Public Transportation Modelling: Planning Bus Lines Routes

PONTIFICAL CATHOLIC UNIVERSITY OF RIO GRANDE DO SUL,BRAZIL

AUTOMATED PLANNING

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WHY?

References

https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html

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https://g1.globo.com/sp/sao-paulo/noticia/2018/09/18/paulistano-demora-quase-3-horas-por-dia-no-transito-e-88-dos-pedestres-se-sentem-inseguros-diz-pesquisa.ghtml

https://www.un.org/en/sections/issues-depth/population/

http://stdetranrs.rs.gov.br/conteudo/23660

Diverse Planning

A

B

path1

path2

path3

path4

{path1,path2,path3,path4,.....}

Diverse Planning

Which criteria to use to compare plans?
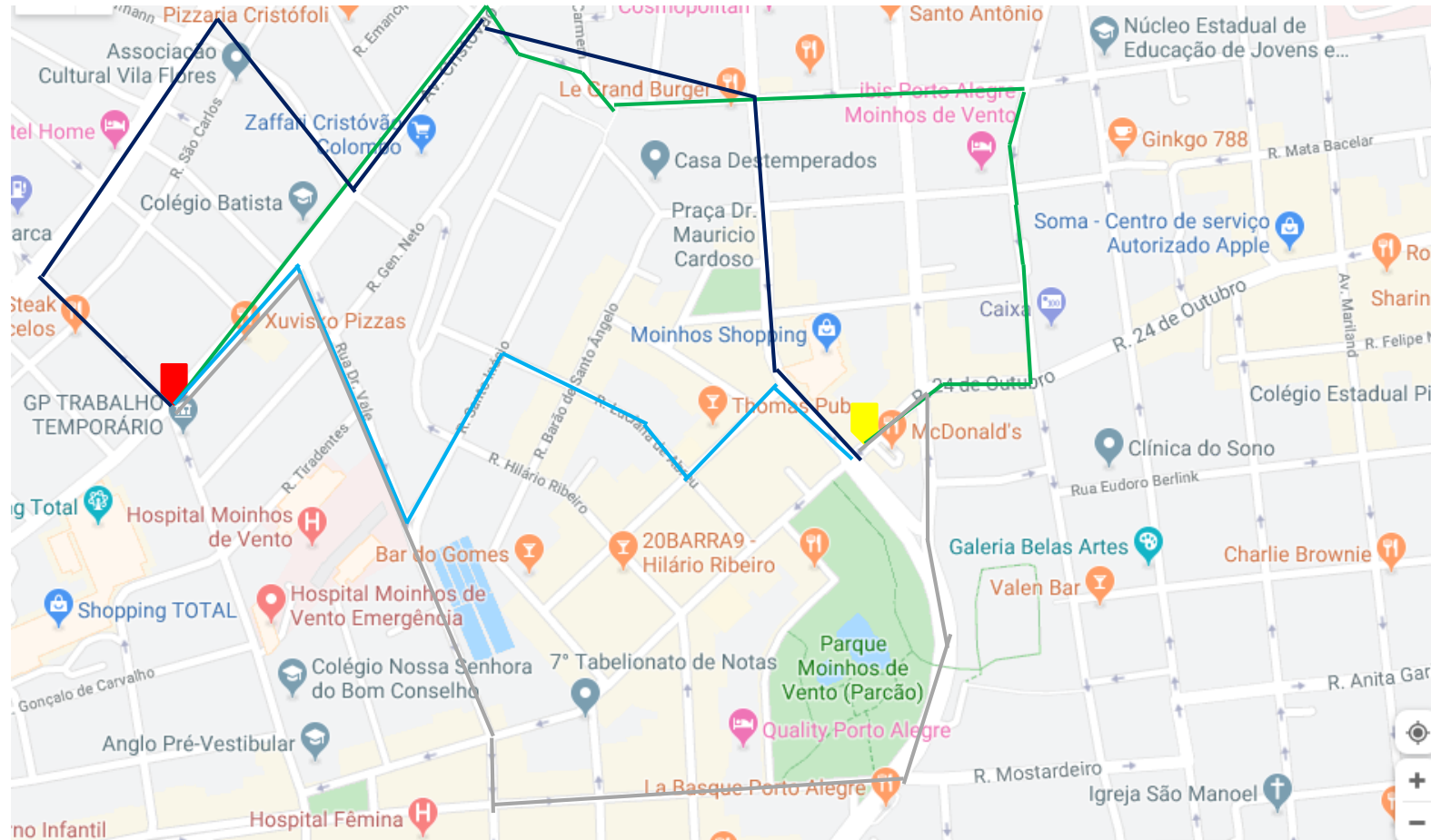
More diverse

{path1,path4}

Diverse Planning
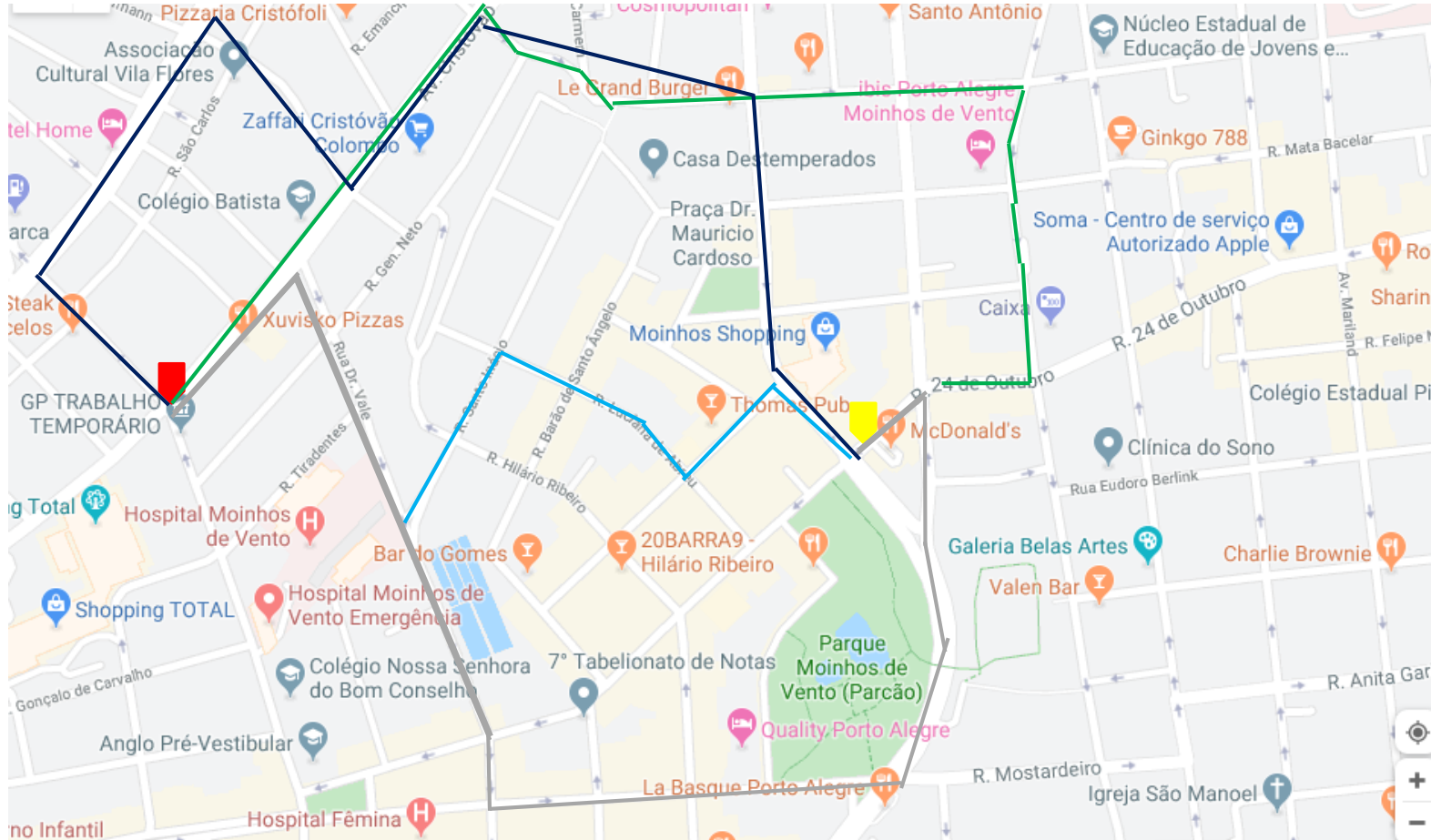
Which criteria to use to compare plans?

More diverse
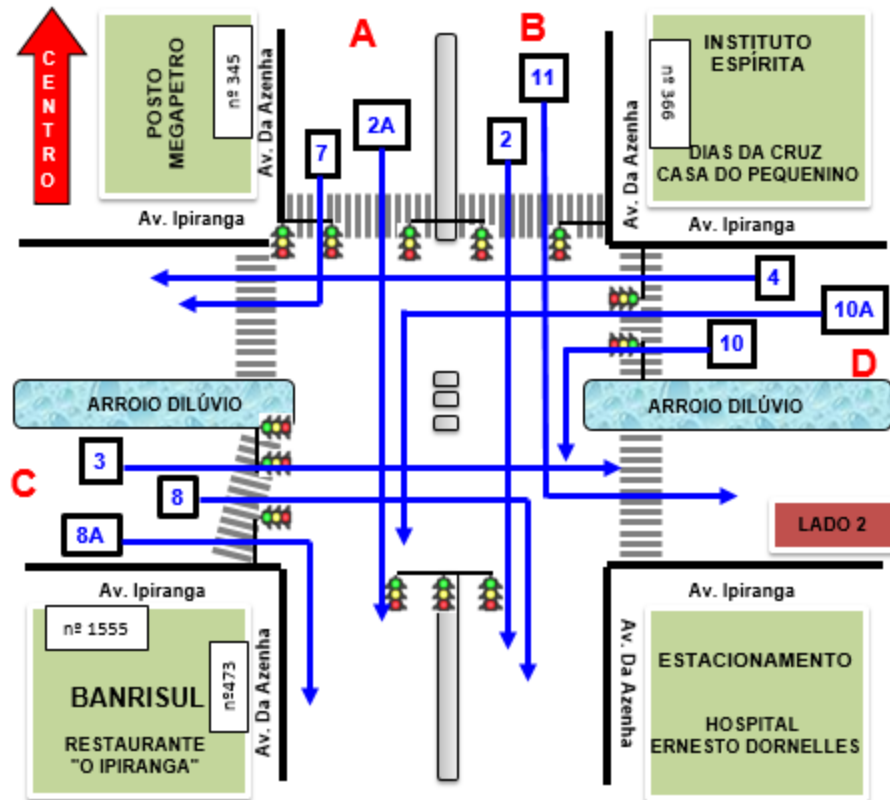
{path1,path4}

Less diverse
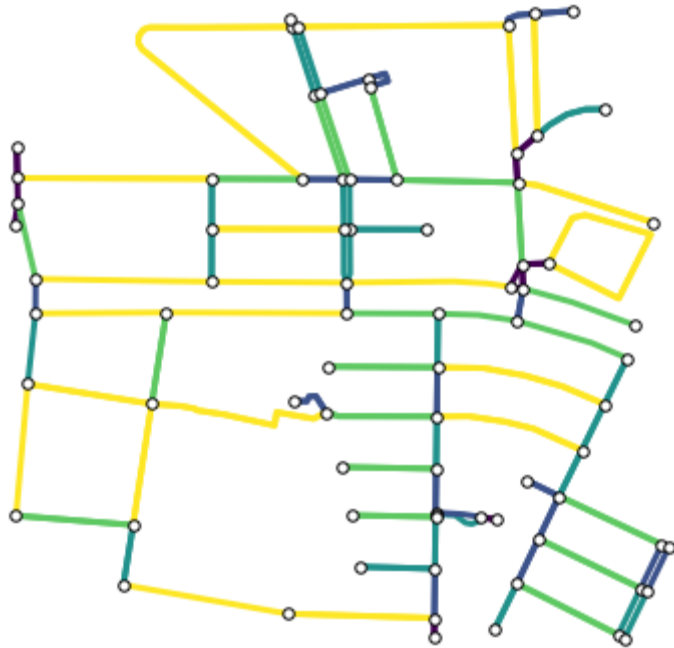
{path1,path2,path3}

Traffic Flow Model

Lighthill Whitham Richards (LWR):

$$Q(x, t) = \rho(x, t) * V(x, t)$$

Flow   Vehicles/length   Velocity

Graph Model

|	access	bridge	geometry	highway	junction	key	lanes	length	maxspeed	name	oneway	osmid	ref	service	tunnel	u	v
0	NaN	NaN	LINESTRING (-51.1607587 -30.0621298, -51.16106...	tertiary	NaN	0	NaN	64.744	40	Rua Nelson Zang	False	27806543	NaN	NaN	NaN	312803356	312805987
1	NaN	NaN	LINESTRING (-51.1607587 -30.0621298, -51.16075...	residential	NaN	0	NaN	66.462	NaN	Rua Marcone	False	454586925	NaN	NaN	NaN	312803356	2509018501
2	NaN	NaN	LINESTRING (-51.1607587 -30.0621298, -51.16044...	tertiary	NaN	0	NaN	72.200	40	Rua Nelson Zang	False	477741068	NaN	NaN	NaN	312803356	312803358
3	NaN	NaN	LINESTRING (-51.1607587 -30.0621298, -51.15917...	residential	NaN	0	NaN	170.557	NaN	Rua Artur de Oliveira	False	562353039	NaN	NaN	NaN	312803356	2288379555

Study Case
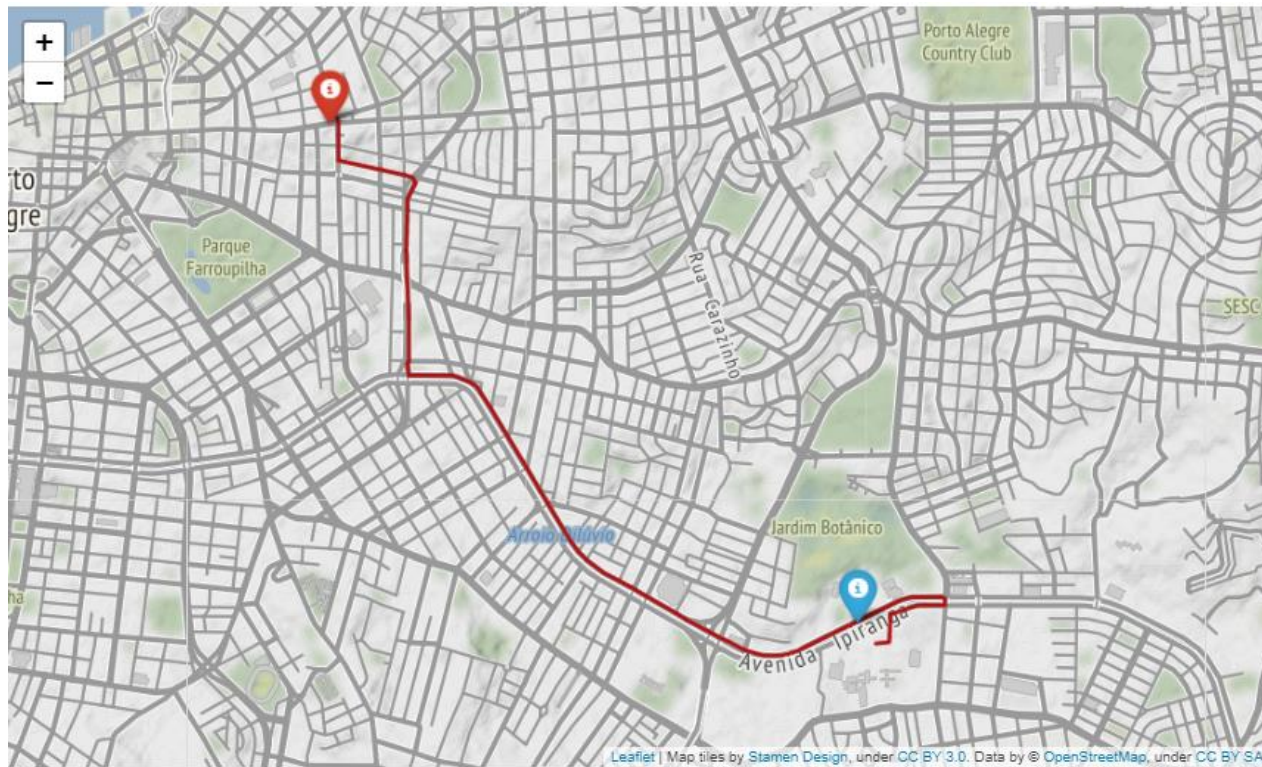
Using A* Algorithm.
Finds the sortest path between two points in the graph.

Study Case
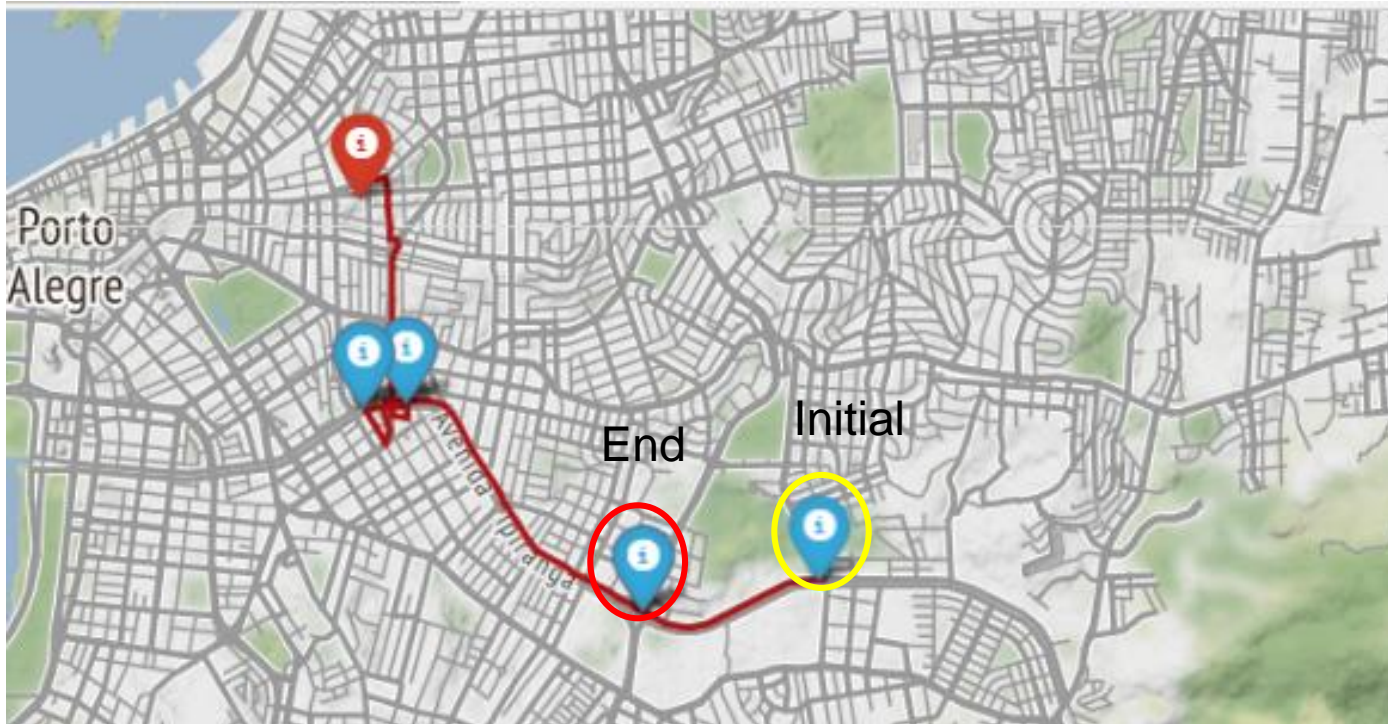
What if we demand that the bus passes through certain bus stops?

Considering every bus stop a initial node and using A* Algorithm to find the shortest path between each one of the bus stops.
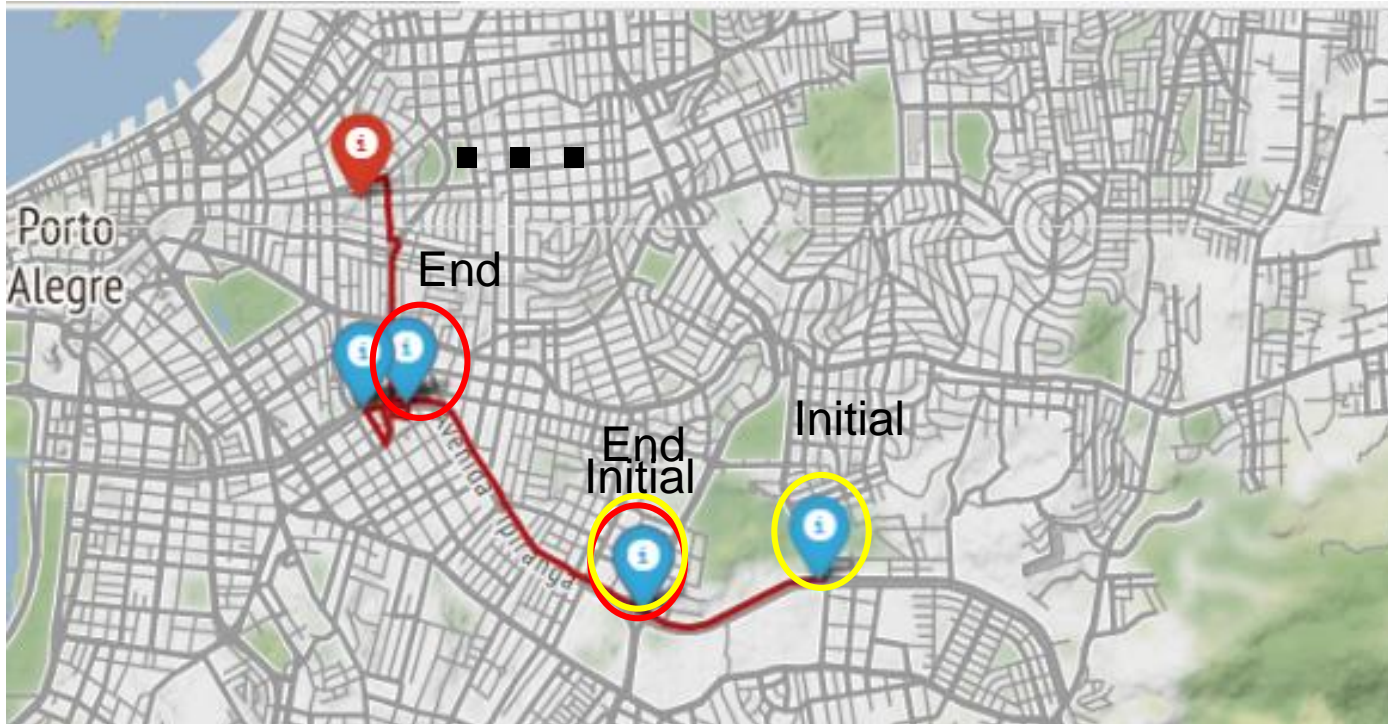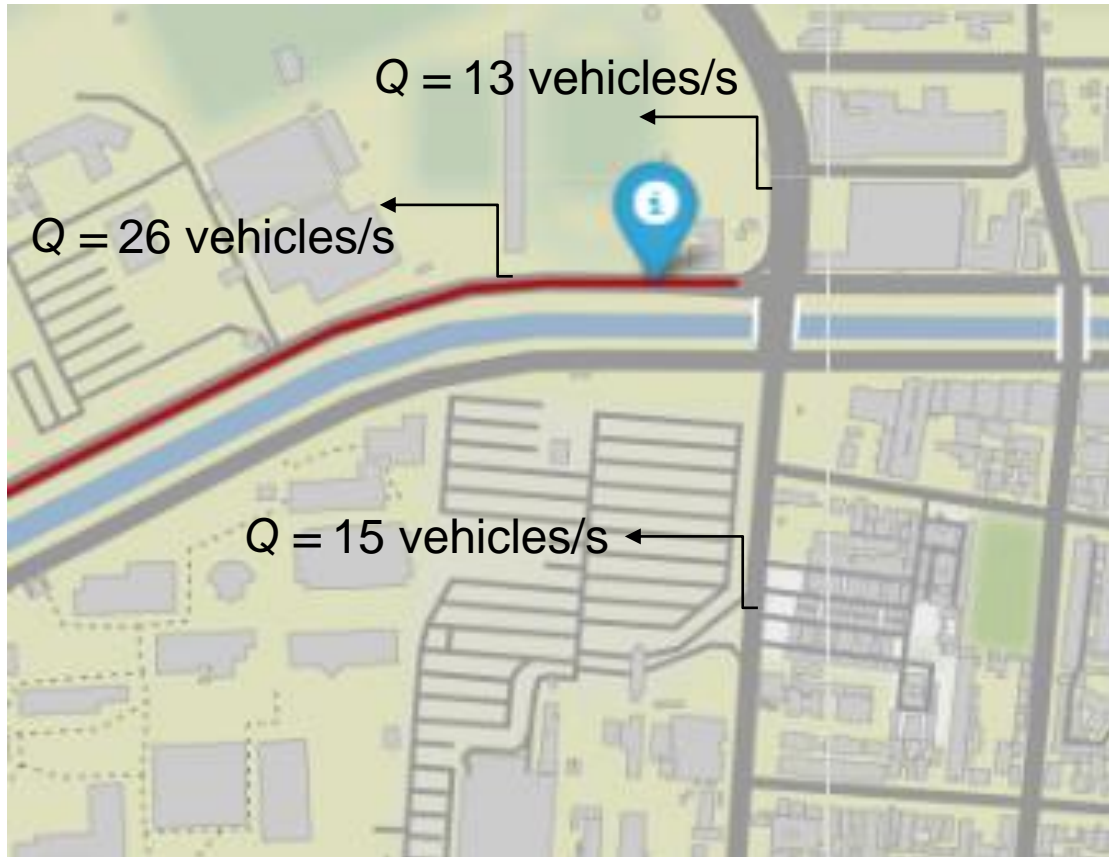
Study Case

What if we demand that the bus passes through certain bus stops?

Considering every bus stop a initial node and using A* Algorithm to find the shortest path between each one of the bus stops.

Study Case

$Q = 13$ vehicles/s

$Q = 26$ vehicles/s

$Q = 15$ vehicles/s

Considering the traffic flow (Q), the algorithm is supposed to select the most congested path.

The planner generates multiple plans {path1,path2...} based on the total cost. That means that only the paths highly demanded are considered.

Providing bus lines to busy streets, it is expected that the traffic volume decreases.

Study Case
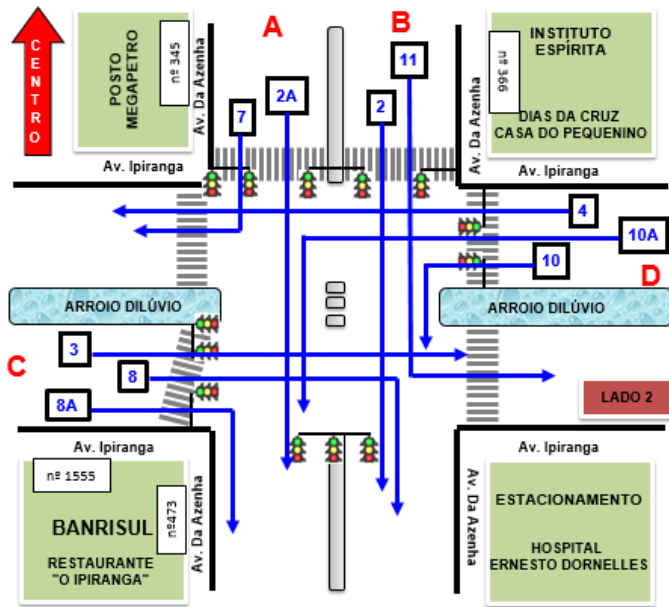
The traffic flow model provides the weight that is considered by the planner.

The planner generates a path that the flow model can asses the impact of the proposed bus lines.

Thank you!

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