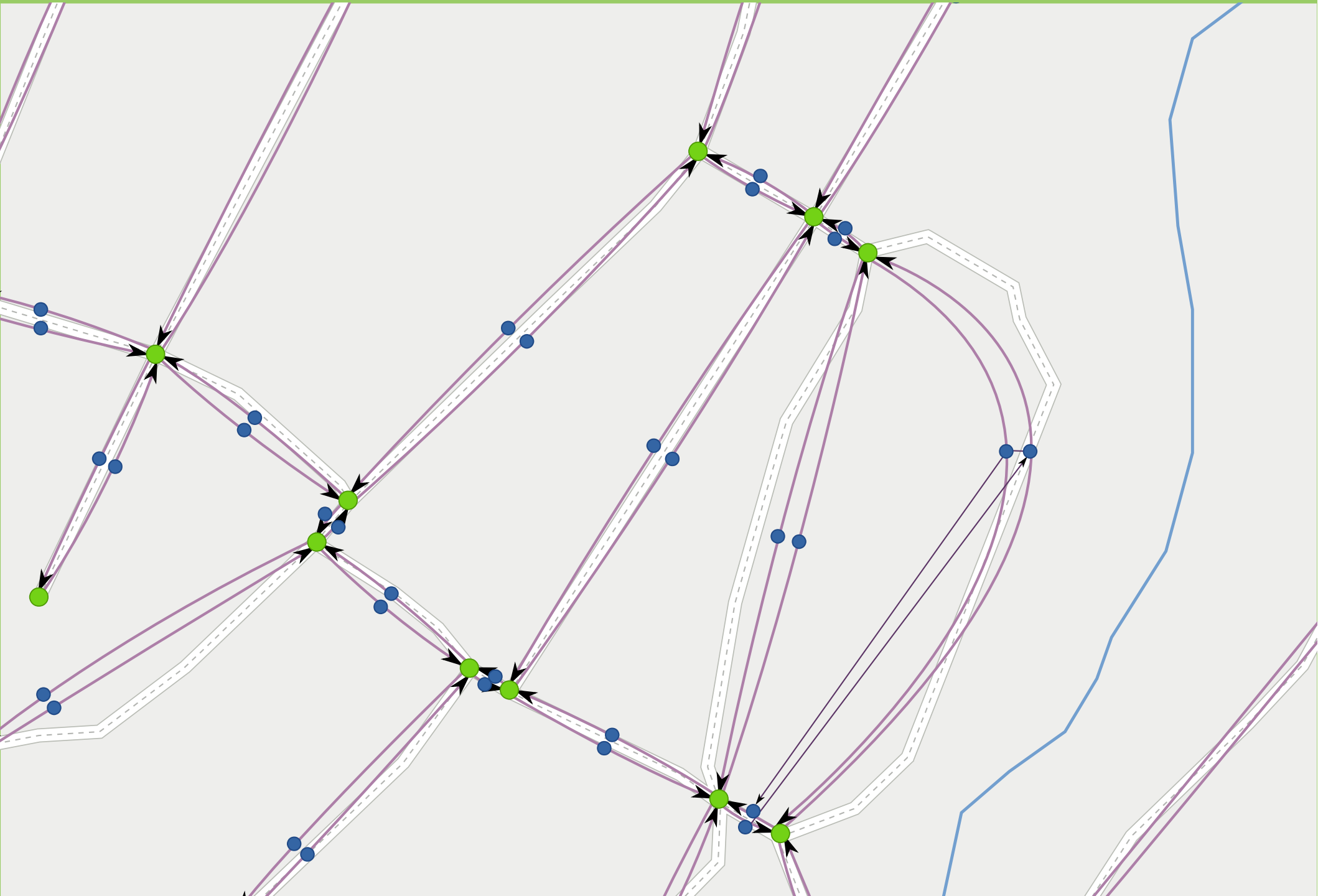
4. line graph



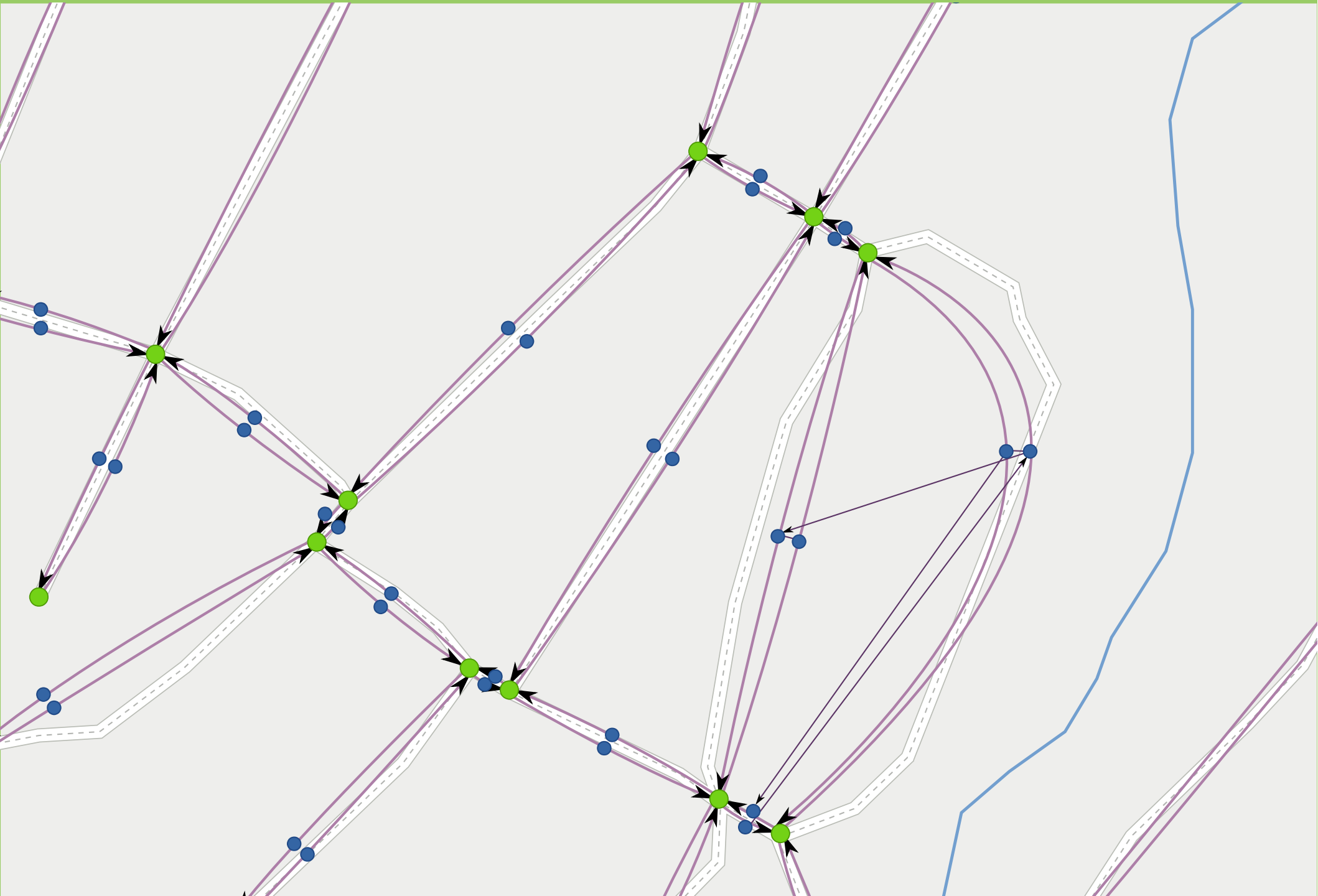
4. line graph



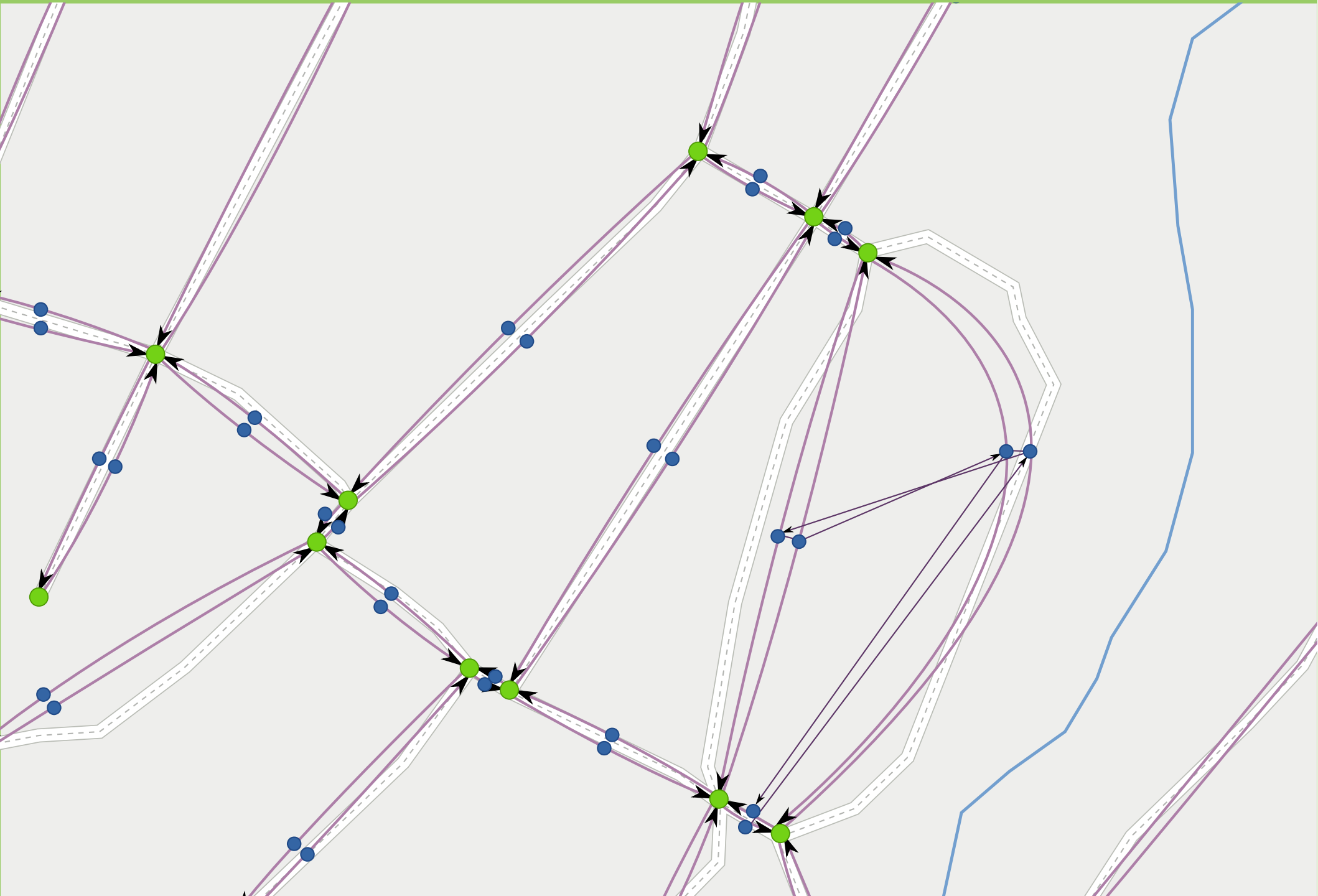
4. line graph



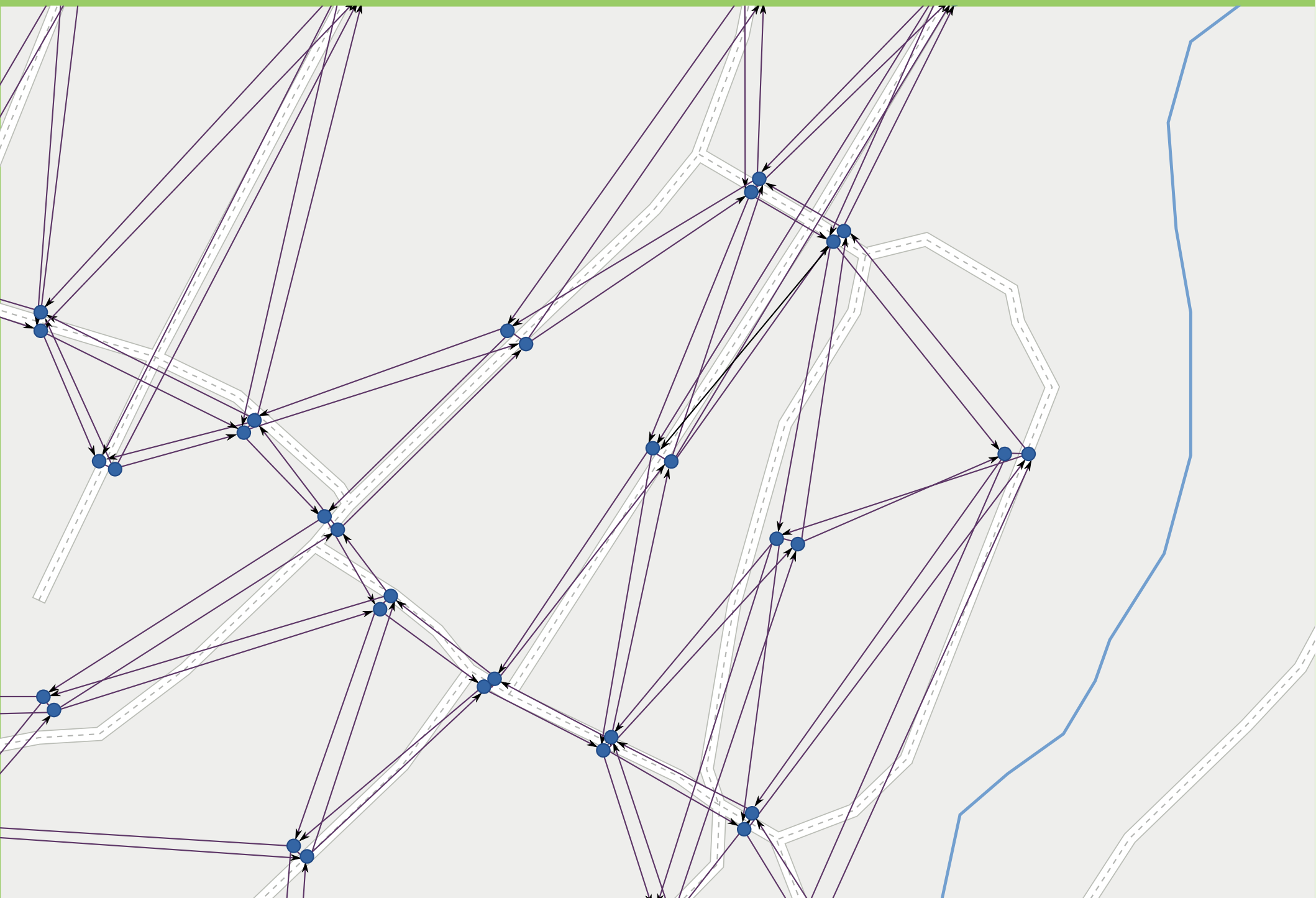
4. line graph



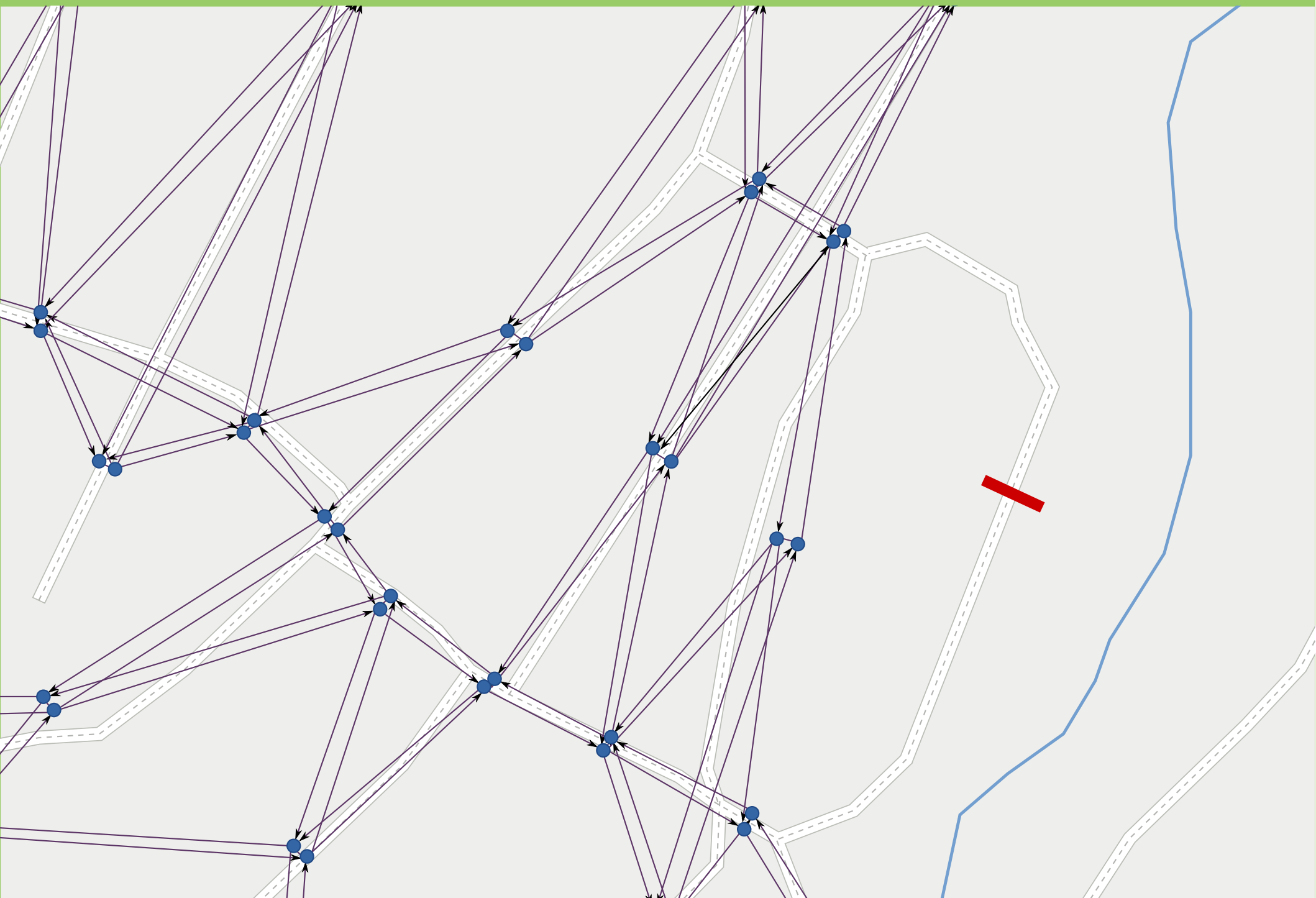
4. line graph



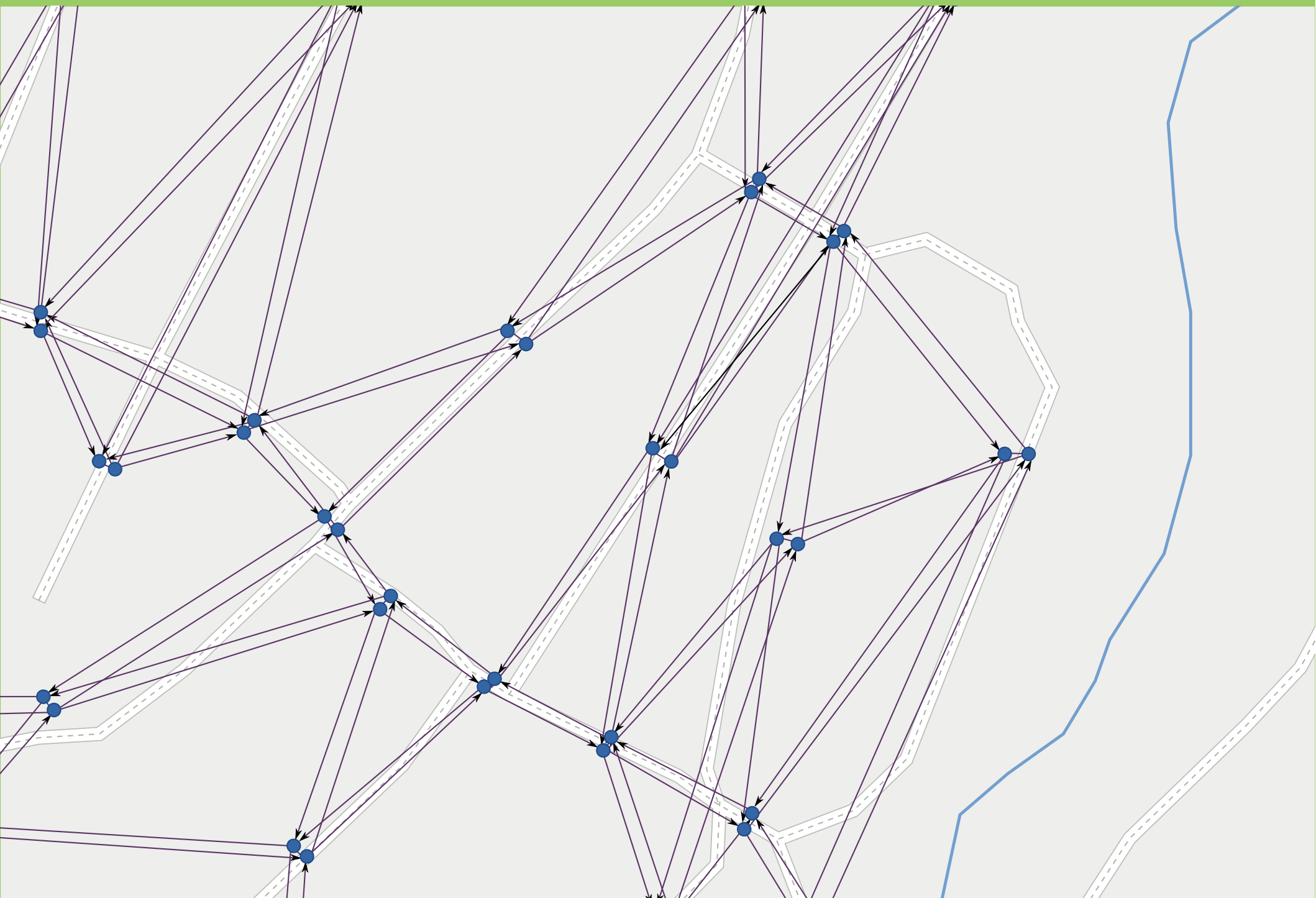
4. line graph



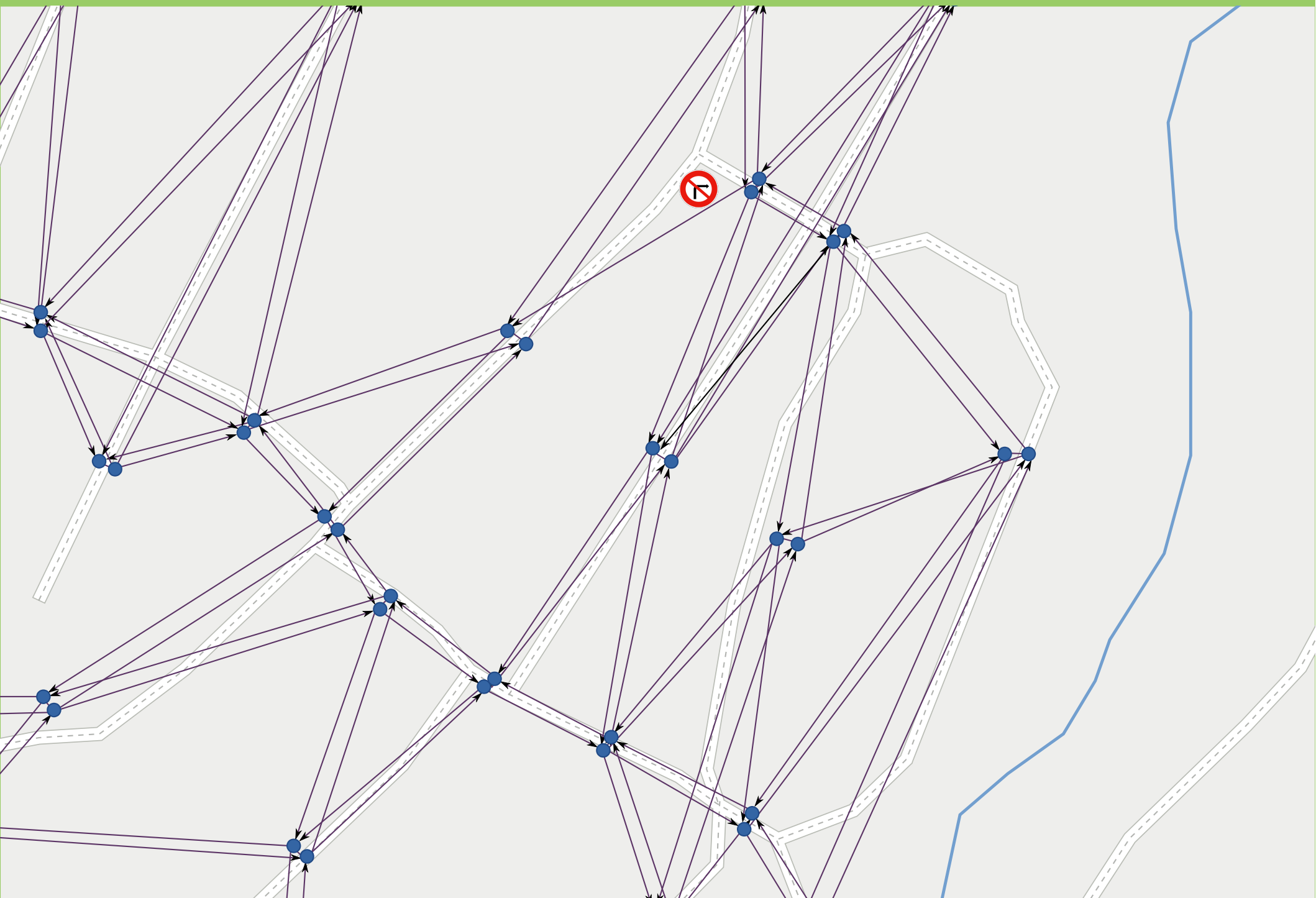
4. line graph



4. line graph



4. line graph



4. line graph

tool:

Boost graph library

```
typedef boost::adjacency_list  
    < boost::listS, boost::vecS, boost::directedS,  
        LineGraphNode, LineGraphLine >  
    LineGraphType;
```



remarks

preliminary

preliminary

load *map* data

preliminary

load *map* data

build *topology*

preliminary

load *map* data

build *topology*

on demand

preliminary

load *map* data

build *topology*

on demand

apply *restrictions*

preliminary

load *map* data

build *topology*

on demand

apply *restrictions*

build *line graph*

configurable

configurable

json

file
for

settings

configurable

json

file
for

settings

database

configurable

json

file
for

settings

database, vehicle properties

configurable

json

file
for

settings

database, vehicle properties,
road speeds

configurable

json

file
for

settings

database, vehicle properties,
road speeds, surfaces

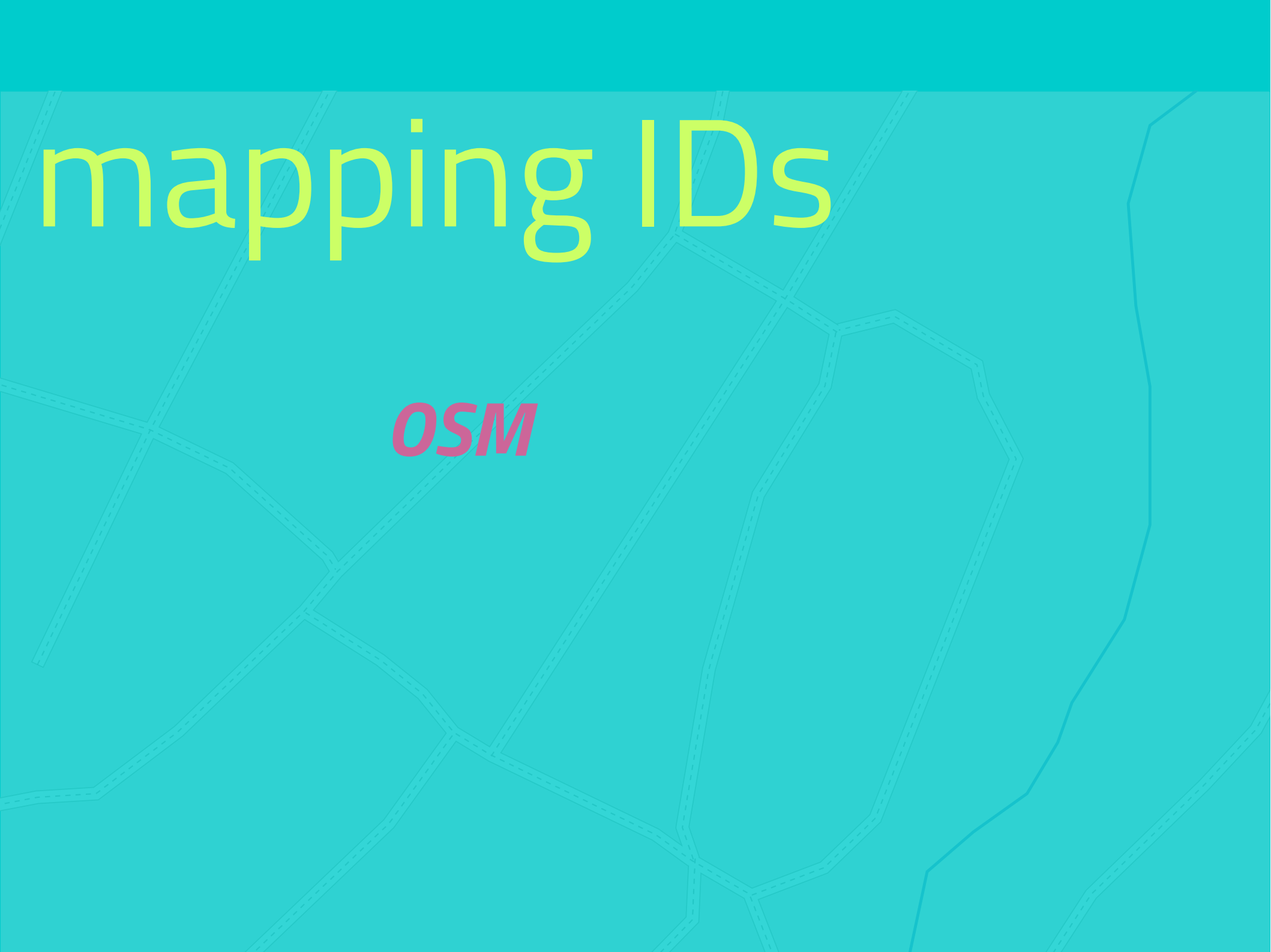
configurable

json

file
for

settings

database, vehicle properties,
road speeds, surfaces,
restrictions and costs, ...



mapping IDs

OSM

mapping IDs

An abstract network diagram is overlaid on a teal background. It consists of several thin green lines that intersect at various points, creating a web-like structure. At these intersection points, there are small green circular nodes. The lines and nodes are distributed across the frame, with a higher density in the lower-left and upper-right areas.

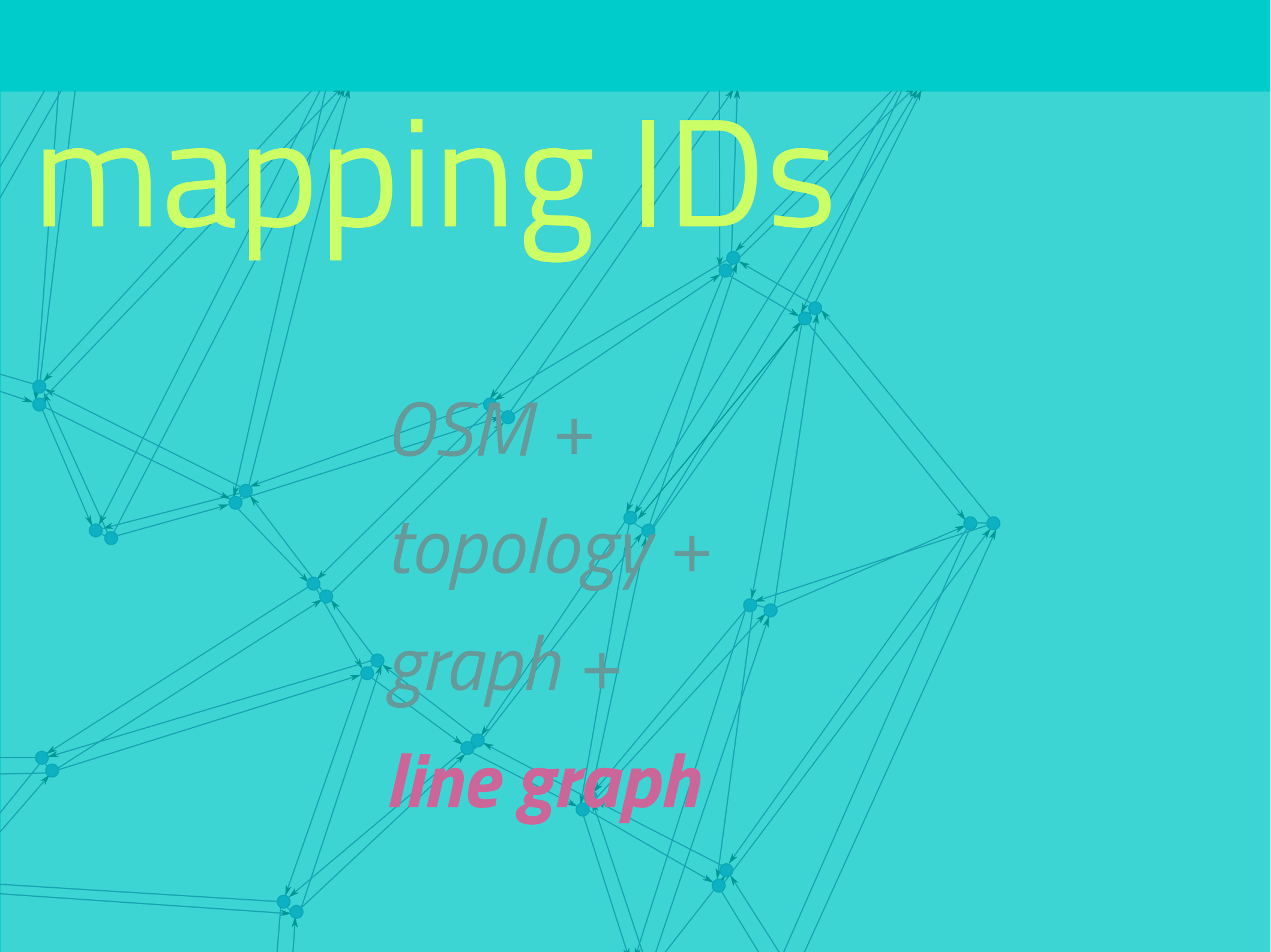
OSM +

topology

mapping IDs

*OSM +
topology +
graph*

A network graph is overlaid on the teal background. It consists of approximately 12 green circular nodes connected by thin blue lines representing edges. The edges are mostly straight but include some curved paths, suggesting a complex network topology. The nodes are distributed across the frame, with some clusters and some isolated points.



mapping IDs

*OSM +
topology +
graph +
line graph*

restrictions

Values:

yes

restrictions

Values:

yes,

no

restrictions

Values:

yes, no,

permissive

restrictions

Values:

yes, no, permissive,

designated

restrictions

Values:

yes, no, permissive, designated,

private

restrictions

Values:

yes, no, permissive, designated, private,

discouraged

restrictions

Values:

yes, no, permissive, designated, private, discouraged,

delivery

restrictions

Values:

yes, no, permissive, designated, private, discouraged, delivery,

customers...

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all,

foot

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all, foot,

vehicle

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all, foot, vehicle,

bicycle

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all, foot, vehicle, bicycle,

motor_vehicle

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all, foot, vehicle, bicycle, motor_vehicle,

motorcycle

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all, foot, vehicle, bicycle, motor_vehicle, motorcycle,

motorcar

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all, foot, vehicle, bicycle, motor_vehicle, motorcycle, motorcar,

goods

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all, foot, vehicle, bicycle, motor_vehicle, motorcycle, motorcar, goods,

hgv

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all, foot, vehicle, bicycle, motor_vehicle, motorcycle, motorcar, goods, hgv ...

by use:

psv

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all, foot, vehicle, bicycle, motor_vehicle, motorcycle, motorcar, goods, hgv ...

by use:

psv,

car_sharing

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all, foot, vehicle, bicycle, motor_vehicle, motorcycle, motorcar, goods, hgv ...

by use:

psv, car_sharing,

emergency

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all, foot, vehicle, bicycle, motor_vehicle, motorcycle, motorcar, goods, hgv ...

by use:

psv, car_sharing, emergency,

hazmat

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all, foot, vehicle, bicycle, motor_vehicle, motorcycle, motorcar, goods, hgv ...

by use:

psv, car_sharing, emergency, hazmat,

disabled

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all, foot, vehicle, bicycle, motor_vehicle, motorcycle, motorcar, goods, hgv ...

by use:

psv, car_sharing, emergency, hazmat, disabled ...

restrictions

values:

yes, no, permissive, designated, private, discouraged, delivery, customers ...

routing:

one-way (explicit / implicit), lanes ...

transportation mode:

all, foot, vehicle, bicycle, motor_vehicle, motorcycle, motorcar, goods, hgv ...

by use:

psv, car_sharing, emergency, hazmat, disabled ...

dimensions:

max height, weight, width ...

conditional restrictions



conditional restrictions



Photo (cropped): Achadwick. ©CC-SA 2.0

http://wiki.openstreetmap.org/wiki/File:UK_motor_restriction_sign_with_exceptions.jpg

motor_vehicle=no

motor_vehicle:conditional=yes @ (18:30-07:30)

psv=yes

conditional restrictions

```
maxspeed=none  
maxspeed:conditional=  
    120 @ (06:00-20:00);  
    100 @ (22:00-06:00)
```

turning restrictions

Relation:

turning restrictions

Relation:

from

turning restrictions

Relation:

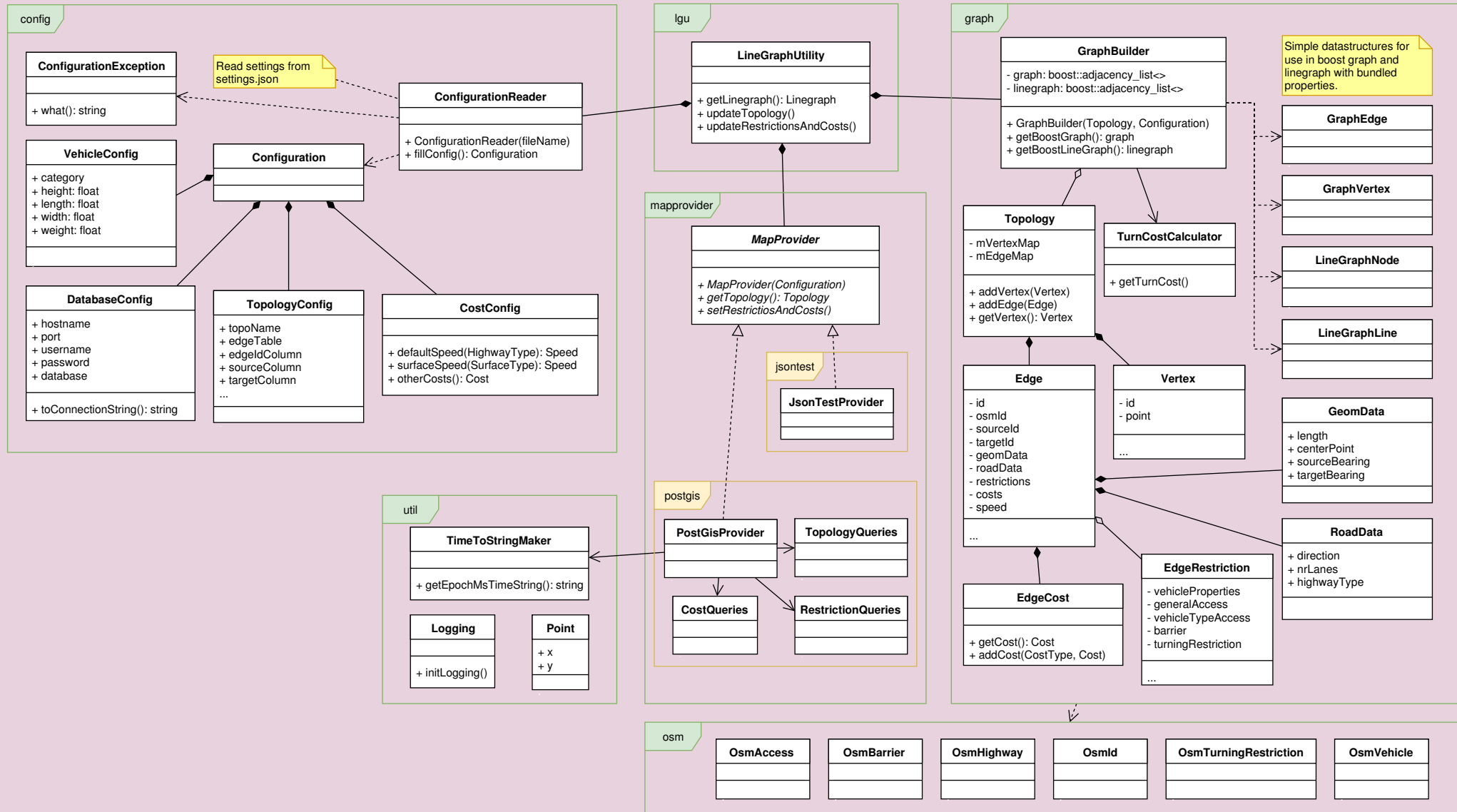
from \rightarrow *via*

turning restrictions

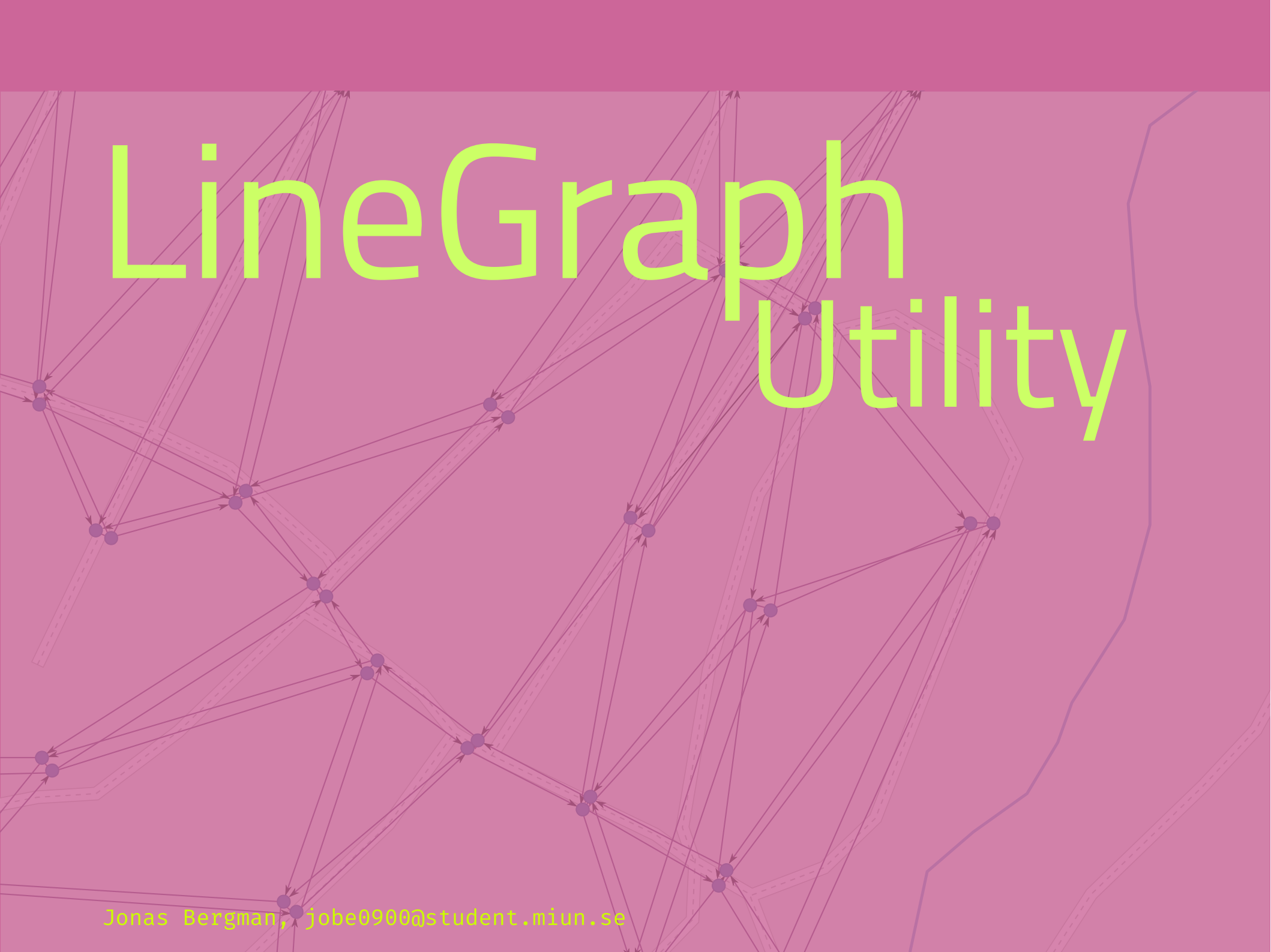
Relation:

from \rightarrow via \rightarrow *to*

class diagram



LineGraph Utility

The background of the slide features a light purple map of a road network. Overlaid on this map is a complex graph structure. The graph consists of numerous small, dark purple circular nodes. These nodes are interconnected by a dense web of thin, dark purple lines representing edges. Some of these edges are directed, as indicated by small arrowheads. The graph appears to be a utility or network layer, possibly representing a transit system or a data network, that is being mapped onto a geographical area.