

7 Avenue Station

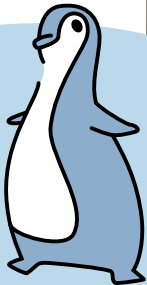
transition.city: bringing transit planning
in the hands of everyone

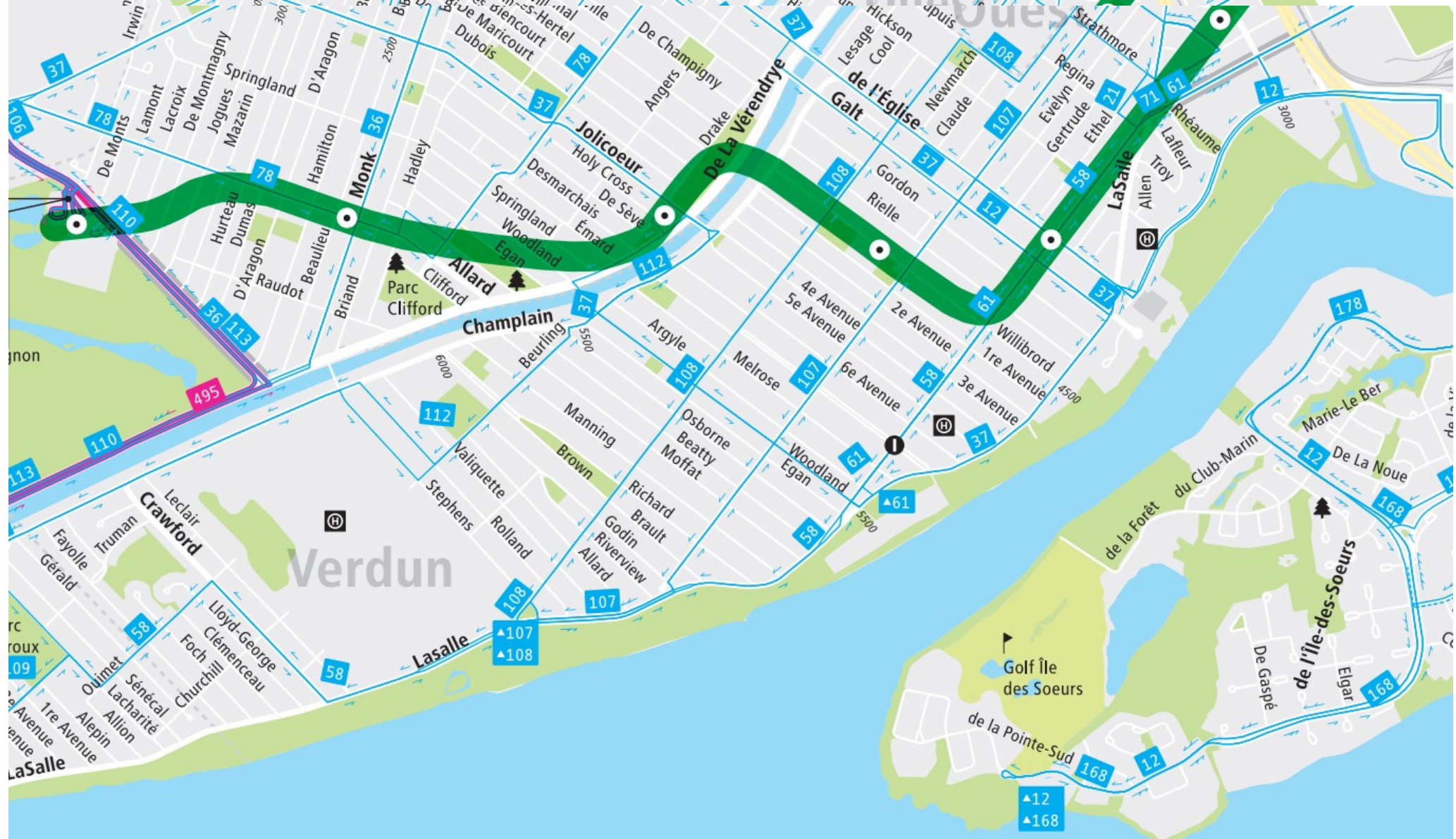
Presented by Yannick Brosseau

Room: 106

Start: 15:00

SCALE





Transition

<http://transition.city>

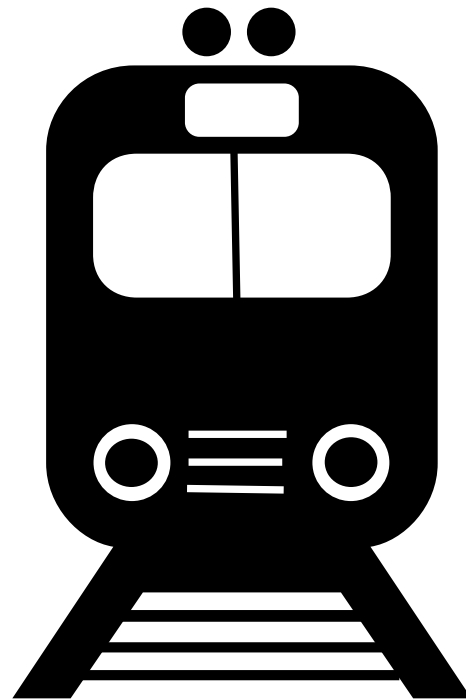
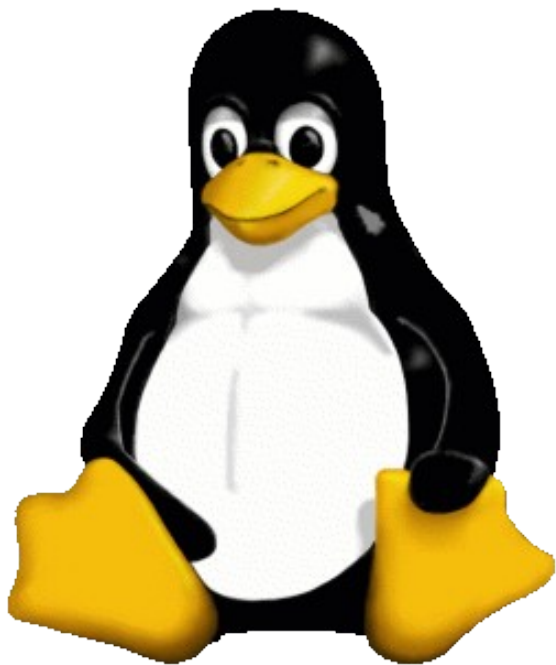
<https://github.com/chairemobilite/transition/>

<https://yannickbrosseau.com>

« Make a transit planning tool that answers the needs of professional planners but is easy enough for everybody »



Aren't you a kernel engineer?



... In a mobility research team

<https://www.polymtl.ca/mobilite/>



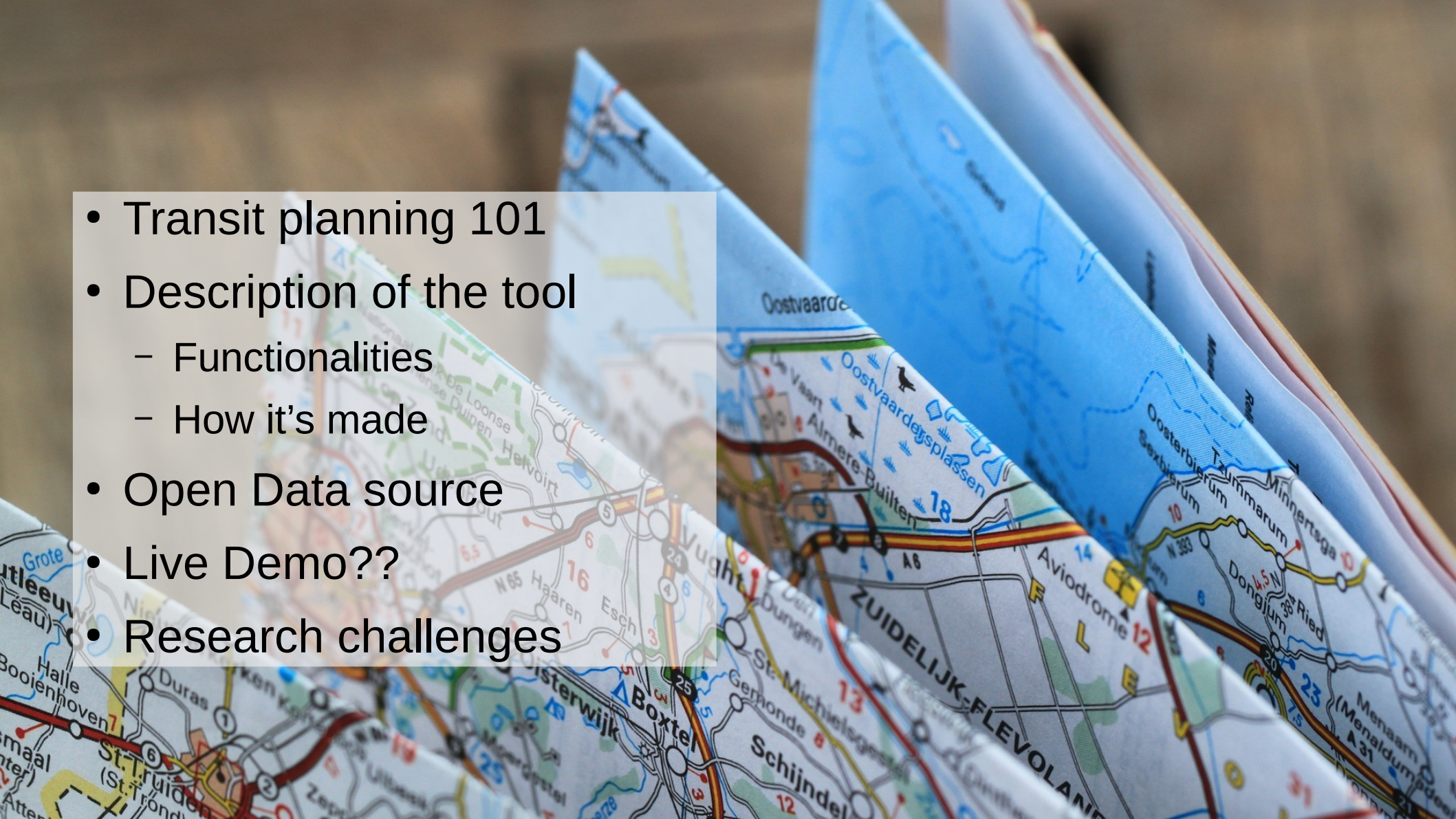
**POLYTECHNIQUE
MONTREAL**

UNIVERSITÉ
D'INGÉNIERIE



Applied research : Our toolbox

- Evolution (Travel survey platform)
- Os2car (Congestion)
- Octavi (Taxi)
- Transition (Transit planning)
 - Include TrRouting

- 
- Transit planning 101
 - Description of the tool
 - Functionalities
 - How it's made
 - Open Data source
 - Live Demo??
 - Research challenges

What is transit planning?

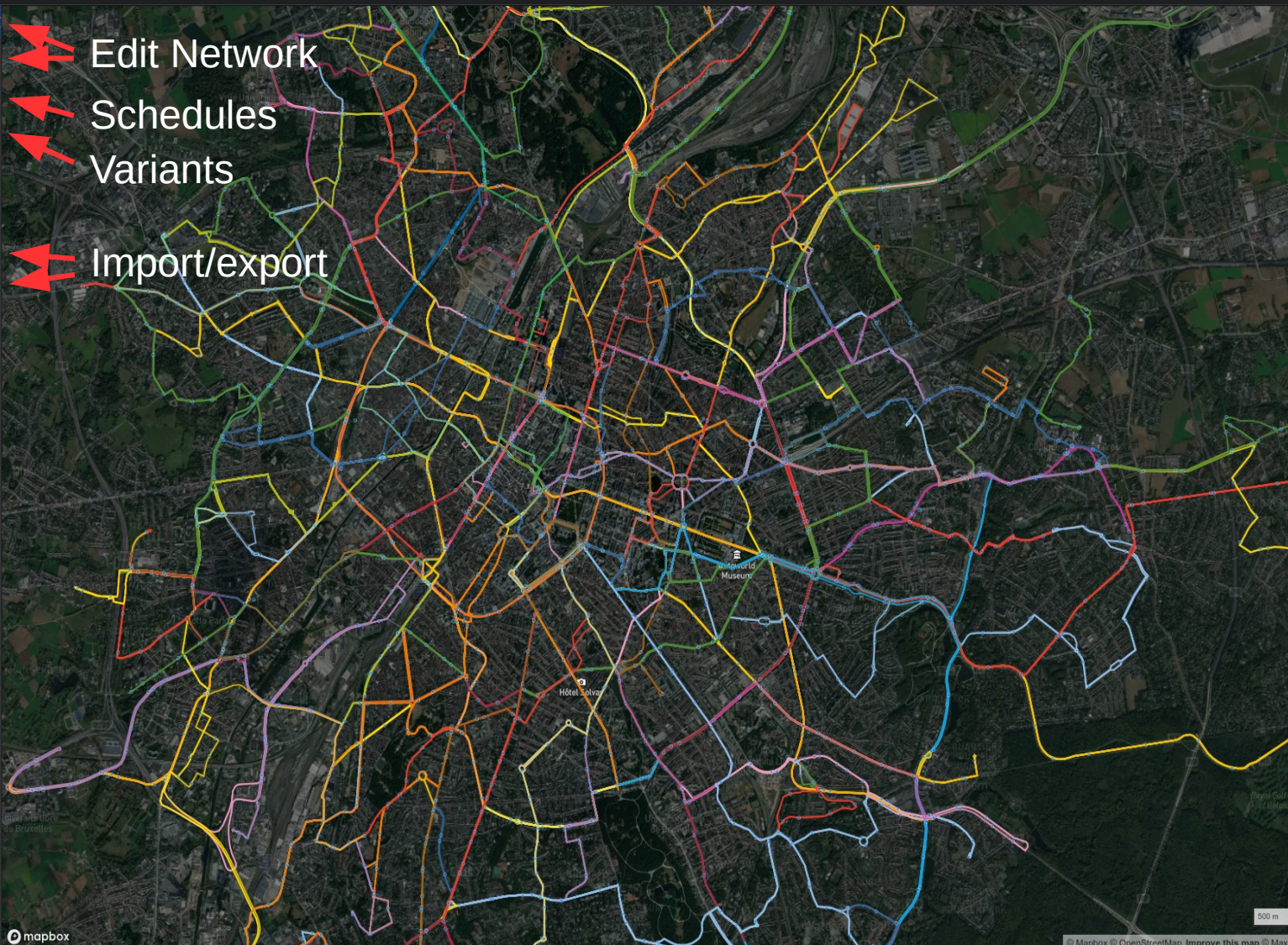


Who are we targeting?

- Transit planners
- Civil servants
- Elected officials
- General public







Edit Network

Schedules

Variants

Import/export

AGENCIES

	STIB-MIVB	STIB	92 lines
Lines			
1	GARE DE LOUEST - STOCKEL	15 paths 3 service	
2	SIMONIS - ELISABETH	6 paths 3 service	
3	ESPLANADE - CHURCHILL	10 paths 3 service	
4	GARE DU NORD - STALLE (P)	13 paths 9 service	
5	ERASME - HERRMANN-DEBROUX	20 paths 3 service	
6	ROI BAUDOIN - ELISABETH	12 paths 3 service	
7	VANDERKINDERE - HEYSEL	23 paths 3 service	
8	LOUISE - ROODEBEEK	14 paths 3 service	
9	SIMONIS - ROI BAUDOIN	5 paths 6 service	
12	BRUSSELS AIRPORT - BRUSSELS CITY	5 paths 4 service	
13	ETANGS NOIRS - UZ-VUB	2 paths 3 service	
14	UZ-VUB - GARE DU NORD	2 paths 3 service	
17	BEAULIEU - HEILIGENBORRE	4 paths 3 service	
19	GROOT-BIJGAARDEN - DE WAND	12 paths 10 service	
20	HUNDERENVELD - GARE DU NORD	4 paths 3 service	
21	MAES - LUXEMBOURG	6 paths 4 service	
25	BOONDAEL GARE - ROGIER	13 paths 3 service	
27	LUXEMBOURG - PLEIADES	4 paths 3 service	
28	BRABANCONNE - KONKEL	10 paths 4 service	
29	DE BROUCKERE - HOF TEN BERG	11 paths 3 service	
33	DANSAERT - LOUISE	2 paths 4 service	
34	PORTE DE NAMUR - SAINTE-ANNE	15 paths 3 service	
36	SCHUMAN - KONKEL	6 paths 3 service	
37	ALBERT - GARE DE LINKEBEEK	4 paths 3 service	
38	GARE CENTRALE - HEROS	6 paths 3 service	
39	MONTGOMERY - BAN-EIK	13 paths 3 service	
41	HEROS - TRANSVAAL	11 paths 3 service	
42	ROODEBEEK - VIADUC E40	3 paths 3 service	
43	OBSERVATOIRE - VIVIER D'OIE	13 paths 3 service	
44	MONTGOMERY - TERVUREN STATION	9 paths 3 service	
45	ROODEBEEK - SAINT-VINCENT	7 paths 5 service	
46	MOORTEBEEK - WTC-GLIBERT	9 paths 5 service	
47	HEEMBEEK - VILVOORDE STATION	6 paths 6 service	
48	ANNEESSENS - DECROLY	13 paths 5 service	
49	GARE DU MIDI - SIMONIS	14 paths 5 service	
50	GARE DU MIDI - LOT STATION	5 paths 4 service	
51	STADE - VAN HAELEN	19 paths 6 service	
52	GARE CENTRALE - FOREST (BERVOETS)	6 paths 3 service	
53	WESTLAND SHOPPING - HOPITAL MILITAIRE	3 paths 4 service	
54	TRONE - FOREST (BERVOETS)	3 paths 4 service	
55	DA VINCI - ROGIER	8 paths 5 service	

Save timetable

4:00 → 6:00 • Morning (4-6AM)	Outbound path Inbound path Interval (sec.) Number of units (vehicles) First trip start time (HH:MM) 4:00
6:00 → 9:00 • AM Peak (6-9AM)	Outbound path Inbound path Interval (sec.) Number of units (vehicles) First trip start time (HH:MM) 6:00
9:00 → 15:00 • Midday (9AM-1:30PM)	Outbound path Inbound path Interval (sec.) Number of units (vehicles) First trip start time (HH:MM) 9:00
15:00 → 18:00 • PM Peak (3-6PM)	Outbound path Inbound path Interval (sec.) Number of units (vehicles) First trip start time (HH:MM) 15:00
18:00 → 23:00 • Evening (6-11PM)	Outbound path Inbound path Interval (sec.) Number of units (vehicles) First trip start time (HH:MM) 18:00
23:00 → 28:00 • Night (11PM-4AM)	Outbound path Inbound path Interval (sec.) Number of units (vehicles) First trip start time (HH:MM) 23:00

 Empty timetable

Allow transferring to the same line ☐ Yes ☒ No

Inbound	LOUISE		9 stops	T_{cp} 14 m
Outbound	MUSEE DU TRAM		27 stops	T_{cp} 46.2 m
Inbound	BUYL		16 stops	T_{cp} 24 m
Inbound	BUYL		24 stops	T_{cp} 39.6 m
Outbound	HERRMANN-DEBROUX		23 stops	T_{cp} 39.6 m
Inbound	LOUISE		9 stops	T_{cp} 14 m
Outbound	BUYL		9 stops	T_{cp} 19 m
Outbound	BUYL		9 stops	T_{cp} 20 m
Outbound	ROODEBEEK		23 stops	T_{cp} 32 m
Outbound	ROODEBEEK		31 stops	T_{cp} 46.2 m
Outbound	ROODEBEEK		5 stops	T_{cp} 9 m
Inbound	MUSEE DU TRAM		5 stops	T_{cp} 10 m
Inbound	LOUISE		32 stops	44 m
Inbound	LOUISE		28 stops	T_{cp} 37.4 m



ROUTING

^ Basic fields

Calculate for the following modes

Transit x

Departure time 18:00

Arrival time

Maximum total travel time including access and egress (minutes) 180

Minimum waiting time (minutes) 3

To account for timetable uncertainty, this value should be greater or equal to 1 minute. Suggested value is 3 minutes.

Maximum access and egress travel time (minutes) 15

To avoid long calculation time, this value has a maximum of 20 minutes.

Maximum access travel time when transferring (minutes) 10

To avoid long calculation time, this value has a maximum of 20 minutes.

Maximum first waiting time (minutes)

If waiting time at first stop is greater than this value for a line, ignore the departure of this line at this stop.

Calculate with alternatives ☒ Yes ☐ No

Scenario test

Origin latitude 33.9437696248762

Origin longitude -118.3998529852566

Reverse

Destination latitude 34.14300124744733

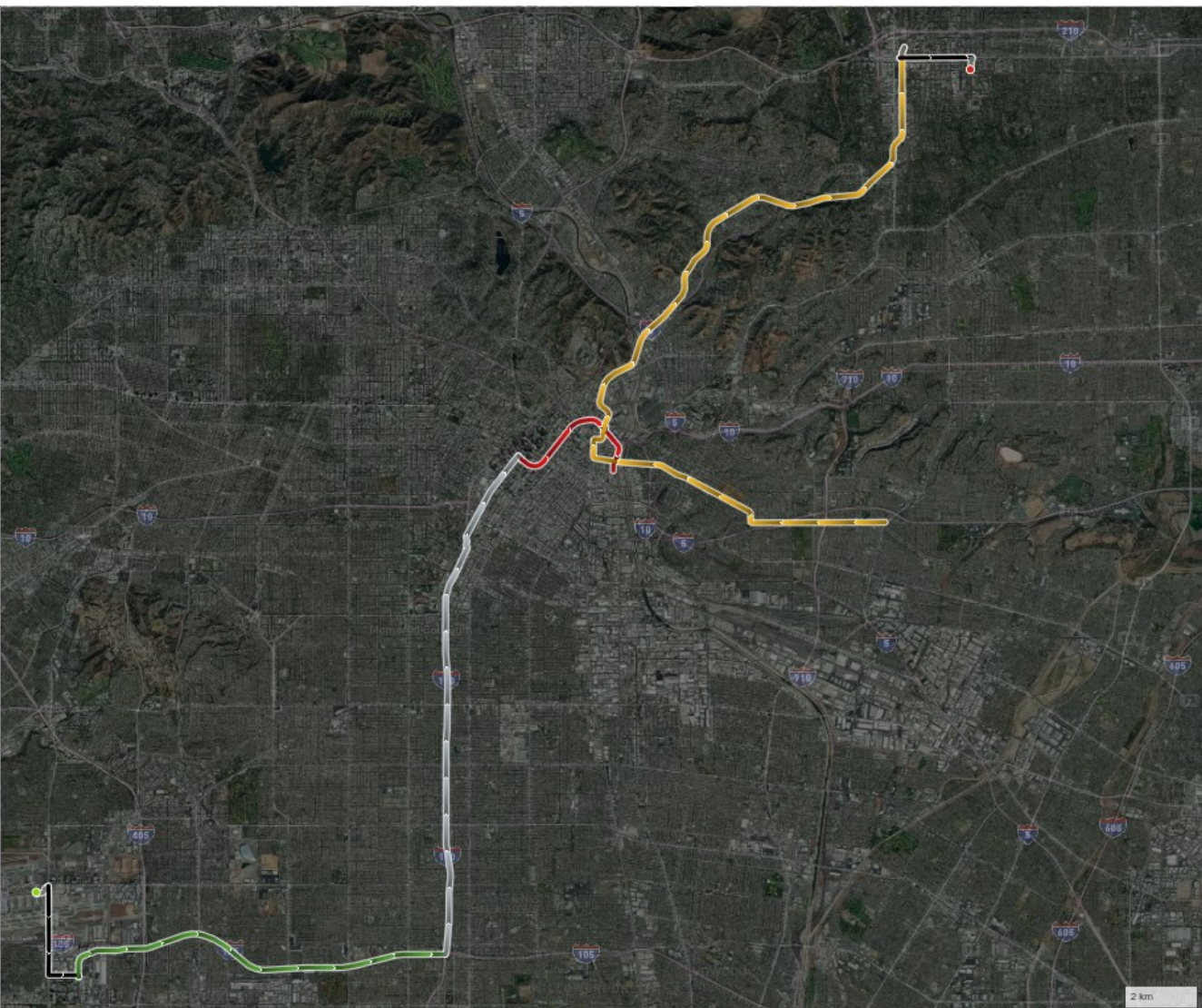
Destination longitude -118.1282957921567

Route name

Save this route

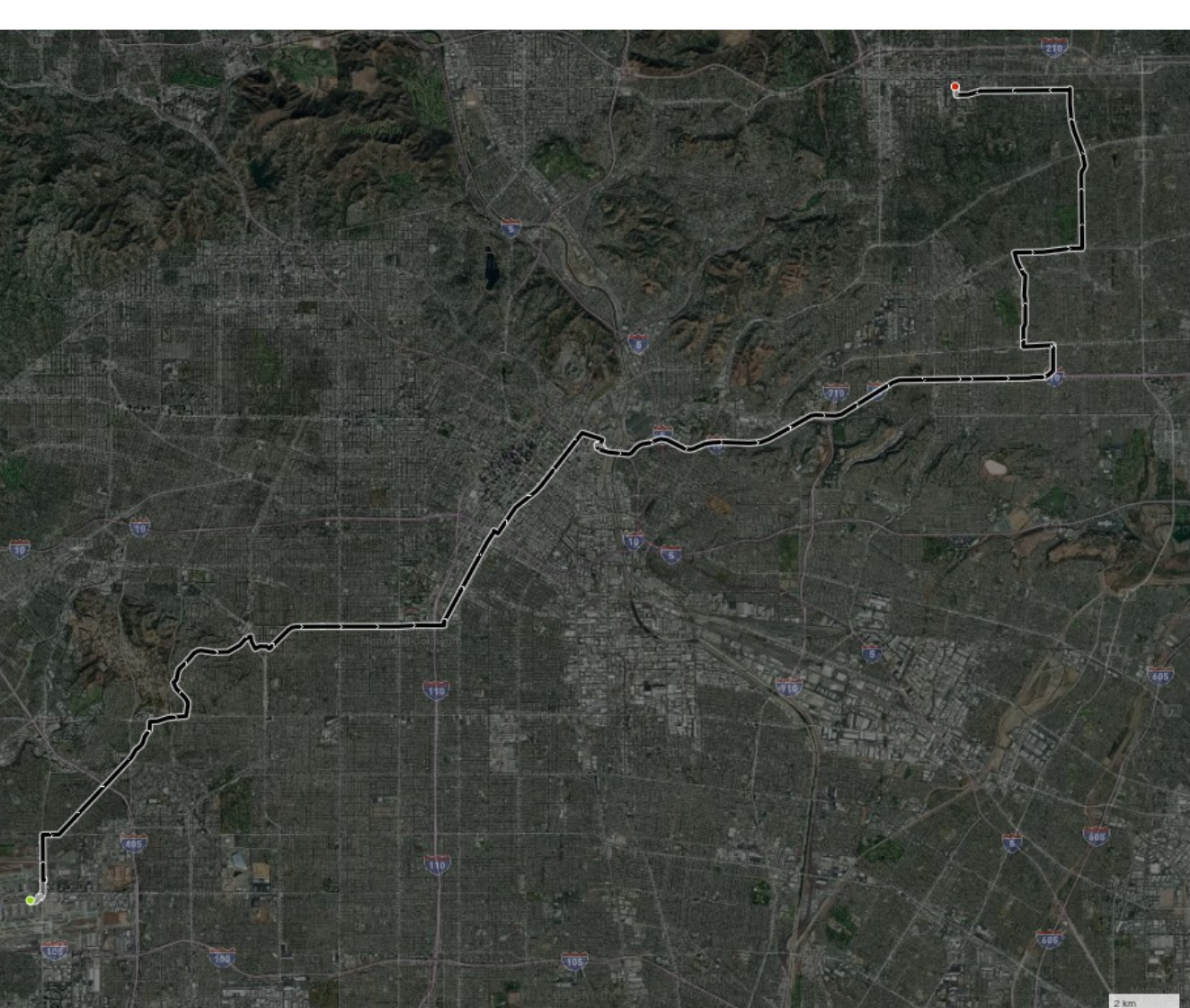
Advanced fields

Batch routing (CSV)



Travel time (optimized departure and arrival) 136 min..
Optimized departure time 65594
Non optimized departure time 64800
Time lost if departure time not optimized 14 min..
Arrival time 72951
Total distance 60482 m
Access travel time 7 min..
Egress travel time 5 min..
Number of transfers 5
Total access travel time when transferring 8 min..
Total in-vehicle time 75 min..
Total access time (access, egress and access when transferring) 20 min..
Total waiting time when transferring 26 min..

Walk	7 min..	498 m
Sepulveda / Century	3 min.. (waiting)	
☐ 232 Metro Local Line Inbound	8 min..	3266 m
Mariposa Station		
Walk	0 min..	0 m
Mariposa Station	7 min.. (waiting)	
☒ Metro C Line (Green) Outbound	12 min..	10750 m
Harbor Freeway Station		
Walk	0 min..	0 m
Harbor Freeway Station	5 min.. (waiting)	
☐ Metro J Line (Silver) 910/950 Outbound	22 min..	14035 m
7th Street / Metro Center Station - 7th & Figueroa Entrance		
Walk	2 min..	130 m
7th Street / Metro Center Station - Metro A Line (Blue) & E Line (Expo)	4 min.. (waiting)	
☒ Metro B Line (Red) Outbound	5 min..	4201 m
Union Station - Metro Red & Purple Lines		
Walk	2 min..	121 m
Union Station - Metro Gold Line	7 min.. (waiting)	
☒ Metro L Line (Gold) Outbound	23 min..	24821 m
Memorial Park Station		
Walk	5 min..	361 m
Colorado / Raymond	4 min.. (waiting)	
☐ 686 Metro Local Line Outbound	5 min..	1922 m
Colorado / Wilson		
Walk	5 min..	377 m

**Transit**

Walking

1/

Travel time (optimized departure and arrival) 156 min..

Travel time (non-optimized departure and arrival) 168 min..

Optimized departure time 65520

Non optimized departure time 64800

Time lost if departure time not optimized 12 min..

Arrival time 74835

Total distance 51844 m

Access travel time 12 min..

Egress travel time 4 min..

Number of transfers 4

Total access travel time when transferring 4 min..

Total in-vehicle time 112 min..

Total access time (access, egress and access when transferring) 19 min..

Total waiting time when transferring 22 min..

Walk		12 min..	929 m
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96th / Sepulveda		3 min.. (waiting)	
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☐ 102 Metro Local Line Outbound	39 min..	12980 m
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Martin Luther King Jr / Gramercy		
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Walk	0 min..	0 m
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Martin Luther King Jr / Gramercy	8 min.. (waiting)	
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☐ 40 Metro Local Line Outbound	17 min..	6200 m
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Broadway / Venice		
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Walk	0 min..	0 m
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Broadway / Venice	4 min.. (waiting)	
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☐ 33 Metro Local Line Outbound	13 min..	4712 m
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Union Station - Vignes Elevator		
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Walk	4 min..	285 m
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Union Station Patsaouras Bus Plaza	5 min.. (waiting)	
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☐ 487/489 Metro Express Line Outbound	37 min..	23422 m
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Del Mar / San Gabriel		
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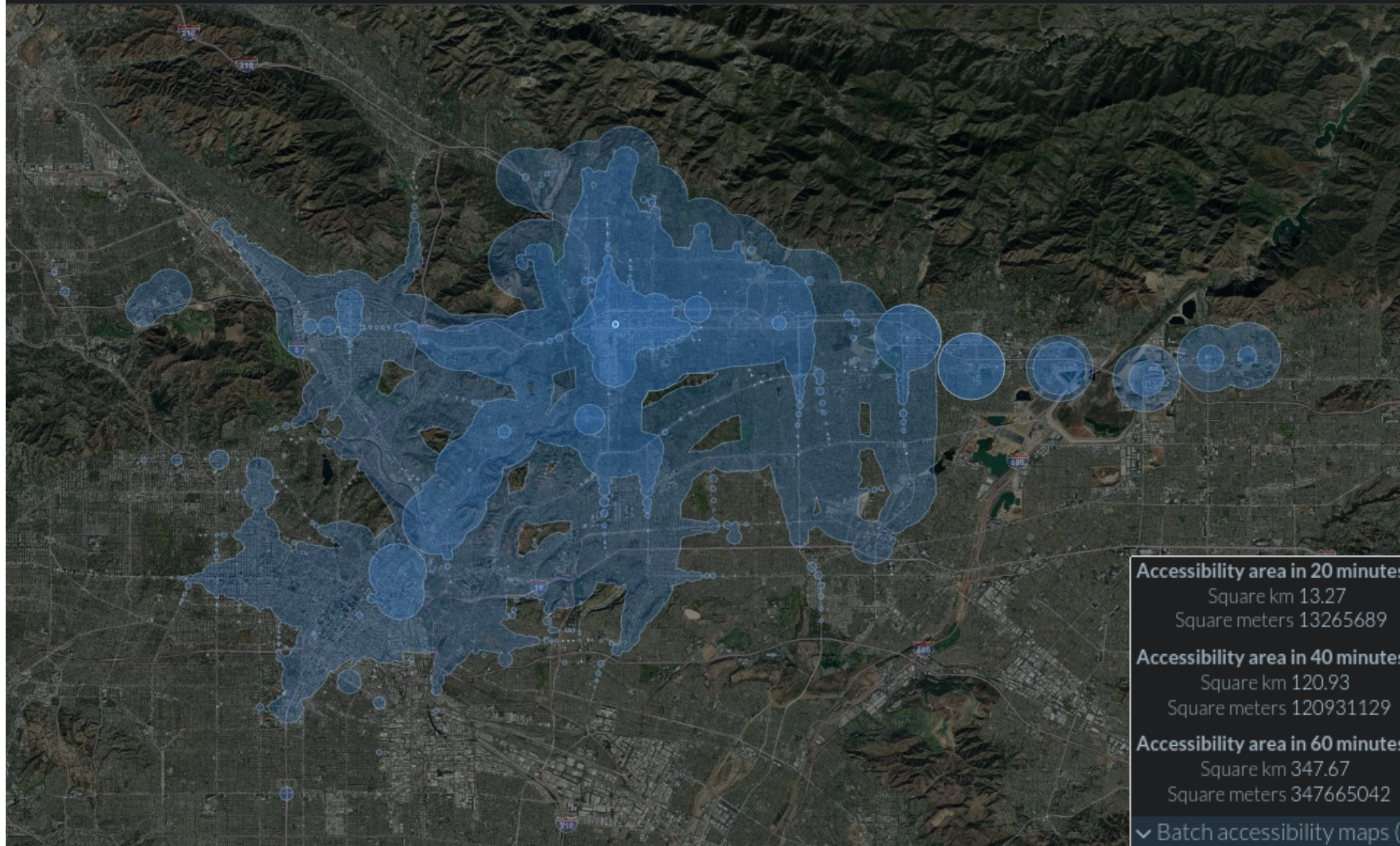
Walk	0 min..	0 m
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Del Mar / San Gabriel	5 min.. (waiting)	
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☐ 267 Metro Local Line Outbound	6 min..	3049 m
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Del Mar / Wilson		
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Walk	4 min..	267 m
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Accessibility area in 20 minutes

Square km 13.27

Square meters 13265689

Accessibility area in 40 minutes

Square km 120.93

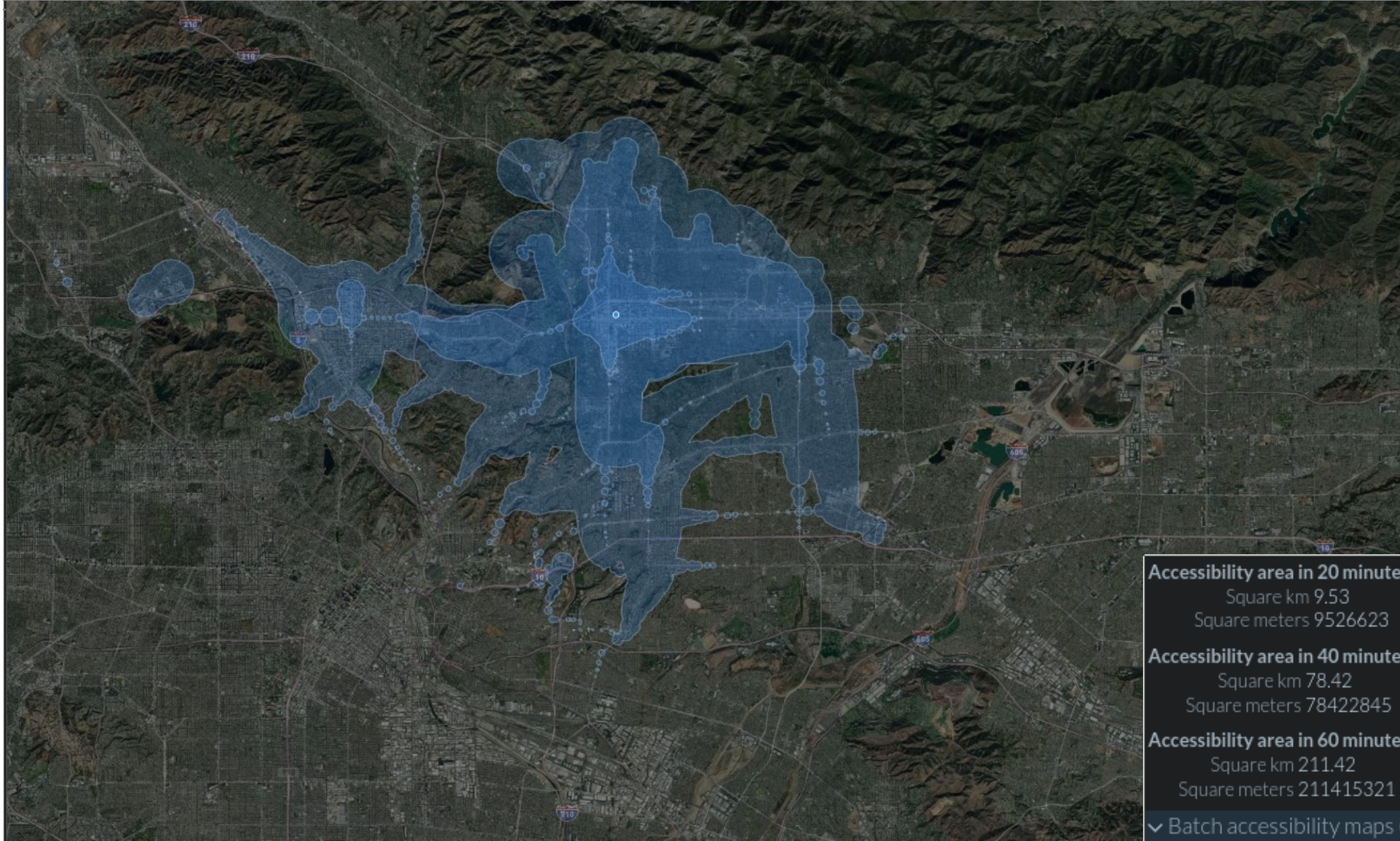
Square meters 120931129

Accessibility area in 60 minutes

Square km 347.67

Square meters 347665042

✓ [Batch accessibility maps \(CSV\)](#)



Accessibility area in 20 minutes

Square km 9.53

Square meters 9526623

Accessibility area in 40 minutes

Square km 78.42

Square meters 78422845

Accessibility area in 60 minutes

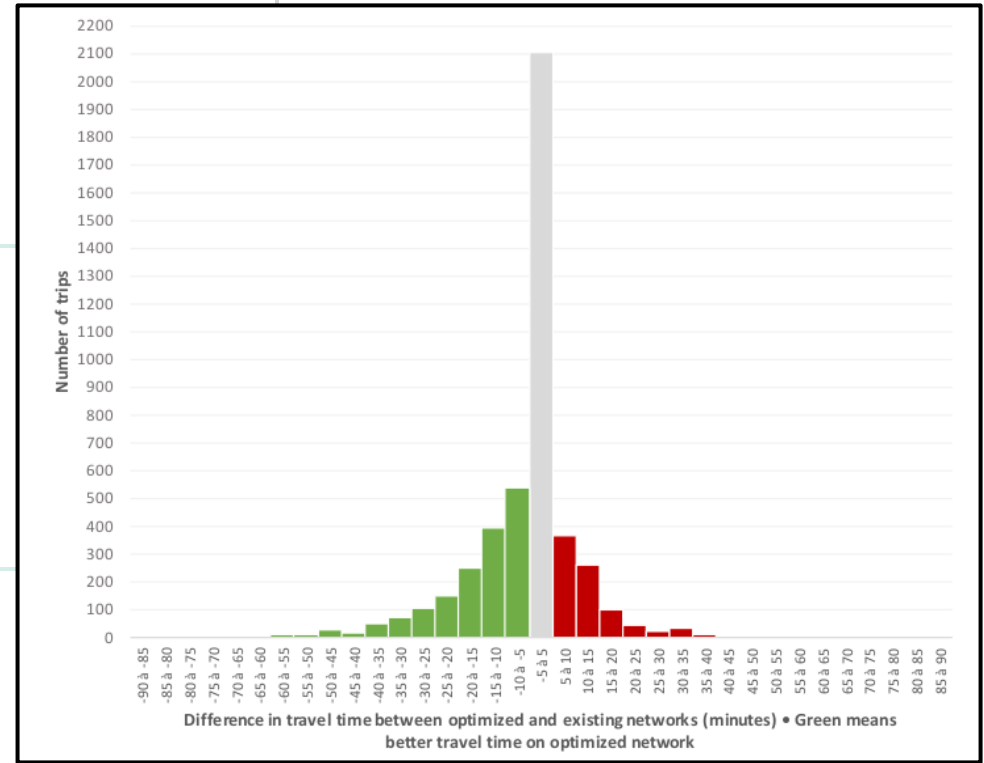
Square km 211.42

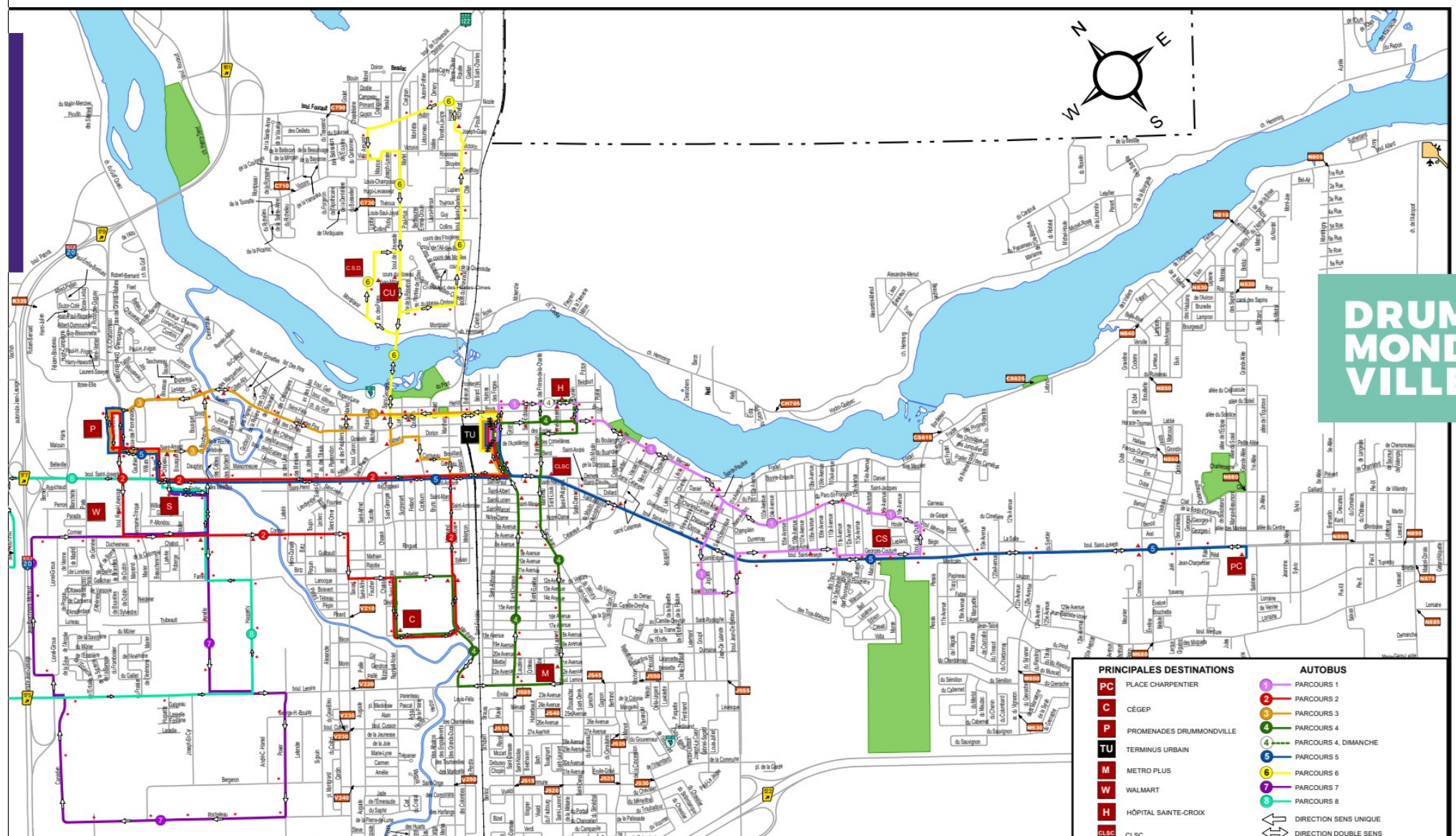
Square meters 211415321

▼ Batch accessibility maps (CSV)

Simulation and optimisation

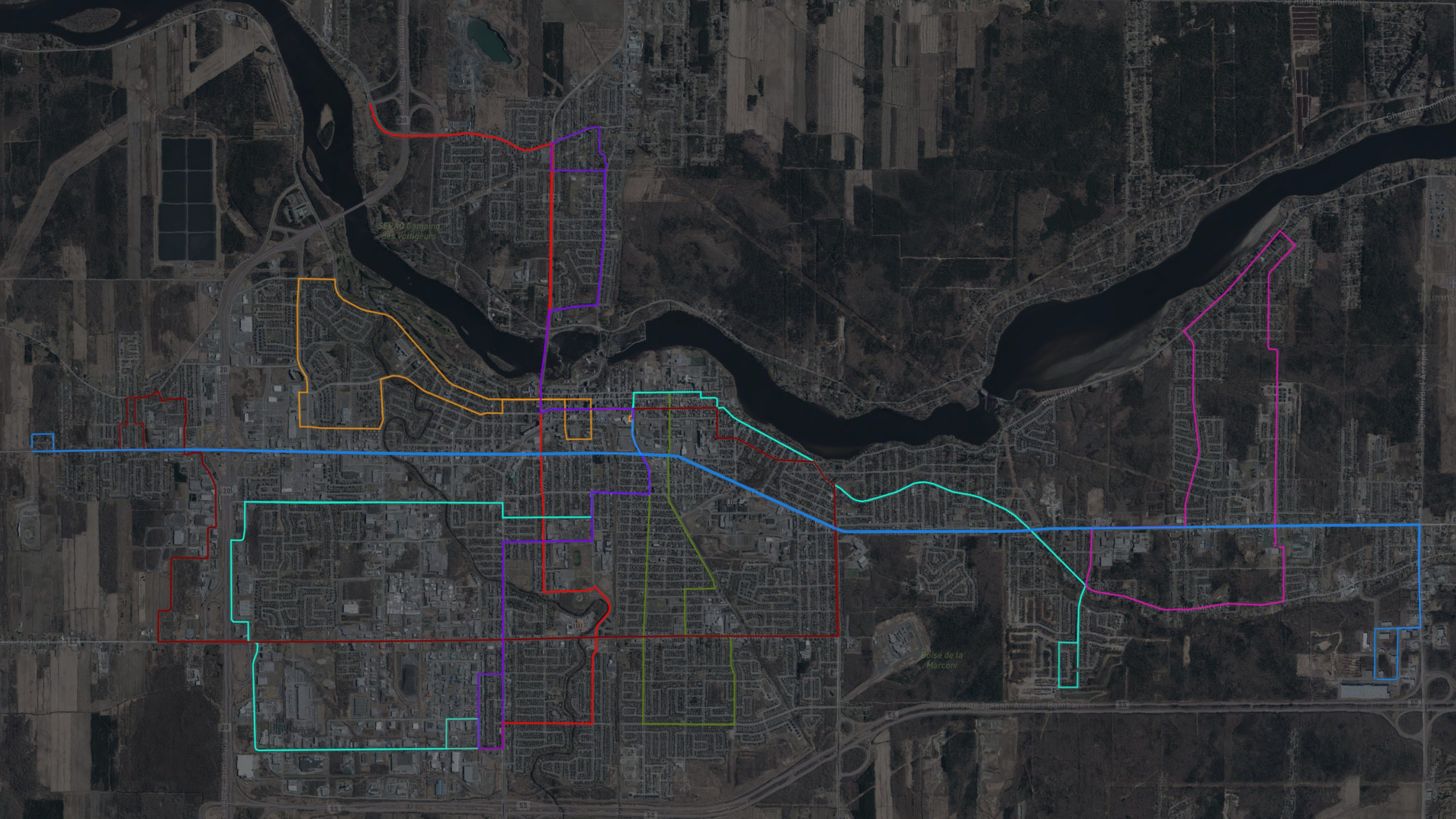
- Genetic algorithm





DRUMMONDVILLE

PRINCIPALES DESTINATIONS		AUTOBUS	
PC	PLACE CHARPENTIER	1	PARCOURS 1
C	CÉGEP	2	PARCOURS 2
P	PROMENADES DRUMMONDVILLE	3	PARCOURS 3
TU	TERMINUS URBAIN	4	PARCOURS 4, DIMANCHE
M	METRO PLUS	5	PARCOURS 5
W	WALMART	6	PARCOURS 6
H	HÔPITAL SAINTE-CROIX	7	PARCOURS 7
CLSC	CLSC	8	PARCOURS 8
			DIRECTION SENS UNIQUE
			DIRECTION DOUBLE SENS



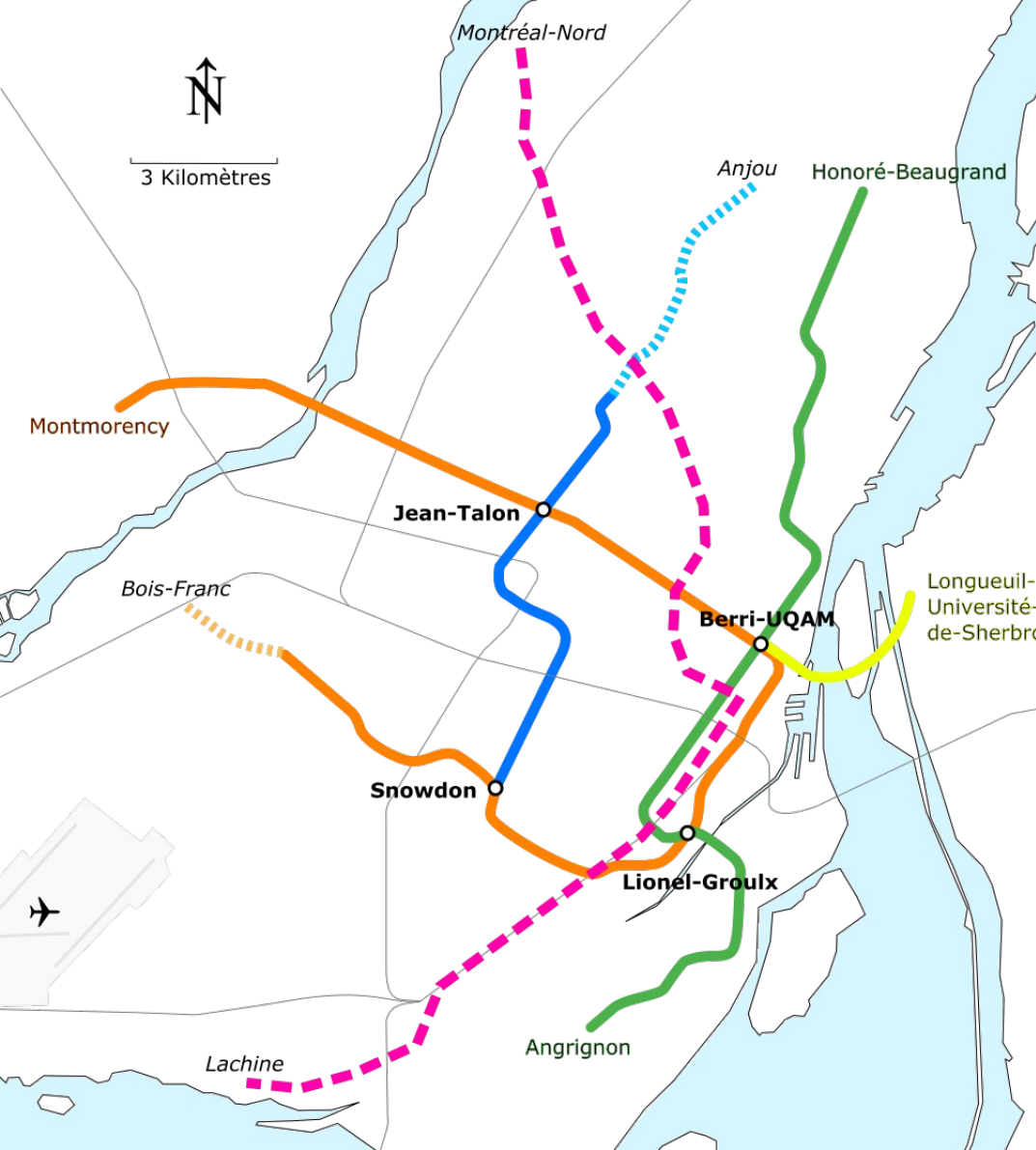
SEPTO (arrondissement des Voltigeurs)

Rivière des Voltigeurs

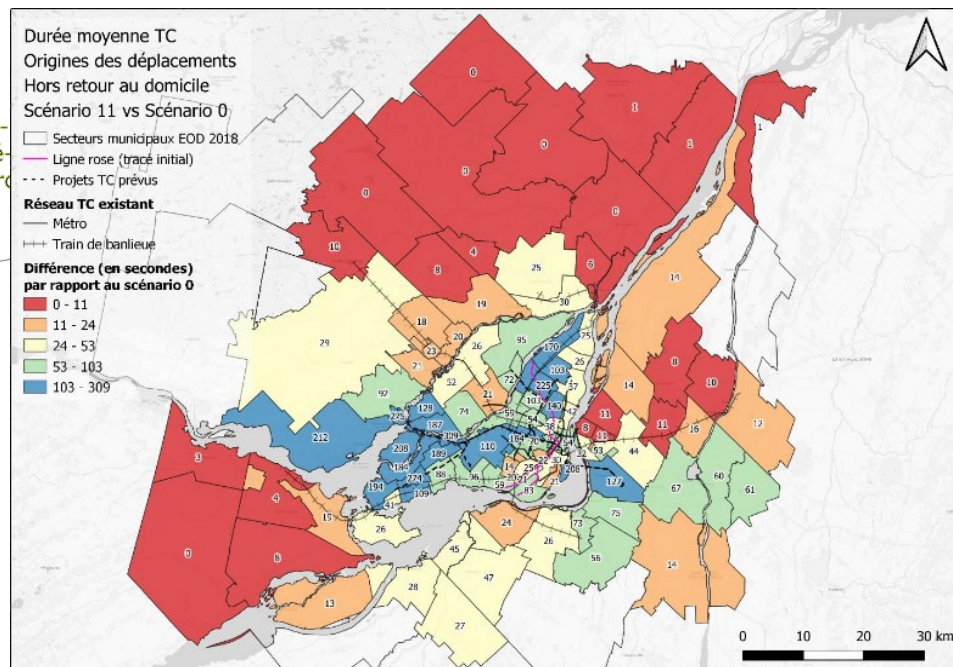
Bois de la Marconi

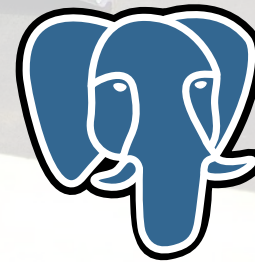
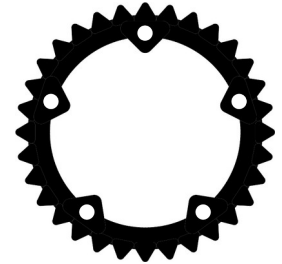
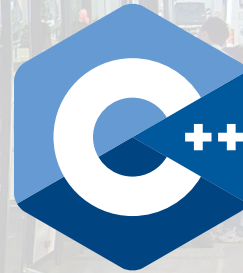
Autoroute Jean-Jacques Lussier (S-100)

Centre de la ville



Indicateur	Mode	3 - Tracé initial ligne rose ⁴ (NE et GSO)		11 - + projets TC prévus ⁵	
		% dépl.	Gain moy	% dépl.	Gain moy
Durée moyenne [minutes]	Automobile conducteur	4,7%	6,1	14,8%	8,6
	Automobile passager	3,8%	5,9	11,2%	7,3
	Transport en commun	11,5%	5,3	27,3%	6,4
	Marche et vélo	2,9%	3,6	5,0%	3,7
	Autres modes	7,0%	5,6	19,3%	8,9







Modern C++ routing engine for
shortest paths in road
networks.

[VIEW DEMO](#)

[DOCUMENTATION](#)



Flexible import of
OpenStreetMap data.



Handles continental sized
networks within
milliseconds.



Supports car, bicycle,
walk modes; easily
customized through
profiles.

Get in Touch.



[IRC Channel](#)



[Mailing List](#)



[Twitter](#)

trRouting

- Connection Scan Algorithm (CSA)
 - <https://i11www.iti.kit.edu/extra/publications/dpsw-isft-r-13.pdf>
 - Intriguingly Simple and Fast Transit Routing?
 - Julian Dibbelt, Thomas Pajor, Ben Strasser, and Dorothea Wagner, from Karlsruhe Institute of Technology (KIT)
- Written in C++ (Might convert to Rust)

Data Sources

- Road and path network
- Transit network
- Population and places
- Trips

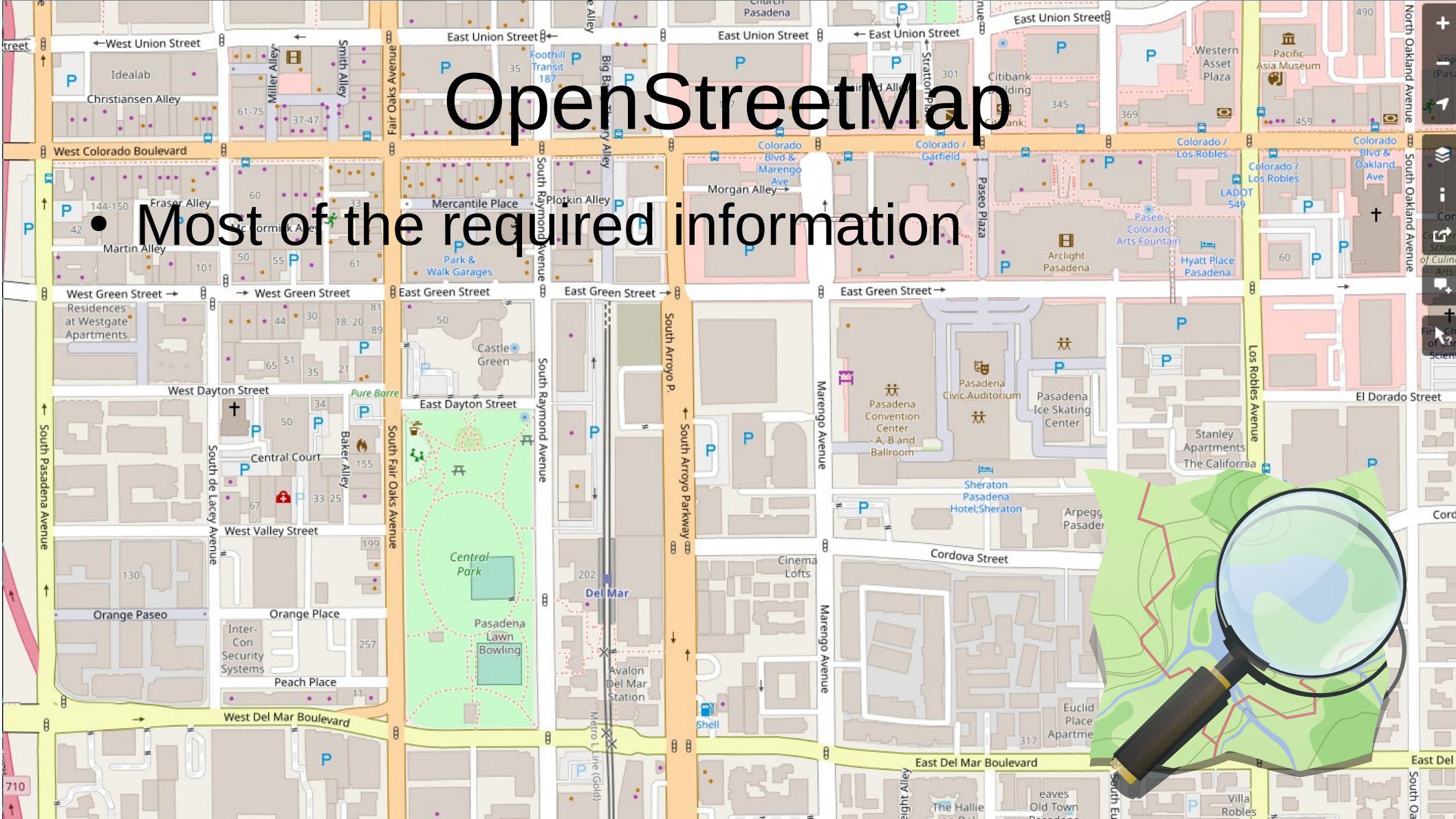
Open Data

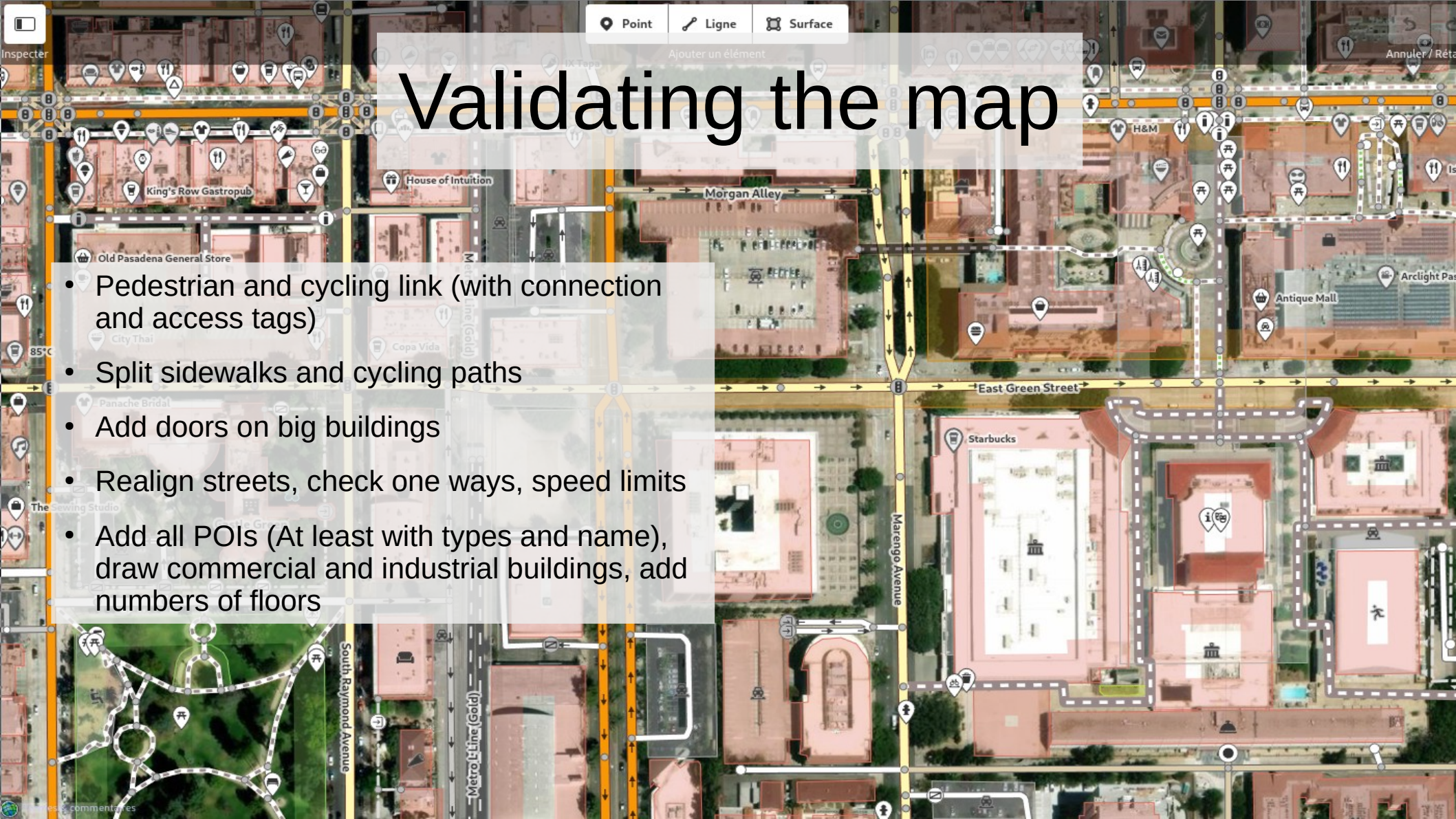
- Open Database License (ODbL)



OpenStreetMap

- Most of the required information



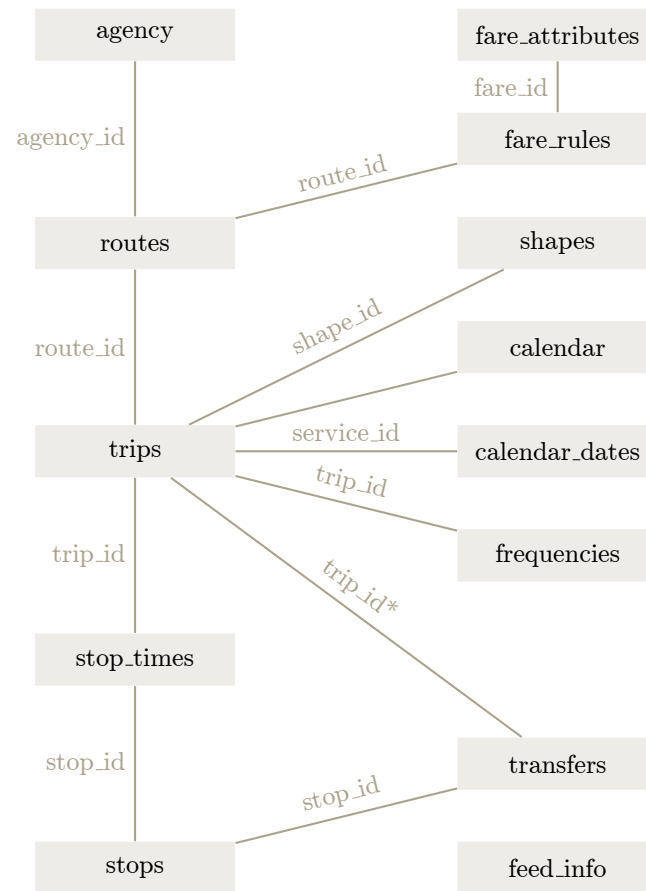


Validating the map

- Pedestrian and cycling link (with connection and access tags)
- Split sidewalks and cycling paths
- Add doors on big buildings
- Realign streets, check one ways, speed limits
- Add all POIs (At least with types and name), draw commercial and industrial buildings, add numbers of floors

GTFS

- General Transit Feed Specification
- 2 variants :
 - Schedules
 - Real-time



<https://developer.metro.net/>

[GTFS SCHEDULE DATA](#)[GIS DATA](#)[REAL TIME APIS](#)[EXPERIMENTAL TOOLS](#)[METRO.NET](#)

Open Metro

Welcome! Here you'll find a variety of Metro data and reports with more added all the time. We're committed to an open and transparent Metro and invite you to use this information to help us improve *your* system.



GTFS Schedule Data

The Google Transit Feed Specification is an open format that Google created to allow transit agencies to easily provide schedule data to Google Transit.



GIS Data

GIS Data are shapefiles representing existing or planned Metro Rail, Metro fixed-guideway buses, and Metro-owned railroad rights-of-way (ROW).

The Mobility Database

<https://database.mobilitydata.org/>

[Go see the catalogs repo](#)

[Home](#) [About](#) [Update a data source](#)

The Mobility Database

The Mobility Database catalogs is a repository of 1800+ mobility datasets across the world. It has over 150 updated datasets previously unavailable on TransitFeeds (OpenMobilityData).

We're in the first phase of building a sustainable, central hub for mobility data internationally.

[See the catalogs repo](#)

[Download the catalogs CSV](#)

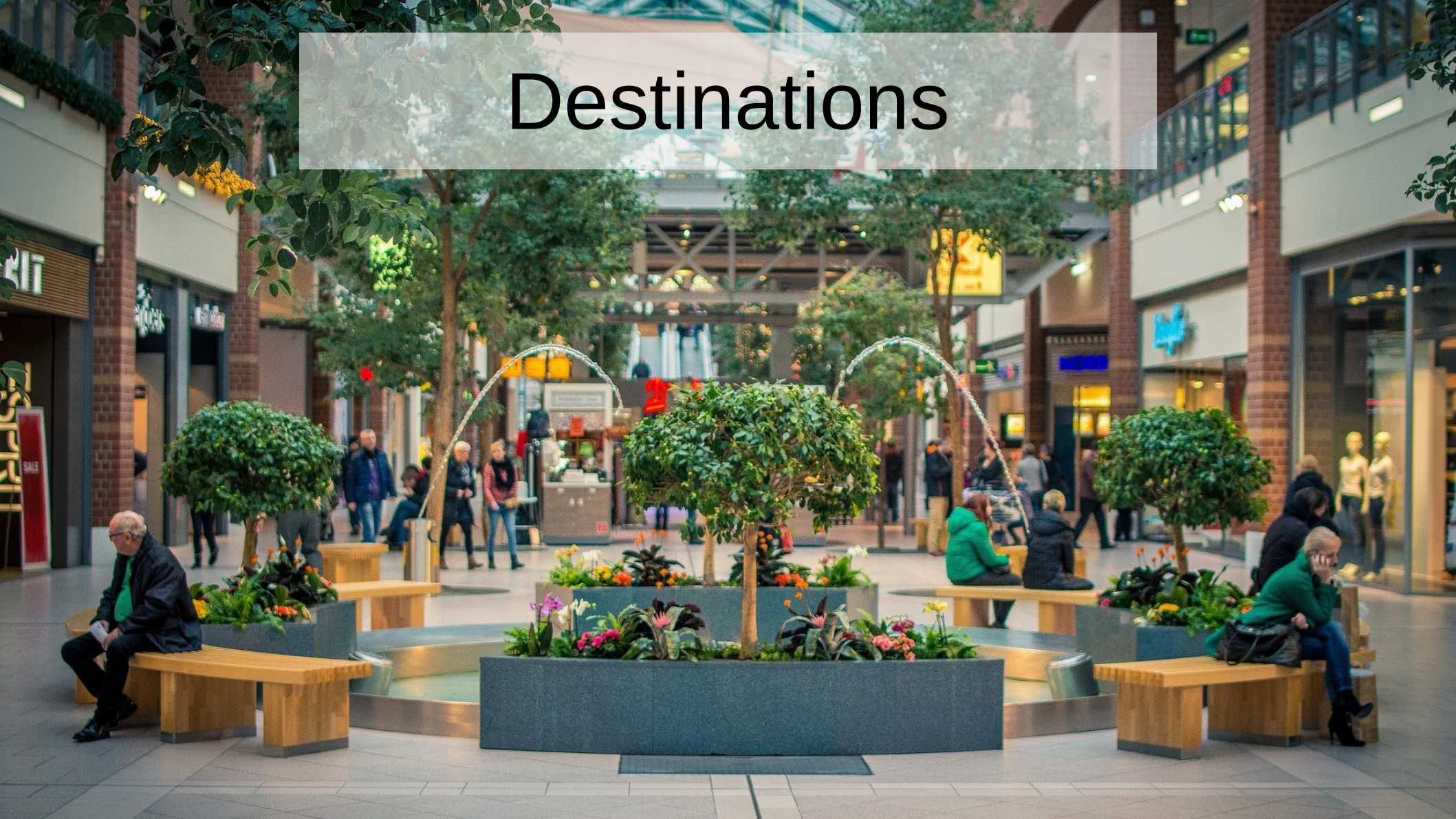
What about TransitFeeds?

A large, dense pile of unsorted LEGO bricks and minifigures in various colors including blue, yellow, red, white, black, and green. The pieces are scattered across the entire frame, creating a textured, colorful background.

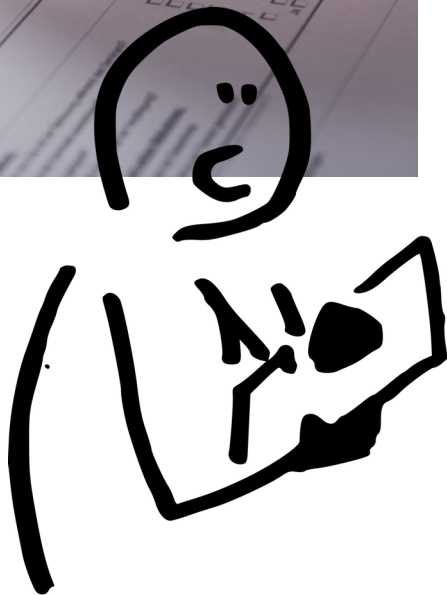
Population

- OSM Buildings
- Land use registers
- Census information

Destinations

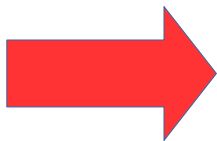
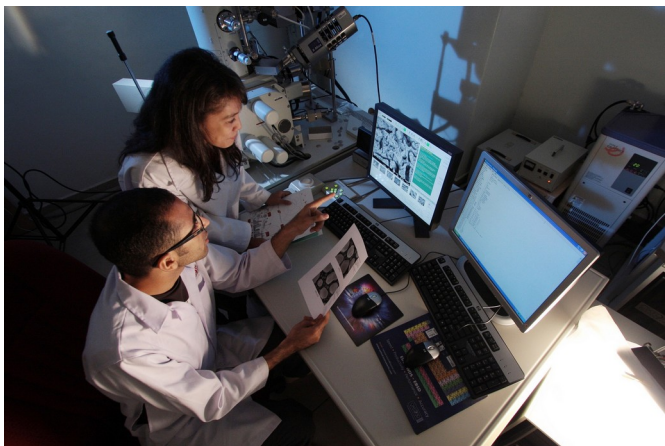


Travel surveys

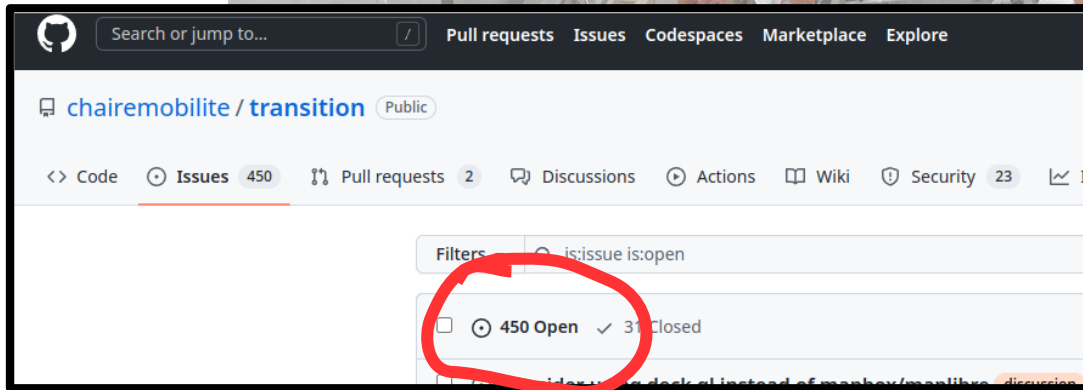


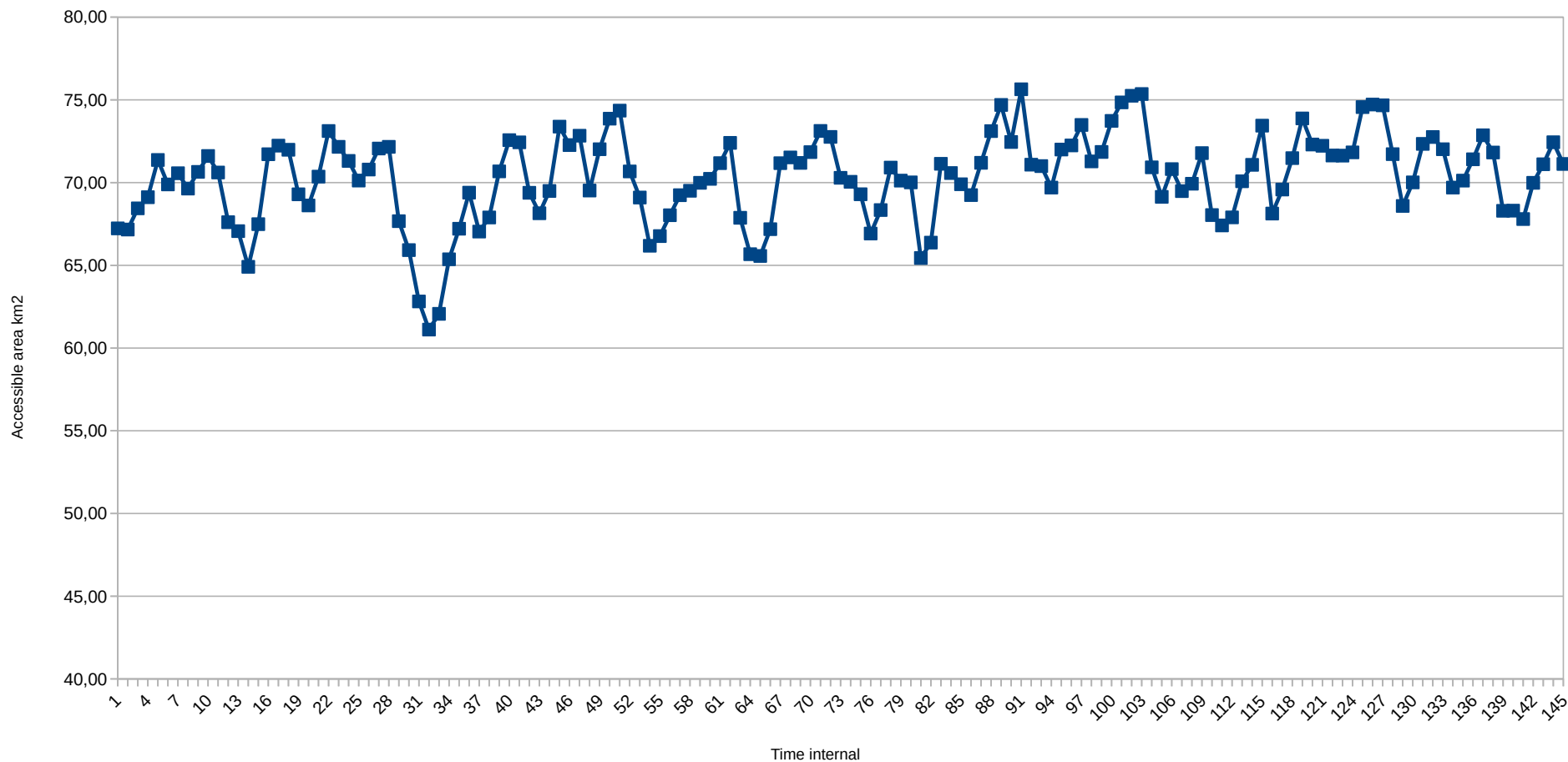


**ON
AIR**



Future plans







References

- Chaire Mobilite publications and reports :
 - <https://www.polymtl.ca/mobilite/publications>
- Transit Network Design using a Genetic Algorithm with Integrated Road Network and OD Matrix
 - <https://link.springer.com/article/10.1007/s11116-019-10047-1>
-

Attributions

- https://commons.wikimedia.org/wiki/File:M%C4%9Bln%C3%ADk,_Gar%C3%A1%C5%BEE_%C4%8CSAD_St%C5%99edn%C3%AD_%C4%8Cechy,_zadn%C3%AD_%C4%8D%C3%A1st_Irisbusu_Crossway.jpg
- <https://foundation.rust-lang.org/policies/logo-policy-and-media-guide/>
- <https://pixabay.com/photos/train-railroad-transport-system-3182761/>
- <https://pixabay.com/photos/call-centre-audio-background-black-5073846/>
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- [https://en.wikipedia.org/wiki/Pink_Line_\(Montreal_Metro\)#/media/File:Montreal_Metro_Geographical_Map_Pink_Line.png](https://en.wikipedia.org/wiki/Pink_Line_(Montreal_Metro)#/media/File:Montreal_Metro_Geographical_Map_Pink_Line.png)
- <https://pixabay.com/photos/earth-globe-planet-world-space-11015/>
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- <https://pixabay.com/vectors/global-warming-earth-thermometer-6795602/>
- Each logos from their respective projects