MORE
Multimodal Optimisation of Roadspace in Europe

D5.3

Option generation and appraisal for current street conditions

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1 Introduction

1.1 The MORE Project

The primary aim of MORE is to provide a comprehensive and objective approach to the planning, design, management and operation of road space on major urban corridors feeding the international TEN-T road networks (Figure 1).

This is so that limited road space and capacity can be optimised, through the development of new concepts, tools and processes (which is developed and tested in five cities). This takes into account the multi-modal functioning of the corridors and their links with major inter-modal interchanges (e.g., ports) to enable city authorities to optimally allocate limited available capacity, in space and time.

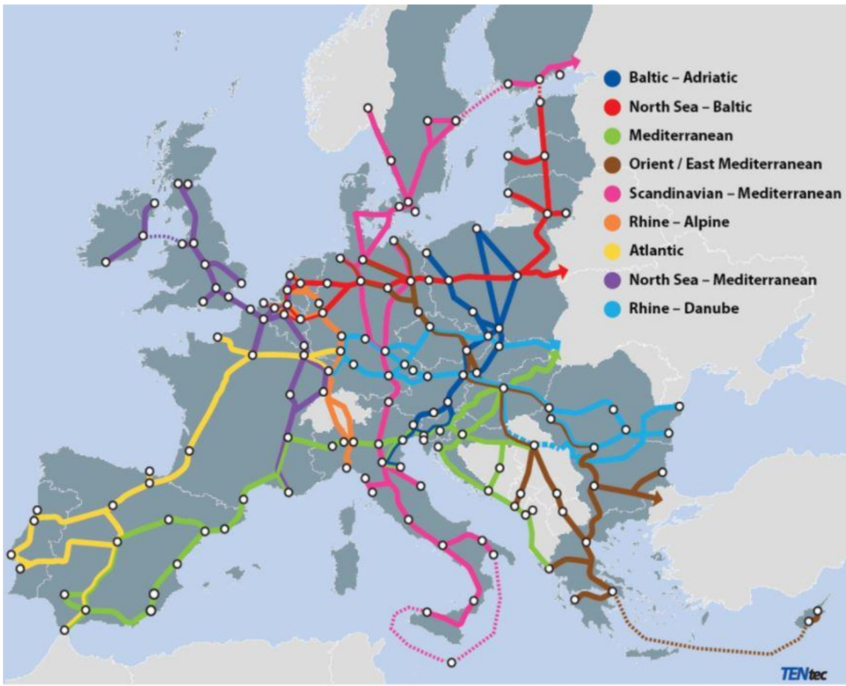


Figure 1. TEN-T Network (Source: European Commission)

The MORE ambition is to understand the current situation of the corridors in the partner cities, but also to understand how future trends may influence the way the roads are used.

1.2 Objective of deliverable

This report presents the experiences of the five cities in following the MORE approach to developing optimal road-space management packages for their selected urban corridors. This focuses on sections currently under stress where there are multiple demands from different road users, mobility modes and land uses. These challenges manifest in cities across Europe often resulting in congestion, poor air quality and unreliable journey times.

The report presents how these road space management packages have been co-created with multiple stakeholders and the public; then modelled and appraised. The street designs which lead to the most positive impacts are highlighted, as are the resulting key performance indicators.

The aim is to enhance the ambition of street design and better accommodate new mobility modes through an innovative process, making use of the four sets of MORE Tools:

- Generate street design options: Policy Interventions Tool and Street Designs Tool
- Stakeholder and public engagement and visualisation tools: Traffweb and Linemap
- Modelling tool to simulate operation of street design: enhanced Vissim
- Valuation of impacts of different street designs: Appraisal Framework Tool

This deliverable comprises one chapter for each of the five city MORE case studies and presents the step-by-step process they have followed in applying these tools.

This approach can now be replicated by other cities across Europe, drawing on the full range of outputs on the MORE website www.roadspace.eu.

2 BUDAPEST

2.1 Current conditions along the Stress Section

The Budapest Section Under Stress is located on Kossuth Lajos street and Rákóczi road, between Váci street and Síp street. Its length is 800 metres. This east-west boulevard is called the Rákóczi axis, and it is one of the most important and busiest roads in Budapest, which goes through the city centre. Traffic and air pollution are high, and the street is not able to play its natural role, where people can feel confident in the city centre. The road axis splits the city centre into two parts, and only a few connections are available to cross the road. Ferenciek square and Astoria are important mobility hubs and places for living in the city centre. The following Figures show the Section Under Stress on a satellite map (north-west orientation) and traffic map (north orientation).

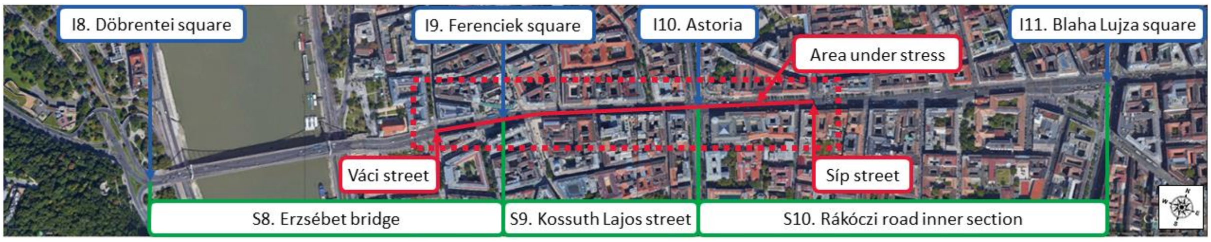


Figure 2. Section Under Stress, satellite map, north-west orientation

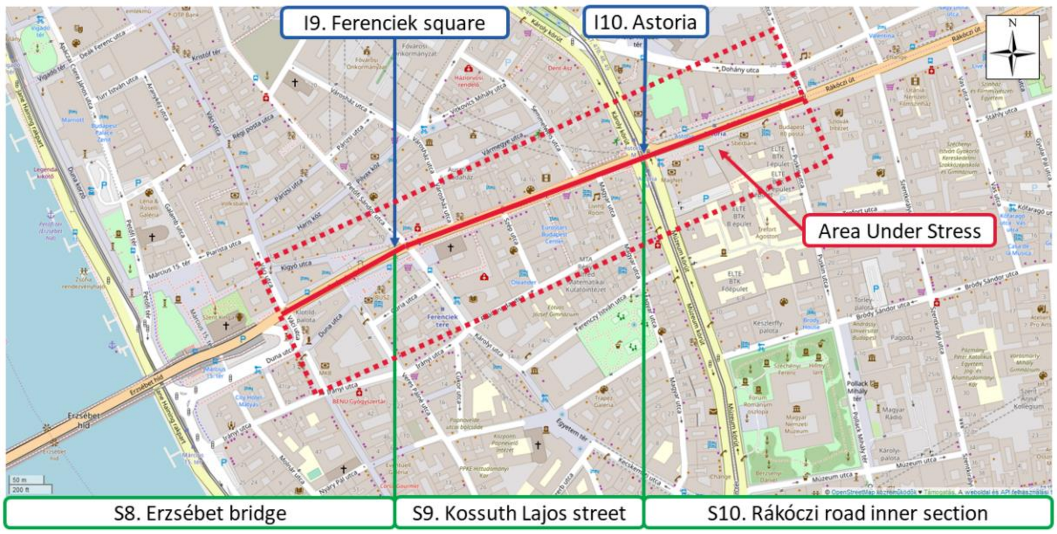


Figure 3. Section Under Stress, traffic map, north orientation

The following Figure shows the whole modelling area with six zones, with zones 1 to 4 being the focus for this study.

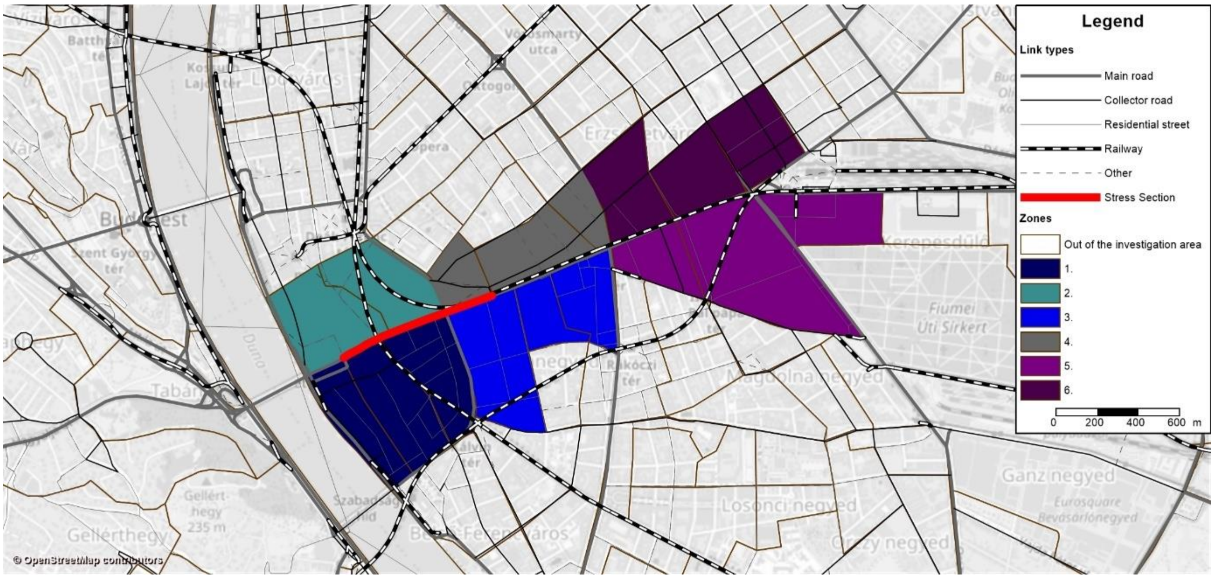


Figure 4. Section Under Stress and surrounding zones

The 1st and 2nd zones are located between the Danube and the Astoria; the 3rd and 4th zones are located between the Astoria and the Blaha Lujza square.

2.1.1 Demography

The following figure shows the detailed population information of the first four zones, divided by occupation.

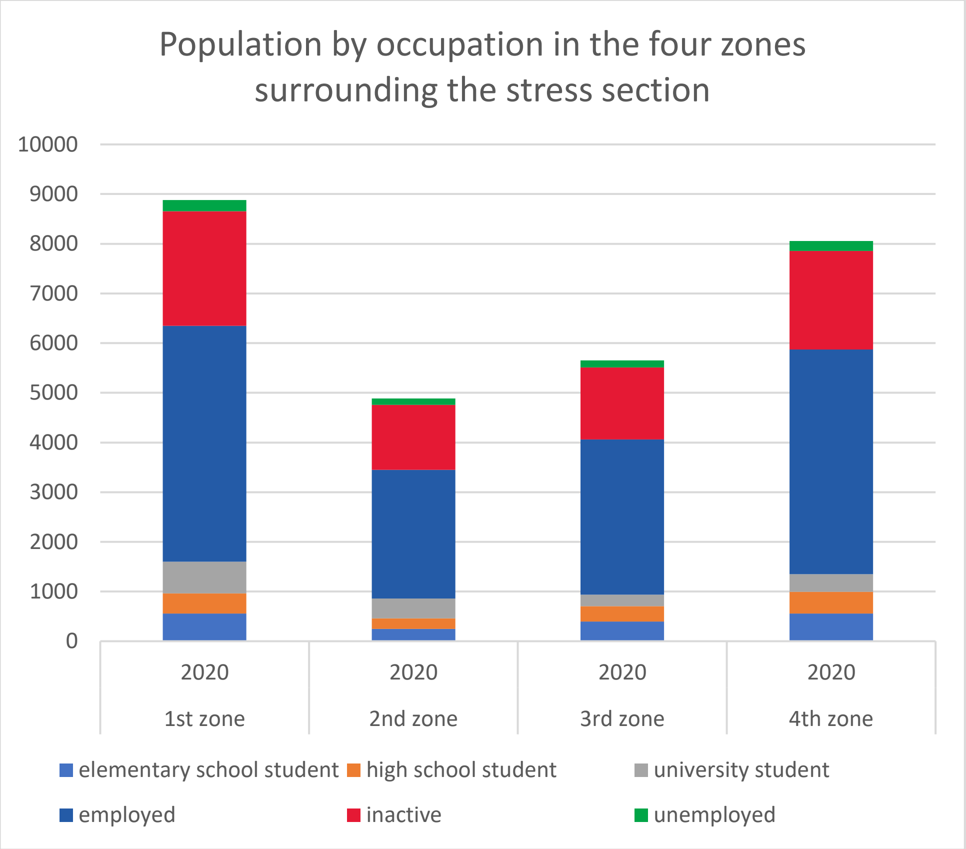


Figure 5. Population details of the first four zones, divided by occupation

2.1.2 Economic Activities

The 4 defined zones have different facilities which generate journey types. There are several educational and healthcare (pharmacy, hospital) institutions. Those zones which are in the centre of Budapest (the 1st and 2nd) have a lot of restaurants, cafes and entertainment places (like theatre, cinema, clubs).

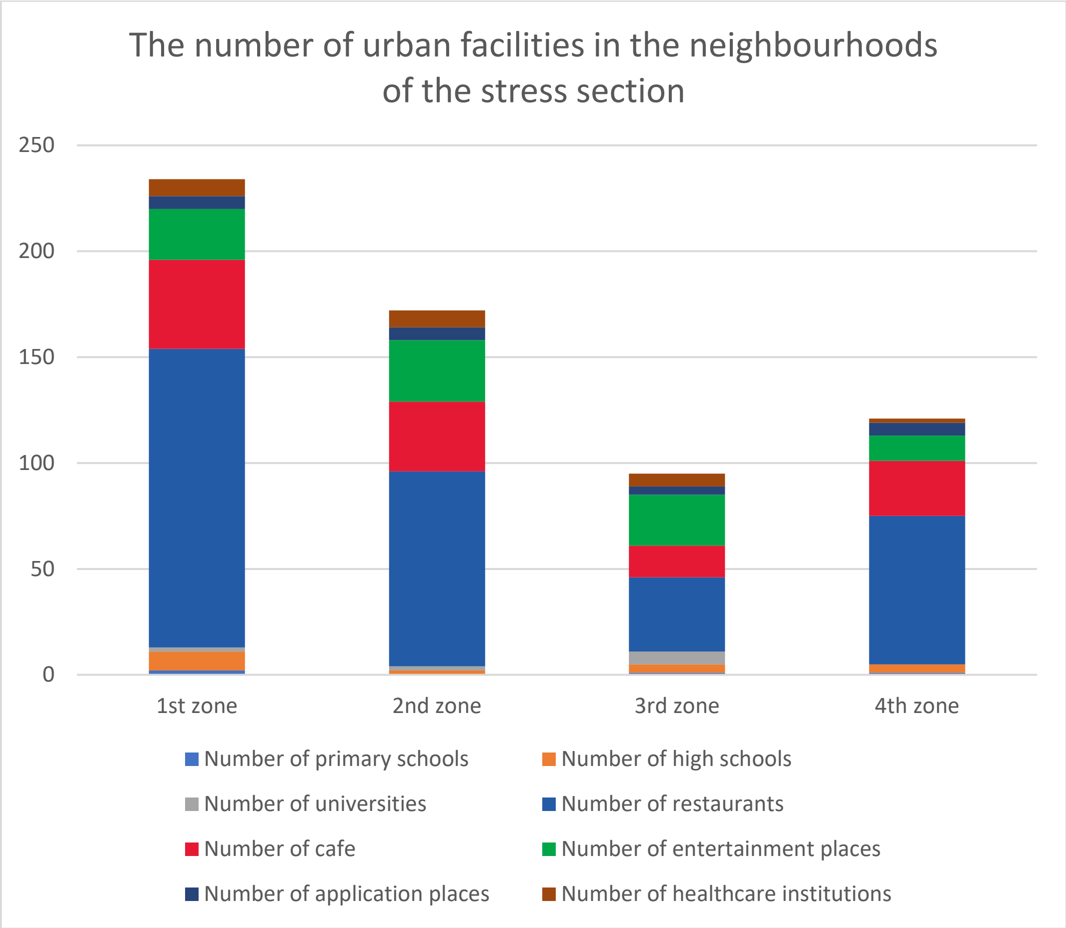


Figure 6. Local facilities in the four zones

Another important parameter for the planning is the number of the employees. The figure below shows the number of jobs in the four zones surrounding the stress section.

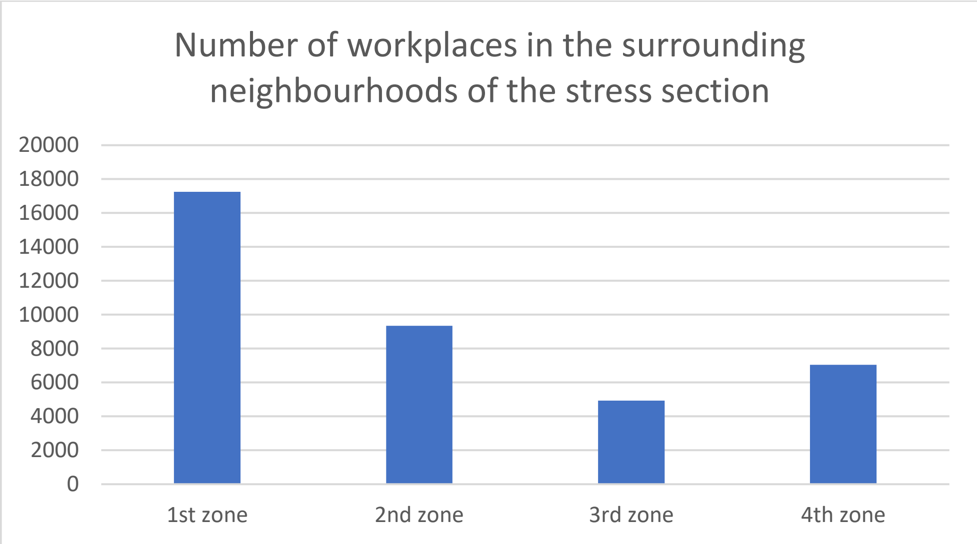


Figure 7. Number of workplaces in the four zones

2.1.3 Kerbside Activities

Parking Areas

Parking is a complex system in Budapest. There is a protected zone in Budapest downtown, where vehicles with permission may be used, which is most of the local residents. The other inner part of the city centre is at Zone 1, rest of the city centre is at Zone 2. Parking is prohibited at the full length of Kossuth Lajos street and Rákóczi road.

City logistic vehicles can use parking and loading points to serve hotels, shops, restaurants and administrative offices. Several loading points are available downtown. Taxi drop-off points are located at the main part cultural, administrative and transportation hubs, and centres of the city, for instance the surrounds of Ferenciek square and Astoria. This is shown in the figures below.

Figure 8. Parking, loading and taxi facilities around Ferenciek square (S8 Erzsébet bridge, I9 Ferenciek square, S9 Kossuth Lajos street)

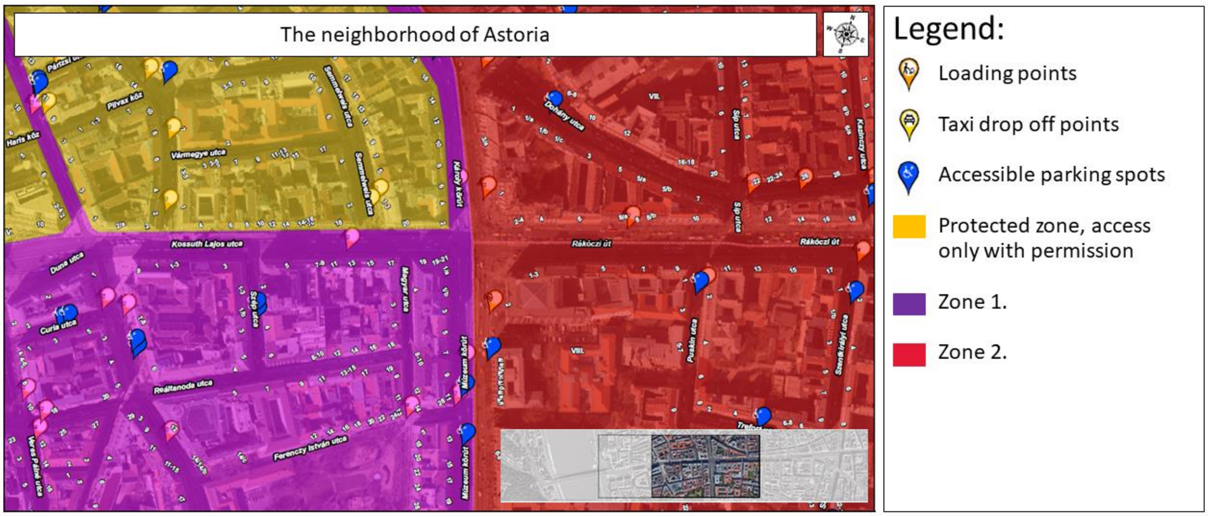


Figure 9. Parking, loading and taxi facilities around Astoria (S9 Kossuth Lajos street, I10 Astoria, S10 Rákóczi road inner section)

2.1.4 Public Transport

The following figure shows the numerous public transport lines in the city centre. As the figure represents, Ferenciek square and Astoria are important transportation hubs in Budapest. They lay at Rákóczi axis bus corridor and many passengers travel through these hubs. Metro line

M3 approaches Area Under Stress at Ferenciek square and metro line M2 approaches Area Under Stress at Astoria.

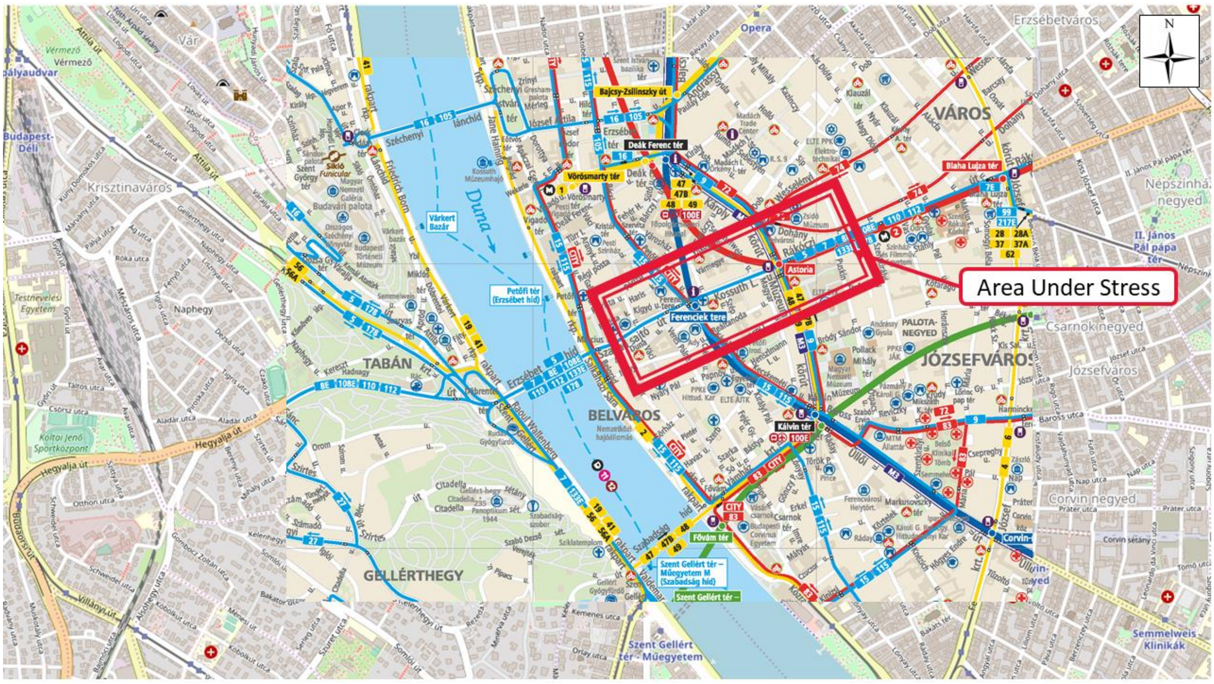


Figure 10. Public transport network in the city centre

The following pictures show public transport stops, pedestrian crossings and underpasses at the neighbourhood of Ferenciek square.

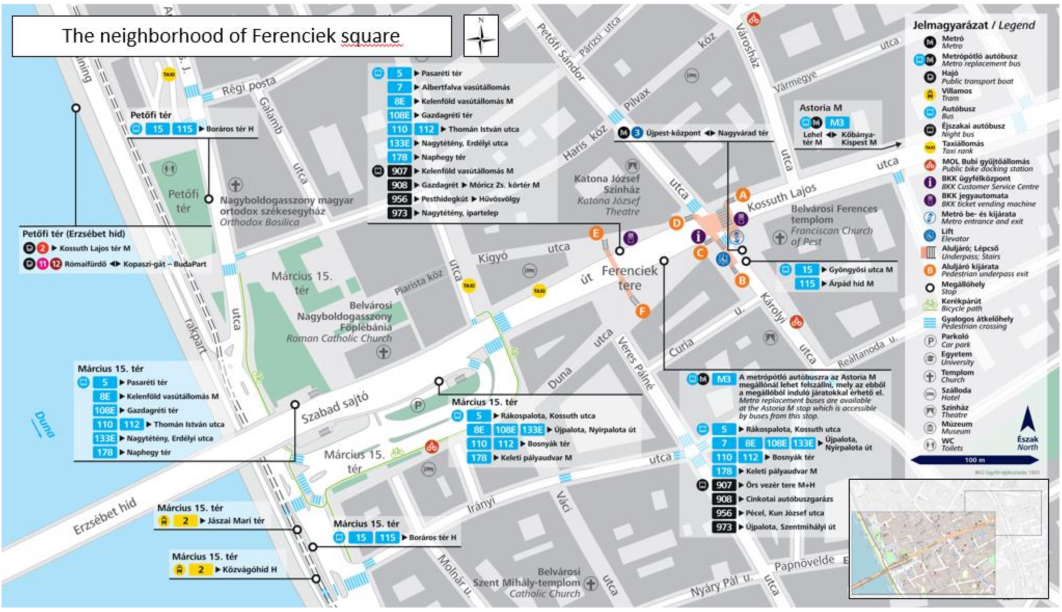


Figure 11. Public transport stops around Ferenciek square

The following figure shows public transport stops, pedestrian crossings and underpasses in the neighbourhood of Astoria.

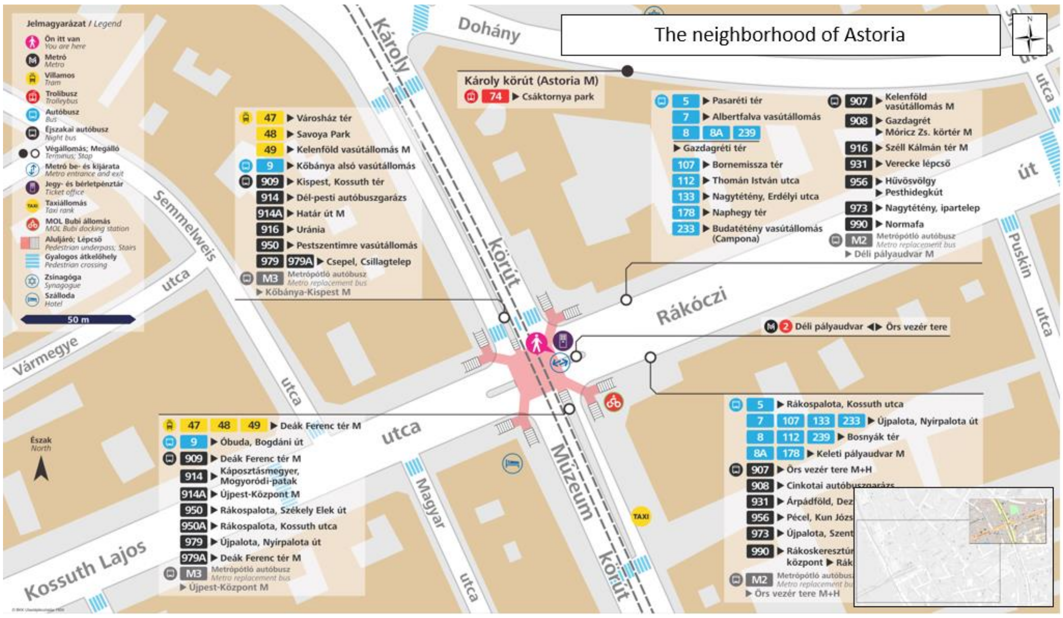


Figure 12. Public transport lines around Astoria

2.1.5 Demand Characterization

Kossuth Lajos street is one of the busiest corridors of Budapest, connecting the centre areas of both Buda and Pest. Road connections on both ends are of better quality, allowing private car users to use this corridor not only for commuting purposes but also to travel through the inner city. Therefore, traffic volume is high for both private and public transportation.

a) Traffic Volume

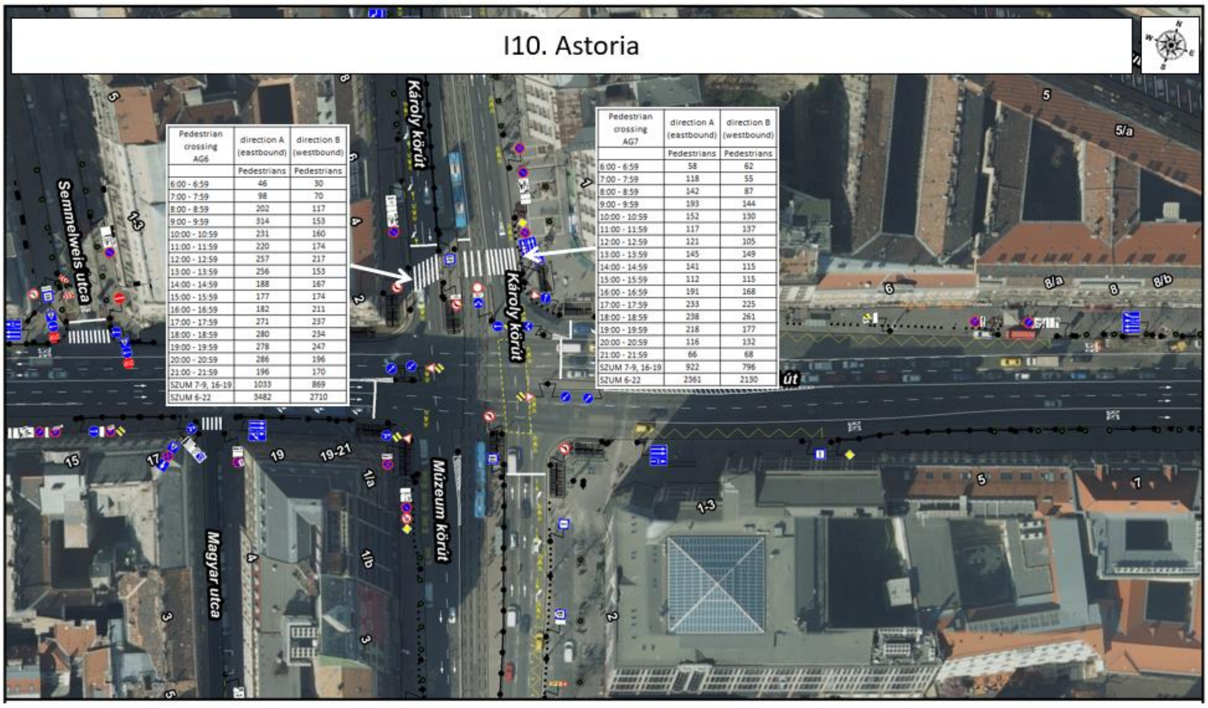
Vehicle traffic and pedestrian data collection took place between 6AM and 10PM on weekdays. The following data was collected at Ferenciek square in each direction.

Table 1. Results of traffic collection, Ferenciek square, 19 Nov 2019

Vehicle types	Ferenciek square	
	Kossuth Lajos street eastbound view	**Kossuth Lajos street westbound view**
Private car	18737	19242
Taxi	2028	2837
Bicycle	119	425
e-Scooter	25	140
Segway	4	83
Motorcyclists	568	460
Bus (Public and Private)	1231	1010
HGV/LGV with 2 axles, < 3.5t	1727	651
HGV/LGV with 2 axles, 3.5t-7.5t	612	666
HGV/LGV with 2 axles, 7.5t <	22	867
HGV/LGV with 3 axles	0	0
HGV/LGV with 4 axles	0	0

b) Pedestrian volume, flows, mobility patterns

The following figures represent daily pedestrian traffic at pedestrian crossings and underpasses at the Astoria section of the street. It shows that in addition to high traffic movement, it has high levels of pedestrian movement showing the conflicting demands on the space. Pedestrian volumes and crossings along other sections of the street are shown in Appendix 1.



Pedestrian crossing AG6	direction A (eastbound)	direction B (westbound)
	Pedestrians	Pedestrians
6:00 - 6:59	46	30
7:00 - 7:59	98	70
8:00 - 8:59	202	117
9:00 - 9:59	314	153
10:00 - 10:59	231	160
11:00 - 11:59	220	174
12:00 - 12:59	257	217
13:00 - 13:59	256	153
14:00 - 14:59	188	167
15:00 - 15:59	177	174
16:00 - 16:59	182	211
17:00 - 17:59	271	237
18:00 - 18:59	280	234
19:00 - 19:59	278	247
20:00 - 20:59	286	196
21:00 - 21:59	196	170
SZUM 7-9, 16-19	1033	869
SZUM 6-22	3482	2710

Pedestrian crossing AG7	direction A (eastbound)	direction B (westbound)
	Pedestrians	Pedestrians
6:00 - 6:59	58	62
7:00 - 7:59	118	55
8:00 - 8:59	142	87
9:00 - 9:59	193	144
10:00 - 10:59	152	130
11:00 - 11:59	117	137
12:00 - 12:59	121	105
13:00 - 13:59	145	149
14:00 - 14:59	141	115
15:00 - 15:59	112	115
16:00 - 16:59	191	168
17:00 - 17:59	233	225
18:00 - 18:59	238	261
19:00 - 19:59	218	177
20:00 - 20:59	116	132
21:00 - 21:59	66	68
SZUM 7-9, 16-19	922	796
SZUM 6-22	2361	2130

Figure 13. Daily pedestrian traffic at pedestrian crossings in Astoria

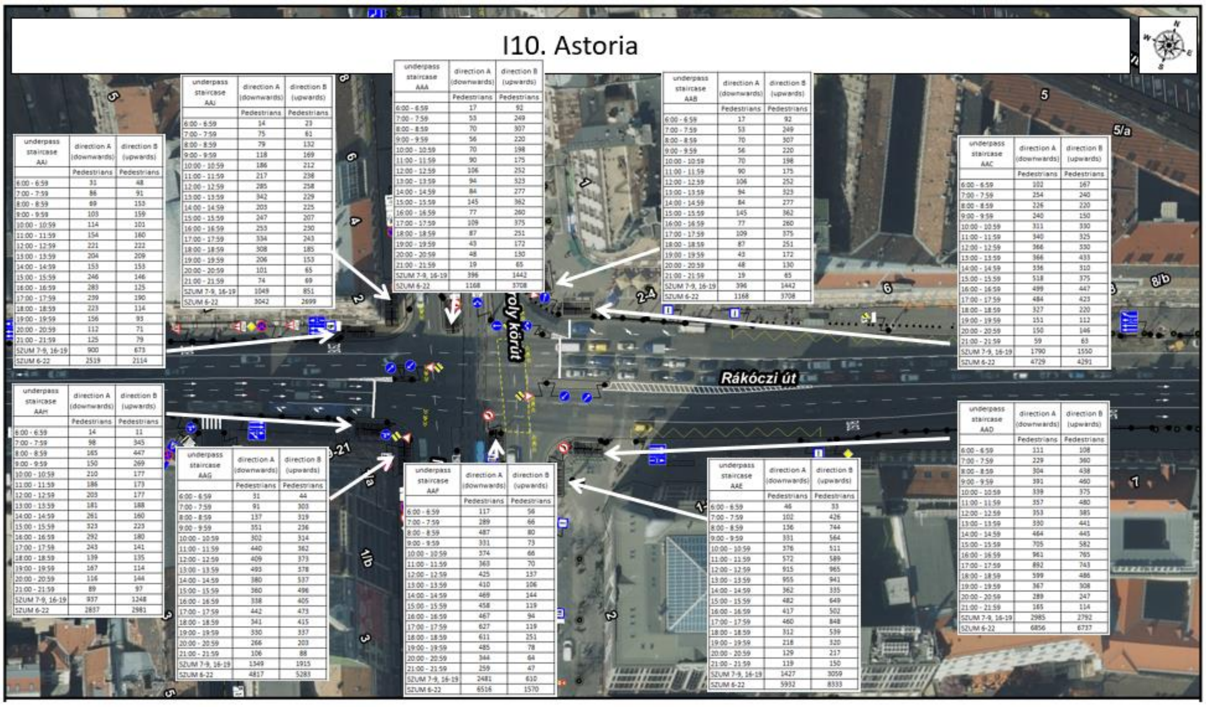


Figure 14. Daily pedestrian traffic at underpass in Ferenciek square

2.1.6 Infrastructure and supply characterisation

c) Number of lanes

There are wide carriageways for private and public traffic along the Street Under Stress: 2 lanes for private transport, 1 lane for public transport, and some additional lines at the neighbourhood of junctions each direction are available for road traffic. The traffic lanes are 3m width. The following map shows the existing road layout and varying number of lanes in different sections.

 Version: 3

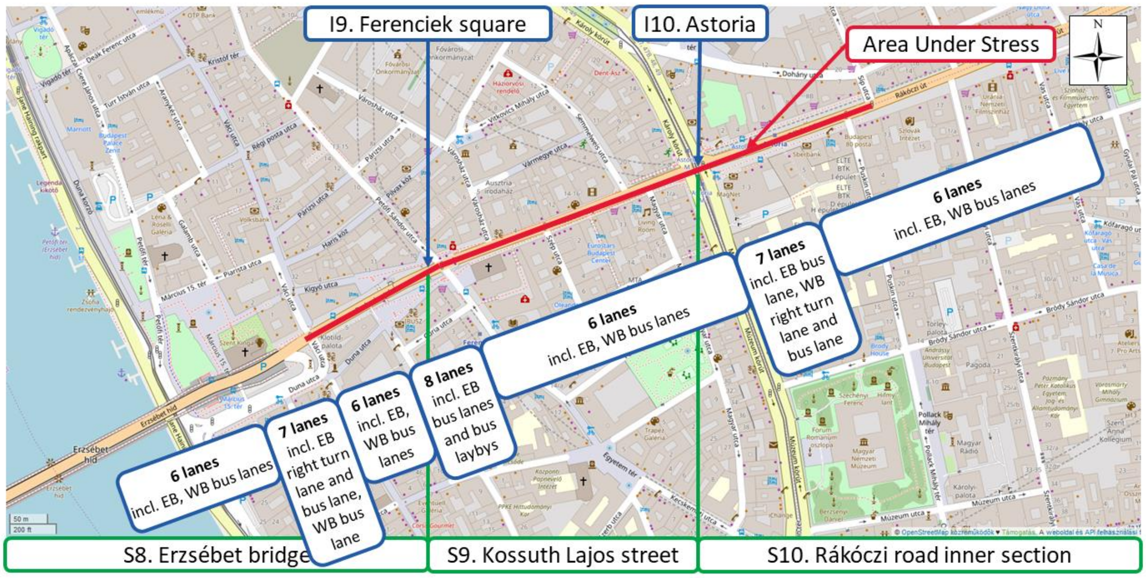


Figure 15. Overview of existing the road layout, the number of lanes in different sections and their purpose

d) Pedestrian available space

Pedestrian movements are limited within the Section Under Stress, with only four pedestrian crossings (at Váczi street, Ferenciek Square, middle of Kossuth Lajos street and Síp street) and two underpasses at Ferenciek square and Astoria. A fence is sited between the carriageway and footpath along Kossuth Lajos street and Rákóczi road except around public transport stops to prevent illegal pedestrian crossing between two sides of the road. Underpasses provide not only pedestrian crossing between two sides of the road, but also metro entrances.

Traffic movement for cars is the main function of the stress section. The 6 traffic lanes need most part of the cross-section of the street, the pedestrians have only 4-4m on each side of the street for walking. The situation is a little bit better around Astoria but the wide of the footway 6m on both sides. There isn't enough space for benches, parking lots, packing and loading points, even bicycle storages. There are only appearing on the streets which are connecting to the stress section.

2.2 Preparations for the street design exercises

2.2.1 Generating street design options in the stakeholder exercises with Traffweb

Traffweb was a tool (https://www.moreconsultation.eu/budapest) used as a first interaction with the section's users and was very useful to be aware of the main concerns of the general public. Before the public consultation started, the webpage was personalized with translation to Hungarian and make some changes the used transport modes and interest to fit the Budapest Stress section. In this way, the participants of the survey could choose from 12 used transport modes and 12 interest options.

Moreover, the people could give general comments for the whole section or location-based comments for smaller part of the street. BKK enlarged the analyzed section at the Traffweb consultation to the whole Rákóczi road from the Erzsébet bridge to Keleti Railway station. In this way, the people could give comments not just from the inner part of Rákóczi axis, but also form the outer part of it. (*Section / intersection numbers from D5.1: S8. Erzsébet bridge (partly), I9. Ferenciek square, S9. Kossuth Lajos street, I10. Astoria, S10. Rákóczi road inner section, I11. Blaha Lujza square, S11. Rákóczi road outer section, I12. Keleti railway station.*)

The public site was available between September - November 2020, and it was launched at BKK's Facebook page and several other posts on the topic ensured higher participation level at the campaign period. Altogether BKK received 190 comments via Budapest Traffweb MORE consultation webpage and received also a lot of Facebook comments under the posts.

The comments gave a following inputs. Most of the participants were local workers and function visitors. 74% of the participants haven't specified a day period, which may allow the conclusion that most of the problems occur along the day in a recurrent way.

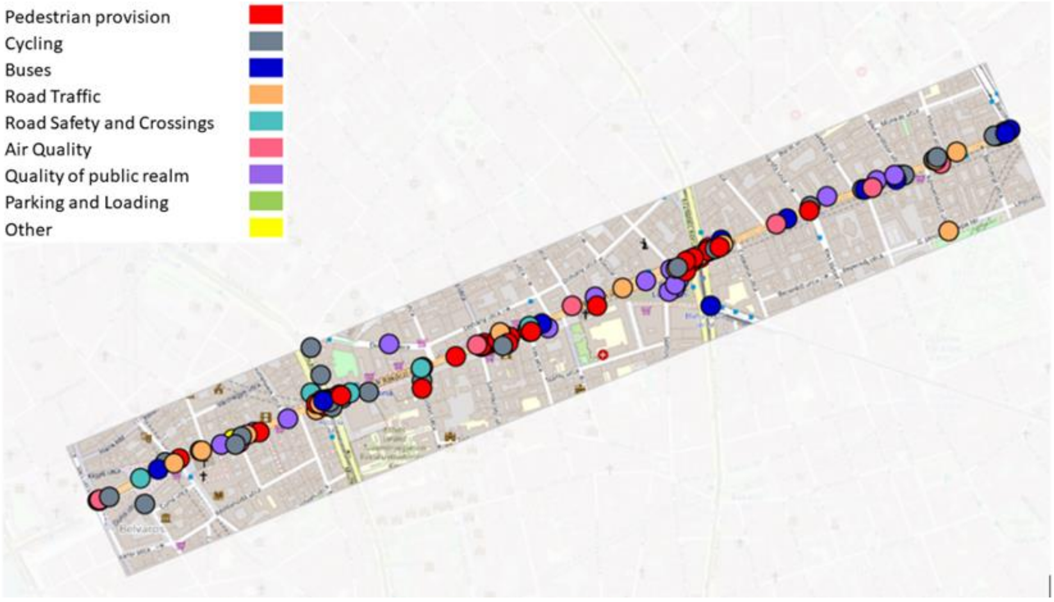
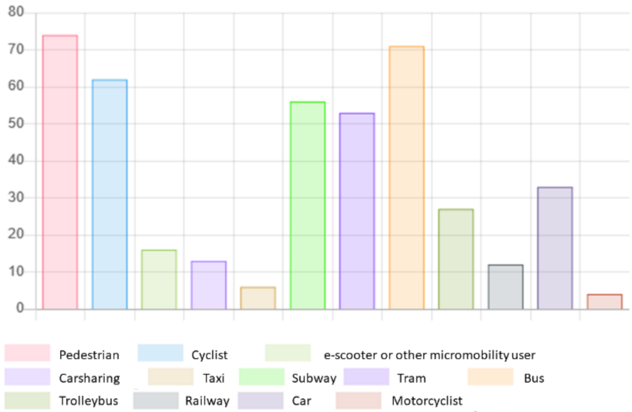


Figure 16. Generating street design options with Traffweb

One third of the comments provided a general overview of the section and weren't related to a specific location. A high percentage of the notifications was related to the liveability and sustainability categories. A big portion of responders would make this section more liveable, in terms of pedestrians and cyclists, wishing unambiguously a street where they can spend their time conveniently. The following charts represent the used transport modes and interest of the participants.



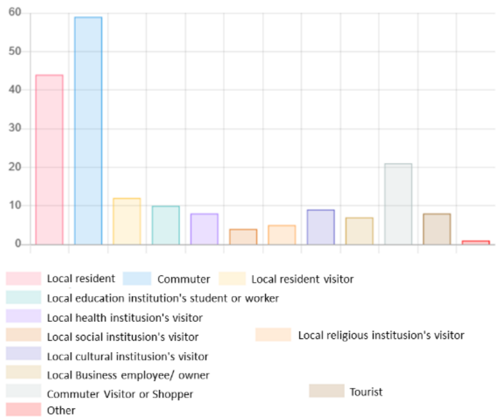


Figure 17. Transport modes used and interest of the participants

As shown in the following map, most of the participants related specific locations. The notifications of the section were classified into five areas:

1. Ferenciek square – Astoria square

- Reducing lanes
- Improving bicycle facilities
- Lack of Trees
- Lack of Benches
- Wider pedestrian crossings
- Lack of pedestrian crossings
- Tram or trolleybus instead of bus

2. Astoria square

- Lack of pedestrian crossings
- Carriageway at bad condition

3. Astoria square – Blaha Lujza square

- Widing sidewalks
- Lack of pedestrian crossings
- Improving bicycle facilities
- Bus lane at the middle of the street

4. Blaha Lujza square

- Untidy public space
- Lack of pedestrian crossings
- Lack of trees
- Lack of Parking
- Bus lane at the middle of the street

5. Blaha Lujza square – Baross square

- Reducing traffic lanes
- Bicycle lane
- Bus lane at the middle of the street
- Lack of trees
- Lack of pedestrian crossings

Figure 18. Comments provided during public engagement via Traffweb

The following table shows a summary of the most relevant comments. The most commented subject was pedestrians crossing, followed by cycle lane and the quality of the public spaces. In terms of parking and goods delivery, the number of notifications was quite low, hence these two could be considered the least important topics.

Table 2. Summary of most important comments made during public engagement via Traffweb

Comments	Citations (percentage)
Lack of Pedestrian crossing	19%
Cycle lane should be installed for improved safety	18%
Reducing the number of lanes	11%
Too much noise and pollution	11%
Bus lane at the middle of the street	10%
Lack of green spaces and trees	9%
Very low public space quality	8%
Widening sidewalks	2%
Too much congestion	2%
Lack of bicycles parking	1%
Parking in Blaha Lujza square	1%
Carriageway at bad condition	1%

2.2.2 Option generation Tool

This chapter will describe the use made of the Policy Interventions Tool and Road Design Tool.

The Option Generation Tool was tested by the Budapest Team, approaching several possible roads uses but focusing mainly on transferring traffic lanes to cyclists or pedestrian use.

e) Policy intervention tool

Regarding the policy intervention tool, several options were tested, being opted to improve walkability conditions and, then, choose to improve conditions to cyclists or/and micro-mobility users or bus drivers/passengers.

Most of the objectives related to facilitating *place* activities and kerbside activities, promoting physical activity, reducing noise and achieving a more sustainable modal split.

The tool provided useful examples that may be used in the section under analysis, sometimes in the whole street, others in some small sections.

Some of the feasible designs that could be used in the section are:

- Reduce number of traffic lanes
- Decrease width of traffic lanes
- Widen footway and/or declutter footway
- Flexible design
- Dynamic parking charging

- Inclusive design
- Part-time parking/loading space

Flexible design

Feasible? Yes

Source of image: ARUP 2018 FlexKerbs - Evolving Streets for a Driverless Future

Type of policy: Time allocation
Road design where space is reallocated among different uses at different times or in response to demand and conditions. Space can be reallocated among a section of the street (footway, kerbside zone, carriageway) or the whole street.

One possibility is to allocate space for movement at peak-time, with some space being for other uses at other times, such as markets at lunch time, seating areas and taxi bays in the evening, parking space at night, and loading bays in early morning

Some design elements can be active at some times only; including part-time or dynamic bus lanes, cycle lanes, pedestrian crossings, and street furniture (e.g. pop-up parklets and seating areas). The design can also include dynamic pricing of parking.

The changes in space allocation can respond to data captured from sensors and be implemented with LED lights on pavements (with a different colour for each allocation) and digital signs, synced with navigation systems on vehicles and on smartphone apps

Two challenges of flexible designs are how to manage transitions and how to enforce restrictions. The latter is relevant for vehicle-based place activities: vehicles may remain in the space after it has been reallocated to movement.

Figure 19. Policy intervention tool, example of feasible high level design option

Kiss & Ride

Feasible? No

Source of image: https://www.cm-amadora.pt

Type of policy: Space allocation
Designated areas next to public transport nodes (train, light-rail, bus stations) or other places (schools, employment centres) for passengers to be picked up/dropped off by personal vehicles. There is no charge for stopping.

The spaces can only be used for a short time (a few minutes). Drivers must stay inside the vehicle, or nearby, while waiting. The spaces may complement park and ride spaces, but should be closer to the station, to reduce the time they are occupied.

Kiss and ride zones may operate only for a few hours (e.g. peak time, school opening/closure times), with the space assigned to other uses (e.g. longer term car parking, bicycle parking) at other times.

This measure reduces cruising for parking and reduces the need to stop in locations that are unsafe (e.g. with no pedestrian crossings, or near junctions) or disrupt other road users (e.g. double parking, or parking next to cycle lanes).

Compliance can be an issue. Drivers may occupy the space for more than allotted minutes, preventing others from using it. They may also use it as a standard parking space, for longer hours. Adequate signage and enforcement is needed.

Figure 20. Policy intervention tool, example of unfeasible high level design option

f) Road design tool

As well as the Policy Intervention Tool, the Road Design Tool is very easy to use and it is useful to provide a first approach to the section. Below are some examples of the use of the tool and which results were produced, considering our inputs.

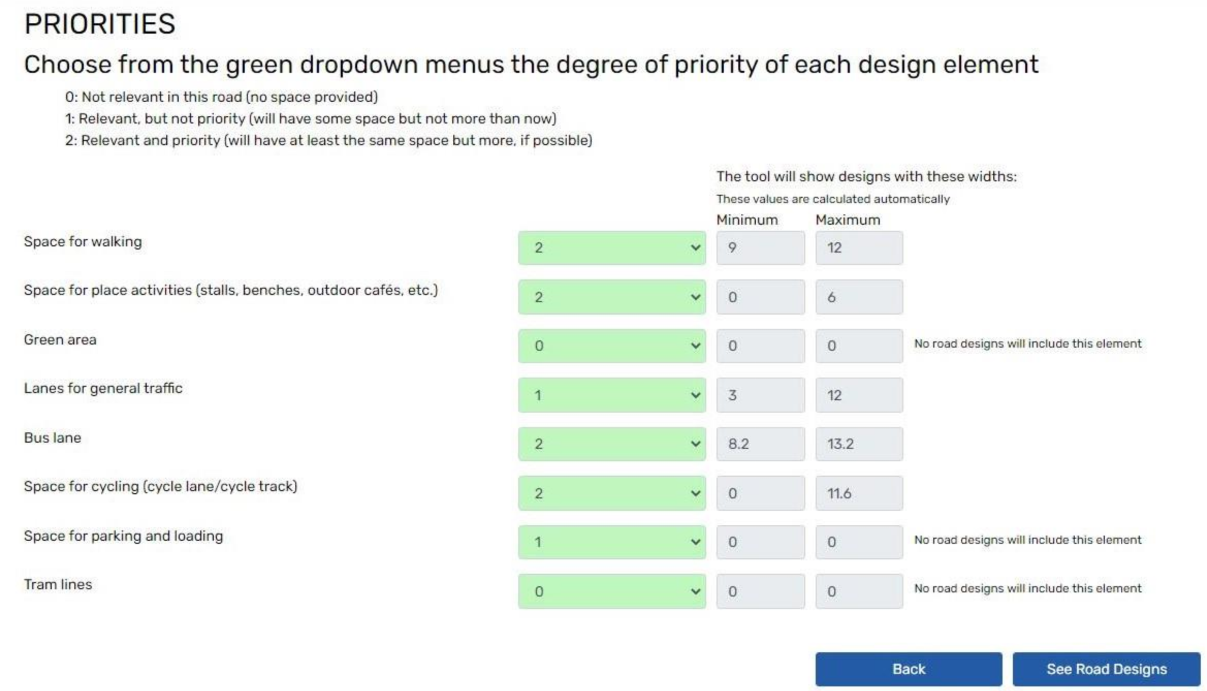
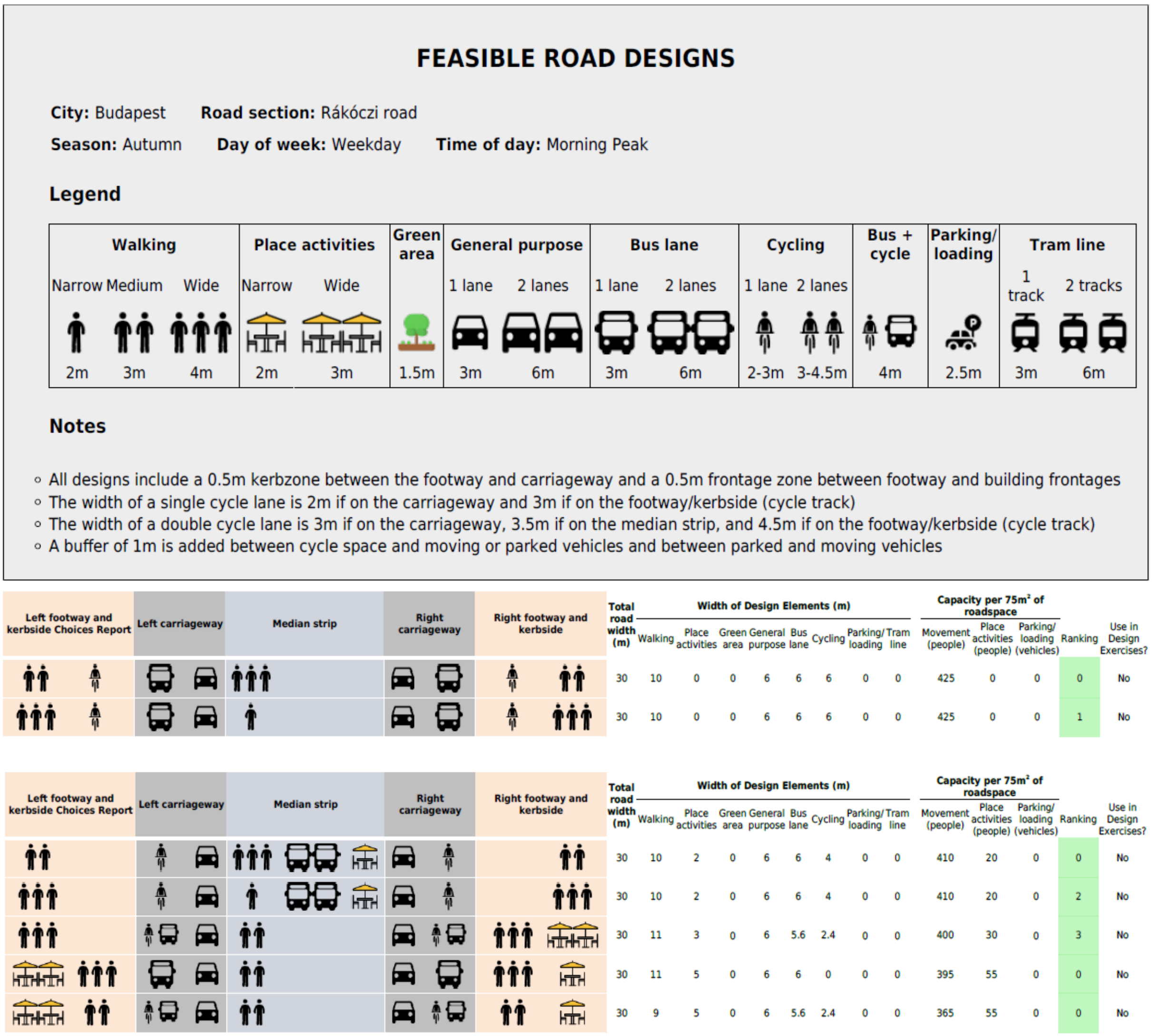


Figure 21. Road Design Tool, selection of design element priorities



Total road width (m)	Width of Design Elements (m): Walking	Place activities	Green area	General purpose	Bus lane	Cycling	Parking/ loading	Tram line	Capacity per 75m² of roadspace: Movement (people)	Place activities (people)	Parking/ loading (vehicles)	Ranking	Use in Design Exercises?
30	10	0	0	6	6	6	0	0	425	0	0	0	No
30	10	0	0	6	6	6	0	0	425	0	0	1	No

Total road width (m)	Width of Design Elements (m): Walking	Place activities	Green area	General purpose	Bus lane	Cycling	Parking/ loading	Tram line	Capacity per 75m² of roadspace: Movement (people)	Place activities (people)	Parking/ loading (vehicles)	Ranking	Use in Design Exercises?
30	10	2	0	6	6	4	0	0	410	20	0	0	No
30	10	2	0	6	6	4	0	0	410	20	0	2	No
30	11	3	0	6	5.6	2.4	0	0	400	30	0	3	No
30	11	5	0	6	6	0	0	0	395	55	0	0	No
30	9	5	0	6	5.6	2.4	0	0	365	55	0	0	No

Figure 22. Road Design Tool produces feasible design options

The tool is very wide-ranging, interesting and an immediate way to simulate conceptual design of street space use and visualise trade-offs.

2.2.3 Design Days

The Design Days workshops were organised by BKK in the framework in the summer of 2021. The aim of Design Days was to identify the present and the future of the stress section of the MORE project and outer part of it (the whole Rákóczi road) in Budapest by transport, social, economic, technological and political aspects. BKK invited to the meetings the Mayor's office's departments and other companies, which have influence on transport, urbanistic or green aspects (Budapest Public Road company (road operator, Budapest transport company (PT provider), Budapest Urban Planning company, Chief Architect of Budapest, Chief Landscape Architect of Budapest, Budapest Public Space Maintenance company.


Figure 23. Design Day workshops in Budapest

Two workshops were hosted in person at BKK HQ. The first tackled the theme of *Urban* aspects, the second concerned *Transport* priorities. Approximately 22 experts participated at each workshop. The 3 hour long events had a specific methodology to reflect and seek the current and future conditions of the whole Rákóczi axis. (Budapest stress section is part of Rákóczi axis). The Urban aspect workshop held on 21st July 2021 with the following entities: BKK Centre for Budapest Transport (Strategic planning, Mobility Development, Project Implementation Depts.), Mayor Office, Chief Architect, Chief Landscape Architect, Budapest City Planning Ltd., Budapest Public Space Maintenance Ltd., Budapest Horticultural Ltd. The Transport aspect workshop held on 26th July 2021 with the following entities: BKK Centre for Budapest Transport (Mobility Development, Mobility Management Depts.), Budapest Public Road, Budapest Transport Ltd., Budapest City Planning Ltd.

The D5.3 document contains the main inputs of the current condition, and the D5.4 document contains the inputs of Future condition from design days.

Methodology of the design days

Firstly, the participants familiarized themselves with the stress section and the whole Rákóczi road, determining its current and future potential and vision, before they used the blocks and acetates. PEST methodology was used to determine the political, economic, social and technological view of the stress section at the current situation.

At the last part of design days, the participants used the blocks and acetates to determine the cross-sections and layouts of the stress section and the whole Rákóczi road. The first part of the workshop helped the experts to have a greater view about what they are thinking about the Rákóczi road.

Summary of the current situations and visions of the Section under Stress

The workshop participants identified the current situation using PEST analysis. The analysis provided an opportunity to develop a political, economic, social and technological picture of the Rákóczi axis and its wider environment.

- Political situation
    - Sustained political support is needed to rethink the Rákóczi axis, to take account of the transport sector,
    - Too much emphasis is placed on "car voters" (delaying the congestion charge, low support for traffic calming measures), and politics is reflected in professional decisions,
    - In addition to clear political support for environmental protection, a change of attitude in the (motoring) society is needed, using direct support and regulatory instruments.

- Economic situation
    - Shops and restaurants are hampered by heavy road traffic, lack of parking and loading facilities, and peripheral location between districts,
    - There are better opportunities for economic activity in the junctions and at the squares,
    - The value of the properties has also been negatively affected by air and noise pollution from traffic, with office and service uses instead of residential functions.

- Social situation
    - The composition of society is constantly changing with suburbanisation, depopulation, ageing, gentrification and the emergence of short-term rentals (Airbnb),
    - The use of public land and property has changed, with a decrease in the number of residents and an increase in the number of renters. Temporary use of land has come to the front, with disused buildings and public spaces losing their function,
    - The area has a high cultural and social value, with a high number of architectural and cultural facilities. Nevertheless, the quality of some shops and places is not conducive to a liveable and safe urban environment in the short term.

- Technological situation
    - When redesigning transport, other urban challenges (e.g. lack of green environment, growing city-logistic demand, outdated utilities, floodplain management) should also be taken into account,
    - In terms of transport function, micro-mobility, electromobility, ride-sharing and autonomous vehicles can be solutions, but they must be for urban sustainability and liveability,

- Concerns about future technologies and the development of a regulatory regime for their use present a number of challenges in the period ahead.

Detailed summary of the current situations and visions of the Section under Stress

The following tables contain the outcomes of the design days to the current condition in each view of PEST analysation. The tables show the view of the participants at each design day.

Table 3. Outcomes of the Design Days – political level

Political situation	
Design Day for Transport aspect	**Design Day for Urban aspect**
Political voter risks (fear-based non-action)) • As long as there is no M0 Western Sector, what is the policy commitment? • Fear of car voters • The congestion charge is politically sensitive Finding from the conflict between political sides • Settlement of property relations (capital-counties-private), ending the feeling of "no man's land", • Government funds? • Consensus would be important • Government and capital at odds (Change status quo, Impact of political interests on transport decision-making Policy options, theming, vision • Shifting perceptions: based on professional opinion politics takes the lead on the more difficult "sacred cow" issues, thereby shaping public opinion • Setting and maintaining objectives, setting functionality and vision is the first task (new vision instead of urban transport axis)	Political voter risks • Cowardice • The introduction of a congestion charge is problematic • Intervention and non-intervention both carry political risk • Opposition of car and cycling lobby • Lack of decision making • Serving mass demand • Contrast between inner city and suburbs Finding from the conflict between political sides • Traffic calming attacks on the city government • Election result? • Underfinancing • The Rákóczi road is at the district boundary, the role of municipalities • Project cycle is not 4 years like political elections • Government priorities are different from Budapest's priorities Policy options, theming, vision • Implementation is assisted by the following considerations for decisions (Sectioning, Phasing, Pilot (Pattern) sections, direct and/or indirect support, regulation)

• Give and take logic: Galvani bridge - downtown traffic calming • Support for electric vehicles at political level	• Preferential renting of empty shops • Making not a "smart" city, but a liveable city • Green policy an end or a means? • Making climate problems visible in society • Technological wonder • Chicken or egg / Land use / Roads • No priority for the environment

The Kossuth Lajos Street-Rákóczi Road axis is one of the main arteries of Budapest, used by tens of thousands of voters every day. While the transport profession agrees on the need to rethink the current allocation of public space and to reduce the amount of space for private vehicles, political decisions are needed to make this a reality.

These decisions are hampered by politicians' attempts to meet broad public demand and the over-emphasis on 'car voters' (delaying the introduction of a congestion charge, low support for traffic calming measures). If the political will is strong enough to support the issues, the policy can act as a catalyst to find solutions. Policy decisions based on professional opinions can make progress on "sacred cow" issues. The use of environmental protection, green policy, direct support and regulatory instruments could be used to shape the attitudes of the motoring public, which would enable the transformation of the Rákóczi út to be carried out with greater social support. As the Rákóczi út is only one element of the Budapest transport system, although its role is significant, political support for a complex network approach and holistic interventions is very powerful.

Table 4. Outcomes of the Design Days – economic level

Economic situation	
Design Day for Transport aspect	**Design Day for Urban aspect**
General economic findings • the economic impact of the gentrification of the surrounding districts, • demand for higher quality services and products • elite shops vs. hawkers are equally found • promoting business life and increasing property values through the involvement of the civil and business sectors Business economic activity	General economic findings • economic centres of gravity that are isolated at transport hubs and near bus stops • no bus stops for express buses between Keleti Railway Station and Blaha Lujza Square, so there is little/no economic activity • vacuum in the city centre Business economic activity • a generally negative street image due to poor quality or closed shops

• closed, run-down or neglected shops are partly being replaced by restaurants • the closure of businesses has been driven not only by location and new shopping malls, but also by inflexible business management structures and management (e.g. short opening hours) • unsuitable environment for quality catering and other services, too much bus and car traffic • difficulty in operating shops and catering facilities due to lack of loading space for catering • lack of parking facilities, accessibility of shops is also poor, therefore shops are concentrated in hubs Real estate as an economic resource • offices and shops replacing residential functions • the boundary between the 7th and 8th districts, a gap between the two districts, no-one's land so less commitment to managing it	• inappropriate use of arcades, empty shop windows • one or two iconic shops, but no general theme or leitmotif to which shops can relate • Rákóczi Street as a product, question of marketability, development opportunities • there is a customer demand, but only for lower quality services and products • large department stores are retreating, the value of small shops can be exploited • access to shops and businesses is difficult Gastronomy, tourism: • catering is emerging as a result of the expansion of the party district, displacing it from residential areas, even in the absence of a suitable environment • catering is working better at the squares than the streets. Real estate as an economic resource • the value of real estate is low in relation to its location • the typical distribution of the properties by use: upstairs apartments for office use, downstairs for services and service functions

Based on the results of the workshops, the economic characteristics of the area defined by the project corridor are fundamentally influenced by the transport function and the impact of the high car and bus traffic. At both workshops, participants noted that traffic, lack of parking and loading facilities, and the peripheral nature of the area between districts all have a negative impact on the quality of service provided to shops and restaurants.

Both workshops also highlighted the isolated nature of the major economic activity at the transport intersections on the Rákóczi út - Kossuth Lajos utca axis. The value of the properties on the transport axis is also negatively affected by motorised traffic congestion, and their central location is more likely to be dominated by office or service and commercial uses rather than residential.

Table 5. Outcomes of the Design Days – social level

Social situation	
Design Day for Transport aspect	**Design Day for Urban aspect**
Demographic trends • Population decline • Depopulation due to Airbnb Evolution of religious beliefs • Religion is no longer a factor Environmental awareness • Increasingly important • Establishing plants, green spaces Rate of emigration • Suburbanisation • Gentrification of districts 7 and 8 Use of public spaces and real estate • Unattractive housing • Increasing the liveability and value of public spaces • Liveable public spaces • Public safety • Property and neighbourhood development • Involving civil society (NGOSs, Associations) and business in the design of public spaces Changes in lifestyle and consumption habits • Managing behavioural norms and social problems • Changing social demands on the use of space • Driving habits (Can shopping be done only by car?; Is there a need for big shopping?) Education • Awareness-raising and disseminating knowledge	Demographic trends • Population decline • An ageing society Evolution of religious beliefs • Fewer people going to church Rate of emigration • Suburbanisation (families disappear and the elderly stay at the neighbourhood) • Gentrification Use of public spaces and real estate • Changing ownership: few residents, more renters at the apartments • High number of architectural and cultural facilities • Low-use, unused buildings are typical • Promotion of diversity of use • Property development • Addressing the problem of interoperability between districts Changes in lifestyle and consumption habits • Services available at low cost • Private transport users have stronger advocacy for financial reasons

Despite the two workshops on different topics, the participants reached similar conclusions on demographic trends, religious beliefs, migration and the inadequacy of the current use of public space and real estate. Taking these factors into account is of paramount importance when rethinking the Rákóczi axis.

However, changes in lifestyle and consumption patterns should not be forgotten, which raises a number of questions. It is a general question: is there a need to maintain the current high-capacity car network, or can its use be replaced by other more efficient ways and means, resulting in a more liveable axis. Efficient use and development of public space and real estate is also essential to create a liveable axis.

Table 6. Outcomes of the Design Days – technological level

Technological situation	
Design Day for Transport aspect	**Design Day for Urban aspect**
Insights on transport • motorised vehicles have an impact on the street environment • urban structure plays a key role in transport • the need to improve the road network • lack of traffic calming measures • transfer between PT vehicles is often inappropriate • the potential of car-sharing schemes is not properly exploited • lack of barrier-free crossings and stops • lack of space for bicycles and micro-mobility devices • pedestrian infrastructure needs improvement (currently narrow pavements) • lack of P+R at the city limits • expectations of self-driving vehicles are beyond reality Insights on city logistics, sustainability • in city logistics there are many problems with parking and loading operations, which are not properly regulated • lack of LEZ zones	Insights on transport • "urban motorway" • transport network design and network role: urban, national and international traffic, significant through traffic • public transport (bus, trolleybus - electric bus, tram) • micro-mobility, car-sharing opportunities not sufficiently exploited • planning for post M2/GHÉV (connection of subway line and suburban railway) and BAVS (Budapest Suburban Railway Node Strategy) • examination of the potential impact of the congestion charge • lack of pedestrian crossings is a safety risk • mixed street activities in time and space Insights on city logistics • last-mile problems can be identified throughout the city, also at the stress section (and the whole Rákóczi road) • weaknesses in the regulatory system

• the use of electric vehicles is not yet widespread enough • the need for an access charge • providing the necessary legal environment for the use of new transport vehicles (drones) • outdated utility system	• the role of cargo bicycles is improving Sustainability, urbanism • the use of modern tools and modern planting techniques rather than outdated horticultural technology • coordination of transport and tree planting • utility network in the Rákóczi axis area unchanged since the 1970s • arcade-like design and lack of green areas

As a result of the analysis of the two workshops from a technological point of view, it can be concluded that the rethinking of the Rákóczi axis (the stress section) is not only a technical transport issue but requires a comprehensive planning. A number of gaps can currently be identified in transport, such as the lack of cycle lanes, micro-mobility and the lack of space for car-sharing schemes. In city logistics, there are many gaps in parking and loading operations. The current design is characterised by a lack of green spaces and an outdated utility system. No appropriate zoning system (LEZ-ZEZ) is in place from an environmental and sustainability point of view. Concerns about future technologies and the development of a regulatory regime for their application pose a number of challenges in the period ahead.

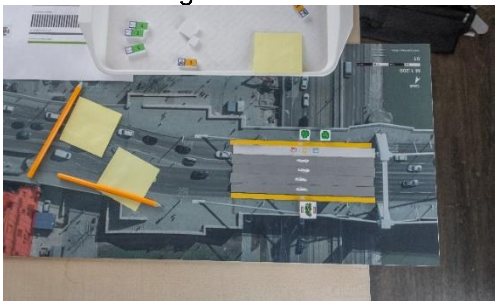
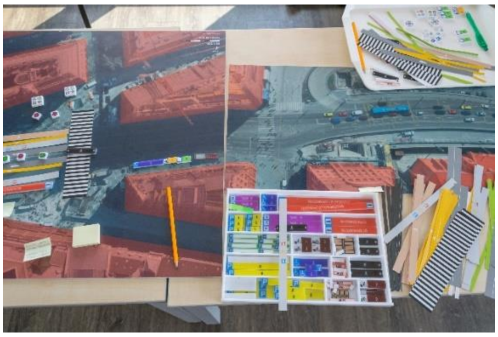
Translating comments into designs – Blocks and acetates

After examining the Stress section and the entire Rákóczi road, participants used the blocks and acetates measures available in the MORE project to express the use of public space. Using the blocks and acetate, the participants of the design days were able to create an ideal cross-sectional design of the Stress Section and the entire Rákóczi Road. During the process, the guests were able to consider the available cross-section, an urbanistic and traffic point of view, for the present (near future 1-2 years) and the medium term (2030). Participants in the workshop formed small groups to propose a design for each section. The versions produced were commented on by the other participants during the workshop, so that a consensus design for the stress section and the whole section could be achieved. The outputs (raw results) are presented in the following table.

Once the outputs (raw results) were in, the experts involved in the MORE project aligned them and looked at how they fit with existing strategic policies (parking, taxis) in several respects and came up with an optimal, good solution. (e.g. parking, taxi, micro mobility, etc.). Based on these and previous inputs, we have got the outcomes of the design days with 3-3 alternative designs were developed for the present (near future, 1-2 years ahead) and future (2030) conditions, next to the current design. These are presented after the raw results of the Design Days workshop.

The table below shows the outputs of the Design Day discussions and how the use of blocks and acetates fuelled the co-creation process.

Table 7. Design Day outputs

Section	Design Day for Transport aspect	Design Day for Urban aspect
From Erzsébet bridge to Astoria (surrounds of Ferenciek square	Pictures: Erzsébet-bridge:  Junction of Váci street at Kossuth Lajos street (start point of the Stress section)  Ferenciek square:  Between Városház street and Szép street:	Pictures: Erzsébet-bridge:  Junction of Váci street at Kossuth Lajos street (start point of the Stress section)  Ferenciek square: 

		Between Városház street and Szép street: 
	Outputs: Erzsébet bridge • two traffic lanes in each direction • public transport lanes • cycle lane in both directions • green areas and benches on both sides of the bridge Junction of Váci street at Kossuth Lajos street (start point of the Stress section) • keeping the existing pedestrian crossing • loading area in the northern part of Váci street, catering terraces, green spaces Ferenciek square: • there is no need to change the public space functions • public transport lanes next to the kerbside • one traffic lane in each direction • cycling lanes at the bus stops between the waiting areas of PT stops and sidewalks • surface pedestrian crossings instead of underpass	Outputs: Erzsébet bridge • pedestrian connection into Danube Junction of Váci street at Kossuth Lajos street (start point of the Stress section) • Keeping the current pedestrian crossing, (Shibuya-type pedestrian crossing not required) Ferenciek square: • surface pedestrian crossings instead of underpass • decreasing the number of the traffic lanes • adding cycling lane • public transport lanes next to the kerbside • some new green spaces • more loading points • more recreation points, seating areas on existing public spaces • parking spots for shared mobility devices • conflict points at cycling lanes and public transport stops

	Between Városház street and Szép street: • one traffic lane in each direction at the middle of the street • public transport lanes • cycling lanes behind public transport stops and other public space functions / features • features on the south side of the street: EV-charger, parking spot for private cars, sharing cars, micro mobility devices, loading areas (city logistic) • new bus stop at the Szép street	Between Városház street and Szép street: • public transport lines next to the kerbsides (outer part of the road) • bus traffic at the middle of the street • cycling lanes behind the bus stops • one traffic lane at each direction • mobility points at the surrounding streets. • loading points for city logistic • point new green areas
Surrounds of Astoria	Pictures: Astoria junction:  Between Astoria and Puskin street (endpoint of the Stress section) 	Pictures: Astoria junction:  Between Astoria and Puskin street (endpoint of the Stress section) 
	Outputs: Astoria junction	Outputs: Astoria junction:

	• standard surface pedestrian crossings instead of shibuya-type pedestrian crossing Rákóczi road: • public transport lanes next to the kerbside (other part of the carriageway) • one traffic lane at each direction and turning lane to the right • green lanes • wider sidewalk • on the northern part of the road • parking spots for private cars and carsharing ones, loading points to city logistic, taxi points on the north side Small Boulevard (road crossing Rákóczi út at Astoria) • installing green areas, fountains and planting trees in the front of East-West Office • micro mobility point instead of Mol Bubi public bike sharing points. • double packing and loading point and accessible parking spot in front of the MTA building. Between Astoria and Puskin street (endpoint of the Stress section) • replacement of a missing surface pedestrian crossing • one traffic lane in each direction at the middle of the street • public transport lanes next to the kerbside (other part of the road; between traffic lane and sidewalk) • green line • wider sidewalk	• more pedestrian crossings at every surrounding street's junction Rákóczi road: • two traffic lanes in each direction, with cycle path • public transport lanes at the middle of the streets • (micro)mobility points and loading areas • pedestrian crossings at the Astoria junction Between Astoria and Puskin street (endpoint of the Stress section) • bus lanes at the middle of the street • two traffic lanes in each direction, with cycle path

	• recreation area and catering terraces on both sides of the road • micro mobility point on the north side of the road • car-sharing parking spot and storage area (change during the day / heterogeneous use of time)	

2.2.4 Fine tuning of the outcomes of Design Days

After the Design Days, a number of discussions were held with BKK experts on the possible design of the Stress Section. Discussions focused on existing strategies and plans, and public space designs were considered. These included: planned cross-sectional design of Budapest bridges in the short and medium term, parking, taxi, city-logistics strategy, public transport network in the short and medium term, traffic calming in the city centre, reduction of road lanes, new cycle lanes, new public space functions in Kossuth Lajos Street and Rákóczi Street (Stress Section), possible design of micro mobility points, mobility points and mobility stations, strategy for shared vehicle storage.

To take these aspects into account, the primary results of the design days were refined to link them to existing plans and longer-term visions. Based on the discussions, 4 alternative options to the current design were identified for the short term (1-2 years ahead). The options identified are:

- Scenario 0: Current condition at the Stress Section (no change)
- Scenario 1: Conservative approach (Minor modifications to the current condition)
- Scenario 2: Transport approach
- Scenario 3: Urbanistic approach

Short descriptions of the scenarios.

- **Scenario 0: Current condition at the Stress section**
    - The version has no change to the current design in terms of public space, numbers and functions of the lanes, width of sidewalks, traffic management, traffic signals. (Every pedestrian crossing has a traffic signal.)
    - Road traffic and pedestrian flow counts conducted for the MORE project in the fall of 2019 provide the traffic volumes on the network. The usage of Public Transport comes from traffic survey in 2019.

- **Scenario 1: Conservative approach (Minor modification to the current condition)**
    - The road and sidewalk (public space) cross-section is the same as the current version (condition)
    - New pedestrian crossings are installed based on the outcomes of Design Days. The new crossings are controlled by traffic signals.
    - Road traffic and pedestrian flow counts conducted for the MORE project in the fall of 2019 will provide the traffic volumes on the network. The usage of Public Transport comes from traffic survey in 2019.

- **Scenario 2: Transport approach**
    - Some changes to the design resulting from the Design Days, but no changes to the current kerbside.
    - 1 car lane per direction, 1 cycle lane per direction, 1 bus lane per direction.
    - The traffic lane for cars is narrow (less than 3m), due to this, the speed limit is 30km/h.
    - Redesigning signal plans at intersections and pedestrian crossings for optimal traffic flow. Every pedestrian crossing is designed with traffic signal at Kossuth Lajos street-Rákóczi road (Stress section)
    - New micro mobility points have been designated (bike storage and e-scooter storage for private and share mobility), city logistics points designated.
    - Expansion of the public space function with parklets and extension of the pavement.
    - At junctions (Váci utca - Kossuth Lajos utca; Ferenciek tere, Astoria (Kossuth Lajos utca - Rákóczi út - Múzeum körút - Károly körút) ensuring existing intersection turns
    - In the BKK macroscopic model, the urbanistic approach to public space design was modelled for analysis and synthesised for the road traffic counts carried out in the MORE project in autumn 2019. Pedestrian traffic is changed, the surveyed data multiplied by 1.1.
    - The usage of Public Transport comes from traffic survey in 2019

- **Scenario 3: Urbanistic approach**
    - The transport-oriented design differs only slightly from the urbanistic approach.
    - Some changes to the design, but no changes to the current kerbside.
    - 1 car lane per direction, 1 cycle lane per direction, 1 bus lane per direction.
    - The traffic lane for cars is narrow (less than 3m), due to this, the speed limit is 30km/h.
    - Redesigning signal plans at intersections and pedestrian crossings for optimal traffic flow. Every pedestrian crossing is designed with traffic signal at Kossuth Lajos street-Rákóczi road (Stress section)
    - New micro mobility points have been designated (bike storage and e-scooter storage for private and share mobility), city logistics points designated.
    - Expansion of the public space function with parklets and extension of the pavement.

- At junctions (Váci utca - Kossuth Lajos utca; Ferenciek tere, Astoria (Kossuth Lajos utca - Rákóczi út - Múzeum körút - Károly körút) ensuring existing intersection turns
- In the BKK macroscopic model, the transport approach to public space design was modelled for analysis and synthesised for the road traffic counts carried out in the MORE project in autumn 2019. Pedestrian traffic is changed, the surveyed data multiplied by 1.1.
- The usage of Public Transport comes from traffic survey in 2019

The most significant changes to the urban and transport approach are, there are the followings:

- Reducing traffic lanes

Reducing the number of traffic lanes has opened up a number of opportunities to promote a more liveable environment and more sustainable modes of transport. By removing the motorway character, new features have been added to the entire stressed section and pedestrian links have been improved

- Cycling lanes

Along the entire length of the section, new safe one-way cycle lanes have been created along both kerbs, which will greatly contribute to boosting street activity and providing space for more sustainable modes of transport. This will create a more vibrant, positive environment for residents and passers-by.

- Connection between cycle lanes and bus stops

The bike lane has been routed behind the bus stop in all cases for safety reasons because bus traffic is very high. Thus, the intersection of the cycle lane along the kerb and the bus traffic is very dangerous and creates an unattractive environment for cyclists.

Layouts of the current condition and 3 alternative scenarios at the current time period (1-2 years ahead)

The figures below show the layouts of the current stress section (Scenario 0), followed by the design changes for each of the three Scenarios 1, 2 and 3. For each scenario, the street is split into three sections (A, B and C).

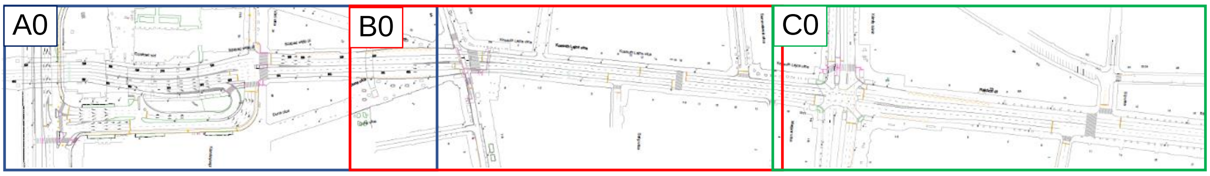
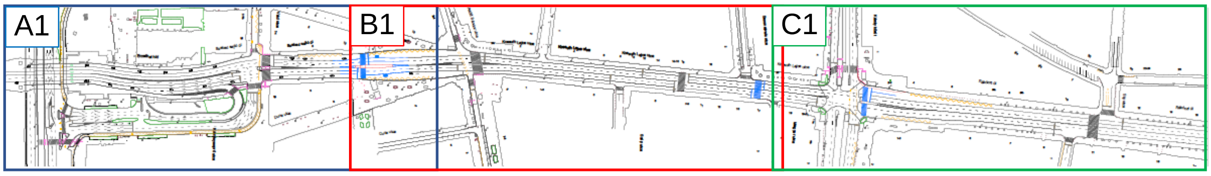
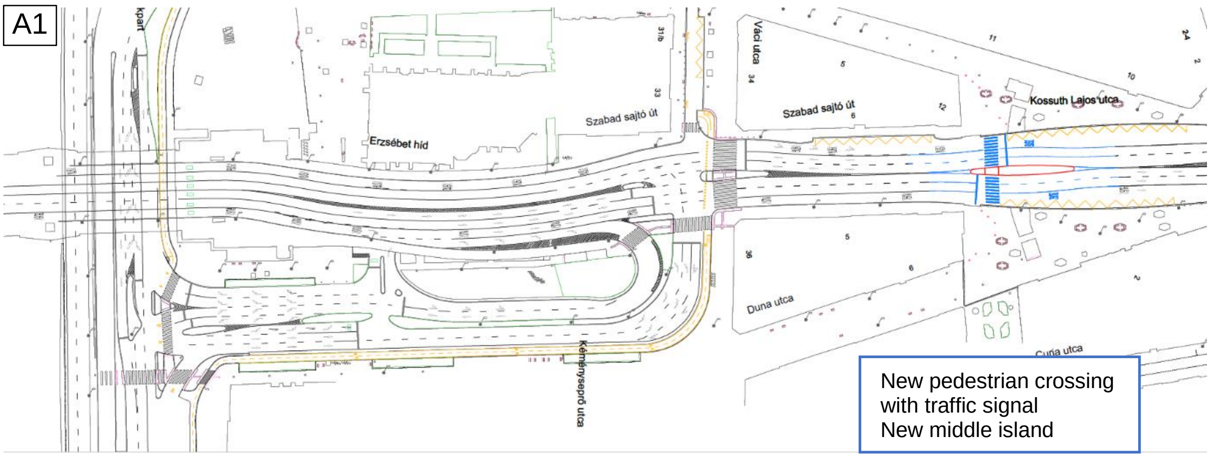
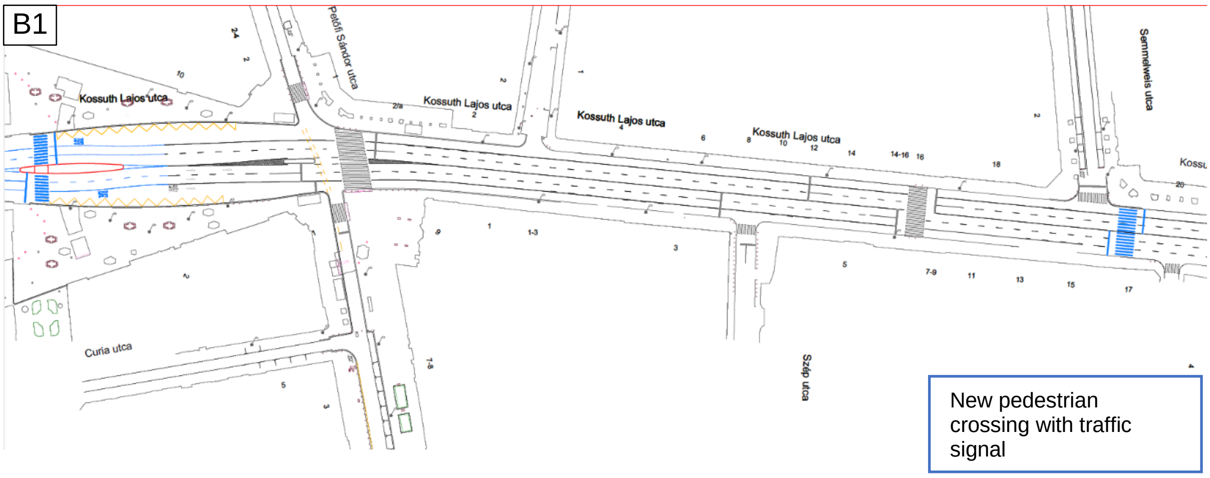


Figure 24. Scenario 0 - Current condition at the Stress section

 Version: 3


A1
B1
C1


A1
Váci utca
Szabad sajtó út
Kossuth Lajos utca
Erzsébet híd
Duna utca
Curia utca
Kéményseprő utca
New pedestrian crossing
with traffic signal
New middle island


B1
Petőfi Sándor utca
Kossuth Lajos utca
Semmelweis utca
Curia utca
Szép utca
New pedestrian
crossing with traffic
signal

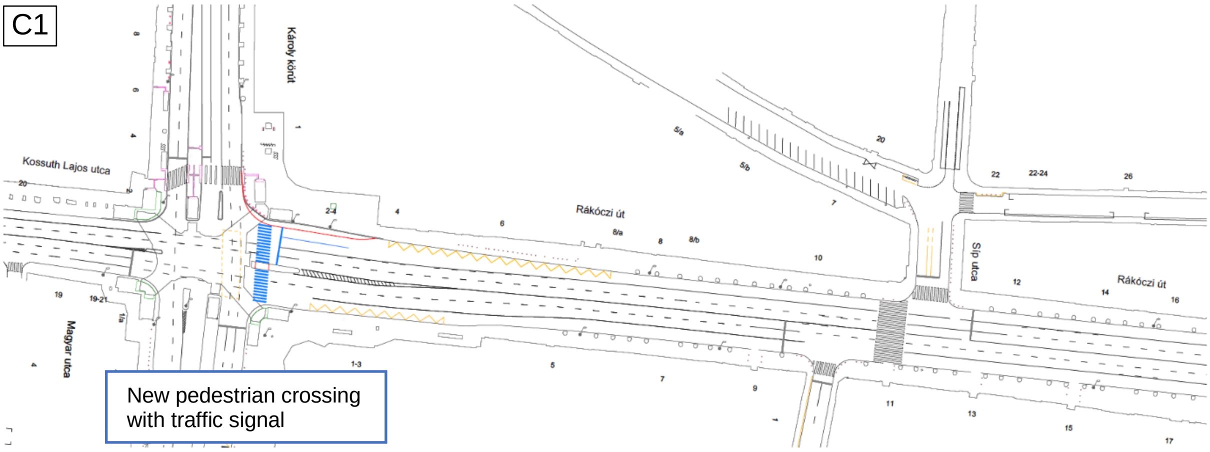
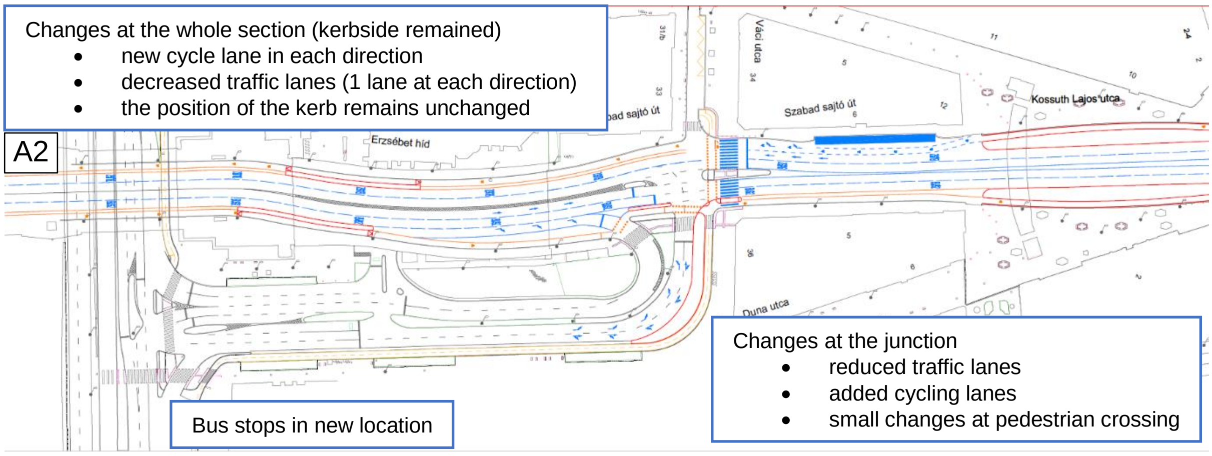


Figure 25. Scenario 1 – Conservative approach. Minor modification to the Stress section



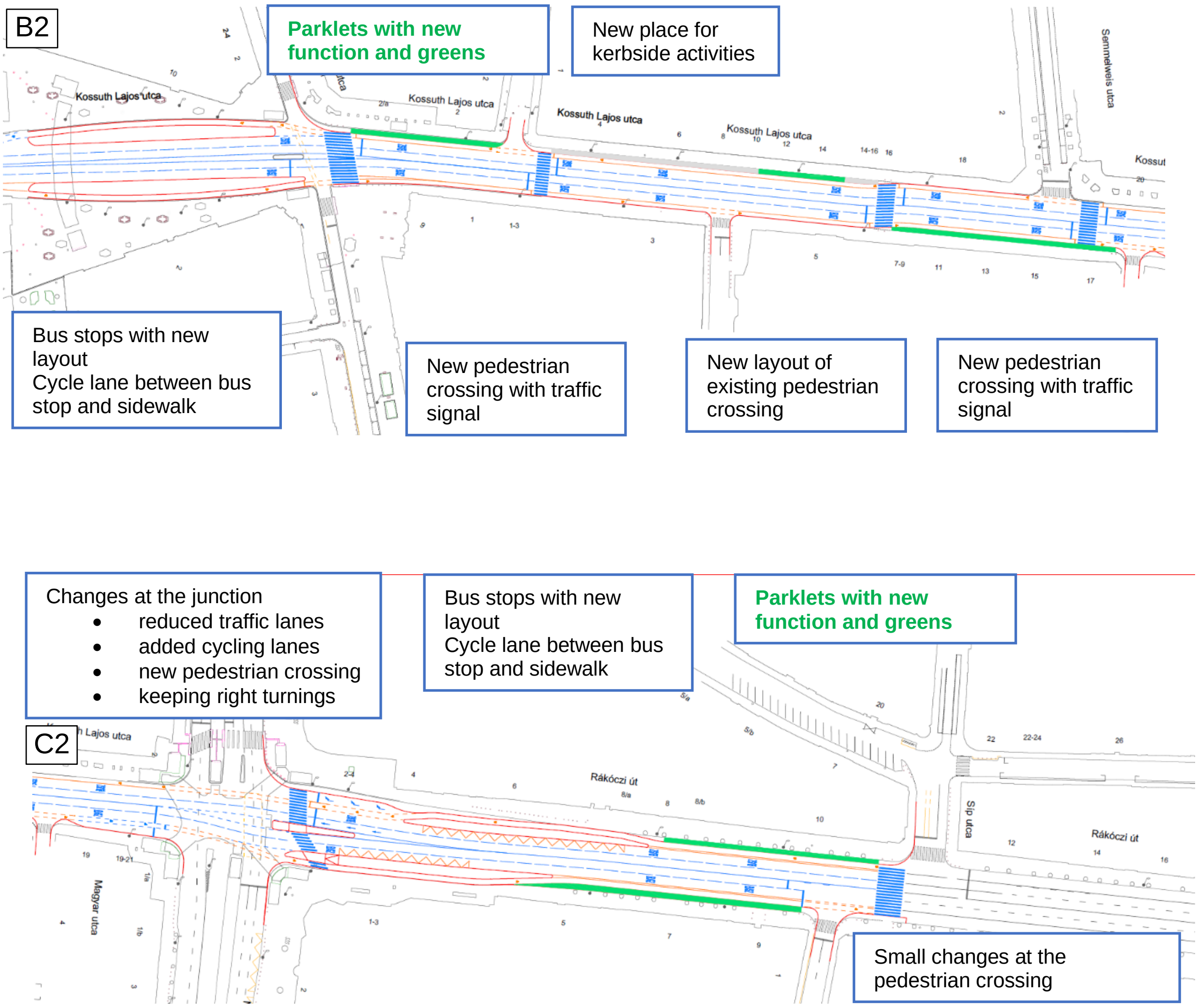
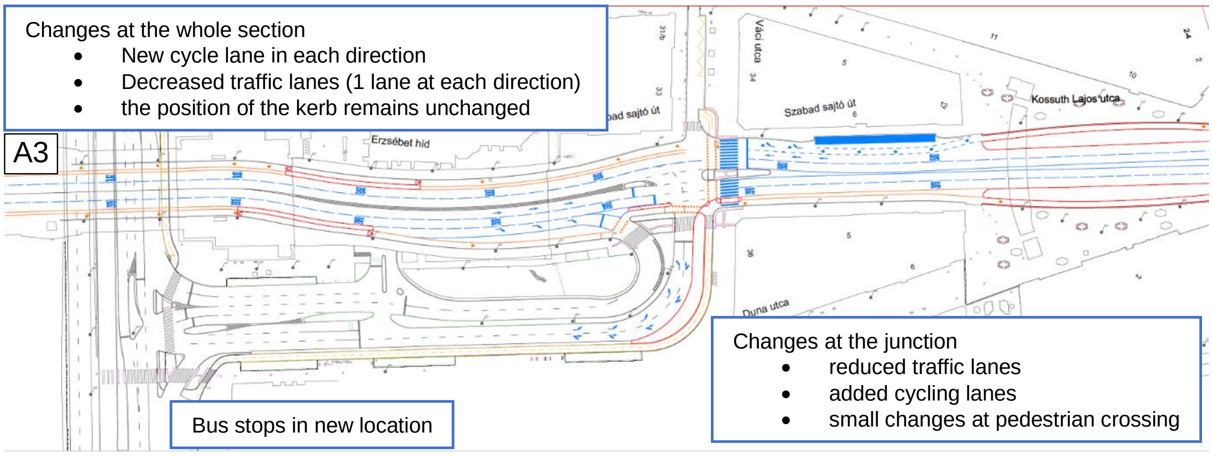
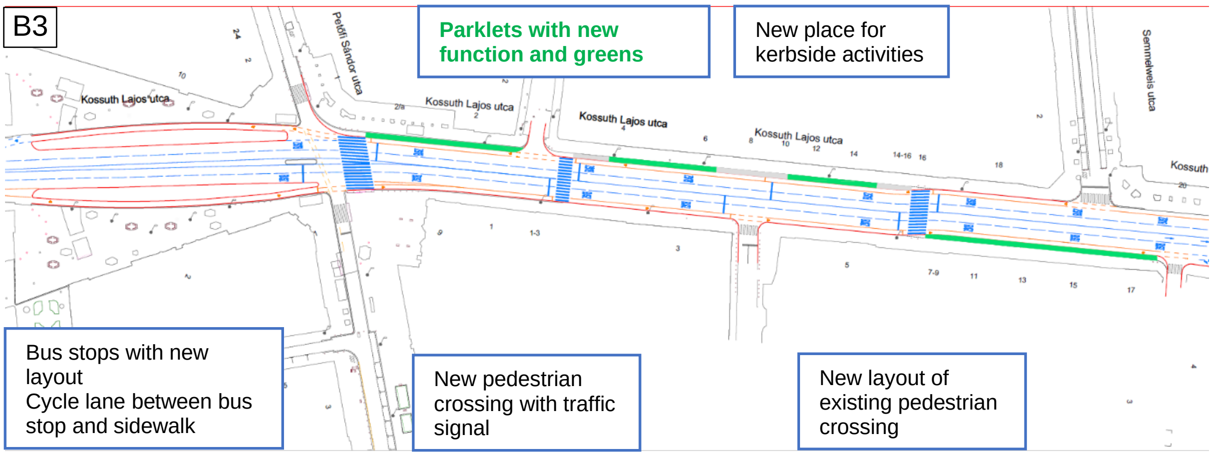


Figure 26. Scenario 2 –Transport approach to stress section


A3
B3
C3


Changes at the whole section
• New cycle lane in each direction
• Decreased traffic lanes (1 lane at each direction)
• the position of the kerb remains unchanged
A3
Erzsébet híd
Váci utca
Szabad sajtó út
Kossuth Lajos utca
Duna utca
Bus stops in new location
Changes at the junction
• reduced traffic lanes
• added cycling lanes
• small changes at pedestrian crossing


B3
Kossuth Lajos utca
Petőfi Sándor utca
Parklets with new function and greens
New place for kerbside activities
Semmelweis utca
Bus stops with new layout
Cycle lane between bus stop and sidewalk
New pedestrian crossing with traffic signal
New layout of existing pedestrian crossing

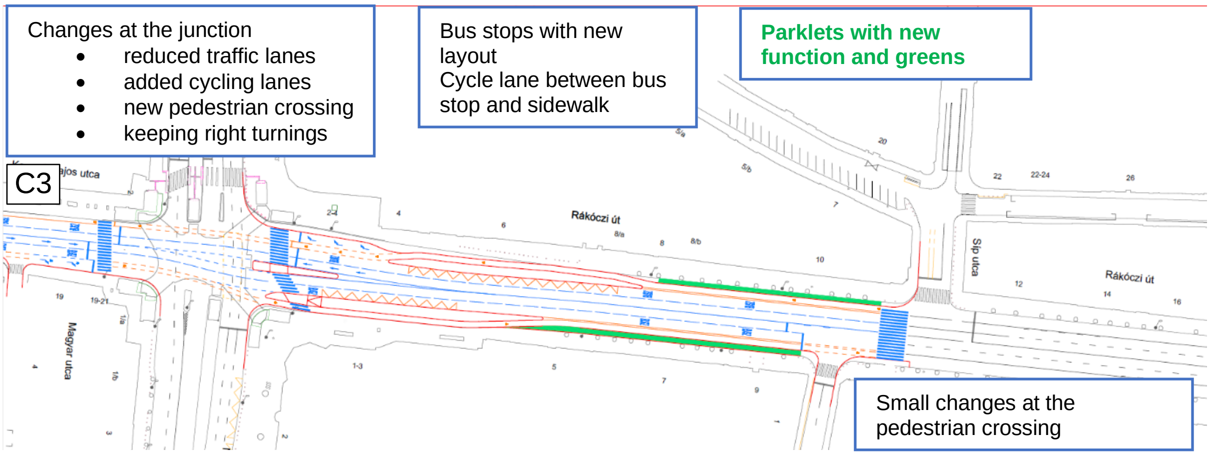
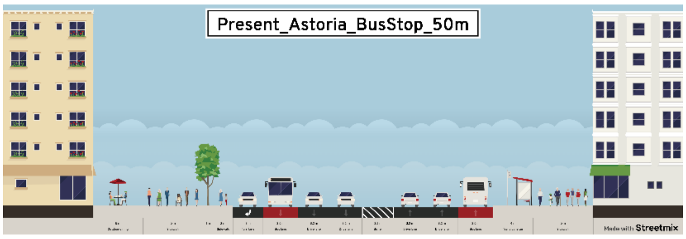
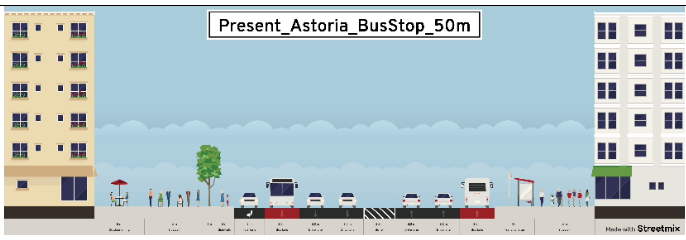
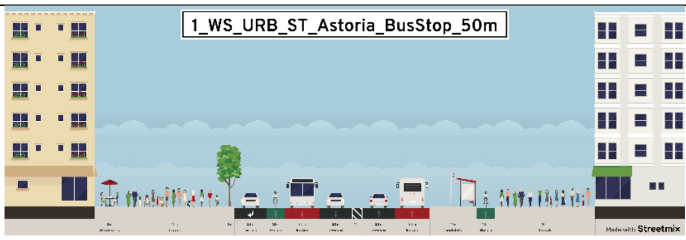


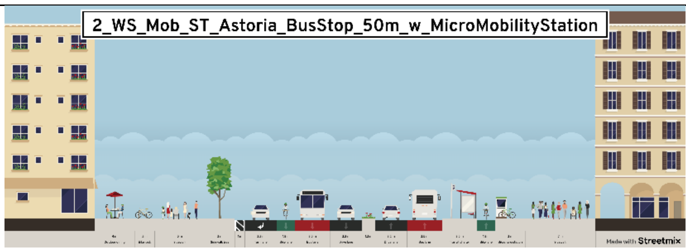
Figure 27. Scenario 3 – Urbanistic approach to the Stress Section

Appendix 2 contains maps and figures comparing the different design scenarios with each other presented by street cross section. This compares how the reallocation of road space changes throughout, section by section, and the trade offs required.

The example of the Astoria section is shown below

Table 8. Design scenario by street cross section, Astoria section

Scenario 0 Current condition at the Stress section		Currently, this section is divided into two lanes for cars and one lane for buses at each direction, and from eastbound direction the right turning lane at the bus lane, while from westbound direction, there is a dedicated turning lane for right turning traffic. The north-east corner of the intersection already has catering facilities and terraces.
Scenario 1 Conservative approach (Minor modification at the current condition)		The version's additional pedestrian crossings is located just on either side of the Astoria intersection (east and west), improving pedestrian crossing capacity between the two neighbouring districts.
Scenario 2 Transport approach version		The urban focus results of the street allocation includes the reduction of the traffic to one lane at each direction and the creation of a cycle lane in the area freed up, as well as a bus stop on a new platform, allowing a wider cross-section of

		pedestrian traffic on the south side.
Scenario 3 Urbanistic approach version		The transport-focused version's road-space allocation for this section is the same as the urban-focused version, but in this version, the free areas are allocated to micro mobility and mobility points on the north and south sides of the axis respectively.

2.3 Building and applying the Vissim model

2.3.1 General description of the modelling phase

The modelling exercise started after the variation generation. As part of the modelling exercise, the road, pedestrian traffic survey and public space analysis data from November 2019 were first processed and refined for the modelling environment. The data available after processing provided the traffic data for modelling. The cross-sectional pedestrian traffic count data was processed with the public transport stop passenger data for refining pedestrian data.

For road traffic, the data processing involved the use of a quarter-hourly traffic input per vehicle category, complemented by using quarter-hourly resolution interchange destination matrices, also separated by vehicle category. As for pedestrian and passenger traffic - where no directionality data were available - the cross-sectional, stop-station passenger traffic was converted into directional concepts using the gravity method, which is widely used in analytical traffic modelling. Here, again retaining the same resolution, this produced a 45 x 45 cell pedestrian destination matrix every quarter hour, which gave both the inbound traffic and its directionality over the whole area.

The floating car measures were used to calibrate the road modelling results. The public transport network and passengers (boarding and alighting) were derived from the 2019 survey. The modelling tasks were performed by a contractor selected through a procurement process. BKK experts consulted with the contractor's experts on a weekly basis.

The Vissim models were created after the preparation of the input data. The modelling exercise was completed for all 4 versions, i.e:

- **Scenario 0** current condition at the stress section

- **Scenario 1** Conservative minor modification at the current condition
- **Scenario 2** Transport approach
- **Scenario 3** Urbanistic approach

In each case, modelling was carried out for 4 periods:

- morning peak hours: 6AM-9AM;
- during the day (interpeak): 11AM-2PM;
- afternoon peak hours: 4PM-7PM,
- evening: 7PM-10PM

Based on the available data, traffic data was modelled and evaluated on a quarter-hourly (900s) basis. The following picture shows the whole modelled area for the base version - current condition at the stress section in Vissim simulation. The base network built in the modelling is larger than the area under study to obtain more accurate modelling results. The traffic signals in the base version (0th version) are the current design, in the other three cases they are optimized for traffic, which optimization is done for all road junctions and new pedestrian crossings.

The urbanistic approach version and transport approach version have major differences with the reduced traffic lanes and new cycle lanes. These modifications were modelled with the Budapest macroscopic model and the traffic inputs for Vissim modelling were refined. The pedestrian traffic increased at these scenarios. These ones have better environment for placing and living in the streets, we taken the current refined pedestrian traffic multiplied with 1,1. This parameter came from BKK's experts experiences.

Table 9. Data collection for each scenario

Version	Road traffic	Public transport	Pedestrian traffic	Signal control
Scenario 0 current condition at the stress section	surveyed and refined traffic	current lines and passenger	refined survey data	current signal control
Scenario 1 Conservative	surveyed and refined traffic	current lines and passenger	refined survey data	optimized signal control
Scenario 2 Transport urbanistic approach	modified based on macroscopic modelling results	current lines and passenger	refined survey data * 1,1	optimized signal control

Scenario 3 Urbanistic transport approach	modified based on macroscopic modelling results	current lines and passenger	refined survey data * 1,1	optimized signal control

During the simulation process 8 vehicle categories were considered (Car, 3 type of lorries; motorcycle, bicycle, other micro mobility devices).

The volume of traffic between the traffic generating and attracting points in the area was distributed on a quarter-hourly basis over the 8 vehicle categories. For this purpose, the data available at the individual nodes were distributed over the entire network and the quarter-hourly network traffic distribution rate was defined for each vehicle category.

For the pedestrian traffic data, only cross-sectional traffic count data were available (area entry and exit points, pedestrian crossings, underpass entrances) and data on the drop-off and pick-up of public transport vehicles. In the modelling, the distribution of pedestrians on the pedestrian network was weighted in the vicinity of Ferenciek Square and Astoria, with the crossing between the two areas being the control point in Kossuth Lajos Street between them.

2.3.2 Methodology

The simulation model was built using PTV AG Vissim 22 software. The geometric specification of the model space was aided by the cadastral dataset in EOV projection of Hungary and vector site drawings showing the planned design.

To reduce simulation errors caused by measurement errors and real fluctuations, the value of traffic inputs and the proportions of route choices for each vehicle category were determined from the counting data series by calculating the rolling average of the previous one hour every quarter hour. In the last case, categories that were extremely rare or very similar in nature were grouped together to eliminate errors in the value assignments due to low quantification. The categories used in the model:

Table 10. Categories used in the model

ID	Description
SZGK	personal car
J1T	lorry with 2 axis, <3,5t
J2T	lorry with 2 axis, 3,5t-7,5t
J3T_J4T	lorry with 3 or 4 axis

ID	Description
KP	bicycle
MOT	motorbike
RR_SW	scooter, Segway
TX	taxi
BUSZ	bus

Several specific considerations had to be taken into account when building the model. First, although the reduction in passenger vehicle throughout in the project cases was accompanied by a reduction in traffic demand, this only affected the Rákóczi road axis and not the vehicles coming from the intersecting Múzeum boulevard, leading to widespread congestion from the Astoria junction.

In order not to create an insurmountable obstacle to further intensification of the already intense traffic situation, it became necessary to deal with vehicle-pedestrian conflicts in a specific way. This has been done with a view to ensuring that the right-of-way is not compromised, but that both vehicles stuck in pedestrian crossings can be crossed by pedestrians and long, random crossing surfaces (e.g. cycle path on the outside of the platform without a designated pedestrian crossing) operate according to a realistic mechanism.

Narrow passenger bus stop platforms, congested in many periods, also required specific modelling procedures. The need for all this can be explained by the fact that the microsimulation software is not specifically designed to study long-standing congested conditions, which are not a fundamental transport planning objective.

Thus, once congestion has already developed in the model, in many cases it is not worth further investigating the scenario in question, but rather its modification, or the modification of the traffic volume, is necessary. However, the above-mentioned procedures also allow a comparative analysis of these congested conditions, while reducing the gap between simulated and real processes.

Traffic volumes for the project cases and future conditions were determined using the load results from the Budapest Macroscopic model. Here, not the numerical values of the traffic volumes on the network segment, but their ratio to each other was used to determine the change in traffic volumes. The following factors are values per inbound cross-section, multiplied by the vehicle and pedestrian traffic volumes from a given direction, the neighbourhood and extension of the section taken into account. Road traffic multipliers based on Budapest Macroscopic Model results.

Table 11. Cross-section factors

Road	Cross-section	Scenario 0 Scenario 1	Scenario 2 Scenario 3
Rákóczi road	Erzsébet bridge	100%	66%
Rákóczi road	Ferenciek square	100%	57%
Rákóczi road	Astoria	100%	53%
Rákóczi road	Blaha Lujza square	100%	46%
Károly boulevard	Deák Frenc square	100%	120%
Múzeum boulevard	Kálvin square	100%	139%

During the Vissim modelling building and calibrating, several actions were managed to develop a realistic model environment. These were the most important ones:

- modelling bike sharing points
- modelling pedestrian crossing at the saturated (confectioned) traffic network
- bus stops with heavy boarding and alighting
- handling a great number of pedestrians at the model, using different levels to speed up the simulation runtime
- using script for input data

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- modelling bike sharing points
- modelling pedestrian crossing at the saturated (confectioned) traffic network
- bus stops with heavy boarding and alighting
- handling a great number of pedestrians at the model, using different levels to speed up the simulation runtime
- using script for input data

The following Figure contains the Scenario 0 Vissim network.

Appendix 3 contains the rest of the Vissim networks.

The entire VISSIM network for **Scenario 0**

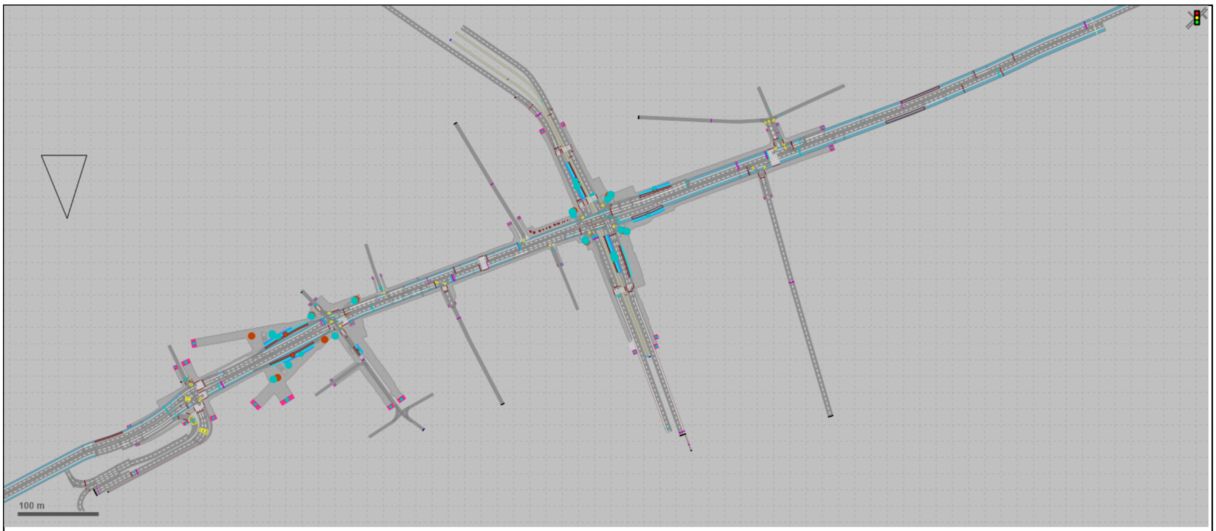


Figure 28. Vissim Network for Scenario 0

2.3.3 Modelling results

This chapter presents the results of the micro-simulation runs for each of the cases under consideration. This deliverable contains the results of current condition.

Modelling results at the current conditions have 4 analyzed scenarios at 4 different times of day. This provides 16 different scenarios managed at the simulation task.

At the evaluation phase the following abbreviations meaning:

- null: base variants: current condition at the stress section (**Scenario 0)**
- C: Conservative (minor modification at the current condition) (**Scenario 1)**
- A: Transport approach (**Scenario 2**)
- B: Urbanistic approach (**Scenario 3**)

For the KPIs, the following statistic parameters were calculated:

- Output data based on 900s inputs (None)
- 95% percentile for the time of a day
- Average for the time of a day
- Maximum for the time of a day
- Minimum for the time of a day
- Standard deviation for the time of a day
- Summarized values (Total)

The following table contains the delays at the network compering with the base version of the variants for the current condition

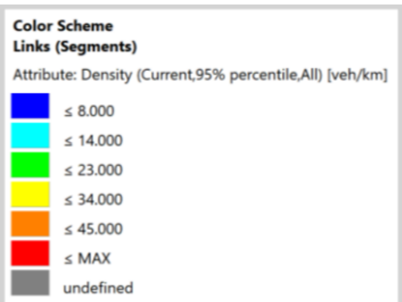
Table 12. Network delays compares across scenarios

ver	time	Average of VEHS(ALL)	Average of VEHDELAY(ALL)	Average of STOPS(ALL)	Average of STOPDELAY(ALL)	Átlag / VEHS(30)	Átlag / VEHDELAY(30)	Átlag / STOPS(30)	Átlag / STOPDELAY(30)
⊟A									
A	06-09h	53,01%	201%	321%	195%	110,59%	115,85%	139,80%	171,97%
A	11-14h	36,37%	231%	296%	249%	100,19%	112,20%	152,00%	152,92%
A	16-19h	39,39%	280%	423%	280%	107,39%	136,25%	195,46%	197,74%
A	19-22h	45,75%	415%	664%	417%	99,59%	119,39%	175,95%	170,52%
⊟B									
B	06-09h	46,06%	315%	488%	321%	104,81%	178,87%	184,30%	349,56%
B	11-14h	28,79%	293%	371%	323%	98,68%	129,94%	167,24%	201,52%
B	16-19h	30,56%	362%	529%	372%	107,67%	174,42%	206,06%	300,15%
B	19-22h	33,78%	602%	951%	624%	100,00%	152,01%	213,27%	265,11%
⊟C									
C	06-09h	104,46%	135%	181%	139%	110,87%	112,47%	135,41%	162,41%
C	11-14h	85,14%	171%	192%	191%	97,55%	106,48%	125,96%	139,98%
C	16-19h	85,50%	155%	193%	164%	106,83%	108,64%	139,42%	143,42%
C	19-22h	90,11%	232%	304%	253%	99,59%	107,39%	129,41%	154,11%
⊟null									
null	06-09h	100,00%	100%	100%	100%	100,00%	100,00%	100,00%	100,00%
null	11-14h	100,00%	100%	100%	100%	100,00%	100,00%	100,00%	100,00%
null	16-19h	100,00%	100%	100%	100%	100,00%	100,00%	100,00%	100,00%
null	19-22h	100,00%	100%	100%	100%	100,00%	100,00%	100,00%	100,00%

The table shows how the traffic performance of the other scenarios varies with delay compared to the baseline null. (ALL) refers to all vehicles on the network, while (30) refers only to public transport vehicles (bus, tram). The results show that, although Scenario1_(C) differs from Scenario0_(null) only in the number of pedestrian crossings added to the stress section, the performance of vehicles on the network is still reduced, they stop more often, spend more time on the network, both for cars and buses.

Scenario2_A_(Transport approach) and Scenario3_B_(Urbanistic approach), which include some changes, show the significant impact of lane reductions on the network's traffic performance. The number of vehicles on the network is halved or halved, while the time loss is doubled or tripled depending on the time of day. However, the results for public transport are more favourable, with no such slowdown in traffic flow.

Density values are used here to characterise the traffic in the whole area. The figures presented below show the 95th percentile values of the five-minute time-segment measurements during the busiest three-hour period in the afternoon (16:00-19:00). Explanations of the colour scales for road traffic and for pedestrians:



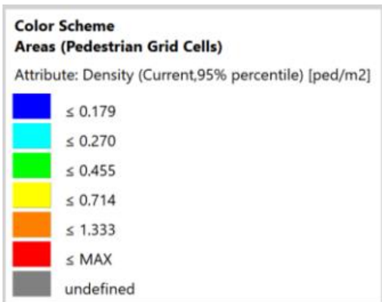


Figure 29. Density values

Scenario 0 Current condition at the stress section

This version describes the current traffic situation. The worst congestion occurs around the Astoria junction. In addition, the traffic figures show that there is also significant congestion on other sections of the stress section. The Vissim study confirms that pedestrian traffic is most significant in the vicinity of the public transport stops, while the rest of the stress section does not encounter any obstacles to pedestrian movement.

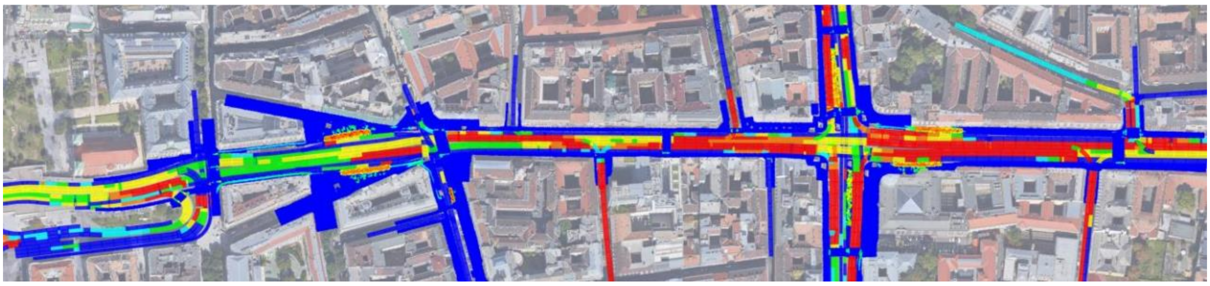


Figure 30. Scenario 0 Current condition at the stress section

Scenario 1 Conservative (minor modification at the current condition)

In this timeframe, Conservative scenario differs very little from the status quo. The same layout of the traffic space, only a new surface crossing is introduced. This is slightly only slightly affected road traffic.

Figure 31. Scenario 1 Conservative (minor modification at the current condition)

Scenario 2 Transport approach

The reduction in the number of lanes on Rákóczi út will also lead to a reduction in through traffic demand, in addition to further strategic traffic management measures. However, the increased volume of traffic on Museum Street will make the Astoria junction difficult to pass even for this reduced traffic on Rákóczi út. Also at the Astoria junction, the narrow bus platforms, due to their narrow buildability, are only accessible to passenger traffic if they are open to the pavements for their full length. Otherwise, if a single pedestrian crossing is the only platform-pavement connection, surfaces cluttered with passenger interchanges provide little space for concentrated pedestrian departures.

Figure 32. Scenario 2 Transport approach

<u>Scenario 3 Urbanistic approach</u>

This option provides more pedestrian crossing opportunities than Transport approach in current timeframes, but does not differ in its main lines (traffic lane reduction in 2022, then an internal bus lane in 2030). The above findings also apply here, with the addition that the increased number of pedestrian crossings slightly worsens the road traffic flow characteristics for individual traffic.

Figure 33. Scenario 3 Urbanistic approach

2.4 Conclusion of design options

Since it was difficult to evaluate the performance of the Rákóczi road against the adverse influence of the traffic on the Museum Boulevard, an attempt was made to evaluate the performance of this road section with a similar reduction of traffic to the Rákóczi axis, in addition to the required studies. In the process, we observed a reduction or disappearance of congestion phenomena. Thus, we can state that the congestion at the Astoria junction clearly shows that the reduction in traffic space resulting from the reallocation of traffic space can only provide a stable, acceptable level of service if it is combined with a network-oriented traffic reduction strategy.

On the pedestrian side, ensuring the width and accessibility of platforms seems to be an important issue, without which passenger interchange will very quickly become impossible. In the same way the provision of traffic space on the sidewalk surfaces of pedestrian crossings. These aspects have been compromised in the current condition of variants A and B and would need to be further refined.

Based on the results, Scenario 3 - Urbanistic approach is the appropriate design in the short term, considering both traffic and liveability aspects. However, if Scenario 1 – Conservative approach interventions are included, the variant with frequent pedestrian crossings can promote the liveability of the stress section. However, in the case of interventions, it is of paramount importance to involve the community, refine the options, gather advantages and disadvantages, and involve local residents in the decision.

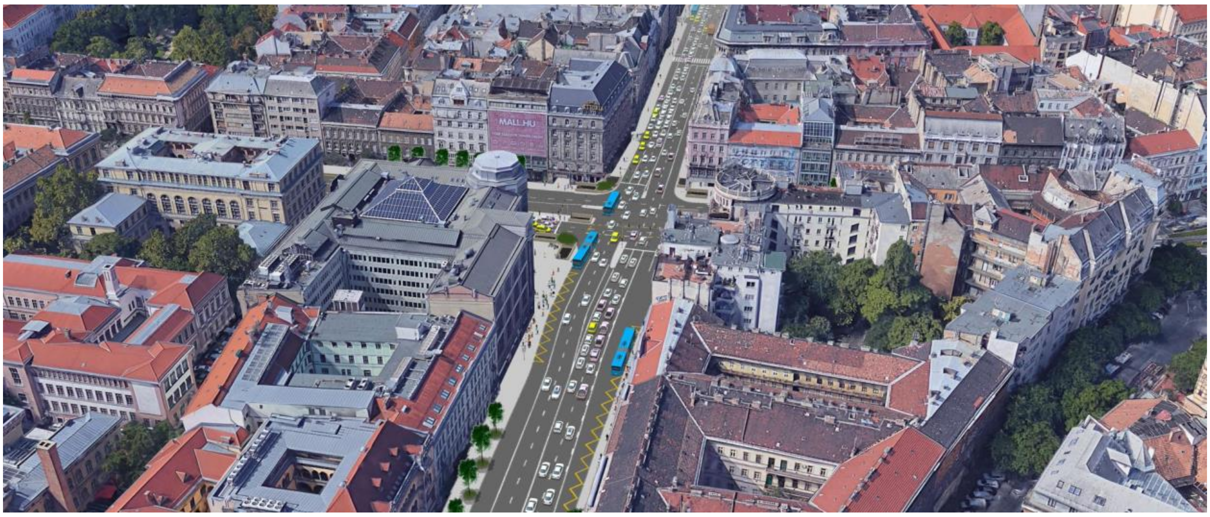


Figure 34. Bird's eye view of Scenario 0: Current condition at the Stress section from Astoria

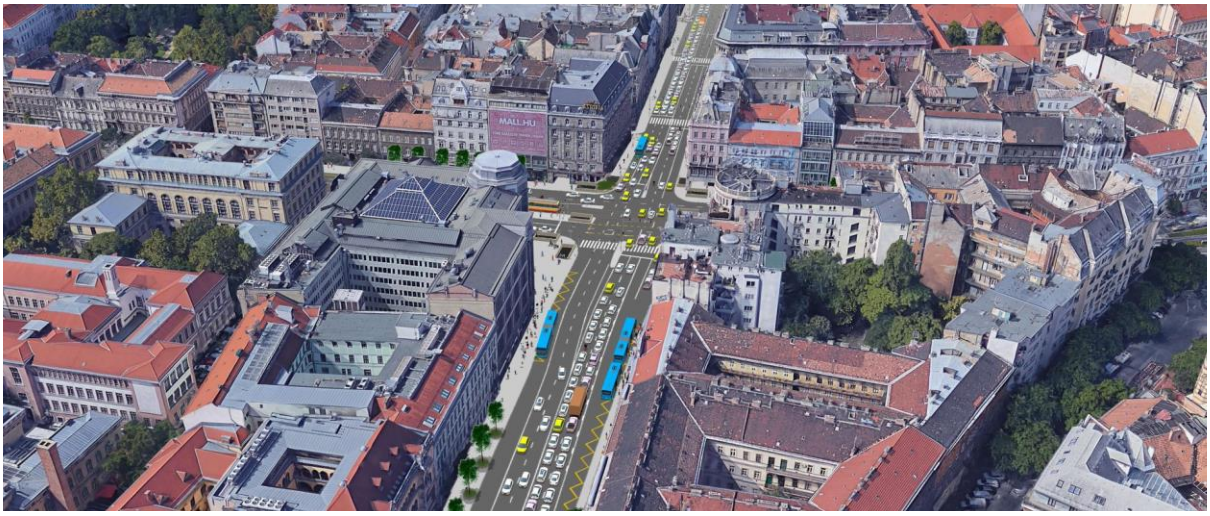


Figure 35. Bird's eye view of Scenario 1: Conservative approach (Minor modifications to the current condition) from Astoria

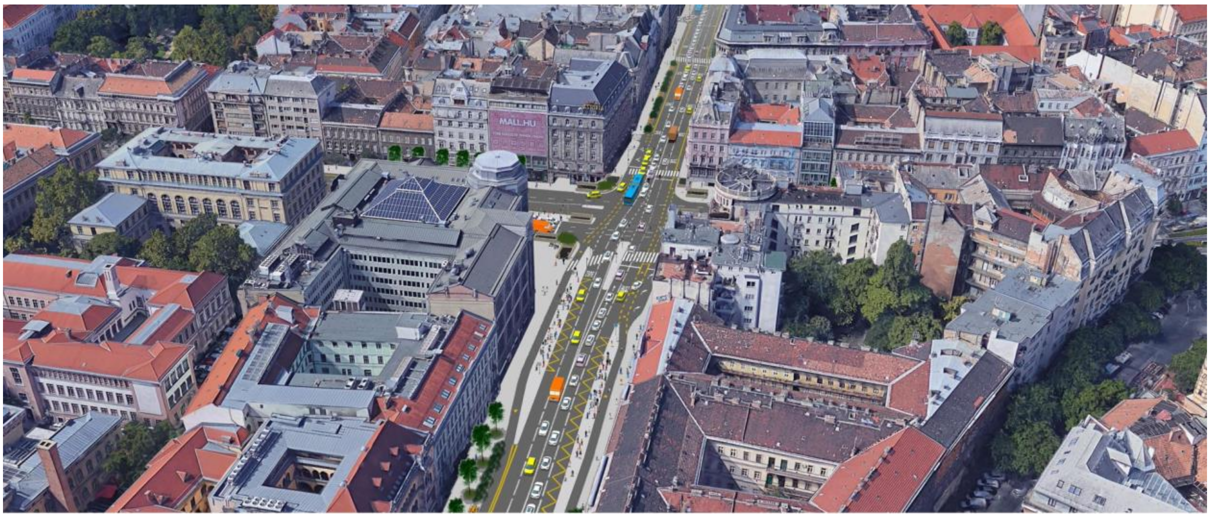


Figure 36. Bird's eye view of Scenario 2: Transport approach from Astoria

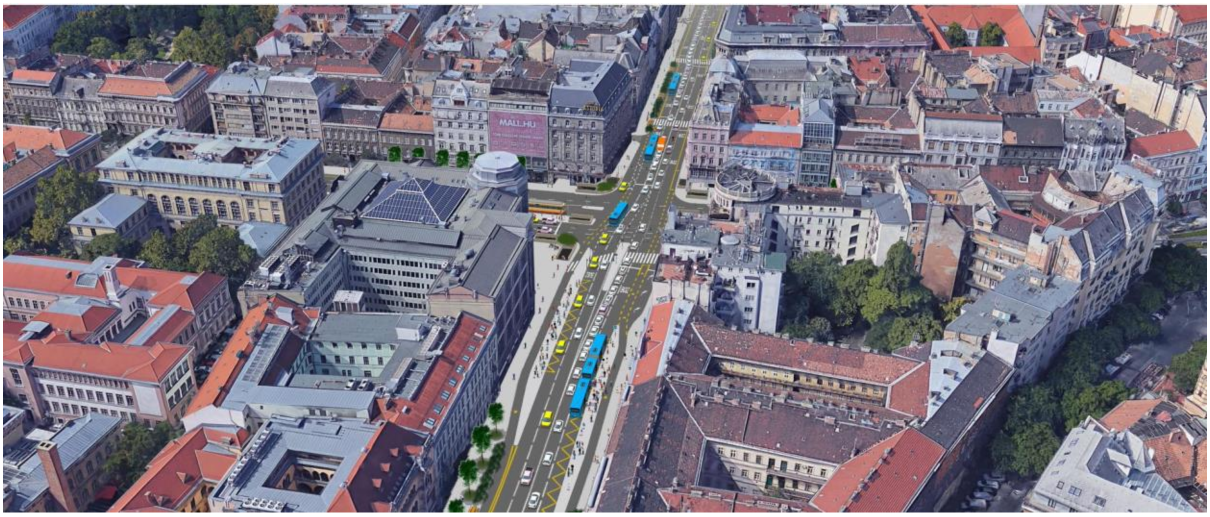


Figure 37. Bird's eye view of Scenario 3: Urbanistic approach from Astoria

3 CONSTANTA

3.1 A brief summary of current conditions along the Stress Section

Constanta's Stress Section is represented by a roundabout junction and the adjacent area surrounding it for about 200m on each arm of the junction. This area accommodates around 4.000 residents, of which 2.911 people are living in collective housing buildings/blocks of flats and more than 40 businesses like banks (4 units), medical units (9 units), beauty salons (4 units), food shops (3 units), Sports books /Casinos (6 units), shopping mall (1 unit) etc.

The Stress Section represents an important connection point in the City street network ensuring the takeover of major traffic flows of the City in the direction of SV-NE making the connection between the national roads that cross the city (E87, DN3 and DN2A) with the Industrial Area, Constanta Port, A2 Motorway and the ring road of Constanta (A4), Mihail Kogalniceanu International Airport, Mamaia resort and the City Centre.

Figure 38. More Stress Section Area

Located at the crossroad of two most circulated streets in the City, respectively, I.C. Bratianu Boulevard (the City main connection to the Rhine – Danube TEN-T network) and Cumpenei Bridge and Dezrobirii streets, it is considered one of the most congested area in Constanta.

In March 2020 a team of experts contracted by the Municipality conducted a traffic survey inside the Stress Section Area, in the framework of MORE project. According to this survey there are about 62.000 vehicles entering the Stress Area. The counting registered bicycles (70), private vehicles /cars (57.229), light freight vehicles (3.383), heavy freight vehicles (255) and buses (793), with a morning peak (7:15 AM – 8:15 AM) of 4.600 vehicles and an afternoon peak (4:45 PM – 5:45 PM) of 5.700.

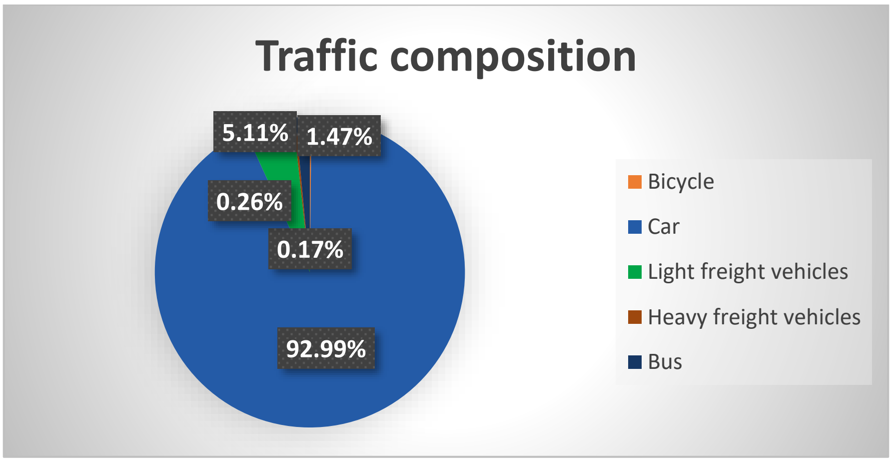


Figure 39. Stress Area traffic composition

3.1.1 Cars

The legal speed limit is 50 km/h and of course for short distances when approaching the junction or the crosswalks the legal speed limit decreases, according to the survey mentioned earlier, the average speed inside the Stress Area is 35 km/h. Even though the average speed seems good, during the day peak hours vehicle ques are forming around the junction.

The infrastructure provided for cars is represented by the carriageway that has a variable width between 25 m and 21 m, the roundabout turning and some chevron parking spaces, sometimes the footways.

The carriageway is in proper conditions, it has a good surface and good street markings and visible traffic signs, including the orientation one but it does not provide any dedicated facilities for alternative travel modes.

Parking inside the Stress Area there are around 50 parking spaces. Parking is only allowed in special designated places, even though some drivers are parking their vehicles on the sidewalks.

Figure 40. Stress Area car infrastructure

Having in mind the constantly increasing car ownership in Constanta, approximately 343 cars/1000 inhabitants, illegal parking remains an important issue for the City, even though the Local Police is implementing a policy for discourage this habit for the past years issuing on average 3 fines per day.

Regarding the supply activities there is a local Regulation that allow delivery only during the night-time, between 11:00 PM and 6:00 AM, so there are no dedicated facilities for this kind of activities, nor any traffic signs.

During the day most of the kerb side activities are related with the county and regional public transport.

3.1.2 Pedestrians

Around 38.000 pedestrians access the Stress Section Area every day. The infrastructure provided for them is mainly represented by the sidewalks, but there are also other facilities like crossings, street furniture, bus stops, public lighting, green spaces etc.

The sidewalks inside the Stress Section are partially in poor conditions, especially the stairways granting access to the nearby houses and businesses.

Figure 41. Stress Area pedestrian infrastructure

As we can see from the pictures above, the widths of the sidewalks inside the Focus Area differs, ranging from 1 m to 2,5/3 m and is not providing any special facilities for disabled people.

38.000 pedestrians are accessing the Stress Section every day, most of these people are walking from their homes, jobs etc. in order to access the area according to a survey conducted in August 2021 regarding people's perception on the Stress Section. There were 163 respondents to the survey, most of them residents (60%), they were interviewed about the travel modes used to access the area, how they perceive the area and how they want it to look in the future. This survey provided important data for the City about the main things that people like, dislike or want to improve inside the Stress Section. Pedestrians consider that they are welcomed in the area and that there are enough businesses, shops and services, more than 80% of the respondents. They also consider that the main assets of the area are: 1. Public transport accessibility (67%); 2. Green spaces (48%); 3. Local shops (39%); 4. The park (11%). The main issues identified are the cleanliness (52%), traffic congestion (34%), the noise (22%) and the lack of green spaces (17%).

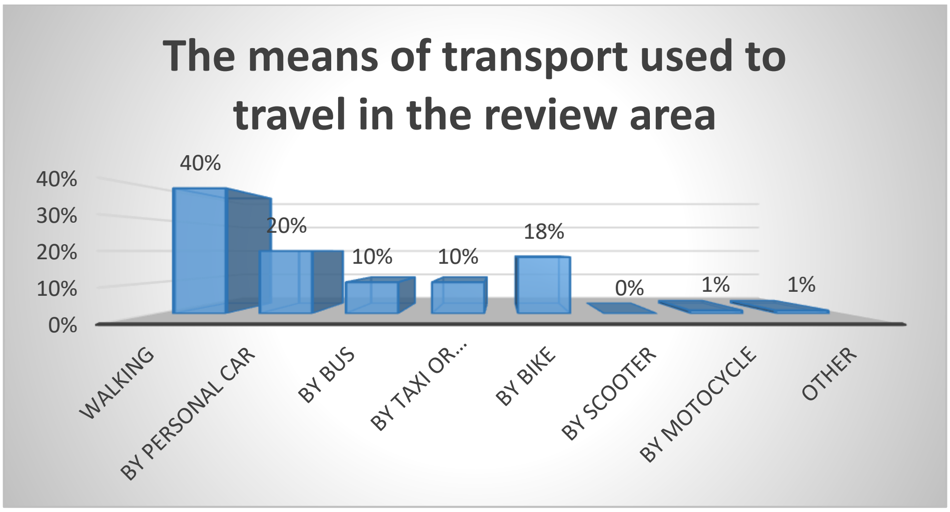


Figure 42. Travel modes used to access the Stress Area

As we can see from figure below, the less used area is the one on the West side of the Stress Section Area, one of the reasons for this is the low place function both residential and commercial of this area, another reason might be that even though the junction has 4 (four) arms, one for each carriageway, it has only 3 (three) pedestrian crossings on surface for all four streets, the fourth pedestrian crossing is located underneath the bridge and is used mostly by a remote group of people, represented by the users of the shopping mall.

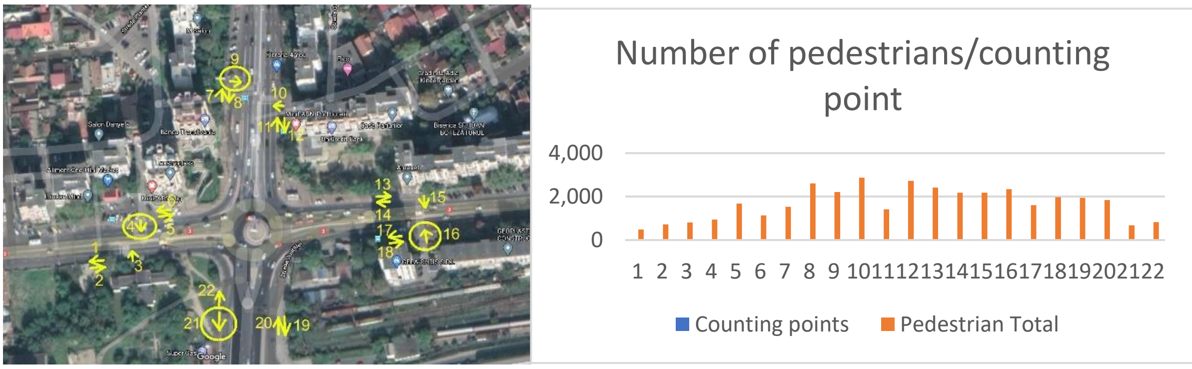


Figure 43. Number of pedestrians inside the Stress Area / counting points

Having in mind that around 38.000 pedestrians access the area per day, an important aspect is pedestrian safety. We identify that illegal crossing is still an important issue inside the Stress Area, with an average of 60 illegal crossings per day. Even though the percentage of people crossing the street illegally seems relatively small compared with the total number of people using the Stress Section, around 0.16%, this is an issue that needs to be reduced to zero, in principle due to the fact that the main causes of accidents on the Feeder Route are illegal crossings and not granting priority to pedestrians.

In order to discourage illegal crossing and for increasing the pedestrian safety, the municipality implemented a series of measures in the past period, like the repositioning of the pedestrian crosswalks, moving them away from the junction and building of pedestrian isles at the middle of the carriageway.

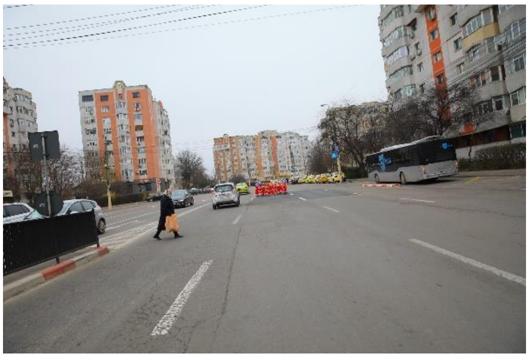


Figure 44. Examples of pedestrians crossing the street

3.1.3 Public transport

The Stress Section Area represent also an important public transport hub, especially for the inter-county transport due to the fact that the area is well served by the local public transport service that ensures good links around the City with high frequency. There are 4 (four) bus stations inside the area served by three important local bus routes. According to the municipality data there are approximately 8.000 people per day accessing the area by public transport.

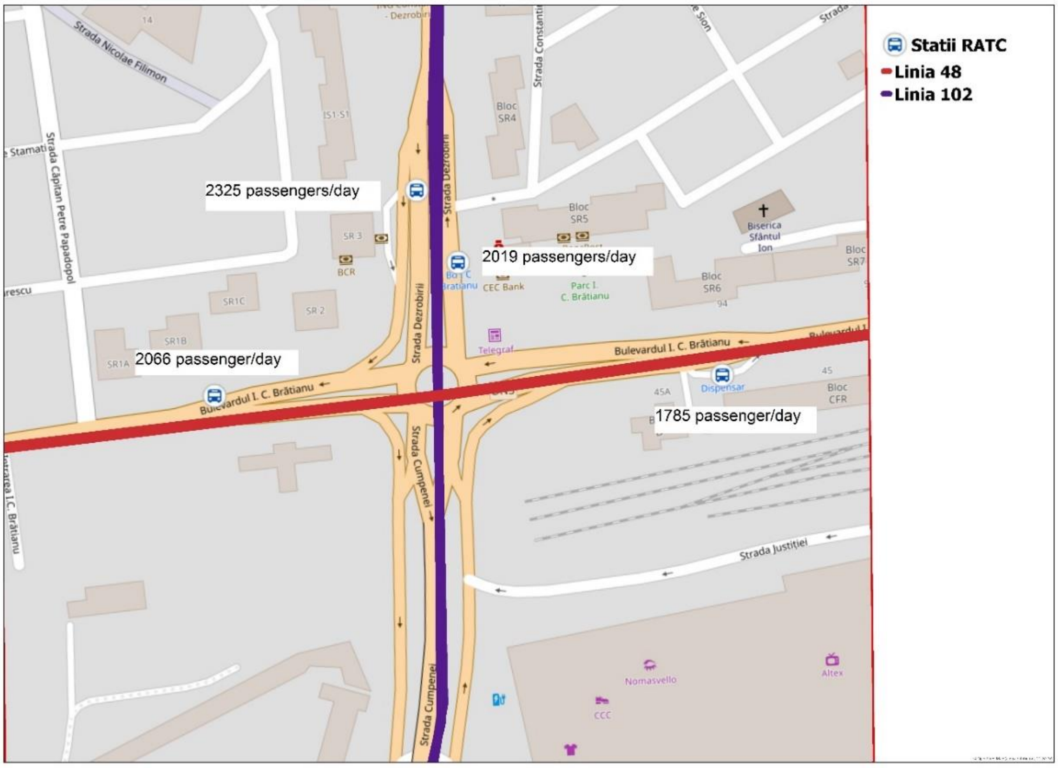


Figure 45. Locations of bus stops and number of passengers/day/bus station

During our discussions with the stakeholders there were three main issues identified related to the public transport service, respectively:

- Bus stops are not providing the optimal conditions for waiting (shelters, benches etc.) and provides only a limited amount of information to the users (no timetables, no panel information, no real time information etc.);
- The pedestrian network state discourages the use of public transport, making the journey to the bus stops difficult;
- The lack of a metropolitan public transport service, having in mind that there are a lot of people that moved from Constanta to the neighbouring Cities and Towns.

3.1.4 Objectives

As we can observe from the information provided above the Stress Section is used by all types of street users, in this respect one of the main issues for the City is to provide a balanced infrastructure and proper facilities in order to satisfy all road users' needs considering the high level and operational objectives of the Constanta's Growth Pole (Functional Urban Area) SUMP.

Table 13. Constanta's Growth Pole SUMP objectives

High Level Objectives	Operational Objectives
1. **ACCESSIBILITY** – Ensure all citizens are offered transport options that enable access to key destinations and services	- Increase number of people with good access to public transport services; - Increase the percentage of fully accessible public transport vehicles; - Reduce bus journey times along key corridors of the highway network; - Increase frequency of the public transport services; - Increase density of the cycle network; - Increase accessibility for pedestrians, including for people with reduced mobility (quality of surface, crossings and obstructions); - Reduce the number of vehicles searching for a car parking space; - Increase engagement with socially excluded groups.
2. **SAFETY AND SECURITY**	- Reduce fatal and serious accidents; - Improve pedestrian safety; - Increase the awareness level on safety and security issues; - Reduce the number of inappropriately parked vehicles.
3. **ENVIRONMENT** – Reduce air and noise pollution, greenhouse gas emissions and energy consumption	- Reduce CO, NOx, VOCs, PM10 and CO2 emissions; - Reduce noise and vibration levels; - No net loss of biodiversity. Improve biodiversity where possible; - Net reduction in risk of water and ground pollution through the design of new infrastructure; - Reduce material use and waste production; - Increase percentage of environmentally friendly vehicles.
4. **ECONOMIC EFFICIENCY** – Improve the efficiency and cost-effectiveness of the transportation of persons and goods	- Increase and improve the pedestrian area; - Increase the awareness level on alternative modes of transport; - Increase non-car mode share; - Reduction of journey time; - Minimise congestion; - Reduce vehicle operating costs (maintenance).
5. **QUALITY OF URBAN ENVIRONMENT** - Contribute to enhancing the attractiveness and quality of the urban environment and urban design for the benefits of citizens, the economy and society as a whole	- Rebalance the use of street space to reduce private car dominance; - Protect and enhance cultural heritage; - Increase the sustainable mobility awareness level.

For the moment, the Stress Section environment seems dominated by cars and the area is considered one of the most congested areas in the City. Therefore, the main problems identified in the area are mostly related with traffic congestion and all the negative aspects this brings, respectively:

- reduced accessibility for pedestrians and bus users;
- increased noise and air pollution;
- reduced safety, especially for people with reduced mobility;
- decreased quality of the urban environment and quality of life;
- increased travel time and slower moving speed.

3.2 Preparations for the street design exercises

The preparation for the street design exercises was a long and complex process, mostly affected by COVID 19 restrictions and by the process of local elections and changing of local government structure.

This activity started with the organisation of a series of online meetings with the local public stakeholders. These meetings were organised with the support of EIP partner in February and April 2021. There were four meetings organised with the following objectives: 1. to identify the main issues and policies priorities for developing the Feeder Route; 2. to understand who the Feeder Route users are and what are; 3. to see what other Cities are doing in the field of street space management and how can we implement suitable measures for the Stress Section; 4. To see how professionals are responding to the exercises that we have to carry out with citizens.

The participants invited to participate in these meetings were representatives of public stakeholders that have key knowledge and experience in the policy development, maintenance and operation on the Feeder Route.

Table 14. Public stakeholder meetings participants

Public stakeholders meetings participants	
National Authority	National Company for Road Infrastructure Administration (CNAIR – responsible for managing the national road network)
	National Road Police
Municipality Departments	Public Services management Department (roads, taxi, public transport, green spaces, public lightning)
	Development and European Funding Department (responsible for the SUMP implementation and obtaining funding for the SUMP projects implementation)
	Urban Planning and Land Use Division

	House Owners Association Department
	Local Police Department
Municipality Company	Confort Urban Company (responsible for road works and parking management)
	CT BUS Company (local public transport)

The second step in organizing the street design exercises was to undertake an assessment in order to identify what is the optimal way to organize these exercises and what are the gaps that needs to be filled in for delivering the foreseen outputs of this activity, based on the guidance provided by MORE partners.

Thus, we understood that at the City administration level we do not have the capacity to use all the software tools developed in the project, especially PTV VISSIM model. In this respect the Municipality contracted a private company for delivering the modelling service for the scenarios developed in MORE project.

The modelling service consisted in the construction of the baseline scenario model and calibration of the model, including running simulations according to some agreed designs for the current and future situations in the Stress Section.

The main inputs for establishing the baseline scenario were the data obtained through the traffic surveys that the Municipality conducted in March 2020. During nice weather on Thursday and Wednesday, a data collection exercise was carried out during a period of 16 hours/day on how street users are accessing and using the Stress Section. The focus of the survey was on the transport modes used to access the area, including a one-day survey on how pedestrians are accessing the Stress Section (for more details see **Chapter 1. Current conditions along Constanta's Stress Section).**

Another important issue that we understood was the lack of information of how peoples, real street users, are perceiving the Stress Area and what do they think about it. In this respect in August 2021, when the COVID 19 restrictions were more permissible, the Municipality organized a qualitative data survey regarding people's perception related to the Stress Section. This survey had two aims: 1. to obtain data; 2. to identify real street users that want to be involved in further MORE activities (design days).

The survey was prepared with the support of TUD partner team and all MORE cities. Good data was obtained during the survey from 163 pedestrians inside the Stress Section in a summer working day and some of the responded were interested to participate in further MORE events. The survey confirmed the results of a previous survey that was undertook at the start of the project using the Traffweb software, where we have 15 participants and 24 comments regarding peoples' perception on the Stress Section.

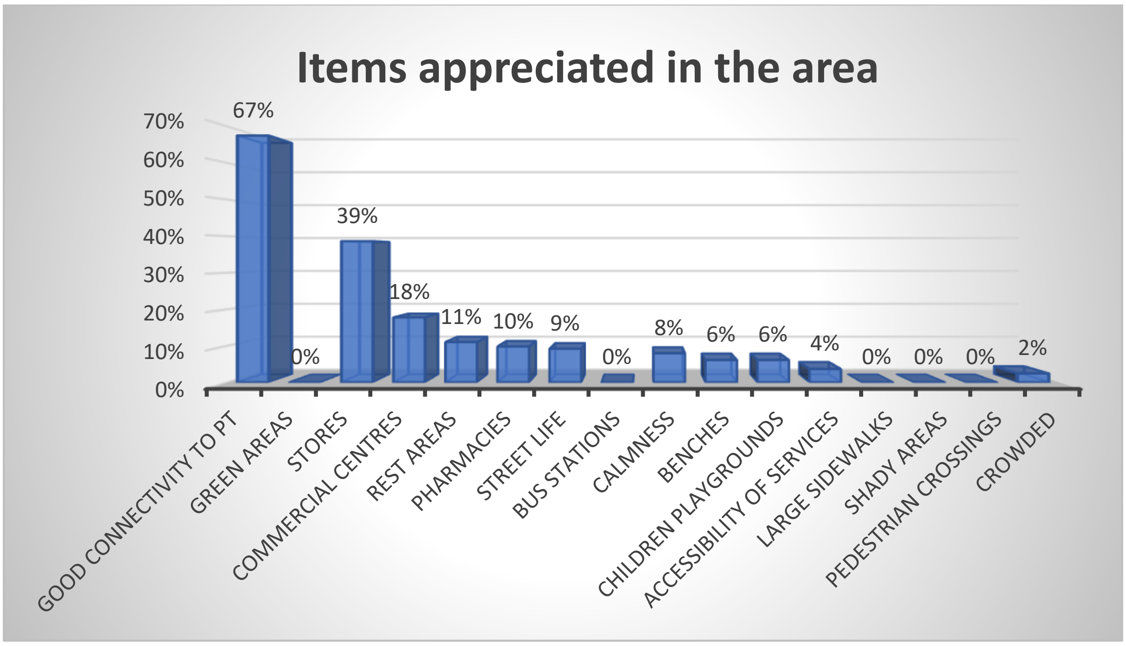


Figure 46. Positive aspects regarding the Stress Area (source: Users' perception survey)

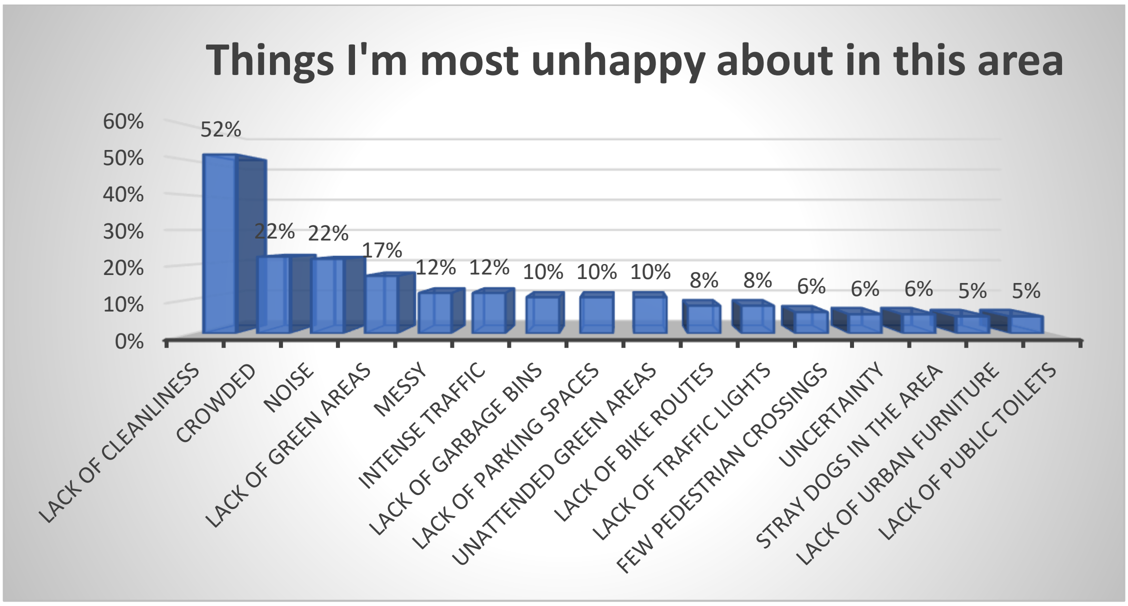


Figure 47. Negative aspects regarding the Stress Area (source: Users' perception survey)

Benefiting from the COVID19 summer restrictions relaxation, the local MORE implementation team decided to organize the design days with the citizens in a venue near the Stress Area and with peoples from around the area. In this respect, in a formal and informal way we started to contact people and businesses asking them if they are interested and can attend the design day events.

The aim of the meetings was to present to the participants the context of MORE project and what we intend to realize with these exercises and, of course, to obtain some designs for the Stress Area.

The events were organized as an informal meeting with a short presentation and afterwards discussions around the map of the Stress Section Area.

After analysing all the data gathered and correlated them with the City development vision we understood that for a proper development of the area we must put people first when considering new designs and also consider in a balanced way the needs of all the road users. In this respect the following provisions were identified by the City for redesigning the Stress Section in a more balanced way and in correlation with the City SUMP strategic objectives (1. Accessibility; 2. Safety and security; 3. Environment; 4. Economic efficiency; 5. Quality of urban environment)

Table 15. Provisions for street users

Street users	Provisions
Pedestrians	- convenient sidewalks (widths, barriers and surface);

	- increase the number of crossings; - clear wayfinding; - street furniture; - green spaces, including for shade; - public lighting; - adapting the infrastructure to the needs of people with reduce mobility, especially for people with disabilities; - reduce the noise and pollution, including the provision of environment information; - increased enforcement of the law, especially related to illegal crossings and street parking/stopping.
Public transport	- increase the PT frequency, including by introducing bus lanes on the Feeder Route and priority in traffic (traffic management system); - clean and energy efficiency fleet; - improve the bus stations (seating and roofing); - providing information for PT users (information panels on buses and bus stations, mobile application, and wayfinding); - increase bus stops accessibility, especially by improving the sidewalk infrastructure; - accessible taxi ranks; - clean taxi vehicles.
Cycling and Micro mobility	- adapting and enforcing clear regulation; - dedicated and safe infrastructure; - proper pavements; - proper lighting; - clear and visible street signals and road markings; - safe parking; - increasing the number of renting places.
Cars	- reduced traffic congestion; - providing parking information; - reduce private cars speed; - clear and visible street markings and signs; - build the infrastructure for EV charging; - introduce the traffic management system; - introduce the vehicle speed detection system; - Better enforcement of the laws.

3.3 Generating ideas for design options: inputs to stakeholder exercises

In the preparatory phase of the design exercises Constanta's project team also used the two tools developed in MORE for identifying design options that are feasible for the Stress Section, respectively the policy interventions tool and the road designs tool.

3.3.1 The Policy intervention tool

This an interesting library-based tool that provides different street space management solutions already tested in different cities according to different inputs related to higher policy objectives and the hierarchy of road users. The tool present different types of policies according to the inputs provided and is also presenting examples from different cities, the impact on road users and on the policy objectives.

The tool was mainly used by Constanta municipality experts and different inputs were introduced in the tool correlated with the City SUMP objectives and different road users' priorities. Thus, we analysed more in depth the impacts different policies have when prioritising people versus cars.

In this respect the tool provided different ideas regarding the redesigning of the Stress Section that were considered during the stakeholders' engagement exercises.

Among the policies presented as feasible by the tool was the one related to reducing the number of traffic lane for general traffic due to the fact that this was in line with the City objectives for the area, which is presented more in depth below.

Reduce number of traffic lanes

Feasible? Yes

Source of image: MORE

Type of policy: Space allocation
Also known as road diet. Removal of one or more lanes for general traffic, in one or both travel directions. This reduces the space for the movement of private motorised vehicles - bus lanes are not usually affected.

The space released is assigned to other uses, e.g. a median turn lane, cycling infrastructure, a walkable/green median strip, a wider footway, and parking space. It also reduces crossing distance for pedestrians.

This requires complimentary measures to reduce conflicts at junctions and to ensure that buses (moving or approaching stops) and cyclists are not negatively affected, in terms of delays and safety.

The reduction of lanes is suitable in built-up areas and roads with moderate traffic volumes and high volumes of pedestrians (including pedestrians crossing the road).

One of the aims of this measure is to reduce traffic speed. Central lines may be removed to further reduce speed. The measure should ensure that there is a separation between the road carriageway and footway.

Effect on road uses

Likely impact of intervention on road uses

Compared to: Keep same number of lanes

Road user	Road use	Impact	Reason
Pedestrians	Walk	+	Released space to widen footway or walkable median
	Cross the road	+	Shorter crossing distance, slower traffic speed
	Stroll	+	Released space to widen footway or walkable median
	Sit (street furniture)	+	Released space to widen footway or median
	Sit (outdoor cafe)	+	Released space to widen footway or median
Pedestrians with restricted mobility	Walk	+	Released space to widen footway or walkable median
	Cross the road	+	Shorter crossing distance, slower traffic speed
Cyclists	Move	+	Released space can be used for cycle lanes or tracks
	Park	+	Released space can accommodate cycle parking
	Rent (dock)	+	Released space can accommodate docks
	Rent (dockless)	+	Released space can accommodate rental bicycles
Micromobility users (scooters, skates, etc.)	Move	+	Released space can be used by micromobility vehicles
Bus drivers	Move	o	Removed lane may be general traffic one. Bus lanes unchanged
	Stop	o	No impact
Bus Passengers	Interchange	o	Removed lane may be general traffic one. Bus lanes unchanged
	Wait	+	Exposed to vehicles at slower speeds
Rail/metro/bus passengers	Interchange	+	Easier to cross to access bus stops
Car drivers	Move	-	Less space
	Park	o	No impact
	Stop	o	No impact
Car share users	Move	o	No impact
Motorcyclists	Move	-	Less space
Taxi drivers (inc. ride-hailing)	Wait	o	No impact
Taxi passengers (inc. ride-hailing)	Wait	o	No impact
Goods vehicles	Move	-	Less space
	Stop	o	No impact
Emergency vehicles	Move	-	Cannot easily pass traffic queues
Service vehicles	Move	o	No impact

Effect on policy objectives

Likely impact of policy intervention on objectives

Compared to: Keep same number of lanes

Objective	Impact	Reason
Movement		
Increase number of trips	o	More trips by non-motorised modes, less by motorised
Reduce travel time	-	Delays for motorised modes
Increase travel time reliability	-	More probability of queues
Reduce congestion	-	More probability of recurrent congestion, less space
Improve trip quality	o	Better trips by non-motorised modes, worse by motorised
Achieve a more sustainable modal split	+	Discourages car travel, better conditions for walking
Place		
Facilitate place activities (e.g. people sitting)	+	Space released for place activities
Facilitate kerbside activities	o	No impact
Improve access to local buildings	o	No impact
Road operation		
Improve resilience (to weather conditions)	+	Fewer motorised vehicles. Scope to add greenery
Increase flexibility (to different road uses)	+	Narrowing can be achieved using movable structures
Wider objectives: economic		
Reduce costs of transport	o	Can be achieved with cheap movable structures
Promote local economy	+	Encourages more walking/cycling trips to shopping areas
Wider objectives: social		
Improve traffic safety	+	Lower speeds, less inter-lane movements
Reduce community severance	+	Shorter crossing distance, slower traffic speed
Increase personal security	+	Encourages more people on street, more passive surveillance
Promote physical activity/health	+	Encourages more walking and cycling trips
Promote social interaction	+	More space for social interactions
Promote social inclusion	+	Reduces car dominance. Streets better for children and elderly
Increase wellbeing	+	Reduces car dominance and encourages walking/cycling
Wider objectives: environmental		
Increase green space	+	Released space can accommodate green spaces
Improve air quality	+	May lead to less motorised traffic
Reduce noise	+	May lead to less motorised traffic
Improve visual environment	+	Less vehicle-dominance, more space can be for greenery
Protect soil/water and reduce flood risk	o	Less vehicle-dominance, more space can be for greenery
Improve local climate	o	Less vehicle-dominance, more space can be for greenery
Reduce energy consumption	+	May lead to less motorised traffic

Figure 48. Policy intervention tool extract from results when prioritising people

Another interesting feasible result, also aligned with the Cities objectives, was the one related to the decreasing of the traffic lanes width.

Decrease width of traffic lanes

Feasible? Yes

Source of image: MORE

Type of policy: Space allocation
Reduction of the width of general traffic lanes, reallocating space to footway, kerb extensions, median strips, or road shoulders. Bus lanes may not be affected. The narrowing can be visual, using textures/colours to separate lanes from other uses.

This releases space for other uses without a large reduction on capacity for motorised vehicles. But may be difficult to accommodate buses and commercial vehicles. And it may contribute to collisions if speeds are high.

This measure also reduces crossing distance for pedestrians. It also encourages lower speeds and discourages vehicles from overtaking cyclists. But with widths between 2.7-3.25m, drivers may try to do it.

The measure is suitable in built-up areas and roads with low traffic volumes (especially of large vehicles) are high flows of pedestrians and cyclists. It is less suitable in curved roads or in busy junctions.

One of the aims is to encourage slower speeds and more careful driving. The central lines separating directions of travel may be removed after the width reduction, to further reduce traffic speed.

Figure 49. Design option suggestion from Policy Interventions Tool

An interesting aspect was that when we put cars as a priority and in correlation with the City objectives no feasible design proposals were identified. The conclusion for this being that the Stress Section is already providing too much for this transport mode.

Road design tool

This tool was also an interesting instrument to use when looking on street designs, especially when considering how the width of the streets can be organised in order to accommodate all types of street users. The tool was used by the local implementation team and having in mind that the width of the streets inside the Stress Section are not equal we used the tool for each arm of the junction, and we chose the option to give priority to active travel (pedestrian, cyclist and public transport users). Different option resulted and most of them were taken into consideration in further discussions and exercises.

Below you can see some results produced by the tool.

Left footway and kerbside Choices Report	Left carriageway	Median strip	Right carriageway	Right footway and kerbside	Total road width (m)	Width of Design Elements (m) Walking	Place activities	Green area	General purpose	Bus lane	Cycling	Parking/ loading	Tram line	Capacity per 75m² of roadspace Movement (people)	Place activities (people)	Parking/ loading (vehicles)	Ranking	Use in Design Exercises?
					29	4	0	3	12	5.6	2.4	0	0	295	20	0	5	Yes
					29	6	0	0	12	0	9	0	0	190	0	0	1	Yes

Left footway and kerbside Choices Report	Left carriageway	Median strip	Right carriageway	Right footway and kerbside	Total road width (m)	Width of Design Elements (m)								Capacity per 75m² of roadspace			Ranking	Use in Design Exercises?
						Walking	Place activities	Green area	General purpose	Bus lane	Cycling	Parking/ loading	Tram line	Movement (people)	Place activities (people)	Parking/ loading (vehicles)		
					29	6	0	3	12	0	6	0	0	170	20	0	0	Yes
					29	6	0	3	12	0	6	0	0	170	20	0	3	Yes
					29	6	0	3	12	0	6	0	0	170	20	0	4	Yes
					28.5	4	0	1.5	12	0	9	0	0	155	10	0	2	Yes

Figure 50. Road design tool results for the left arm of the junction (I. C. BRATIANU BOULEVARD sense to A2 motorway)

Left footway and kerbside Choices Report	Left carriageway	Median strip	Right carriageway	Right footway and kerbside	Total road width (m)	Width of Design Elements (m)								Capacity per 75m² of roadspace			Ranking	Use in Design Exercises?
						Walking	Place activities	Green area	General purpose	Bus lane	Cycling	Parking/ loading	Tram line	Movement (people)	Place activities (people)	Parking/ loading (vehicles)		
					30.5	6	3	1.5	12	6	0	0	0	325	40	0	2	Yes
					30	8	5	3	12	0	0	0	0	155	70	0	1	Yes

Figure 51. Road design tool results for the right arm of the junction (I. C. BRATIANU BOULEVARD sense to Ferdinand Boulevard)

The main objectives for the above design option were to improve the pedestrian movement and safety and to create room for place activities and cycling, including some provisions for PT service improvement.

As we can see from the Figures above, the tool outputs were very diverse and presented some good examples on how the street space can be reorganized in order to serve all these objectives.

Having in mind that the Stress Section is located on an important street that connects to the TEN-T network and is one of the main entrances/exits of the City, connecting neighbouring localities, most of the designs, according to the input options, provided designs suitable for areas located in the City centre or important commercial areas. Thus, all of the designs provided by the tool were used only to provide examples and to guide participants in thinking in a more opened way and to understand that there are multiple ways for rearranging the street space.

The results produced by the tools were considered in the design exercises and were further discussed in the co-creation exercises, both the design days and internal focus group meetings. These results constituted a good discussion point due to the fact that we could show the participants different options that can be generated during the stakeholder's exercises.

Interestingly one of the outputs of the tool was just a little bit modified and was proposed for simulation (the one ranked 5) and further analysis.

3.4 Generating street design options in the stakeholder exercises

In September – October 2021, two design days were organized with citizens using blocks and acetates. There were 30 participants at these one and a half hour meetings, 15 participants for each of them, most of them citizens living or working inside/near the Stress Section Area. The selection method used was random among the people living inside/near the studied area. Some contact data were obtained during the Users' perception Survey and the others were obtained from different nonofficial sources. Each participant was approached individually and asked to take part to the meetings.

The local management team prepared a short ppt. presentation for providing the participants information about the MORE project, scope of the meeting, specific information about the Stress Area and some initial ideas regarding the street space reallocation exercise.

For each of the meetings a map with the Stress Section Area was prepared, and using the blocks and acetates the participants tried to obtain a design of the Area. The first intention was to obtain a complete design for the entire Feeder Route (both streets and surrounding area), but due to time restriction we proposed a design just for the Stress Section. In this respect, we obtained 2 designs that were further taken into consideration for modelling.

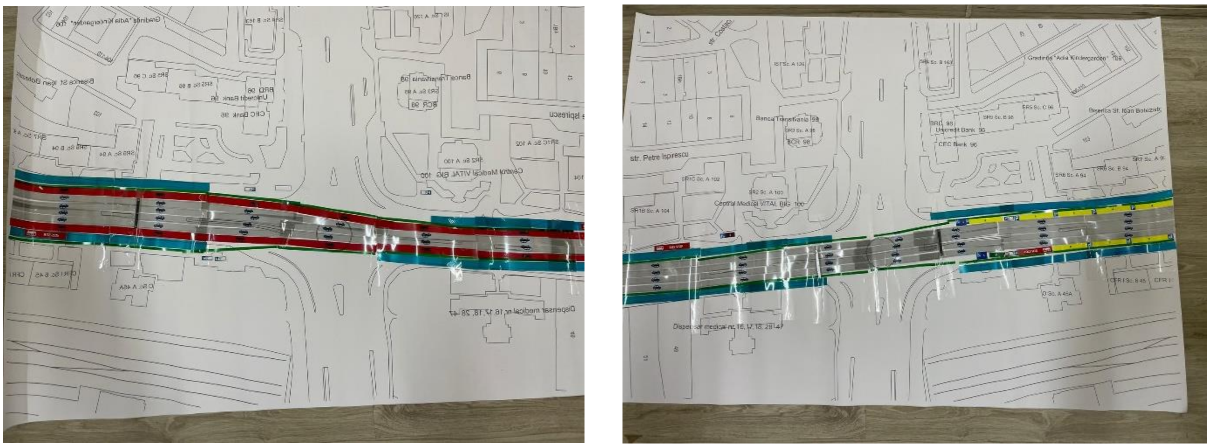


Figure 52. Design Day outputs using blocks and acetates in Constanta

After organizing the Design Days, two internal meetings were organised with the local implementation team and different municipality experts from the public service department and the public transport company in order to define the final designs for the Stress Area.

The final scenarios that went to the modelling were established during a meeting with the company contracted for developing the PTV Vissim model and running the simulation. Thus, we agreed with 10 scenarios that were simulated for AM and PM peaks, in order to have 20 modelled scenarios.

Afterwards, due to the fact that in the municipality there was no person found to work with the Linemap software, we came on an understanding with the company contracted to run the PTV simulation to aid us on also building the designs in Linemap. In this respect, all 10 agreed designs were introduced in Linemap software, as follows.

Table 16. AM an PM peak time scenarios description

<table>
<tr><th></th><th>Unique identifier code</th><th>Scenarios</th><th>Provisions</th></tr>
<tr><td>1</td><td>CON_S1_1010_2021_M_0_ABKLMPQ0</td><td rowspan="2">Description

Introduction of dedicate bus lanes along the hole Feeder route and the elimination of all parking spaces.

The first lane for vehicles is transformed into a dedicated lane for public transport, thus favouring the PT service and users.
All the on-street parking spaces inside the area are eliminated.

High level / operational objectives

1. Accessibility:

- Increase number of people with good access to public transport services;

- Reduce bus journey times along key corridors of the highway network;

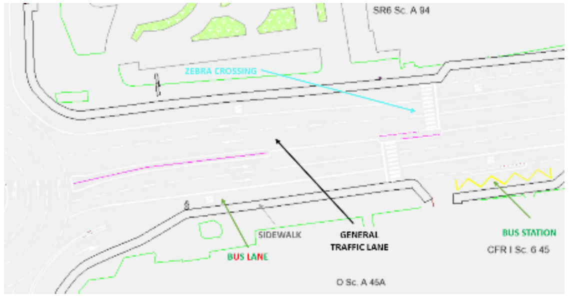
- Increase frequency of the public transport services;

- Reduce the number of vehicles searching for a car parking space.

2. Environment – Reduce air and noise pollution, greenhouse gas emissions and energy consumption.

3. Economic efficiency – Improve the efficiency and cost-effectiveness of the transportation of persons and goods

- Increase non-car mode share;
- Reduction of journey time;
- Minimise congestion;
- Reduce vehicle operating costs (maintenance).

4. Quality of urban environment</td><td rowspan="2">
</td></tr>
<tr><td>2</td><td>CON_S1_1020_2021_M_0_ABKLMPQ0</td></tr>
</table>

<table>
<tr><td></td><td></td><td>- Rebalance the use of street space to reduce private car dominance.</td><td></td></tr>
<tr><td>3</td><td>CON_S2_1010_2021_M_0_ABJKLMPQ</td><td rowspan="2">Description

Increasing the frequency of the public transport service from 10m to 5m and using the same street geometry as in previous scenarios (introducing bus lanes).

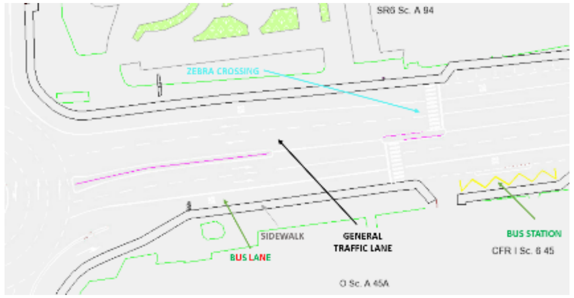
High level / operational objectives

1. Accessibility:
- Increase number of people with good access to public transport services;
- Reduce bus journey times along key corridors of the highway network;
- Increase frequency of the public transport services;
- Reduce the number of vehicles searching for a car parking space.

2. Environment – Reduce air and noise pollution, greenhouse gas emissions and energy consumption.

3. Economic efficiency – Improve the efficiency and cost-effectiveness of the transportation of persons and goods
- Increase non-car mode share;
- Reduction of journey time;
- Minimise congestion;
- Reduce vehicle operating costs (maintenance).

4. Quality of urban environment

- Rebalance the use of street space to reduce private car dominance.</td><td rowspan="2">
</td></tr>
<tr><td>4</td><td>CON_S1_1020_2021_M_0_ABJKLMPQ</td></tr>
<tr><td>5</td><td>CON_S3_1010_2021_M_0_ABFJKLMP</td><td>Description</td><td></td></tr>
</table>

6	CON_S3_1020_2021_M_0_ABFJKLMP	Introduction of dedicated bike lanes and eliminating the first vehicle lane. The bike lanes with a width of 1,25m and an protection/buffer area of 1,5 m are built on the first vehicle lanes. The number of vehicle lanes is reduced all the other elements of the streets remain the same as in the current situation, including the parking spaces. **High level / operational objectives** **1. Accessibility**: - Increase density of the cycle network; - Reduce the number of vehicles searching for a car parking space. **2. Safety and Security** - Reduce fatal and serious accidents. **3. Environment –** Reduce air and noise pollution, greenhouse gas emissions and energy consumption. - Increase percentage of environmentally friendly vehicles. 4. **Economic efficiency** – Improve the efficiency and cost-effectiveness of the transportation of persons and goods - Increase non-car mode share; - Minimise congestion; **5. Quality of urban environment** - Rebalance the use of street space to reduce private car dominance.	

 Version: 3

<table>
<tr><td>7</td><td>CON_S4_1010_2021_M_0_ABCJKLMP</td><td rowspan="2">Description

Increasing the sidewalks surface + speed reduction for cars (30 km/h).

The first vehicle lane will be removed and reconfigured in sidewalks. The width of the sidewalks is increased by 30% and a buffer area of 2m width is created. The buffer area will then be used either for increasing the green spaces inside the area or for installing different street furniture elements.

The speed limit is decreased from 50km/h to 30km/h and all the on-street parking spaces are removed.

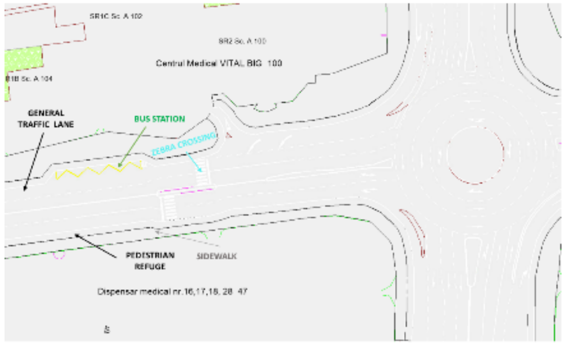
High level / operational objectives

1. Accessibility:
- Increase number of people with good access to public transport services;
- Increase accessibility for pedestrians, including for people with reduced mobility (quality of surface, crossings and obstructions);
- Reduce the number of vehicles searching for a car parking space.

2. Safety and Security

- Reduce fatal and serious accidents;

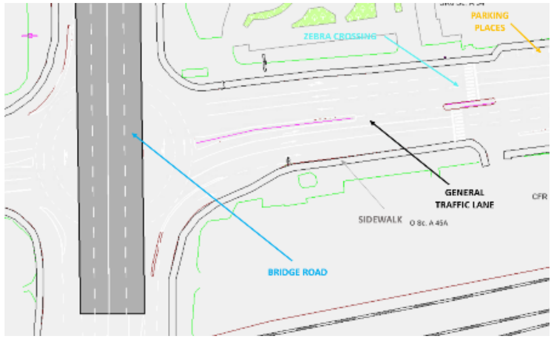
- Improve pedestrian safety.

3. Environment – Reduce air and noise pollution, greenhouse gas emissions and energy consumption.
- Increase percentage of environmentally friendly vehicles.</td><td rowspan="2">
</td></tr>
<tr><td>8</td><td>CON_S4_1020_2021_M_0_ABCJKLMP</td></tr>
</table>

 Version: 3

		4. **Economic efficiency** – Improve the efficiency and cost-effectiveness of the transportation of persons and goods - Increase non-car mode share; - Minimise congestion; - Increase and improve the pedestrian area; **5. Quality of urban environment** - Rebalance the use of street space to reduce private car dominance.	
9	CON_S5_1010_2021_M_0_ABDJKLMP	**Description** The street geometry remains the same as in the current situation except that the roundabout junction is removed and replaced with a traffic light signalized junction. The pedestrian crossings are moved closer to the junction (26 -30 m) and are also traffic light signalized. **High level / operational objectives** **1. Safety and Security** - Reduce fatal and serious accidents; - Improve pedestrian safety. **Observation:** This scenario was proposed for simulation due to the fact that most people travelling inside the Stress Section considers that the introduction of a traffic light-controlled junction will improve the current conditions. The idea appeared	
10	CON_S5_1020_2021_M_0_ABDJKLMP		

 Version: 3

		in all the stakeholders' engagement exercises, both with citizens and professionals. Moreover, the introduction of the traffic signalized junction will improve the street markings and signs and will constitute a first step in introducing the junction into the City traffic management system which is under development.	
11	CON_S6_1010_2021_M _0_ABJKLMPQ	**Description** An over ground passage for vehicles is built above the Feeder Route. The street geometry remains the same as in the current situation. The over ground passage for vehicles will have 2 lanes per direction with a 4m width and a buffer area of 1.5 m width. The junction can also be crossed under the bridge due to the fact that the roundabout will remain in place. **Observation:** Even though this scenario is not aligned with the City objectives in the field of sustainable mobility due to the fact that it is promoting vehicle traffic, it was proposed for simulation because the idea emerged in the stakeholders' engagement exercises with the mobility professionals.	
12	CON_S6_1020_2021_M _0_ABJKLMPQ		

 Version: 3

<table>
<tr><th></th><th></th><th></th><th></th></tr>
<tr><td>13</td><td>CON_S7_1010_2021_M_0_ABDJKLMP</td><td rowspan="2">Description

The street geometry remains the same as in the current situation, except the fact that the pedestrian crossings are removed and instead three over ground passages for people are built.

The over ground passages are 2.5 to 4 m wide and must be accessible for people with disabilities.

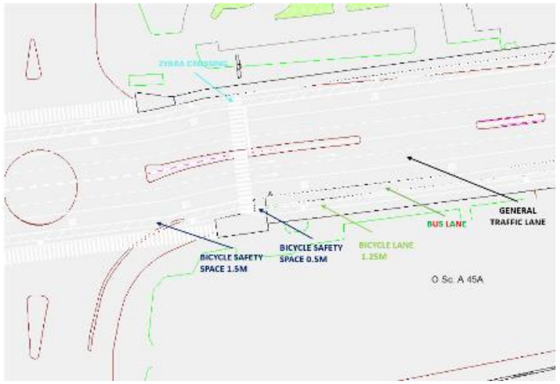
This scenario is looking both in increasing the pedestrian safety and also in increasing the junction capacity for general traffic.

High level / operational objectives

1. Safety and Security
- Reduce fatal and serious accidents;
- Improve pedestrian safety.

2. Environment – Reduce air and noise pollution, greenhouse gas emissions and energy consumption.

3. Economic efficiency – Improve the efficiency and cost-effectiveness of the transportation of persons and goods.</td><td rowspan="2"></td></tr>
<tr><td>14</td><td>CON_S7_1020_2021_M_0_ABDJKLMP</td></tr>
<tr><td>15</td><td>CON_S9_1010_2021_M_0_ABFGJKLM</td><td>Combined scenario no 1 (map resulted from the design day 1)</td><td></td></tr>
</table>

16	CON_S9_1020_2021_M_0_ABFGJKLM	**Description** The Feeder route provides 2 lanes dedicated for general traffic with a width of 3.3 – 3.7 m., 3.5m width dedicated bus lanes in each direction, 1.25m width dedicated bike lanes in each direction, with a buffer area of 1.5m, sidewalks with a width of 2m. minimum. The crossroads were moved closer to the junction (43 and 37 m away). The bus stops were removed and the bus will stop on the dedicated bus lanes. All parking spaces were removed. **High level / operational objectives** **1. Accessibility**: - Increase number of people with good access to public transport services; - Increase the percentage of fully accessible public transport vehicles; - Reduce bus journey times along key corridors of the highway network; - Increase frequency of the public transport services; - Increase density of the cycle network; - Increase accessibility for pedestrians, including for people with reduced mobility (quality of surface, crossings and obstructions); - Reduce the number of vehicles searching for a car parking space.	

		2. Safety and Security - Reduce fatal and serious accidents; - Improve pedestrian safety; - Increase the awareness level on safety and security issues; - Reduce the number of inappropriately parked vehicles. **3. Environment –** Reduce air and noise pollution, greenhouse gas emissions and energy consumption. - Increase percentage of environmentally friendly vehicles. 4. **Economic efficiency** – Improve the efficiency and cost-effectiveness of the transportation of persons and goods - Increase and improve the pedestrian area; - Increase the awareness level on alternative modes of transport; - Increase non-car mode share; - Reduction of journey time; - Minimise congestion; - Reduce vehicle operating costs (maintenance). **5. Quality of urban environment** - Rebalance the use of street space to reduce private car dominance. **Observation** The scenario was developed during the design day no. 1 and is looking only at the Feeder Route space reorganization.	

<table>
<tr><th></th><th></th><th></th><th></th></tr>
<tr><td>17</td><td>CON_S8_1010_2021_M_0_ABFJKLMS</td><td rowspan="2">Combined scenario no 2 (map resulted from the design day 2)

Description

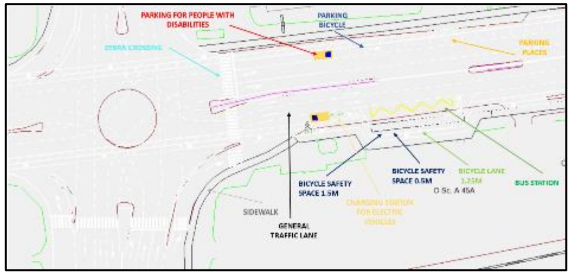
The roundabout junction is removed and replaced with a traffic signalized junction.

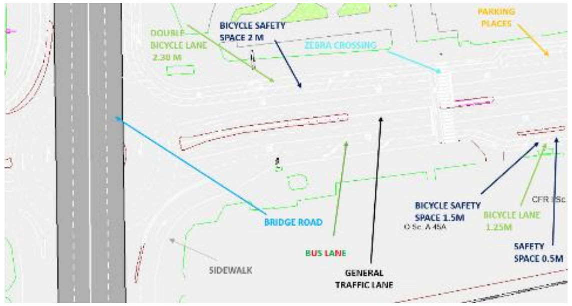
The Feeder Route provides 2 lanes for general traffic (3 -3.5 m width), bike lanes in each direction (1.25 m width) with a buffer area of 0.5m, space of 1.5 m for green spaces and street furniture and a 2m wide sidewalk.

On the right arm of the junction, when moving towards the City centre, after the Bus bay stop there are 30 parking spaces, 1 parking space for people with disabilities, 1 bike parking and 2 parking spaces for EV, including the charging point.

When moving towards the City exit we have 44 parking spaces, one place parking for people with disabilities and parking for cyclists.

Observation:

Even though this scenario is not totally aligned with the City objectives in the field of sustainable mobility due to the fact that it is promoting vehicle traffic, it was proposed for simulation because the idea emerged in the design day exercises and was considered a suitable design for the area.</td><td rowspan="2">
</td></tr>
<tr><td>18</td><td>CON_S8_1020_2021_M_0_ABFJKLMS</td></tr>
</table>

<table>
<tr><td>19</td><td>CON_S1_1010_2021_M_0_ABFJKLMS</td><td rowspan="2">Combined scenario no 3 (a mix of the scenarios presented above 1 - 14 with the best results)</td><td rowspan="2">
</td></tr>
<tr><td>20</td><td>CON_S1_1020_2021_M_0_ABFJKLMS</td></tr>
</table>

3.5 Building and applying the Vissim model

With the designs already established and the Linemap drawings done, the next step was to start building the transport model for running the simulations. Briefly, the model was developed following next steps:

1. Data gathering for road junction design, vehicles, pedestrians, parking places/parking manoeuvres, bus stops etc.;
2. Defining all the possible scenarios based on the stakeholders' engagement activities carried out in the project and on the experts' opinion;
3. Selecting the scenarios to be tested;
4. Drawing the maps for each scenario using LineMap tool to include the design options required;
5. Importing the maps from LineMap in VISSIM tools and setting up the final details, according to the rules governing the field;
6. Including the traffic volumes in VISSIM for each period of time (AM / PM);
7. Running and calibrating the model;
8. Extracting traffic parameters.

For each scenario, including the baseline, that was tested the inputs were the following:

- Data related to the geometrical details of the junction;
- Desired speed distribution;
- Vehicle volumes;
- Pedestrian volumes.

The outputs of the VISSIM model were the following:

- Average travel time [s/veh];
- Average delay [s/veh];
- Average delay stopped [s/veh];
- Average speed [km/h].

Below is a synthetically presentation of the scenarios simulation results for AM and PM traffic peaks inside the Stress Area provided by the PTV Vissim software.

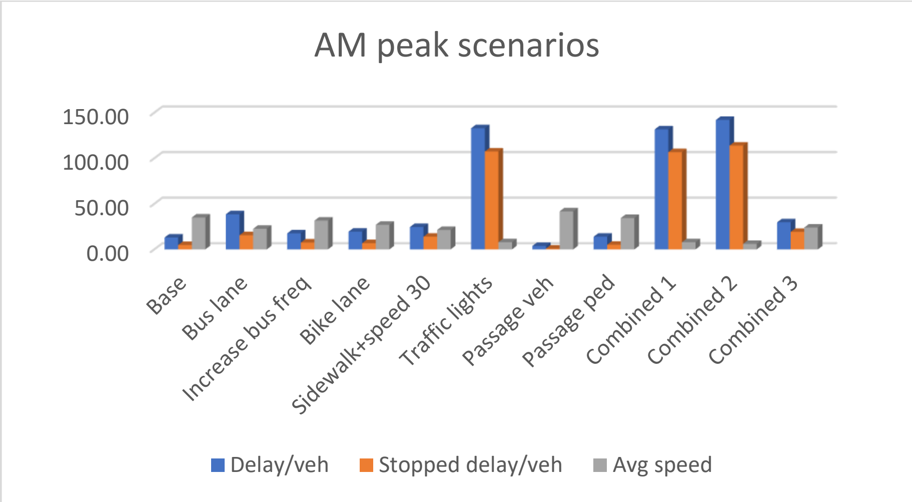


Figure 53. AM peak scenarios PTV results

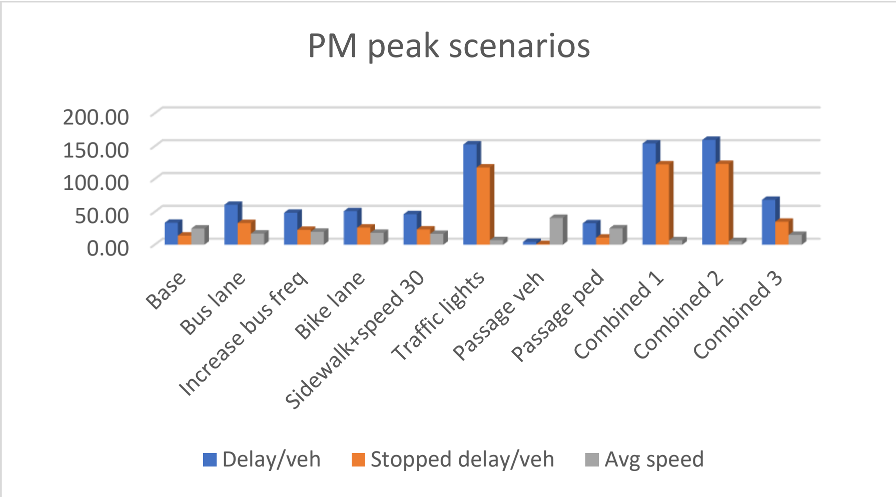


Figure 54. PM peak scenarios PTV results

As we can observe from the comparison presented above, the scenarios with the best results are the combined ones' and the one with a traffic light junctions, instead of a roundabout one as it is now.

The design with the best results after the simulation, taking into consideration the objectives of the City in the field of promoting sustainable mobility was the AM combined no 1 design, this was produced during the first design day and is presented in more detail below.

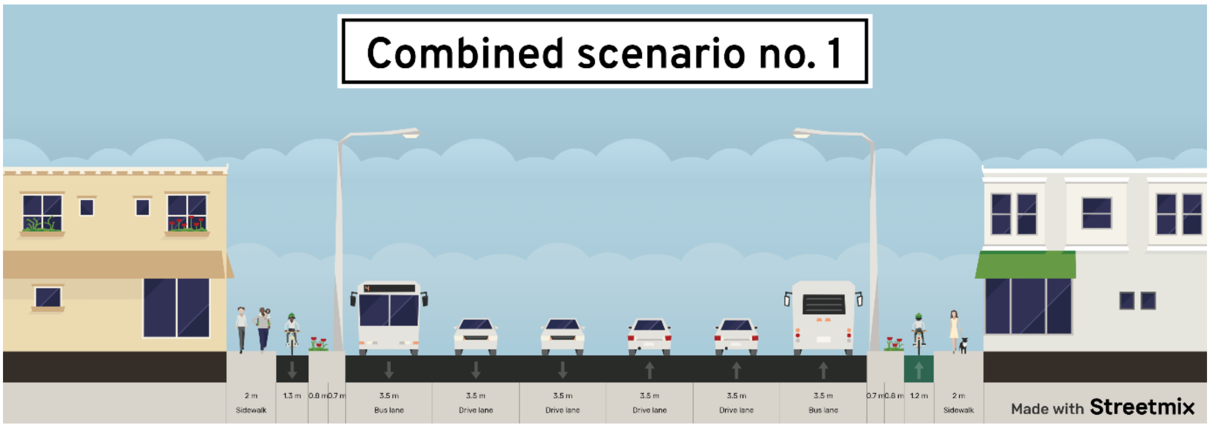


Figure 55. Design option - Street mix

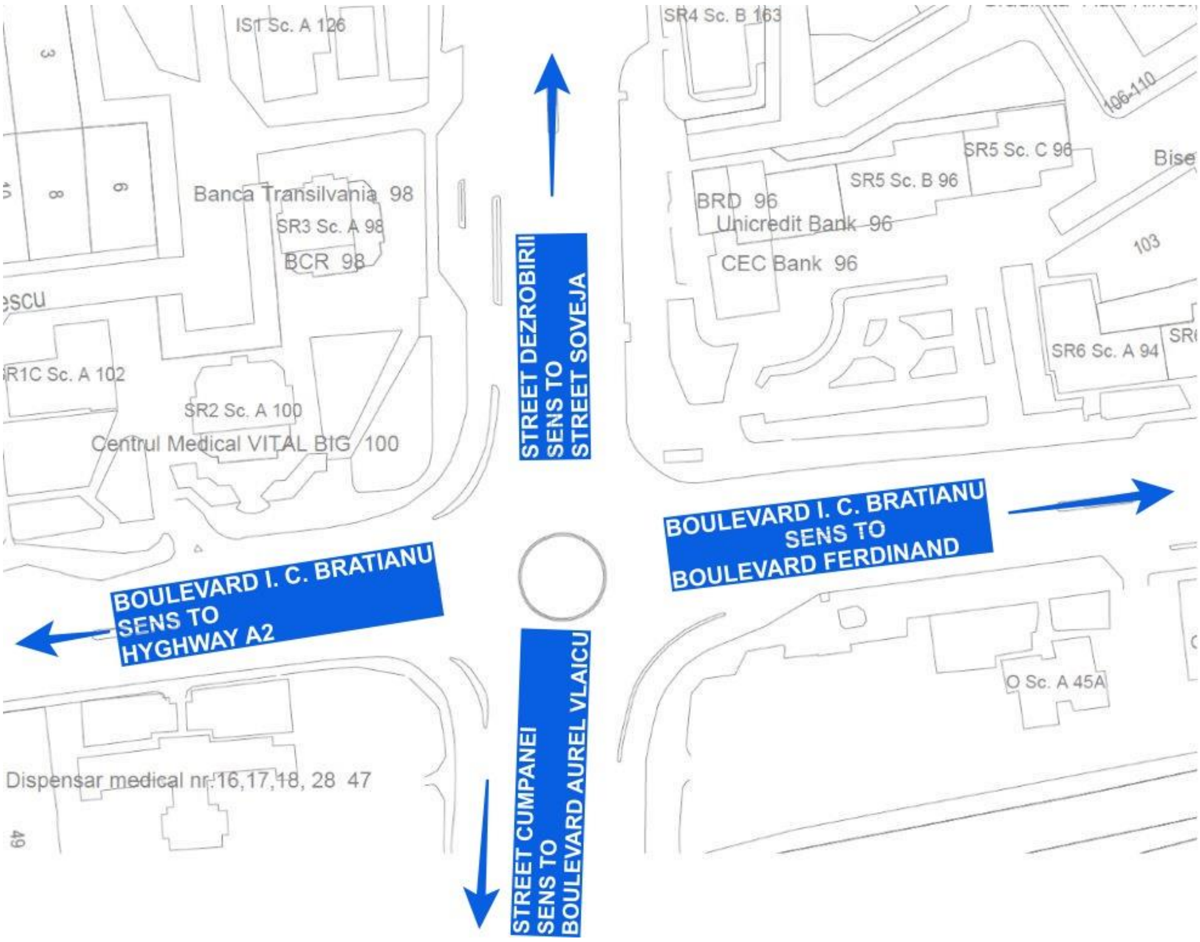


Figure 56. Stress Section

Table 17. CON_S9_1010_2021_M_0_ABFGJKLM – scenario description

THE CURRENT SITUATION	PROPOSED SITUATION
BOULEVARD I. C. BRATIANU SENS TO BOULEVARD FERDINAND - 3 lanes per direction for general traffic. - The pedestrian crossing is built 96.4 meters away from the junction. - On the right carriage way (direction to Ferdinand Blvd.), after the pedestrian crossing, we find a 27.1m long Bus bay station, and afterwards parking spaces - On the left carriage way (direction to Ferdinand Blvd.) we find after the pedestrian crossing angled parking spaces.	**BOULEVARD I. C. BRATIANU SENS TO BOULEVARD FERDINAND** - 2 lanes per direction for general traffic. - 1 bus lane per direction with a width of 3.5 m. - 1 cycling lane per direction with a width of 1.25 m wide and with safety buffer of 1.5 meters width. - The pedestrian crossing is moved 43 meters away from the junction. - All parking spaces are removed. - The bus will stop on the dedicated bus lane, at a distance of 105 meters from the old bus station.
BOULEVARD I. C. BRATIANU SENS TO A2 - 3 lanes per direction for general traffic. - The pedestrian crossing is built 91.2 meters away from the junction. - On the right carriage way (direction to A2), after the pedestrian crossing, we find a 24.3m long Bus bay. - On the left carriage way (direction to A2) there are no parking spaces for vehicles.	**BOULEVARD I. C. BRATIANU SENS TO A2** - 2 lanes per direction for general traffic - 1 bus lane per direction with a width of 3.5 m. - 1 cycling lane per direction with a width of 1.25 m wide and with safety buffer of 1.5 meters width. - The pedestrian crossing is moved 35.7 meters away from the junction. - All parking spaces are removed. - The bus will stop on the dedicated bus lane, at a distance of 30 meters from the old bus station.
STREET DEZROBIRII SENS TO STREET SOVEJA - The pedestrian crossing is built 86.7 meters away from the junction. - On the right carriage way (direction to Soveja Street) there are 3 lanes for general traffic.	**STREET DEZROBIRII SENS TO STREET SOVEJA** - This scenario does not approach this area. - To implement the scenario, the pedestrian crossing will be

- After the pedestrian crossing on the right carriage way, there is a Bus bay station with a length of 23.5 m, followed by a taxi station with 5 places, and afterwards there are angled parking spaces. - On the left carriage way (direction to Soveja Street) there are 4 traffic lanes, near the intersection a lane is dedicated for turning right. Subsequently, after the pedestrian crossing, we move to 3 lanes per direction. - Near the junction we find a Bus bay with a length of 29.1 m, and after the pedestrian crossing there are angled parking spaces in the spike.	rearranged to a distance of 13.7 meters away from the junction.
STREET CUMPENEI SENS TO BOULEVARD AUREL VLAICU - 3 lanes per direction for general traffic - On the right carriage way (direction to Bd. Aurel Vlaicu) there is a right turning lane that comes from Bd. I.C. Bratianu. - On the left carriage way (direction to Aurel Vlaicu Blvd.), there is a right turning lane that connects with I.C. Bratianu Blvd.	**STREET CUMPENEI SENS TO BOULEVARD AUREL VLAICU** - This scenario does not intervene in this area. - To implement this scenario, the pedestrian crossing will be rearranged to a distance of 11.9 meters away from the junction.

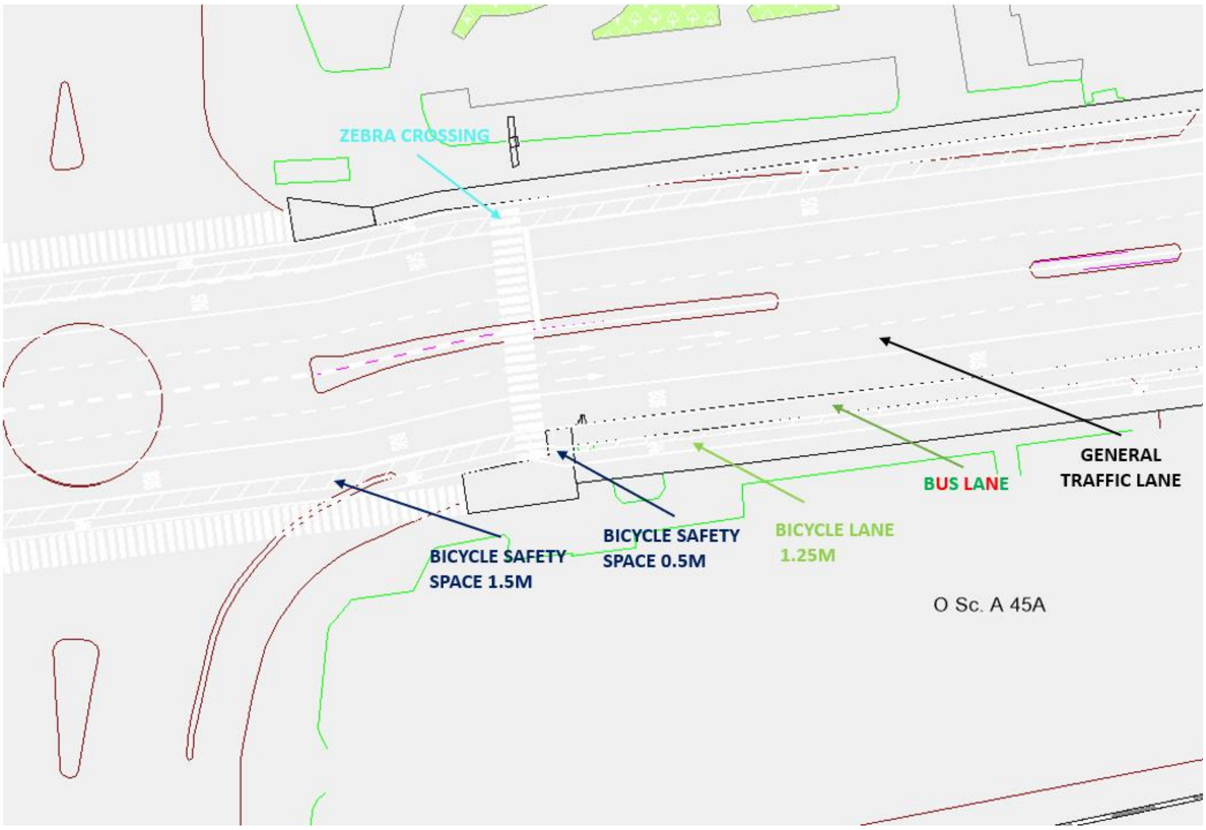
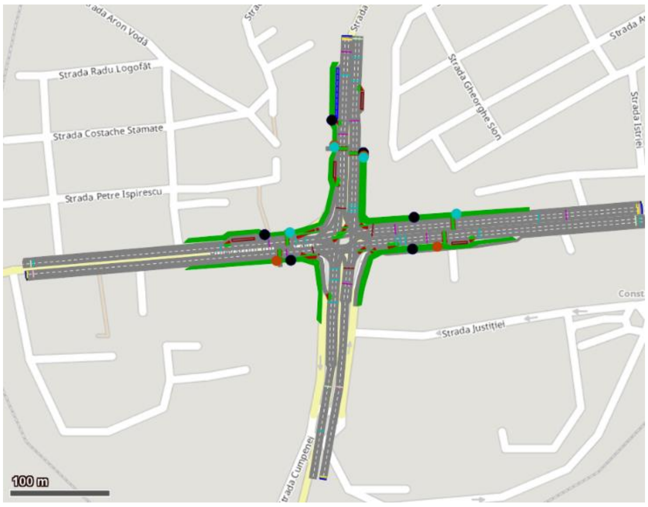


Figure 57. CON_S9_1010_2021_M_0_ABFGJKLM –Linemap Scenario design

Table 18. CON_S9_1010_2021_M_0_ABFGJKLM – Scenario input data

Code	Description	Data
OM_in1	Unique Identifier for option	**CON_S9_1010_2021_M_0_ABFGJKLM**

OM_in2	Screenshot of the modelled network (including all network objects and scale bar)	
OM_in3	Desired speed distribution (name of standard distribution or values of individual distributions)	50 km/h
OM_in4	Entering vehicle input volumes	

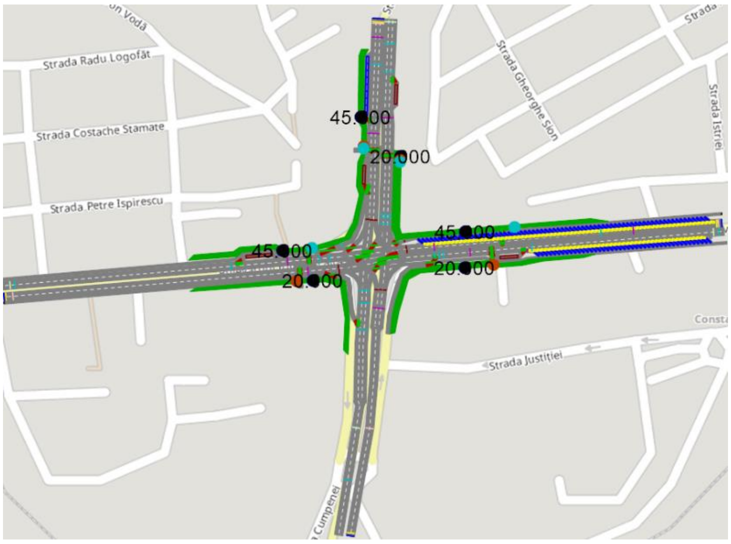
OM_in5	Pedestrian input volumes	
OM_in6	Pedestrian distancing values (modelling parameters e.g. due to COVID-19 social distancing)	Not used

Table 19. CON_S9_1010_2021_M_0_ABFGJKLM – Scenario output data

Code	Description	Data
OM_out1	Unique Identifier for option	**CON_S9_1010_2021_M_0_ABFGJKLM**
OM_out9	Average travel time [s/veh] = Total of travel times / number of vehicles - at **network level** - for motorised vehicles and bicycles - average across simulation runs	142.07
OM_out10	Variance and 95% percentile of average travel times across simulation runs - at **network level** - for motorised vehicles and bicycles	
OM_out11	Average travel time [s/veh] = Total of travel times / number of vehicles [for the **stress section**] - for motorised vehicles and bicycles - average across simulation runs	Not applicable
OM_out12	Variance and 95% percentile of average travel times across simulation runs [for the **stress section**] - for motorised vehicles and bicycles	Not applicable
OM_out13	Average delay [s/veh] = Total of delay / number of vehicles - at **network level** - for motorised vehicles and bicycles - average across simulation runs	142.07
OM_out14	Variance and 95% percentile of average delay across simulation runs - at **network level** - for motorised vehicles and bicycles	
OM_out15	Average delay [s/veh] = Total of delay / number of vehicles [for the **stress section**] - for motorised vehicles and bicycles - average across simulation runs	Not applicable
OM_out16	Variance and 95% percentile of average delay across simulation runs [for the **stress section**] - for motorised vehicles and bicycles	Not applicable
OM_out17	Average delay stopped [s] - at **network level** - for motorised vehicles and bicycles - average across simulation runs	113.83
OM_out18	Variance and 95% percentile of delay stopped across simulation runs - at **network level** - for motorised vehicles and bicycles	
OM_out19	Average delay stopped [s] [for the **stress section**] - for motorised vehicles and bicycles - average across simulation runs	Not applicable

OM_out20	Variance and 95% percentile of delay stopped across simulation runs [for the **stress section**] - for motorised vehicles and bicycles	Not applicable
OM_out21	Average speed [km/h] or [mph] = total distance / total travel time - at **network level** - for motorised vehicles and bicycles - average across simulation runs	6.02
OM_out22	Variance and 85% percentile of average travel speeds across simulation runs - at **network level** - for motorised vehicles and bicycles	
OM_out23	Average speed [km/h] or [mph] = total distance / total travel time [for the **stress section**] - for motorised vehicles and bicycles - average across simulation runs	Not applicable
OM_out24	Variance and 85% percentile of average travel speeds across simulation runs [for the **stress section**] - for motorised vehicles and bicycles	Not applicable
OM_out36	Environmental impact (CO, NOx; VOC, Fuel Consumption by node evaluation) - on **network level** - average across simulation runs	N/A

3.6 Appraisal of design options

After concluding the PTV Vissim simulation we analysed the outputs of each design option and considered that the scenarios that are most suitable for appraisal are the two scenarios that were proposed during the design days. The main reason for doing so consisted in the fact that these two scenarios were produced by the people accessing or living inside the Stress Area and each scenario has its own approach.

The combined scenario no. 1 is looking to give enough space for each street user and to balance the way the street space is used, while the combined scenario no. 2 looked mostly to promote the car use, both moving and parking, and also providing some space for cyclists, including cycle tracks and parking.

Having in mind that in Romania there are no standard cost provided for new investments objective, these costs are obtained according to the national legislation only after concluding some technical and economical studies (e.g. technical inspections, topological and geotechnical studies, feasibility studies and technical designs), we understood that we will not be able to use the cost benefit analyses or the multi- criteria analyses. In this respect, we come to the conclusion that, according to the data that we have, we can only conduct the technical/political assessment.

The technical political assessment exercise consisted in completing some excel files with the data that we had regarding some predefined indicators related to:

- The street design (e.g. allocated street space for different road users, types of pedestrian crossings, bus stops etc.);
- Movement function (e.g. volumes of traffic per type of users, speed, travel time, speed etc.);
- Place function (vehicle-based activities and people based activities);
- Wider impacts (economic, social and environmental).

Most of these data were collected during the MORE project and were specific for the Feeder Route and the Stress Section. Unfortunately, the Municipality did not have to many extra data that could be inserted as input for the tool, due to the general issue in Romania and of course in Constanta regarding the lack of consistent traffic data, for example we did not have consistent data related to the wider impact specific for the Stress Section.

The next step was to complete the political priorities that we intend to follow, these were provided considering the City SUMP objectives mainly, the results of the stakeholder's engagement meetings and the results of the survey regarding people perception on the Stress Section, as follows:

Table 20. PTA tool input for political priorities

Roaduser	Use	Priority
Pedestrians	Walk	2
	Cross the road	2
	Stroll	1
	Sit (street furniture)	2
	Sit (outdoor café)	2
Pedestrians (restricted mobility)	Walk	2
	Cross the road	2
Cyclists	Move	2
	Park	2
	Rent (dock)	1
	Rent (dockless)	1
Micromobility (scooters, skates,etc.)	Move	2
Bus drivers	Move	1
	Stop	1
Bus passengers	Move	2
	Wait	2
Rail/metro/bus passengers	Interchange	1
Car drivers	Move	1
	Park	0
	Stop	0
Car share users	Park	0
Motorcyclists	Move	1
Taxi drivers (inc. ride-hailing)	Wait	1
Taxi passengers (inc. ride-hailing)	Wait	1
Goods vehicles	Move	1
	Stop	1
Emergency vehicles	Move	1
	Stop	1
Service vehicles	Stop	1

Objective		Priority
Movement	Increase number of trips	☐
	Reduce travel time	☐
	Increase travel time reliability	☐
	Reduce congestion	☑
	Improve trip quality	☑
	Achieve a more sustainable modal split	☑
Place	Facilitate place activities (e.g. people sitting)	☑
	loading)	☑
	Improve access to local buildings	☐
Road operation	Improve resilience (to weather conditions)	☐
	Increase flexibility (to different road uses)	☐
Wider objectives: economic	Reduce costs of transport	☑
	Promote local economy	☑
Wider objectives: social	Improve traffic safety	☑
	Reduce community severance	☑
	Increase personal security	☑
	Promote physical activity/health	☑
	Promote social interaction	☑
	Promote social inclusion	☑
	Increase wellbeing	☑
Wider objectives: environment	Increase green space	☑
	Improve air quality	☑
	Reduce noise	☑
	Protect soil/water and reduce flood risk	☐
	Improve local climate	☐
	Reduce energy consumption	☐
	Improve regional/global environment	☐

Based upon the information provided, the tool made a comparison of these design options and provided an assessment taking into consideration predefined performance indicators resulted from the political priorities provided, NACTO design standards and some environmental standards.

Below you can see the synthesis of the impact analysis provided by the tool.

Table 21. PTA tool output - Synthesis of the impact analysis

		Number of indicators for which option is best	Number of violations of political priorities	Number of violations of standards
Option 0 (Do nothing)	*Base line*	20	-	4
Option1	*Combined scenario no. 1*	6	15	2
Option2	*Combined scenario no. 2*	10	12	3

As we can observe from the table above, the Combined scenario no. 1 represent the best option if we take into consideration the number of violation of standards.

Both proposed designs violets the best practice standards provided for cycling space and inclusion and the Combined scenario no. 2 is also violating the standards for public transport.

Thus, taking into consideration the provisions related to inclusion, especially the provisions for people with disabilities that can be provided by conceiving a more inclusive design, which the tool did not took into consideration, like for example better street markings, reduction of speed limit etc., we decided on the Combined scenario no. 1.

Another reason for considering that the most suitable scenario is the Combined no. 1 was that, even though as presented by the tool this violates 15 political priorities and not 13 as its competitor, from our perspective this is the most balanced one regarding the types of users that are accommodated on the street space. This design option is looking to create enough space for pedestrians, cyclists, public transport and general traffic, while the Combined scenarios no. 2 is encouraging more car use, especially due to the consistent parking provisions.

4 LISBON

4.1 A brief summary of current conditions along the Stress Section

The stress section includes Rua Morais Soares that connects Praça (Square) Paiva Couceiro to Praça do Chile. Praça Paiva Couceiro, given its relevance in the community as well as its place´s diversity is also included in the analysis.

The length of this section is around 1.125m (Rua Morais Soares' section - 685 meters, plus a perimeter of 440 meters around Praça Paiva Couceiro).

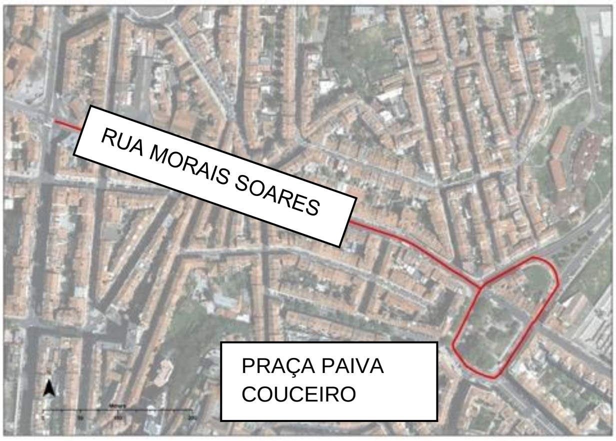


Figure 58. Stress Section

The map on the side shows the section under analysis, some points of interest around its influence area as well as where the movements that use Rua Morais Soares can be distributed, assuming the importance of this street to spread many movement flows.

Rua Morais Soares is one of the most important roads that connect the east part of the city, and the movements that come from the TEN-T network to the city centre, namely the business and historic centre. Besides its importance in the road network, it is also a very dense commercial and service zone. It generates high levels of demand, attracting large flows of people throughout the day on different transport modes, causing several double-parking problems, and with a high pedestrian flow pressure, despite the lack of comfortable and appealing conditions to walk.

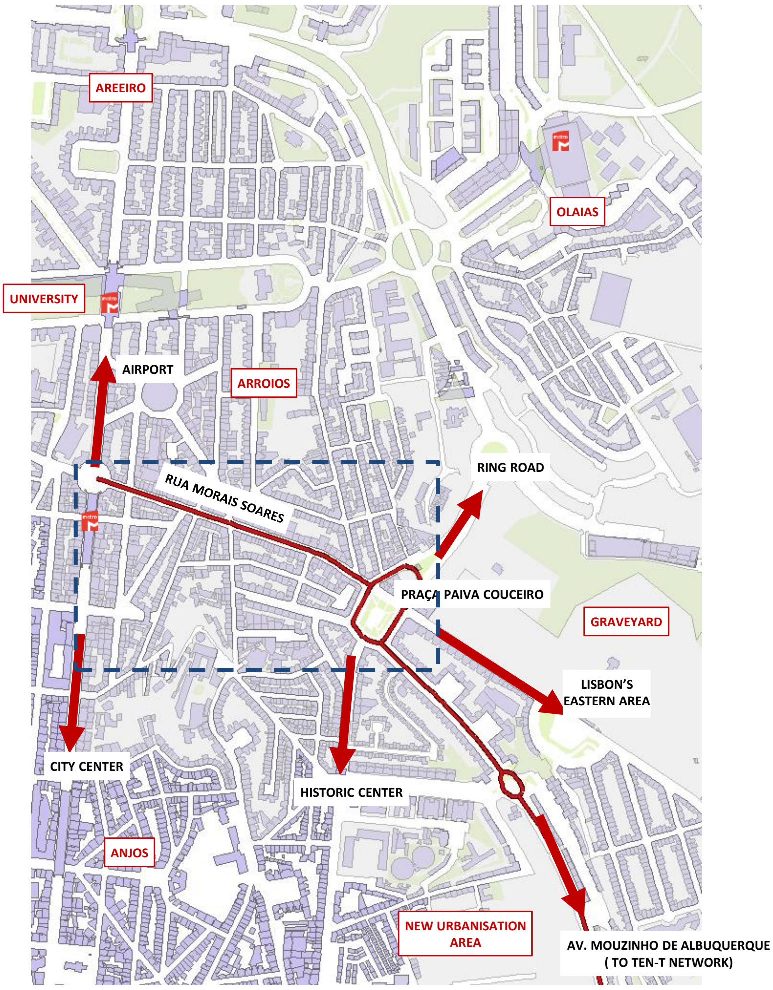


Figure 59. Location of the stress section under study and its surroundings

4.1.1 Demography

Figure 60 shows the buildings within a buffer of 500 meters around the section with the corresponding number of residents. The divisions correspond to the subsections established by the last census to identify some demographic and economic characteristics and will also be used to define population evolution to foresee the consequences of future scenarios.

Since the sections have different levels of users (i.e., users that use the street to stroll or sit or board public transport and others that only use it to move to surrounding streets), two buffers of 100 and 500 meters around the section were considered, which will enable to define different levels of access to the street. The first one will be used to identify demand levels of kerbside and shop users and the second one, which has a broader reach, will be used to define local traffic and pedestrian movements.

According to the last census in 2011, in the inner section, which corresponds to a buffer of around 100 meters around the section, live 6.300 people. Considering a buffer of around 500 meters, the population rises to 32.000.

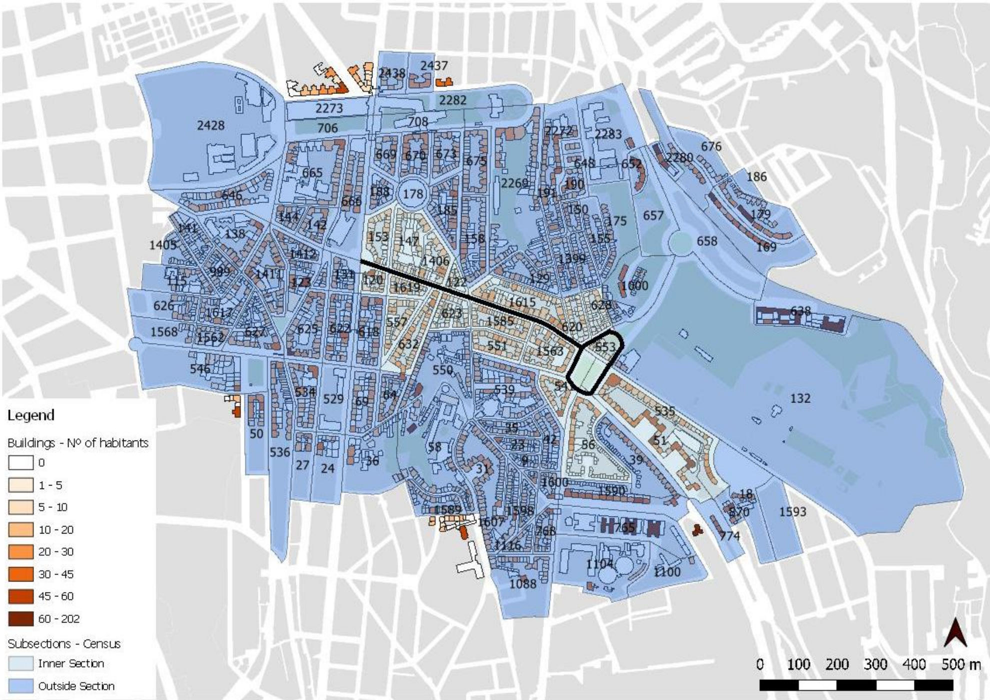


Figure 60. Population distribution around the section (Source: Census 2011)

The subsections were used as zones for the local traffic movements.

4.1.2 Economic Activities

In terms of economic activities, identification and characterization work were done over the type of activities that currently exist in the analysed section. As it was already mentioned, this area has a strong component of commerce and daily services, having a total number of 174 commercial and service establishments, the largest part (56%) of which is dedicated to commerce, like groceries, specialized food stores and common daily products.

In the following map, the type of store or services is individually identified.

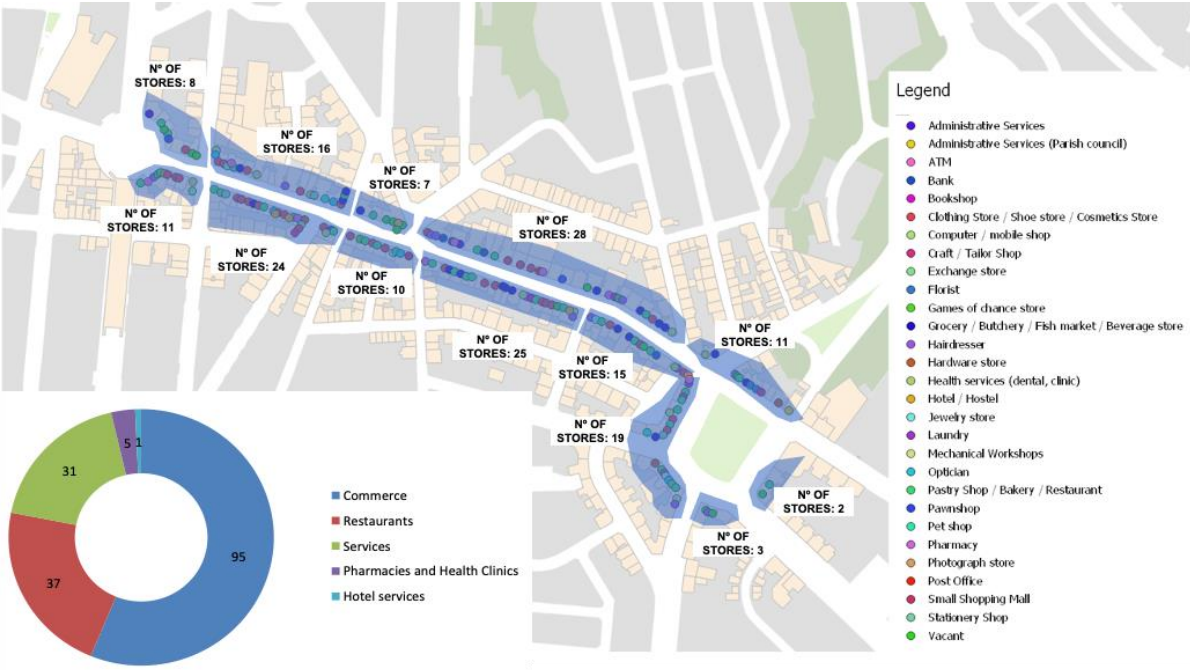


Figure 61. Number and type of stores/commerce

The number and type of stores will enable to identify the main origin/attraction zones which will be useful to understand place and kerbside activities. In addition, the relation between the number of stores and the number of parked vehicles will enable to identify a ration of number of stores by demand of load/unload parking and low rotation metered parking. With this number, it will be possible to anticipate future parking demands according with the adopted scenario.

Figure 62 shows the shop users' demand distributed by section. This calculation considers a demand reference value by type of store by hour, differentiated by time period. These values will support current pedestrian modelling and define stores' demand evolution, which will be essential to foresee public space and kerbside needs.

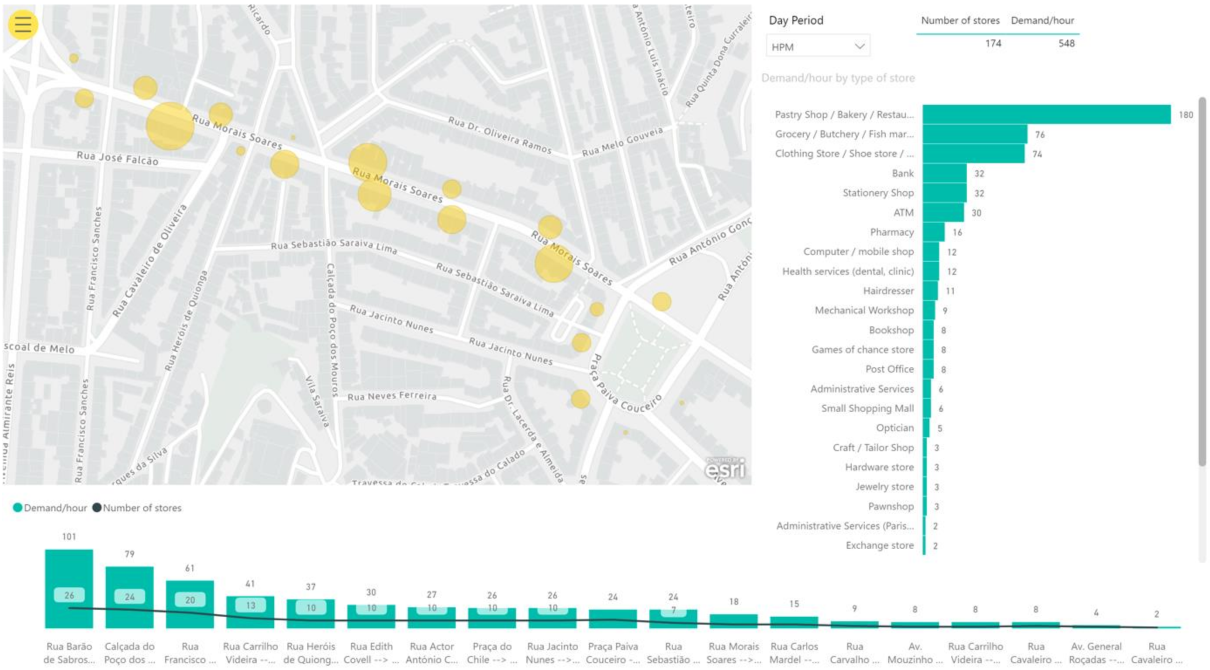


Figure 62. Place activities characterization (morning peak hour)

4.1.3 Kerbside Activities

The analysis of the parking activities correlated the number of parking users and the number of stores and population living in the street's immediate surrounding. To achieve this objective, two main steps were followed:

- Identification of the parking patterns differentiating between high rotation parking users – load/unload (until 90 minutes) and metered parking (until 120 minutes), which may be considered as commerce supply and clients – and low rotation metered parking (higher than 120 minutes), which may be considered as residents' parking for the population living in the immediate street's surrounding;
- Definition of an average relation between parking demand and commerce activity and population. This relation may be used for the quantification of future demand, according to the scenarios' evolution.

The following two figures show the parking behaviours, i.e., the volume of parked vehicles along the day (from 8:00 until 18:00), the average parked time and some characteristics of the parking spaces, namely their location and how long they are vacant, in percentage.

 Version: 3

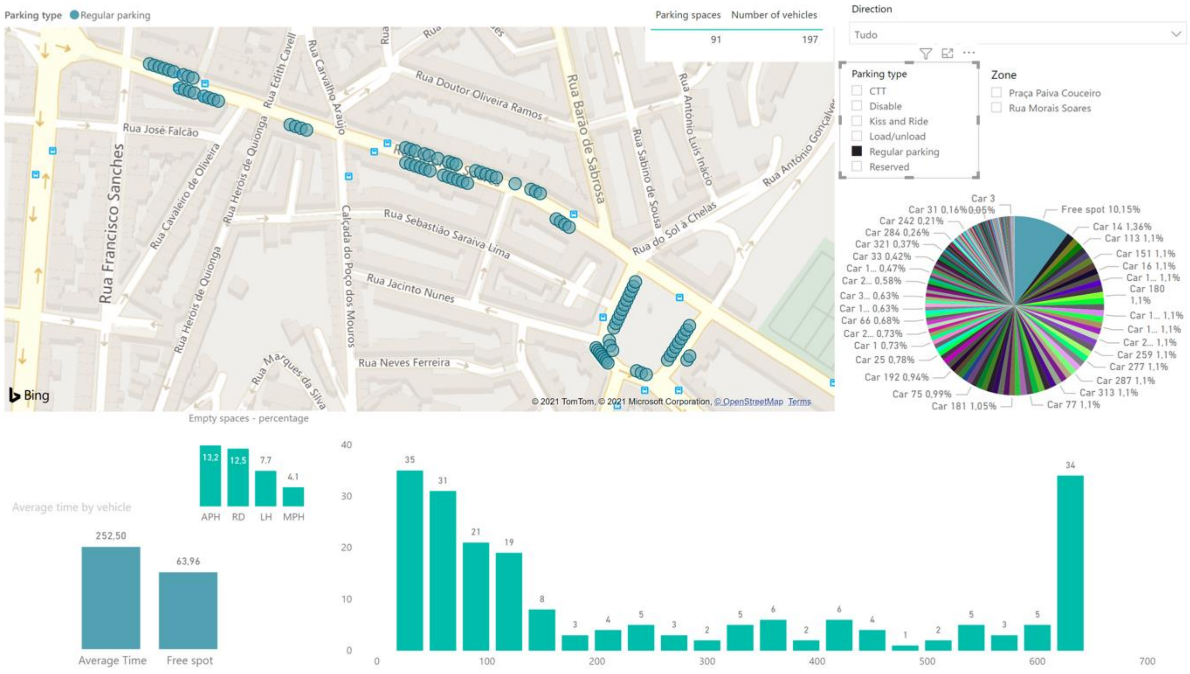


Figure 63. Metered parking characteristics

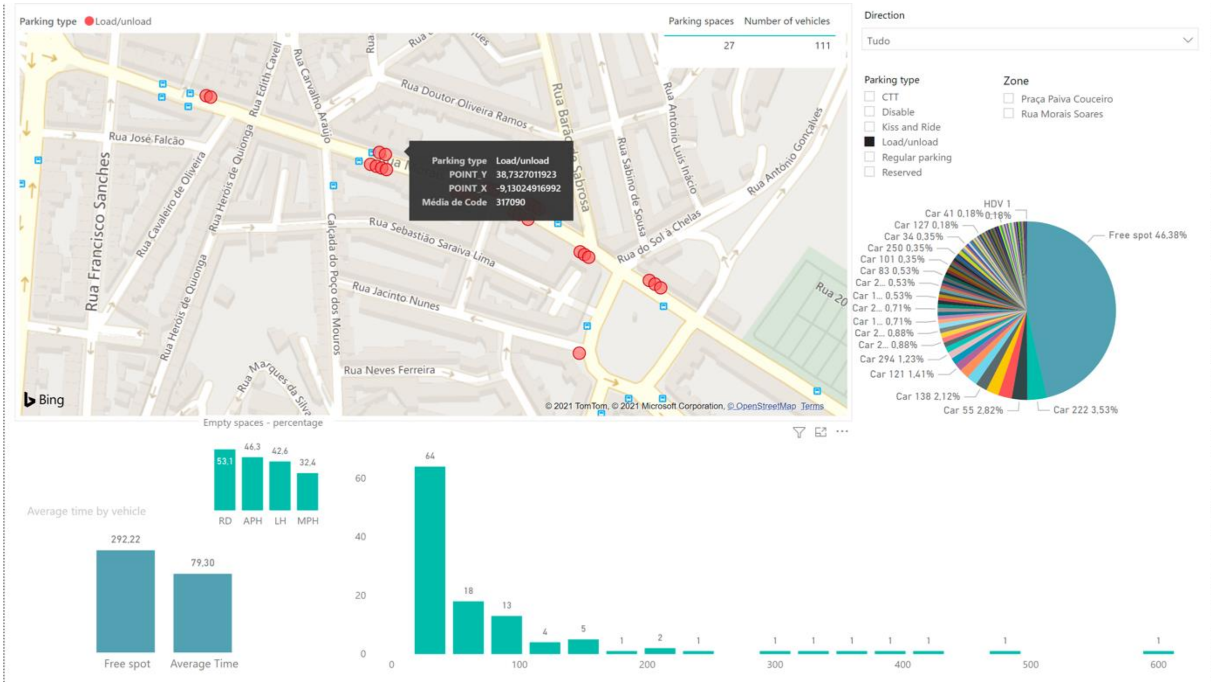


Figure 64. Load / unload parking characteristics

4.1.4 Public Transport

This section assumes a high relevance in the city's bus network, due to its location between the east and west sides of the city, serving as a confluence point of five bus lines that spread all over town, connecting Lisbon's east, centre, southwest and north areas.

Figure 65 shows the number of passengers by bus stop during the morning peak hour. The number of boarding passengers assumes a very relevant point of origin and destination for the street users.

In terms of subway offer, the section under analysis is served directly by the green line through Arroios station. However, this subway station was closed for works (reopened in September in 2021) and the nearby station of Alameda, served by green and red lines, worked as an alternative. One of the most important pedestrian flows is clearly influenced by Alameda Station but, with the Arroios subway station reopening, these flows should be transferred to this station.

Figure 65. Number of bus validations by bus stops, morning peak hour

4.1.5 Demand Characterization

As to be aware of the section's utilization by traffic and pedestrians, counts were performed in two weekdays to acknowledge main flows and movement patterns along three time periods (morning, lunch and afternoon).

Based on these countings, the section's network was modelled using PTV Visum, both for traffic and pedestrians, to develop different transport modes' OD matrices for the current situation that could be extrapolated for future scenarios.

The adopted methodology is described below, namely the development of the traffic and pedestrian models and their main conclusions.

4.1.6 Traffic Volume

According to survey work results, the peak periods are between 8 and 9 AM, 12:15 PM and 1:15 PM and 5 – 6 PM. Despite the large capacity of the street, none of these periods have a huge traffic flow volume, some congestion problems that exist mostly due to abusive double parking. The following figure shows rounded traffic volumes in both ways in the three periods.

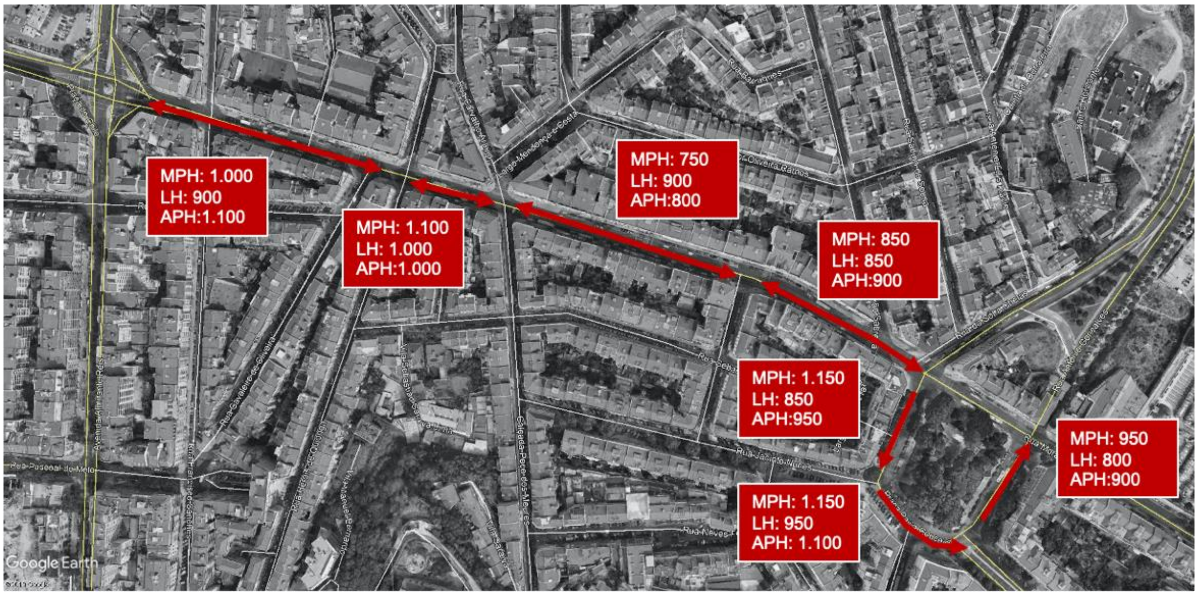


Figure 66. Total Traffic volume by time periods

According to the observed volumes of movement by each transport mode, the car is clearly the most used vehicle in the section, with around 80% of the total transport modes.

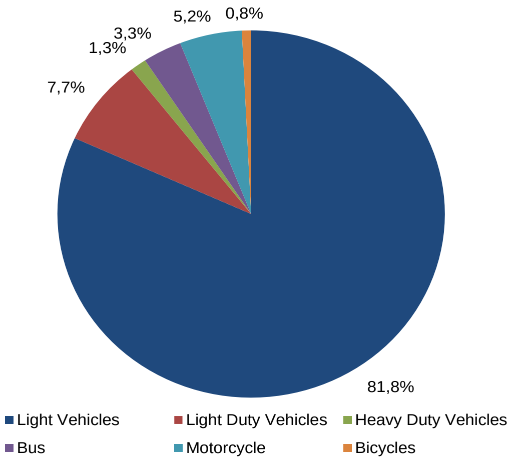


Figure 67. Modal share in the section under study

With the countings' support, a traffic model was developed and calibrated to establish a relation between the existing population and the traffic movements, which methodology is described in the Deliverable 5.2.

Figure 68 shows one example of the car movement, calculated through PTV Visum that will be used for the microsimulation tool PTV Vissim. The modelling will also consider all the other transport modes.

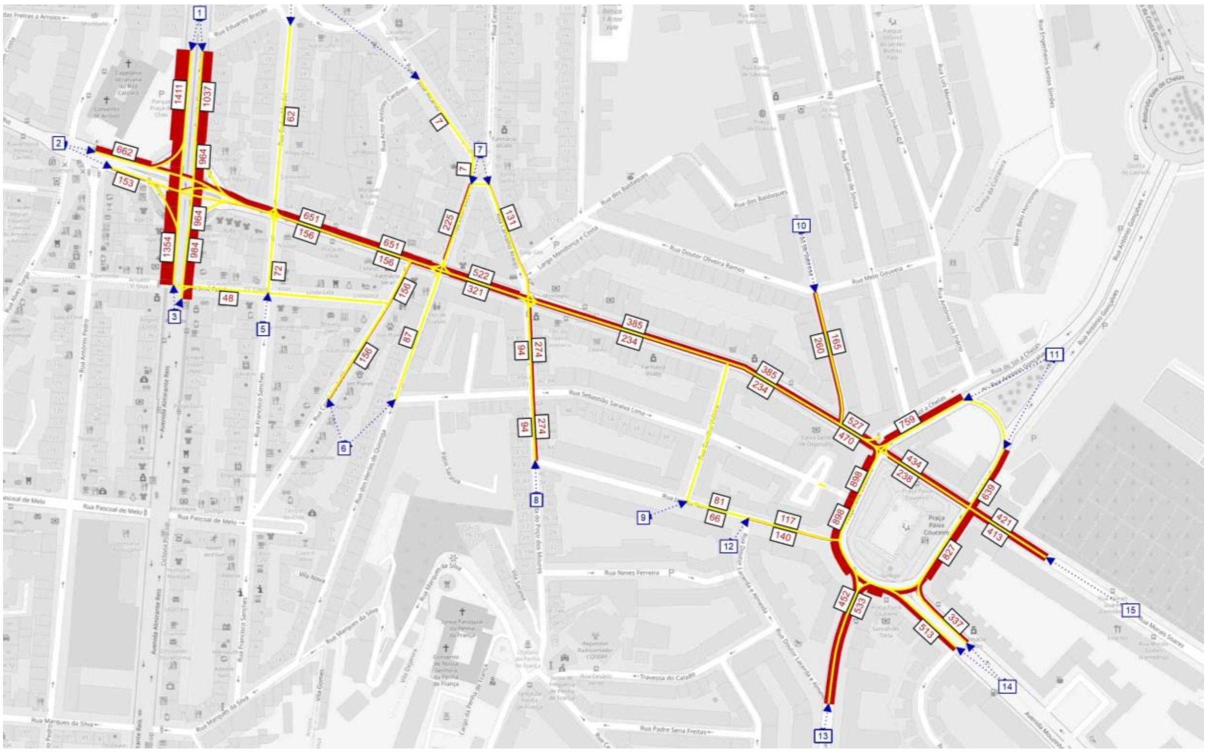


Figure 68. Section's traffic model, car, morning peak hour, 2019

4.1.7 Pedestrian volume, flows, mobility patterns

In order to know the main pedestrian flows and movements, on December 11th and 12th, local counting for pedestrian crossings were made in the same periods as the traffic ones.

Considering the three periods, afternoon peak hour counted more 25% pedestrians than the morning peak period and 11% more pedestrians than the lunch peak period.

According to the pedestrian counting, sections 1 and 2 and the west side of section 3 are the most overloaded areas, which may also be justified by the strong connections between Rua Morais Soares' north and south zones, which often don't use this street like a destination point but only as a crossing point. In these sections, often, a peak period of 500 to 600 pedestrian per hour and per sidewalk is reached.

Figure 69. Pedestrian movements along the section, afternoon peak hour – Wednesday 11th December 2019

Figure 70 shows the pedestrian movements, estimated by PTV Visum that will be used in the PTV Vissim.

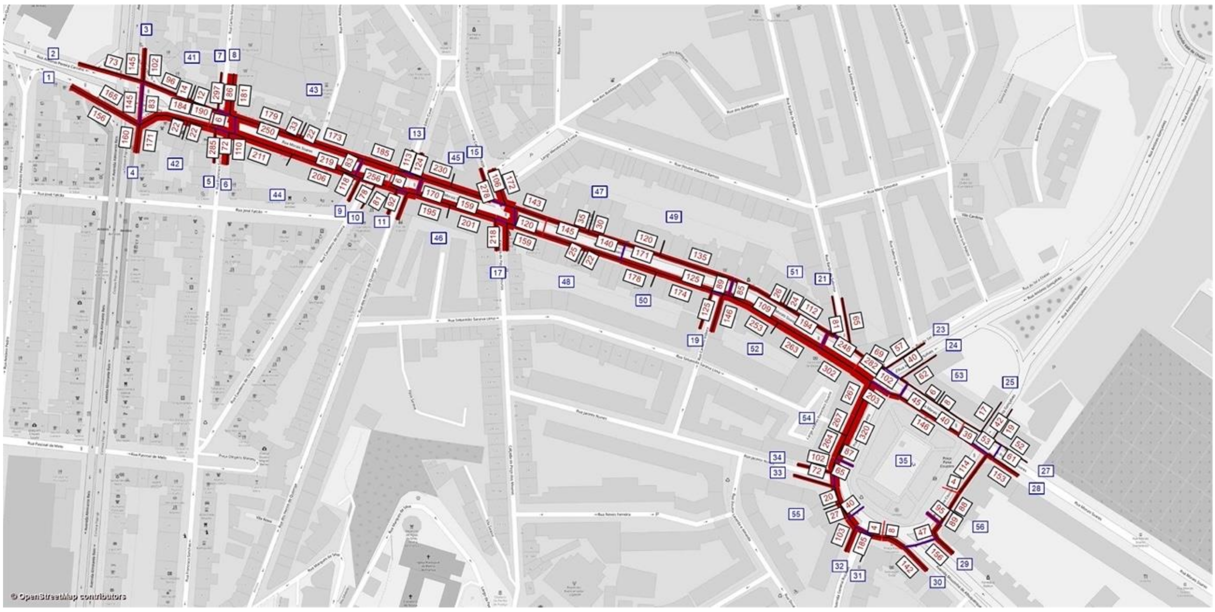


Figure 70. Pedestrian modelling, 2019, morning peak hour

4.1.8 Infrastructure and supply characterization

g) Number of lanes

This section has a very homogeneous number of lanes along Rua Morais Soares in contrast with Praça Paiva Couceiro, that has different number of lanes in different sections.

The following figures show the number of lanes and respective directions in Rua Morais Soares, Praça Paiva Couceiro and in the cross-cutting streets that access to them.

There is only one bus lane in operation, although there is an intention of implementing two bus lanes in Rua Morais Soares in each direction.

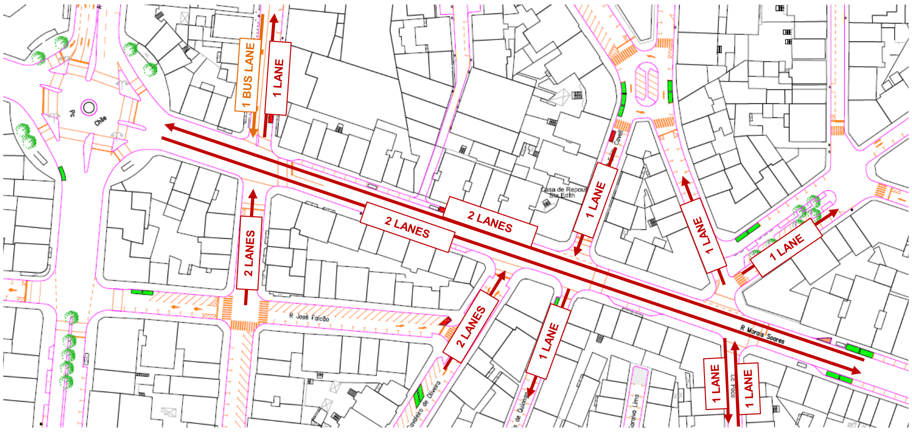


Figure 71. Number of lanes in Rua Morais Soares and in the transversal streets (Section between Praça do Chile and Calçada Poço dos Mouros)

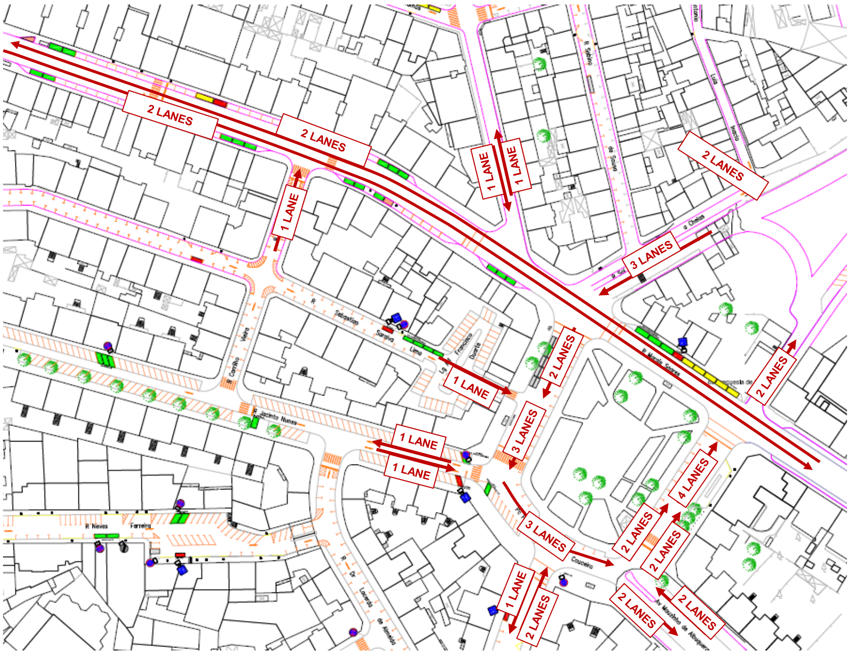


Figure 72. Number of lanes in Rua Morais Soares and Praça Paiva Couceiro and in the transversal streets

h) Pedestrian available space

Rua Morais Soares street's profile is mostly dedicated to traffic flow and parking bays. The sidewalks are usually very narrow, frequently with less than 1,80 meters, which is clearly insufficient for the large number of pedestrians that use the street. Often, the sidewalks are occupied by several objects, like traffic signs, garbage bins and, frequently, shops' furniture shortens the sidewalk width and creates obstacles for people walking.

Other problem in this section, which relates to the limited area provided for the people, is the lack of spaces available for people to rest and meet and the absence of shadows, which is not adequate for the high flow and demand generated by the street's diversity. Besides this, many street users are elderly or have mobility problems, and require more comfortable walkways and places to stay.

The following figure is illustrative of the usual street profile along the corridor.

Figure 73. Cross-section of Rua Morais Soares between Calçada Poço dos Mouros and Rua Carrilho Videira

In Praça Paiva Couceiro, the characteristics are very different, especially as the available space is much larger, despite vehicles (flow and parking) being massively present, all around the square. The road contours a garden in the middle of the square that has a lot of places for people to stay, with shadows, whereas the other side of the road has large sidewalks that are used to install esplanade and other stores' furniture.

However, Praça Paiva Couceiro is the crossing point of two important city's ring roads which causes heavy traffic flows. This, combined with a wide street profile around the garden, invites to higher speed driving, enhances conflicts between vehicles and pedestrians and increases, for instance, pedestrian crossing insecurity and noise problems.

It may be said that despite the large sidewalks that exist here, complemented by places to stay and sit, with plenty of trees to provide shadow in both sides of the square, the width of the street causes a great barrier for people, especially considering the age and mobility conditions of most of the people who use this place.

The following figure show a cross-section that demonstrates the considerations above referred.

Figure 74. Cross-section of Praça Paiva Couceiro between Rua Morais Soares and Rua Jacinto Nunes

4.2 Preparations for the street design exercises

To discuss what should be improved in the section' design was important to have different views of the problem and to recognize what the priorities should be regarding street use. This demanded a discussion on the project and its different constraints, regarding the section under analysis, to understand the most significant problems from other perspectives and which possible solutions could be adopted to improve space quality.

To achieve this objective two different approaches were done in order to complement the view from experts, who are used to working in public space projects, with street users:

- Three virtual design sessions with different groups of experts from the municipality and external entities, organized in May 2021;
- Two presential public participation days, in September 2021, developed on site in order to get the users suggestions and comments.

4.2.1 Virtual Designs Sessions

As referred to above, three virtual design sessions were organized in May 2021, which involved the participation of several representatives of municipal departments from different public space areas of activity as well as representatives of external entities, all related with the place or with the street users. The following table shows the represented entities in the design days session:

Figure 75. Virtual Design Day session

Table 22. Represented entities in the virtual design days

Sessions	Entities
Session 1	- Mobility Strategy and Planning Department
Session 2	- Public Space Department - Urbanism Department - Traffic Management Department - Pedestrian Accessibility Department

Session 3	- International Federation of Pedestrians - Disabled Association (CVI – Centro de Vida Independente) - Parish Council of Penha de França

Originally, the virtual design days were meant to discuss street's design for a long-term perspective. But discussing future scenarios without discussing the current one turned out to be very complicated, despite several attempts to conduct the discussion to that objective. In this way, the proposed solutions focused mainly on current situation.

The sessions had and estimated time of one hour and a half but all of them took a longer time than expected, especially session 2 that took 2 hours and half.

The sessions had the following agenda:

1. Presentation of the project
2. Brief summary of the work done
3. Presentation of the elements gathered from Traffweb and street's survey
4. Presentation of the scenarios for the future
5. Discussion about the street's design.

The purpose of the discussion about the street design, was to draw possible solutions by sections. However, despite the section has several problems, they are very homogeneous, so the discussion focused in the most pressured section of the street, due to place activities and movements.

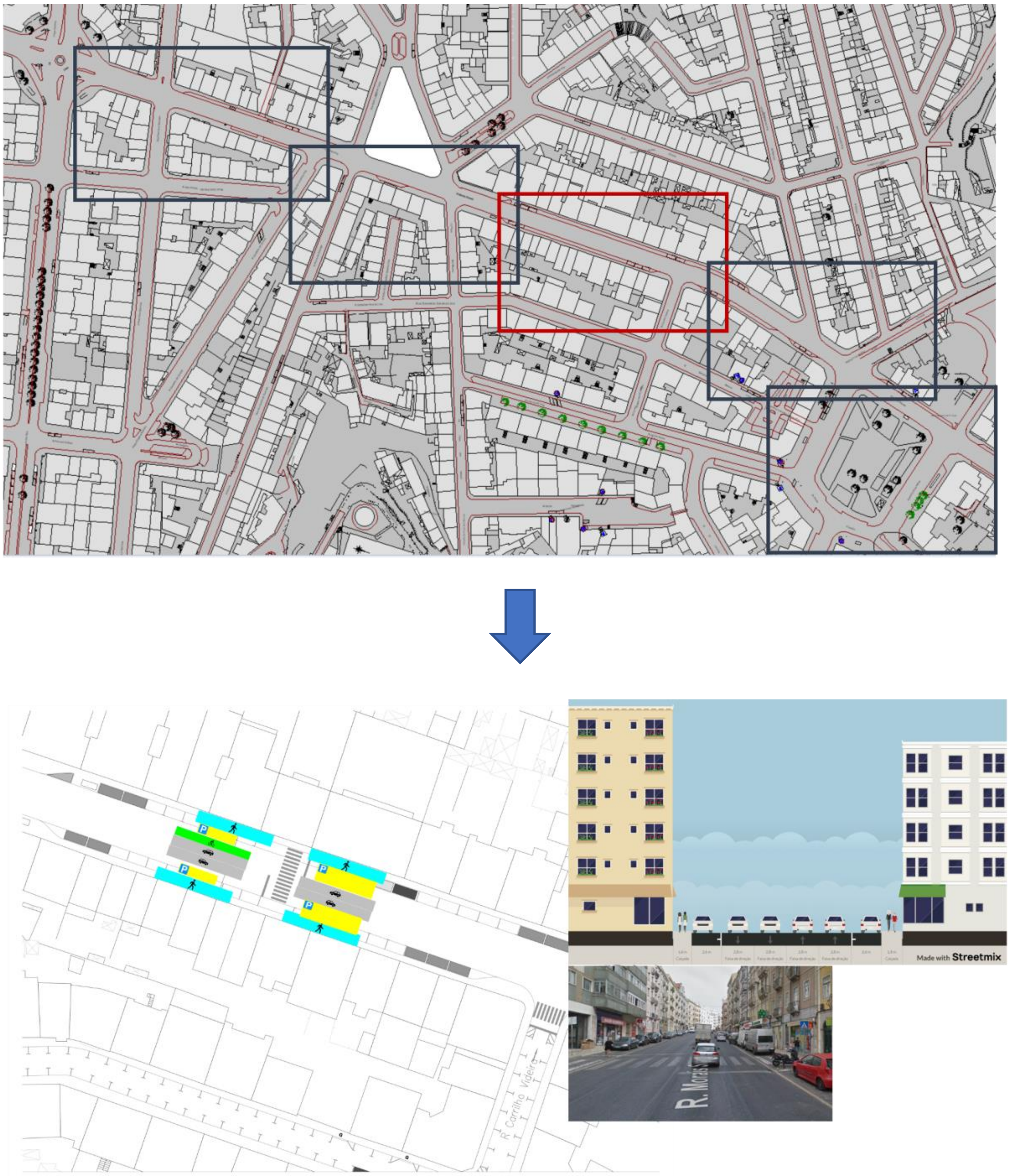


Figure 76. Presentation of the elements gathered from Traffweb and street survey

Before the session, several methodologies were tested to support the designing process. Some designs were drawn before the meeting to be analysed afterwards, but, after the drawing, the use of available space was not quite understandable. Due to this reason, MS Powerpoint was used to paste blocks in the section's map as the participants gave their suggestions. Despite the lack of accuracy of this tool, it is friendly to use and to discuss the available space with the participants. Even though the discussion was very interesting and fruitful, many of the suggestions were discussed in abstract instead of targeting them to a specific location. Even so, five main scenarios were proposed, which took into consideration different priorities for the street's use:

Suggestion 1: Reduce of one lane in each way and introducing of diagonal parking

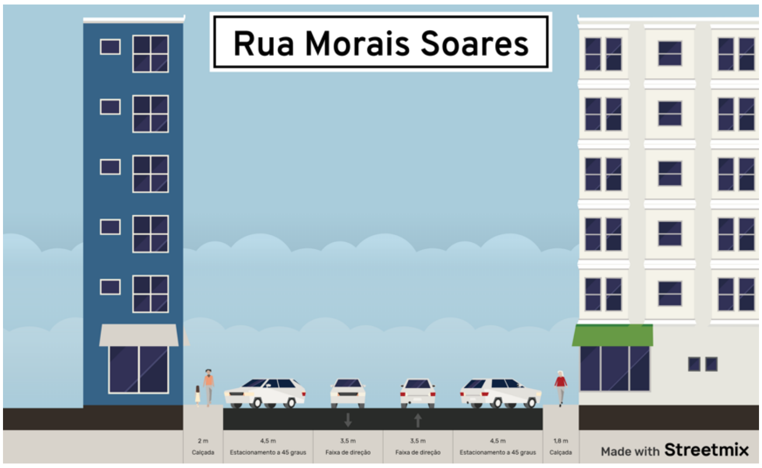


Figure 77. Suggestion 1: Reduce of one lane in each way and introducing of diagonal parking

Suggestion 2: Reduction of one lane in each way, maintain existing parking and introduction of one cycle lane in each side of the road. Slight sidewalk enlargement.

Figure 78. Suggestion 2: Reduction of one lane in each way, maintain existing parking and introduction of one cycle lane in each side of the road. Slight sidewalk enlargement.

Suggestion 3: Removal of one lane on one side, existing parking remains, and sidewalk is enlarged.

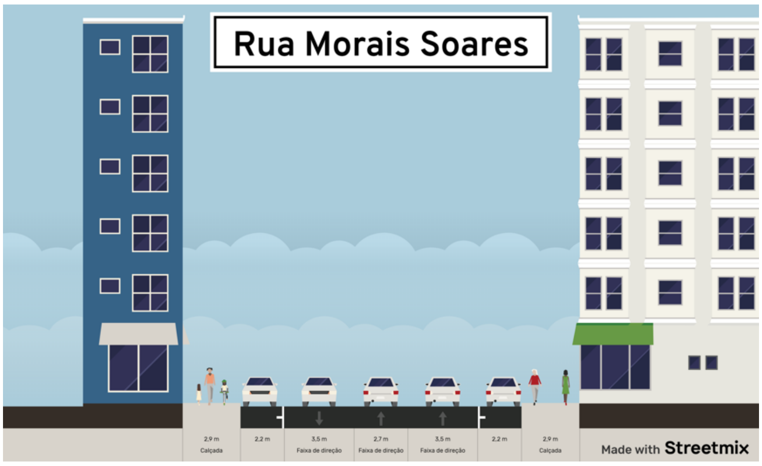


Figure 79. Suggestion 3: Removal of one lane on one side, existing parking remains, and sidewalk is enlarged.

Suggestion 4: Transformation of the right lanes of the existing ones into bus lanes.

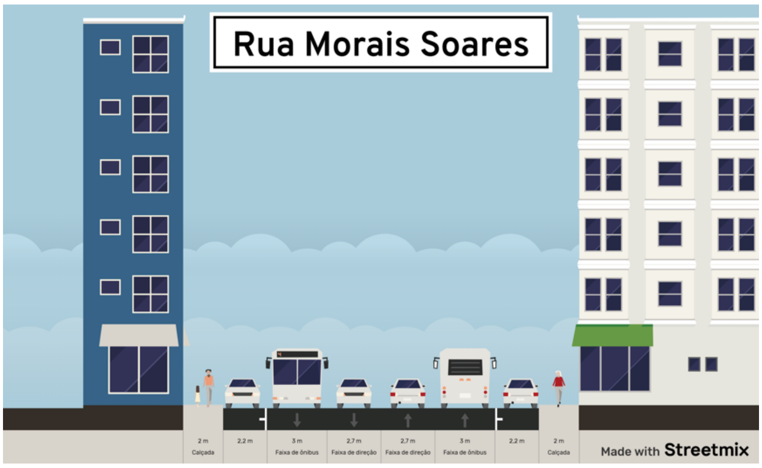


Figure 80. Suggestion 4: Transformation of the right lanes of the existing ones into bus lanes.

Suggestion 5: Removal of one lane each side and introduction of two-way cycle lane in one of the sides. Sidewalks are enlarged.

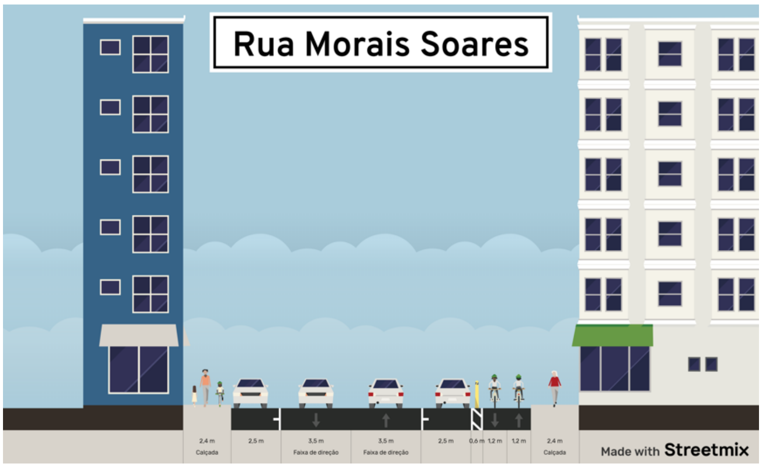


Figure 81. Suggestion 5: Removal of one lane each side and introduction of two-way cycle lane in one of the sides. Sidewalks are enlarged.

Despite different views from the problem, all the solutions have two things in common. The street space available can be reduced in, at least, one lane and the parking should be maintained or even increased. There wasn't a common view about which movement should be prioritized, although the lack of a good public space for walking was recognized by all.

4.2.2 Public participation

Besides the virtual design days with an expert panel, public participation with the section users was also organized. Since a relevant percentage of the users are elderly people and, consequently, with a tendency to be more info-excluded, a face-to-face public participation, divided into two periods, was locally organized to obtain the street users' perspectives.

Due to Covid-19 and public restrictive measures the public participation was successively postponed, but it was always considered as a priority because it seeks and facilitates the involvement of the most potentially affected or interested in a decision. The principle of public participation holds that those who are affected by a decision have the right to be involved in the decision-making process, implying that the public's contribution influences the decision, which not only has advantages in the decision-making process, but also has social benefits. Public participation has the social output of increasing the public's feeling of belonging and it also increases the level of confidence in public decisions.

Figure 82. Public participation stand

Considering the importance of having people participating in the decision-making process, this event was made in two different days September 28th and 29th) in different periods (AM and PM peaks) to obtain perspectives from different type of users. A stand was mounted in the street and people were invited to participate in the designing using the blocks and acetates in a section map. As well as in the design days, the same section was chosen not only because is the most pressured section, but also because, coincidentally, the stand was located there.

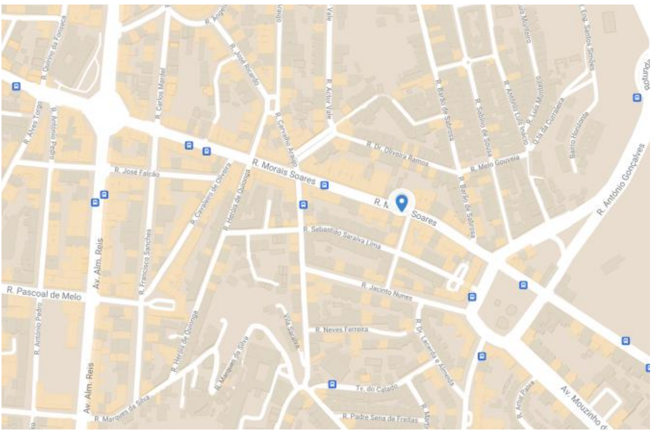


Figure 83. Location of public stand


Figure 84. Public participation on street designs

The most relevant proposals are shown in the following images, as well as a comparison between the final solution and the current situation. Despite the designing process has fallen in one section, the suggestions may be used in the other ones.

Suggestion 1: Removal of one lane in each side of the road, implementation of one cycle lane in each side and sidewalk enlargement.

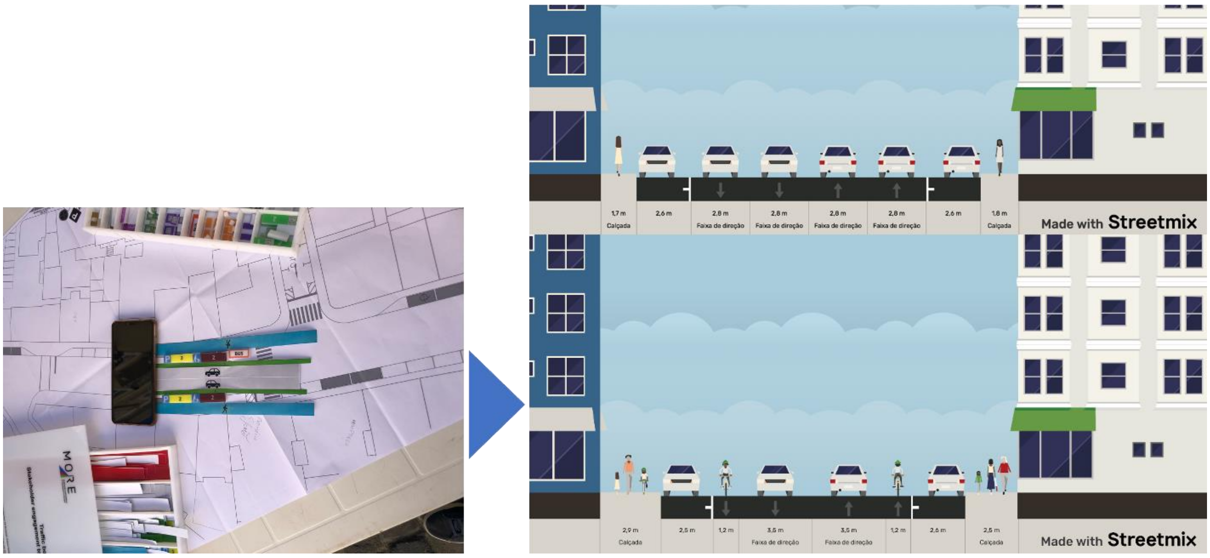


Figure 85. Suggestion 1: Removal of one lane in each side of the road, implementation of one cycle lane in each side and sidewalk enlargement.

Suggestion 2: Removal of one lane in one side, removal of parking places on one side and transformation into diagonal parking on the other side, conversion of one of the lanes into a bus lane, sidewalks enlargement and planting of trees.

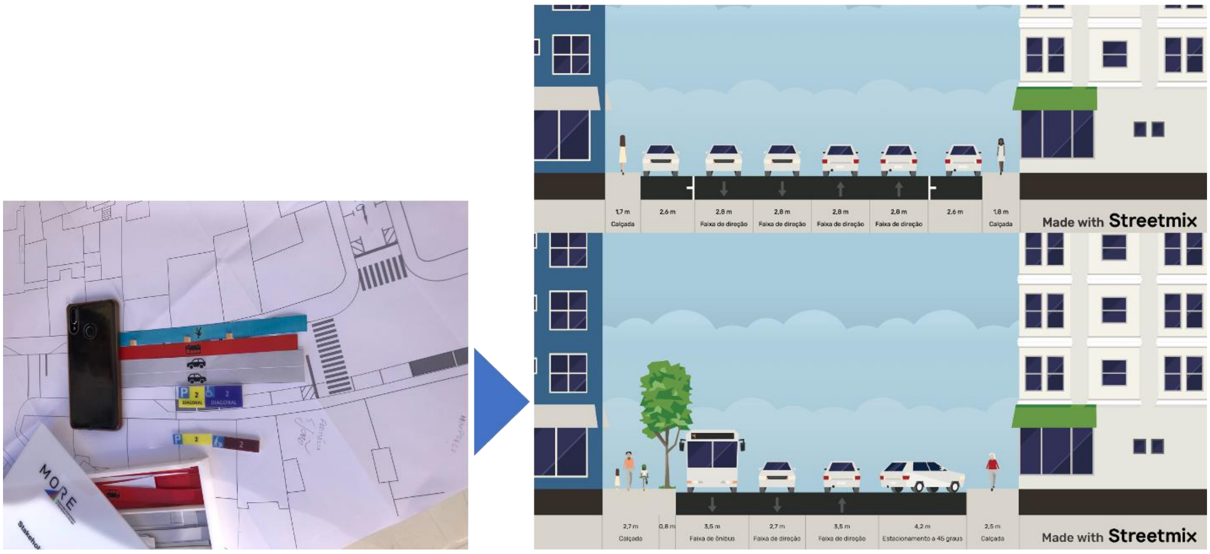


Figure 86. Suggestion 2: Removal of one lane in one side, removal of parking places on one side and transformation into diagonal parking on the other side, conversion of one of the lanes into a bus lane, sidewalks enlargement and planting of trees.

Suggestion 3: Removal of one lane in each side of the road, removal of parking places on one side and transformation into diagonal parking on the other side, sidewalks enlargement, plantation of trees and inclusion of pedestrian refuges.

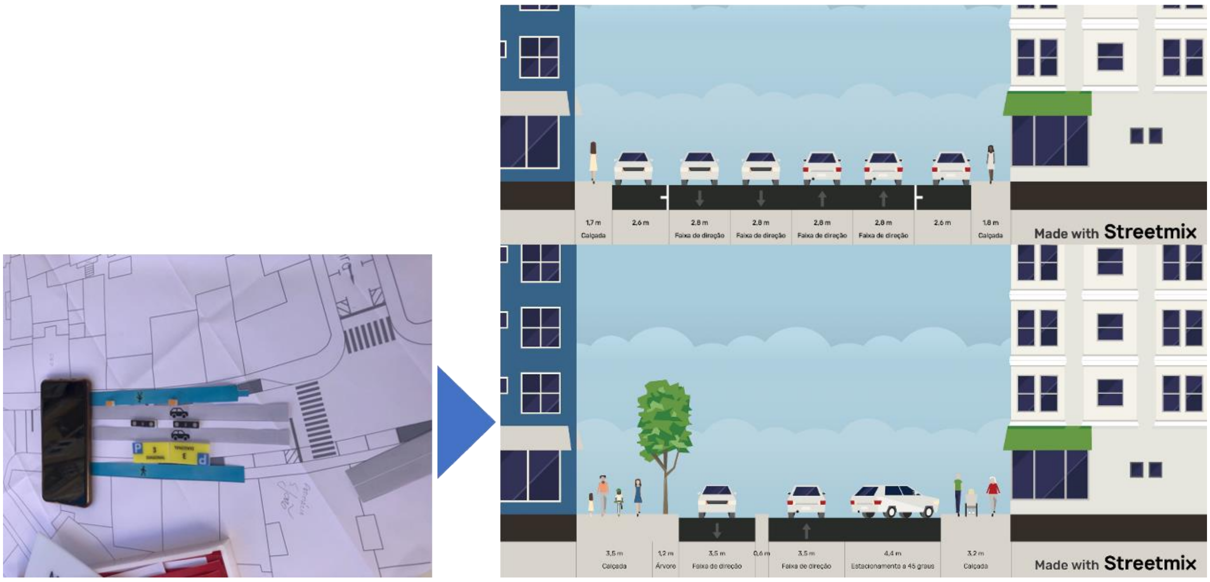


Figure 87. Suggestion 3: Removal of one lane in each side of the road, removal of parking places on one side and transformation into diagonal parking on the other side, sidewalks enlargement, plantation of trees and inclusion of pedestrian refuges.

Suggestion 4: Removal of one lane in each side of the road, implementation of a cycle lane on each side, removal of parking on one side, sidewalk enlargement to induce place activities like terraces, inclusion of equipment like benches, bike parking, electric vehicles charging stations.

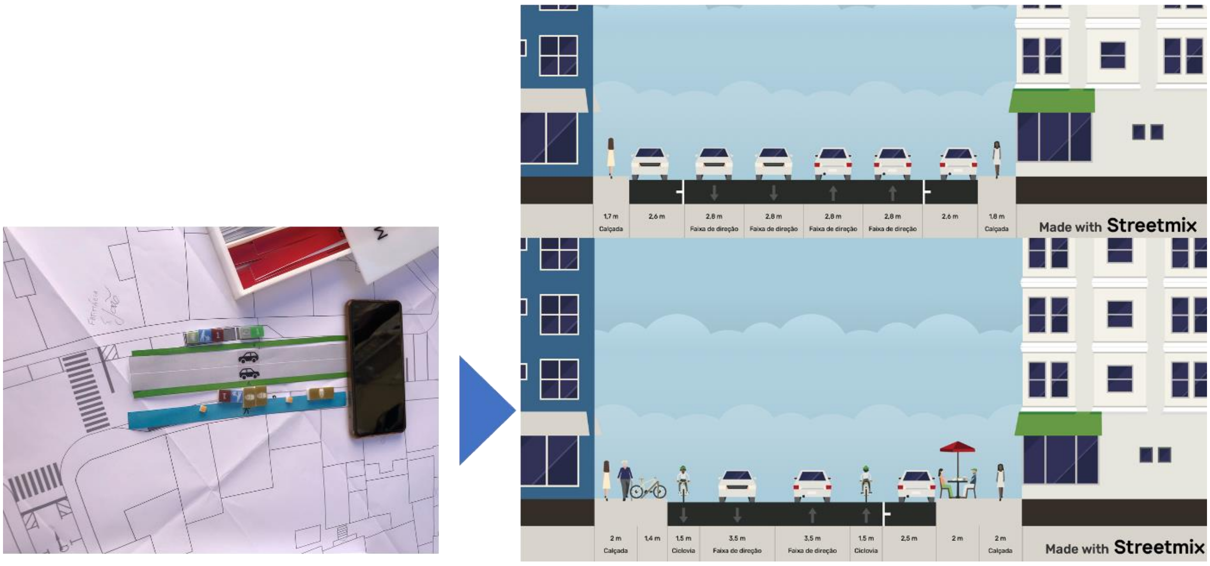


Figure 88. Suggestion 4: Removal of one lane in each side of the road, implementation of a cycle lane on each side, removal of parking on one side, sidewalk enlargement to induce place activities like terraces, inclusion of equipment

Suggestion 5: Removal of one lane on one side of the road, transformation of one lane into a bus lane, slight sidewalk widening, inclusion of pedestrian refuges with trees in the middle of the street.

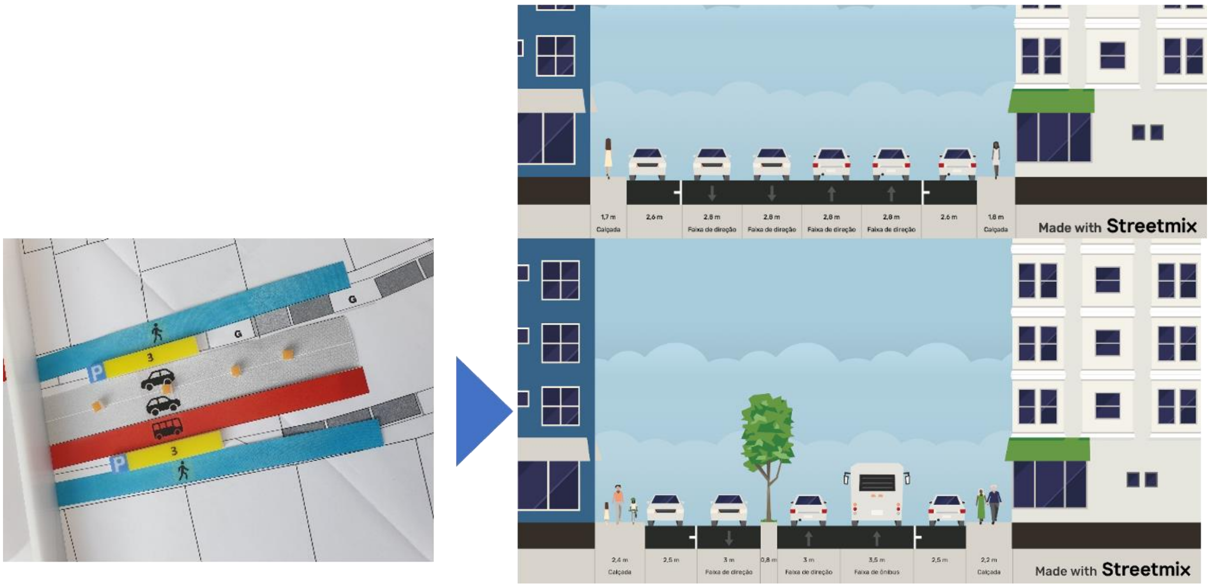


Figure 89. Suggestion 5: Removal of one lane on one side of the road, transformation of one lane into a bus lane, slight sidewalk widening, inclusion of pedestrian refuges with trees in the middle of the street.

People showed much interest to participate in the designing process, especially the elderly. This is a good complement on the comments made in other tools like Traffweb, where the users are commonly younger. As general comment of the participants suggestions, it can be said:

- Most of the people suggested to reduce the number of lanes and increase sidewalks width.
- Double parking is commonly viewed as the main problem.
- Parking had several different suggestions (parking on one side only, diagonal parking, parking removal), which reflects that this is the most sensitive theme.
- Cycle lanes are very polarized among the participants, being difficult to be aware if their opinion is due to a perception of the need (or not) of installing it or to an “ideological” perception. The inverse also applies.
- The use of blocks and acetates invites people to do localized suggestions instead of discussing the problem in abstract. It also leads people to make suggestions not only about the road design but also about the installation of other infrastructures /equipment, like benches, terraces, bicycle parking, greenery, etc.

4.3 Design options: inputs to stakeholder exercises

The Roadspace Allocation Option Generation Tool was tested by the Lisbon Team, approaching several possible roads uses but focusing mainly on transferring traffic lanes to cyclists or pedestrian use.

4.3.1 Policy intervention tool

Regarding the policy intervention tool, several options were tested, being opted to improve walkability conditions and then, choose to improve conditions to cyclists or/and micro mobility users or bus drivers/passengers.

Most of the objectives sought were related to facilitate place activities, promote local economy, increase road safety, achieve a more sustainable modal split, improvement of air quality and reduce of noise and increase flexibility to different road uses.

The tool provided useful examples that may be used in the section under analysis, sometimes in the whole street, others in some small sections. However, in some cases, while choosing the degree of priority for each type of road use, in the policy interventions tab, we found that some options generated were difficult or inadequate for the specific, central city access road of Rua Morais Soares. For instance, greenways in this area would not be feasible for this road is an essential traffic link to the city centre. Nevertheless, the tool is easy to comprehend and includes an impressive wide set of information gathered.

Some of the feasible designs that could be used in the section are:

- Decrease number of parking spaces
- Reduce number of traffic lanes
- Decrease width of traffic lanes
- Widen footway and/or declutter footway
- Flexible design
- Dynamic parking charging
- Kiss and Ride
- Inclusive design
- Part-time parking/loading space

Source of image: https://www.cm-amadora.pt

Type of policy: Space allocation

Designated areas next to public transport nodes (train, light-rail, bus stations) or other places (schools, employment centres) for passengers to be picked up/dropped off by personal vehicles. There is no charge for stopping.

The spaces can only be used for a short time (a few minutes). Drivers must stay inside the vehicle, or nearby, while waiting. The spaces may complement park and ride spaces, but should be closer to the station, to reduce the time they are occupied.

Kiss and ride zones may operate only for a few hours (e.g. peak time, school opening/closure times), with the space assigned to other uses (e.g. longer term car parking, bicycle parking) at other times.

This measure reduces cruising for parking and reduces the need to stop in locations that are unsafe (e.g. with no pedestrian crossings, or near junctions) or disrupt other road users (e.g. double parking, or parking next to cycle lanes).

Compliance can be an issue. Drivers may occupy the space for more than allotted minutes, preventing others from using it. They may also use it as a standard parking space, for longer hours. Adequate signage and enforcement is needed.

Reduce number of traffic lanes

Feasible? Yes


Source of image: MORE

Type of policy: Space allocation
Also known as road diet. Removal of one or more lanes for general traffic, in one or both travel directions. This reduces the space for the movement of private motorised vehicles - bus lanes are not usually affected.

The space released is assigned to other uses, e.g. a median turn lane, cycling infrastructure, a walkable/green median strip, a wider footway, and parking space. It also reduces crossing distance for pedestrians.

This requires complimentary measures to reduce conflicts at junctions and to ensure that buses (moving or approaching stops) and cyclists are not negatively affected, in terms of delays and safety.

The reduction of lanes is suitable in built-up areas and roads with moderate traffic volumes and high volumes of pedestrians (including pedestrians crossing the road).

One of the aims of this measure is to reduce traffic speed. Central lines may be removed to further reduce speed. The measure should ensure that there is a separation between the road carriageway and footway.

Source of image: MORE

Type of policy: Space allocation

Also known as central reservation. Space between traffic lanes in different directions. It can be painted, raised with kerbs, or planted. Physical barriers (e.g. guardrailings) may be added, or kept, if already existent, to separate vehicles.

If the median has no physical barriers, it allows vehicles to pass cyclists or slower vehicles; emergency vehicles to cross over into the opposite lane; and pedestrians to stop and cross in two stages (at crossing facilities or informal crossings)

If the median is raised, wide enough, and has few gaps, it also allows pedestrians to walk along the road. Alternatively, it can provide space for place activities (e.g. seating areas), car parking, bicycle parking, or street furniture (e.g. lighting).

Median strips can be green spaces (e.g. trees, swales, grassed strips). If wide, they can be used as a cycle track or as a corridor for trams, light railway systems, or buses. Underground rivers can also be restored to run at-surface along the median.

The presence of a median strip, especially if kerbed, may reduce travel speeds, as gives drivers less flexibility. Kerbed medians without ramps also become a barrier to pedestrians with impairments at informal crossings.

Figure 90. Policy intervention tool design options

4.3.2 Roadspace design tool

As well as the policy intervention tool, the Roadspace Design Tool is very easy to use, and it is useful to provide a first approach to the section. However, the predefined widths are very strict which withdraw flexibility to new designs. This inconvenience is evident in Rua Morais Soares, where there are several place activities and limited space available, and it would be useful to have a wider range of dimensions that would accommodate more solutions. Due to this reason, in the case of Rua Morais Soares, the suggestions from the tool were very limited and sometimes didn't even provide any solution. Below are some examples of the use of the tool and which results were produced, considering our inputs:

1. it would be interesting to explore if the data filled out (in the dropdown menu) in the context tab could be saved, for an easier process of retrying design options;
    a. If we try out the intended options for the road, no road designs appear, since there is not enough space for a cycle track, although it was presumed that traffic lanes could be reduced if needed;

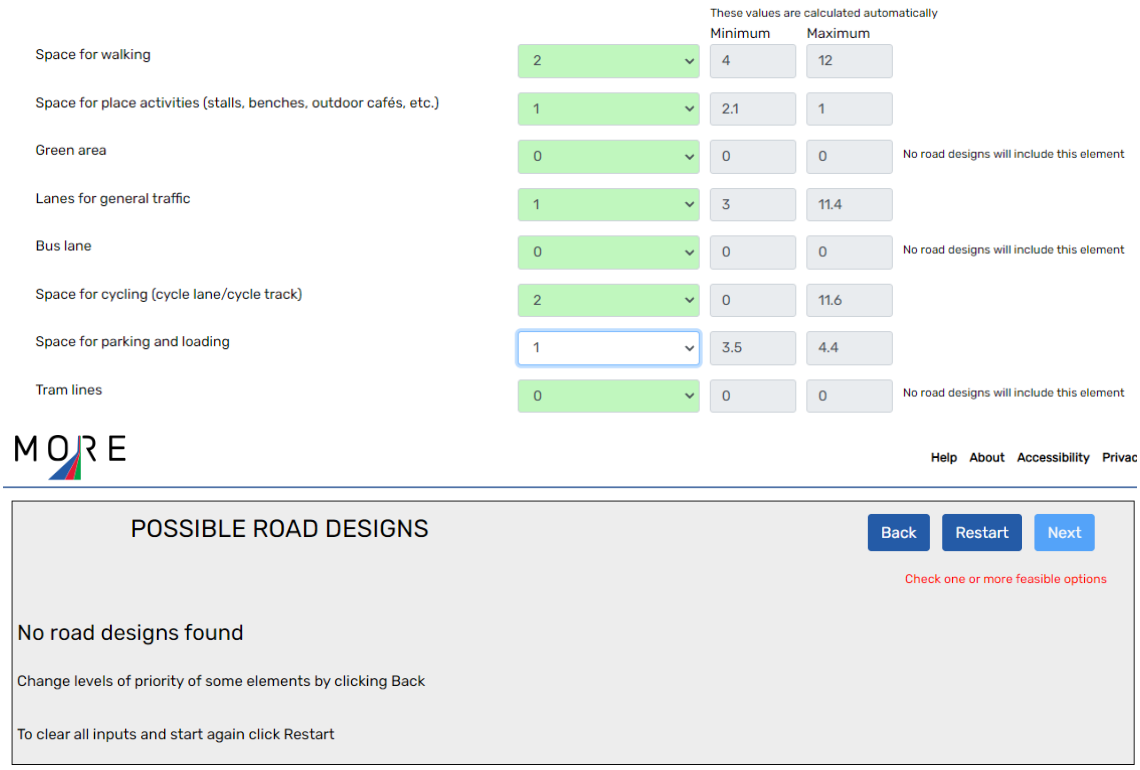
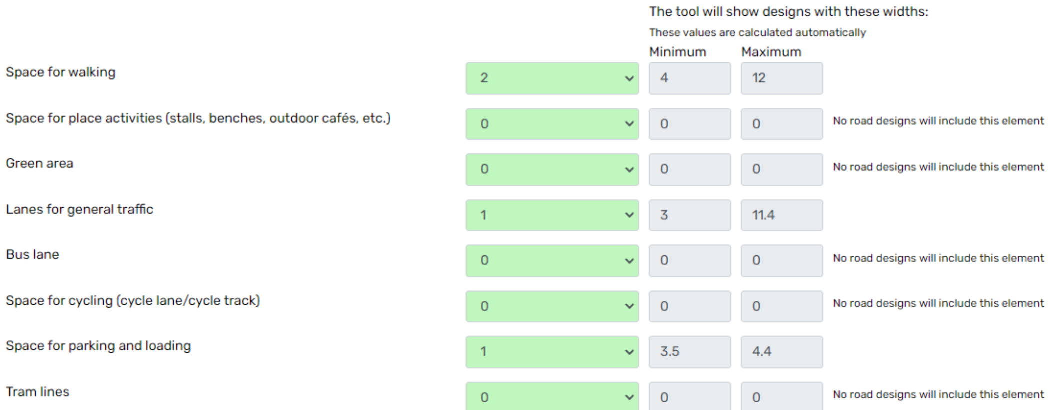


Figure 91. Roadspace design tool

b. If we rule out cycling and place activities, we generate road designs, but it would be important to be able to consider removing the Median strip and reducing parking, for instance, and converting it into a cycling lane.



Left footway and kerbside Choices	Left carriageway	Median strip	Right carriageway	Right footway and kerbside	Total road width (m)	Width of Design Elements (m): Walking	Place activities	Green area	General purpose	Bus lane	Cycling	Parking/ loading	Tram line	Capacity per 75m² of roadspace: Movement (people)	Place activities (people)	Parking/ loading (vehicles)	Ranking	Use in Design Exercises?
					19.5	8	0	0	6	0	0	3.5	0	145	0	5	2	☐
					19.5	8	0	0	6	0	0	3.5	0	145	0	5	1	☐
					19.5	8	0	0	6	0	0	3.5	0	145	0	5	4	☑
					19.5	8	0	0	6	0	0	3.5	0	145	0	5	3	☑

Figure 92. Design options produced by tool

c. Another solution to produce road designs is to remove reference, in the current situation, to space occupied by outdoor cafes in the sidewalk. That leaves all the sidewalk space for walking (but ignores that there are activities going on there). That allows the generation of road design, such as the example below:

Left footway and kerbside Choices	Left carriageway	Median strip	Right carriageway	Right footway and kerbside	Total road width (m)	Width of Design Elements (m): Walking	Place activities	Green area	General purpose	Bus lane	Cycling	Parking/ loading	Tram line	Capacity per 75m² of roadspace: Movement (people)	Place activities (people)	Parking/ loading (vehicles)	Ranking	Use in Design Exercises?
					19.5	8	0	0	6	0	0	3.5	0	145	0	5	2	☑
					19.5	8	0	0	6	0	0	3.5	0	145	0	5	1	☑
					19	6	0	1.5	6	0	0	3.5	0	110	10	5	4	☑
					19	6	0	1.5	6	0	0	3.5	0	110	10	5	3	☑

Space for walking	2	4	12	
Space for place activities (stalls, benches, outdoor cafés, etc.)	1	0	0	No road designs will include this element
Green area	2	0	3	
Lanes for general traffic	1	3	11.4	
Bus lane	0	0	0	No road designs will include this element
Space for cycling (cycle lane/cycle track)	2	0	11.6	
Space for parking and loading	1	3.5	4.4	
Tram lines	0	0	0	No road designs will include this element

Figure 93. Design options produced by tool

The tool is a very wide-range, interesting and immediate way to simulate roadspace use. For very busy, narrow streets, that accommodate too many functions, it may be difficult to represent all the solutions that seem to be available, as follows:

Figure 94. Different types of street designs

4.4 Generating street design options in the stakeholder exercises

4.4.1 Traffweb

Traffweb was a tool used as a first interaction with the section's users and was very useful to be aware of the main concerns of the general public. This tool was circulated throughout the municipality's social network as well as in the parish council newsletter and received around 150 comments.

Around 90% of the comments were provided by residents and most of the participants haven't specified a day period, which may allow the conclusion that most of the problems occur along the day in a recurrent way.

Half of the comments provided a general overview of the section and weren't related to a specific location. For instance, the lack of quality of sidewalks applies to almost all the section. However, the map shows that the identified problems are distributed for all the section, having several points with a high concentration of comments that should be considered in the solutions.

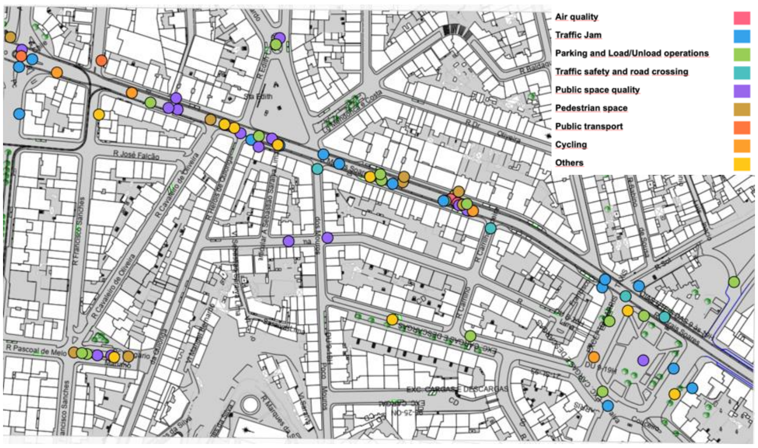


Figure 95. Location of the occurrences identified by the Traffweb users

As it is shown in the following graphic, pedestrian space was the most commented subject, followed by traffic and park and load. If in case of pedestrian space most of the comments referred the lack of quality of sidewalks, in the case of traffic, the comments differ a lot between them, with comments asking to leave the road space as it is currently and others asking to reduce the number of lanes, since the right ones are used, most of all, to double parking.

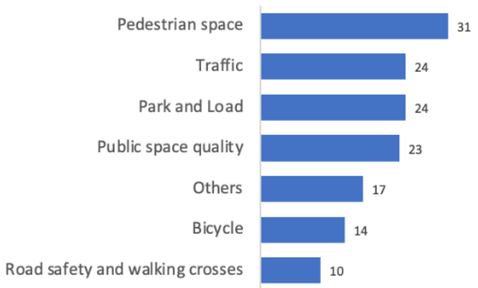


Figure 96. Commented subjects by the Traffweb users

The following table shows a summary of the most relevant comments. The existence of double parking and the sidewalks' width and bad quality are the most commented. However, the number of comments asking to maintain the number of lanes and the existing parking bays increased significantly immediately after the implementation of a pop-up cycle lane in the avenue perpendicular to Rua Morais Soares, in Avenida Almirante Reis.

Table 23. Traffweb results

Comments	Citations (percentage)
Lack of quality of sidewalks – too narrow, lot of obstacles, and inadequate pavement especially for aged population	23.6%
Too much double parking	14.3%
Lack of parking places for residents	10.7%
Maintain the number of lanes	7.1%
Lack of short length parking spaces – to customers and load/unload operations	7.1%
Lack of green spaces and trees	5.7%
Use of Bicycle is unsafe – double parking, buses frequency – a cycle lane should be installed	5.7%
Very low public space quality. Unsafe to some pedestrians.	5.0%
Too much noise and pollution	3.6%
Reduce the number of lanes in the street – most of the times, one lane is used for double parking.	3.6%
Lack of bicycles parking	3.6%
Parking in Praça Paiva Couceiro is disorganized creating unsafe situations for pedestrians	2.9%
Traffic lights on this street must be reviewed at all intersections especially for walkers;	2.1%
Too much congestion	1.4%
Recover the tram line.	1.4%
Reinforce public transport headway	1.4%
Lack of places to rest in the kerbside.	0.7%

4.4.2 Linemap

Linemap was used, in the case of the section under study, to test the solutions proposed in the design days, as an analysis tool to see how the blocks fit in the street instead as a street design tool.

Since the street has different widths along the section, it obliges to find solutions under a flexible mode, section by section. In the case of this tool, the blocks width is fixed making it low flexible, which several times makes it difficult to analyse the section's capacity. For this reason, as referred to above, this tool was used to integrate blocks under small sections of the street supporting the analysis, on how many and which type of blocks could be incorporated.

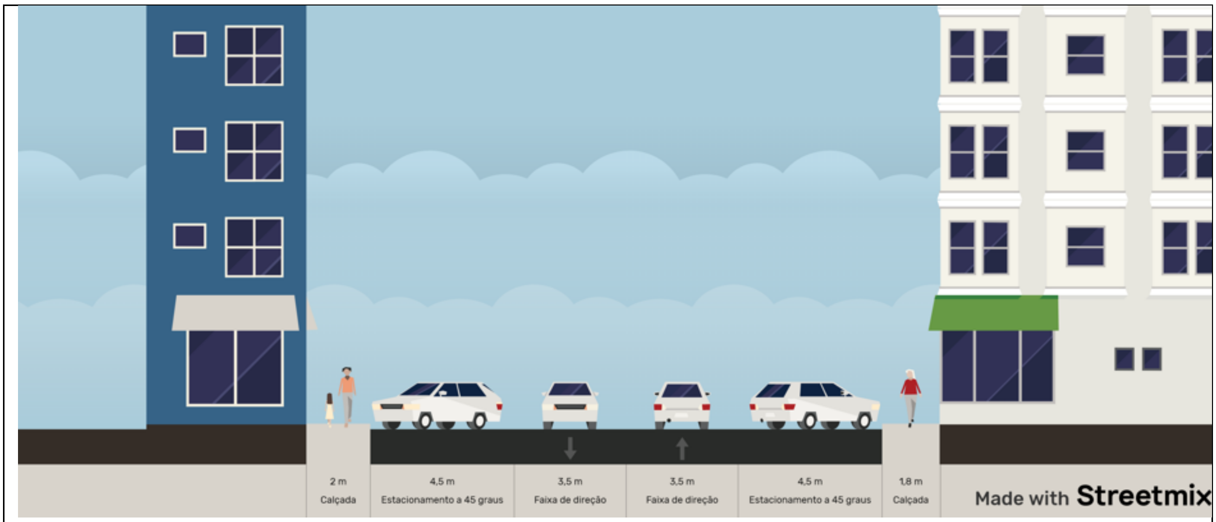
The following image shows an example of a solution with larger sidewalks and a cycle lane on each side. However, the remaining available space between both cycle lanes perhaps is not enough to host sufficient road lanes, being necessary to propose sidewalks narrower than 3 meters, which is not possible to configure within the tool.

Figure 97. Example of an analysis using Traffweb

4.4.3 Generated design options

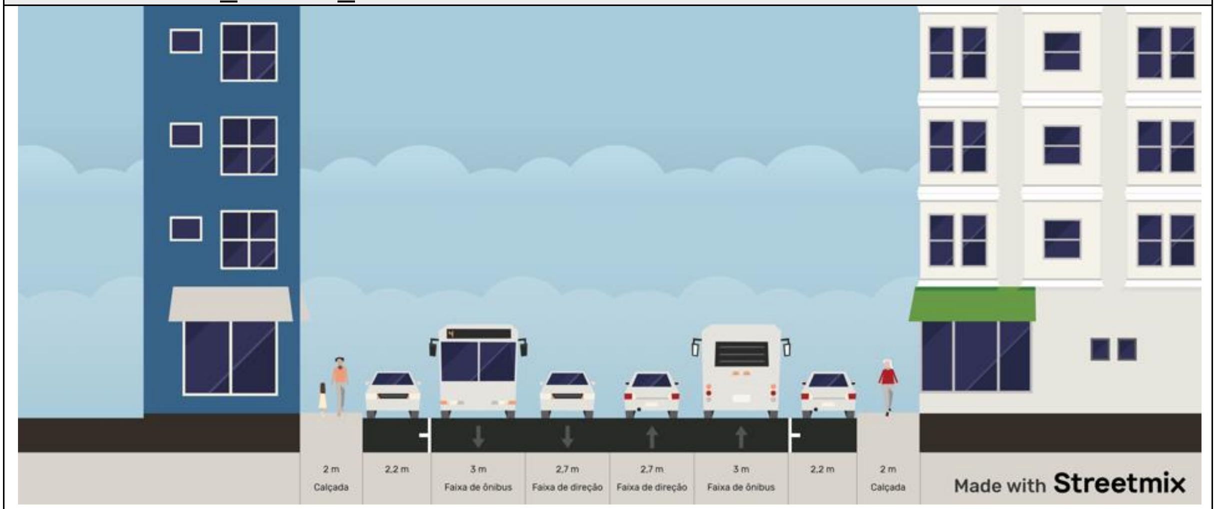
Considering the options generated by the design days and public participation, with the support of the developed tools, the following solutions will be modelled and analysed. Each suggestion identifies what are the main proposals and which negative impacts are expected to arise and should be considered in the modelling process.

Scenario 1: Precedence to parking
ID Number: LIS_S14010_AMR00000



Proposals:	Expected negative impacts:
• Reduce one lean in each way; • Change parallel parking to diagonal parking • Slight sidewalk widening	• Maybe one lane in each way won't be enough to have an efficient traffic flow and will produce traffic jams. • Bus flow should have a significant negative impact. • The sidewalks should enlarge about 30 cm in each way, which it is not significative to enhance good conditions to walk or use the street. • The number of parking places will increase significantly, which can be seen as an invitation to go to the street using private transport.

Scenario 2: Precedence to public transport
ID Number: LIS_S14010_JKLS0000

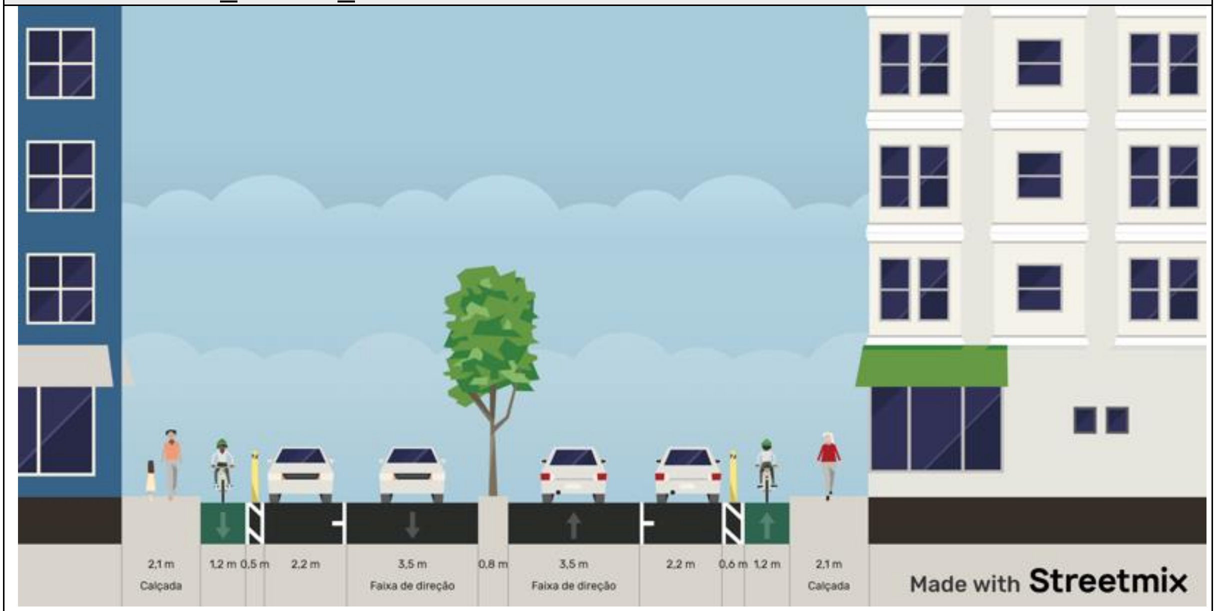


Proposals:

- Transform the right lane in a bus dedicated lane
- Maintain current parking spaces
- Reduce the parking places width

Expected negative impacts:

- Maybe one lane in each way won't be enough to have an efficient traffic flow and will produce traffic jams.
- The buses will have a positive impact, although there are several right turns, so those spaces may be occupied by other vehicles.
- Since current parking situation remains, the right lanes would be used by cars to park in the parking places and besides, double parking should remain.
- The introducing of a bus lane will oblige to reduce parking width. 2,2 meters may not be enough, in some load/unload operations.
- The situation for pedestrians remains the same.

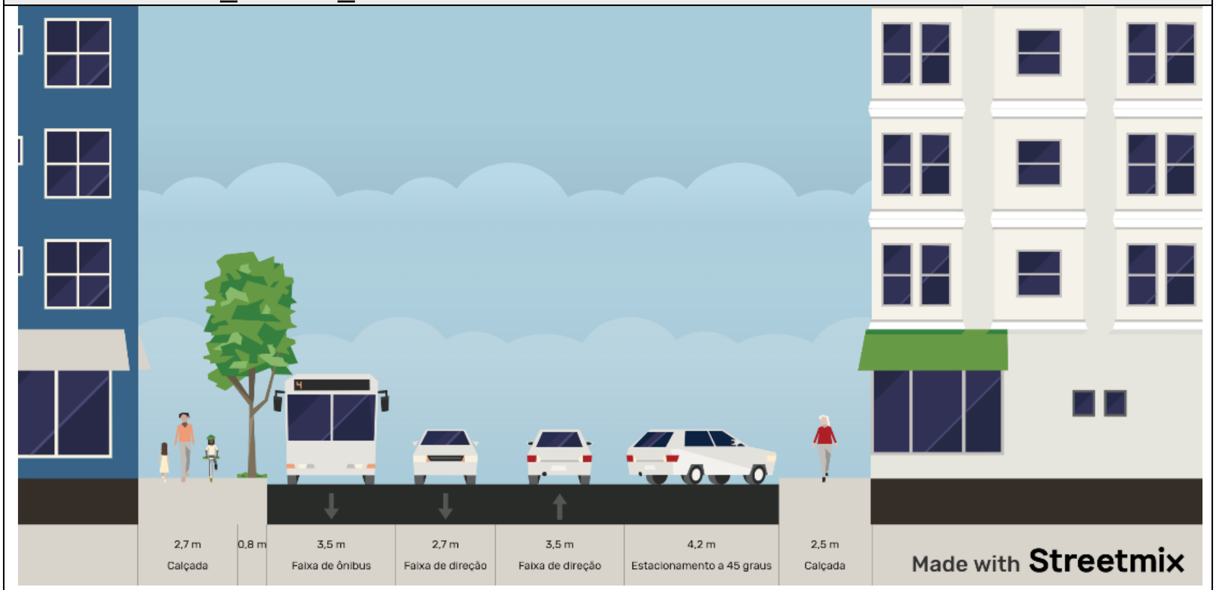
<table>
<tr><th colspan="2">Scenario 3: Precedence to cycle lanes</th></tr>
<tr><td colspan="2">ID Number: LIS_S14010_ABCFH000</td></tr>
<tr><td colspan="2">
</td></tr>
<tr><td>Proposals:

• Introduction of a one-way cycle lane on each side of the road between sidewalks and parking.
• Slight sidewalks' enlargement
• Narrowing the parking places
• Introduction of pedestrian refuges with trees</td><td>Expected negative impacts:

• Maybe one lane in each way won't be enough to have an efficient traffic flow and will produce traffic jams.
• Bus flow may have a significant negative impact.
• Right turns should be a problem for the safety of using the cycle lane.
• Parking width will reduce from 2,5 meters to 2,2 meters which may not be enough, in some load/unload operations.
• The situation for pedestrians is mostly the same.
• Current number of bicycles doesn't seem to justify a cycle lane. However, it may induce the number of active modes there.</td></tr>
</table>

Scenario 4: Precedence to pedestrians, bus and greenery

ID Number: LIS_S10000_ABCDEJK0



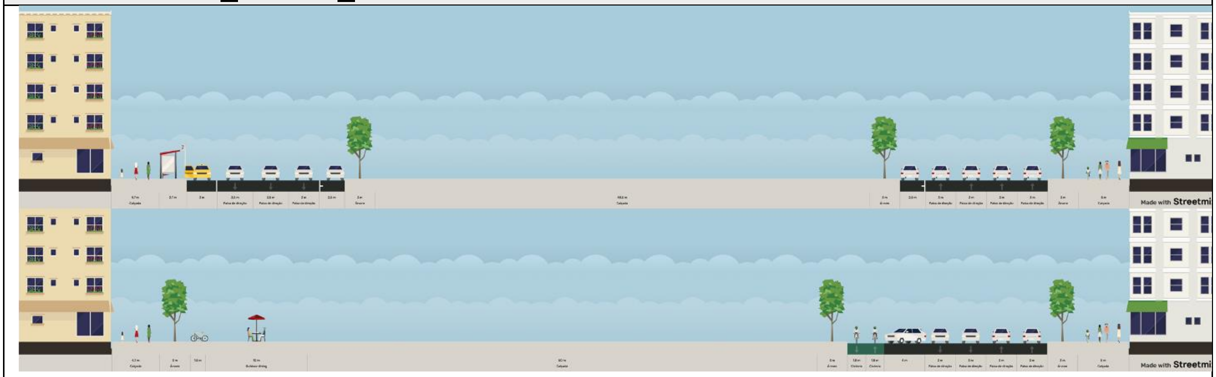
Proposals:

- Transform right lane in the east to west side in a bus lane.
- Remove one lane in the west to east side
- Significant sidewalks' enlargement and plantation of trees in one side
- Remove parking from one side and transform parallel parking in diagonal parking in the other side,

Expected negative impacts:

- The road capacity should be enough to have an efficient traffic flow in both ways in the morning peak hour, but maybe is not enough at afternoon peak hour.
- Parking would remain in the side with lower traffic volume, which may induce traffic volume in neighbouring streets, due to parking finding and to use the streets to inverse direction to find a place in the other direction.
- Diagonal parking may lead to some accidents.
- The buses will have a positive impact, although there are several right turns, so those spaces may be occupied by other vehicles.

Scenario Paiva Couceiro

<table>
<tr><td colspan="2">ID Number: LIS_S14010_ABCD0000</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Proposals:

• Remove of traffic from one side and make a continuous space between the square and its west side.
• Create two-way direction on the east side of the square
• Transformation of the current parking lot into a diagonal parking in the inverse direction.</td><td>Expected negative impacts:

• The number of lanes may not be enough to have a fluid traffic flow.
• This solution will oblige to create some left turns, since current situation worked as a roundabout.
• Need of installing more traffic lights, having an impact in the traffic flow.
• Maybe there will be a need to install signalized crossings to pedestrians since two-way lanes in each direction may increase the risk of being hit.
• The removal of traffic from that side will remove some routes, which may induce traffic in adjacent streets
• Several movements would concentrate in the same roads, leading to some traffic disorganization.</td></tr>
</table>

Figure 98. Generated Design Options

The impacts referred above, will be considered during the modelling process and will be evaluated to propose eventual mitigation measures, and support the hierarchization of the solutions.

4.5 Building and applying the Vissim model

4.5.1 Calibration and methodology

The following images, show the entire street divided by sections. In each section's images, it is possible to see the modelling scheme and the locations where the nodes and sections, that will be used to analyse both vehicles and pedestrians, are identified.

The nodes were used to calibrate the Vissim model, comparing it with the counting and the Visum model developed previously to the microsimulation analysis. These network objects will also enable to evaluate the impacts of future street's design solutions in the transport modes use, analysing if it will improve or worsen traffic flow conditions, for all the studied transport modes.

Besides the node's evaluations, several sections were distributed by several locations to calibrate the Vissim model, comparing it with the counting and the pedestrian model developed through Visum. Since the countings were made in walking crosses, the calibration analysis has also focused there. However, to analyse future impacts in the street, especially in the space availability to walk and practice activities, sections were considered, some of them in spaces with low current conditions for pedestrians' use, that will allow to evaluate the impacts of new street's design.

Besides this information, the following images provide some additional information, like the sidewalks' width, number of lanes, parking location and places where several double-parking occurrences exist, which was considered in the modelling work.

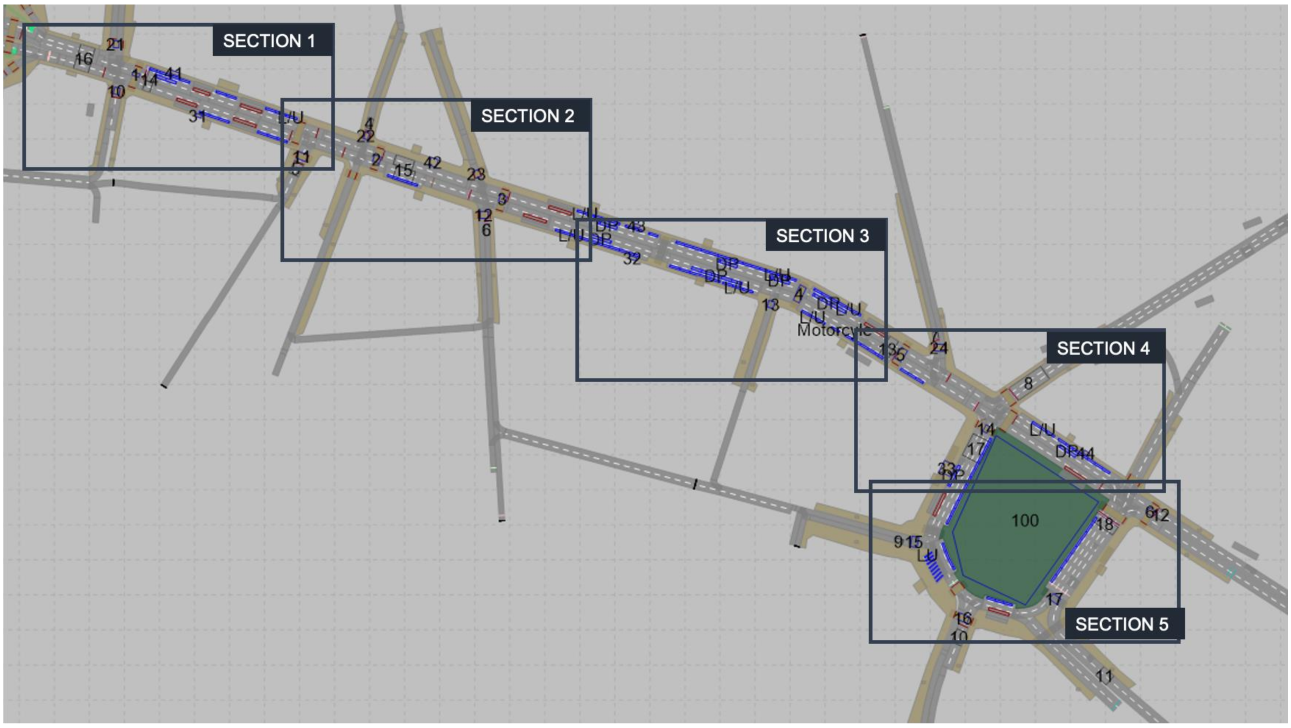


Figure 99. Map of the section under study

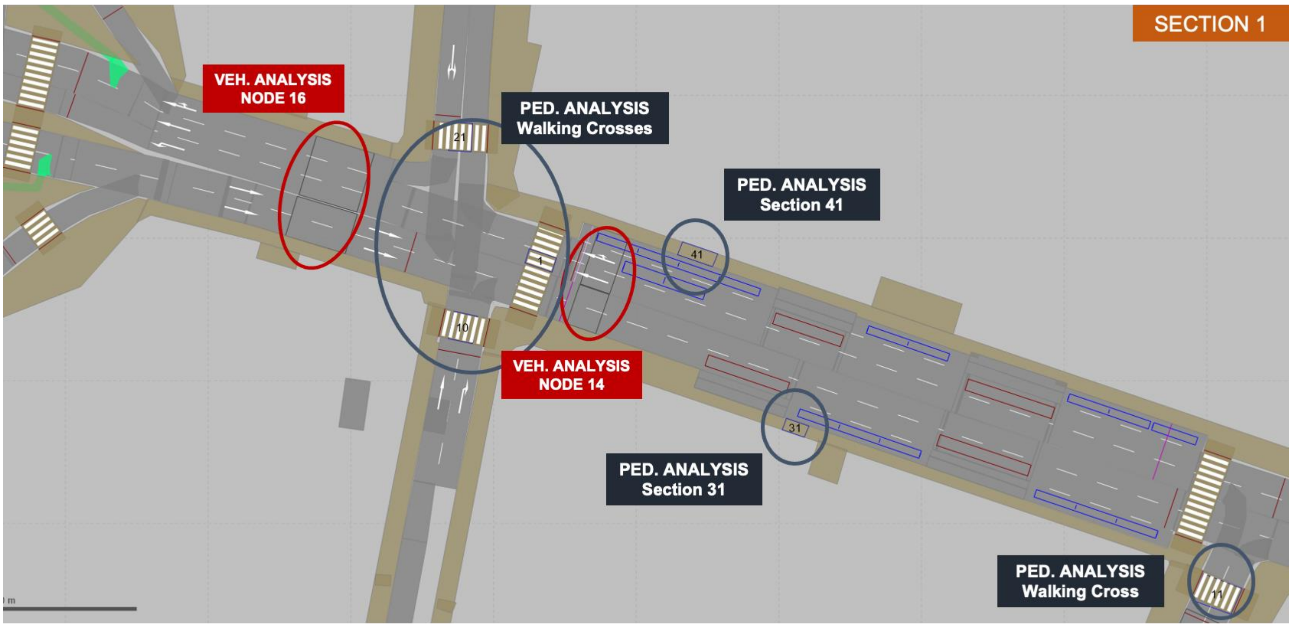


Figure 100. Location of the nodes and sections used for analysis purpose, section 1

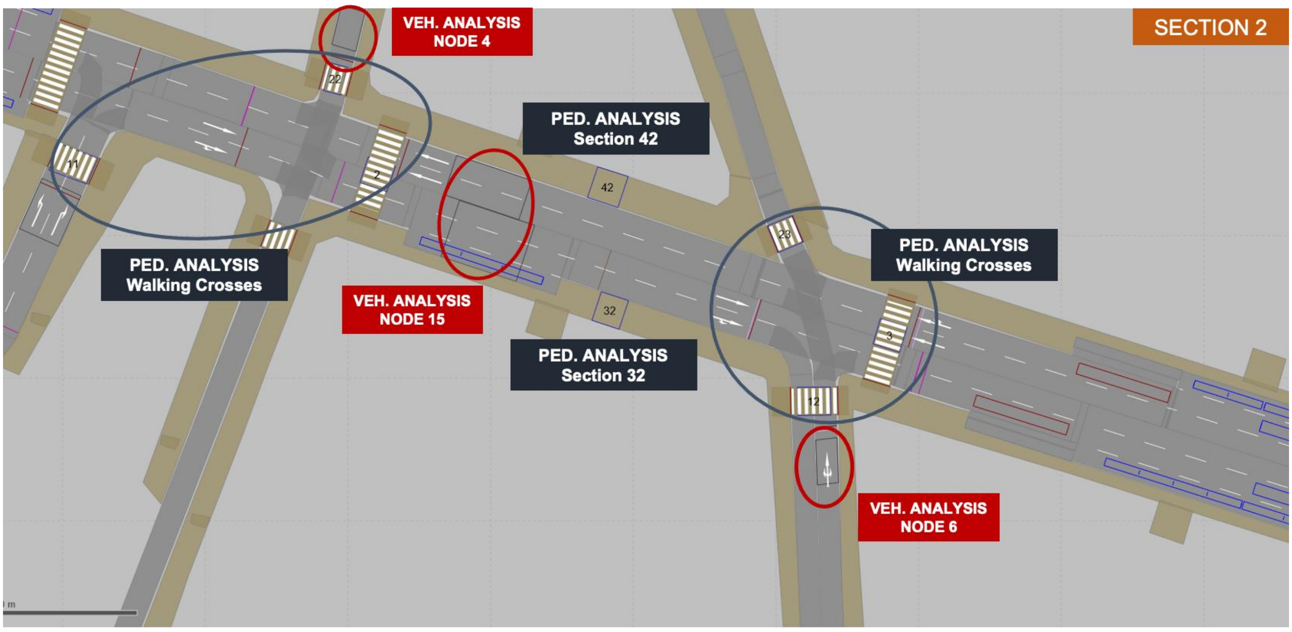


Figure 101. Location of the nodes and sections used for analysis purpose, section 2

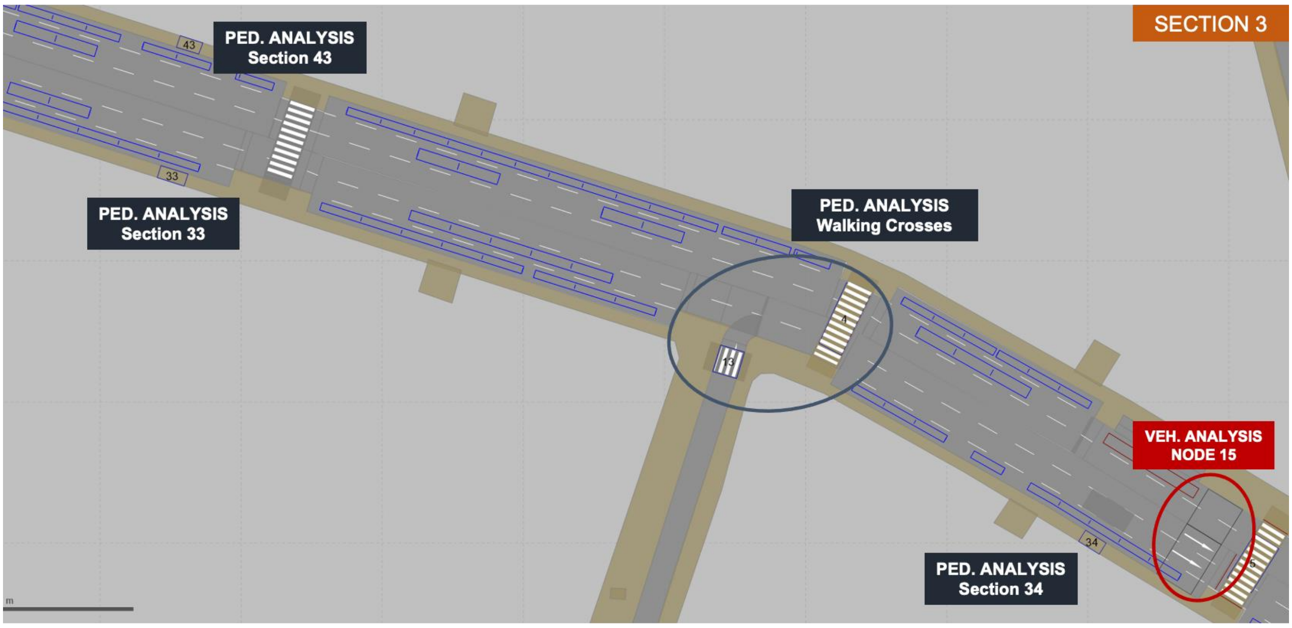


Figure 102. Location of the nodes and sections used for analysis purpose, section 3

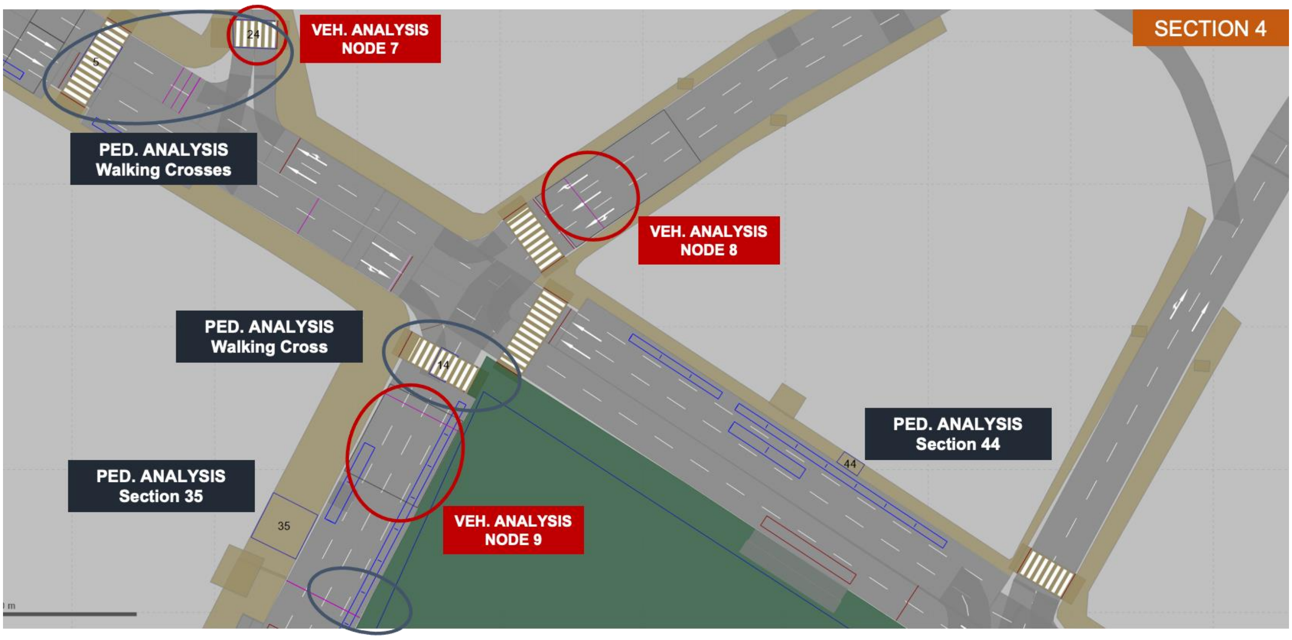


Figure 103. Location of the nodes and sections used for analysis purpose, section 4

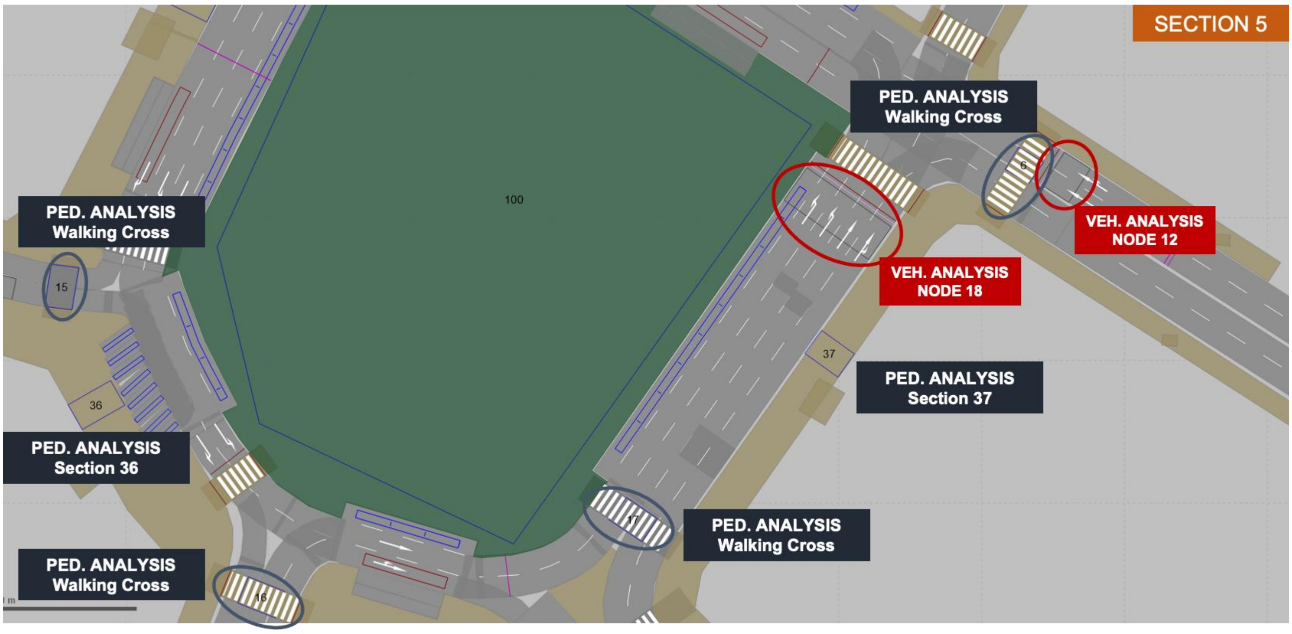


Figure 104. Location of the nodes and sections used for analysis purpose, section 5

As referred to above, the nodes and sections were used to calibrate the model, to determine its adequacy to reality. However, during Covid-19, a new cycle lane was built in the main avenue at the west of the street, which is already considered in the model, which has impacts in some nodes' results (nodes 1 and 3), since the original avenue's traffic flow capacity has reduced, which, consequently, lead to less traffic volume in Rua Morais Soares in the direction west to east.

In order to compare the Vissim model volumes with the ones resulted from the Visum model, the GEH statistic was adapted. This statistic formula allows to compare two sets of traffic volumes, through the following formula:

$$GEH = \sqrt{\frac{2(M-C)^2}{M+C}} ,$$

Where M is the hourly traffic volume from the Vissim model and C is the Visum model hourly traffic volume).

For traffic modelling work in the "baseline" scenario, a GEH of less than 5.0 is considered a good match between the modelled and observed hourly volumes.

In Appendix 4, a comparison is made, for the evaluated transport modes, between the traffic flow observed with Vissim and those that came from the Visum model at the morning and afternoon peak hour. The buses are not included, since their headway as well as their paths were introduced according with the information provided by the public transport company.

After modelling current scenario, some parameters were defined to compare the design changes with the current situation and to know how they would impact, essentially, in traffic and pedestrian movements.

Those parameters will come out directly from the microsimulation results and will provide a quantitative support of the impacts that any change in the street design, as, for instance, the reduction of number of lanes, creation of dedicated lanes to a transport mode or changes in the kerbside width, will cause in the quality of service.

The identified parameters that will support the decision are:

<u>Traffic movements</u>:

- Number of vehicles – Comparison between the solutions and how the will positively or negatively affect the number of vehicles in the network and identify the intersection with higher impacts.
- Number of stops and stops delay – Identification of the average number of stops by vehicle and their consequent average delay time are originated by the scenarios
- Vehicle delay – Identification of the average delay time by vehicle
- Queue length – Maximum traffic length in specified locations
- Vehicle travel time –identification of the time that a vehicle will spend to travel between two points
- Speed – Identification of the average vehicles speed in identified points of the network

- Level of Service – Immediate comparison of the quality of service provided by the infrastructure for all scenarios.

Pedestrian movements:

- Number of pedestrians – Identification of the number of pedestrians that enter in each section
- Density and Experienced density – Identification of the maximum density in each section, namely the number of pedestrians by square meter.
- Speed – Identification of the average speed by pedestrian
- Level of Service – Identification of the level of service in each section, that come out from the density results.

Obviously, several other indicators could be adopted, but the above-referred ones will help to analyse the impacts in each transport mode and define priorities in the new design scenarios.

Nonetheless, besides the quantitative results, a qualitative description of the movements flow behaviour will be done to help to understand some results.

In the following chapters the above identified indicators will be quantified for each scenario in the PM peak period, according with the model's outputs. The AM Peak period analysis is presented in Appendix 4.

4.5.2 Scenario 0

The scenario 0 will be the reference point to understand the impacts of the suggested scenarios since it will allow to identify the impacts of other designs.

Figure 105 and Figure 106 show some of the characteristics of the section, namely the number of lanes and kerbsides' width, which will allow to compare future street's design and will impact on the modelling results. Some of the general characteristics of the section are:

- Traffic lanes: Most of road along the section has two traffic lanes without segregation between traffic modes. The right lanes have a high frequency of bus stops and are commonly used for double parking. Praça Paiva Couceiro, is surrounded by one-way roads with high-capacity lanes (3 and 4 lanes), especially in the west and east corridors.
- Parking: There are around 130 parking places in all section, assigned to different typologies, like general traffic, load/unload, disabled and motorcycle. Normally the parking rotation is low, even in the load/unload parking places where the average parking time is around 30 minutes. There is a very high use of double parking along the section.
- Kerbside: The sidewalks' width is narrow, giving the number of pedestrians that circulate there, especially in the places with parking places and bus stops. In Morais Soares the sidewalks' width are between 1,70 and 1,90 meters in most of the section.

In Praça Paiva Couceiro, sidewalks are very large, but there is a large discontinuity between the square and the sidewalks.

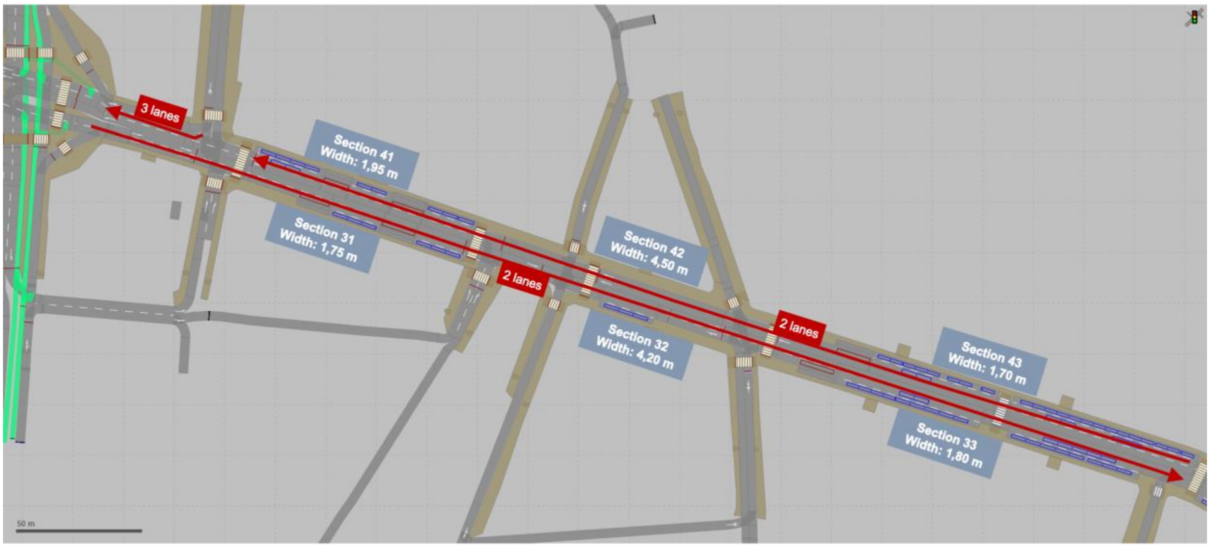


Figure 105. Section's characteristics, Scenario 0

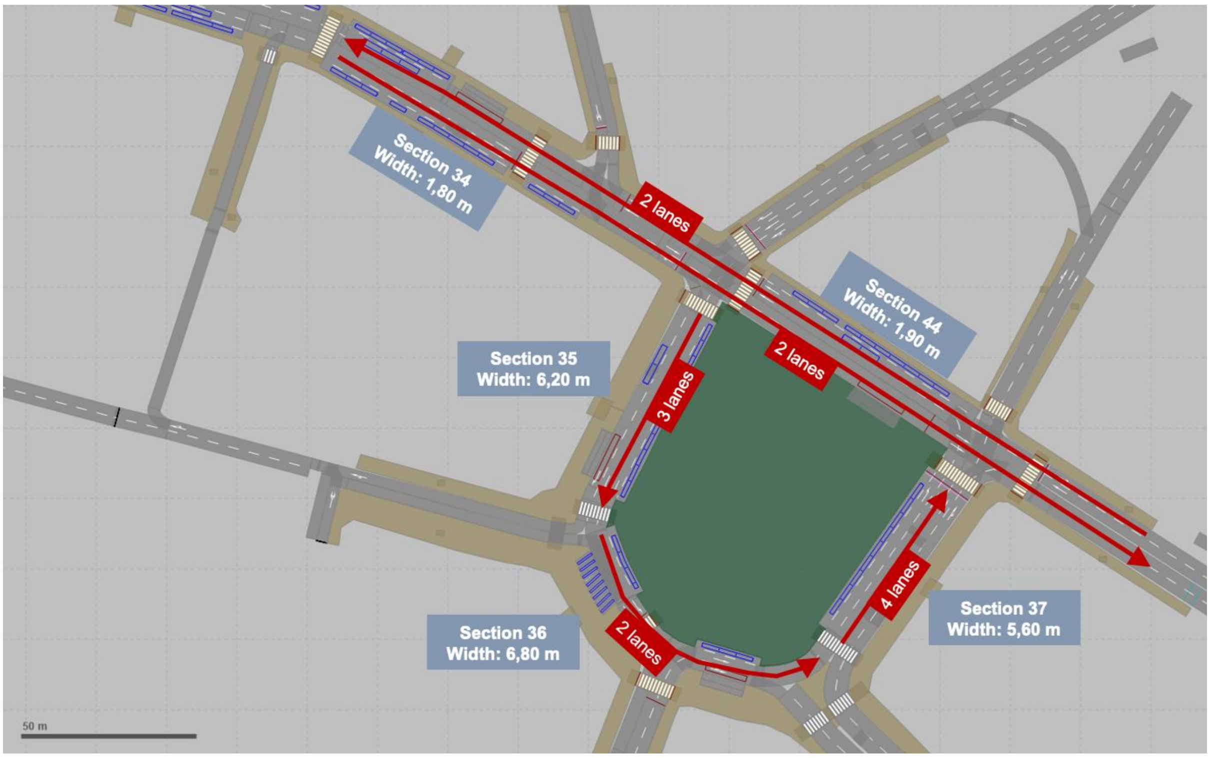


Figure 106. Section's characteristics, Scenario 0

Therefore, the microsimulation results will be described, for PM peak period[1]:

Concerning PM Peak period, traffic movements reduce between 90 and 150 vehicles from east to west and increase between 70 and 140 vehicles in the opposite direction. However, despite a more balanced traffic flow, the congestion problems are very similar, occurring large queue lines near Avenida Almirante Reis and smaller ones near Praça Paiva Couceiro.

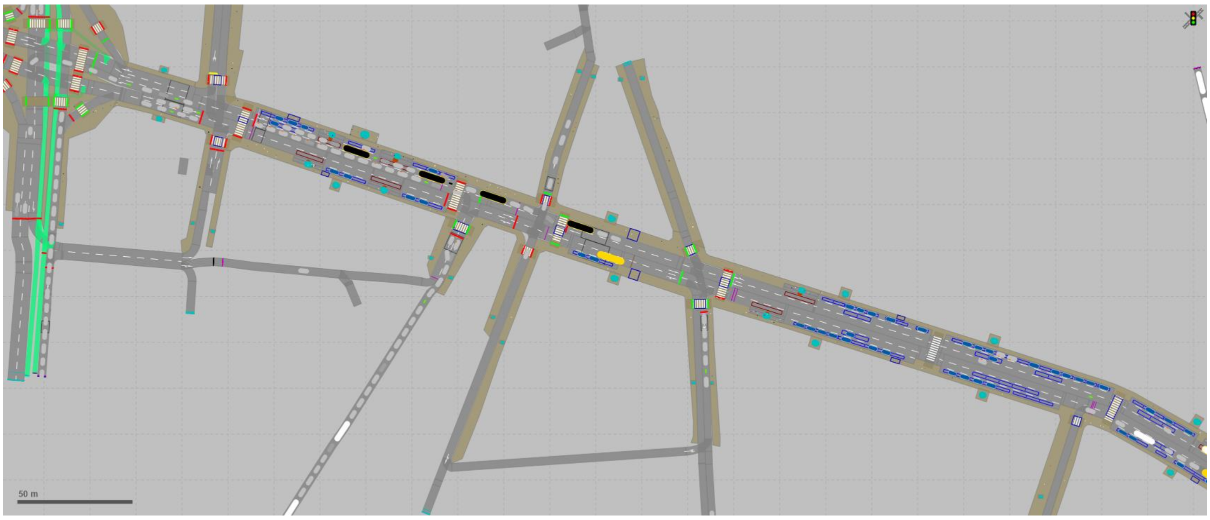


Figure 107. Simulation, intersection near Avenida Almirante Reis, Scenario 0, PM Peak

[1] AM Peak period analysis: Appendix 4

Figure 108. Simulation, intersection between near Praça Paiva Couceiro, Scenario 0, PM Peak

Considering the measurements at the nodes, as shown in Figure 109 and Figure 110, as well as in the AM Peak, the direction from east to west has higher delays that the opposite direction, although not significant ones. Comparing with scenario 0, as expected, the first reduces a little the delay time and number of stops and in the opposite way they marginally increase.

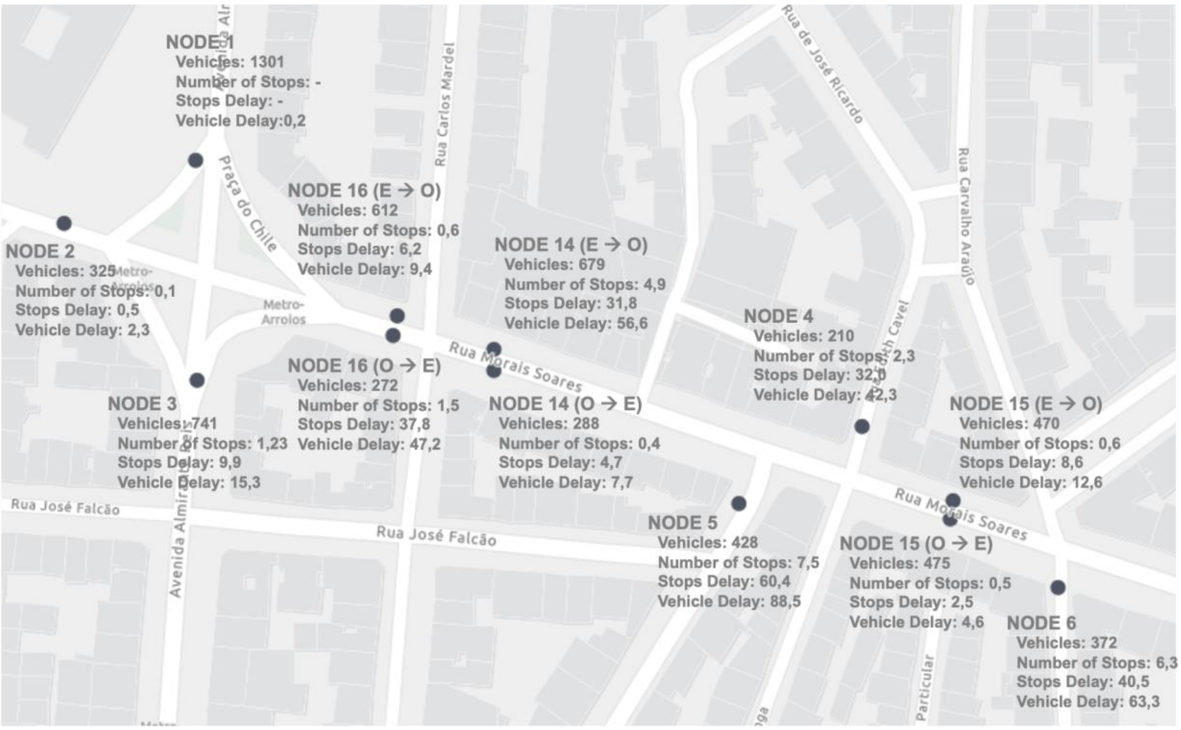


Figure 109. Nodes' results, Scenario 0, PM Peak, Section 1

Regarding Praça Paiva Couceiro, the traffic flows are also very similar in both time periods, remaining with very few delays and number of stops, even on the perpendicular streets.

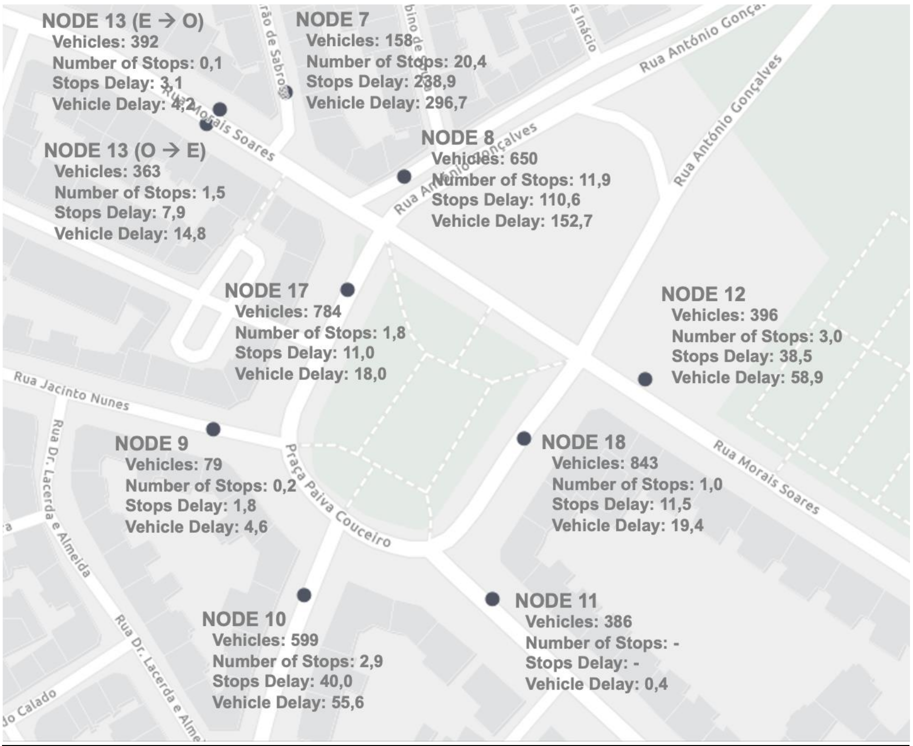


Figure 110. Nodes' results, Scenario 0, PM Peak, Section 2

Concerning the queue lines extension, the longer one along the road occurs near Praça do Chile, with an average length of 157 meters, whereas near Praça Paiva Couceiro is only 36 meters, which shows that even in different time periods, most of the traffic moves from east to west. Some access streets remain with large queue lines and difficulties to access the main street, especially for those movements coming from Av. General Roçadas and Rua Barão de Sabrosa.

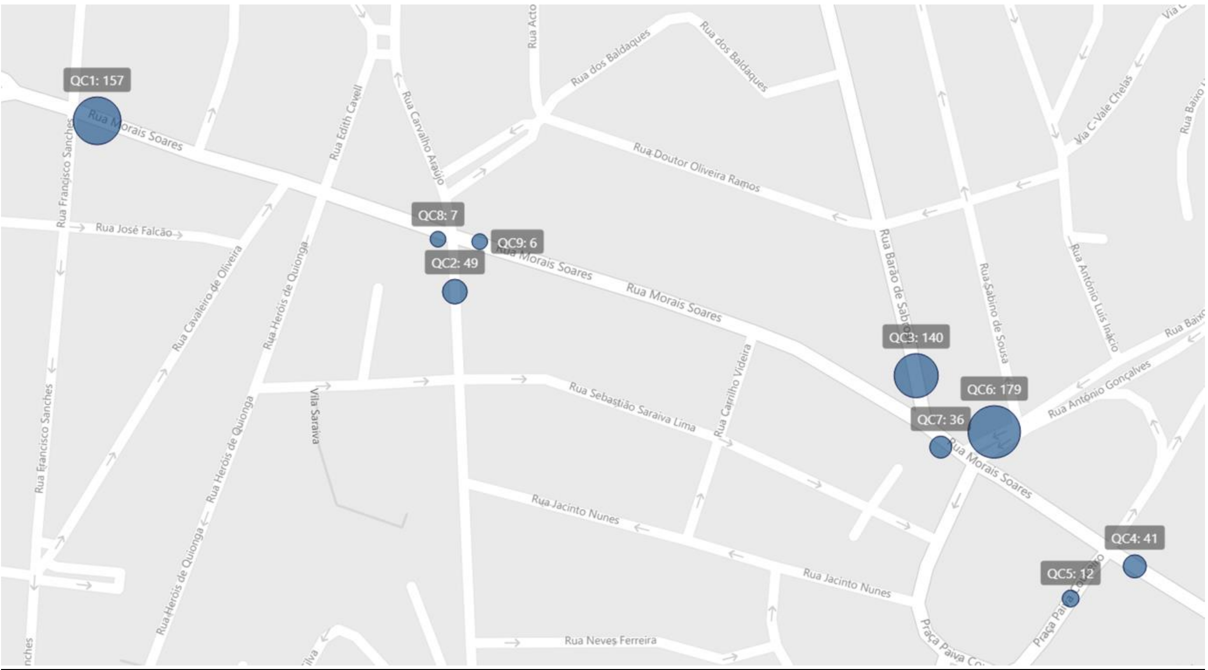


Figure 111. Average queue length (m), Scenario 0, PM Peak

The level of service also proves what is referred above, i.e., that the main road presents very good service quality, except in the intersection with Av. Almirante Reis where it transforms from a level B to a level F quality of service. Concerning the perpendicular streets, they vary from level E to F.

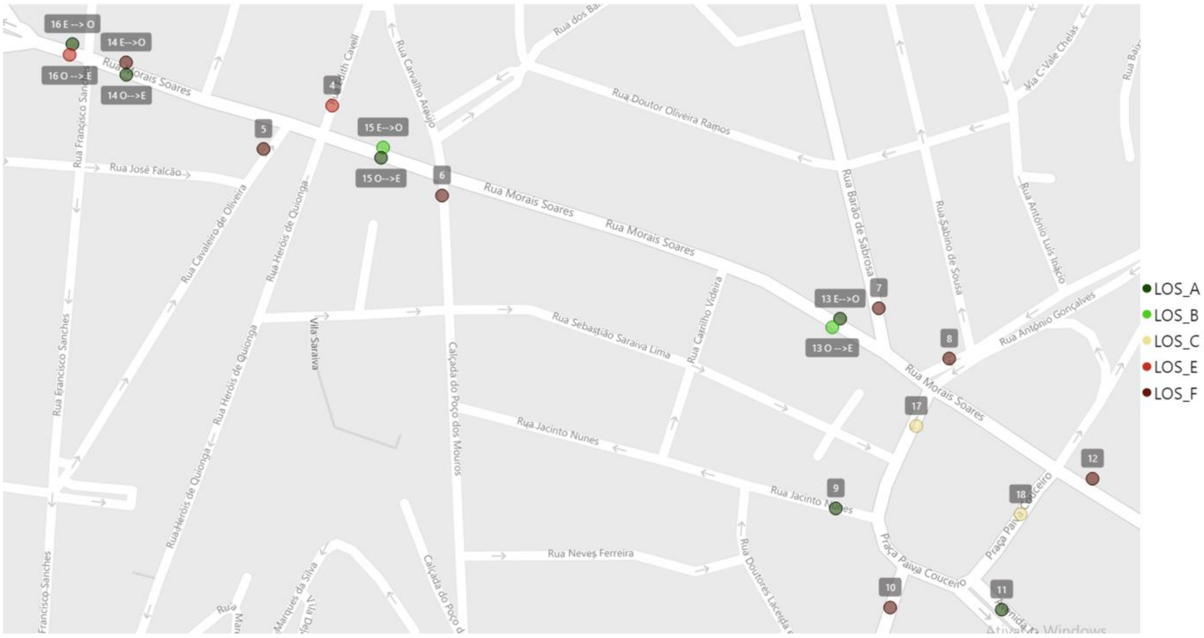


Figure 112. Vehicles' level of service, Scenario 0, PM Peak

Figure 113 shows some characteristics regarding pedestrian movement resulted from Vissim simulation, as the number of pedestrians per hour, average speed and maximum density as well as the current level of service.

The number of pedestrians, relatively to the AM Peak, increase significantly in the southern side of the street, especially at west from Calçada Poço dos Mouros, so, in almost all sections, the level of service remains very poor without corresponding to the needs of the zone, except in small area with large sidewalks.

In Praça Paiva Couceiro, since the existing sidewalks are very large, the conditions to pedestrians are considered very good. However, the discontinuity created by the large roads on both sides reduces the quality of this public space.

Table 24. Level of service criteria[2]

[2] Fruin, 1971

Level of Service	Flow Rate (pedestrian/minute/meter)	Density (pedestrian per square meter)
A	<= 7	<= 0,08
B	7 – 23	0,08 – 0,27
C	23 – 33	0,27 – 0,45
D	33 – 49	0,45 – 0,69
E	49 - 82	0,69 – 1,66
F	≥ 82	≥ 1,66

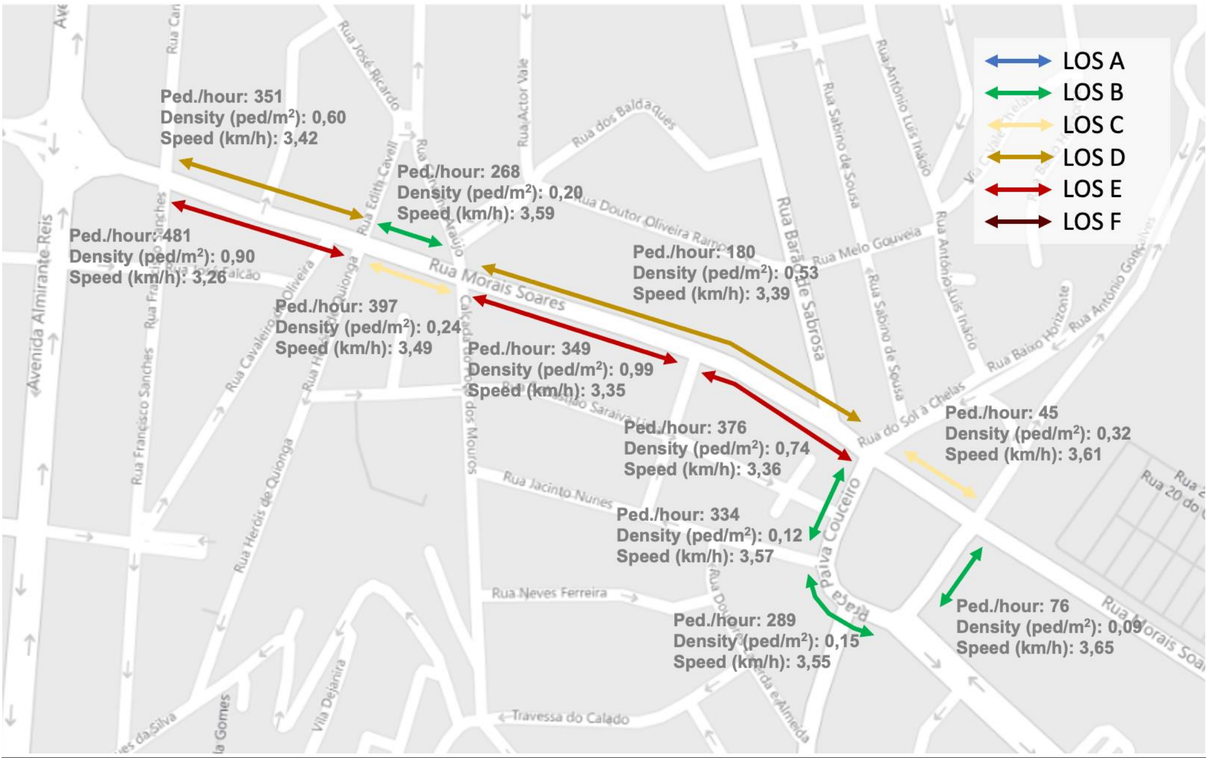


Figure 113. Pedestrian's characteristics and level of service, PM Peak, Scenario 0

Considering the obtained results, during both AM and PM Peak the traffic volume doesn't appear to justify two lanes, at least from west to east, since most of this space is used for illegal double parking. From east to west, the traffic is clearly higher in both time periods, and some congestion situations may occur. However, similarly to the inverse way, also the right lane is abusively used for parking, which doesn't allow to properly analyse its real need. In further scenarios, some new designs will be tested to prove the necessity of both lanes or if, at least, one of them, could be assigned to other transport mode, kerbside activity or to enlarge pedestrian area.

4.5.3 Scenario 1

Scenario 1 essentially provides priority to parking above the other transport modes, since the existing parallel parking places will be transformed into diagonal parking to provide a higher number of parking places.

Figure 114 and Figure 115 show some of the characteristics of the section, namely the number of lanes and kerbsides' width, which will allow to compare future street's design and will impact on the modelling results. Some of the general characteristics of the section are:

- Traffic lanes: Most of road along the section has one traffic lane for each way without segregation between traffic modes. Considering the increase of parking places and the high-capacity reduction, double parking is expected to disappear. Praça Paiva Couceiro, is surrounded by one-way roads with high-capacity lanes (3 and 4 lanes), especially in the west and east corridors.
- Parking: 173 parking places will be created in all section, assigned to different typologies, which correspond to an increase of 30% of the existing ones.
- Kerbside: The sidewalks' width increase, on average, 25 cm in each way, i.e., in Morais Soares the sidewalks' width will have around 1,90 and 2,20 meters in most of the section. Praça Paiva Couceiro design remains the same.

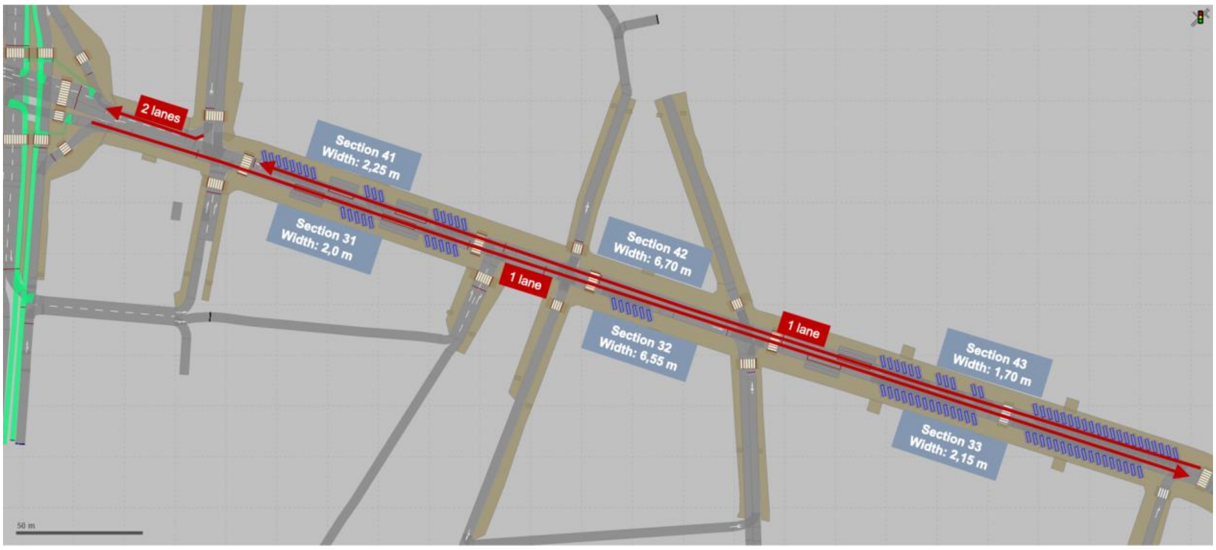


Figure 114. Section's characteristics, Scenario 1

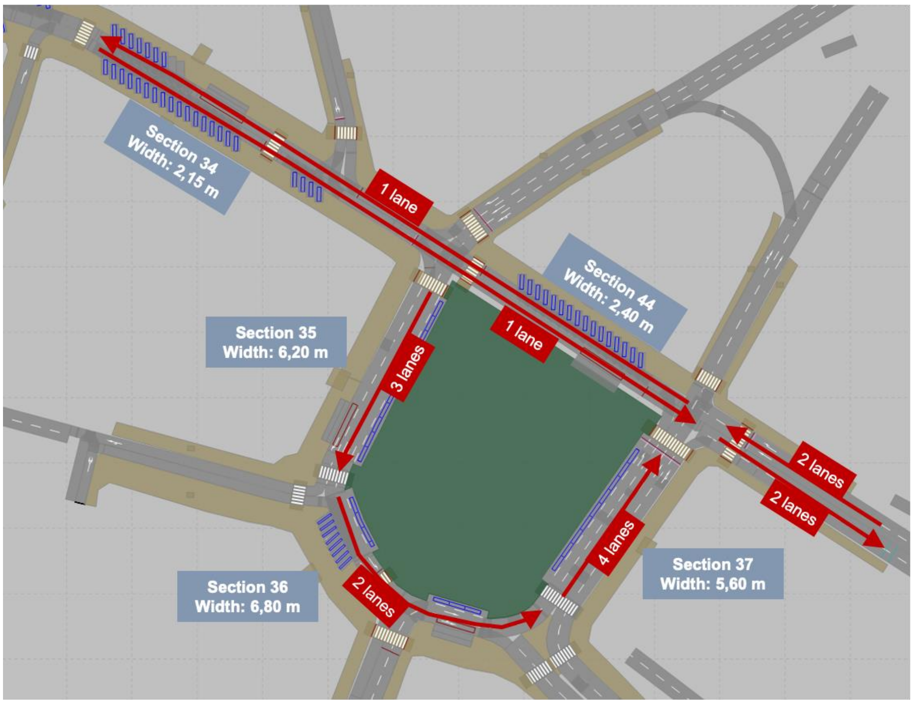


Figure 115. Section's characteristics, Scenario 1

Considering the new design, the software's outputs will be presented, considering PM peak period[3].

For the PM Peak, despite the slight reduction of the number of vehicles in the east to west direction, the congestion problems are still very similar as in the AM Peak, since most of the congestion problems occur in that direction, mainly caused by the intersection with Av. Almirante Reis.

[3] AM Peak period analysis: Appendix 4

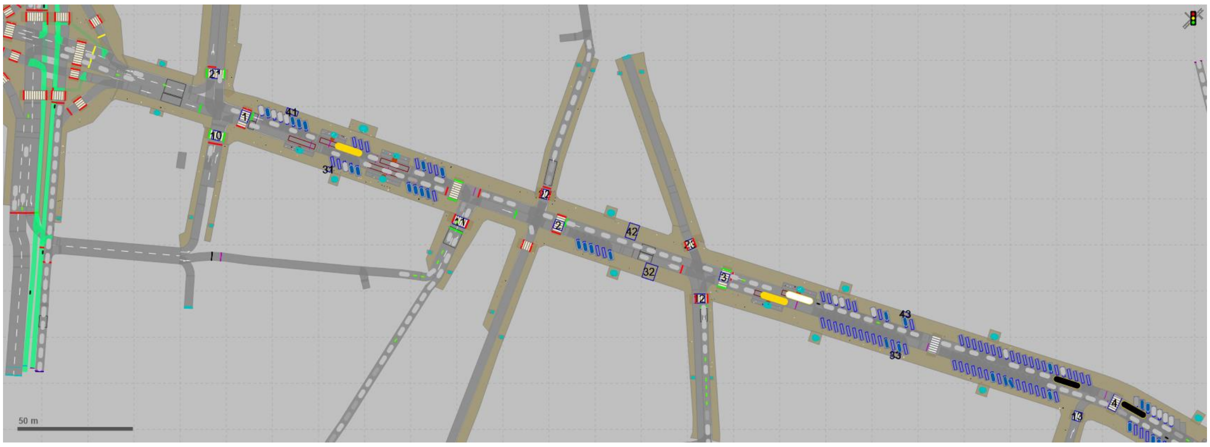


Figure 116. Simulation, Rua Morais Soares, Scenario 1, PM Peak

In the opposite direction, despite the traffic movements increase, traffic still flows fluently, despite some occasional traffic stops caused by parking and bus stops, occurring some congestion problems in the intersection with Praça Paiva Couceiro. However, neither long queue lines nor significant delay time along that direction occurs.

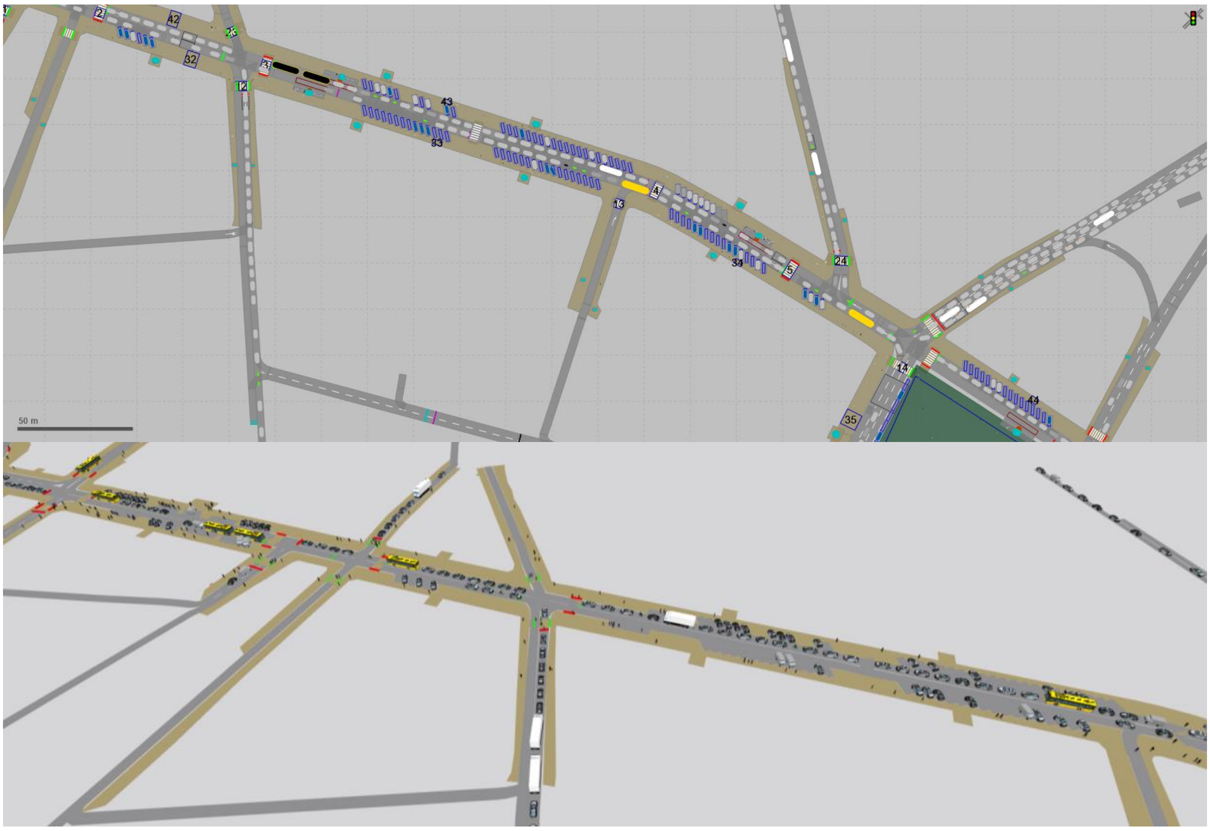


Figure 117. Simulation, Rua Morais Soares, Scenario 1, PM Peak

Comparing with scenario 0, a clear reduction of the number of movements is verified from east to west, which is explained for the road capacity reduction, not being able to answer to the traffic demand. In the opposite direction the number of vehicles is very similar to scenario 0, which demonstrates that there isn't a capacity problem, not being verified any significant change in the delay times, except near Praça Paiva Couceiro.

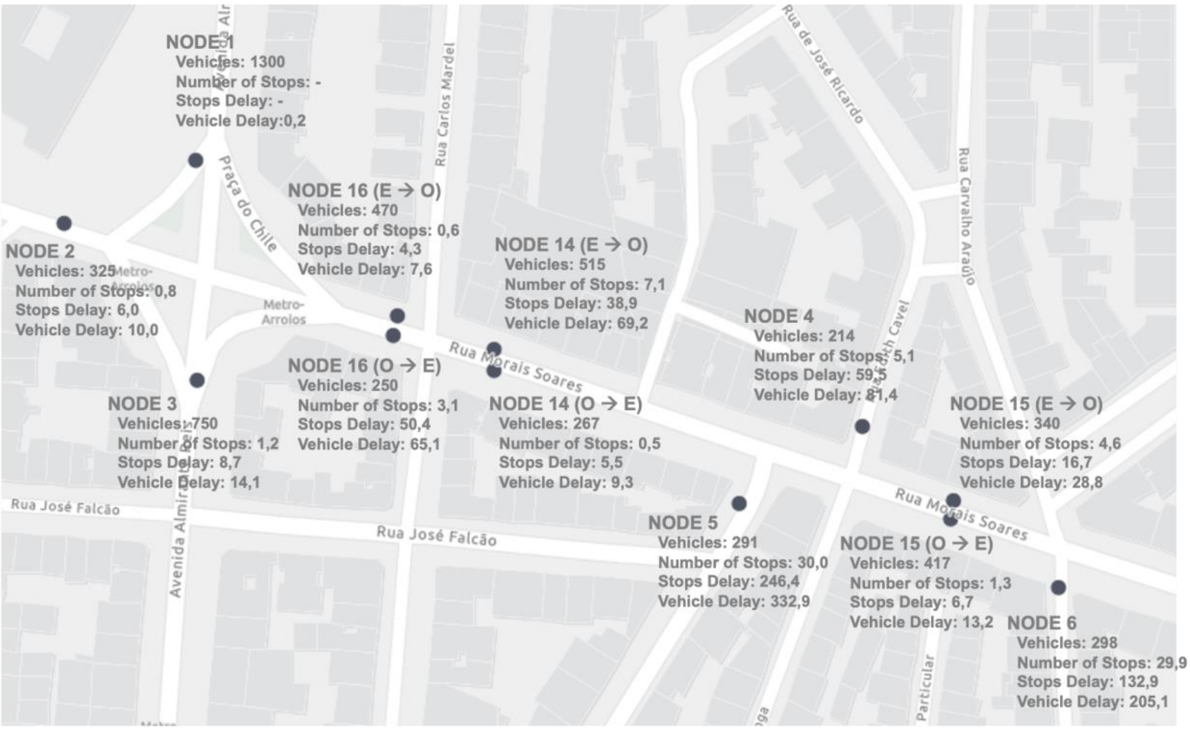


Figure 118. Nodes' results, Scenario 1, PM Peak, Section 1

In Praça Paiva Couceiro, the reduced capacity of Rua Morais Soares has negative impacts for the movements coming from east (node 12). The number of movements and delays around the square are not significantly different from the current situation.

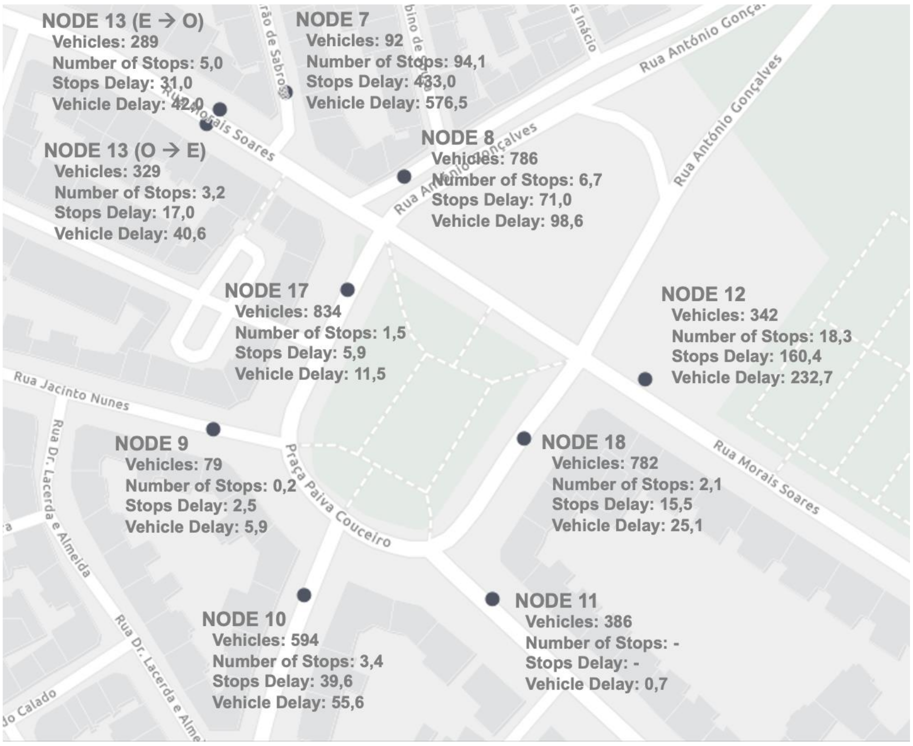


Figure 119. Nodes' results, Scenario 1, PM Peak, Section 2

During this time period, as well as in the AM Peak, the longest queue lines occur near the intersection with Av. Almirante Reis and in the street's middle in the east to west way. The movements coming from the east (QC4) also substantially increases current queue length. From west to east, there aren't particularly relevant extensions despite a small increment near Praça Paiva Couceiro.

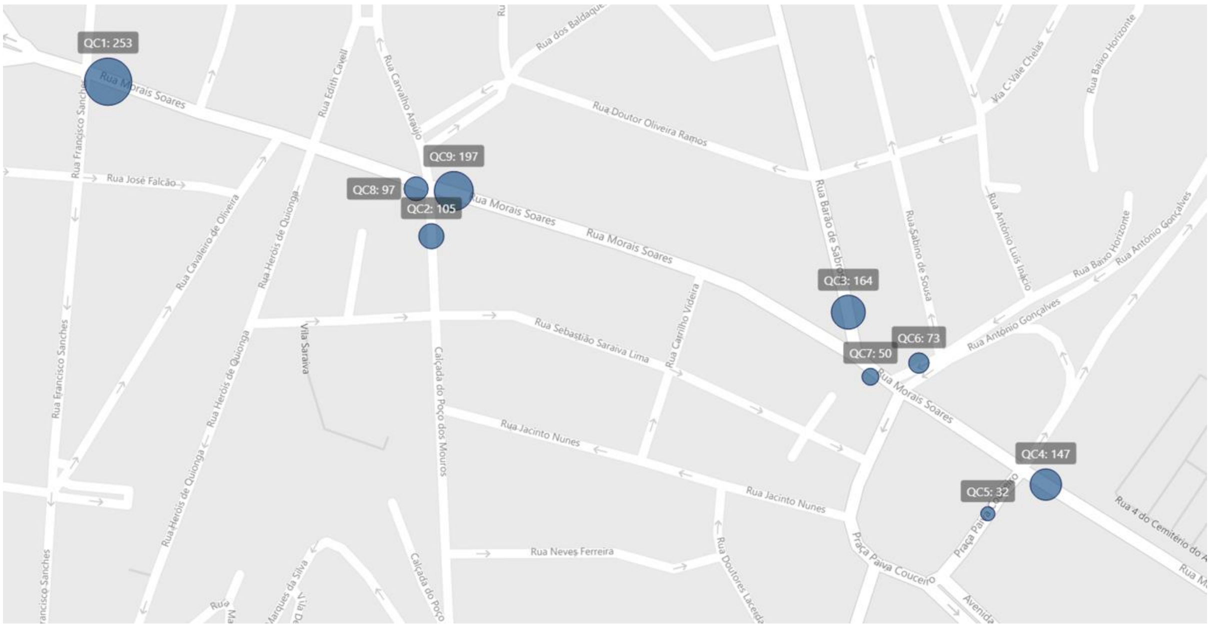


Figure 120. Average queue length (m), Scenario 1, PM Peak

Comparing the level of service between this scenario and current conditions, the quality of service for the movements from east to west is worse than is offered currently with several points with level E, which shows that this scenario doesn't answer to the current demand conditions.

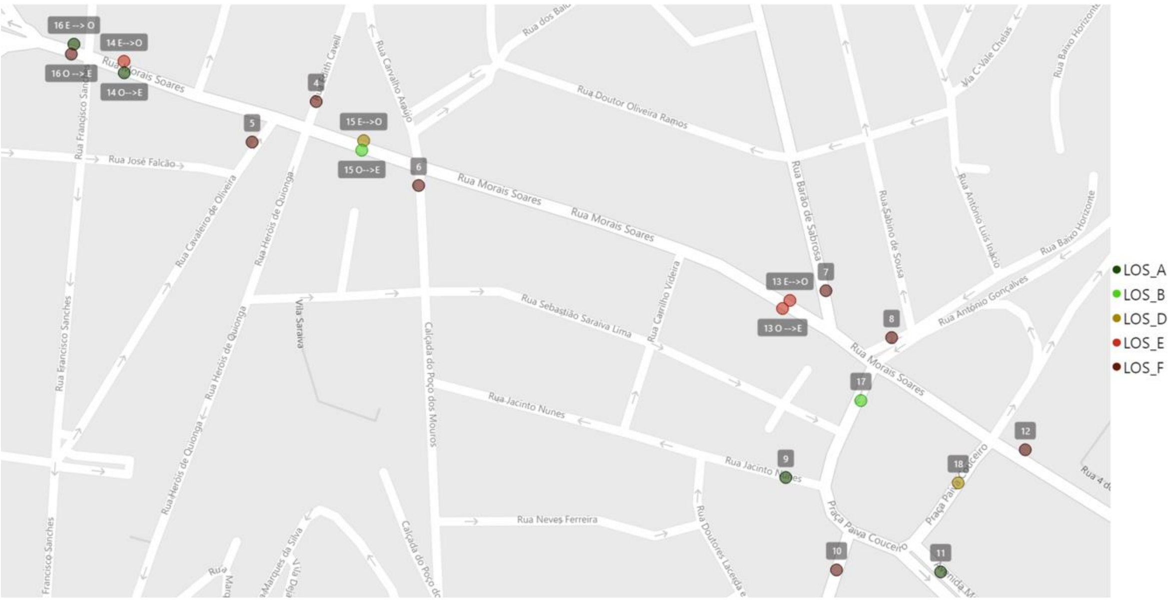


Figure 121. Vehicles' level of service, Scenario 1, PM Peak

As well as in the AM Peak, in this time period the conditions for pedestrians also improve, where the most visible section is in the east side of the street, transforming level E service into Level D.

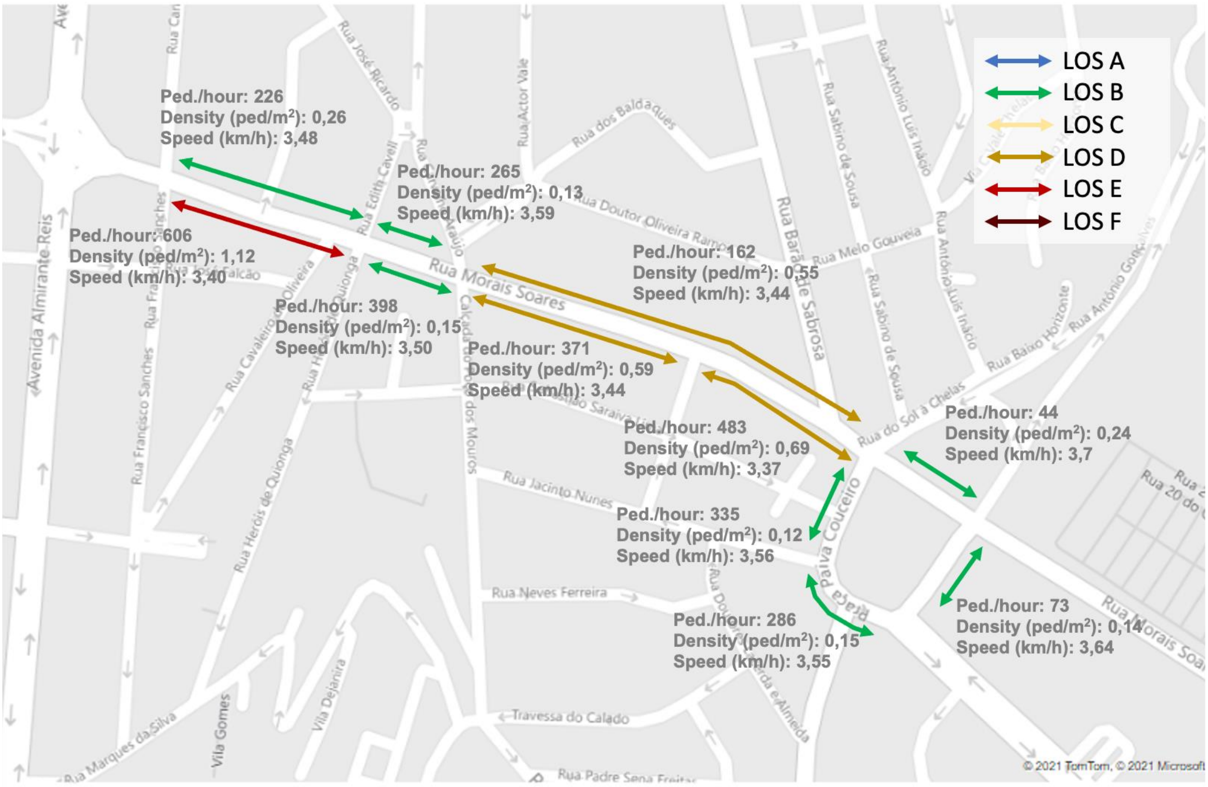


Figure 122. Pedestrian's characteristics and level of service, Scenario 1, PM Peak

In this scenario, it is visible that one lane in each direction doesn't seem enough to answer to the demand needs without creating significant delays and long queue lines in both day periods, especially from Paiva Couceiro to Praça do Chile (east to west). In the opposite direction, in both time periods one lane is enough to answer to the needs, despite a small increase in delay times near Praça Paiva Couceiro in the PM peak period, however without influencing traffic flow.

Regarding pedestrians' movements, a slight enlargement in the sidewalks' width is proposed along most of the street, however the new design configuration doesn't allow to provide significant changes within it. Besides that, the changes are more dedicated to implement some improvements in the pedestrians' movements and not in creating additional areas that could be used to promote street activities.

4.5.4 Scenario 2

Scenario 2 clearly gives priority to bus movements above other transport modes, since two right lanes are transformed in to two bus dedicated lanes. However, right turns are still allowed as well as parking, so it is expected that both bus lanes will be occupied by other transport modes.

Figure 123 and Figure 124 show some of the characteristics of the section, namely the number and type of lanes and kerbsides' width, which will allow to compare future street's design and will impact on the modelling results. Some of the general characteristics of the section are:

- Traffic lanes: Most of road along the section has one traffic lane for general traffic and other dedicated to bus circulation, however with access to parking and right turns allowed. Considering the transformation of one of the lanes in both directions into a bus lane, double parking is expected to disappear. Praça Paiva Couceiro, is surrounded by one-way roads with high-capacity lanes (3 and 4 lanes), especially in the west and east corridors.
- Parking: The number and location of parking spaces will remain the same as the current situation.
- Kerbside: The sidewalks' width won't suffer any change, since the lanes width will remain the same as well as the number and location of parking bays.

Figure 123. Section's characteristics, Scenario 2

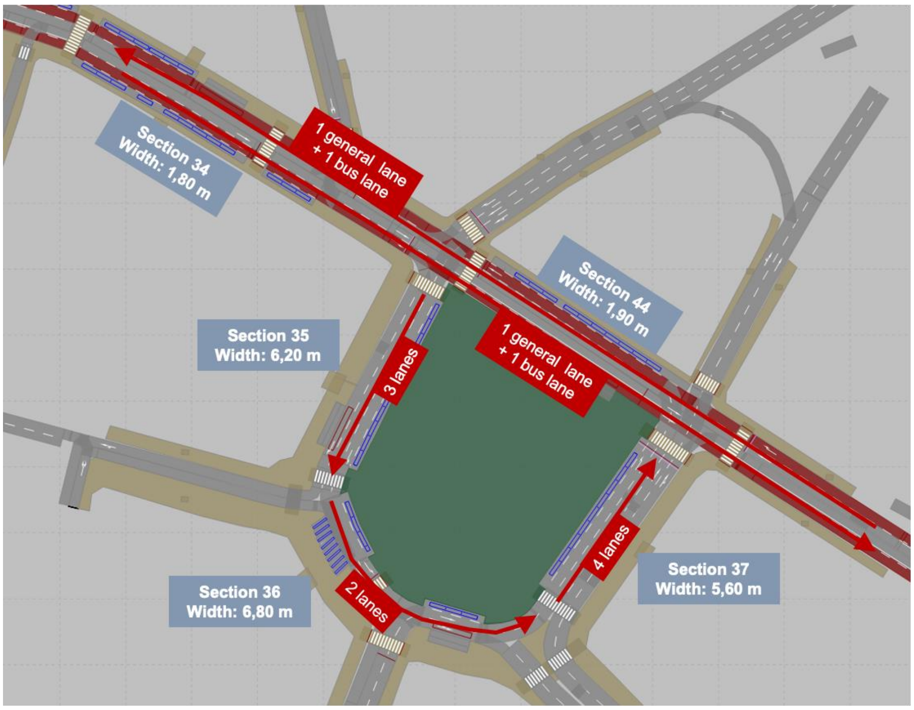


Figure 124. Section's characteristics, Scenario 2

Considering the new design, the software's outputs will be presented, considering PM peak period[4].

Regarding PM Peak, most of the constraints remain in the east to west direction as in the AM Peak without being noticed relevant constraints in the opposite direction. In fact, the road capacity from west to east is more than enough to answer to verified traffic volume increment from AM to PM Peak period. Considering this, during PM Peak the flow conditions from east to west improved and in the opposite way it is not noticed any relevant constraint.

As shown in Figure 125, near Praça Paiva Couceiro there isn't any line, which demonstrates the adequacy of road capacity to the traffic demand.

[4] AM Peak period analysis: Appendix 4

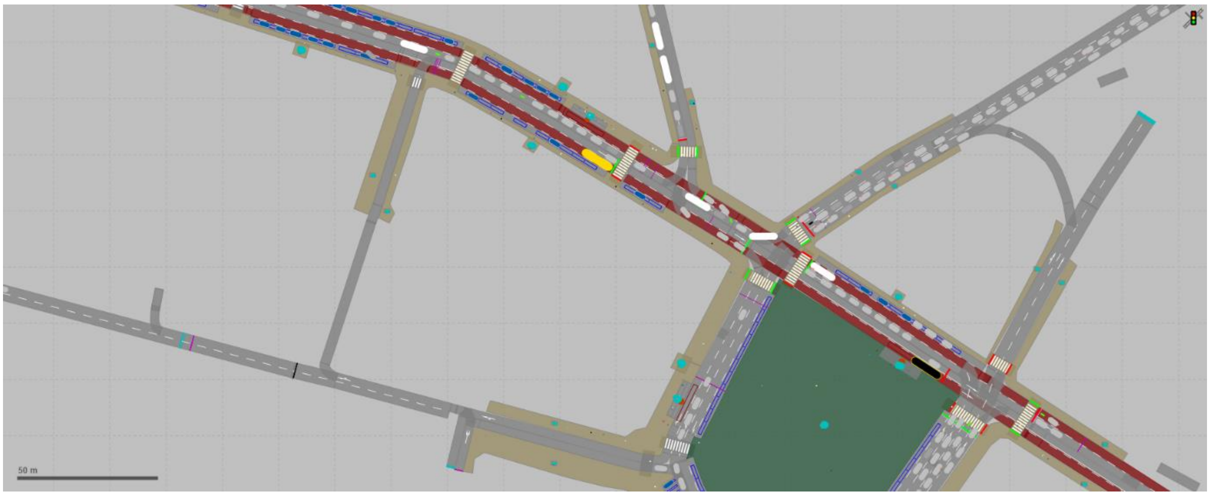


Figure 125. Simulation, Rua Morais Soares, Scenario 2, PM Peak

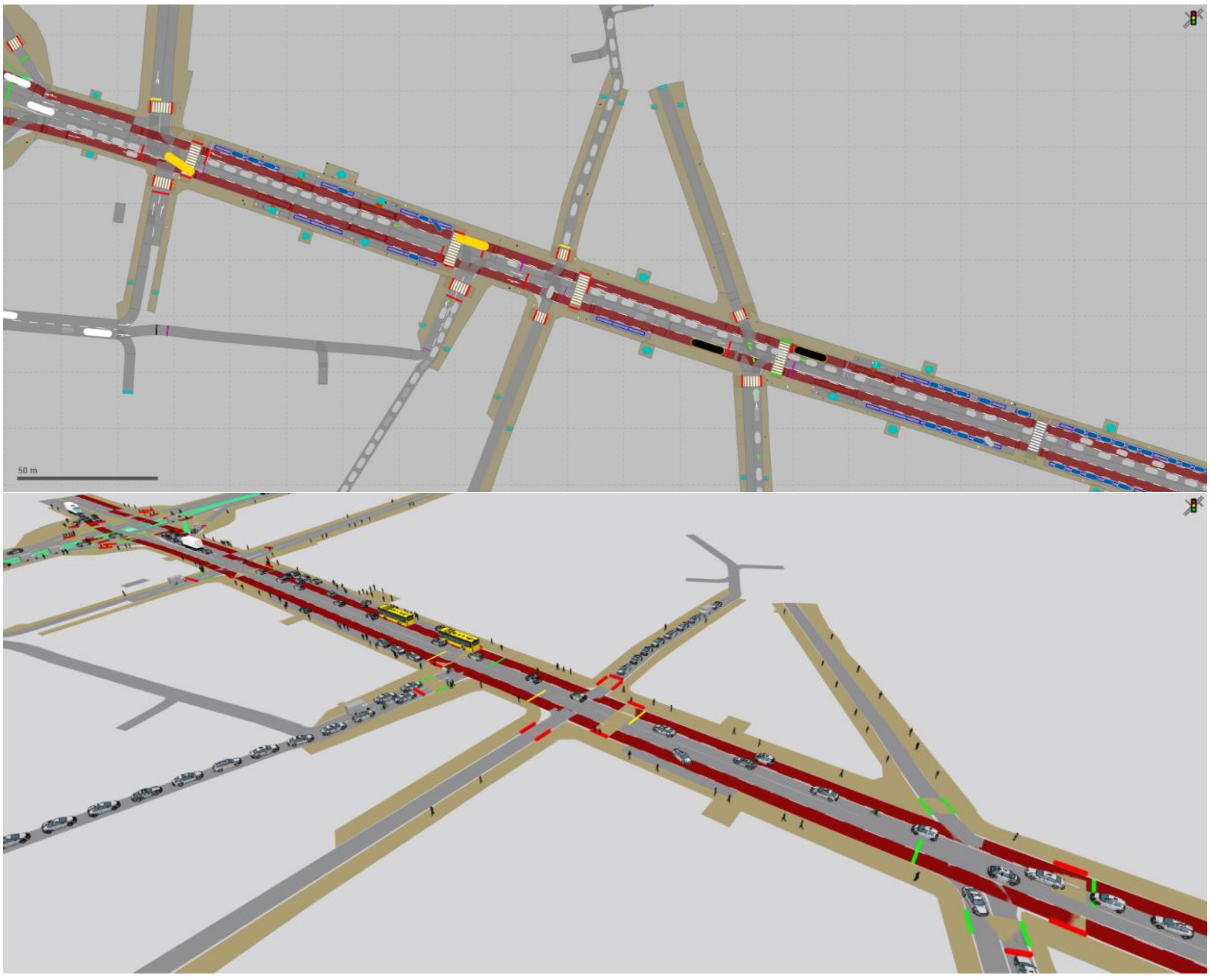


Figure 126. Simulation, Rua Morais Soares, Scenario 2, PM Peak

Looking at the nodes' results, in general, the differences between the current situation and scenario 2 are not very relevant and, in fact, in scenario 2 improves a little, showing that double parking is more detrimental than the implementation of a bus lane.

Figure 127. Nodes' results, Scenario 2, PM Peak, Section 1

In Praça Paiva Couceiro there isn't any substantial change about traffic flows when compared with current situation, still having low delay times and few stops.

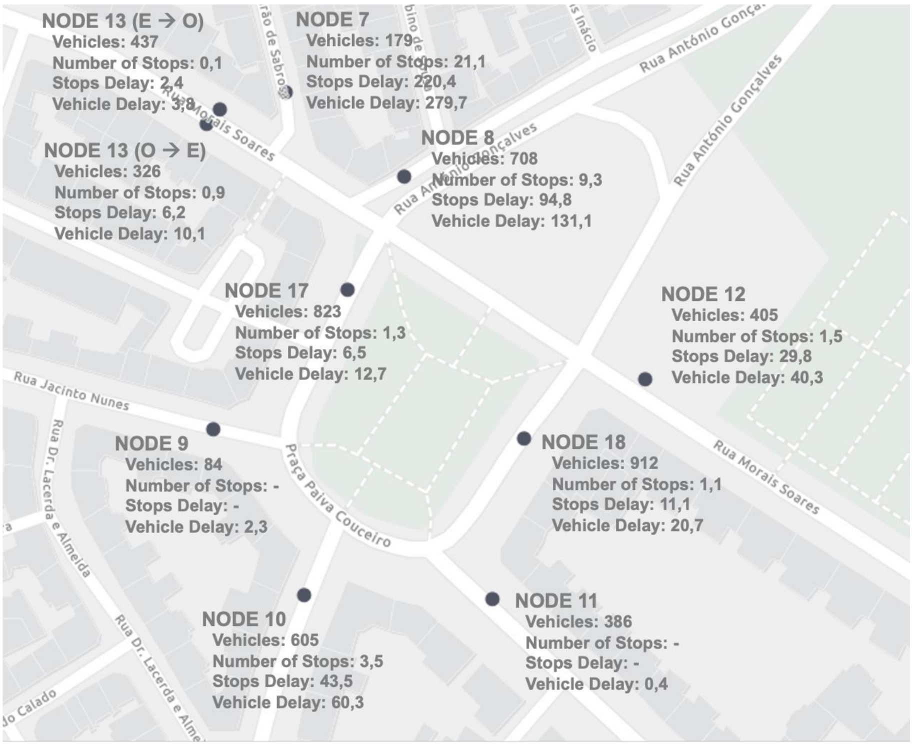


Figure 128. Nodes' results, Scenario 2, PM Peak, Section 2

Regarding queues' length, once again there aren't large differences to the current scenario, despite near the intersection with Av. Almirante Reis, the scenario 2's queue length is smaller. The only location with more relevant difference is in QC2 where the current queue length is of 50 meters and in this scenario increases to 155 meters.

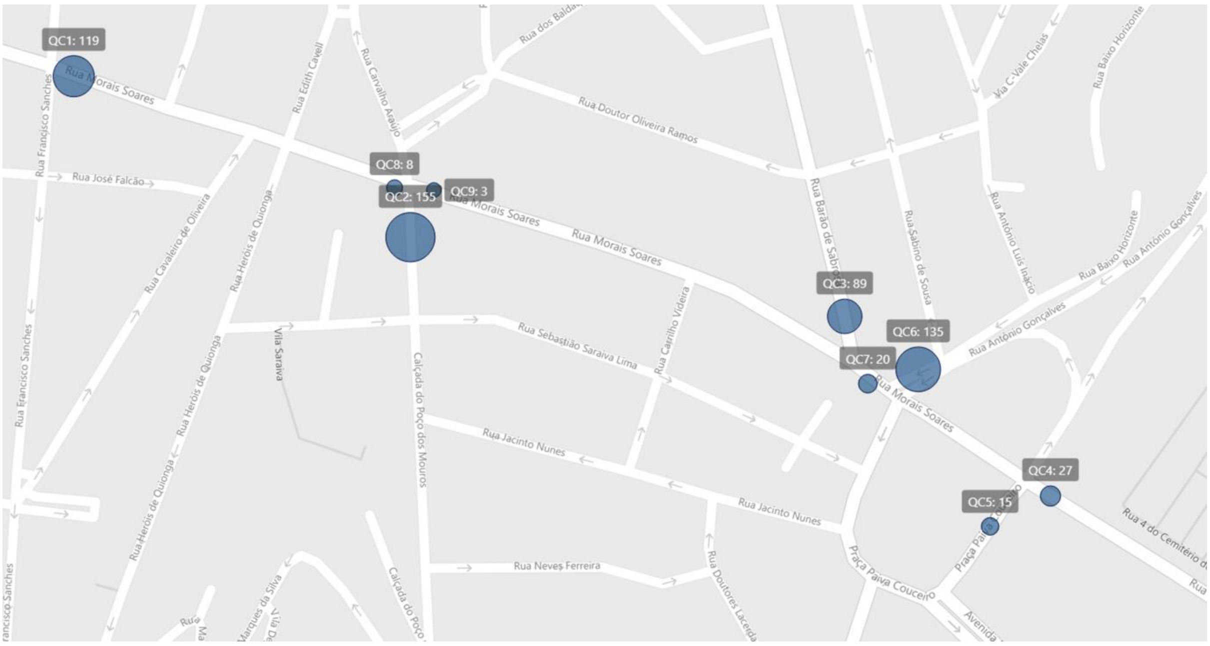


Figure 129. Average queue length (m), Scenario 2, PM Peak

The level of service is good along the road, being more balanced than the AM Peak. Only one section along the road shows a LOS below C by contrast with the perpendicular streets which, in general, presents a bad quality of service.

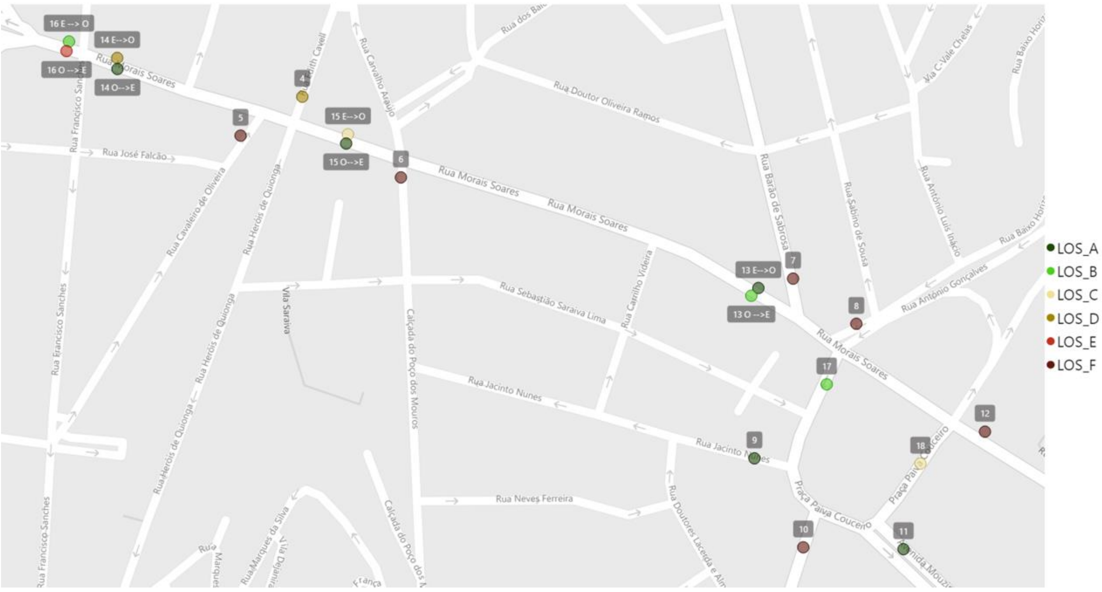


Figure 130. Vehicles' level of service, Scenario 2, PM Peak

Since there aren't differences between current sidewalks' design and the one proposed in this scenario, the level of service here is very similar with current conditions, i.e., most of the southern section is level E and the northern one is level D, confirming the idea of an insufficient space available for a good circulation quality.

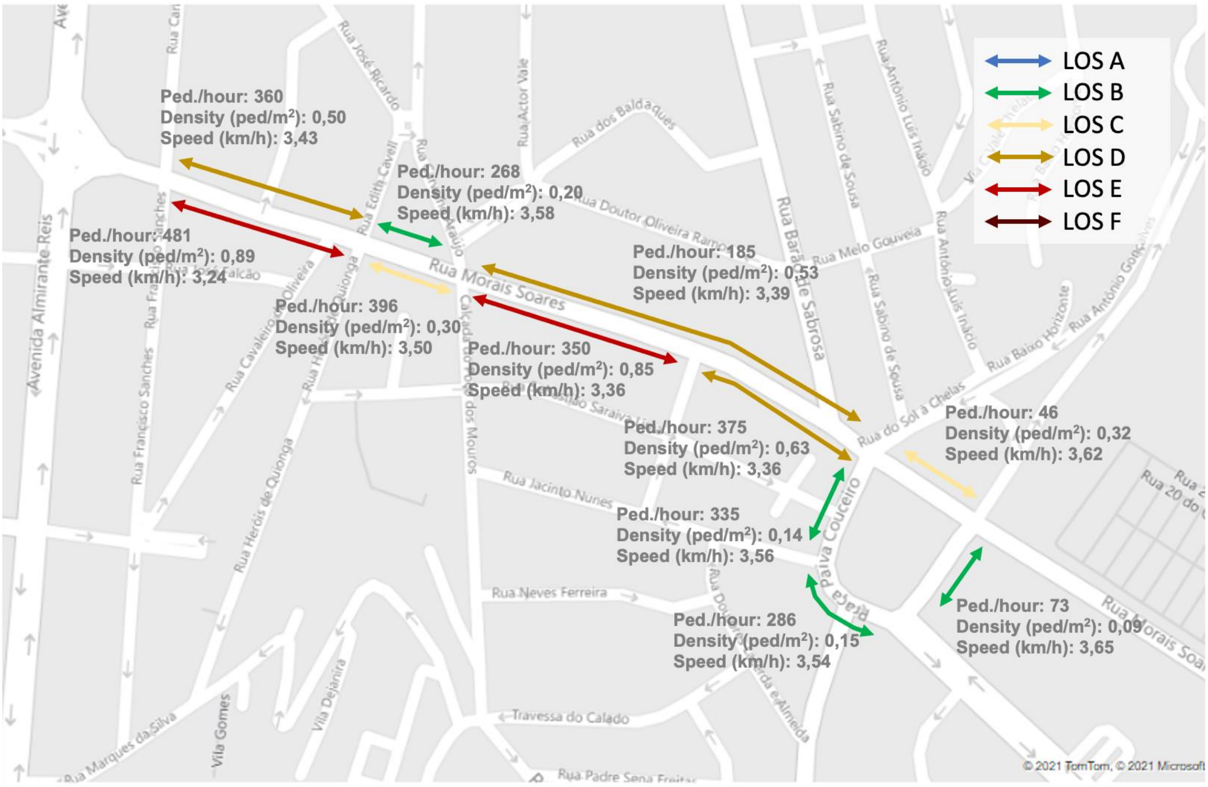


Figure 131. Pedestrian's characteristics and level of service, Scenario 2, PM Peak

The solutions proposed in scenario 2 seems to be enough to answer to traffic movements, providing a better service to public transports and, in some sections, improving the general traffic flow. In fact, if from east to west a bus lane seems an adequate solution, the traffic volume in the opposite direction doesn't seem to justify its implementation because the benefits in terms of delays and number of stops are not very relevant.

4.5.5 Scenario 3

Scenario 3 considers the implementation of a cycle lane between parking and the sidewalk and the sidewalks' enlargement. To install this infrastructure, the reduction of one lane in each direction was assumed, plus the installation of a pedestrian refuge between the two lanes. The rest of the space will be used to maintain the existing number of parking spaces, implement the cycle lane and enlarge sidewalks. Since right turns are still allowed, the implementation of the cycle lane should be made carefully in those intersections to avoid incidents.

Figure 132 and Figure 133 show some of the characteristics of the section, namely the number and type of lanes and kerbsides' width, which will allow to compare future street's design and will impact on the modelling results. Some of the general characteristics of the section are:

- Traffic lanes: Most of road along the section has one traffic lane for general traffic with right turns allowed. The parking bays are immediately adjacent to the general lanes and cycle lane is implemented at the parking's right side. Considering the reduction of one lane in both directions, double parking is expected to disappear. Praça Paiva Couceiro, is surrounded by one-way roads with high-capacity lanes (3 and 4 lanes), especially in the west and east corridors. The cycle lanes will be one way lane, following traffic direction with a width of 1,2 meters.
- Parking: The number of parking spaces remains the same, but they have to be misplaced from the current location to an immediately position right aside the traffic lane.
- Kerbside: The sidewalks' width will increase and a pedestrian refuge could be implemented between both lanes, which, besides improving crossing street safety could be used to plant trees along the road.

Figure 132. Section's characteristics, Scenario 3

In the northern section of Praça Paiva Couceiro, the existing parking bay was transformed into a general lane, since one lane was not being enough to drain the traffic coming from Praça Paiva Couceiro to Rua Morais Soares, which was creating congestion situations in the west to east movements in Rua Morais Soares.

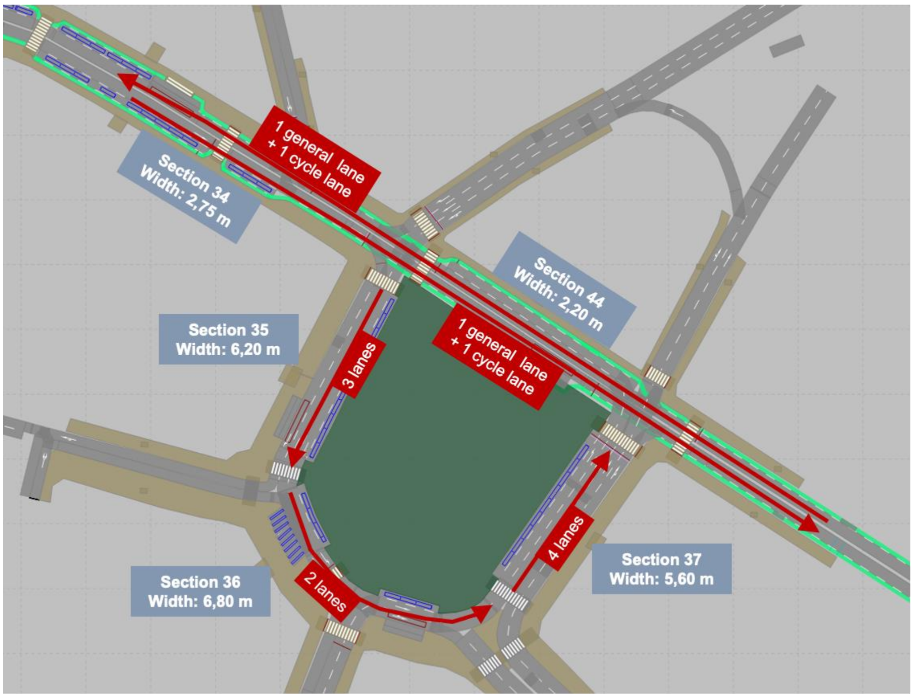


Figure 133. Section's characteristics, Scenario 3

Considering the new design, the software's outputs will be presented, considering PM peak period[5].

[5] AM Peak period analysis: Appendix 4

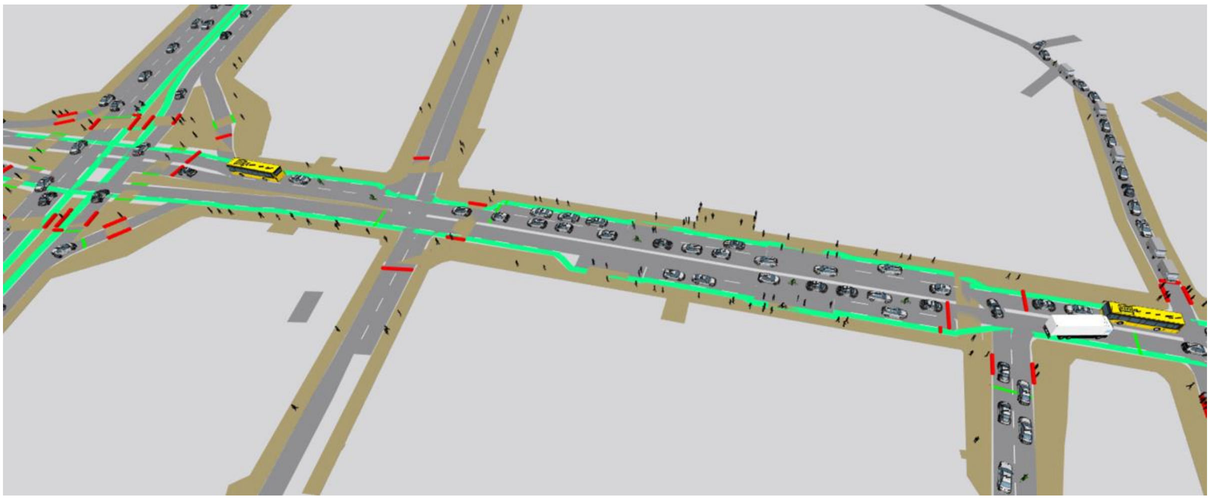


Figure 134. Simulation, Rua Morais Soares and Praça Paiva Couceiro, Scenario 2, PM Peak

Analysing the indicators in each node, the number of vehicles in the east to west direction is clearly less than in current situation, which demonstrates an insufficient capacity for the current demand patterns, which creates longer delay periods and a higher number of stops. In the inverse direction, there aren't significant differences regarding current indicators, which reinforces the perception that one lane is enough to answer to traffic volume needs.

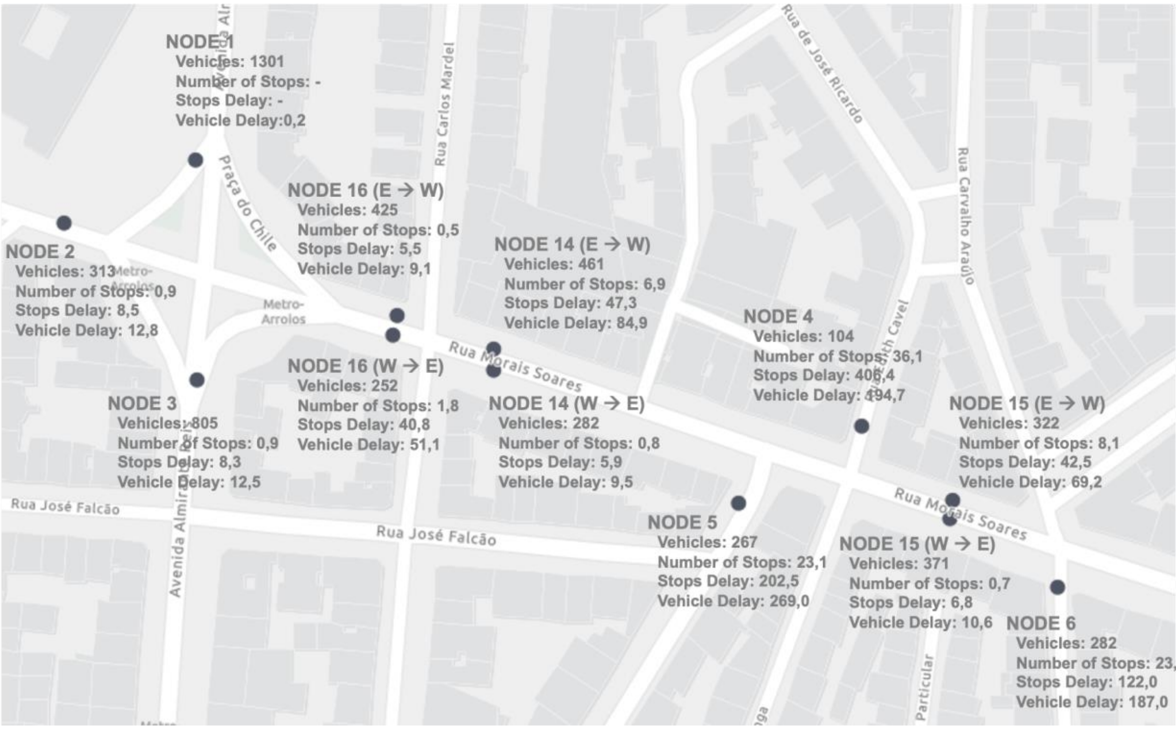


Figure 135. Nodes' results, Scenario 3, PM Peak, Section 1

Regarding Praça Paiva Couceiro’s indicators, there are not significant differences between scenarios, which suggests that the impacts of an implementation of a cycle lane in Rua Morais Soares wouldn’t have a visible impact in traffic flow here.

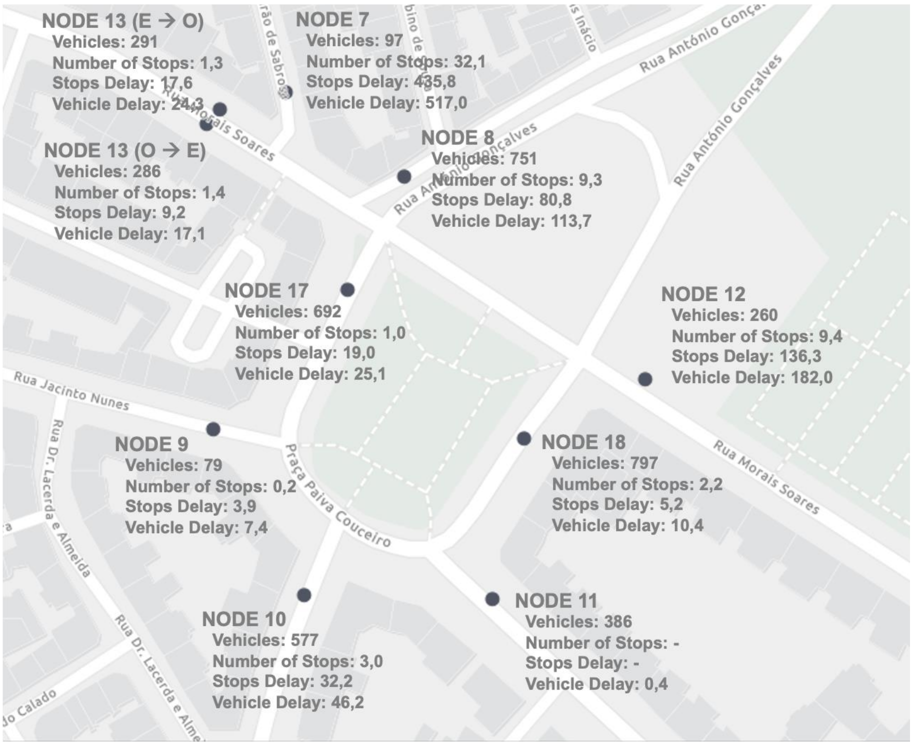


Figure 136. Nodes' results, Scenario 3, PM Peak, Section 2

One of the most visible negative impacts of this solution is the long queue lines that are formed after the reduction of one lane from east to west direction for all traffic types, especially caused by the mix between bus movements and the rest of the transport modes. In the inverse direction, the queue length increase near the intersection between Rua Morais Soares and Calçada Poço dos Mouros (QC8) but, in general, there aren’t visible negative impacts.

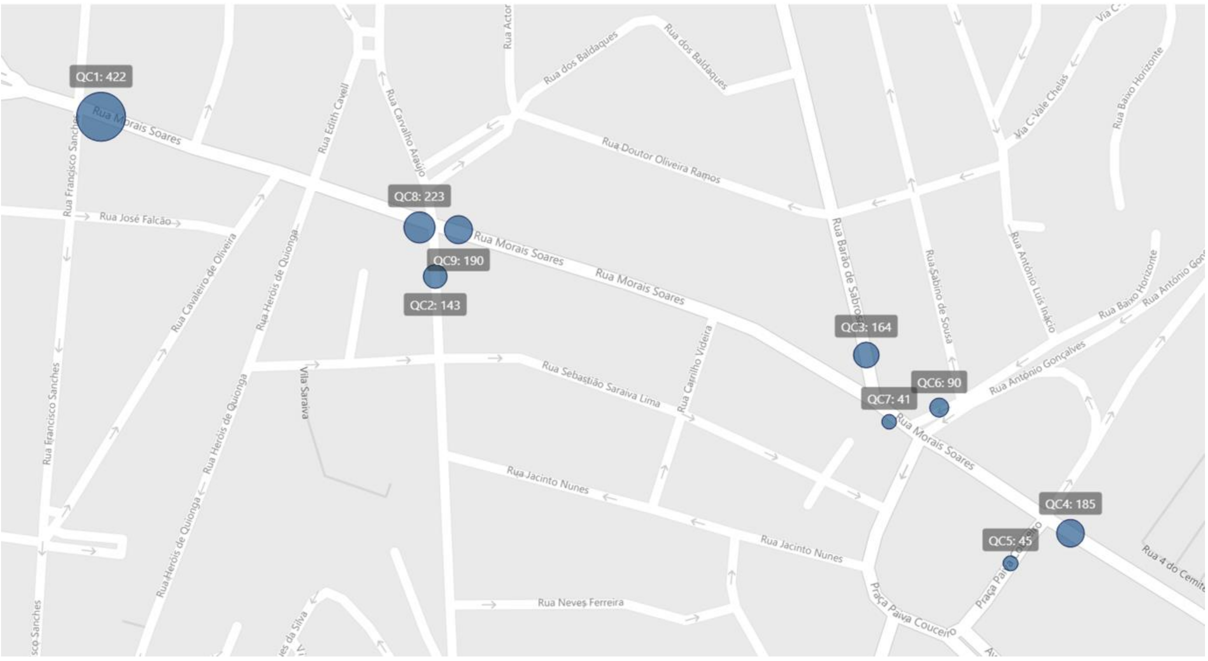


Figure 137. Average queue length (m), Scenario 3, PM Peak

To support this analysis, from west to east the level of service provided remains with a good quality, however, in the inverse direction, the quality of service is clearly worse than in current situation.

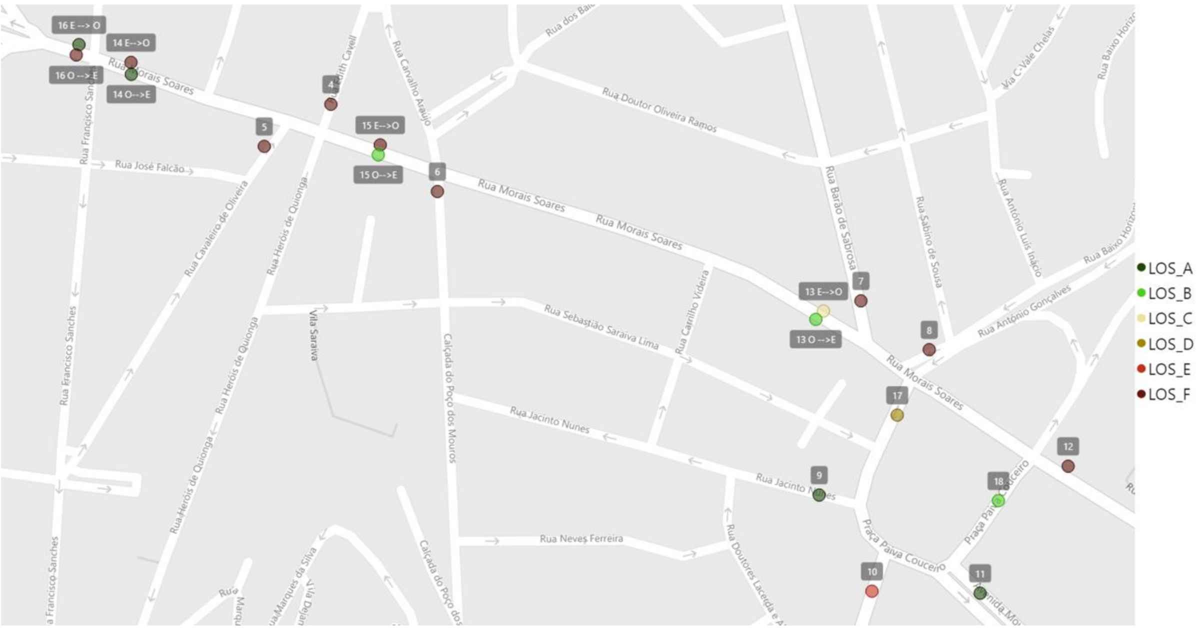


Figure 138. Vehicles' level of service, Scenario 3, PM Peak

Concerning pedestrian activities, since the sidewalks in this solution are larger, consequently, the level of service is also generally better in almost all section being the worst LOS the level D in the southern side of Rua Morais Soares.

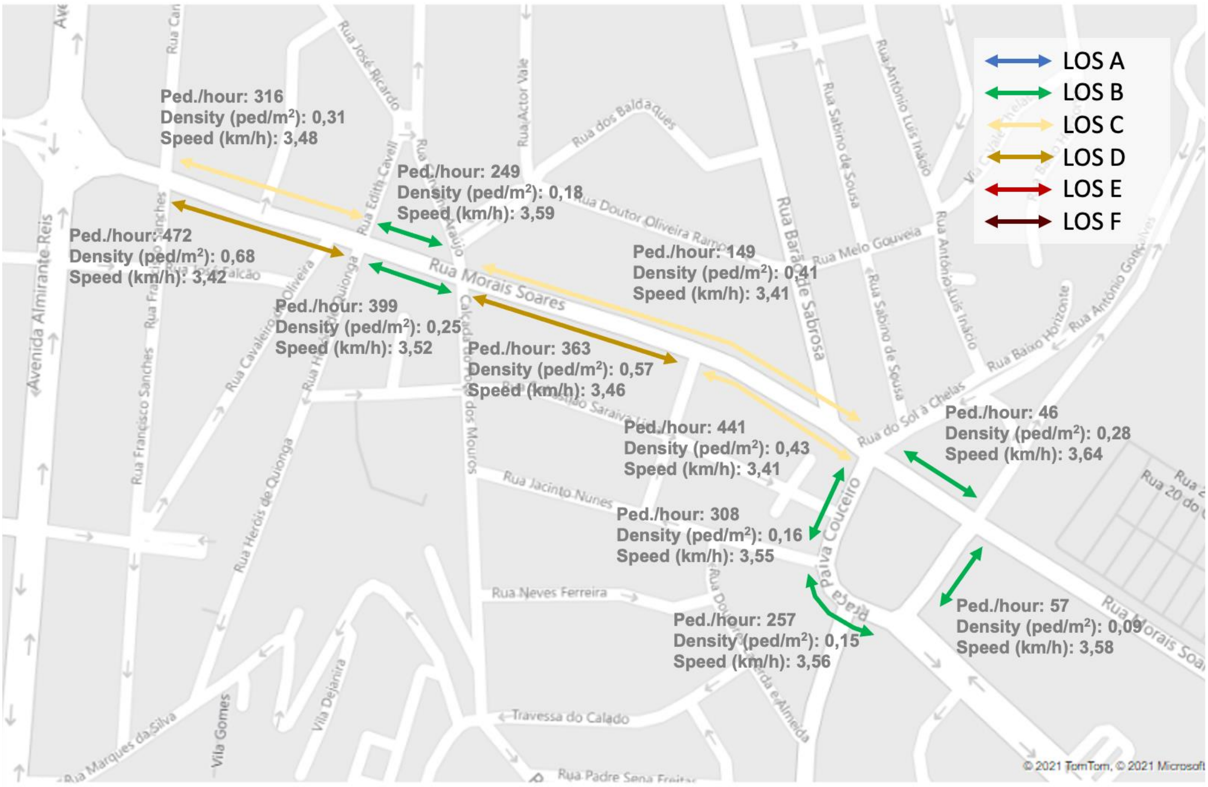


Figure 139. Pedestrian's characteristics and level of service, Scenario 3, PM Peak

Scenario 3, despite implementing an infrastructure that could promote the use of active modes, shows clear capacity problems in general traffic lanes which would lead to severe congestion situations, with clear jeopardy for public transport movements, especially at AM Peak period. Considering current cycle demand, it doesn't seem to justify the installation of a dedicated cycle lane in this street.

Regarding pedestrian movements, despite a visible improvement when compared with current situation, the proposed design doesn't consider large areas that could promote street activities or install urban equipment. In this scenario, a pedestrian refuge of 80 cm between both general lanes is considered which could be used not only to supports street crossing but also to plant greenery along the road.

4.5.6 Scenario 4

The design proposed for the scenario 4 has the intention of answering to the outputs from the previous scenarios. The new design aims to fit the section's capacity to the demand of the different transport modes, giving priority, essentially to public transport and pedestrians. The new design, through a new parking scheme, provides more space to implement greenery and some urban equipment, like terraces and benches.

- Traffic lanes: Most of the road will have one lane for general traffic in each way and a bus lane in the east to west direction. In the west section, near Praça do Chile (East to West) and in the east section, near Praça Paiva Couceiro (West to East) the number of lanes increase the help the traffic flow in both intersections.
- Parking: Parallel parking changed to diagonal parking and parking bays' location are interspersed along the road, which allows to provide parking in both sides, implement large sidewalks area and more places to install greenery or equipment. However, the number of parking spaces reduces 20% to 95 places.
- Kerbside: The sidewalks' width significantly increases and several areas along the section are created to increase places to use the street like terraces, benches, greenery.

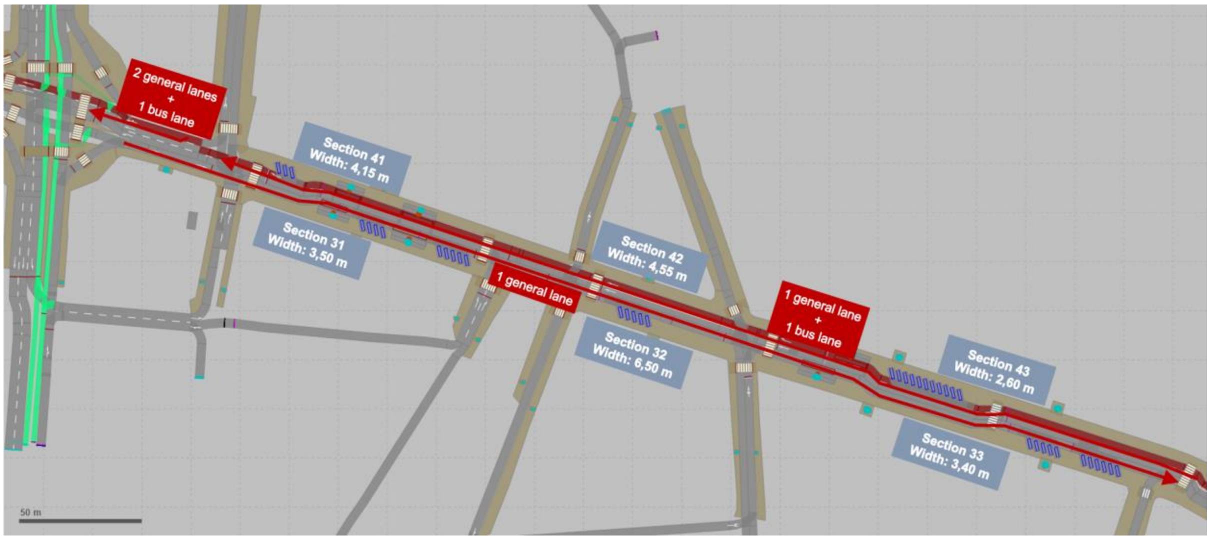


Figure 140. Section's characteristics, Scenario 4

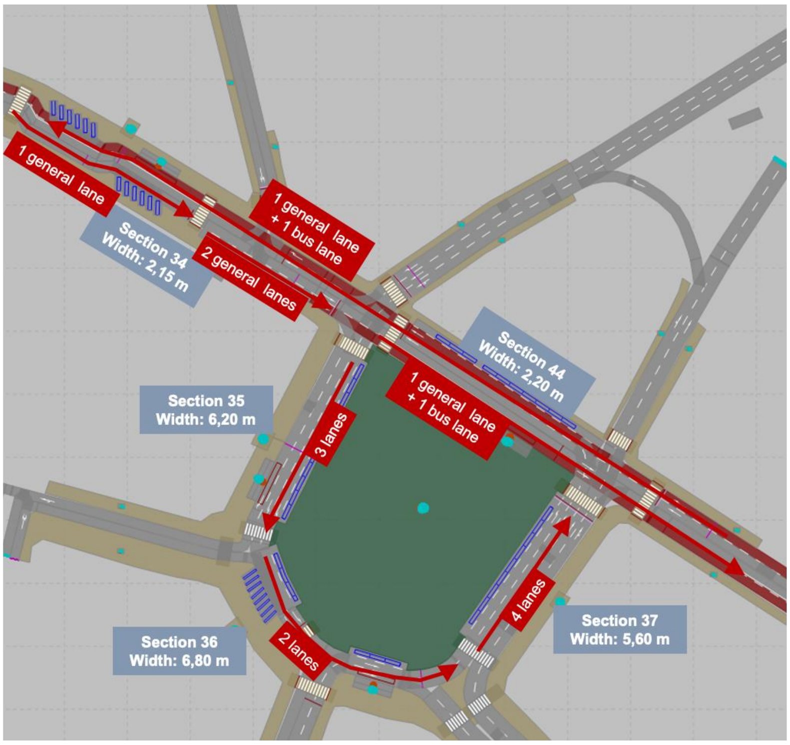


Figure 141. Section's characteristics, Scenario 4

Considering the new design, the software's outputs will be presented, considering PM peak period[6].

During PM Peak, in the east to west direction a slight reduction of between 80 and 100 vehicles is noted, although in the opposite direction there is an increase between 60 to 80 vehicles, so the problems in both time periods are very similar.

In this scenario, during PM peak period, as well as in the AM Peak, from east to west the highest congestion situations are located in the intersection with Praça do Chile as it may be seen in Figure 142 and Figure 143. However, in Rua Morais Soares, there aren't very significant delays, comparing with the base scenario, and the bus circulation is clearly improved.

[6] AM Peak period analysis: Appendix 4

Figure 142. Simulation, Rua Morais Soares near Praça do Chile, Scenario 4, PM Peak

Figure 143. Simulation, Rua Morais Soares near Praça do Chile, Scenario 4, PM Peak

In the inverse direction, despite a slight increment in traffic, there are not congestion situations and the traffic flows without significant constraints, as it may be seen in the following two figures. However, despite a good condition for the traffic flows, along the section there are long queue lines.

Figure 144. Simulation, Rua Morais Soares near Praça Paiva Couceiro, Scenario 4, PM Peak

Figure 145. Simulation, Rua Morais Soares near Praça Paiva Couceiro, Scenario 4, PM Peak

Considering the nodes' indicators, this solution, from east to west answers to the vehicle demand, maintaining two lanes, but segregating general traffic from bus movements. In this way, the traffic flow is similar, remaining with few differences about delay time and number of stops. In the inverse direction, reducing the number of lanes to only one, there isn't any significant difference regarding the number of movements and despite a slight increase of the delay time and in the average number of stops by vehicle, the level of service remains very acceptable for the traffic flow.

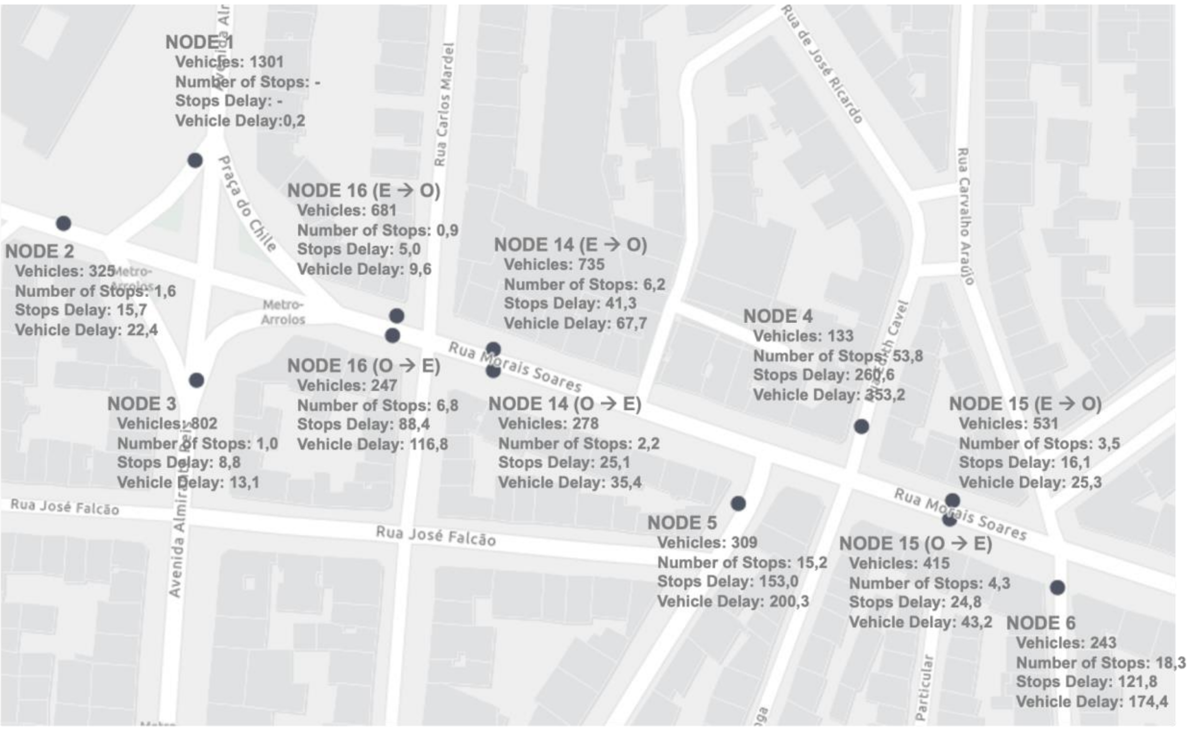


Figure 146. Nodes' results, Scenario 4, PM Peak, Section 1

In Praça Paiva Couceiro, the indicators are very similar between this solution and the current situation.

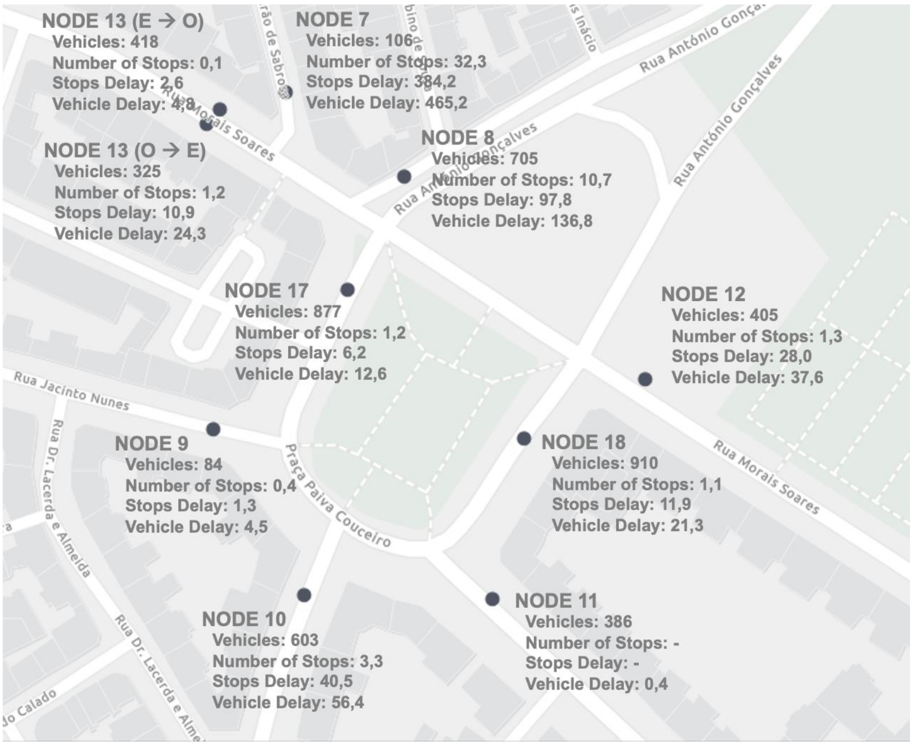


Figure 147. Nodes' results, Scenario 4, PM Peak, Section 2

From east to west, it is expected to have a larger queue length near the intersection with Av. Almirante Reis, but without significance. In the inverse direction, the queue length increased near the intersection between Rua Morais Soares and Calçada Poço dos Mouros (QC8) but, in general, there are not large differences comparing with the current situation.

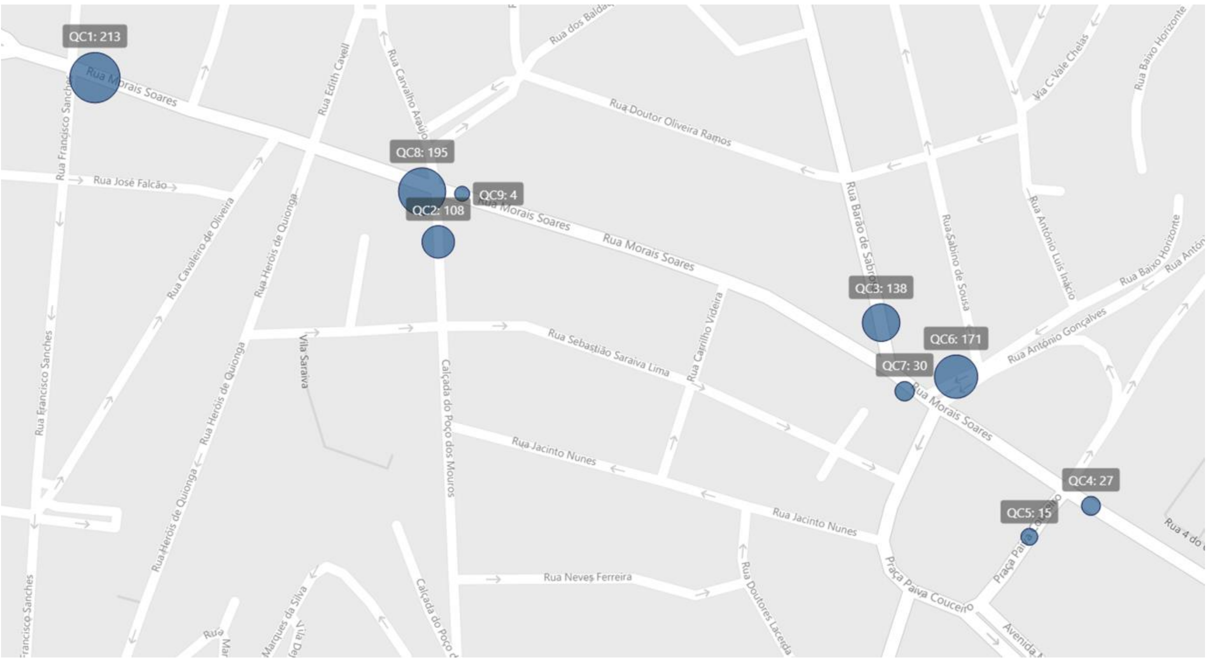


Figure 148. Average queue length (m), Scenario 4, PM Peak

As it may be seen in Figure 149, from east to west the level of service is good or even very good, except near the intersection with Av. Almirante Reis where there are some congestion situations and the provided level of service is “E”, which is, in fact, better that current situation. In the opposite direction, the level of service is worse, but, even so, it still offers a reasonable flow capacity, being at level C in most of the street, except in a small section, before Calçada Poço dos Mouros, where it is level “D”.

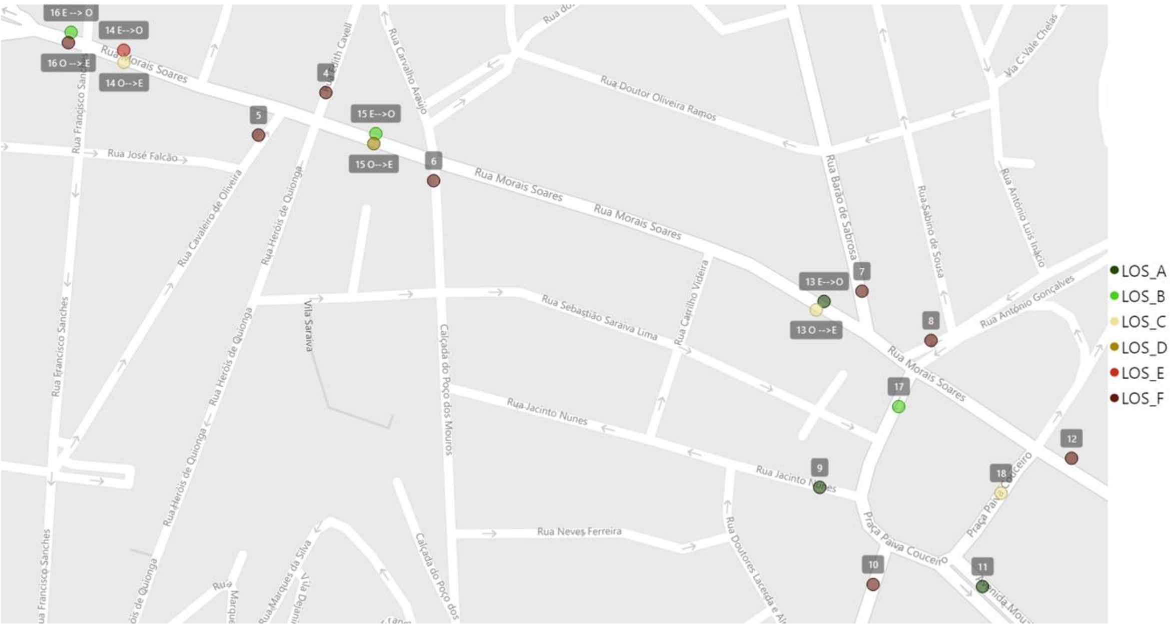


Figure 149. Vehicles' level of service, Scenario 4, PM Peak

Considering pedestrian movements for PM Peak, as well as in the AM Peak, almost all sections present a level of service at C or above, except in sections near Avenida Almirante Reis, where, during peak time, it has a high affluence of pedestrians. However, this proposal clearly brings better conditions for pedestrian activities, not only for their movements, but also providing enough space to install some urban equipment and greenery.

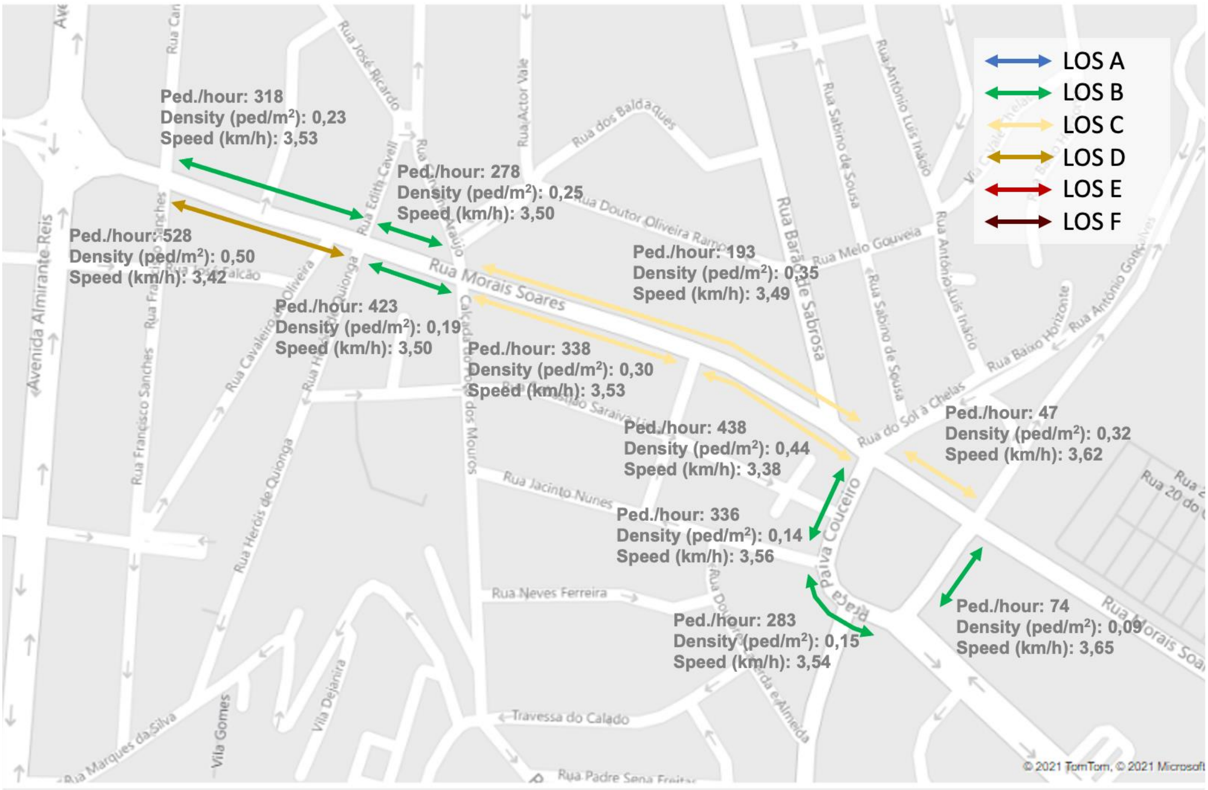


Figure 150. Pedestrian's characteristics and level of service, Scenario 4, PM Peak

Scenario 4, in terms of traffic flow, tried to summarize the conclusions provided by the simulation of the other scenarios, considering their major strengths and weaknesses. In this scenario, from east to west the number of lanes remain the same, however, a segregation between general traffic and bus movements was implemented, despite some right turns and parking still being allowed. In the opposite direction, only one lane was kept, which seems enough to efficiently answer to the existing traffic movements, even with general traffic and buses sharing the same space. It is expected that this solution will lead to lower traffic speed, improving the conditions to use some active modes, despite not being the ideal solution for this kind of transport mode. According with the model's outputs, the buses' time of travel don't suffer relevant delays.

This solution conceives a reduction of 20% of parking spaces, but the change from parallel to diagonal parking in staggered sections will enable a very significant increase in the pedestrian area, not only to provide better conditions to their movements, but will also provide larger areas to install equipment and greenery that may contribute to improve the street's quality.

4.5.7 Analysis between scenarios

In this chapter an analysis between the developed scenario will be made, which will enable to compare the impacts of each one of them will have in the network. The analysed parameters are:

- Vehicle travel time
- Delay
- Number of vehicles
- Queue length
- Pedestrian level of service
- Air quality

In terms of vehicle travel time, the analysis focuses in the two different directions, since traffic movements from east to west are much higher than in the inverse direction. Considering car movements, starting at the west side of the street, it may be seen that the reduction of number of lanes won't have a significant impact on travel times and, sometimes, it can even benefit traffic flow, since many times, double parking leads to higher travelling times. According with the suggested scenarios, the adoption of a bus lane had even reduced time of travel in all routes, however, time of travel is very similar between all routes, except in route number 8 that needs to do a U-turn in Praça Paiva Couceiro.

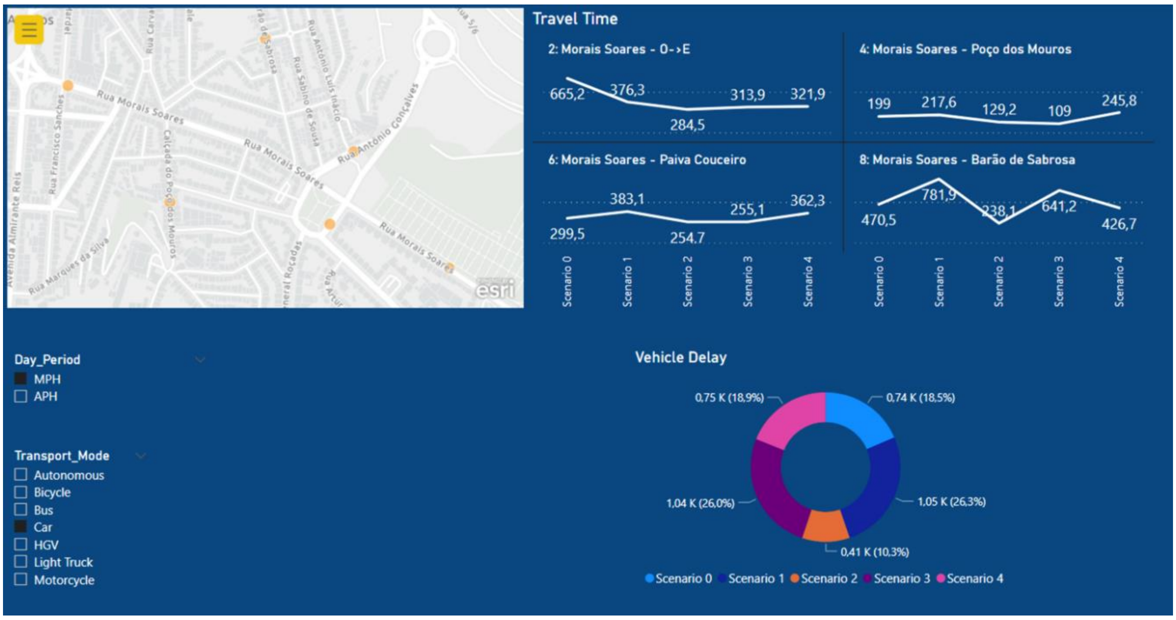


Figure 151. Number of vehicles and travel time by scenario for movements starting in the west side of Rua Morais Soares, Car, AM Peak

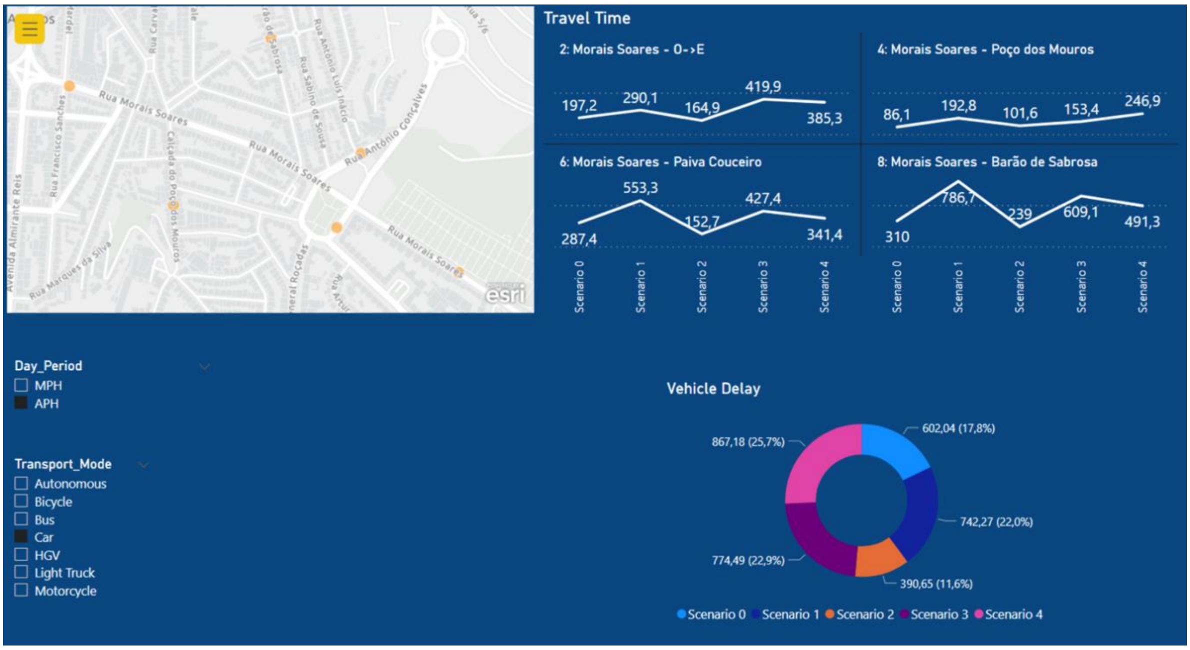


Figure 152. Number of vehicles and travel time by scenario for movements starting in the west side of Rua Morais Soares, Car, PM Peak

In the opposite direction, from east to west, the time of travel is very different between scenarios, since scenario 0 and scenario 2 (bus lanes) are much more efficient than the other two scenarios, with less travel times and less delays. This analysis allows the conclusion that one lane may not be enough to respect current demand, especially if buses and cars share the same space.

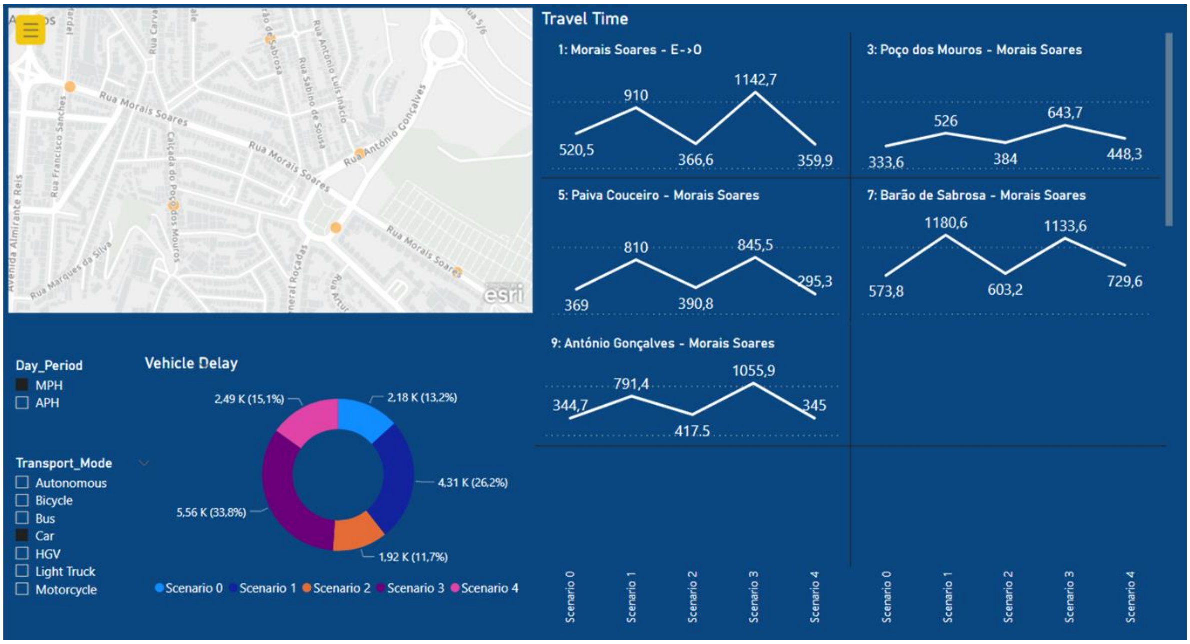


Figure 153. Number of vehicles and travel time by scenario for movements going in direction of the west side of Rua Morais Soares, Car, AM Peak

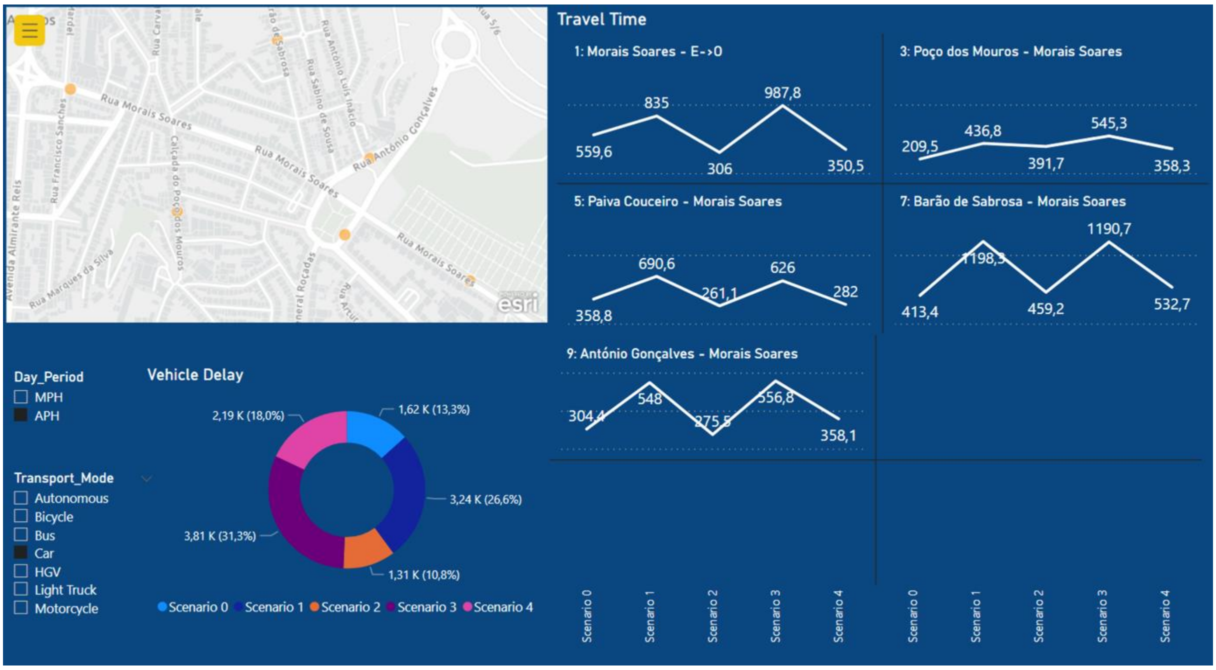


Figure 154. Number of vehicles and travel time by scenario for movements going in direction of the west side of Rua Morais Soares, Car, PM Peak

Considering that the bus circulation has a big impact in the traffic circulation and Rua Morais Soares performs such an important connection in the public transport network, a detailed analysis about the impact of each scenario in the bus travel time was made. Similarly, as the example above, despite the bus circulation slightly benefits of a segregated lane, there aren't significant upgrades in the network that justifies maintaining one lane, only for bus circulation.

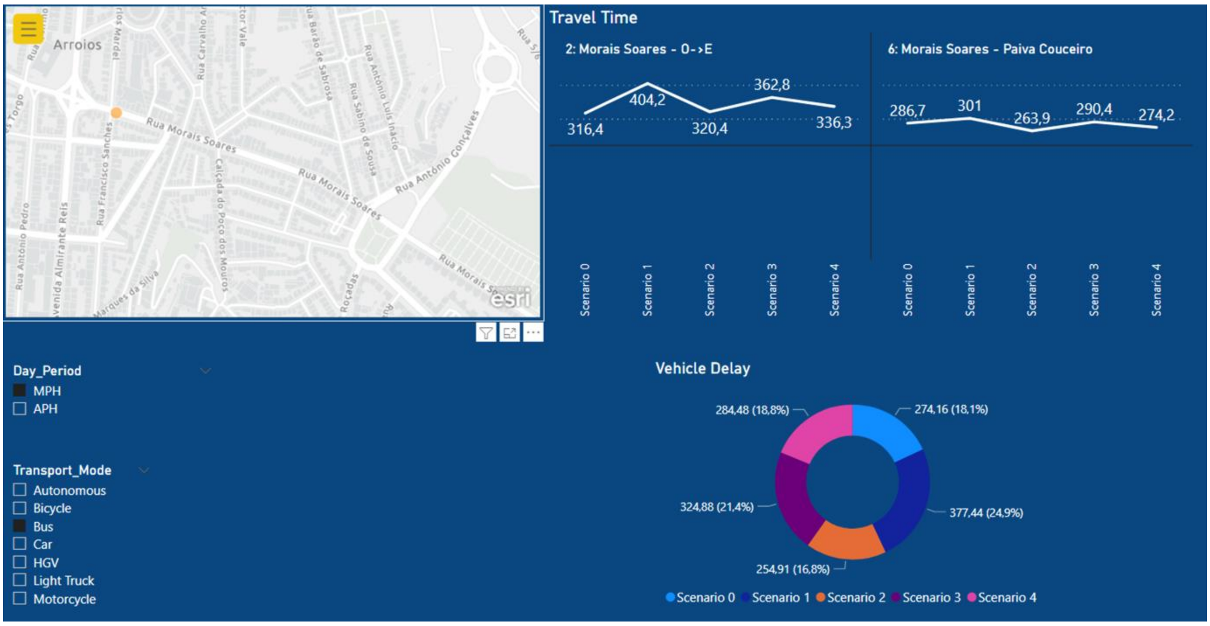


Figure 155. Number of vehicles and travel time by scenario for movements starting in the west side of Rua Morais Soares, Bus, AM Peak

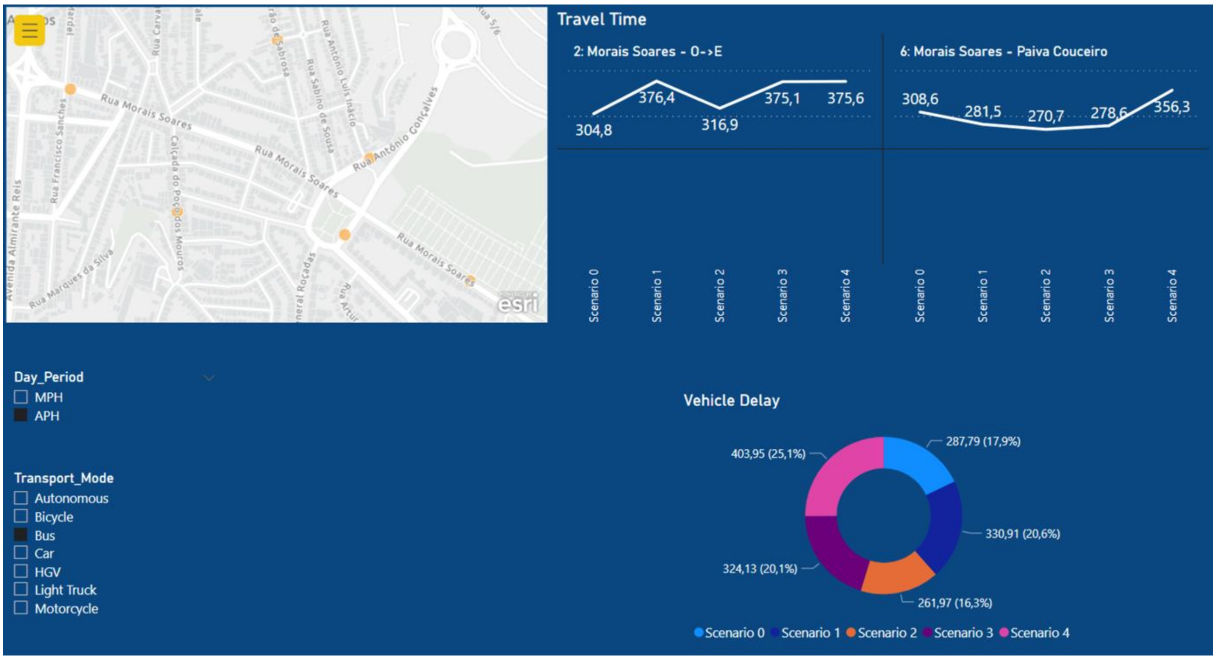


Figure 156. Number of vehicles and travel time by scenario for movements starting in the west side of Rua Morais Soares, Bus, PM Peak

In the opposite direction, the bus circulation is really harmed by the reduction in the number of lanes. Scenario 2 offers clear advantages to bus movements and, on the contrary, scenarios 1 and 3 have much higher travel times and delay times.

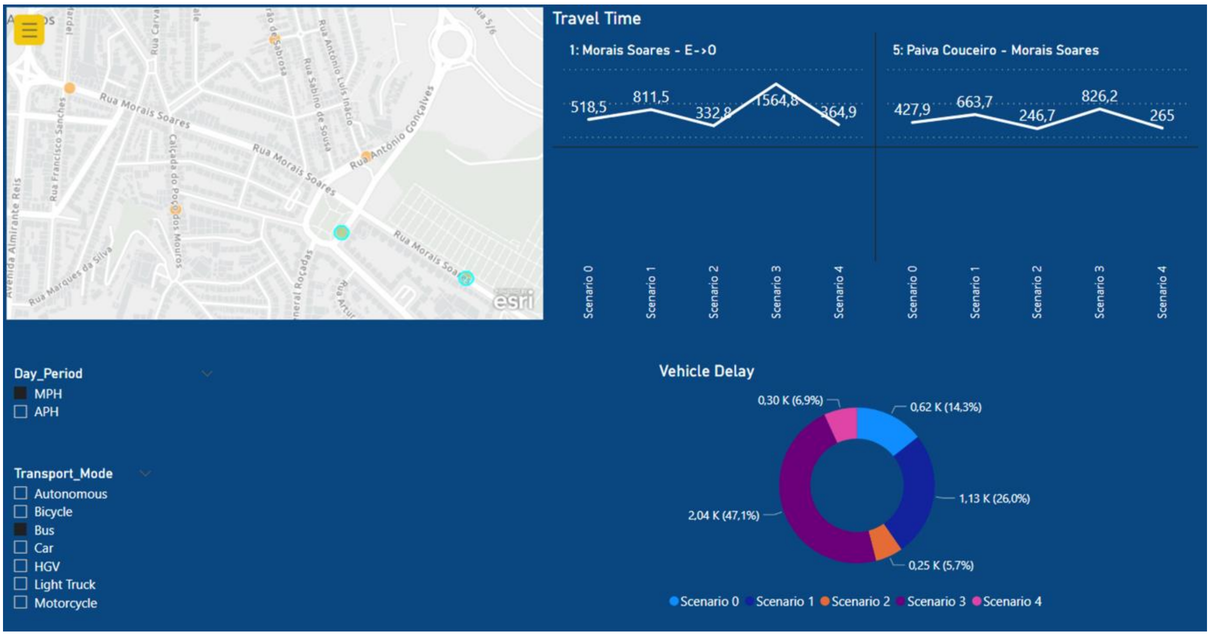


Figure 157. Number of vehicles and travel time by scenario for movements going in direction of the west side of Rua Morais Soares, Bus, AM Peak

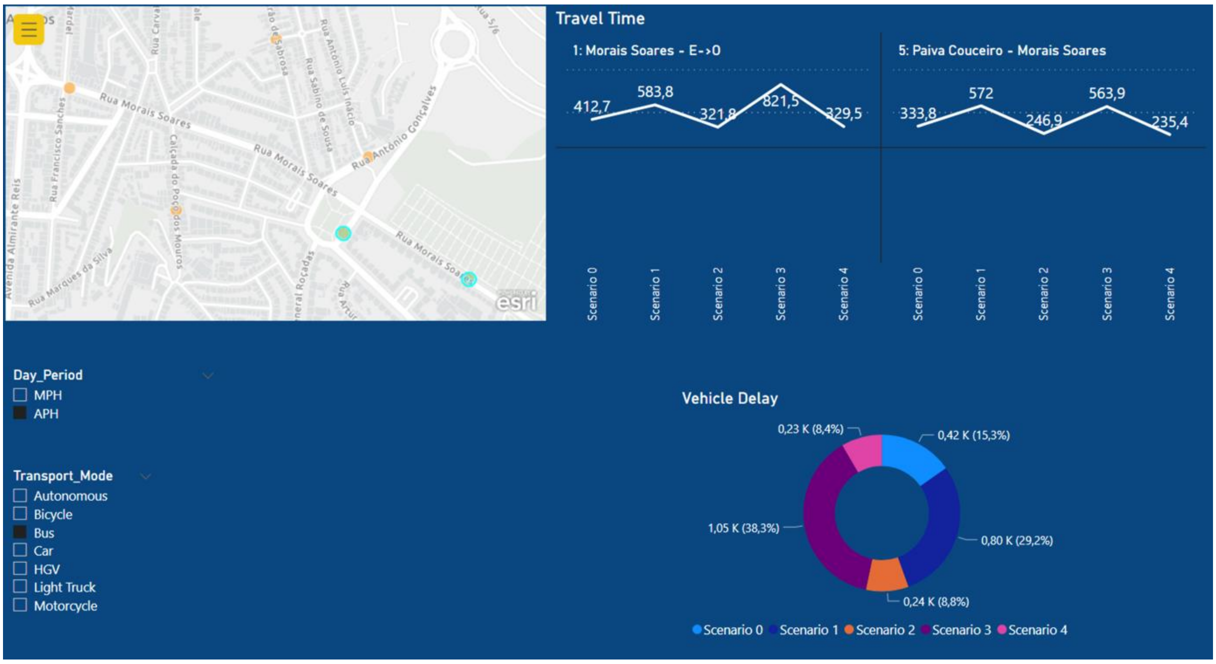


Figure 158. Number of vehicles and travel time by scenario for movements going in direction of the west side of Rua Morais Soares, Bus, PM Peak

Regarding queue lengths, scenario 3 and 1 foresee longer queue lines than in the other scenarios, especially in in the east to west direction, in queue counters 1 and 9. In the inverse direction (queue counters 7 and 8), the queue length values are more similar between scenarios. This tendency repeats both in AM and Peak, since despite during PM Peak the difference between both directions is not so pronounced, the east to west direction remains with higher traffic volumes.

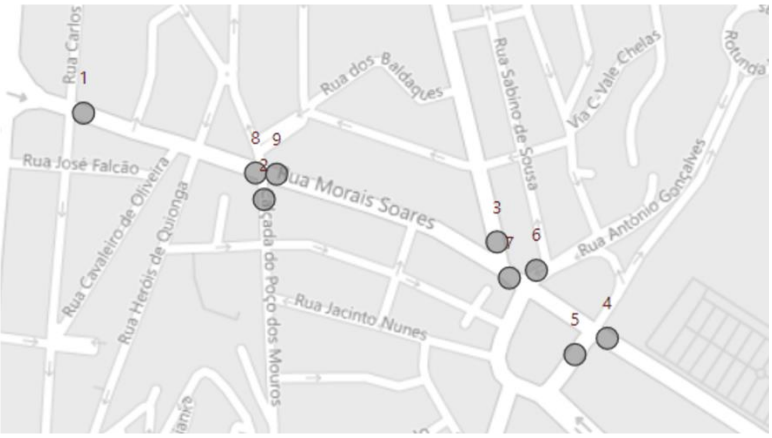


Figure 159. Location of the queue counters

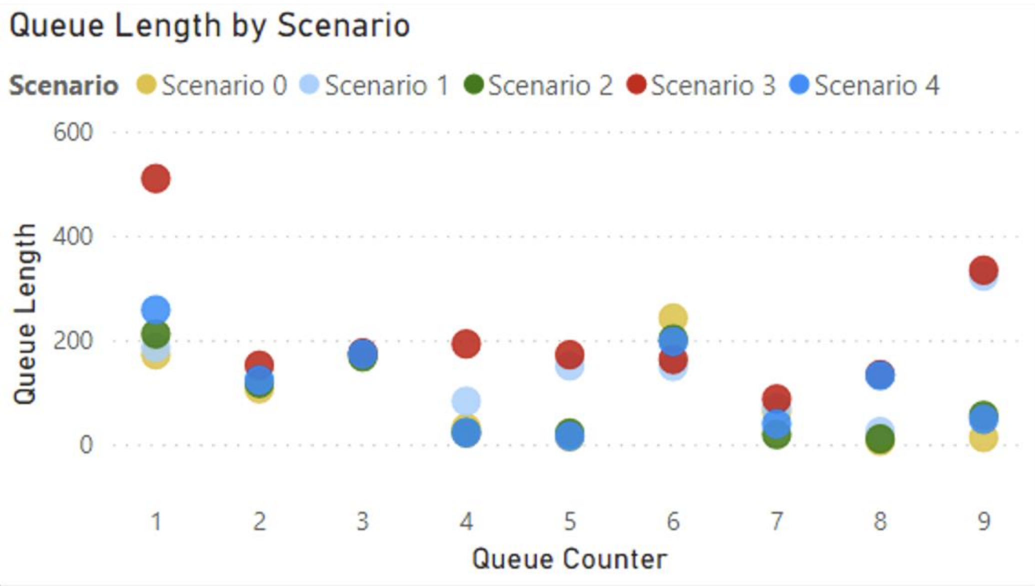


Figure 160. Queue length by scenario and queue counter, AM Peak

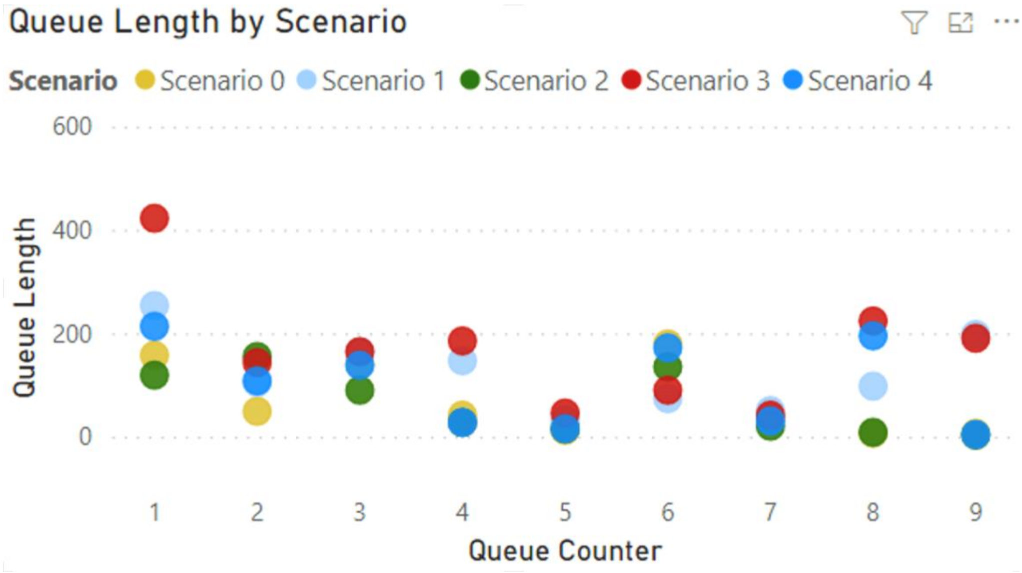


Figure 161. Queue length by scenario and queue counter, PM Peak

Another measurement used is the number of vehicles, as it supports the analysis if the new designs are able to respect the demand. As well as the above-mentioned analysis, the number of vehicles in scenario 1, and especially in scenario 3, in the east to west direction are much less than the other three scenarios, which may be explained by the expected queue lines in these two scenarios, that don’t allow to have a fluid traffic flow.

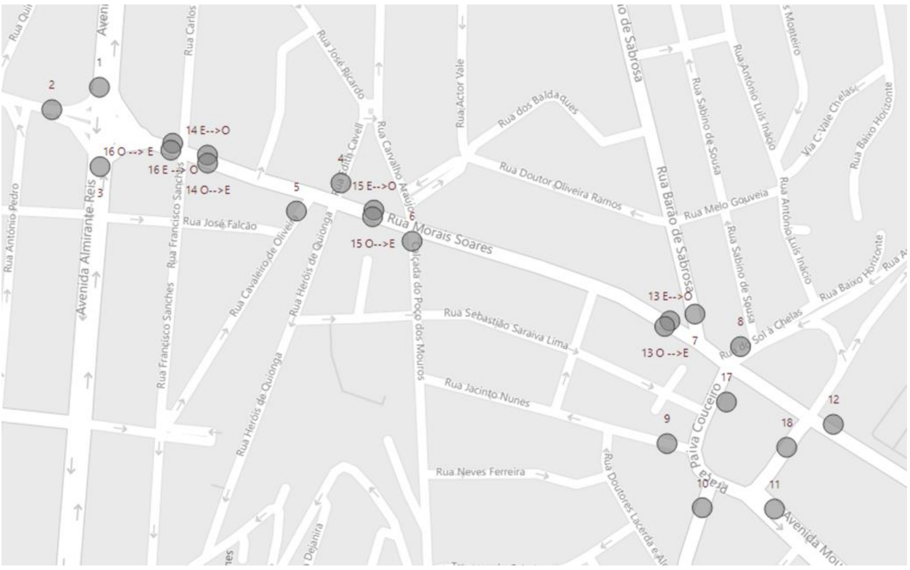


Figure 162. Location of the nodes used for analysis

Looking at the number of vehicles, taking as example, the nodes placed along Rua Morais Soares (nodes 13, 14, 15 and 16) from east to west, scenario 1 and 3 are usually below the other scenarios which can indicate a capacity constraint.

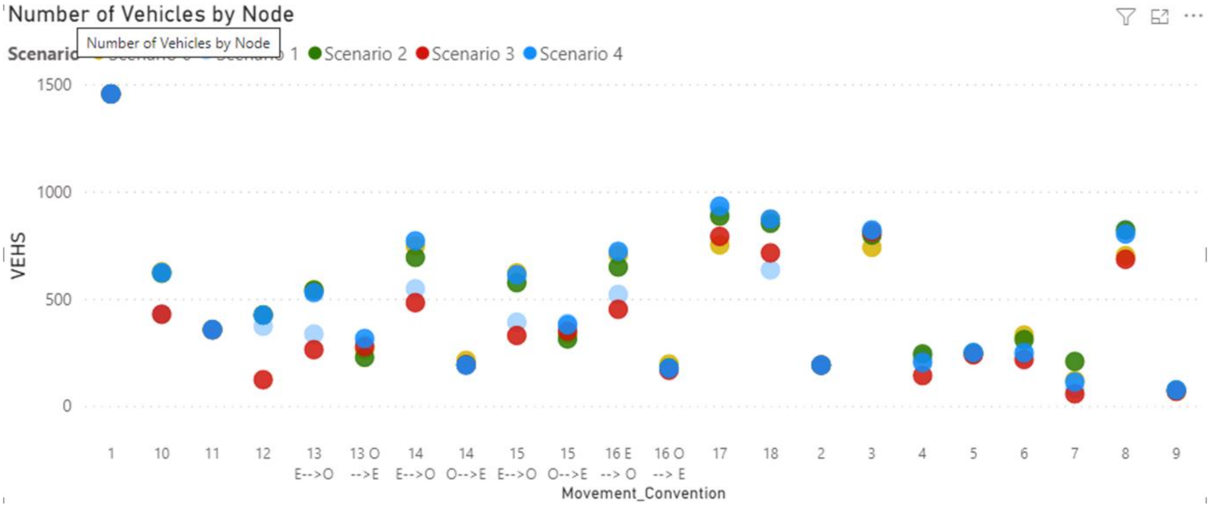


Figure 163. Number of Vehicles by scenario, by node, AM Peak

Regarding PM Peak, the same tendency, in the same direction, repeats, however with less differences between scenarios than in the other time period.

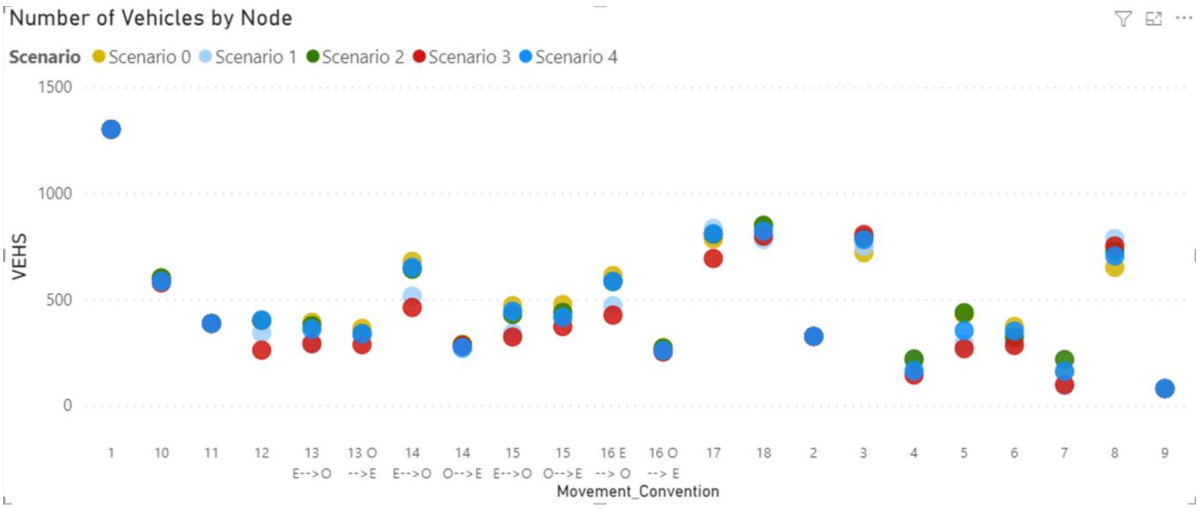


Figure 164. Number of Vehicles by scenario, by node, PM Peak

Regarding air quality, Figure 165 shows the sum of emissions measured in each node, using the values resulted by PTV concerning CO (monoxide), NO_x (nitrogen oxides) and VOC (Volatile organic compounds). In AM Peak period Scenarios 0, 2 and 4 are very balanced, even with less air emission in scenario 3. Scenario 1, and in a lower scale scenario 3, have much higher values which should be explained by the congestion occurrences.

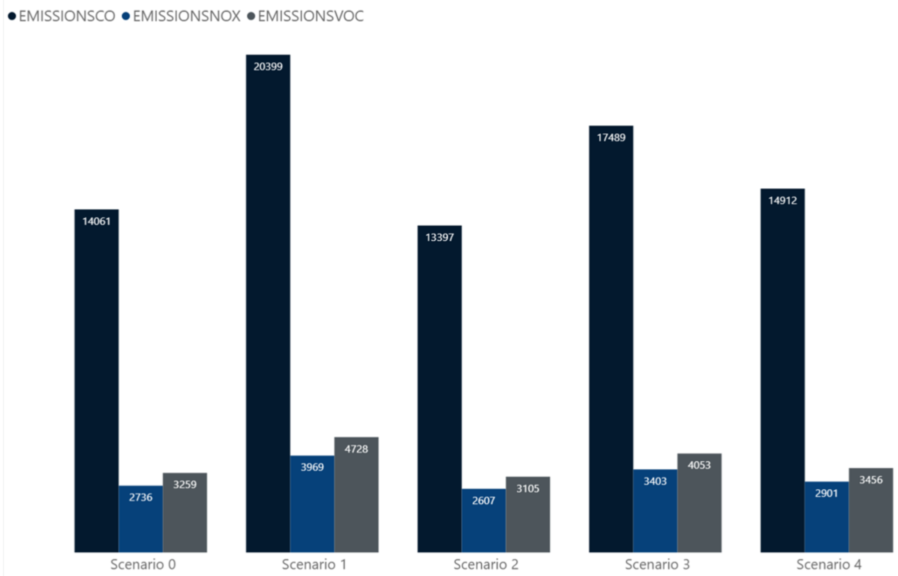


Figure 165. Emissions value by scenario and type of emissions, AM Peak

During PM Peak, similar results are expected to happen.

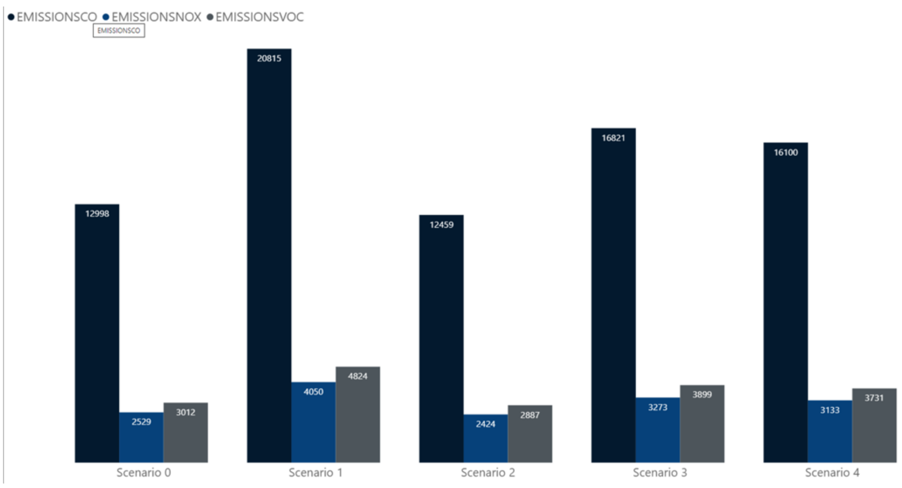


Figure 166. Emissions value by scenario and type of emissions, PM Peak

Concerning the pedestrian movement level of service, Scenario 4, since higher width enlargement were proposed, presents the best level of services than other scenarios, presenting a level C or above in almost all sections in both time periods. One of the main advantages in scenario 4 is the existence of some areas along the street that could allow for the installation of some equipment that could promote the use of street, like trees and greenery and even some terraces and places to stay and rest.

Figure 167. Pedestrian level of service for all scenarios, AM Peak

Figure 168. Pedestrian level of service for all scenarios, PM Peak

In the following table a summary of the advantages and disadvantages of each scenario's street design, as well as of the current situation, is shown. The list of advantages and disadvantages comes from the observation of the model and the quantification of its outputs.

Table 25. List of each scenario's main advantages and disadvantages

Current situation
Advantages: <u>Traffic movements</u>: Low or non-existence of congestion problems in both directions. <u>Parking</u>:

<table>
<tr><td colspan="2">Easy to park and leave the parking spaces, traffic in each lane is not high

Disadvantages:

<u>Traffic movements</u>:

Right lanes are commonly used as double parking

High capacity for the demand invites to drive at higher speeds.

Dangerous to use the lanes with active modes

Buses have to overpass several parked cars, reducing their time of travel and causing delays.

<u>Pedestrians:</u>

Very narrow sidewalks, without public equipment that could promote the street use.

Lack of greenery and shadows</td></tr>
<tr><th>Scenario 1 – Precedence to parking</th><th>Scenario 2 - Precedence to public transport</th></tr>
<tr><td>Advantages:

<u>Traffic movements</u>:

Lower traffic speed.

Double parking should disappear

Adjustment of the road capacity, from west to east, to demand needs.

<u>Parking</u>:

Increase access for those reliant on parking spaces

<u>Pedestrians:</u>

Slight sidewalks’ enlargement

Diagonal parking creates a sense of distance from sidewalks and building to the traffic lanes.</td><td>Advantages:

<u>Traffic movements</u>:

Lower traffic speed, due to the increase of traffic in the general lanes

Public transport is benefited with better conditions to circulate, assuming there isn’t double parking in the bus lanes.

The existence of a bus lane is less harmful to general traffic flow than double parking.

<u>Parking</u>:

Parking remains with the same number of places

Disadvantages:

<u>Traffic movements</u>:</td></tr>
</table>

Disadvantages: Traffic movements: Public transport operation is clearly jeopardized with much higher travel times. Long queue lines and congestion situations along the road, especially from east to west direction. Perpendicular streets have difficulties to pass the vehicles into the main street. Worse air quality due to congestion situations Parking: Pedestrians: Sidewalks' enlargement is not that significative, and it still offers low quality service in several sections. Lack of places to stay, rest and use the street. Lack of greenery and shadows.	Medium queue lines near the intersection with Av. Almirante Reis. Right turns and parking is still allowed which may create some constraints into bus circulation. In some periods, due to less bus headway times, the bus lanes may be an ineffective use of space, especially in the west to east direction, where the traffic volume doesn't seem to justify the implementation of a bus lane. Parking: To park the car is necessary to invade bus lanes. Pedestrians: No change at the sidewalks' quality and width
Scenario 3 - Precedence to cycle lanes	Scenario 4 - Precedence to pedestrians, public transport and greenery
Advantages: Traffic movements: Lower traffic speed, due to the increase of traffic in the general lanes Promotion of the use of active modes. Adjustment of the road capacity, from west to east, to demand needs.	**Advantages:** Traffic movements: Lower traffic speed, due to the increase of traffic in the general lanes and the creation of diagonal parking. Public transport is benefited with better conditions to circulate, assuming there isn't double parking on bus lane.

<u>Parking</u>: Parking remains with the same number of places. <u>Pedestrians:</u> Significative sidewalks' enlargement and visible level of service improvement. Existence of a pedestrian refuge between both general traffic lanes, which could be friendly to cross the street and useful to plant trees. **Disadvantages:** <u>Traffic movements</u>: Public transport operation is clearly jeopardized with much higher travel times. Long queue lines and congestion situations along the road, especially from east to west direction. Insufficient road capacity for the traffic demand. Perpendicular streets have difficulties to pass the vehicles into the main street. Worse air quality due to congestion situations. Existence of several right turns which may be dangerous for cycle lane users. <u>Pedestrians:</u> Lack of places to stay, rest and use the street.	Adjustment of the road capacity, from west to east, to demand needs. <u>Pedestrians:</u> Significative sidewalks' enlargement and visible level of service improvement. Creation of large areas that could be used to promote street activities, install places to stay and rest or plant trees and greenery. Diagonal parking creates a sense of distance from sidewalks and building to the traffic lanes. **Disadvantages:** <u>Traffic movements</u>: Medium queue lines and congestion situations along the road, especially from east to west direction. Right turns and parking is still allowed which may create some constraints into bus circulation. <u>Parking:</u> Increase of pedestrian areas oblige to reduce number of parking spaces (20%). Take the car out from diagonal parking space may be dangerous. To park the car is necessary to invade bus lane.

Despite the possible existence of trees along the middle of road, the sidewalks remain without greenery	

4.5.8 New design for Praça Paiva Couceiro

Besides the proposal of new designs for Rua Morais Soares, there is an intention of Lisbon Municipality to create a continuity between Praça Paiva Couceiro and its western side, avoiding crossing the large street that create a sensation of staying in an island besides being zones of potential sinistrality, giving the high speeds and, sometimes, the low visibility in some walking crosses, besides being a zone used by elderly people.

Figure 169 shows current square's design where is possible to see it is surrounded by large one way roads, with high traffic volumes and speed. However, in contrast with Rua Morais Soares, the sidewalks are very large, despite not having such an economic and social diversity as the street.

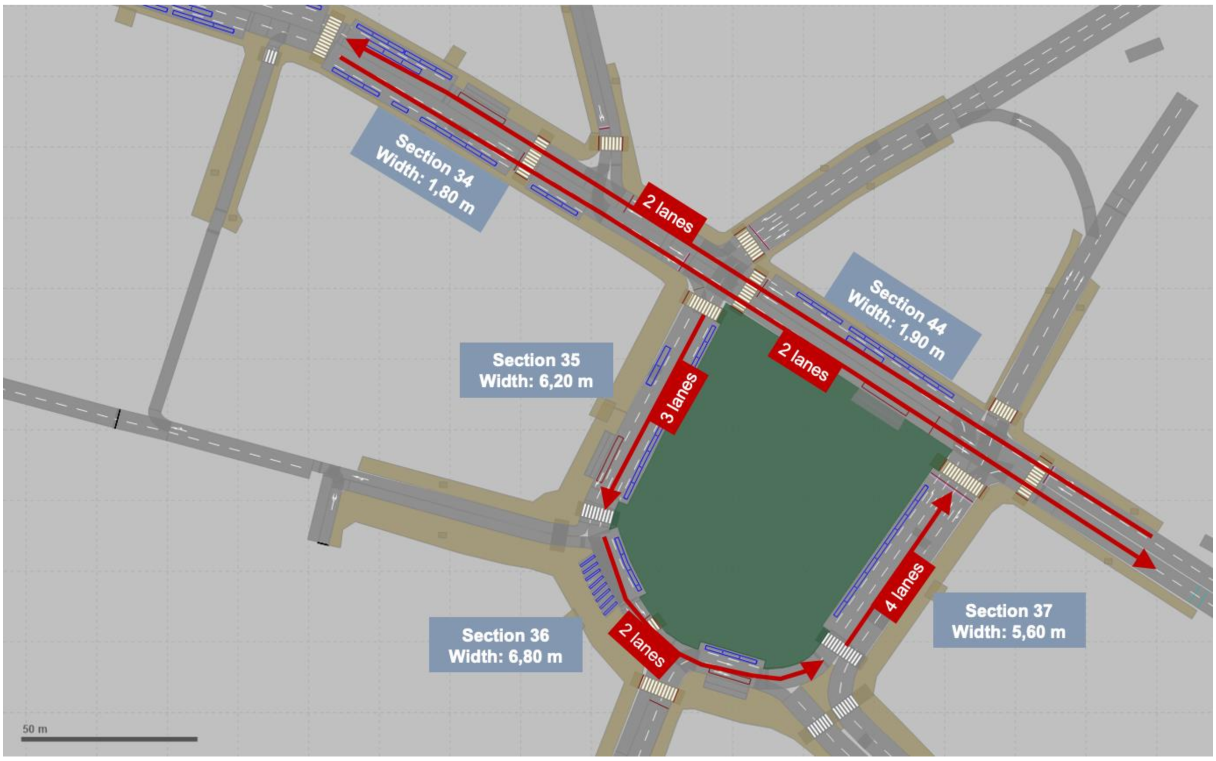


Figure 169. Praça Paiva Couceiro, current situation

 Version: 3

To create a continuity between the central zone of the square and its western side it is needed to remove the lanes but creating conditions to access to the perpendicular streets, a local street in the western side and important connectors between the city centre and the surroundings in the square's southern and eastern sides.

Besides an important node, between main roads, the square is also used as a roundabout, mainly by the movements coming from Rua Morais Soares that wish to return or turn into the northern side of the street, since left turns are forbidden along the street.

Considering these limitations, a new configuration of the traffic flows is projected, transforming current one-way road into a two ways one, with 2 lanes in each side, proposing new left turns, that will be done through the support of new traffic lights or a new configuration of an existing one. In the case of access to the local street there is no need of traffic lights since there isn't any conflict area. It is also proposed a diagonal parking in the eastern side of the square.

Figure 170 shows Praça Paiva Couceiro suggested design, being signalized the promoted changes.

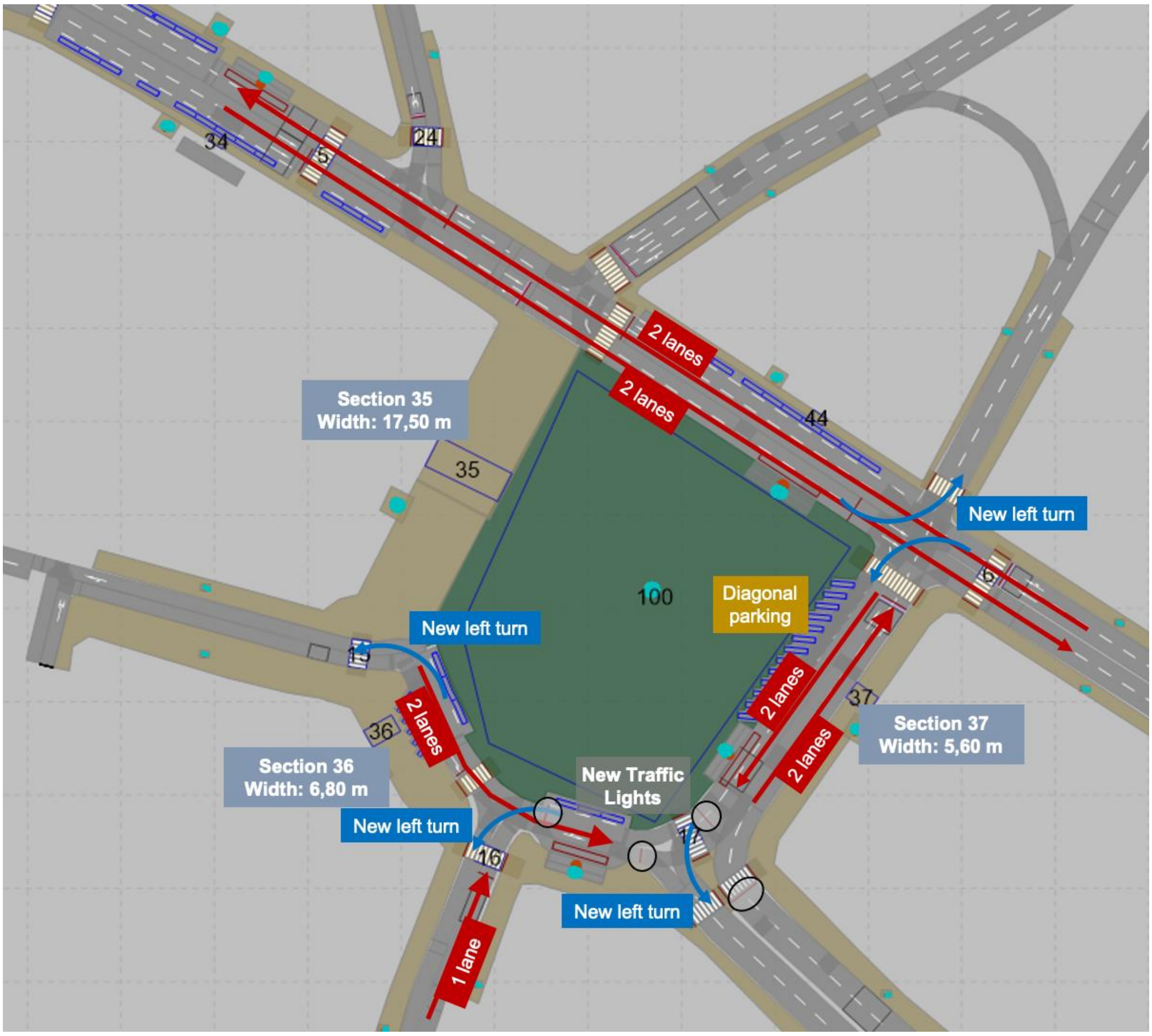


Figure 170. Praça Paiva Couceiro, suggested scenario

The new design, despite offering much more interesting conditions to promote the use of street and improving safety conditions, through lower average speed and the implementation of new traffic lights, also has several traffic flow problems in the square but also in adjacent roads. The new solution leads to congestion situations in the square that in the current scenario don't exist and also aggravate some situations as the new access from Rua Morais Soares, with influence in the northern streets that are not able to pass their vehicles, creating capacity problems in those streets.

The movements coming from the east that have to turn left to access Praça Paiva Couceiro, do not show any considerable congestion situation.

The constraints are very similar in both time periods, being slightly worse during AM Peak.

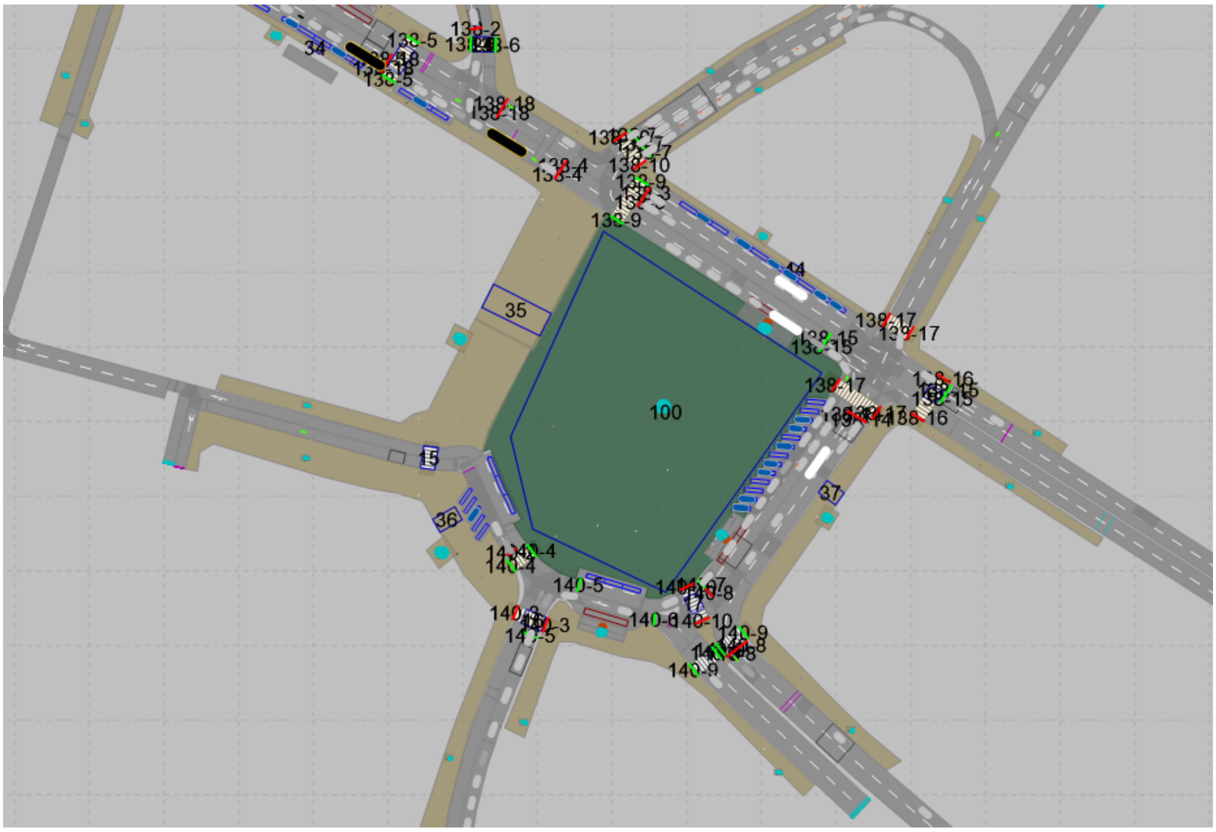


Figure 171. Simulation, Praça Paiva Couceiro, PM Peak

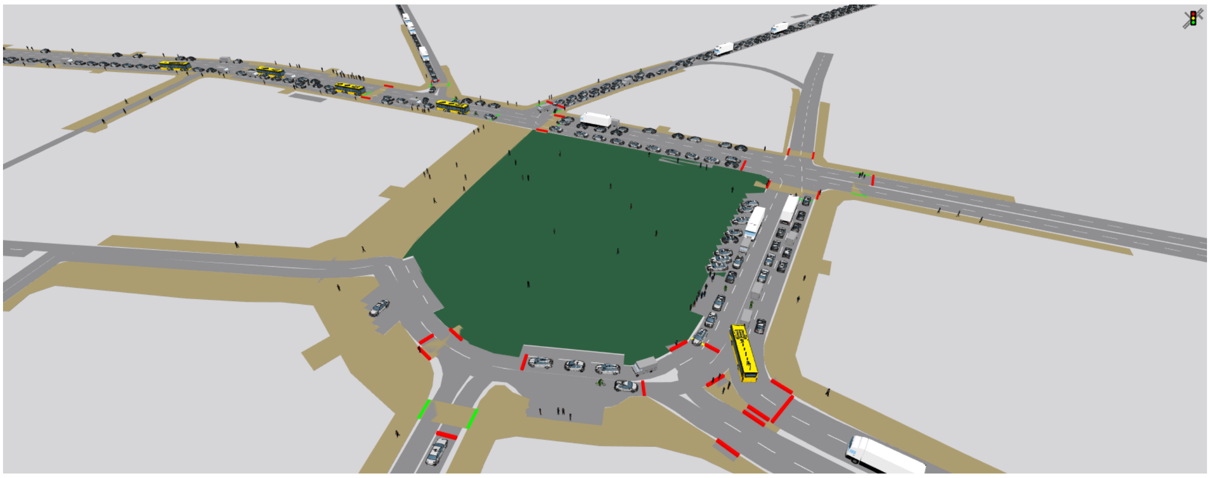


Figure 172. Simulation, Praça Paiva Couceiro, PM Peak

In the following, the results coming from the new design will be analysed for the PM peak period[7].

Concerning nodes' indicators, the proposed solution can't absorb all the vehicles coming from west, since node 17 has less two hundred vehicles than in the current situation. This situation shows that this solution has negative impacts in the streets that feed Praça Paiva Couceiro, mainly in Rua Barão de Sabrosa (Node 7) and Rua António Gonçalves (Node 8) where the capacity clearly declines. In Rua Morais Soares, despite having similar vehicle movements, the number of stops and the delay times increase substantially. Regarding the streets that access directly to Praça Paiva Couceiro, there aren't significant differences, except in Node 10, where there are less one hundred vehicles than current situation.

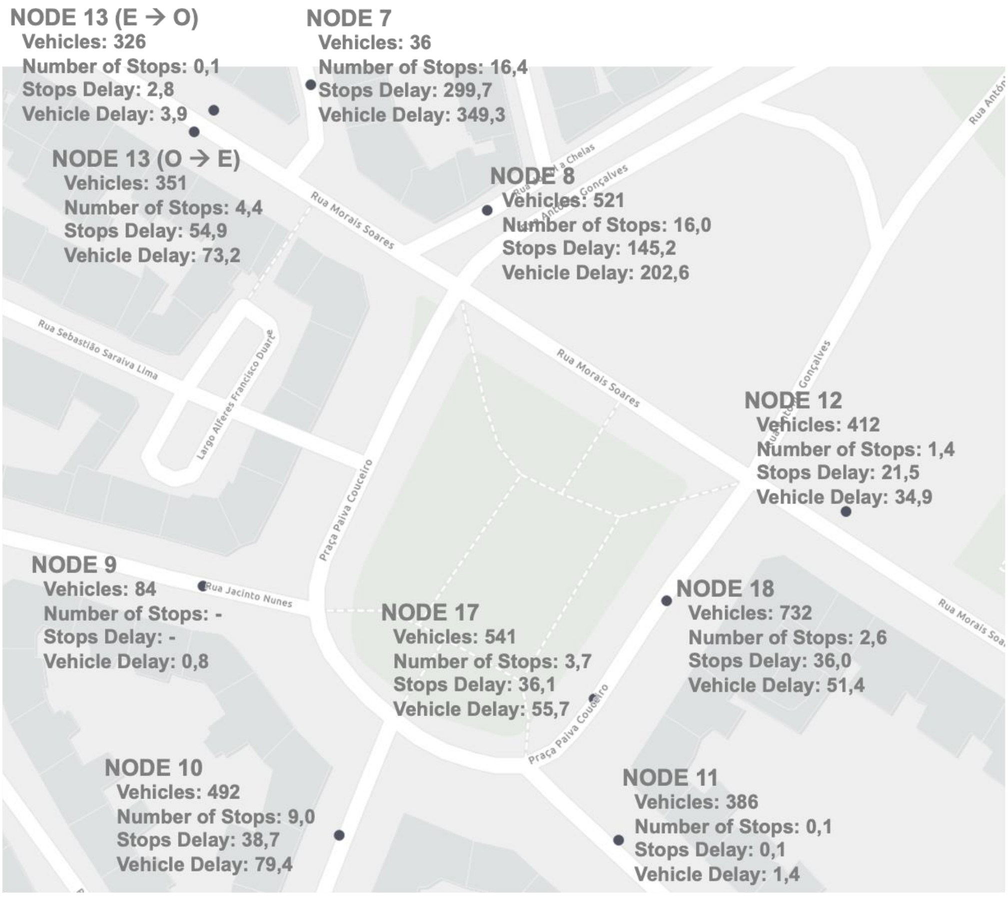


Figure 173. Nodes' results, Scenario Praça Paiva Couceiro, PM Peak

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[7] AM Peak period analysis: Appendix 4

As a consequence of the capacity reduction, as shown in Figure 174, almost all intersections have longer queue lines than in current situation, even on locations where currently there aren't almost congestion situations as in Praça Paiva Couceiro (QC5) but also in Rua Morais Soares (QC7). In the first case the queue line is 130 meters longer and in the second one is 80 meters longer.

Figure 174. Average queue length (m), Scenario Praça Paiva Couceiro, PM Peak

As expected, with this new solution the level of service suffers a huge decline, reducing to Level "F" in almost all the intersections.

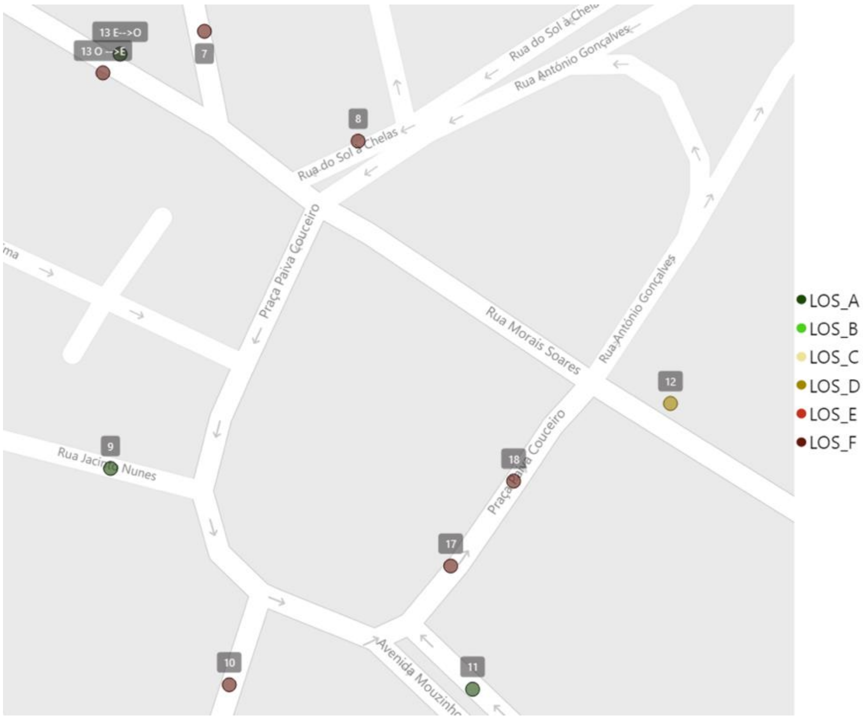


Figure 175. Vehicles' level of service, Scenario Praça Paiva Couceiro, PM Peak

Regarding pedestrian activities, the existing level of service, in terms of movements, were already very good. However, with the suggested proposal it is created a continuity between Rua Morais Soares and Praça Paiva Couceiro, which would increase safety at crossing the street but could also enhance several street activities, contradicting the sense of island surrounded by large roads that exists nowadays.

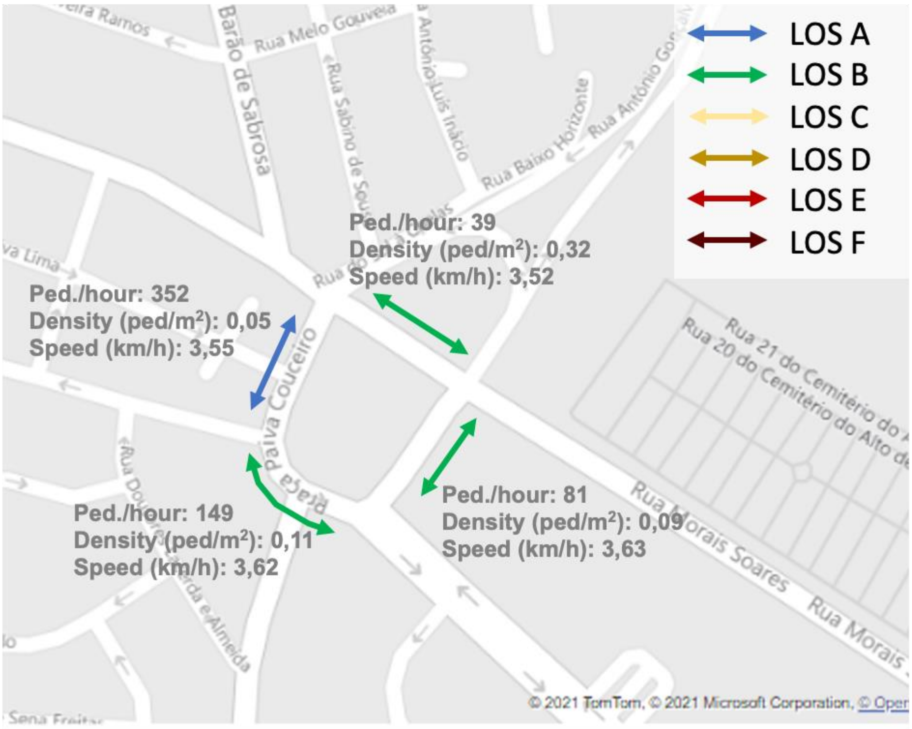


Figure 176. Pedestrian's characteristics and level of service, Scenario Praça Paiva Couceiro, PM Peak

Concerning Praça Paiva Couceiro scenario, most of the analysis is focused on the way in which traffic flows after removing the lane in the west side of the square, namely in terms of congestion, volume capacity and air quality.

As identified above, this solution will lead to fewer cars in the square, given the reduction of capacity in the intersections, due to the implementation of traffic lights to allow left turns, decreasing the periods for traffic flowing. Figure 177 shows the difference between the existing number of vehicles and how many are expected after the proposal implementation and the consequences in the vehicles delay times.

Figure 177. Difference of the number of vehicles and delay time between current scenario and suggested scenario for Praça Paiva Couceiro, PM Peak

However, this traffic reduction will lead also to longer queue lines and congestion situations during peak periods. Figure 179 allows to compare current queue lengths and those that are expected to occur with the new proposal.

Only in the intersection identified as Queue counter 4, there is a slight decrease, in clear contrast with nodes 5, 6 and 7.

Figure 178. Location of queue counters for Praça Paiva Couceiro

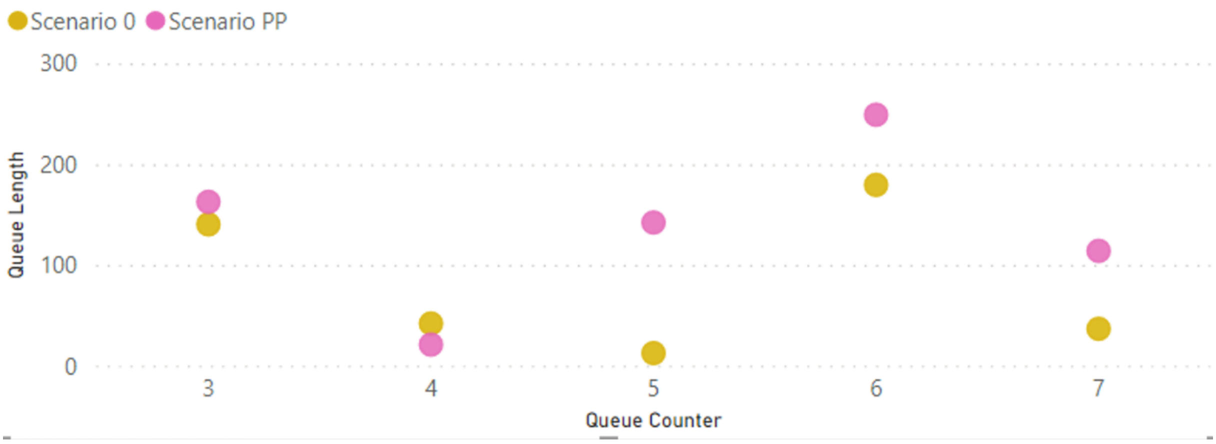


Figure 179. Compare of queue lengths between current scenario and suggested scenario for Praça Paiva Couceiro, PM Peak

Analysing air emissions, given the increase of congestion situations, even with less traffic volumes, the emissions' volume is expected to be higher than in current situation. Of course, it may be compensated by the gains occurring in the new pedestrian area and in its expected improvements for pedestrian activities and active modes use.

Figure 180. Air emissions, PM Peak

Despite the very relevant improvements this proposal may help to implement in Praça Paiva Couceiro, and in its area of influence, for pedestrian and street activities, traffic flow conditions are expected to deteriorate a lot, leading to congestion situations in almost all the intersections around Praça Paiva Couceiro.

Considering the new solution, the worst impacts will be not in Praça Paiva Couceiro itself but in some surrounding streets like Rua Barão de Sabrosa and Rua António Gonçalves that are not able to drain the vehicles into the square.

4.6 Appraisal of design options

According with the level of importance given by each assessor, identified in Appendix 4, the overall best solution is the scenario 0, and the other ones have very different classifications. Design number 4 was considered the best solution for Assessor 2 but, in contrast, the worst solution for Assessor 3.

Table 26. Multi-criteria analysis output, appraisal tool

MULTI-CRITERIA ANALYSIS: OUTPUT

Multi-criteria analysis of options for roadspace reallocation in Rua Morais Soares, Lisbon

	Option 0 (Do nothing)	Option 1	Option 2	Option 3	Option 4	Option 5
	LIS_S14010_00000000	LIS_S14010_AMR00000	LIS_S14010_JKLS0000	LIS_S14010_ABCFH000	LIS_S10000_ABCDEJK0	
	Scenario 0	*Scenario 1*	*Scenario 2*	*Scenario 3*	*Scenario 4*	
	1	2	3	4	5	6
	Overall ranking					
Average	1,7	3,3	3,7	3,3	3,0	
Assessor 1	1	2	5	4	3	
Assessor 2	3	5	4	2	1	
Assessor 3	1	3	2	4	5	

The tool was tested in one segment, considering afternoon peak movements and the model outputs in both directions. Considering that traffic flows in each way are unbalanced and the new design solutions, especially in scenario 4, are not symmetric, there are some doubts about the interpretation of the results by the tool. In fact, the congestion situations occur mostly in one direction whereas in the inverse way traffic flows without relevant constraints in all solutions, so providing results considering both directions may be hindering the overall results. In contrast, analysis the results in both directions separately doesn't seem a feasible option, since a road segment, or even whole network, should be analysed as a whole.

However, the possibility of studying the scenarios using a multi-criteria analysis is a very good support to the decision, since it allows to evaluate how some political aspects and how the weight given to some indicators may influence the final decision. This tool allows also to evaluate the effect of the evolution of some indicators in the tool's final score, allowing to analyse if, for instance, the reduction of traffic sinistrality or the growth of property prices would lead to other scenario's choice.

5 LONDON

5.1 A brief summary of current conditions along the Stress Section

5.1.1 Movement characteristics

The New Cross study area includes New Cross and New Cross Gate national rail and Amersham Gyratory. Daily mode share average along New Cross Road shows a considerable domination by private cars and LGVs. Buses (including coaches) and pedal cycles both account for seven per cent of total flows at this point on the corridor, and motorcycles nine per cent – a higher mode share for these modes than anywhere else along the corridor. LGV and HGV mode share remain relatively constant along the length of the corridor. This reflects the function of the A2 for commercial traffic and the location of commercial and industrial land along the most central section of the corridor.

It is well served by the bus network with services connecting to wider southeast London and the city. There are 10 east-west routes serving the A2 with bus lanes providing existing priority already along much of the stress section. Along most of the inner section of New Cross Road going westbound into central London, bus speeds are <10mph during the morning peak with intermittent bus lanes along the corridor

There is high pedestrian density between New Cross Gate and New Cross stations, as well as at key bus interchange locations along the corridor in both AM and PM peaks.

The severance caused by the road sees people cross at several informal locations, that could put pedestrian safety at risk. This includes large volumes of people crossing in the area immediately to the east of guard railing outside New Cross Gate station, near the Sainsbury's and Costa on Lewisham Way and near New Cross station, highlighting the desire lines and demand for access to and from these locations.

There is a higher-than-average number of Killed and Seriously Injured along New Cross Road, particularly effecting pedestrians, cyclists, and powered two-wheeler users, also known as vulnerable road users, compared to their mode share. Between 2014 and 2017, 348 injuries were recorded, with 29 serious injuries in this timeframe and two fatalities.

There are no formal cycling routes provided along the A2 at New Cross Road however cycle superhighway 4 and Quietway routes are located a short distance away from the corridor. Despite the lack of facilities there is considerably high demand for cycling, particularly between the stations. Cycle parking facilities are provided outside New Cross Gate Station and on street though informal cycle parking is observed along the stress section suggesting demand exceeds supply of cycle parking facilities.

Amersham Gyratory on the A2 forms part of the TLRN abnormal loads network for large or heavy vehicles, as well as local access for servicing vehicles for New Cross and Deptford town centres. Freight flows are considerably high along New Cross Road and into Deptford.

Journey time reliability is very low along New Cross Road, at the junction of the A2 and A202 and Deptford where road capacity is most constrained. Vehicle delay in the PM peak is significantly worse than that experienced during the AM with most of the corridor subject to delays of more than 1.5 minutes per kilometre.

5.1.2 Place-based characteristics

The different characteristics of the street lends itself to a range of activities taking place along its length and, in part, dictated by the surroundings of the street, time of the day and day of the week.

Outside of New Cross Gate station, while the dominant activity is people going into and out of the station, the nature of the environment and proximity of people also results in many people stopping to meet and talk. Conversely, where people are waiting for buses, such as to the northern end of Lewisham, this wasn't observed as lending itself to such a level of social interaction; however, this was replicated outside of the larger retail premises and coffee shop to the south.

PM10 levels reach EU limit along the western section of the A2 within the study area. Whilst NO2 levels greatly exceed EU limit along entire A2 corridor.

To accommodate healthy streets improvements along New Cross Road, there will likely be a requirement to manage servicing and deliveries and reduce freight flows at certain times of day.

In summary, the main issues identified by data analysis reveals journey time reliability, particularly for buses, pedestrian severance, pedestrian safety issues and air quality concerns along the length of the stress section.

5.2 Preparations for the street design exercises

5.2.1 **Design Brief**

The street design exercises were an opportunity to consider how the corridor could be designed and operated taking into consideration the key priorities and road user requirements set out in the D5.1 design brief and the place and movement function of New Cross that varies throughout the day.

The overarching outcomes the street design exercises should seek can found in Table 27. These have been identified to align with the Mayor's Transport Strategy, as well as subsequent TfL Strategies such as the London Environment Strategy, as well as taking into consideration local Borough plans.

Table 27. Key Priorities for the street design exercises

Key Priorities	
Provide safe and consistent cycle provision	Introduce road danger reduction measures
Improve bus journey time	Improve air quality
Improve walking conditions	Improve access to public transport
Reduce severance for pedestrians	Improve interchange between modes
Reduce speed	Reduce private car trips and consolidate freight

In creating road space designs that deliver the above key priorities, road user requirements have been considered that will be used to evaluate success in achieving these outcomes. These include providing pedestrian crossing, provide safer cycling provision, reduce speeds, accessible bus stops, cleaner and greener vehicles, increased footway and clear and concise restrictions for parking and loading.

The stress section was divided into three shorter sections in preparation for the design exercises due to the changing characteristics (movement and place) throughout the length of the section and in order to aid with identification of feasible interventions and road space allocation discussions. The diagram below highlights the 'stress section' of New Cross under review for the MORE design workshops which is approximately 1.6km in length.

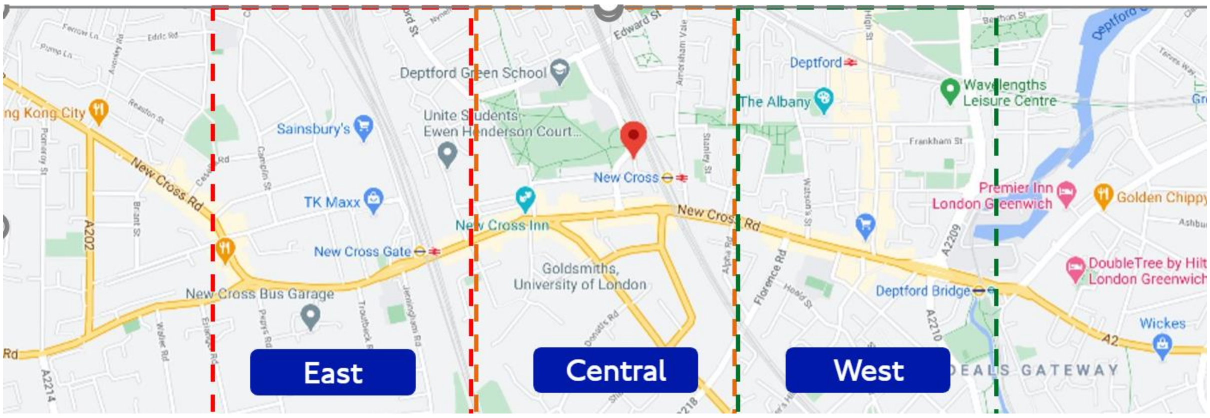


Figure 181. A2 New Cross Road Stress Section Segments

The eastern section of the stress section is characterised by the junction with A202 leading to Southwest London which is a significant area for bus interchange as well as the location of the busiest rail station on the corridor of New Cross Gate. The central section is perhaps the most complex due to the gyratory configuration and main road to access South London via the A20. The Western side of the stress section is typically the most constrained in terms of road space widths available.

5.2.2 Design Options

Using the design brief provided for design priorities and road-user requirements, as outlined above, 25 road space designs were specified to be created for the A2 New Cross study area. Given the characteristics of the corridor and key priorities identified, this led us to two distinct thematic areas to consider in producing the road space designs of:

- Place priority
- People moved priority

These two areas are considered to address each of the key priorities in Table 27, but recognise that there are clear competing elements of the road space that require compromise to the detriment of one or the other mode when prioritised. Therefore, it is deemed necessary to achieve the greatest benefits to allocate priority to each of these modes separately when developing designs.

Place priority refers to giving consideration to the stress section as a place, considering it's high priority function and land-uses of shops, cafes, restaurants where people would like to spend time and enjoy activities on the street in itself. In terms of design considerations, this not only refers to more space allocated for pedestrian activities on the footway but also crossing facilities in places where pedestrian desire lines dictate as opposed to where the least impact to traffic occurs.

People moved priority aligns to the improved access to public transport, bus journey times and reducing private car trips indicators of the key priorities identified in the design brief (Table 27). Specifically, on the corridor, Buses act as the most efficient mode to transport significant numbers of people at all times of day for which road space should be prioritised.

Furthermore, designs were specified to be created using the existing operational layout, in terms of the one-way gyratory configuration of the stress section and also to consider how the corridor could work, or deliver the aspired benefits for prioritised modes, with a two-way functioning of the gyratory in the central section of the stress section.

Time of day was also a specification for the road space designs, focussing on morning, afternoon, and evening modal flows throughout the length of the corridor and how this varies throughout the day. Table 28 summarises the designs to be generated, separated between People moved and place-based for each.

Table 28. Designs to be generated in the street design exercise for each segment of the stress section

People Moved Priority		Place-based/ Place Priority	
Unique ID	**Description**	**Unique ID**	**Description**
LON_S1_0810_2021_M_ABDEJKT0	New cross-PT-(2-WAY)-AM PEAK	LON_S1_0810_2021_M_ABCDERT0	New cross-PP-(2-way)-AM PEAK
LON_S1_0830_2021_M_ABDEJKRT	New cross-PT-(2-WAY)-IP	LON_S1_0830_2021_M_ABCDERT0	New cross-PP-(2-WAY)-IP
LON_S1_0820_2021_M_ABDEJKT0	New cross-PT-(2-WAY)-PM PEAK	LON_S1_0820_2021_M_ABCDET00	New cross-PP-(2-WAY)-PM PEAK
LON_S1_0820_2021_M_ABDEJK00	New cross-PT-GYRATORY(1-way)-PM PEAK		
LON_S1_0810_2021_M_ABDEJK00	New cross-PT-GYRATORY(1-way)-AM PEAK		

LON_S1_0830_2021_M_ABDEJKR0	New cross-PT-GYRATORY(1-way)-IP		

5.2.3 Virtual Design Sessions

Due to the impact of the COVID-19 pandemic and original plans to engage with members of the public and local businesses and schools along the corridor to co-create road space designs, a revised method utilising virtual meeting tools was employed to develop designs.

Figure 182 sets out the process used to generate designs virtually, which was tried and tested following a pilot process where a series of workshops with TfL Transport Strategy and Planning team members was hosted in December 2020 to produce a current design for the corridor. Following this, we reviewed progress from the pilot workshops and surveyed participants to get feedback on how the sessions could be run more effectively remotely. We made adjustments to the format and finally settled on the process outlined below to generate designs.

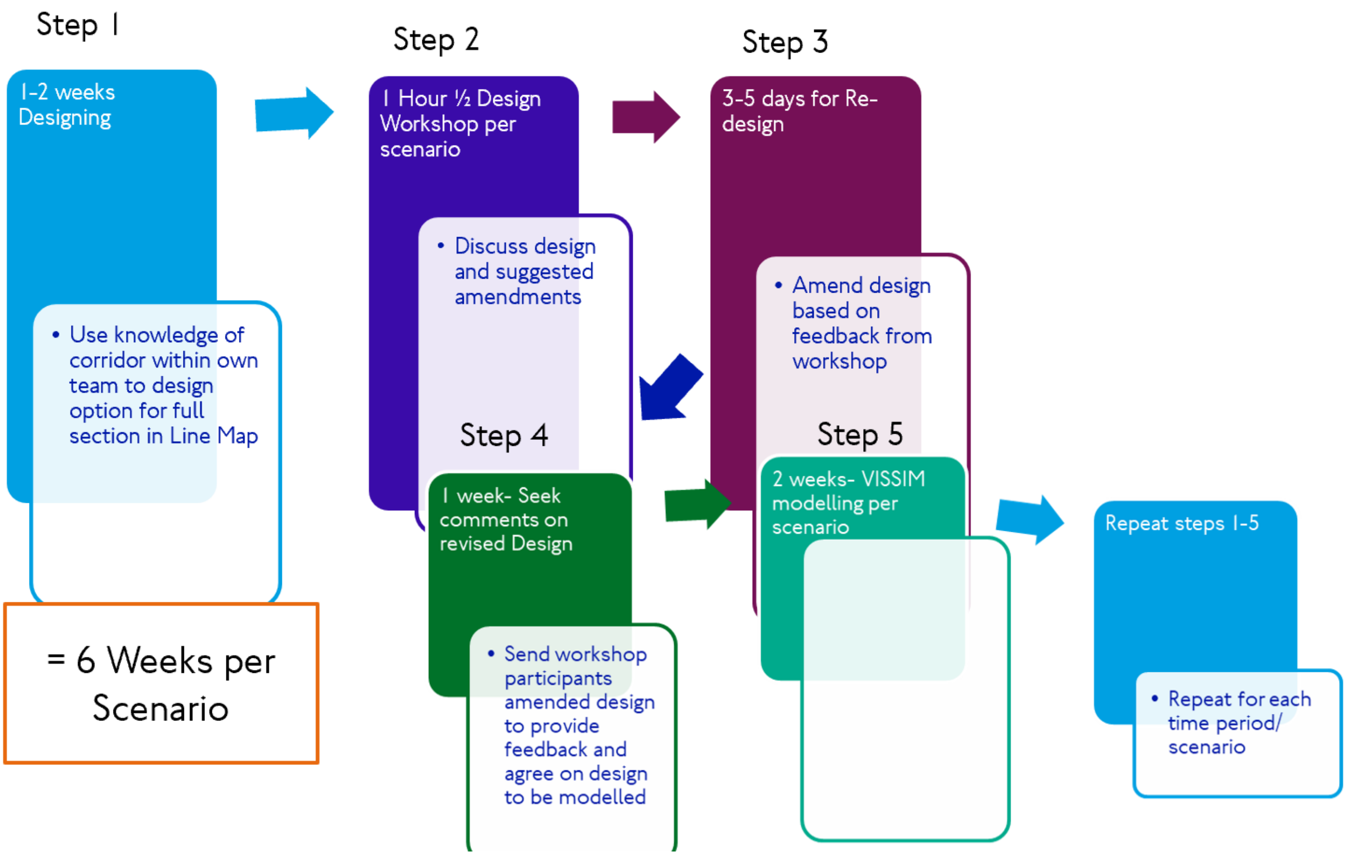


Figure 182. Virtual process for generating road space designs

For the pilot workshops, attended by relevant professionals within TfL representing walking, cycling and buses, a data pack was provided before the workshop which provided an overview of some of the key characteristics and travel demand data for the A2 on New Cross Road, where many professionals in attendance were not familiar with the detailed movement or place aspects of the corridor or stress section details.

The intention of the information was to give some background context to the local area and present the demand and operation of the corridor at different times of day to help inform design development for the design options to be generated during the time available in the session. Background information included:

- Local characteristics: land use, population, and demographics
- Mode usage: Bus, rail and car demand incl. average delay data
- Place and movement function
- Parking and loading conditions
- Road danger collision data

Following our experience with the pilot workshops, and limited progress made in these sessions, it was decided the best approach for generating designs was to design these using the tools provided by the project in LineMap to develop a design idea that aligned with the options to be generated and share these for comment amongst the stakeholders recruited. These could then be amended taking on board feedback received and taken forward for modelling, if appropriate.

Stakeholders were recruited internally within Transport for London given the ongoing pandemic impacts, digital tools, and time constraints to develop designs. Professionals with a broad, multi-modal, and technical expertise were sought to feedback on designs generated, with the areas represented demonstrated in the table below.

Table 29. Participants recruited for Stakeholder engagement inputs to generate road space designs

Participant number	Organizational representatives	
	Organization	Role in organization
1	Transport for London	Technical Specialist- Pedestrians
2	Transport for London	Technical Specialist- Cycling
3	Transport for London	Principal City Planner
4	Transport for London	Principal City Planner
5	Transport for London	Principal City Planner
6	Transport for London	Principal City Planner

7	Transport for London	Principal City Planner
8	Transport for London	Principal City Planner
9	Transport for London	City Planner
10	Transport for London	City Planner
11	Transport for London	Principal Network Planner- Traffic Operations
12	Transport for London	Highways and Traffic Engineer
13	Transport for London	Strategic Planning & Delivery Manager

5.3 Generating ideas for design options: inputs to stakeholder exercises

This chapter will describe the use made of the tools developed in Task 4.1/D4.1 (Policy Interventions Tool and Road Design Tool).

Before the design workshops, and following attendees being presented with the ‘data pack’ for the stress section, a range of possible interventions identified by the Policy intervention tool and road space design tool were briefly presented to a technical group of participants for further discussion of benefits and issues. Examples of these include: inclusive design, footway extension, pedestrian crossing facilities, low speed zones, etc.

Option generation tool

The graph below indicates the road users’ priorities inputted to the option generation tool in line with the design priorities developed. A score of 1 indicates the road user or performance indicator should not be worse off than the current provision and a score of 2 indicated the user or performance indicator should be better off than now. A score of zero was given to all other indicators and road users to suggest that, if needed, provision could be worse off than now.

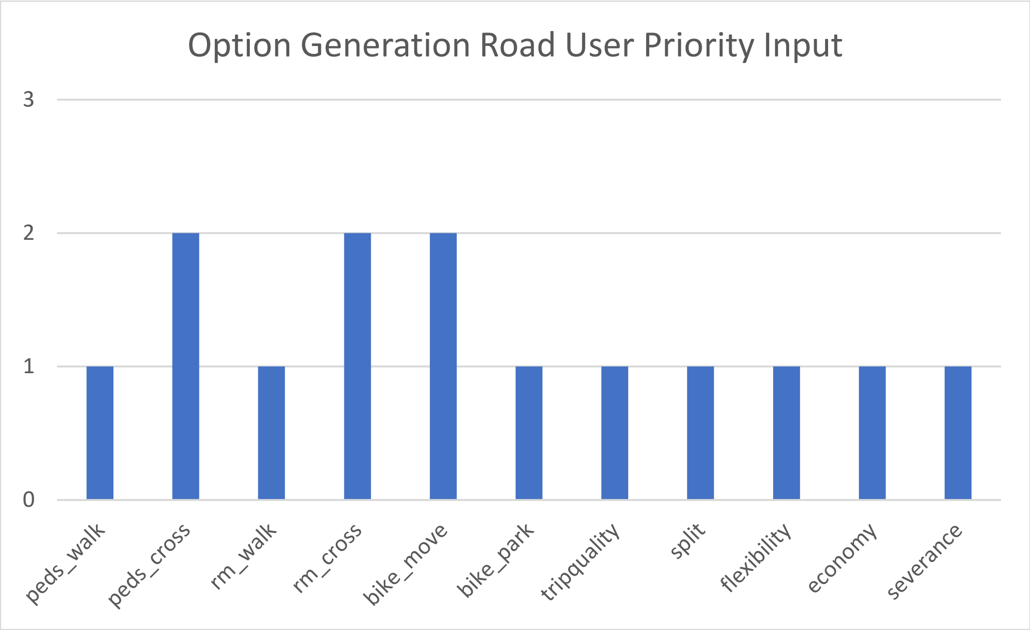


Figure 183. Option generation road user priority input

Policy Intervention Tool

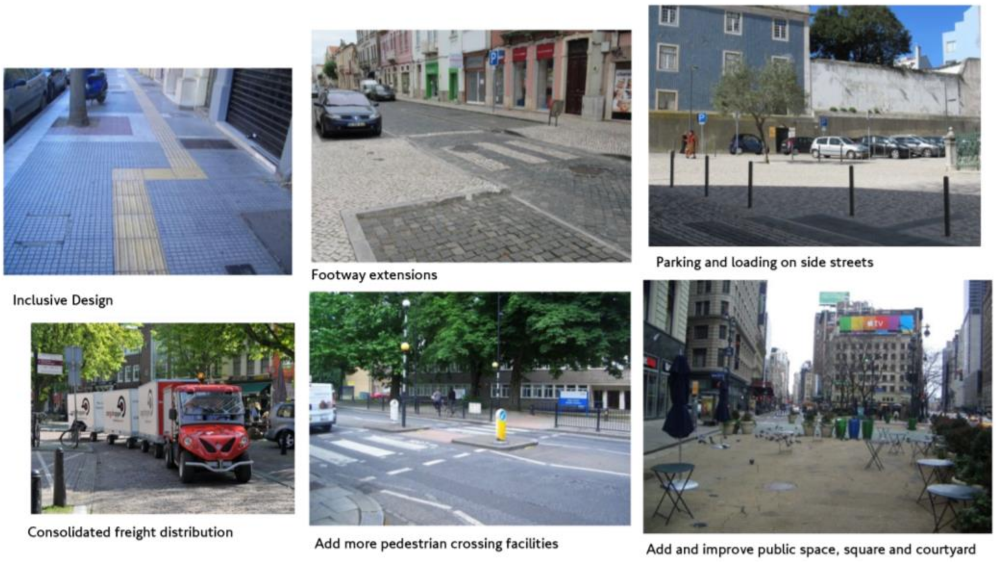
Details of policy interventions generated, options investigated and depth of investigation (description, road uses, objectives, evidence).

Table 30. Policy interventions (P) using web tools: output and application data

Code	Data
OGP_out1	List of Policy Interventions generated
OGP_out2	List of options investigated
OGP_out3	Extent to which each option investigated (whether Description, Road Uses, Objectives, and Evidence tabs were open)
OGP_out4	Interventions that were selected, from the list provided by the tool, as being potentially feasible options
OGP_out5	Interventions that the city is planning to use as part of a specific design option exercise

Feasible interventions from Policy tool 1/2

Before the group design activity, a range of possible interventions identified by the Policy tool were briefly presented to a technical group of participants for further discussion of benefits and issues.



Feasible interventions from the Policy tool 2/2

TfL RESTRICTED

Figure 184. Feasible options suggested by tool

Road designs tool

For the road space designs tool, the objectives selected were directly aligned to the design objectives developed through the D5.1 design brief and as highlighted in Table 27.

Table 31. Road designs (D) using web tools: input data

Code	Data
OGD_in1	Name of city
OGD_in2	Sub-segment number (e.g. S1.1)
OGD_in3	Space currently allocated to each design element, in a cross-section view of the road
OGD_in4	Priorities given to the different design elements

Table 32. Road designs (D) using web tools: output and application data

Code	Data
OGD_out1	List of options generated for the cross-section allocation of design elements
OGD_out2	Cross-section options that were selected, from the list provided by the tool, as potentially feasible options.
OGD_out3	Ranking of the five best options among the ones selected as feasible (1-5)
OGD_out4	Cross-section options that the city is planning to use as part of a specific design option exercise

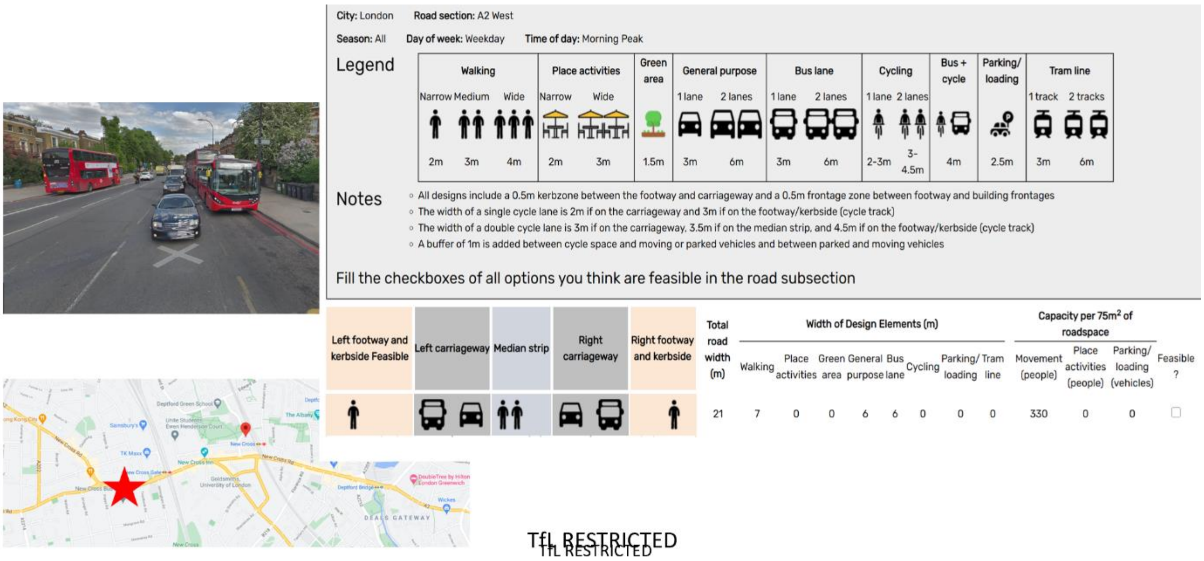


Figure 185. Street design options – allocation of space to different modes

A survey was provided to participants to gather feedback on the tools, in summary this revealed:

Road Space Design Tool

- No road designs found came up quite a lot
- Not enough priorities allowed to be selected- it might be useful if it could default to showing some of your priorities and saying which ones are shown in the results
- Effectively need to already know what you are able to fit in before running the tool
- It appears that the median is used a lot in the options- perhaps too much? How does city choice affect the results?
- Suggested scoring into modal categories and other street features (e.g. street furniture)

Policy Interventions Tool

- Broad options and a huge amount of information
- Having a maximum of 3 preferred road uses is quite limiting
- Images for options would be useful if these reflected the city originally selected

Following the presentation of policy interventions and design options to be considered in the virtual design sessions. The first pilot workshop included annotations of the street layout map in Microsoft Whiteboard with moveable highway measures. Feedback from attendees stated that sticky notes was useful, they wanted to view extended street view and required a steer for local priorities.

After the first workshop, changes were made for the second workshop taking the steer from what the attendees had said and this proved to be more successful, though still took a considerable amount of time to produce. The details of these have been captured in the figures below.

Our first pilot workshop

Format

What worked well?

Annotations of the street layout map in Microsoft Whiteboard

Moveable highway measures

Feedback

- Stickie notes useful for highlighting issues and testing interventions
- Participants wanted view existing street layout
- An example to inspire ideas for design
- Steer on local priorities and issues

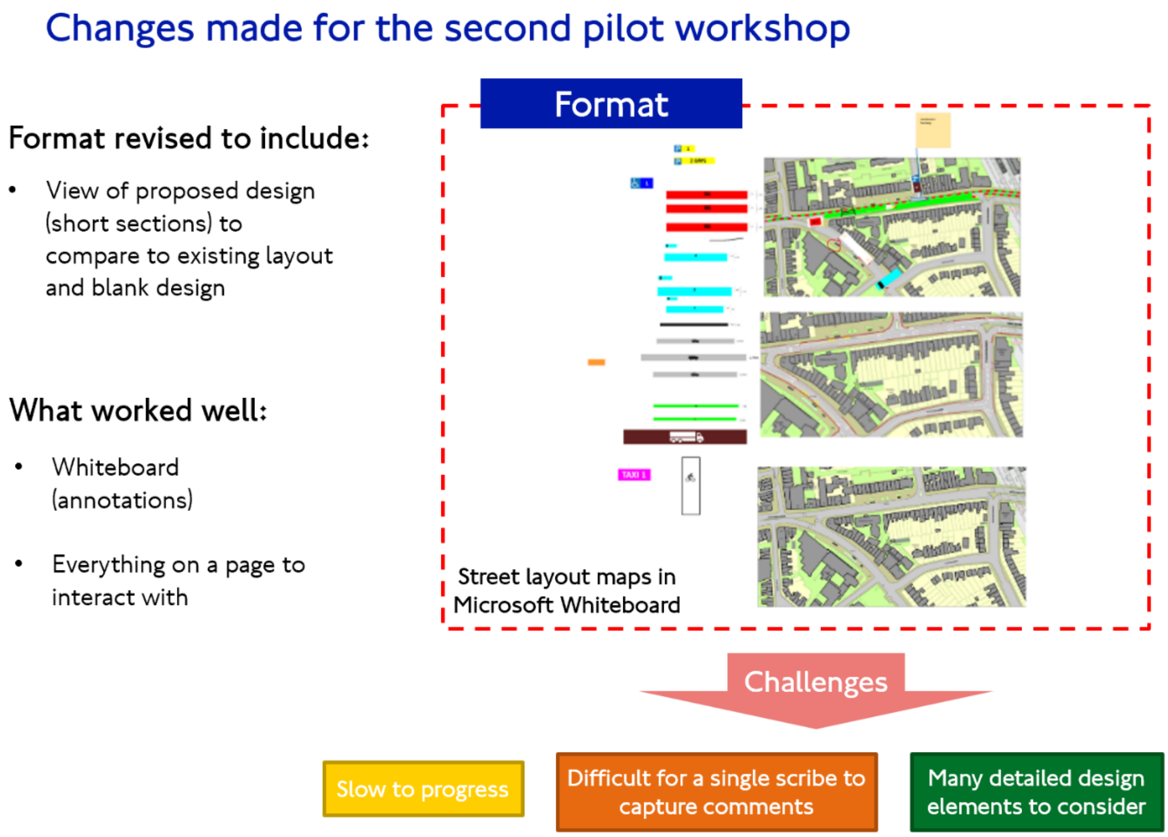


Figure 186. Design Day workshop activities

5.4 Generating street design options in the stakeholder exercises

This chapter will make use of the tools developed in Task 4.2/D4.2 (Physical street layout toolkit, LineMap and Traffweb stakeholder tools).

The design options to be created have been described in Section 5.2.2 and set out in Table 28. Some elements of the option generation tool suggestions have been embedded into the options such as Bus Gates and parking and loading bays half on footway. No options considered the road design tool outputs. Below is a description of the design improvements made for each of the design options and illustrations of the main design option features where appropriate.

As depicted earlier, the A2 in New Cross includes a gyratory that currently operates as a one-way system, but as part of the design options we've proposed a 2-way bus access only through a section of the gyratory, hence the depictions between 1-way & 2-way in Table 28.

The design improvements involved two scenarios for the three times periods during the day (AM peak, and Inter-Peak & PM peak.)

The designs included two scenarios:

- 1-way gyratory scenario: where the traffic in the central section of the roads circulate in 1-way, which is the existing condition of the road
- 2-way gyratory scenario: where the traffic circulation on the central section of the road is 2-way

The traffic circulation at east and the west sections of the road were kept the same as in the existing condition for all design options and road-use priorities.

As a rule of thumb for time variations between all design options, the following approach was adopted at East, Central and West sections:

- If the parking or loading bay is on the footway, or the bus lane continues around it unimpeded, then it can operate during the peak periods (i.e., during the red route hours) and also through the inter-peak hours usually between 11:00-16:00.
- If it impedes bus flow or the footway- depending on priority, then it is removed in the appropriate peak period depending on traffic flow:
    - AM Peak/inbound/south side of street
    - PM Peak/outbound/north side of street

5.4.1 Public Transport Priority Design Options

In the public transport 2-way design options which include the following designs:

- **New cross-PT-(2-WAY)-AM PEAK-**LON_S1_0810_2021_M_ABDEJKT0
- **New cross-PT-(2-WAY)-IP-** LON_S1_0830_2021_M_ABDEJKRT
- **New cross-PT-(2-WAY)-PM PEAK-** LON_S1_0820_2021_M_ABDEJKT0

The detailed changes to the West segment can be seen in Figure 187, and include:

- Adding of signalized crossing in front of building 186
- The loading bays and the parking bays in front of Fairlawn mansion building were shifted partly to the footway.
- The loading bay in front of building 243 was removed and new footway was added in front of building 267.

- The side roads around building 263: new station entrance at New Cross Gate station was added, a built out was added to straighten the existing footway, the road is closed from the east side.
- And a signalized crossing was added to the west side of this section to aid interchange from buses to train.
- New loading bay was added in front of building 267, replacing the bus stop at this location.
- In front of building 297: loading bay was added beside the parking bays and they are all moved partly to the footway to lessen impact on traffic flow.

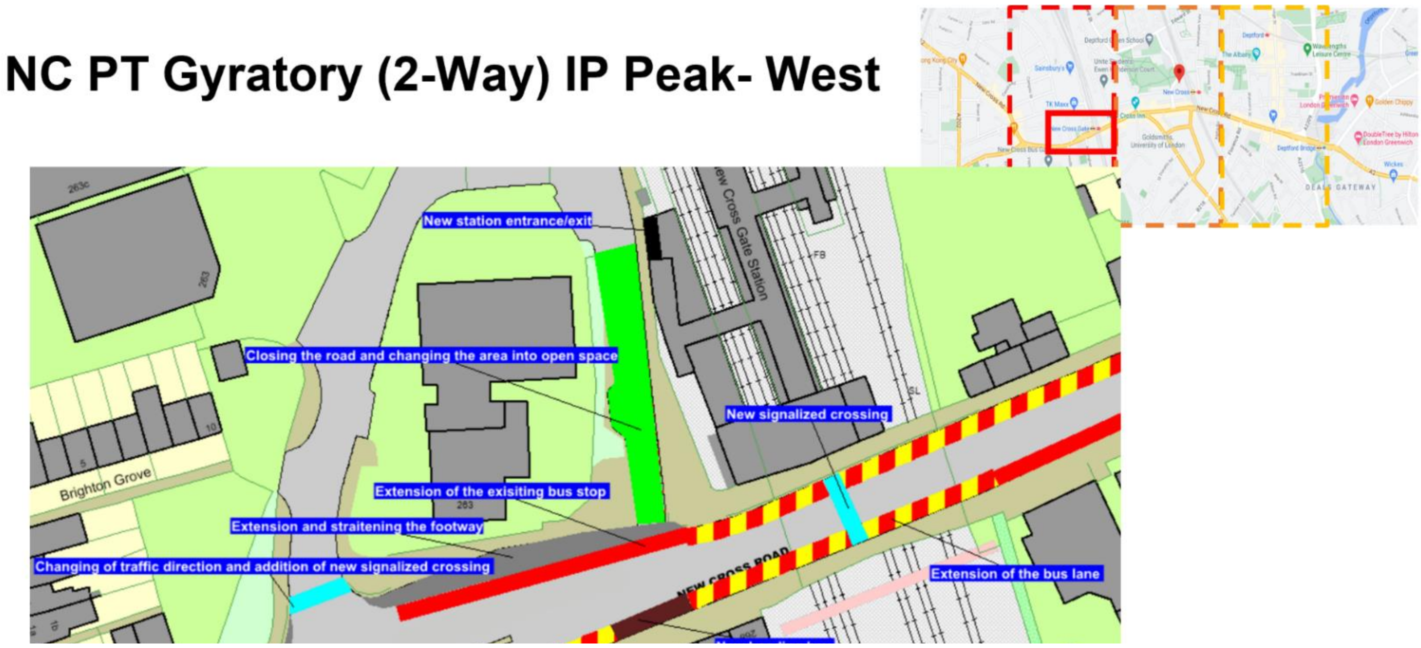


Figure 187. Annotated changes made to the West Segment of Stress Section for Public Transport Priority Design Options

The detailed changes to the East segment can be seen in the below figure and include:

- The bus stop in front of building 414 was shifted to the west.
- The loading bay in front of building 447 was shifted to the footway.
- New loading bay was added in front of building 459 on the footway.
- Moving the bus stop in front of 487 to the west.
- Shifting the loading bay to the west and to partly to the footway.
- In front of building 57: a bus gate and pedestrian crossing was added, the existing pedestrian crossing is removed.

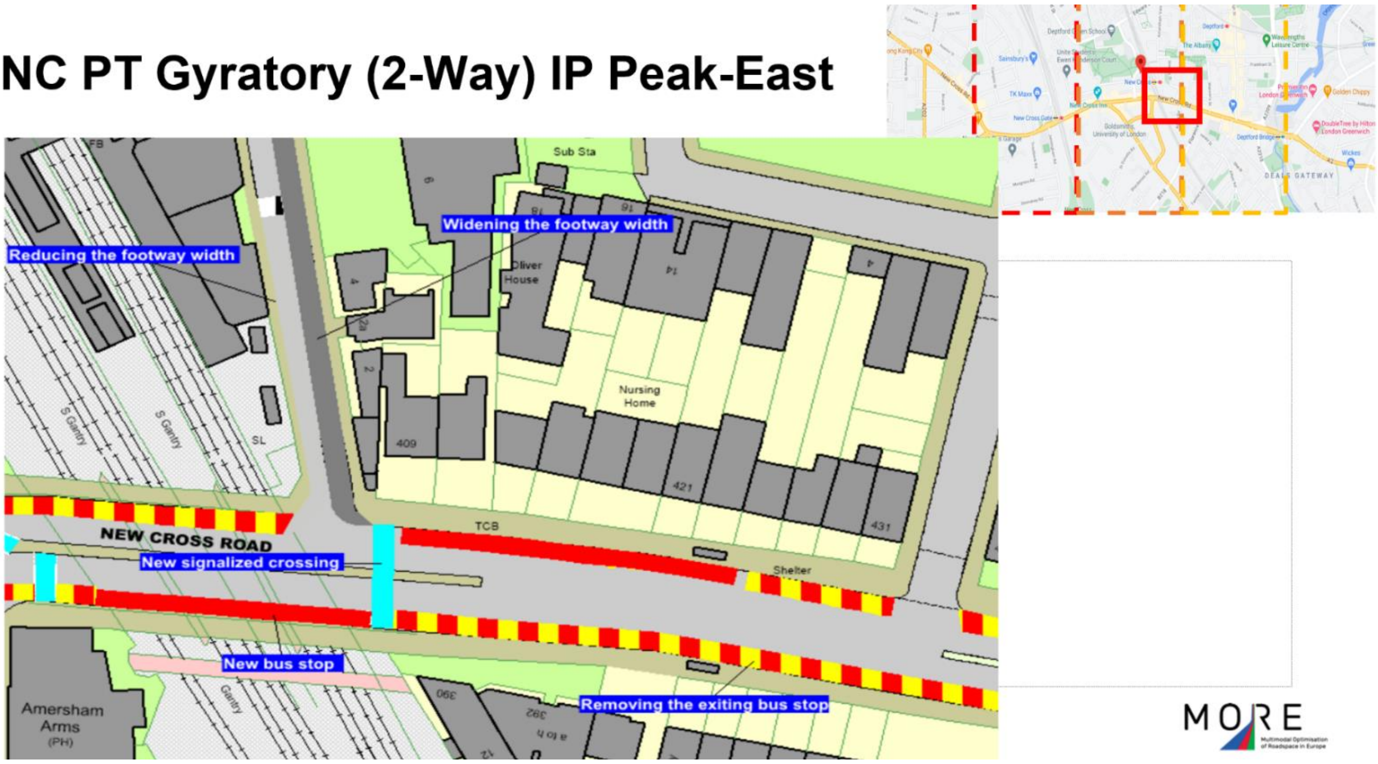


Figure 188. Annotated changes made to the East Segment of the Stress Section for Public Transport Priority design options

For the central segment two-way design options in the AM and PM peaks, Amersham, Parkfield Road, Lewisham Way and New Cross Road –all loading bays and parking bays (carriageway and footway) were removed. The loading and parking bays were reinstated during the inter-peak design option.

In the public transport 1-way (existing gyratory operation) design options which include the following designs:

- **New cross-PT-GYRATORY(1-way)- PM PEAK-** LON_S1_0820_2021_M_ABDEJK00
- **New cross-PT-GYRATORY(1-way)-AM PEAK** LON_S1_0810_2021_M_ABDEJK00
- **New cross-PT-GYRATORY(1-way)-IP-** LON_S1_0830_2021_M_ABDEJKR0

The west and eastern segments of the stress sections remained the same for the 1-way existing gyratory operation design options, with changes only made to the central segment.

In the AM peak, Amersham Road, Parkfield Road and Lewisham Way –all on-carriageway bays: 2 sets of loading bays and 3 sets of parking bays were removed. In the PM peak, at New Cross Road (the northern side of the gyratory), the loading bay at west end on north side of street (outside 339 – 343) and the long parking bay on the south side of the street were removed.

In addition, the following changes were made to the central segment for the 1-way design options:

1- At the east side of new cross station, the road beside building 409: the footway was widened from east side, and the width of footway from westside was reduced in width.
2- A signalized crossing was added in front of building 409.
3- In front of building 345 the loading bay was moved.
4- Infront of building 308: a new loading bay was added at the footway, the parking bays in the opposite side of the road were shifted partly to the footway.

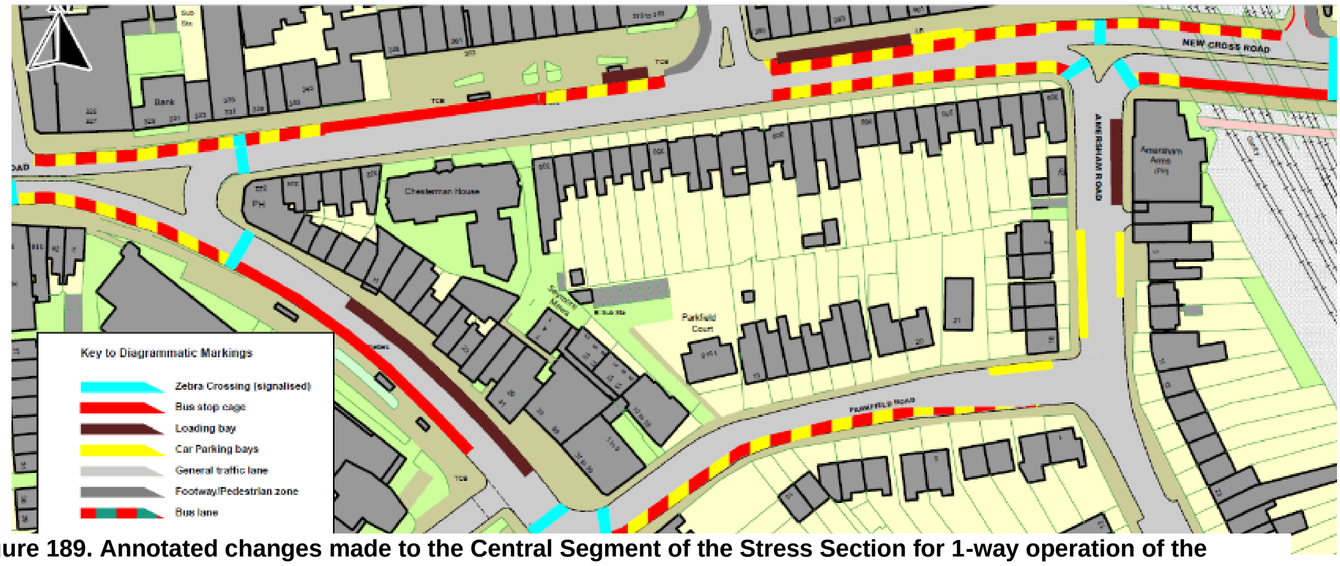


Figure 189. Annotated changes made to the Central Segment of the Stress Section for 1-way operation of the gyratory for Public Transport priority design options

5.4.2 Place-based priority Design Options

For place-based priority designs, a similar concept was taken forward for each of the time periods where pedestrian flows where high in peak periods in certain locations along the stress section primarily to access the rail stations in the west and east segments but also for interchanging between buses, most distinctly in the western segment.

It was decided in the workshops that the 2-way operation of the gyratory configuration in the central segment lends itself to serving pedestrians as a priority more so than the current 1-way operation. Particularly where the north side of the gyratory, at New Cross Road, was proposed to be bus and cycle only access and where the land-use is highly retail and leisure, including seating for eating outside of establishments. By only permitting access to buses and cycle, workshop attendees thought this may improve the presence of the area as a place to sit, rest and enjoy with improved air quality, reduced noise and road danger risk- which all align to the design objectives.

The Place Priority 2-way design options include the following designs:

- **New cross-PP-(2-way)-AM PEAK-** LON_S1_0810_2021_M_ABCDERT0
- **New cross-PP-(2-WAY)-IP-** LON_S1_0830_2021_M_ABCDERT0
- **New cross-PP-(2-WAY)-PM PEAK-** LON_S1_0820_2021_M_ABCDET00

The Place Priority/ place-based priority design options uses same concept as PT priority 2-way gyratory for many of the changes whereby easy access for interchanging between modes has been given good consideration, as well as additional and direct crossing points. For the central segment, the main changes are:

- At the west junction of the gyratory: the median was cut from the south side and new traffic lane was added.
- In front of the curve close to building 322: the footway was widened; a bus lane was added, and signalized crossing were added throughout the junction.
- At the northern side of Amersham Road, a bus stop was added.
- At the intersection of Amersham road with Parkfield road, the hatched area weas removed, the one-way road to the south was changed by removing the build out footway to make the road wide enough for 2-way traffic
- In front of building 345 the loading bay was moved.
- In front of building 385: the loading bays and the parking was shifted to the footway, and a bus stop dedicated to right turning busses only was added.

For the western segment, some of the changes include:

- At the east side of new cross station, the road beside building 409: the footway was widened from east side, and the width of footway from westside was reduced in width.
- A signalized crossing was added in front of building 409.
- Infront of building 308: a new loading bay was added at the footway, the parking bays in the opposite side of the road were shifted partly to the footway.

As a general point to note and key differentiator to the PT design options are that most on-footway parking and loading bays have been reposition back on to the carriageway to not impede pedestrian flows. These have the same time 'rules' as for PT priority depending on traffic flow.

Several kerb buildouts have been proposed throughout the length of the section. These are clearly 24 hours and should be considered for adding benches, cycle parking, trees, etc. With some of the buildouts, including the one shown in the figure below, loading to service the retail units is permitted only up to 10.00 (12.00 on Amersham Road), to keep the widened footway clear for pedestrians and street activities.

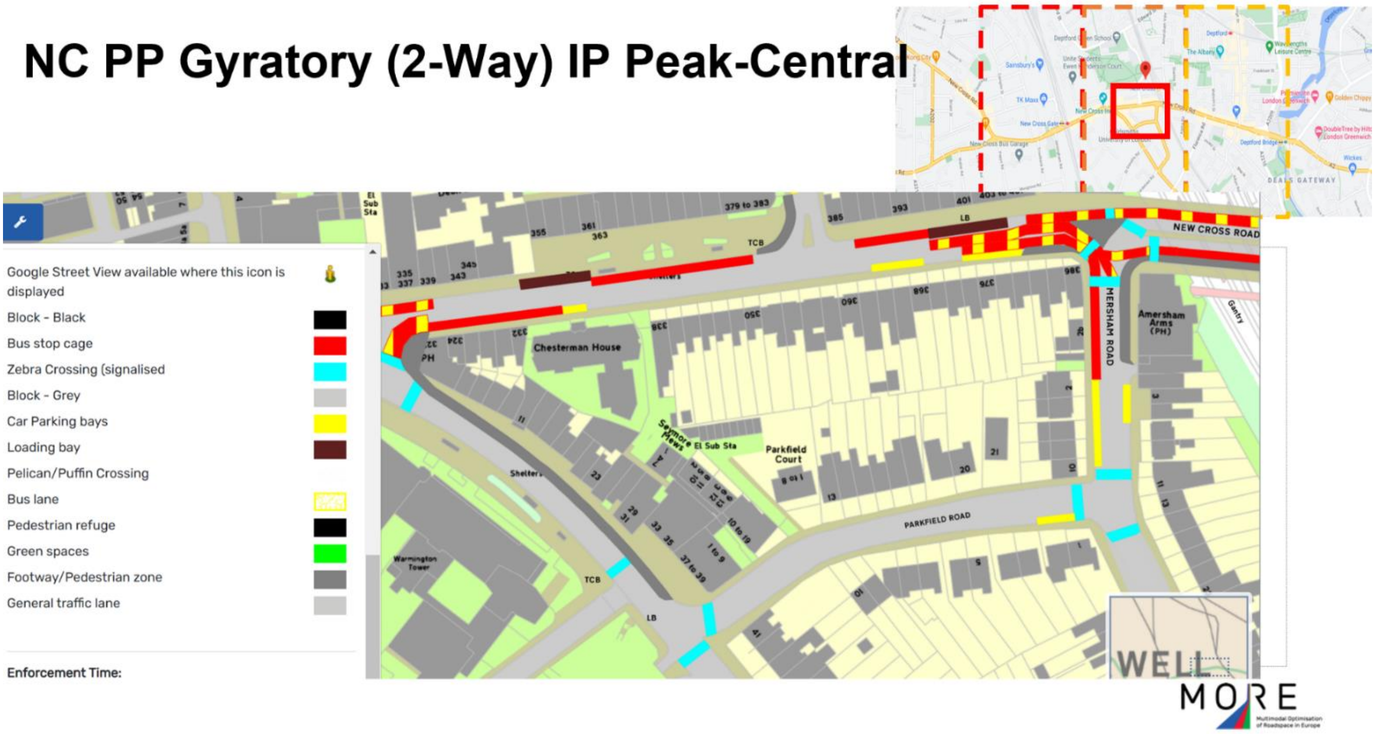


Figure 190. Annotated block changes to the Central Segment of the Stress Section for the 2-way operation of the gyratory for Place Priority design options

Feedback was sought from the professionals identified in Table 29 on the design options generated for each modal priority and to begin preliminary sifting of designs generated. Most of the comments received related to the amendment of the operation of the gyratory to introduce 2-way functioning, to allow bus and cycle only access on the northern arm.

A summary of the comments received can be found below:

- The new proposed junction arrangement on the west side of the existing one-way system was deemed to be very complicated from original design option generated which would result in inefficient operation of the stress section.
- The junction in question above covers a very large area, has multiple stop lines, and will result in long cycle times and very long pedestrian wait times. The traffic signal inter-greens are likely to be very high figures to allow sufficient clearance, adding to the delay to all road users.
- The junction method of control will be key to managing this impact
- The proposals for the Junction of Amersham Road/Parkfield Road requires changes at the Lewisham Way/Amersham Road junction but this area was initially outside of scope of the design option. This was amended following the feedback received and amended in the most recent design option.
- The proposed Northbound bus stop on Amersham Road was cited as being too close to the stop line and/or with not space for vehicles to safely overtake.
- For bus routes coming north on Lewisham Way (21, 136, 171, 172, 321, 436, N21, N171, N136) the removal of the MARQUIS OF GRANBY / GOLDSMITHS bus stop results in a large gap in the network. Identified where additional serving stop would be located in reiteration of designs.
- It was suggested that the inclusion of a crossing over New Cross Road at Clifton Rise in such close proximity to crossings at the Lewisham Way / New Cross Road will have capacity issues and potentially show the 2-way option as leading to significant congestion here in modelling.
- The short right turn lane from Lewisham Way onto New Cross Road is another constraint. This was adapted following feedback on the junction and at New Cross Road / Amersham Road junction to optimise these locations.
- the straight ahead bus lane could potentially conflict with left turning traffic westbound / southbound, so would potentially need a bus gate. The way this junction is arranged in combination with Lewisham Way / New Cross Road junction, might suggest the vast majority of general traffic is still to be routed round Parkfield Road.

For the one-way, existing operation of the gyratory, feedback was received for the junction of Amersham Rd/Lewisham Way. They posed that if vehicles could turn right from Lewisham Way into Amersham Rd, this would remove the need for vehicles to turn right at the junction to the west of the Amersham gyratory, and therefore possibly allow the proposals for the junction at the west side of gyratory, much more efficient / less complicated.

It was noted that for the public transport priority designs, we had included a number of pedestrian enhancements as part of these design options with additional crossings and footway widening in some locations to accommodate high numbers of interchanging between bus-bus and bus-rail along the stress section and that as a result it was more of a ‘balanced’ approach for what is deemed a public transport priority design option.

The potential need for design option changes to the west and east segments was also highlighted, which remain fairly consistent between the 1-way and 2-way gyratory sub-options.

It was thought relieving the pinch points in each of these segments may help from a traffic management perspective with the 2-way options. Considering more banned turns and/or not including the signalised crossing outside building 186 could be considered an example.

A number of iterations were made to each of the design options following the feedback received and design workshops. On assessment with traffic management and modelling experts, the designs to take forward for modelling are highlighted in Table 33. In both the Public transport and place based priority design options it was decided to take forward the 2-way gyratory operation as it was deemed this operation had the most potential to provide the benefits we were looking for in each of the priority scenarios, i.e. enhanced bus journey times for public transport priority and better 'place' outcomes for the Place Priority.

As the AM and PM peak design options included the same parking and loading restrictions for each time period, it was deemed only necessary to model one of these. On initial assessment of the data available, the PM peak period was chosen to take forward as this had the greatest level of competing demands and therefore impact to be made with the design options.

Table 33. Summary of design options sifted that will be taken forward for modelling and appraisal

Design Reference	Description
LON_S1_0830_2021_M_ABDEJKRT	New cross-PT-(2-WAY)-IP
LON_S1_0820_2021_M_ABDEJKT0	New cross-PT-(2-WAY)-PM PEAK
LON_S1_0830_2021_M_ABCDERT0	New cross-PP-(2-WAY)-IP
LON_S1_0820_2021_M_ABCDET00	New cross-PP-(2-WAY)-PM PEAK

The number and lengths assigned to each footway/ kerbside design element and carriageway design element for the Public Transport and Place Priority design options can be found in **Appendix 5.**

For each of the options to be taken forward for modelling and appraisal, a more detailed map of the designs (road markings) can also be found in **Appendix 5**.

5.5 Building and applying the Vissim model

Please note that all modelled results are indicative only, are pre-feasibility, non-audited designs of the highway and signal design and therefore should not be used or relied upon outside of the MORE project. A model used for supporting scheme development in London must be built according to the MAP, Modelling Guidelines and include a Scheme Impact Report.

5.5.1 Base Model Origins

TfL Network Management commission, audit and develop Vissim models routinely to determine operational impacts of a schemes on London's road and bus network,

Transport for London have already calibrated and validated a 2019 Vissim model for the AM (08:00-10:00) and PM (16:00-18:00) for the New Cross area. The model is a cordon of a much longer model that covers the A2 Corridor through South-East London to its Terminus in Central London.

The model time periods are:

- AM (morning)
- PM (afternoon)
- IP (interpeak)

The modelled vehicles are:

- Cars/Light Goods Vehicles,
- Taxis,
- Medium Goods Vehicles,
- Heavy Goods Vehicles,
- Motorcycles, and
- Pedal Cycles.

The scope of the Vissim model is as follows.

Figure 191. Vissim model scope in London section under stress

The traffic signals in the model are controlled by an emulation of London's Urban Traffic System (UTC) which holds the signal plans and controls the signals through the Split Cycle Offset Optimisation Technique (SCOOT).

The Interpeak (IP) base model has been developed by using Transport for London Urban Traffic Control System (UTC) measured flow profiles and applied them to the PM model.

Speed distributions are those from the Department for Transport (UK) – *Vehicles Speeds in Great Britain (2005).*

Diagrams showing vehicle inputs are given in the full model results spreadsheets.

This highway network forms the basis of the MORE Vissim model.

Additional changes were made to the Vissim model to add the pedestrian elements to the model.

Please note that all modelled results are indicative only, are pre-feasibility, non-audited designs of the highway and signal design and therefore should not be used or relied upon outside of the MORE project. A model used for supporting scheme development in London must be built according to the MAP, Modelling Guidelines and include a Scheme Impact Report.

5.5.2 Pedestrian Network

Pedestrian simulation was not added to the whole network. Three separate pedestrian areas of the network were coded into the model.

The orange areas show the walkable areas for pedestrians, the red areas represent obstacles, and the green areas represent areas where pedestrians can enter and exit the network. The star shows the location of New Cross Gate Station.

Area One (West)

Figure 192. Pedestrian model coding Area One (West)

Area Two (Central)

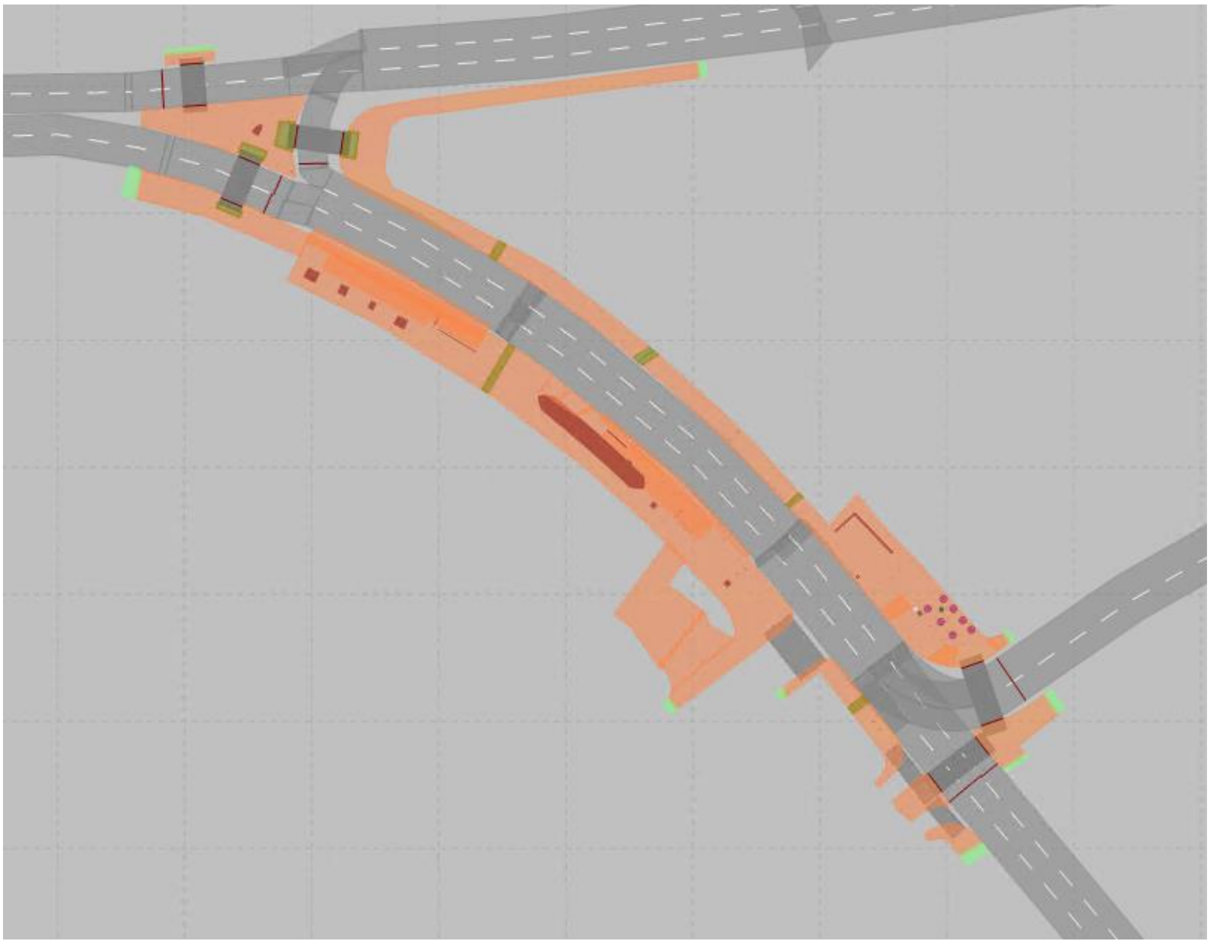


Figure 193. Pedestrian model coding Area Two (Central)

Area Three (East)

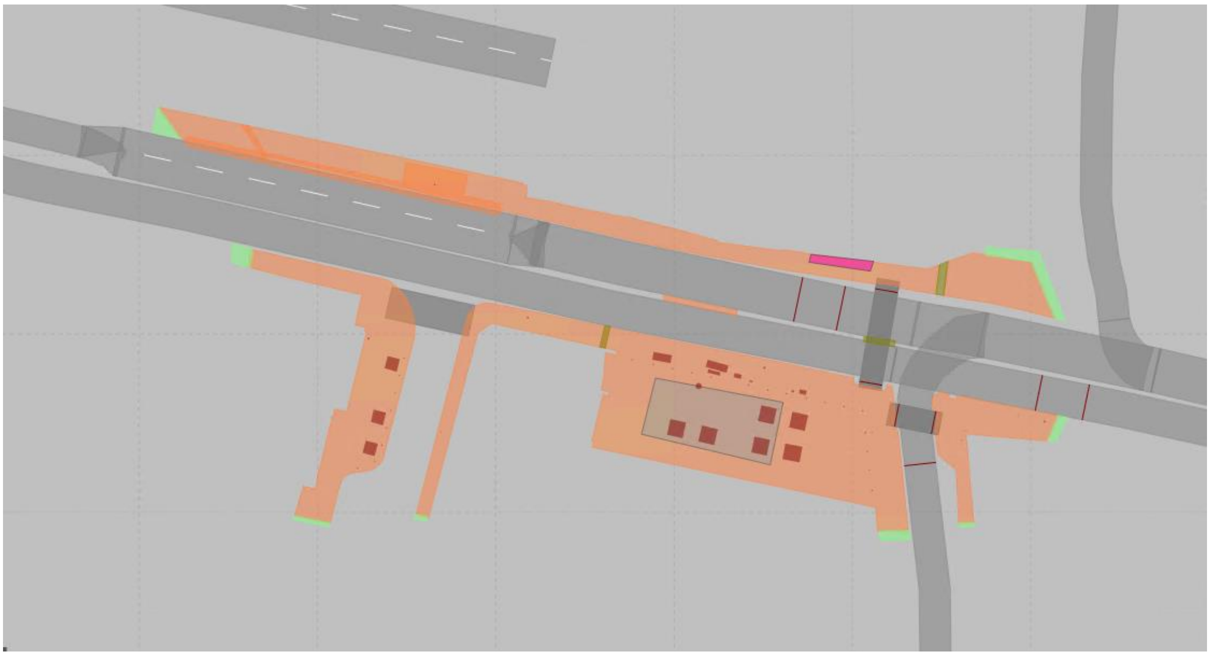


Figure 194. Pedestrian model coding Area Three (East)

The modelled pedestrian network contains obstacles representing sizeable obstructions on pedestrian areas, bus stop waiting areas and controlled pedestrian crossings. To represent the nature of trains arriving, a signal that operates every 6 minutes has been coded at the exit of New Cross Gate station in order to model the 'pulse' of pedestrians coming out of the station after a train arrives.

Unfortunately, due to the COVID-19 pandemic a pedestrian survey to form the basis for a pedestrian model could not be undertaken. Existing data sources have been used which are:

- Pedestrian survey for *Place Surveys*,
- Existing footway and crossing counts in the area, and
- Boarding, Alighting and Transfer public transport data.

The available data was combined to synthesise pedestrian inputs and routing for pedestrian simulation for each modelled peak periods.

5.5.3 Modelled Designs

The modelled designs are as followed:

Table 34. Modelled designs

Design Reference	Description
LON_S1_0830_2021_M_ABDEJKRT	New cross-PT-(2-WAY)-IP
LON_S1_0820_2021_M_ABDEJKT0	New cross-PT-(2-WAY)-PM PEAK
LON_S1_0830_2021_M_ABCDERT0	New cross-PP-(2-WAY)-IP
LON_S1_0820_2021_M_ABCDET00	New cross-PP-(2-WAY)-PM PEAK

The largest change to be modelled was the introduction of the '2-Way Gyratory' system that moves the eastbound A2 traffic on to Parkfield Road, reserving the A2 New Cross Road section between Lewisham Way and Amersham Road for Bus, Cycle and Taxi only. This is shown by the green arrows in the Changed image below.

This required changes at 5 signalised junctions to enable the two-direction of traffic.

Original

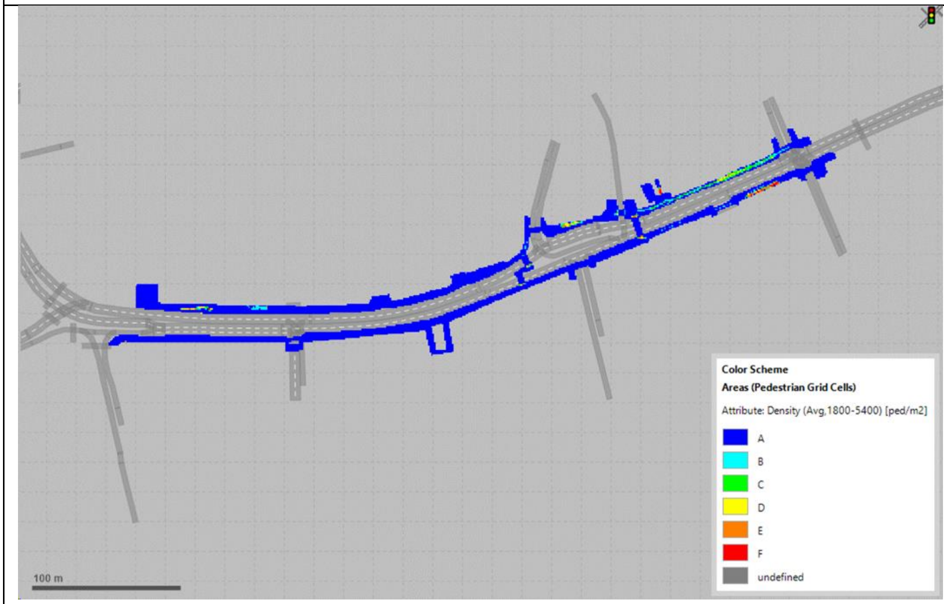
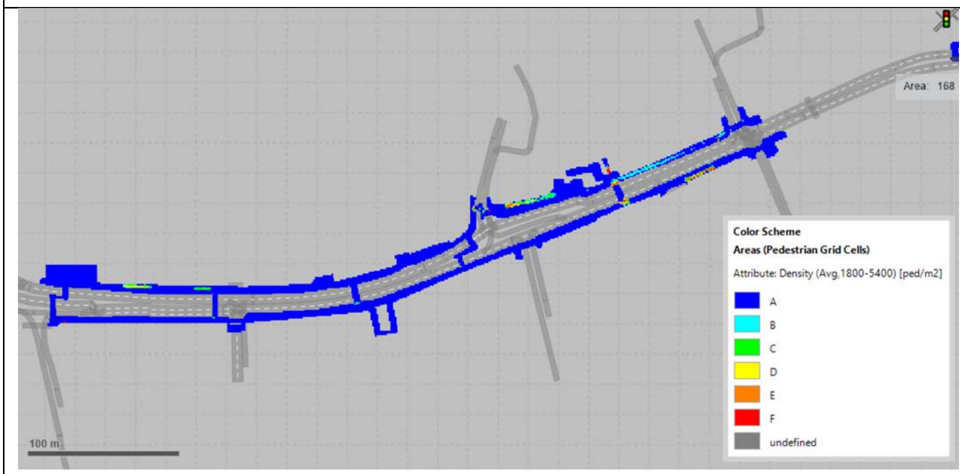
Figure 195. Current 2-Way Gyratory' system

Changed

Figure 196. Proposed changes to 2-Way Gyratory' system

The following images show the modelled pedestrian and vehicle densities between the different options.

PM Model Comparisons (Current Situation v Public Transport Priority v Place Priority)

PM Current – Pedestrian Density (LOS) – Segment 1 - (1700-1800)

PM Public Transport Priority – Pedestrian Density (LOS) – Segment 1 - (1700-1800)

PM Place – Pedestrian Density (LOS) – Segment 1 - (1700-1800)

 Version: 3

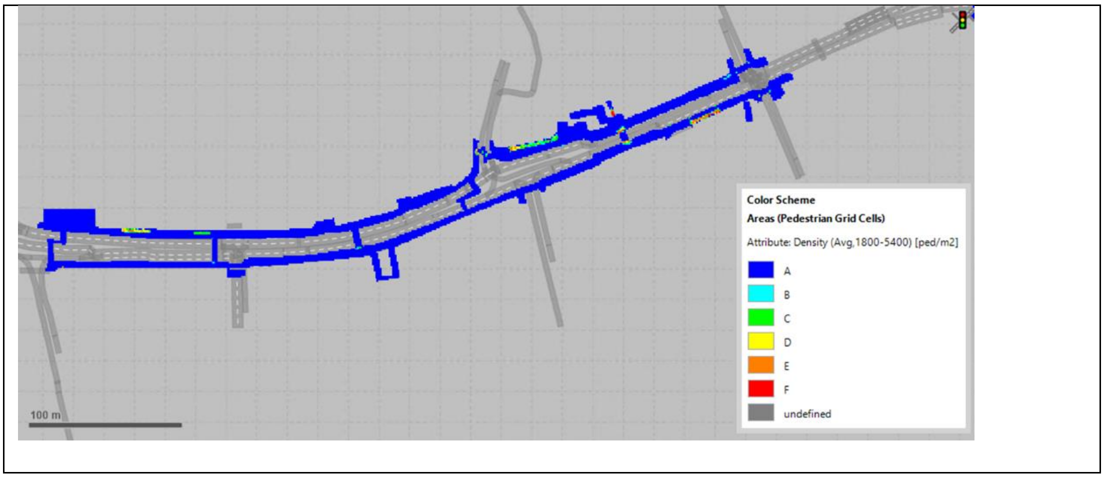
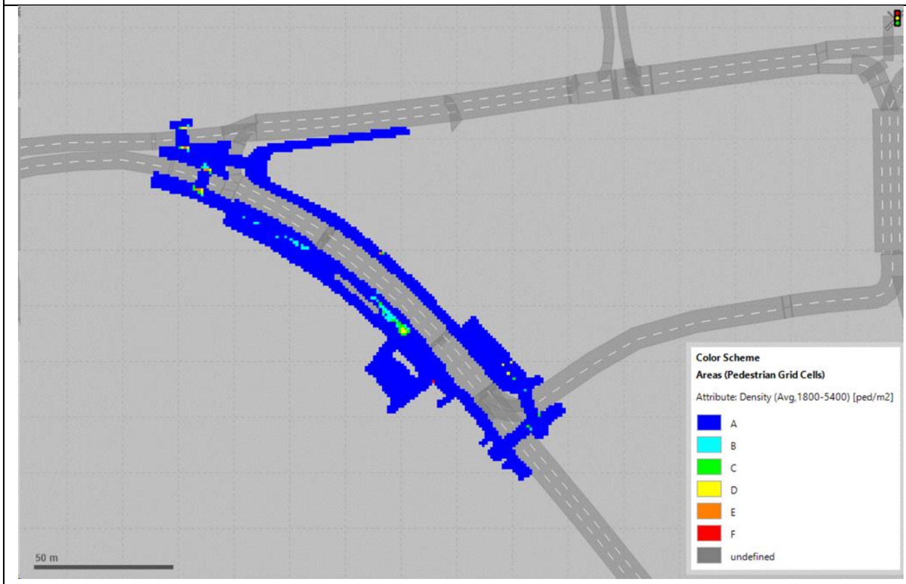
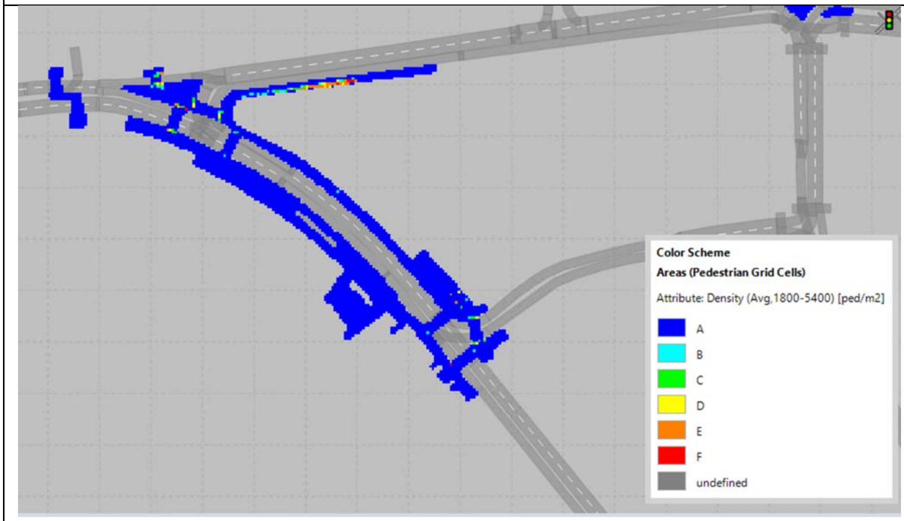


Figure 197. Modelled pedestrian and vehicle densities segment 1

In segment 1, modelled pedestrian density is generally Level of Service (LOS) A, representing low density throughout. There are some areas where density is higher, most notably on the pavements on the eastern section of Segment 1 in the Current Condition. The PT Priority scenario shows a slight benefit in this location, due to the relocation of the bus stop. In the pedestrian place scenario this area shows LOS A due to the wider pavement.

PM Current – Pedestrian Density – Segment 2 - (1700-1800)

PM Public Transport Priority – Pedestrian Density – Segment 2 - (1700-1800)

PM Place Priority – Pedestrian Density – Segment 2 - (1700-1800)

 Version: 3

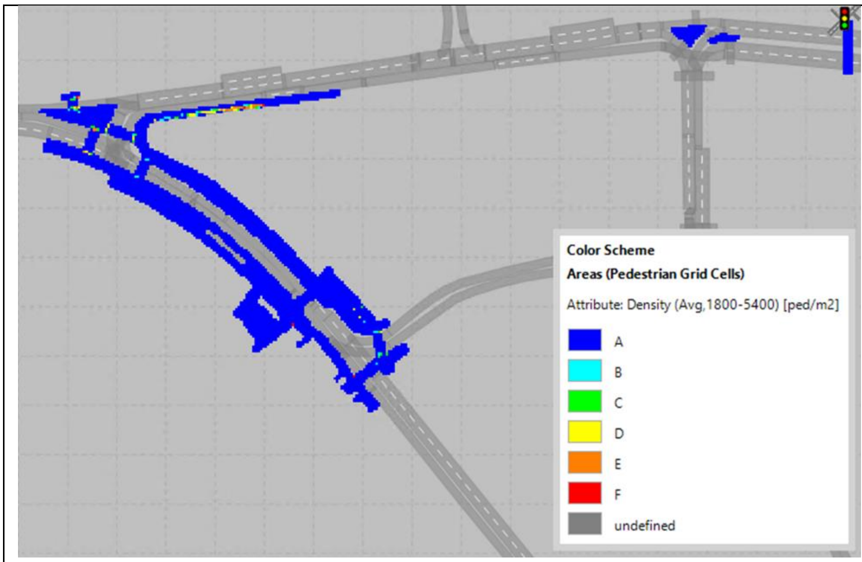


Figure 198. Modelled pedestrian and vehicle densities segment 2

In segment two, the density plots show LOS A throughout the segment in all scenarios, however in the Public Transport Priority and the Place Priority scenarios show lower LOS D, E and F on the southern pavement on the A2 New Cross Road, where there is a relocated bus stop, as pedestrians wait for buses in a smaller area.

PM Current – Pedestrian Density – Segment 3 - (1700-1800)

PM Public Transport Priority – Pedestrian Density – Segment 3 - (1700-1800)

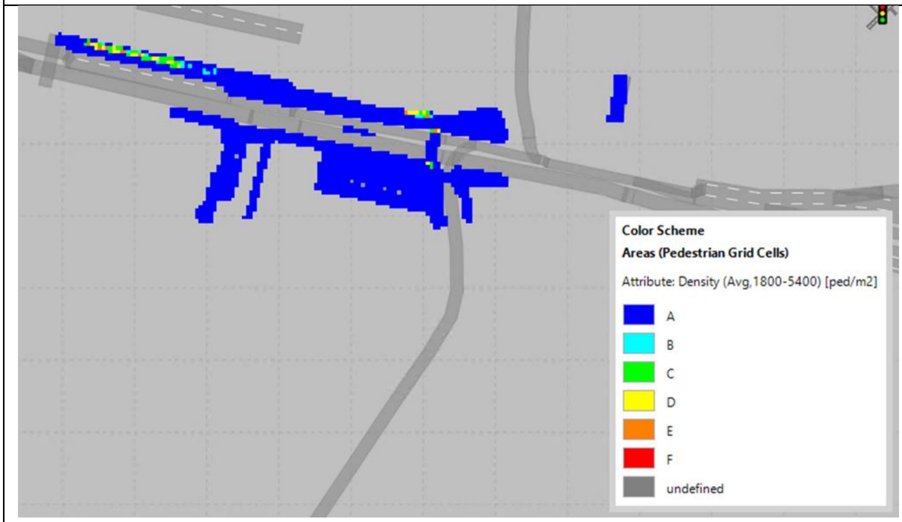
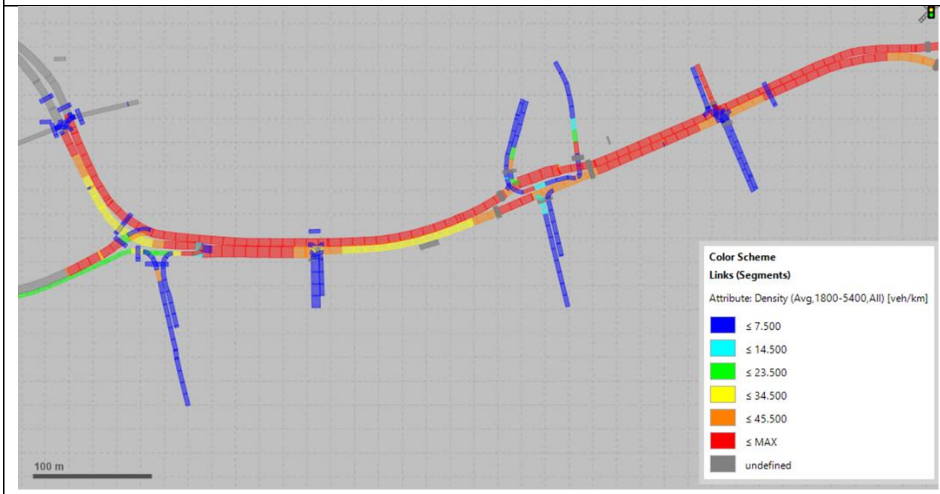
PM Place Priority – Pedestrian Density – Segment 3 - (1700-1800)


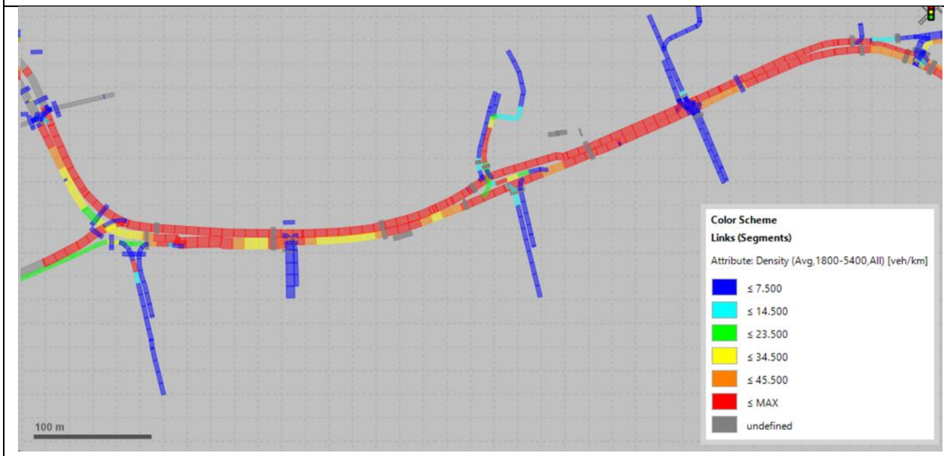
Figure 199. Modelled pedestrian and vehicle densities segment 3

In Segment 3, the plots show similar LOS in all three scenarios.

PM Current – Vehicle Density – Segment 1 - (1700-1800)



PM Public Transport Priority – Vehicle Density – Segment 1 - (1700-1800)



PM Place Priority – Vehicle Density – Segment 1 - (1700-1800)

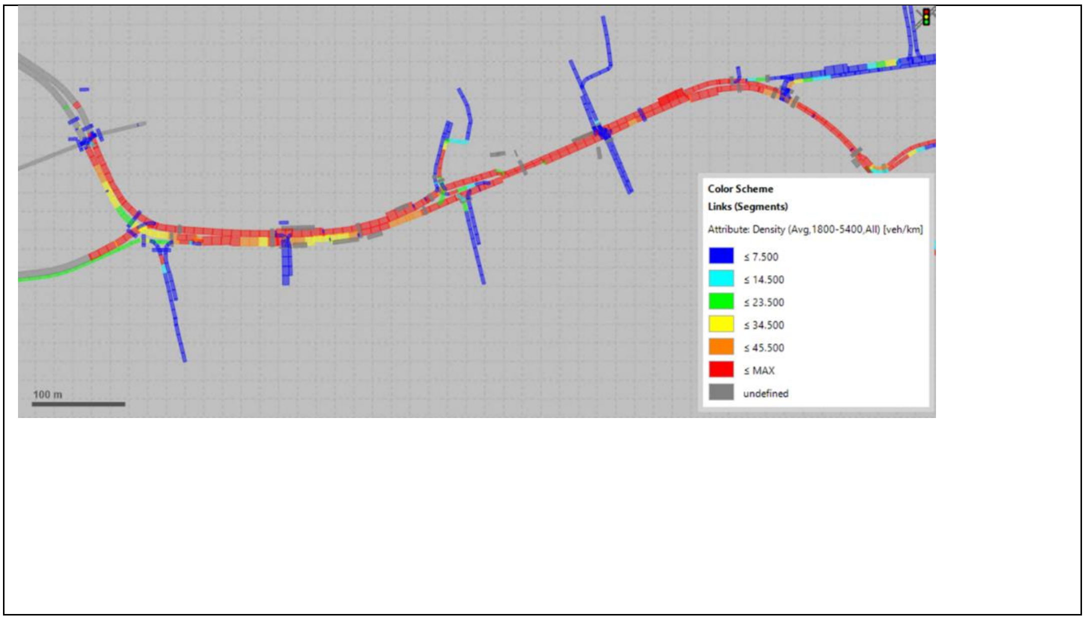
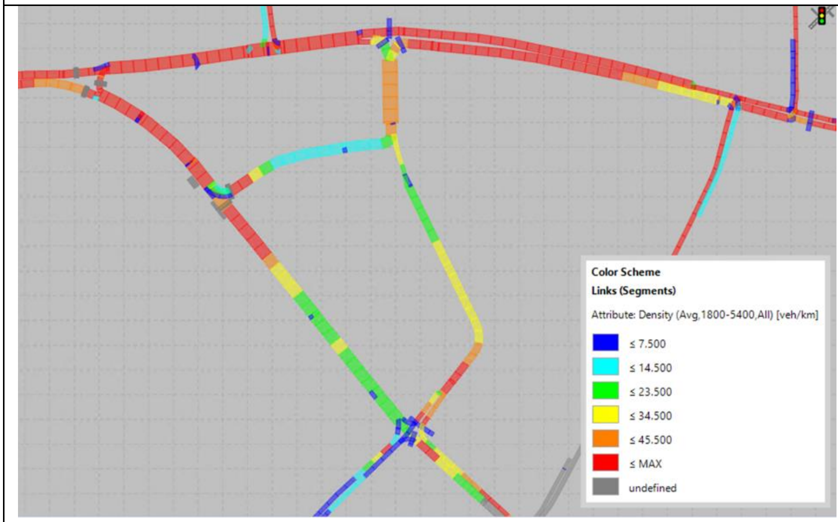
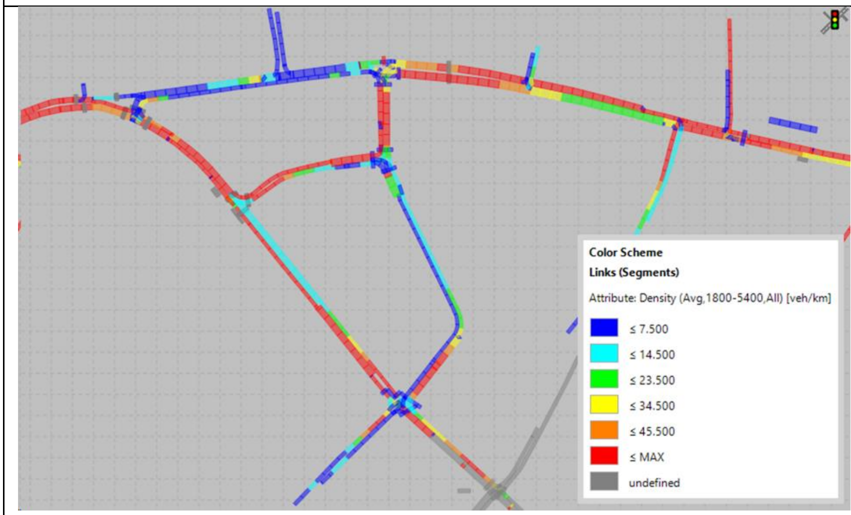


Figure 200. Modelled vehicles densities

Vehicle density shows high levels of vehicle density (>45.5 vehicles per kilometre) throughout the segment.

PM Current – Vehicle Density – Segment 2 - (1700-1800)

PM Public Transport Priority – Vehicle Density – Segment 2 - (1700-1800)

PM Place Priority – Vehicle Density – Segment 2 - (1700-1800)

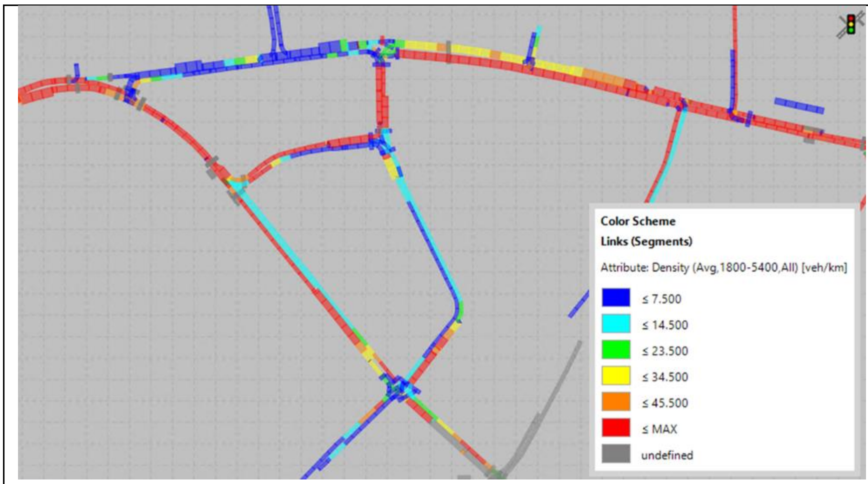
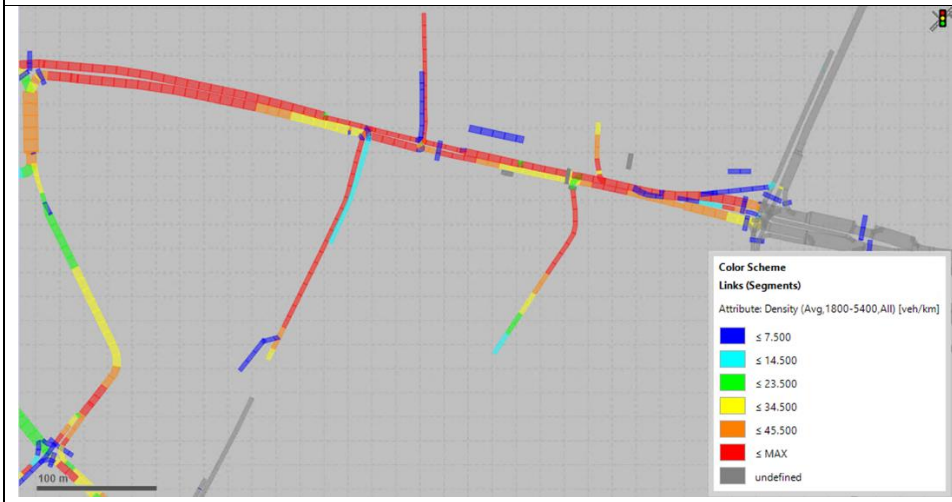
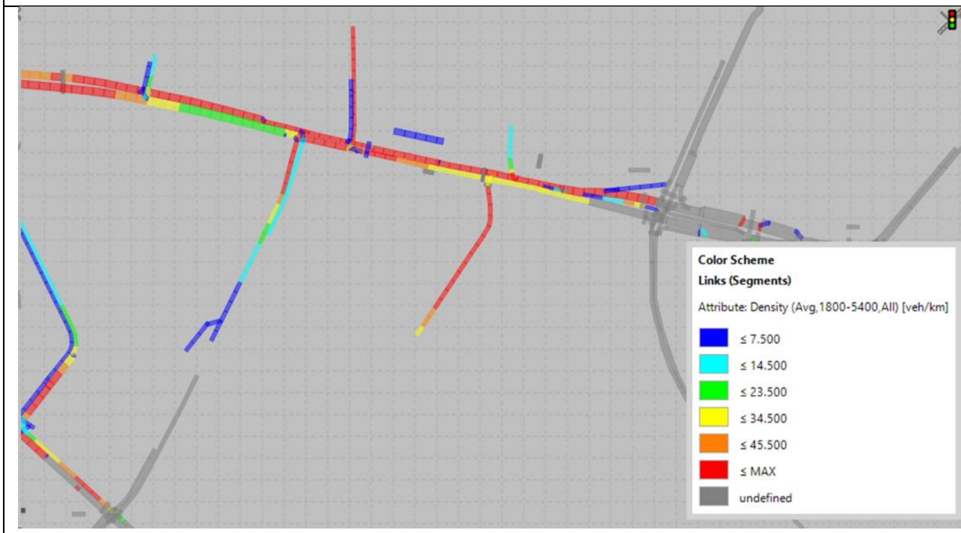


Figure 201. Modelled vehicle densities

Segment 2 shows a much different picture between the PT and PP scenarios compared to the current scenario, due to the change in how the vehicles route through this section. In the PT and PP scenarios, the Bus/Taxi only link (northern link) of the gyratory system shows average vehicle density <7.5 vehicles/kilometre. The other links show an increase in vehicle density as the general (non-PT traffic) now share the western southern and eastern links in both directions.

PM Current – Vehicle Density – Segment 3 - (1700-1800)

PM Public Transport Priority – Vehicle Density – Segment 3 - (1700-1800)

PM Place Priority – Vehicle Density – Segment 3 - (1700-1800)

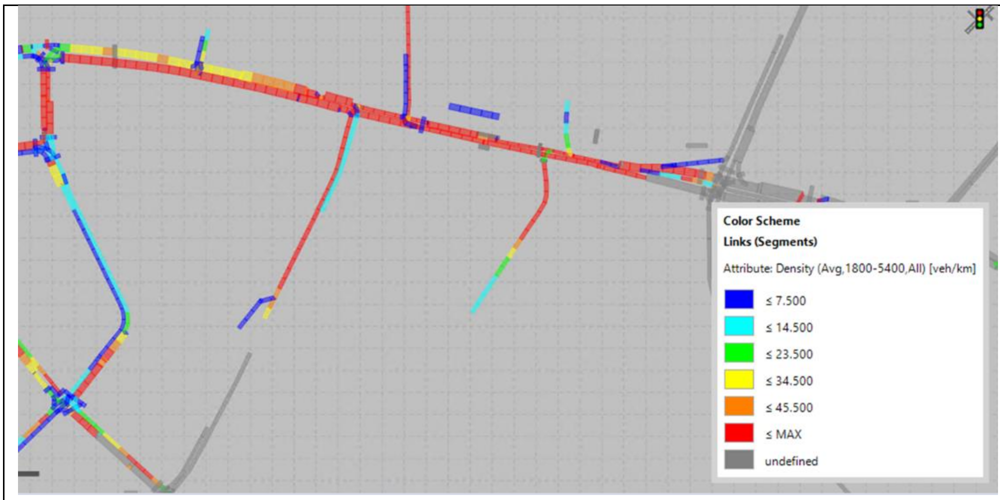


Figure 202. Modelled vehicle densities

The plots above shows that Segment 3 densities are different throughout the scenarios. There is a reduction in Vehicle Density eastbound on the A2 in both the PT and PP scenarios. In the PP scenario there is a higher density westbound – this is due to the reduction in the capacity at the gyratory westbound in the PP scenario compared with the PT scenario.

Table 35. Average speed modelling results

	Average Speed (mph) - OUT_21				
	All	Motorised	Cyclists	Cars (excluding Taxi)	Bus
Current					
1700-1800	6.0	5.9	9.5	5.9	6.1
1800-1900	7.4	7.2	10.2	7.2	7.0
Public Transport Priority					
1700-1800	6.0	5.9	9.3	5.8	6.6
1800-1900	6.1	5.9	9.3	5.8	6.7
Place Priority					

1700-1800	6.1	6.0	8.8	5.9	6.2
1800-1900	5.7	5.5	8.7	5.4	6.1

The average speed in the model shows that the general trend is that the higher speeds are in the Current and Public Transport Priority scenarios, with the exception of motorised vehicles in Place Priority. In contrast to the Current Scenario, the Public Transport Priority and the Place Priority have lower average speeds in all vehicle types in the second hour compared to the first hour. This is due to the build-up of queues throughout the modelled time period.

Buses in the Public Transport Priority Scenario have a higher speed in the first hour and a lower speed in the second hour in comparison to the Current Scenario. This shows that the overall lowering of speeds due to queues has an impact on the bus services, however the speed drop is less than average cars.

Table 36. Average delays modelling results

	Average Delay (s) - OUT_13				
	All	Motorised	Cyclists	Cars (excl Taxi)	Bus
Current					
1700-1800	232	245	60	241	237
1800-1900	176	187	50	187	179
Public Transport Priority					
1700-1800	232	248	79	246	208
1800-1900	233	250	83	251	193
Place Priority					
1700-1800	228	242	90	241	237
1800-1900	255	273	98	275	237

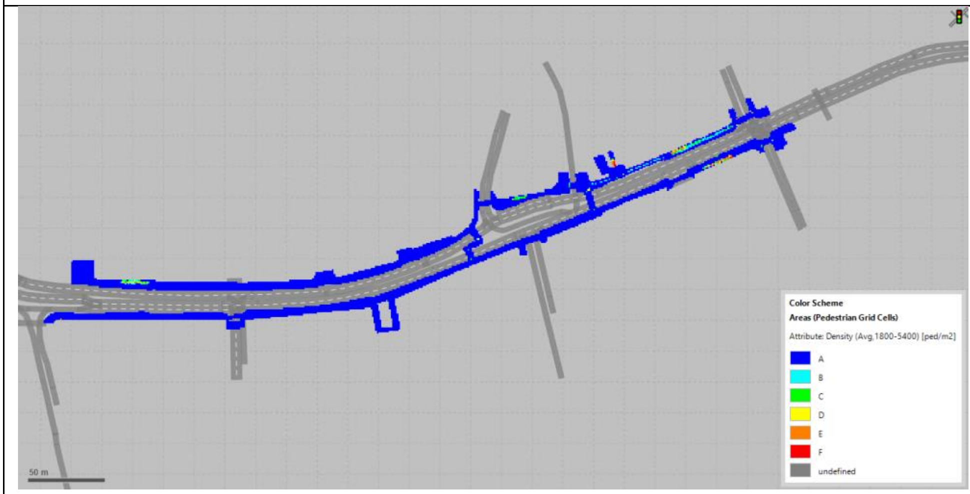
Average Delay per vehicle shows the same pattern to speeds.

Table 37. Two-way modelled flows

2-way Modelled Flows (All Vehs) – OUT 2		Current	Public Transport	Place Priority
1700-1800	Segment 1	2001	1895	1914
	Segment 2	2150	1906	1885
	Segment 3	1590	1616	1518
1800-1900	Segment 1	2041	1962	1985
	Segment 2	2272	1982	1969
	Segment 3	1689	1671	1407

The two-way modelled flows in the different segments shows that the Current Condition has a higher flow than the Public Transport and Place Priority Scenarios in all segments. The Place Priority has a similar level of flow compared to Public Transport in Segment 1, however it has reduced 2-way flows in Segment 2 and Segment 3. This is due to higher levels of congestion in the stress section that restricts flow, leaving queueing to enter it.

IP Current – Pedestrian Density (LOS) – Segment 1 - (1200-1300)



IP Public Transport Priority – Pedestrian Density (LOS) – Segment 1 - (1200-1300)

IP Place Priority – Pedestrian Density (LOS) – Segment 1 - (1700-1800)

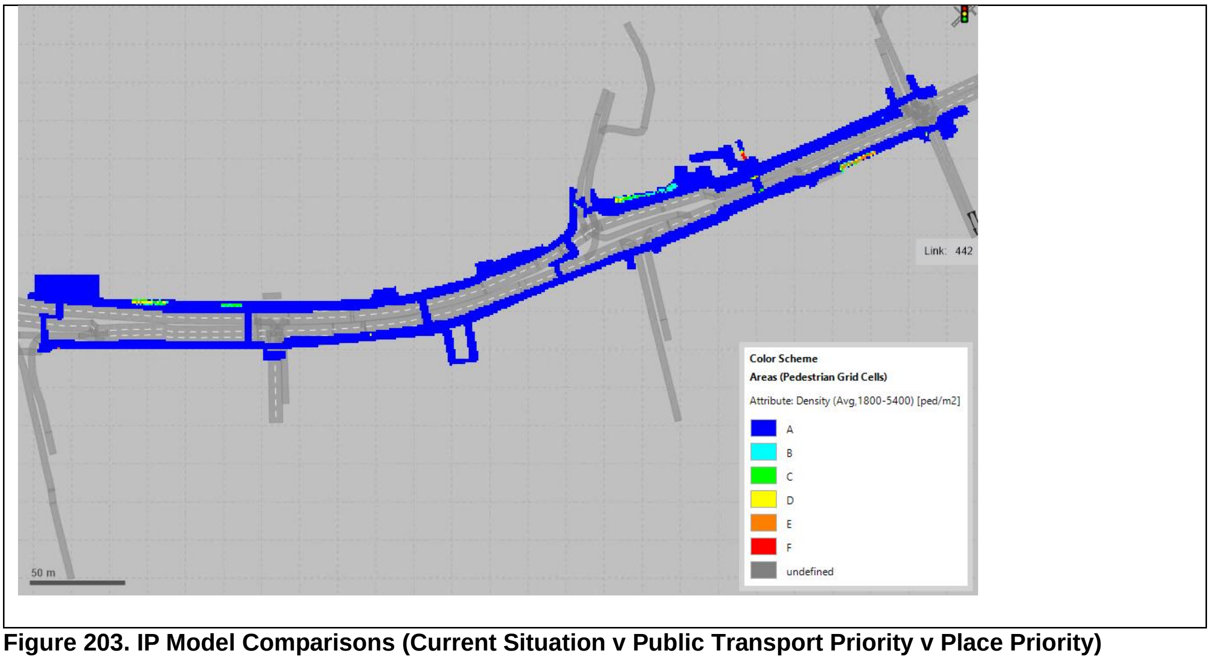
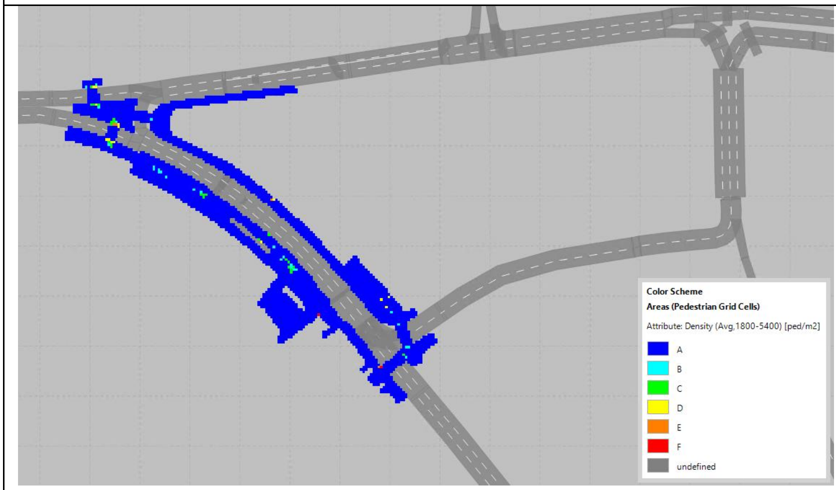
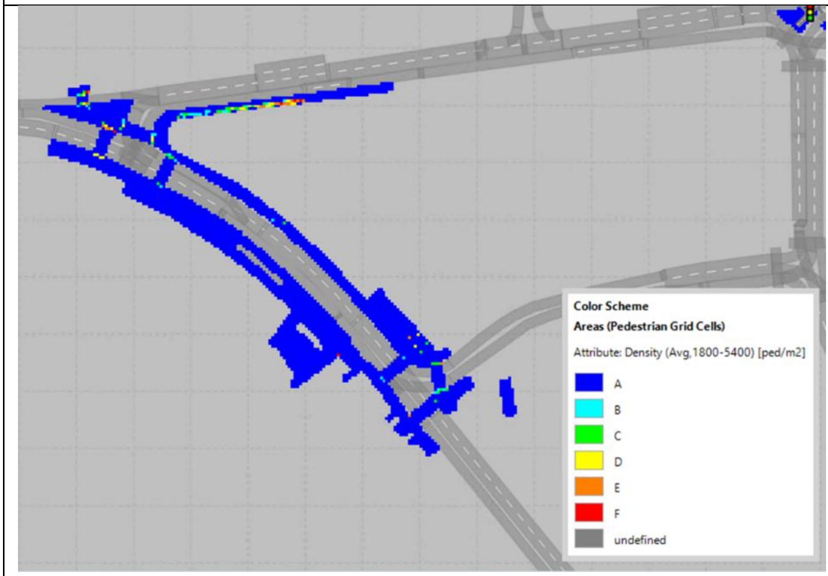


Figure 203. IP Model Comparisons (Current Situation v Public Transport Priority v Place Priority) Pedestrian density Segment 1

In comparison to the Current Condition, both Public Transport Priority and Pedestrian Priority shows an increase in LOS B to LOS A on the Northern Pavement of the A2, east of New Cross Gate Station. This is due to the relocation of the bus stop to the west in these scenarios. The rest of the segment shows LOS A, apart from at bus stops where this is higher.

IP Current – Pedestrian Density (LOS) – Segment 2 - (1200-1300)

IP Public Transport Priority – Pedestrian Density (LOS) – Segment 2 - (1200-1300)

PM Pedestrian Place – Pedestrian Density (LOS) – Segment 1 - (1700-1800)

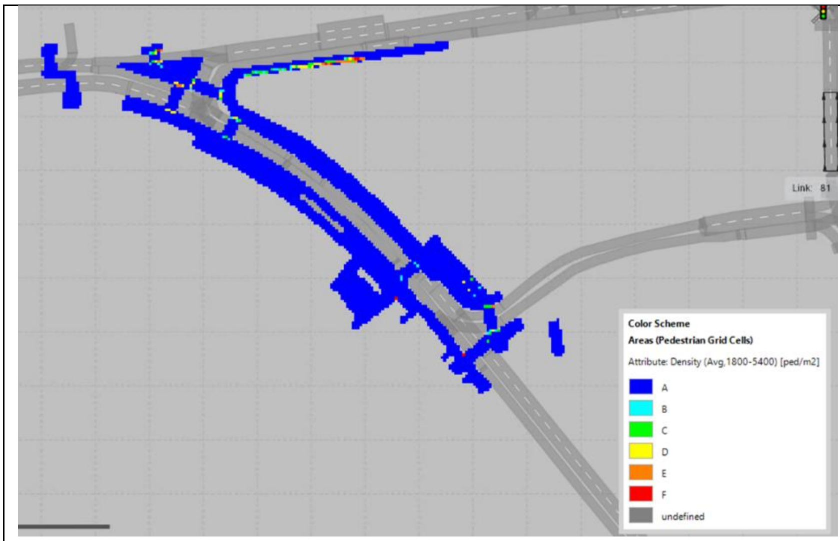
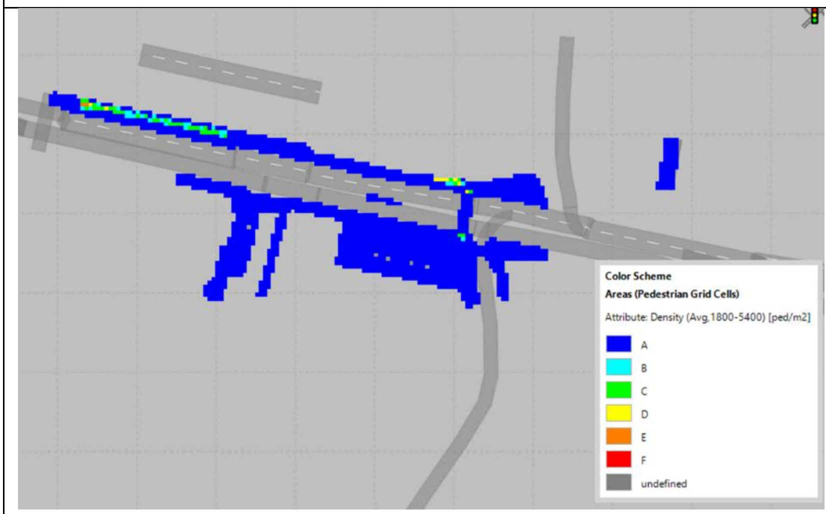


Figure 204. IP Model Comparisons (Current Situation v Public Transport Priority v Place Priority) Pedestrian density Segment 2

The plots above show LOS A throughout most of the segment, however where the bus stop has been relocated in Public Transport Priority and Place Priority, the modelled LOS has gone from LOS A to LOS B-F, where pedestrians wait for their bus service.

IP Current – Pedestrian Density (LOS) – Segment 3 - (1200-1300)

IP Public Transport Priority – Pedestrian Density (LOS) – Segment 3 - (1200-1300)

IP Pedestrian Place – Pedestrian Density (LOS) – Segment 3 - (1700-1800)

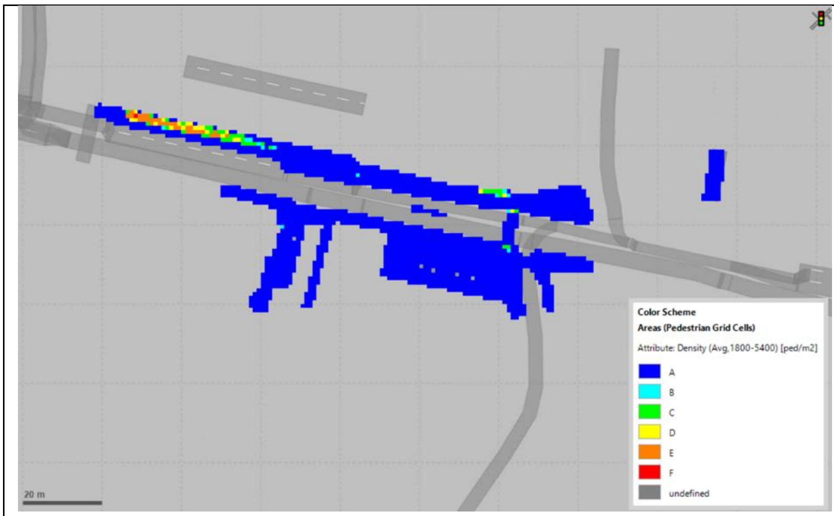
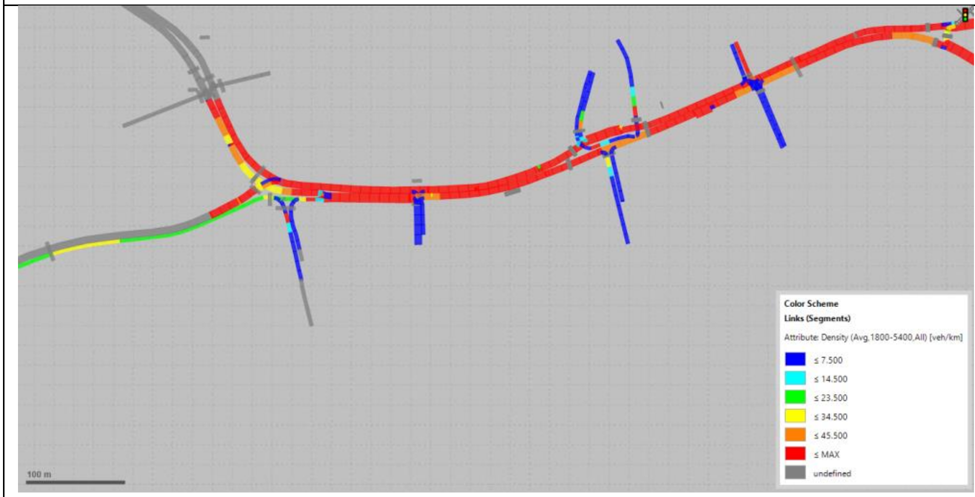
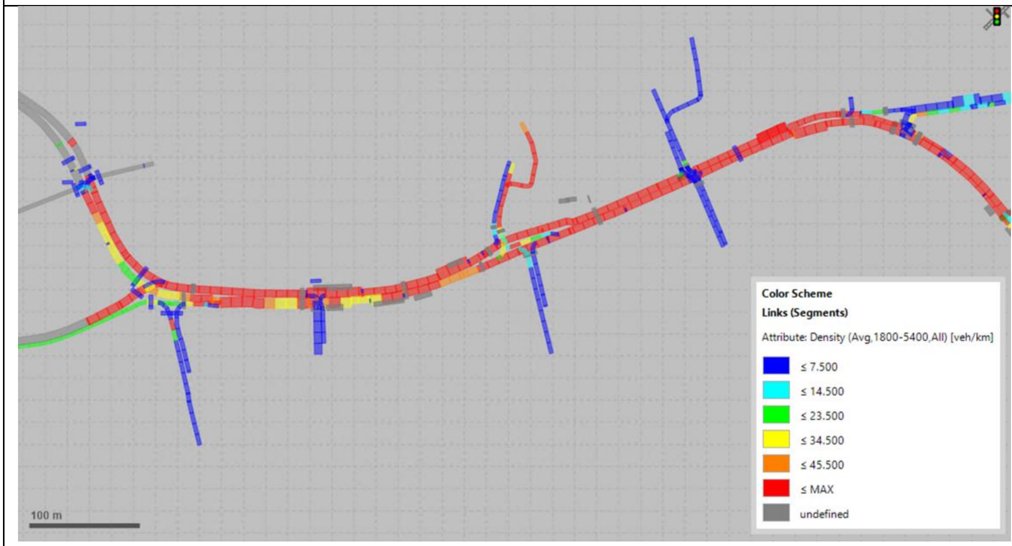


Figure 205. IP Model Comparisons (Current Situation v Public Transport Priority v Place Priority) Pedestrian density Segment 3

Segment 3 shows a similar LOS throughout all modelled scenarios.

IP Current – Vehicle Density – Segment 1 – Hour 1

IP PT Priority – Vehicle Density – Segment 1 – Hour 1

IP PP Priority – Vehicle Density – Segment 1 – Hour 1

 Version: 3

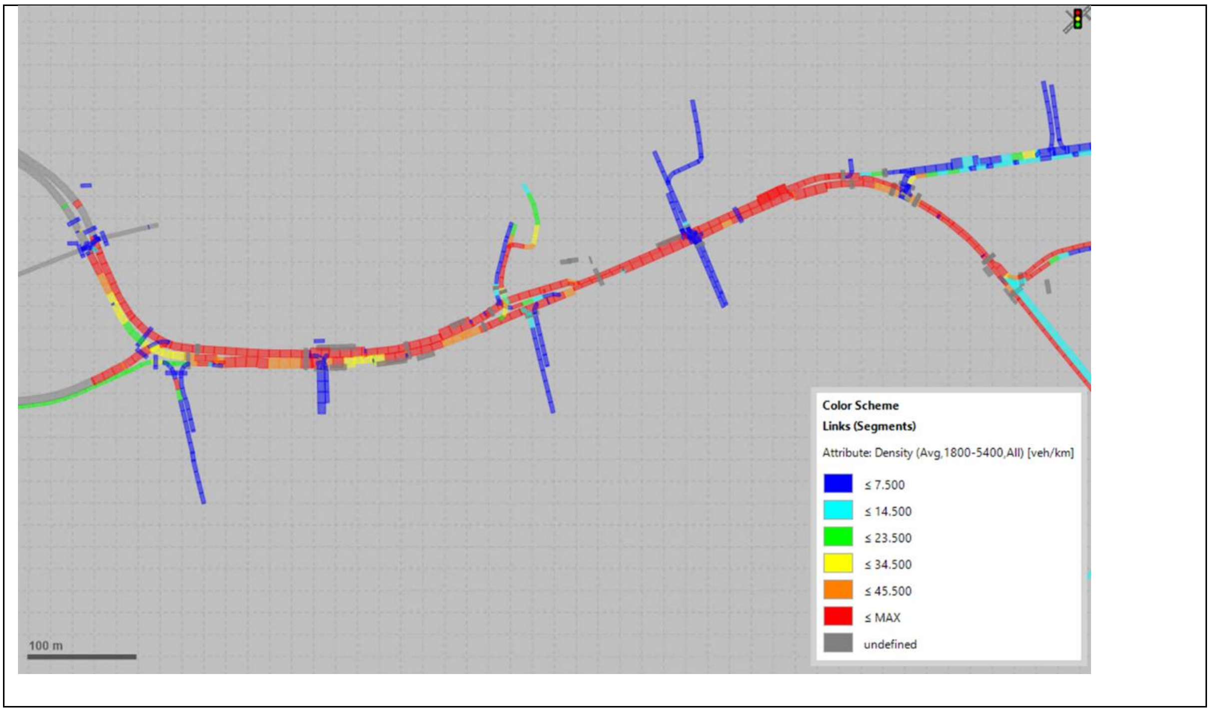
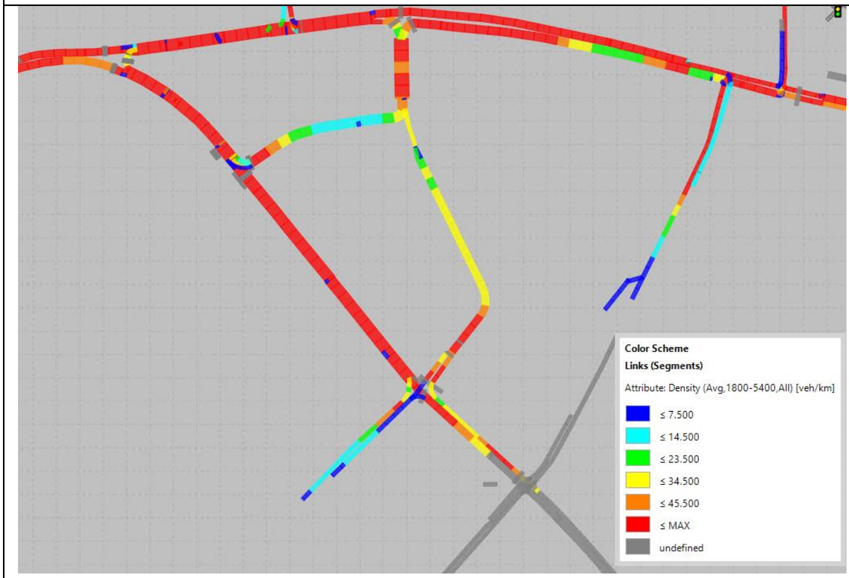
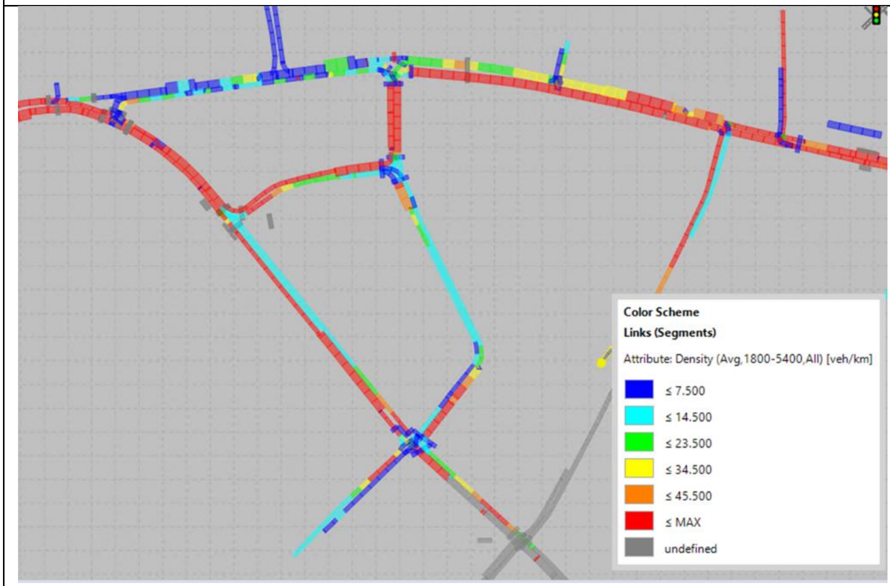


Figure 206. Model Comparisons (Current Situation v Public Transport Priority v Place Priority) Vehicle density Segment 1

In Segment 1, vehicle density shows a similar pattern through all scenarios, however there is a slightly higher density in Segment 1 westbound in the current condition compared to Public Transport Priority and Place Priority.

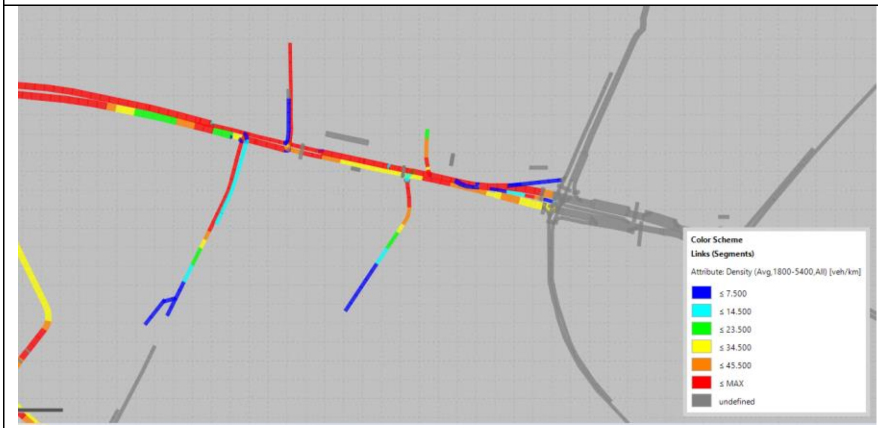
IP Current – Vehicle Density – Segment 2 – Hour 1

IP PT Priority – Vehicle Density – Segment 2 – Hour 1

IP PP Priority – Vehicle Density – Segment 2 – Hour 1

 Version: 3

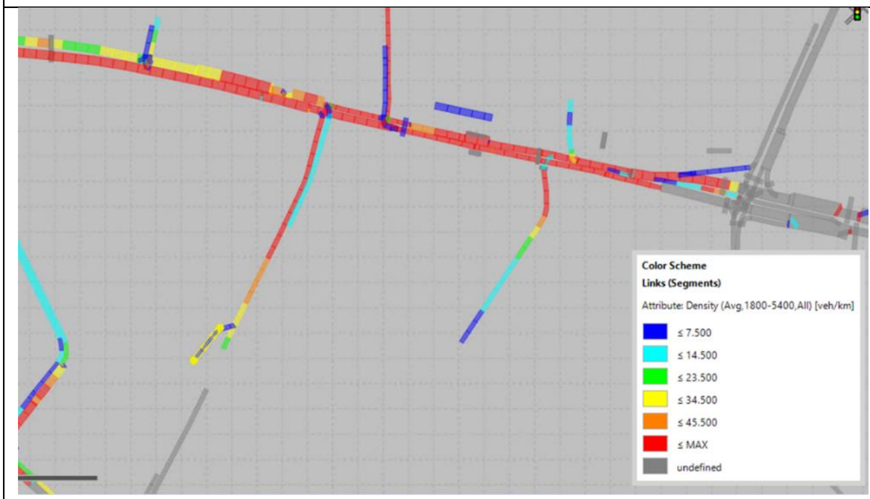
Figure 207. Model Comparisons (Current Situation v Public Transport Priority v Place Priority) Vehicle density Segment 2

Segment 2 vehicle density plots clearly show the changes of the reconfiguration of the gyratory. The northern link in Public Transport Priority and in Place Priority is showing a much reduced Vehicle Density as there are no private vehicles routed this direction any more.

IP Current – Vehicle Density – Segment 3 – Hour 1



IP PT Priority – Vehicle Density – Segment 3 – Hour 1



IP PP Priority – Vehicle Density – Segment 3 – Hour 1

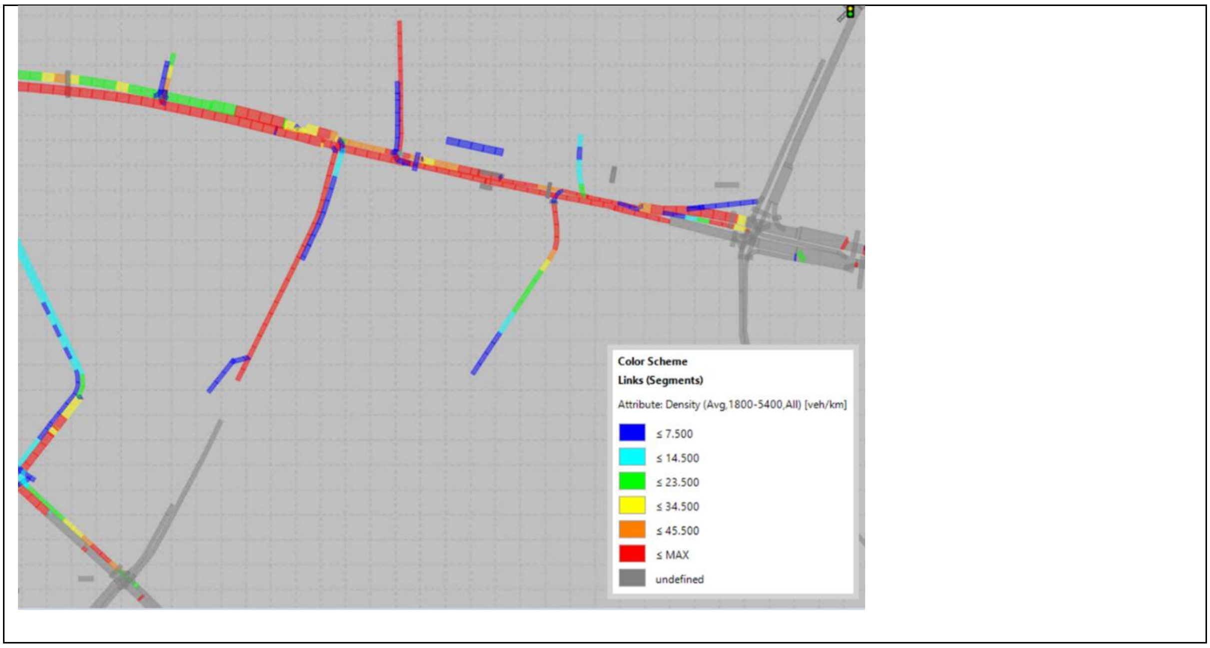


Figure 208. Model Comparisons (Current Situation v Public Transport Priority v Place Priority) Vehicle density Segment 3

Between the Current and Pedestrian Priority and Place Priority, there is a slight reduction in the vehicle density eastbound and increase westbound. This seems due to the reduction in flow through Segment 2.

Table 38. Average speeds across all scenarios and modes

	Average Speed (mph) - OUT_21				
	All	Motorised	Cyclists	Cars (excl Taxi)	Bus
Current					
1230-1330	6.0	5.9	9.5	5.8	5.8
1330-1430	7.4	7.2	10.2	5.5	5.7
Public Transport Priority					
1230-1330	5.4	5.3	8.8	5.3	5.7
1330-1430	5.2	5.0	8.6	5.0	5.4
Place Priority					
1230-1330	5.4	5.3	8.7	5.2	5.6
1330-1430	5.2	5.0	8.1	5.0	5.4

The average speeds in the Current scenario are modelled to be higher than in the Public Transport Priority or Place Priority scenarios. In contrast to the Current Scenario, the Public Transport Priority and the Place Priority, the second hour is showing lower speed than the first hour.

The average speed of bus services is higher in the public transport The average speed of bus services is slightly lower in the public transport priority scenario than in the current condition, however the drop in speed is less than the drop in speed in general traffic. This shows that the bus priority measures partially mitigate the impacts from the other elements of the scheme in this scenario.

Table 39. Average delays across all scenarios and modes

	Average Delay (s) - OUT_13				
	All	Motorised	Cyclists	Cars (excl Taxi)	Bus
Current					
1230-1330	232	245	60	243	260
1330-1430	176	187	50	262	261
Public Transport Priority					
1230-1330	252	268	92	265	307
1330-1430	275	295	107	291	345
Place Priority					

1230-1330	258	275	94	273	313
1330-1430	276	295	125	291	336

The Average Delay is showing a much higher delay in the second hour for both the Public Transport Priority and the Place Priority in comparison to the Current Scenario.

There is an increase in delay to bus services in the public transport scenario and place priority in comparison to the Current Condition.

Table 40. Average flows across all scenarios and segments

2-way Modelled Flows (All Vehs) – OUT 2		**Current**	**Public Transport Priority**	**Place Priority**
1230-1330	Segment 1	2001	1846	1903
	Segment 2	2150	1816	1868
	Segment 3	1590	1508	1367
1330-1430	Segment 1	2041	1957	1929
	Segment 2	2272	1938	1911
	Segment 3	1689	1384	1286

The modelled flows showing lower flows in all segments, in both hours, and particular much lower flows in Segment 3 in the second hour.

5.6 Appraisal of design options

This chapter draws on T4.4/D4.4 and the appraisal methods used for the design options. Each modelled option was inputted into the tool, see below for identifier code of each option. However, the tool required extremely detailed information for the most part which was not available at the scale or detailed level of the stress section for each of the design options. Therefore, the results for each of the appraisal methods should be treated with caution due to the limited data available for input and the subjectiveness of many of the indicators assessed against.

Furthermore, as previously stated, all modelled results are indicative only, are pre-feasibility, non-audited designs of the highway and signal design and therefore should not be used or relied upon outside of the MORE project. A model used for supporting scheme development in London must be built according to the MAP, Modelling Guidelines and include a Scheme Impact Report.

The modelled design options assessed were:

Table 41. Assessed design options

Option	Unique Identifier	Description
Option 0 (Do Nothing)	LON_S1_0820_2021_M_ABDEJK00	Existing gyratory function (PT Design)
Option 1	LON_S1_0820_2021_B_ABDEJKT0	Public Transport Priority- PM
Option 2	LON_S1_0830_2021_B_ABDEJKRT	Public Transport priority- IP
Option 3	LON_S1_0820_2021_B_ABCDET00	Place priority- PM
Option 4	LON_S1_0830_2021_M_ABCDERT0	Place priority- IP

5.6.1 Political and Technical assessment

The Political and technical assessment (PTA) required the same inputs used for the Option generation and road space design tools in terms of political priority considered for each road user/ use and objectives. As a result, and in combination with the VISSIM outputs for each performance indicator the following summary table has been provided from the PTA which highlights Option 1 as the best option in the appraisal.

Table 42. Outcome on Performance Indicators

	Number of indicators for which option is best	Number of violations of political priorities	Number of violations of standards
Option 0 (Do nothing)	29	-	6
Option1	9	3	6
Option2	10	3	6
Option3	10	3	6
Option4	13	3	6

As the table indicates, the number of violations of political priorities were the same across all designs, as were the violations of standards. The meant the ranking of best option came down to the number of performance indicators for which option is best.

As can be seen from the table, the impact of time periods were limited in each of the design priorities of PT and place.

Perhaps surprising to see was that the existing road space layout and function performed best against the performance indicators, by a considerable margin, in this appraisal against all of the design options generated. The reason for this is because Option 0 is the best for almost all movement indicators and for all modes. The other design options, particularly the place-based options, are best for place indicators, but there are not so many of them with complete data from the VISSIM outputs, hence the aggregate results suggest 0 is best due the quantity of data provided for the movement indicators compared to place.

Wider impacts could not be calculated for any of the options due to difficulties in estimating the safety impacts for each design option which would require engineering expertise and road safety audits to be completed on the designs. Even with technical review it would not be considered acceptable to estimate the number of incidents a design option may result in. There is also limited methodologies and expertise for an officer to be able to calculate how each option may impact economic factors such as property values or visits to local businesses.

This was however the most straightforward of the appraisal tools to use and receive outputs from, particularly as all the information was to hand and in-line with the inputs of previous MORE tools used.

5.6.2 Cost-Benefit Analysis

The inputs to this appraisal method were limited for the design options due to limited knowledge of the impact design options would result in to monetised indicators. For example, a detailed assessment of each design option, much more detailed than the LineMap designs would be required to understand the cost of the design for the tool to generate a net-benefit over 5 years. This is not deemed to be appropriate to estimate at this concept stage of the design process and further feasibility work would be required to understand the costs associated for each element of the designs.

It was helpful that the tool provided built-in monetary values, particularly as expertise beyond that available by an officer not specialising in economics would be required to generate monetary values of changes in performance indicators for all options.

The net benefit could not be calculated due to insufficient knowledge of the implementation and maintenance cost of each of the design options modelled. The benefit-cost ratio (BCR) has been calculated based on the change in performance indicators against the Do Nothing option VISSIM outputs. The results are as follows:

Whilst the tool was completed to the best of officer abilities, we were not able to produce any results for the BCR due to insufficient data available to make a comprehensive assessment of all options. The Cost benefit appraisal uses only the movement indicators, where a monetary value can be applied. For these indicators, Option 0 is always the best. There is a definitive lack of data on the monetary values of place indicators which is a major limitation. Furthermore, due to limitation as stated above in calculating implementation and maintenance costs for design options, calculating benefit-cost ratios would not be reasonable: there are only costs and no benefits.

5.6.3 Multi-Criteria Analysis

The Multi-Criteria Analysis (MCA) has revealed the following results, consistent with outputs of all the appraisal tool results for assessing the design options option 0- the existing gyratory design and operation has returned the best outcome.

Table 43. Overall ranking

	Option 0	Option 1	Option 2	Option 3	Option 4
Overall Ranking	1.0	2.0	2.0	4.0	4.0
Overall Score	69%	8%	8%	5%	5%

Similar to the CBA outputs, this is due to the insufficient data available to input for place based performance indicators and the reduced reporting in comparison to movement performance indicators.

Whilst much of the inputs were automated for the design options performance indicators, the tool required input for maximum and minimum values for each performance indicator per road user group. This was considered to be the most complex aspect of the appraisal tool as the values are subjectively determined by the inputter and impacted by a number of factors. This is further complicated at the spatial level at which the best and worse values should be deemed against comparable to the stress section being analysed.

The worst values cannot also be worse than what has been generated for the design options values. This indicates that the design options will have a positive impact which is not necessarily true, particularly considering the experimental and concept nature of the design options.

For the London example it was also limited to request the MCA be ranked by multiple assessors. The policy direction and objectives are set by the Mayor of London and professionals within TfL all work towards these as set out in the Mayor's Transport Strategy. This results in limited variation in the ranking of results given all officers are governed by Mayoral objectives.

As a general note and feedback on the appraisal tools, it was felt there needed to be more of a discussion and engagement with cities and partners about what's realistic, but also useful to analyse from VISSIM. As stated previously, the appraisal methods used in this study do not meet the requirements of TfL's modelling guidelines or Department for Transport feasibility assessment. Therefore, outputs from the appraisal should be treated with caution and considered an indication as per the concept nature of the design options explored in this project. Further detailed assessment and expert input would need to be consulted before a definitive conclusion could be drawn on appraisal of designs.

5.7 Wider public engagement (using TraffWeb)

Public engagement using Traffweb was limited to issues consultation prior to option generation and road space design tool piloting. Engagement took place face-face using informal drop-in interview targeting local businesses and interest groups around the New Cross stress section area.

The engagement took place in August and September 2019 and resulted in:

- 40 Stakeholders met or spoken to via Informal interviews
- 20 responses from 10 Individuals

A number of major stakeholders within the stress section signed up to join the co-production of designs, including:

- Goldsmiths University
- Primary and secondary school
- Royal Mail
- Local library/ learning centre
- Local community centre
- Local advocacy group

However, due to the impact of the COVID-19 pandemic it was not possible to continue with co-production with members of the public to produce designs. Nevertheless, the issues consultation gave us a rich opportunity to engage with a wide audience and to understand issues of the Streetspace from the people who live and work in the area. There was a mix of stakeholders represented including residents, commuters and the majority of responses from local business employees/ owners as the chart below indicates.

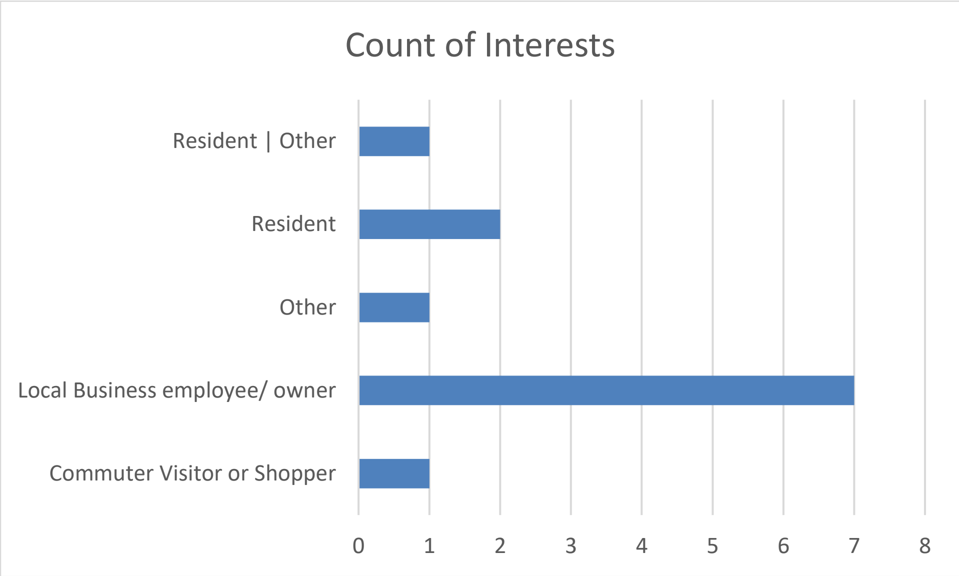


Figure 209. Responses received by group

The modes respondents also travelled by were mixed, the majority were car drivers or passengers but there were also bus passengers and pedestrians represented in the responses.

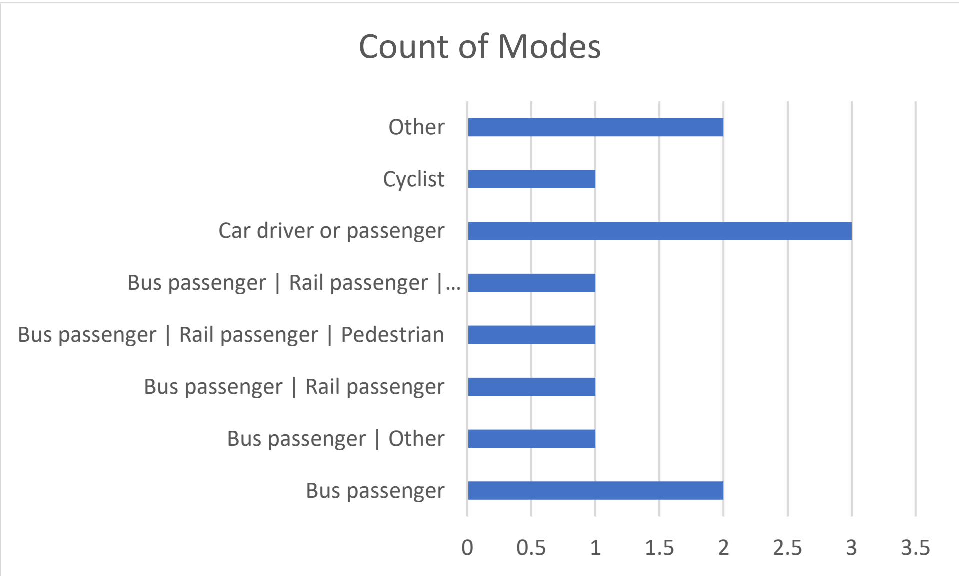


Figure 210. Respondents by modes used

In terms of the issues raised by respondents, these can be seen below. The tool potentially highlights these issues to users with check boxes for relevant indicators that respondents may not suggest themselves without prompts.

The main issues highlighted were related to parking and loading and road safety and crossings on the stress section. The safety element most raised was the level of informal crossings taking place and the removal of guardrail at busy sections on the footway that people felt represented a safety hazard.

For parking and loading, businesses mentioned trying to re-time deliveries to ensure heavy traffic is avoided. Congestion was also the third most sited issue by respondents which is in-line with the data analysed for D5.1 with high levels of delay for all motorised modes.

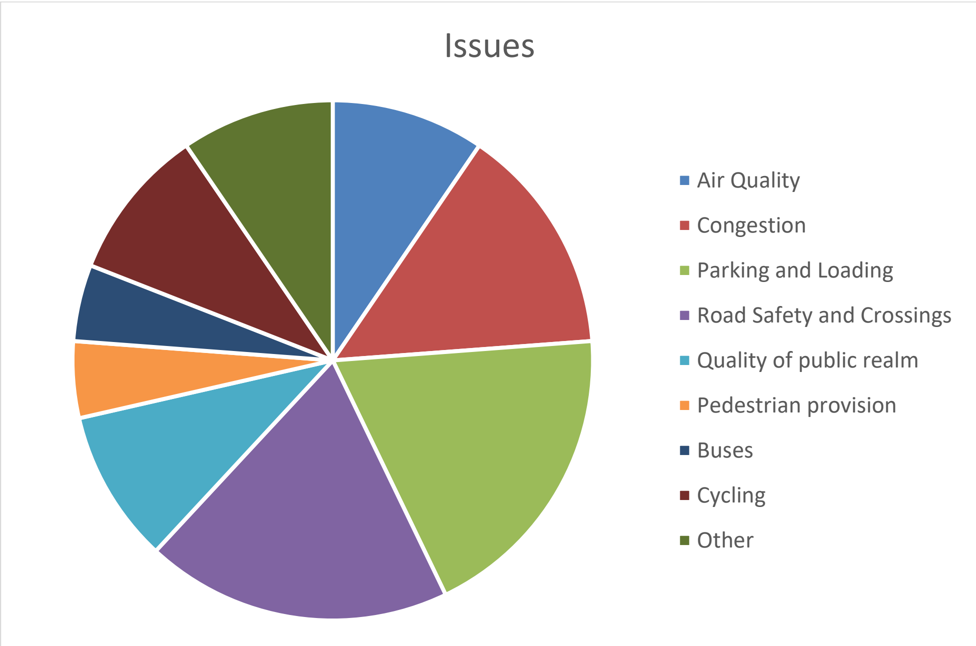


Figure 211. Issued flagged by respondents

Our face-face approach to engagement and providing the tool as a link to complete at a later date or on an I-Pad whilst we were with stakeholders worked well to capture respondents' thoughts. However, some general feedback on the tool was received:

- The Map was too small and not clear how to navigate on some screens. Comments that it was too blurry
- It was observed that people don't identify places well with OS Map. Some people aren't familiar with maps and particularly OS, where there are only street names and building

numbers. The names of shops/ landmarks would be useful to help people locate themselves and the issues.

- There was no way to go back in the tool if selecting new comment and change your mind. Previous answers can't be submitted.
- People don't tend to distinguish issues by time- consider it a problem 'all the time'
- Many issues people were commenting on fell under more than one category- i.e., the speed of cyclists makes me feel unsafe- falls under cyclists and safety.
- Once finished inputting in the tool, respondents would continue to tell us about more issues that they hadn't considered when using tool that then weren't captured.

6 MALMO

6.1 A brief summary of current conditions along the Stress Section

6.1.1 Introduction

Malmö has a rather unique approach of the city partners of the MORE project. While there are some issues with stress along the section for the current conditions, the characteristics of the stress section will change dramatically over the next decades as described in D5.2 - Case Study Design Methodology – Future Conditions.

The results of future condition street design exercises will be presented later in future deliverable D5.4. As a substitute for current condition street design exercises, this report goes in-depth into the extensive model development and analysis performed by the City of Malmö within the MORE frames. The final part of the report is a test of the tool TraffWeb in wider public engagement exercises together with the results and conclusions drawn, both from a city-specific and MORE perspective.

The stress sections traffic flows of today is analysed through the simulations, presented in chapter 3 where the potentials of gating and a mobility hub is investigated. The stress section on Hans Michelsensgatan is presented below:

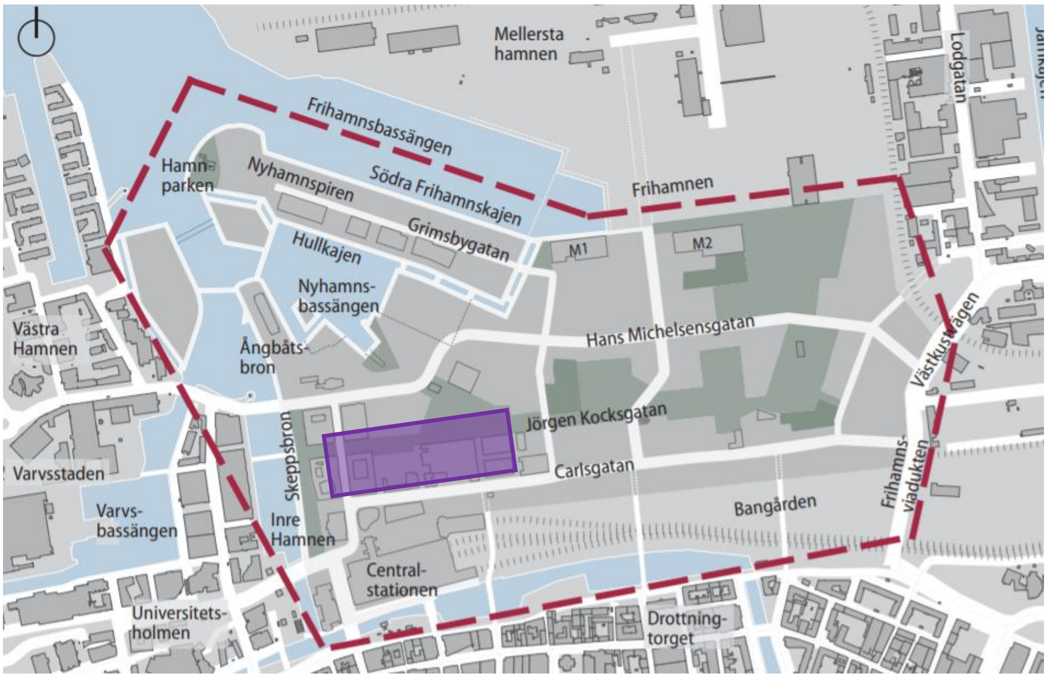


Figure 212. Stress section.

For the future conditions of the study area, feeder route and stress section, Malmo has used the three main scenarios as a base for modelling and discussions on how urban life is affected. The scenarios serve as a foundation for the public engagement activities presented in Chapter 6.5. Accounted for in previous deliverables, the scenarios can shortly be described as per below:

Mobility: Traffic planning is car-favouring, extrapolating the current modal share and giving plenty of spaces for car and goods traffic hence coping with an expected increase of motorized flows. While seemingly increasing accessibility for car users, noise and barrier effects are to be expected.

Sustainability: Based on Sustainable Urban Mobility Plan (SUMP) objectives, this scenario is all for promoting mobility in a sustainable, more carbon-efficient way. Public transportation and bicycling have good prerequisites but can be conflicting to both cars and pedestrians.

Liveability: This scenario focuses on the local urban life of the area and adjacent streets. The promoting of the city environment makes it possible to have people strolling along wider sidewalks, stopping by at a café or local store to make errands. However, great measures are needed to redirect incoming traffic efficiently.

6.1.2 Background

The corridor chosen as study area stretches from the inner city of Malmö, adjacent to Malmö central station and the University in a north-easterly direction towards the highway and functional TEN-T link of E6/E20. The TEN-T corridor stretches along the outer ring of the city. There are nine intersections in total where the TEN-T corridor connects with city streets network of Malmö.

Figure 213. Study area (green) and its relation to the main TEN-T network corridors in Malmö (pink).

The properties of the feeder route change going from the eastern to the western parts. The eastern parts of the route run along with industrial areas and are characterized mainly as a controlled-access highway, with few signalled intersections and high speeds combined with unprioritized, but separated bicycle lane.

The more westward the feeder route runs, the more a developed cityscape edges the road. The industries changes to offices and sidewalks. While the capacity of motorized traffic flows decreases with fewer traffic lanes and lower speed limits, the section comes under stress.

6.1.3 Stress section: Hans Michelsensgatan

The west-most part of the corridor, Hans Michelsensgatan is sided by a mix of street-level parking lots and high-rise office and commercial buildings. Separate curbs for pedestrians are found on both sides of the road, however, there is no infrastructure for bicycles. The street will change character hugely in the coming decades as the area of Nyhamnen is developed. The current traffic flow is approximately 11 300 vehicles per average weekday.

Figure 214. Hans Michelsensgatan, facing west

Along with the western parts of Hans Michelsensgatan, just east of the bridge of *Universitetsbron* the section has sidewalks on both sides. On the south side, two sidewalks are separated by an almost 7-meter-wide green space with trees. For motorized traffic going west, there is one lane going straight forward while one is used for turning right. In the opposite direction, the lane is 8 meters wide without any visual separation. This indicates it is only one lane until it by a crossing east of the stress section splits into two. The cars going in opposite directions are separated by a median. There is no dedicated space for cycling along the stress section.

6.1.4 Traffic flows of current condition stress section

Many of the vehicles using the corridor has northern and western parts of the central Malmö as starting position or destination. The majority of the private vehicles traversing the corridor in rush hour are commuters with workplaces in central Malmö and Västra hamnen. The majority of the heavy vehicles has starting point or destination in the harbour area and the rail-road good hub.

Table 44. Traffic flow (motor-vehicles per average weekday) in corridor sections.

Index	Corridor section (today)	Traffic flow	Peak hour
1	Hans Michelsensgatan by Skeppsbron	11000	1200
2	Jörgen Kocksgatan by Navigationsgatan	15000	1600
3	Carlsgatan by Vanuatuan	9000	1000

The corridor section with index 2 will be part of Hans Michelsensgatan in the future when the area of Nyhamnen is rebuilt, while Jörgen Kocksgatan will be more of a green street – prioritizing pedestrians and bicyclists.

6.2 Building and applying the simulation models

The following chapter accounts for the work the City of Malmö has performed with building and applying simulation models, both integrating mobility hubs and gating as methods of decreasing traffic queues and disturbances in the transport network. This substitutes some of the work that other cities have done with their current condition stress section.

The numbers in the models and results presented in the chapter are based on the current flows in the network.

6.2.1 Mobility hub

Background

The possibility to investigate the potential and the effects of a mobility hub for the Western harbour and Nyhamnen area in Malmö is studied in the ongoing MORE project. The Western Harbour is a new district in Malmö located on a former shipyard area less than a kilometre north of the central station and just west of the stress section. The idea of the hub is mainly to ease traffic congestion on the only road connection in the east along Hans Michelsensgatan and Universitetsbron. This by giving car travellers an alternative to park the car at the mobility hub and change to a shuttle bus, a bike or an electric scooter for the last part of the trip to the many office buildings in the Western harbour area. The location of the mobility hub is studied on a site a few hundred meters east of the Western harbour area. To help attract travellers to the mobility hub parking fees are assumed to be increased in the Western harbour area.

Malmö municipality has recently developed a mesoscopic traffic simulation model using the software DYNAMEQ. The DYNAMEQ model covering Malmö and its surroundings, shown in Figure 215, has been used to evaluate mobility hubs potential of attracting people travelling to work in the Western harbour. The mesoscopic model is based on the same network as the macroscopic SAMPERS/EMME model that Malmö has been using for a longer time. SAMPERS is originally a national demand model where route choice is modelled in the EMME software. SAMPERS is developed by the Swedish Transport Administration but used by Malmö municipality to make its forecast scenarios for travel demand.

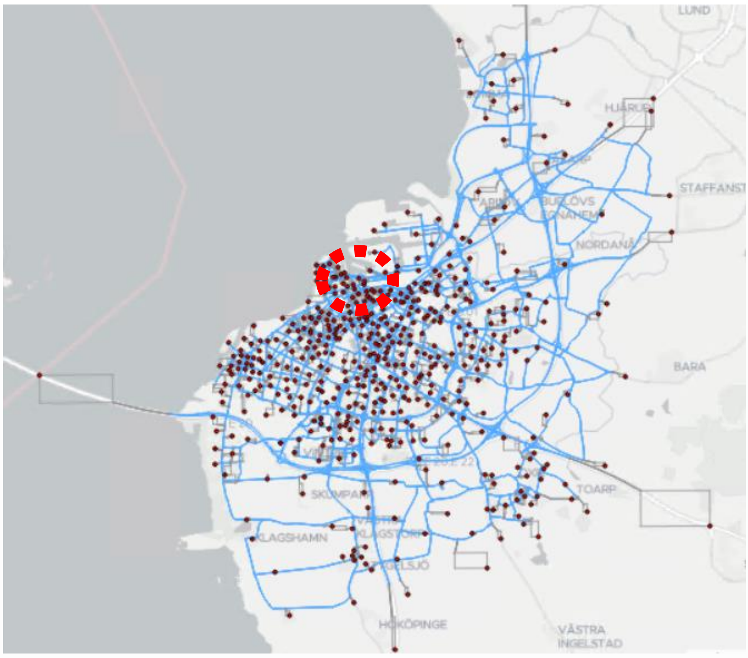


Figure 215. Mesoscopic model covering Malmö and its surroundings. Road network in blue and red dots are modelled origins and destinations The Western harbour and Nyhamnen area in the red circle.

This chapter aims to describe the methodology used to model the mobility hub. Further, the aim is to draw some conclusions of the potential for the mobility hub to attract car travellers working in the Western Harbour and Nyhamen area to change mode for a part of the trip.

Methodology and assumptions

The mobility hub is implemented and evaluated in the mesoscopic traffic model based on generalized cost expressions. Generalized cost (GC) is widely used as a measure of the attractiveness of different travel alternatives described in equivalent units of money or travel time. The GC ideally include all sacrifices to make a trip, also part of the trip apart from time and fees, such as perceived inconvenience, that are aspects travellers try to minimize.

The meso-level simulation results can provide an estimate on what approximate levels of parking fees are needed for the mobility hub to be an attractive option. Further, the simulation results show for which origins and destinations the mobility hub attract trips. However, the mesoscopic simulation is not able to model the option to not use a car at all for the trip to the Western harbour even though this will be more likely than today if parking fees are increased. Therefore, in addition to the mesoscopic simulation, the macro-level model SAMPERS[8] was

[8] SAMPERS is a national demand model with route choice on a macro level in EMME, originally developed by the national road administration and used for travel forecasts in Malmö.

used to study the effect of increased parking fees, in the Western Harbour, on mode choice and travel demand. This to be able to show a simulated estimate on the actual number of trips the mobility hub can attract.

6.2.2 Modelled mode choice alternatives

The following three different alternatives to travel and from the office area in the Western harbour are simulated in the mesoscopic simulation model using GC expressions:

- ***Alternative 1: Car all the way****.* The current behaviour to travel by car the entire way to the offices in the Western harbour.
- ***Alternative 2: Car and change to a shuttle bus at mobility hub.*** The car is parked at the mobility hub and to shuttle bus between the office area and the hub.
- ***Alternative 3: Car and change to bike (or electric scooter) at mobility hub.*** The car is parked at the mobility hub and a bike (or electric scooter) is used to travel between the office area and the hub.

The GC simulated in DYNAMEQ was based on the perceived cost for different parts of the trip such as travel time, exchange time and fees, with values from national guidelines presented in ASEK. ASEK provides recommendations regarding which economic analysis methods and calculation principles should be applied in socio-economic analyses of measures in the transport sector. ASEK must also recommend which calculation values are to be used for socio-economic analyses and the production of traffic forecasts.

To take in to account the effects of increased parking fees on reducing overall car trips to the Western harbour demand adjustments were made based on the SAMPERS result. SAMPERS results imply that 30% of today's car travellers to and from the Western harbour change to another mode for the whole trip (mostly bike and public transport) or avoid travelling to the area at all. This if parking fees are increased by 100 SEK per day. A further assumption is made that about 30% of the car travellers still left will consider the mobility hub as an option, this based on mode choice elasticities in SAMPERS.

6.2.3 Assumptions on travel speeds and fees

Table 45. Assumptions on travel speeds and fees

Part of trip	Assumptions
Car	Travel time from simulation including delays due to congestion.

Bus	Travel time on the bus from simulation assuming separate lanes for the bus at speed 40 km/h for the shuttle bus between the hub and the Western harbour office area. Dwell time at bus stop 30 seconds Average waiting time for bus, one-one way, 5 minutes
Walking	5 km/h average speed
Bike	10 km/h average speed
Parking fee	50-100 SEK per day

6.2.4 Implementation in the simulation model

The implementation of the alternatives in the DYNAMEQ model is shown in Figure 216. The shuttle bus (blue) is modelled with a speed of 40 km/hour (assuming separate bus lanes were needed) including waiting time at the mobility hub and dwell time at the 4 bus stops along the way, and with walking speed from the bus stop to the destination in the Western harbour area. Bike or electric scooter paths (green) is modelled with a speed of 10 km/hour the whole way from the mobility hub to the destination. Car travel is simulated in the road network (grey) including delay due to congestion and with a parking fee expressed as additional travel time connected to the destination in the Western harbour. Car trips also include a short walk at 5 km/hour for the last part of the trip from the parking facility to the office.

Figure 216. Implementation of shuttle bus (blue) and bike/electric scooter (green) paths between the mobility hub (orange triangle) and the destinations in the Western harbour and Nyhamnen area (red dots). The road network is represented in grey.

The following GC expression was used for each of the three alternatives in the simulation:

Table 46. GC expressions used in simulation

Alternative	Generalized Cost expression
Alt 1: Car all the way	Travel time in the car between home and office + Parking fee + Travel time walking from parking garage to office
Alt 2: Car and change to a shuttle bus at a mobility hub	Travel time in the car between home and hub + Waiting time for shuttle bus + Travel time in shuttle bus + Travel time walking from bus stop to office
Alt 3: Car and change to bike (or electric scooter) at mobility hub	Travel time in the car between home and hub + Travel time by bike (or electric scooter) to office

6.2.5 Valuation of the perceived cost for different parts of the trip

To use the generalized cost expressions a valuation of the different parts of the trip needs to be described in equivalent units of money or travel time. The following values are associated with the different parts of the trip based on ASEK which is guidelines from the national road administration on valuation in socio-economic analysis.

Following values are used for the different parts of the trip in each alternative:

Table 47 Values used for different parts of the trip

Part of trip	Value per person hour[9]	Comment
Travel time	127 SEK/hour	The value of travel time for average car travel (*Samtliga bilresor privata och tjänsteresor in ASEK)* is used for time in car, on a bus, on a bike or walking. This assuming that car is the main mode for the trip in all alternatives.
Waiting time for shuttle bus	317 SEK/hour	The value is 2.5 * Travel time (general factor for changing from one mode to another in ASEK).

The implementation of generalized cost in the simulation model is done expressing all parts of the trip in equivalent units of travel time based on 127 SEK/hour. A parking fee of 50 SEK is therefore expressed as an additional travel time of 24 minutes. The valuation of waiting time,

[9] ASEK increased from values for 2014 to 2020

considered to be a sacrifice 2.5 times larger than ordinary travel time, makes 5 minutes of waiting time for the shuttle bus equal to 12.5 minutes of additional travel time.

6.2.6 Results

Simulation results showing the number of travellers using the mobility hub during morning peak hour on each link (if more than 10) and the paths used through the road network travelling to the hub. The afternoon peak has also been simulated, resulting in roughly the same number of trips. With regards to this, only the morning peak hour is represented in the following results.

Trips via mobility hub, morning peak hour, parking fee 50 SEK per day

With a parking fee of 50 SEK per day 185 trips are made via the mobility hub. Almost all trips are coming from the east.

Figure 217. Number of trips via mobility hub travelling on each link (showing if more than 10). Morning peak hour parking fee 50 SEK per day.

Trips via mobility hub, morning peak hour, parking fee 100 SEK per day

With a parking fee of 100 SEK, 241 trips are made via the mobility hub. Most of the trips coming from the east.

Figure 218. Number of trips via mobility hub travelling on each link (showing if more than 10). Morning peak hour parking fee 100 SEK per day.

6.2.7 Discussion

Mesoscopic simulation has been used in addition to an adjusted car travel demand for the Western harbour, considering increased parking fees, based on macro-level forecasting in SAMPERS, to study the mobility hub. The simulation was carried out the existing DYNAMEQ model for Malmö using generalized cost expressions for the different trip alternatives.

Two significant aspects suggest that the mobility hub is less attractive than what has been modelled: Firstly, the perceived cost of time for car traveller working in the Western Harbour is most likely higher than the average values that ASEK suggests. This considering that the salary levels are believed to be above average in the area. A higher perceived cost for travel time makes the mobility hub less attractive. Secondly, parking at the mobility hub means that the car is less accessible during the day (let alone later in the evening if going by shuttle bus) since the owner becomes dependent on a bus timetable or a bike ride to access the car. The reduced accessibility to the car is not modelled in the simulation and is believed to be a significant aspect.

There is also an aspect that suggests that the mobility hub is more attractive than modelled. In the simulation, the time in car queues is modelled with the same perceived cost as travel time in general. This although guidelines in ASEK suggests higher cost on time spent in queues than the rest of the trip. However, time spent in car queues entering the Western harbour is on average only about 1 minute today across Universitetsbron. This suggests that it could be compared to a parking fee of 6 SEK[10] and therefore believed to have only marginal effects on the results.

6.3 Gating

For the Nyhamnen area, a microsimulation model has been developed in VISSIM covering the existing and future networks of Nyhamnen development and its surrounding connections to Västra Hamnen in the west and Inre Ringvägen in the east. In the east two connections has been modelled including both Västkustvägen in the northeast and Stockholmsvägen in the southeast. As of today, there are 11 signalized intersections within the network (Figure 219).

[10] In the simulation there is on average 1 minute of time in queue for a car passing Universitetsbron to enter the Western harbour and about 1 minute more of uncertainty about the travel time to arrival. According to ASEK the generalized cost for this is about 6 kr for a two-way trip in addition to the modeled generalized cost. This assuming time in queue having 1.5 times the cost of ordinary travel time and that 1 minute of travel time uncertainty having the cost of 0.9 times ordinary travel time.

Figure 219. Study area and model coverage. The two eastern links are Västkustvägen (northern) and Stockholmsvägen (southern).

During the morning rush hour, some queuing and slow-moving traffic is observed in the model along Hans Michelsensgatan caused by the pedestrian and bicycle crossing at Skeppsbron (Figure 220). The queue also affects the intersection between Hans Michelsensgatan and Utställningsgatan which then results in extended queues from the east.

In the eastern parts of the studied area, the situation during morning rush hour seems to be coping well with the traffic volumes and no extended queuing is observed in the model (Figure 221).

Figure 220. Morning rush hour without gating, the western part of the model, average speed

Figure 221. Morning rush hour without gating, the eastern part of the model, average speed

To evaluate the effects of gating in one or more signalized intersections a test has been carried out which focuses on reducing the queuing along Hans Michelsensgatan and the two focus areas where queuing is observed during the simulations of the situation today (Figure 222).

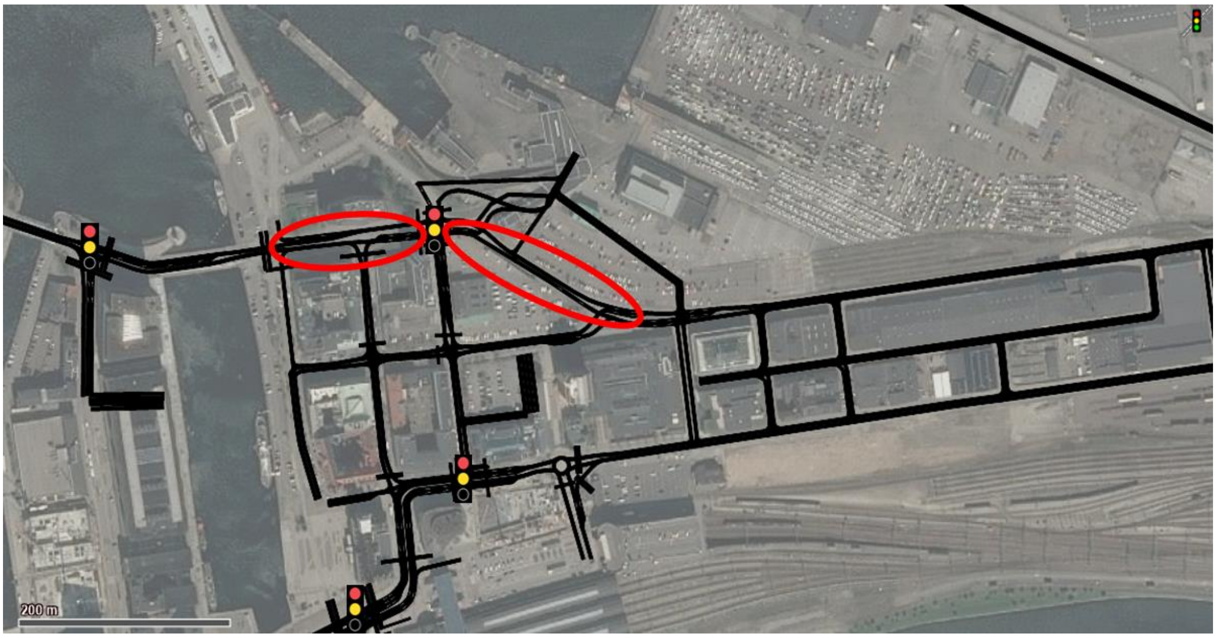


Figure 222. Focus areas of initial gating.

6.3.1 Methodology of initial gating

For each signal within the gating network, a series of different detectors has been placed in the surrounding network to assess the queues. The detectors responsible for determining gating in the intersection Hans Michelsensgatan - Utställningsgatan have in the test been placed as shown in the blue ring in the overview below (Figure 223). The same placement logic is then used for all gated signals (yellow markings show detectors for the signals Grimsbygatan and Carlsgatan in the east).

Figure 223. Occupancy rate for queue detectors.

To calculate the occupancy rate of the detector an inbuilt exponential smoothing is used as described in the VISSIM manual (Equation 1).

Equation 1. Vissim formula for calculating occupancy rate

You can use exponential smoothing to smooth the occupancy rate of a detector. This is necessary as detectors are either fully occupied or not occupied and thus do not provide sufficient information for signal control decisions. Exponential smoothing allows you to calculate the occupancy rate with help of the following equation, using the last *t* seconds:

$$s\left(t\right) = \alpha \cdot x + \left(1 - \alpha\right) \cdot s(t-1)$$

Thereby the following applies:

s(t)	new, exponentially smoothed value
s(t-1)	old, exponentially smoothed value (1 second ago)
x	new detector value
α	Smoothing factor [0 to 1]

Smoothing factors used in the initial tests are:

- Increasing: 0.001
- Decreasing: 0.001

The level of queueing downstream of the intersection is calculated every second in the model and the gating decision is then updated at 60-sec intervals in the initial tests.

Based on the occupancy rate at the focus location, a level of gating is then chosen for the signalized intersection during the next 60 sec.

When gating is active, green time for the focused phase is reduced in the direction towards the focused queuing area (Figure 224 and Table 48).

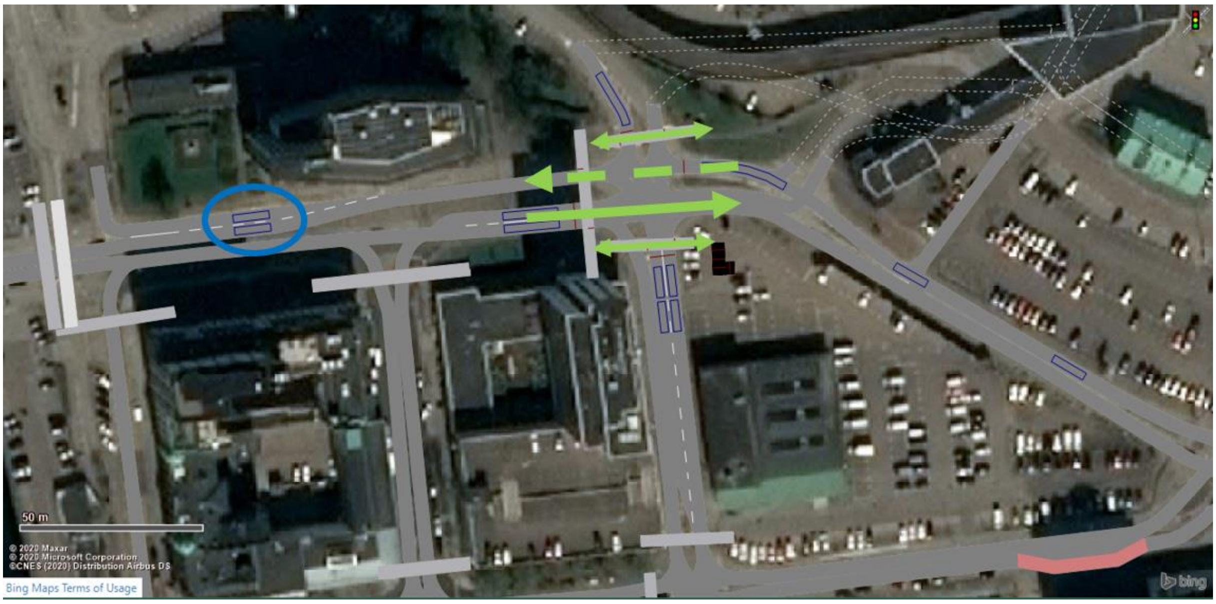


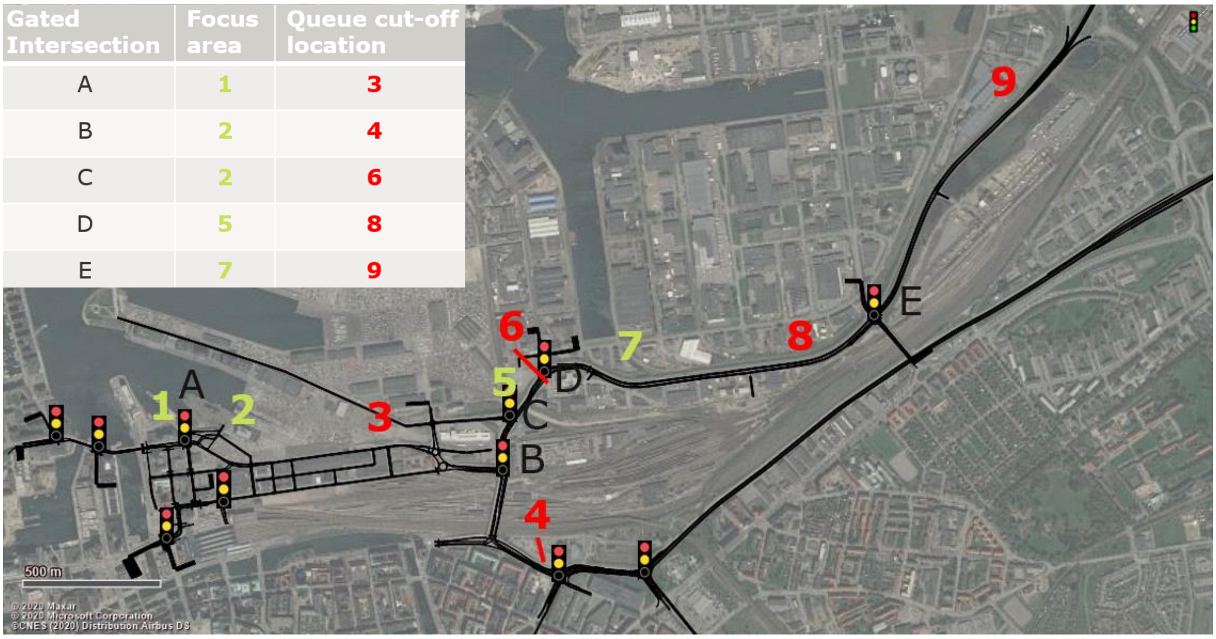
Figure 224. Gating logic approach within gated signals.

Table 48. Level of green time reduction

Queue	Level	Green time reduction	Phase
<= 50%	**0**	- 0	As usual
>50%	**1**	- 12	Extra phase
>65%	**2**	- 20	Extra phase
>80%	**3**	- 28	Extra phase

Each signal gates depending on the occupancy rate of queue detectors at the downstream signals within the gating network. Se placement of focus areas in green for which queuing is measured for the corresponding intersection (Figure 225).

While gating is active, queues will be building up upstream in the network. To assure that these queues do not reach critical lengths and thereby create further problems, a set of cut-off detectors has been placed in the network. When a queue is detected at these locations, the gating at the downstream signal will be terminated to prevent further queuing.



Gated Intersection	Focus area	Queue cut-off location
A	1	3
B	2	4
C	2	6
D	5	8
E	7	9

Figure 225. Gating logic and connections between intersections in the network

6.3.2 The situation during morning rush hour, average speeds of passing vehicles during 15-min intervals

During the morning rush hour with gating active, a higher average speed is observed along with both the focus areas of the Hans Michelsensgatan before and after the intersection Hans Michelsensgatan – Utställningsgatan (Figure 226).

Figure 226. Morning rush hour with gating, western part of the model, average speed

In the southeastern part of the network, queueing is observed along Frihamnsviadukten from the gated signal at Carlsgatan and upstream to the cut-off detectors before the intersection Hornsgatan – Drottninggatan (Figure 227).

Figure 227. Morning rush hour with gating, the southeastern part of the model, average speed

In the eastern parts of the studied area, increased queuing can be observed along Västkustvägen both at the intersection with Grimsbygatan and the intersection with Lodgatan. At the studied traffic volumes, the gating at Lodgatan manages to keep the queuing at Grimsbygatan at a constant level at the same time as the queuing along Västkustvägen does not reach critical levels (Figure 228).

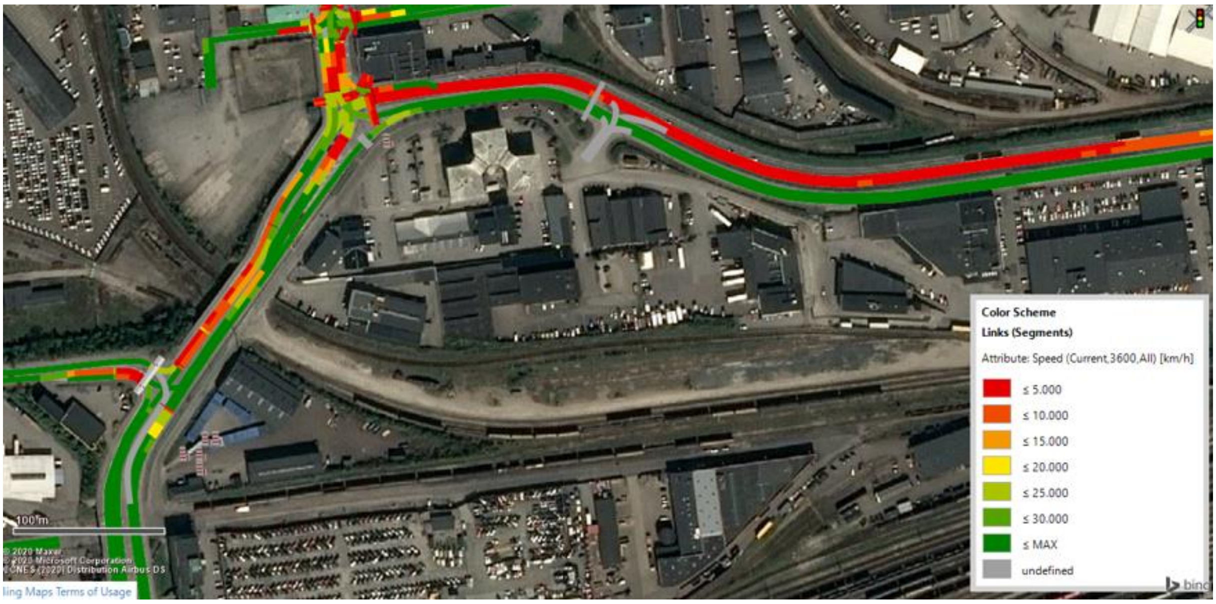


Figure 228. Morning rush hour with gating, eastern part of the model, average speed

In the most eastern parts of the network increased queuing can be seen also at the intersection Västkustvägen - Sjölundavidaukten due to gating being activated by the queuing from the Lodgatan intersection (Figure 229).

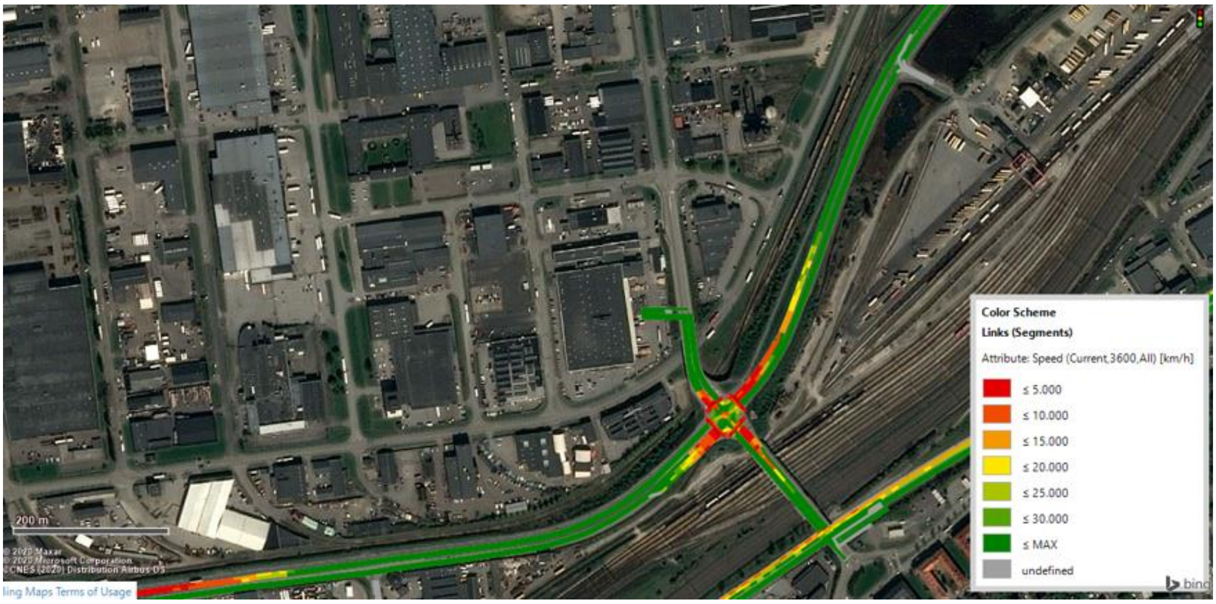


Figure 229. Morning rush hour with gating, the most eastern part of the model, average speed

6.3.3 Comparison results, queue lengths at intersections towards Västra Hamnen

As shown below gating is increasing the queue lengths in the intersections in the east of the study area to lower the average queuing in the west part of the model (Figure 230 and Figure 231).

At times when gating is either in the process of starting up or in situations where gating for some reason has had to be deactivated the lag due to large distances can lead to longer maximum queue lengths for Utställningsgatan.

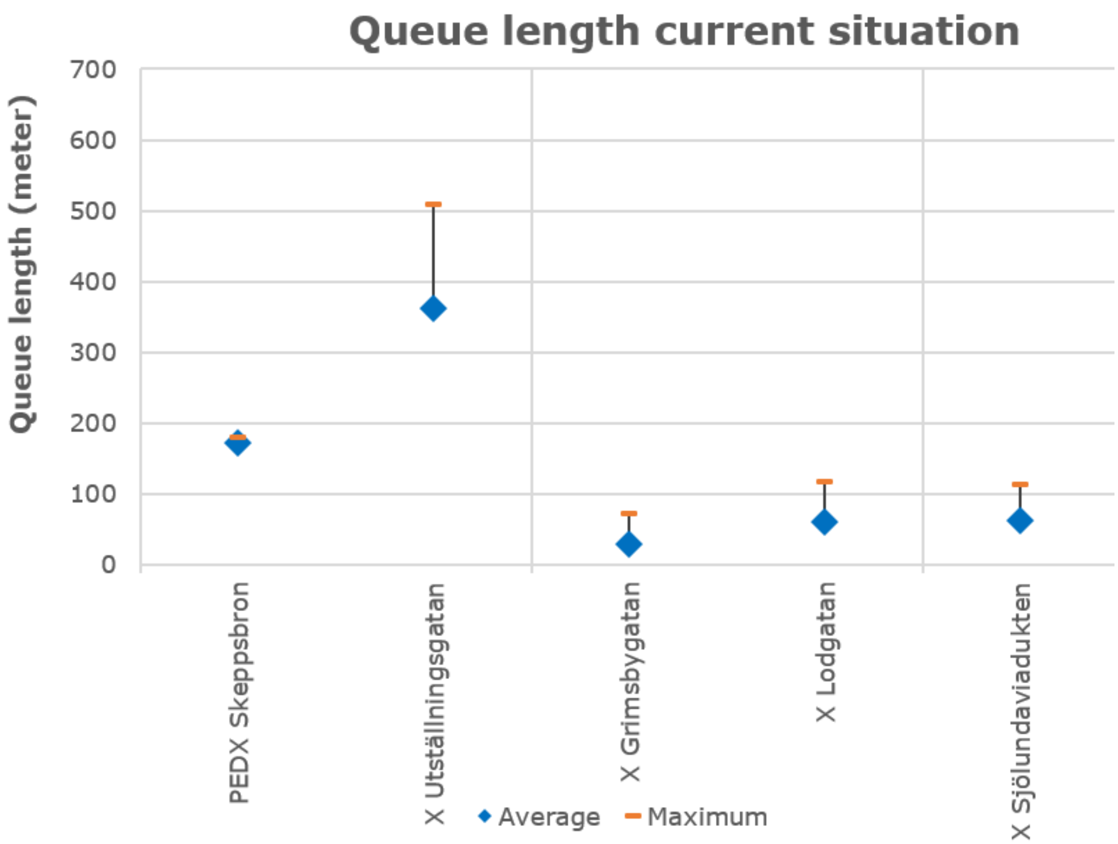


Figure 230. Queue length, current situation.

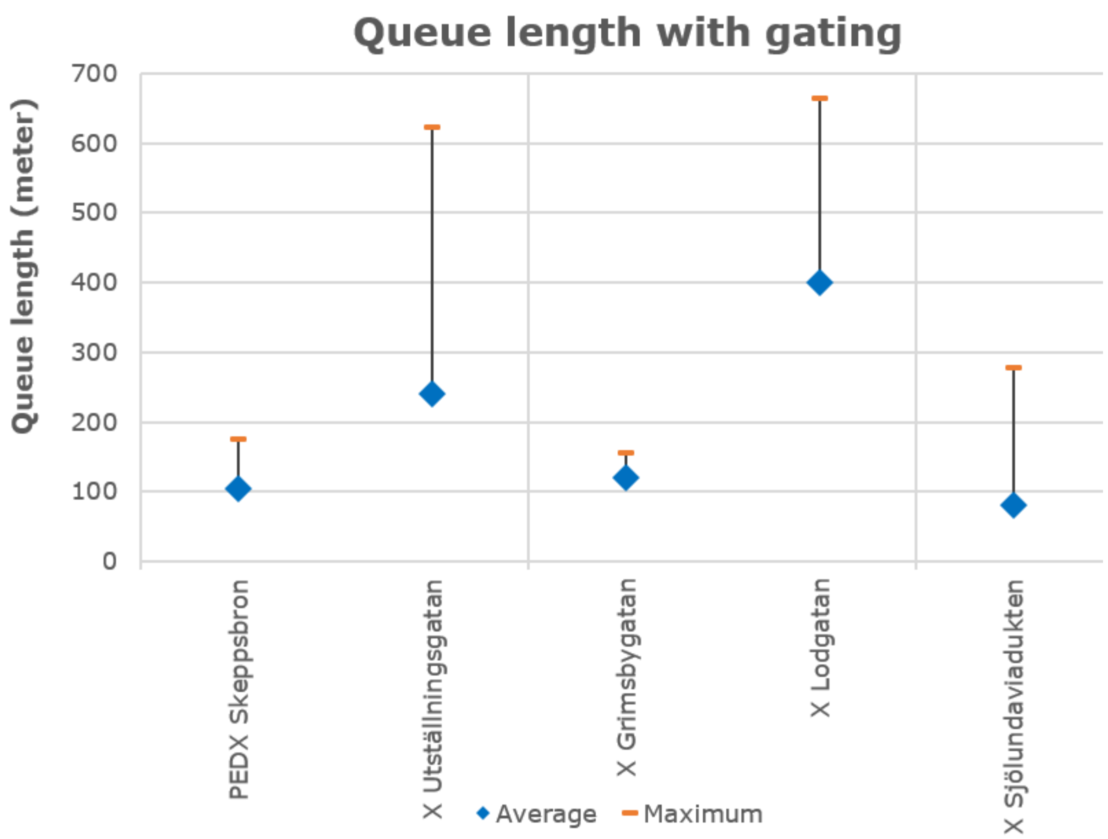


Figure 231. Queue length, current situation with gating.

As gating is activated, travel times increase in the eastern part of the network. The biggest increase in travel time is observed in connection to the queuing along Västkustvägen between Sjölundaviadukten and Lodgatan (Figure 232 and Figure 233).

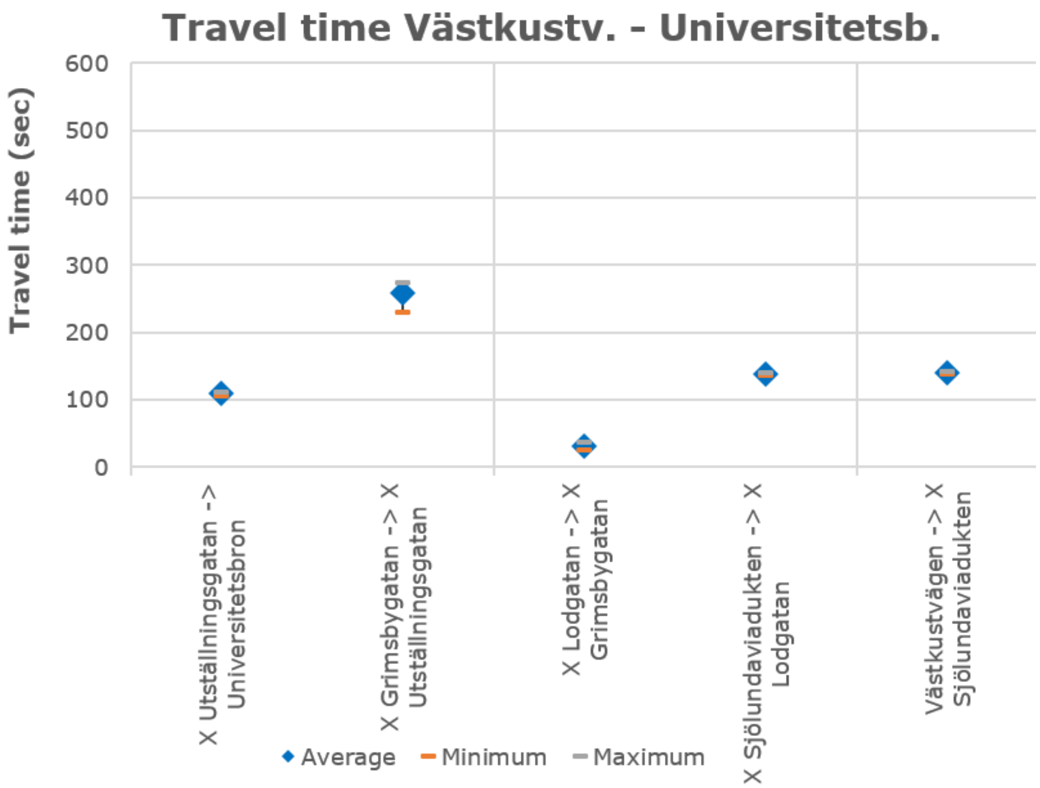


Figure 232. Travel time, current situation.

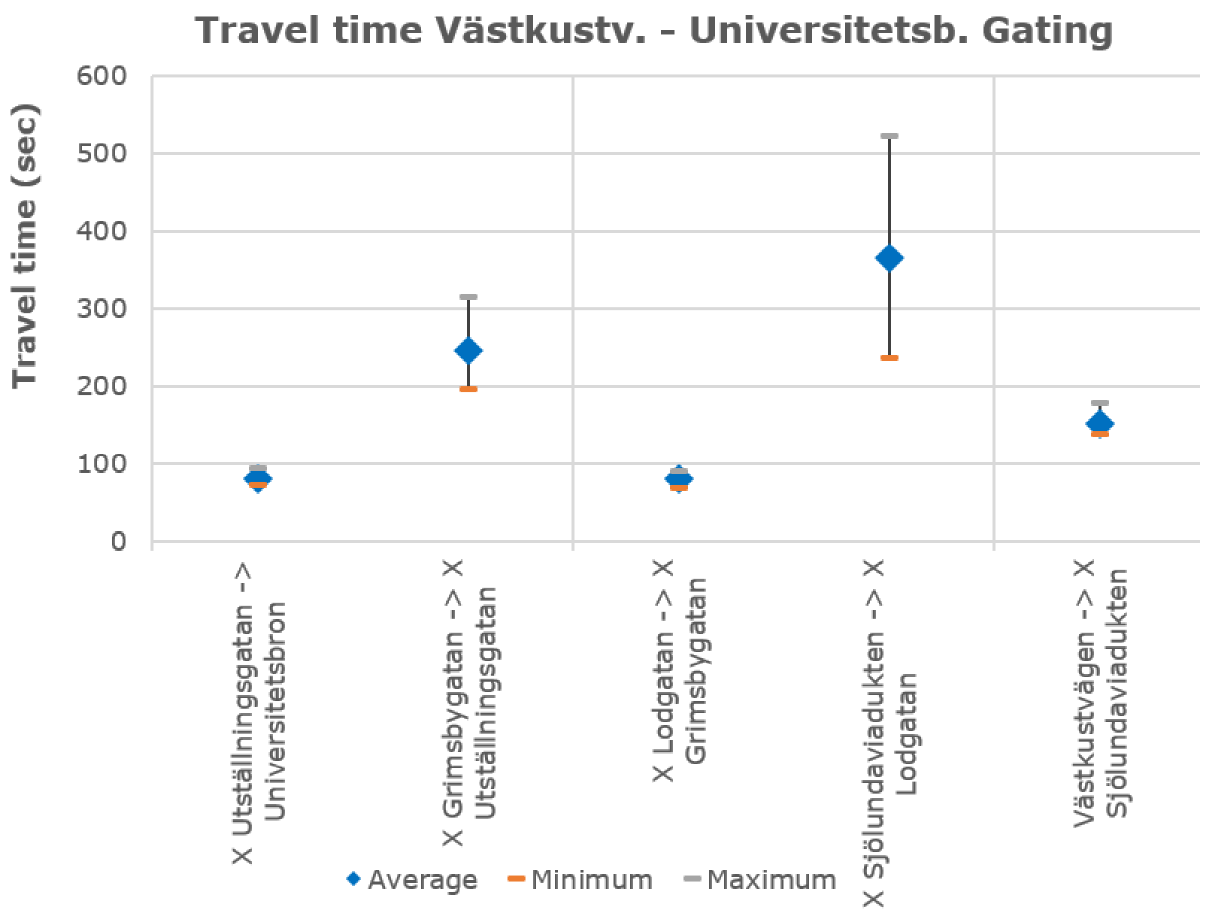


Figure 233. Travel time, current situation with gating.

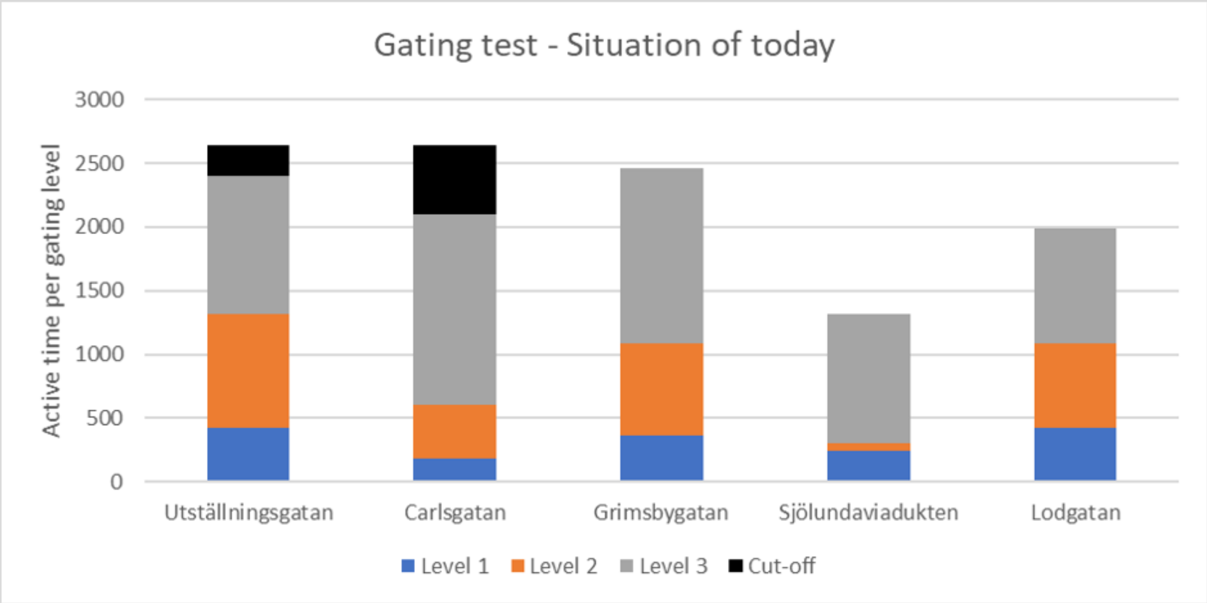


Figure 234. Gating level intervals

6.3.4 Things to consider for future testing of gating

Based on the simulation results of the gating, some questions can still require more time for testing:

- Is the interval for checking queue-status every 60s plausible or should it be increased?
- What effects will an increased interval have on the fluctuations of the gating?
- How many seconds can/should be deducted from the main phase during each level of gating?
- What should be done with the “gated” time?
- Prolonged green time for opposite movement (as in initial testing)?
- Separate phasing for pedestrians?
- Prolonged green time for connecting streets (and how does that affect route choice)?
- Placement of queue detectors/sensors and smoothing factors for queue measurement
- How large are the margins for the gating? At which flows will critical levels be reached and gating ineffective?
- In the future network, how will the increased number of unsignalized pedestrian crossings affect the possibilities for an effective gating?

6.4 Conclusions

6.4.1 Mobility hub

On an overall level, it is considered possible to model the attractiveness for car travellers to use the mobility hub with the methodology used. The simulation results indicate that a mobility hub, at the studied location, could attract about 150-250 travellers during peak hour. The option to go by bike between the mobility hub and the offices in the Western harbour is shown to be more attractive than a shuttle bus every 10 minutes. The results are based on a scenario of an increase in parking fees in the Western Harbour by 50-100 SEK per day compared to today and that a shuttle bus is in traffic from the mobility hub, free of charge.

One of the main conclusions is that the mobility hub has the potential to attract a substantial amount of car travellers if parking fees in the Western Harbour area is increased compared to today. However, increasing parking prices in the area is complicated, as the parking facilities is owned by private companies with no incentive to do so as it could affect them in multiple ways.

A question for the future is if the forecasted increase in population in Malmö will increase congestion to an extent where travel time by car to the Western harbour is significantly longer thus helping a mobility hub attract car travellers even without or with a smaller increase in parking fees.

6.4.2 Gating

The fact that the queuing in the western part mainly occurs due to the pedestrian and cyclist crossing and its irregularity in connection to nearby intersections makes gating difficult in this area. If the crossing would have been signalized a more effective and foreseeable gating might be possible.

To achieve a reduction in queues along Hans Michelsensgatan a large deduction of green time is needed within the gating logic. This must be considered in choosing what to do with the signal timings for the intersection as a whole in future testing.

The distance between focus areas and gated signals results in a "lag" where queuing is observed at the focus areas even if gating is active in upstream signals because traffic is already on the way at a too high flow rate at the time queuing occurs.

In summary of time, each level of gating has been activated during the simulation of the peak hour and it is clear that a large amount of gating is needed to affect queuing in the focus areas. It can also be observed that both the intersection at Utställningsgatan and Carlsgatan, the gating has reached a situation where gating for a period of time has had to be cut off due to queuing upstream (Figure 234).

6.5 Generating street design options in the stakeholder exercises

6.5.1 Citizen participation activities using Blocks and Acetates

In addition to the extensive dialogue project conducted by the City of Malmo during the fall of 2020, another citizen participation activity was made. The activity consisted of using the MORE-developed Blocks and acetates-extension of the LineMap package.

While COVID-19 made it difficult to gather citizens in indoor activities, it was necessary to use the tool in an outside environment. In line with the previous dialogue project, the activities took place on one day each on three of the six reference areas chosen for that project. To make the blocks, acetates and maps easy to use and move between reference areas, a cargo bike was rebuilt to a “station”.

Figure 235. Public engagement stand

In preparation for the activities, maps showing the street in the reference area were printed and also laminated to withstand rain. In addition to that, the cargo bike station had a roof to protect the blocks and acetates from wet weather conditions. During the activities, two to three persons with experience within citizen dialogue and/or traffic and urban planning were present from the city administration.

Results, such as complete street section proposals, were not able to be produced during the activities. Instead, more comments regarding changing the street or surrounding streets came in. This was similar to some of the input from the dialogue activities earlier in the fall.

One conclusion from the activities is that it seemed difficult to communicate to the people along the street what the actual purpose of the activity was. Many citizens approached the station, asking what already decided changes were being presented by the city. This shows that inhabitants are not familiar with creative citizen participation, but rather that similar activities “only” are to show what has already been determined by planners and politicians.

Another conclusion was that there are challenges in the knowledge gap between e.g. traffic planners and a resident, as the resident is might not have insight into the local transportation system, available public space for rebuilding and plans in the area. A planner has an approach that can see connections and draw conclusions on what could happen on the parallel street if certain measures are made on the current street. However, as the citizen tend to be a resident or has his/her workplace in the area, he/she can have a better understanding of often occurring problems and conflicts along the street.

Conclusions are that using blocks and acetates can be an activity to both establish an understanding with citizens regarding the urban and transport planning processes of the city as well as getting more insight into how the street works and is experienced when living close by. However, the tools could be more favourably used in an environment where a reference group of citizens can be introduced properly to the street and its surroundings while having a dedicated time frame to discuss the problems and potential changes of the street.

Figure 236. Physical toolkit used together with a cargo bike.

6.6 Wider public engagement (using TraffWeb)

During the fall of 2020, Malmö conducted an extensive dialogue project as input in a co-creation process of future urban planning. This section of the report summarizes the project.

6.6.1 Background

The current conditions of Nyhamnen, including the future stress section, are far from the type of urban area that it will become in the future. While having mainly industry and logistic facilities and lacking residents today, the upcoming development of the area means dense land-use and high flows of motorized traffic. Meanwhile, city objectives are that the streets should welcome street life with e.g., cafés and local shops. Having a citizen participation activity in today's Nyhamnen would not capture the qualities of the future urban area and would have made the exercise very vague for participants.

To engage and explore the views and opinions of Malmö citizens, citizen dialogues have been conducted at 6 reference areas spread across the central parts of the city. The reference areas were chosen with regards to their respective characteristics representing scenarios mobility, sustainability and liveability. Most of the reference areas chosen have, by Malmö standards, high vehicle flows and dense land-use to resemble the main streets of future Nyhamnen. It should be added, however, that the most trafficked reference areas still lack around 3000 vehicles/hour on a normal day compared to the future stress section in Nyhamnen.

Table 49. Reference areas' association to the future developed area Nyhamnen. *Erik Dahlbergsgatan is associated with the green street of Jörgen Kocksgatan, that runs through both eastern and western part of Nyhamnen.

	Mobility	Sustainability	Liveability
Western Nyhamnen	Mariedalsvägen	Södra Förstadsgatan	Regementsgatan
Eastern Nyhamnen	Sallerupsvägen	Stora Varvsgatan	Erik Dahlbergsgatan*

Some of the reference streets are subject to change during the coming years in light of the Big City Package, where five BRT-like bus lines will run in the city. Having reference streets linked to this study meant engaging project leaders and gaining knowledge of citizen attitudes in the early stages of the Big City Package.

Figure 237. Overview of reference areas and their scenario representation

Table 50. Overview of stress section (present and projected) and reference street traffic flows. *_larger value in regard to close-by public transport node._

Street	General traffic flow (AADT)	Public transport users	Bicycle
Hans Michelsensgatan (2018)	11 000	<100	<200
Hans Michelsensgatan (2040)	18 000	1 000*	4 000
Mariedalsvägen	15 000	1 000	<1 000
Sallerupsvägen	12 000	600 / 11 000*	4 500
Södra Förstadsgatan	13 000	1 700	4 000
Stora Varvsgatan	15 000	400	6 000

Regementsgatan	8 000	400 / 1 000	3 000
Erik Dahlbergsgatan	2 000	-	4 500

6.6.2 Methodology

The MORE-developed tool TraffWeb has been used for the dialogue project. TraffWeb uses an issue-based approach, i.e., that a citizen fills out what issues he or she sees at a location. To complete the results further, another method has been used. Through an experience-based survey, developed together with DTU and integrated into the tool by Buchanan Computing, other values and knowledge can be gathered.

Apart from answering more open questions, as "*What do you want to change about this street?*", the respondents got to choose between key-value words that they best thought described the street they were currently on. The words, developed together with Malmö officials in the fields of both dialogue as well as traffic and urban planning, have values are covered within the three visions **mobility**, **sustainability** and **liveability**.

Mobility, based on the "Car-oriented city". Foci are road building and accessible car parking, resulting in e.g., urban spread. The keywords for mobility are:

- Convenient
- Dangerous
- Fast
- Disordered

Sustainability, "Sustainable mobility city" according to CREATE, focus on the accessibility for more climate-friendly transport modes such as bicycle and public transit. The keywords for sustainability are:

- Climate-smart
- Smooth
- Ridesharing
- Accessible

Liveability, "City of Places", shifts the focus to the place-related demands for the people. Enjoyment, life quality and activities along the streets are at the centre of attention. The keywords for liveability are:

- Pleasant
- Intimate
- Streetlife
- Inviting

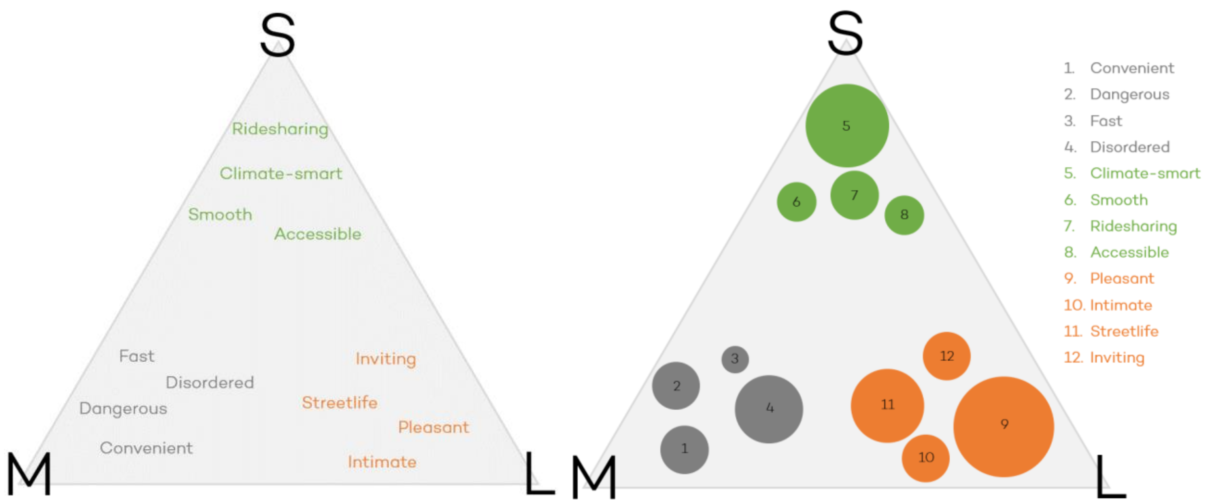


Figure 238. Key-value words and their representation in a "value triangle". S=Sustainability, M=Mobility, L= Liveability. Size of the value circles depends on the number of answers.

In addition to key-value words, the respondents answered on how the experienced the street regarding e.g., noise, traffic and personal safety and greenery. This *experience estimation* was done using a 4-degree Likert-scale. The scale is commonly used when gathering peoples' opinions. Using four degrees means a neutral option is not included. This enabled the respondents to additional reflection and take a stand in each question.

This street is traffic safe			
Strongly disagree	Disagree	Agree	Strongly agree
☐	☐	☐	☐

Figure 239. Example of a four-degree Likert scale used in the survey.

Figure 240 below show an example of how the result of the statement above is visualized. Here, 13% of the respondents strongly disagree that they experience the street as a traffic safe one. Disagree, Agree and Strongly agree has received 30, 32 and 25 per cent of the answers respectively.

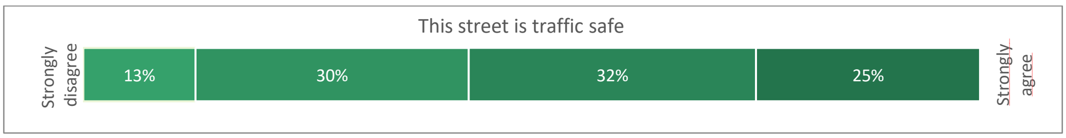


Figure 240. Representation of answers for the four-degree Likert scale used in the survey. This example covers traffic safety for a Liveability-street (Regementsgatan).

Lastly, the respondent had the opportunity to answer three more open questions about the reference street and surrounding area:

- What do you appreciate the most about this place?

- What do you appreciate the least about this place?
- What would you like to change about this place?

This way, Malmö citizens could express things that were not covered by the original survey questions. The respondents were, however, restricted to a maximum of three topics per open question. This was to limit the survey time per respondent.

6.6.3 Data collection

The data collection was made through the *Traffweb*, an online tool developed by Buchanan Computing. The tool enabled citizens to enter answers by themselves via any online device. However, Malmö chose that for two days per reference street being out on-site on each reference street and gather data. This had three main objectives:

- Easier to reach out and have more respondents;
- While a City of Malmö-employee entered information from the respondent into the survey, he/she could help guide the respondent through the survey;
- The respondent could look around and think of how he/she experience the street right there and then.

Collection of data focused on the experience-based survey with key-value words and Likert scale, but also options to give opinions on whatever the citizens liked, disliked or wanted to change about the current street. Issues that were lifted during the dialogue activities were also entered into the issue-based part of Traffweb.

The citizen participation activities were conducted from the end of August to the beginning of October. Most of the activities (9) were made during weekdays, while 3 were on Saturdays. To adapt to the pandemic, plenty of sanitizing gels were placed out on tables and project participants were allowed to touch the iPads which were used to enter the data into Traffweb. The original dates for the activities were moved from spring to fall, which meant that the project took place when the spread of the virus was at a minimum in Sweden.

6.6.4 Results

Issues

During the dialogue, 285 issues were reported. Apart from four entries that were made online by citizens themselves, all issues reported were entered on-site by employees and consultants of the city of Malmö via Ipads while talking to citizens. The two streets with the most issues reported are the mobility streets of Sallerupsvägen followed by Mariedalsvägen.

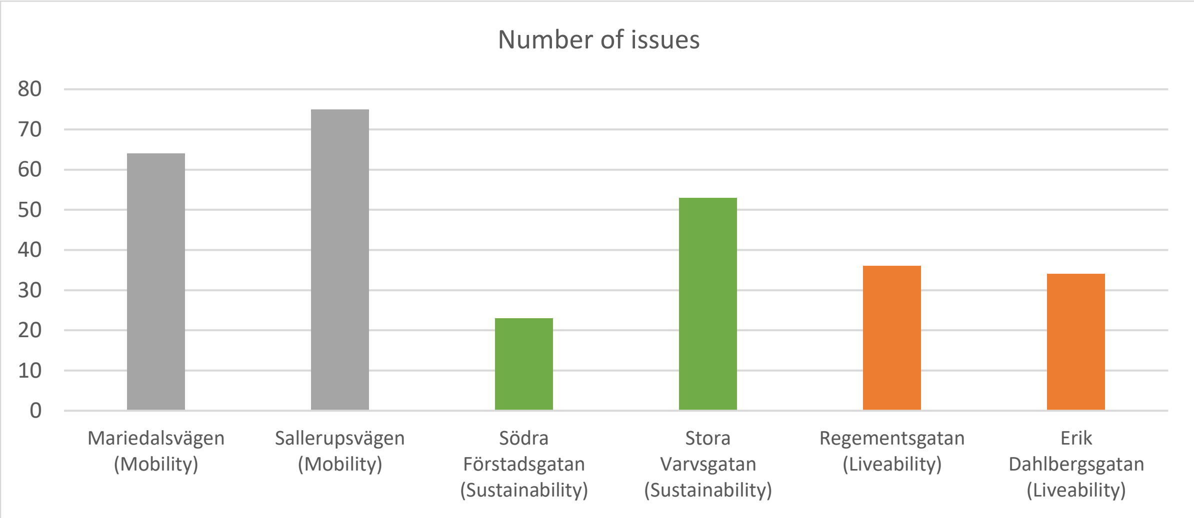


Figure 241. Number of issues on each of the reference streets

All the issue categories were represented during the dialogue activities. Most frequently occurring were issues regarding road safety and crossing, cycling and quality of the public realm. The category *Other* normally contains several issues per answer, often regarding parking, littering or more general comments such as improving possibilities for shops and restaurants.

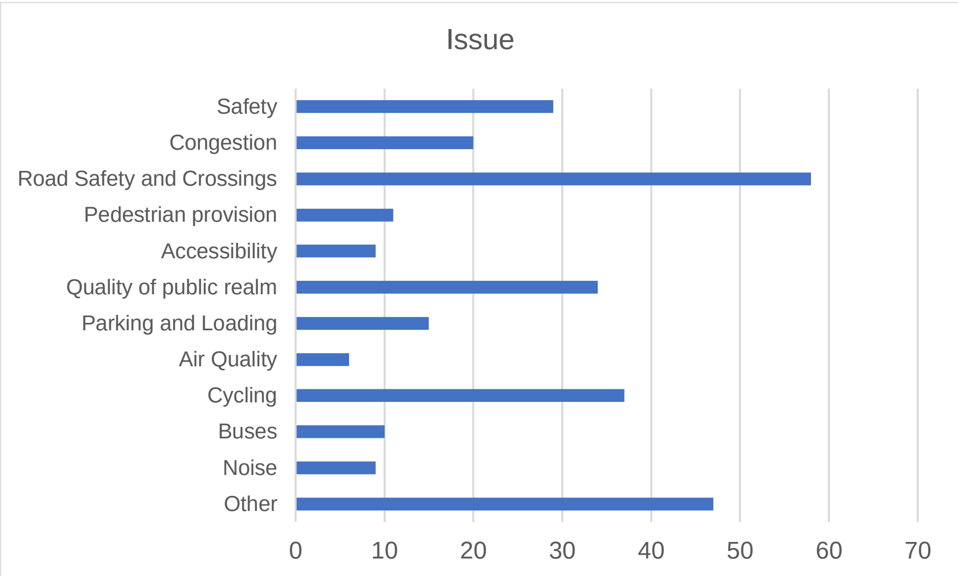


Figure 242. Identified issues during the citizen participation activities

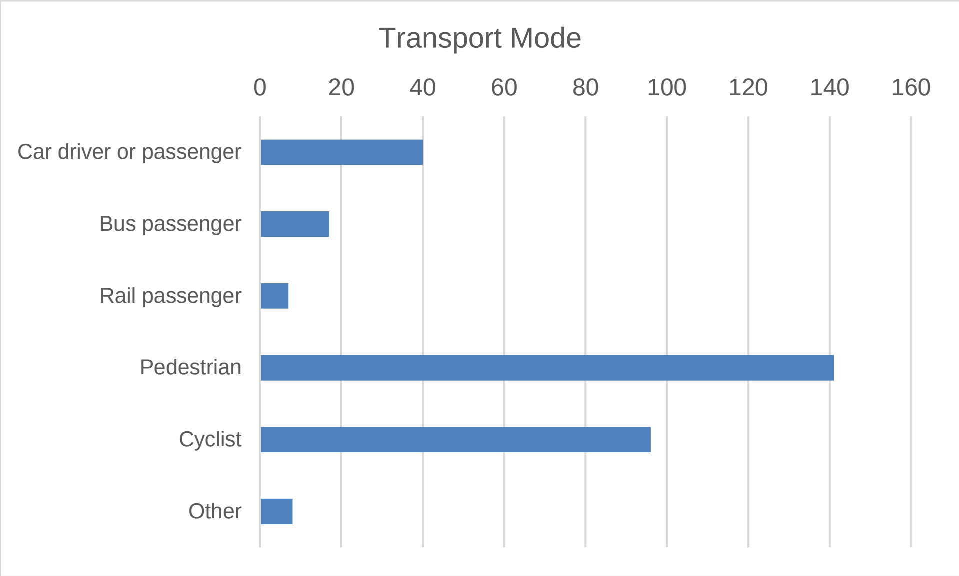


Figure 243. Transport mode of respondents

As seen in Figure 243, most respondents were travelling by foot at the time of them answering the survey. Many were also bicyclists who stopped by. As shown in Figure 244 and observed during the participation activities is that the majority of the respondents were living in Malmö, frequently along or in the vicinity of the reference streets. This indicates that citizens are more engaged when it comes to their nearby, everyday environment rather than the street they only visit sporadically. Individuals who travel by active modes such as by foot and bike are also more likely to experience the streets' qualities (or lack thereof), due to them moving slower and being more exposed than transport users in vehicles.

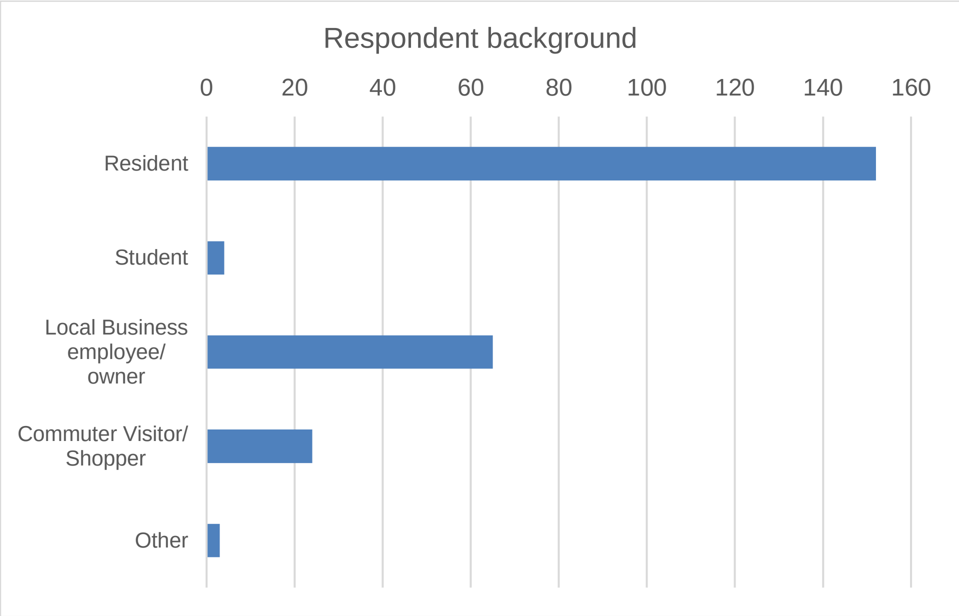


Figure 244. Respondents' background from the public engagement activities.

When the issues occur, according to the respondents, is shown in Figure 245 below. The majority of the respondents answered with general issues, rather than specific events. Another aspect impacting the link between the time of day and issue could be found with most respondents being local residents. This means, that these respondents are exposed to the issues during different hours of the day as they move around in their respective neighbourhoods.

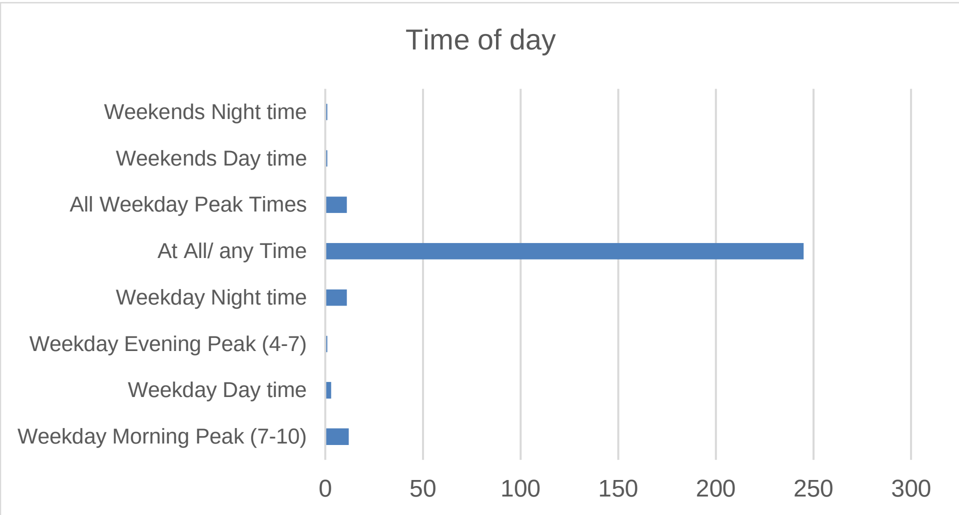


Figure 245. Time of day the issues are experienced.

Experiences

The following sub-chapter touches on topics covered in report D5.2, however, it aims to go deeper in the analysis of both results and use of the tool.

Having near 1300 respondents answering the experience-based survey, the results were that places with high mobility characteristics lacked qualities that contribute to *place-related* functions. The majority of the asked citizens had come to the street on foot, but most were also frequent users of public transport, bike and car.

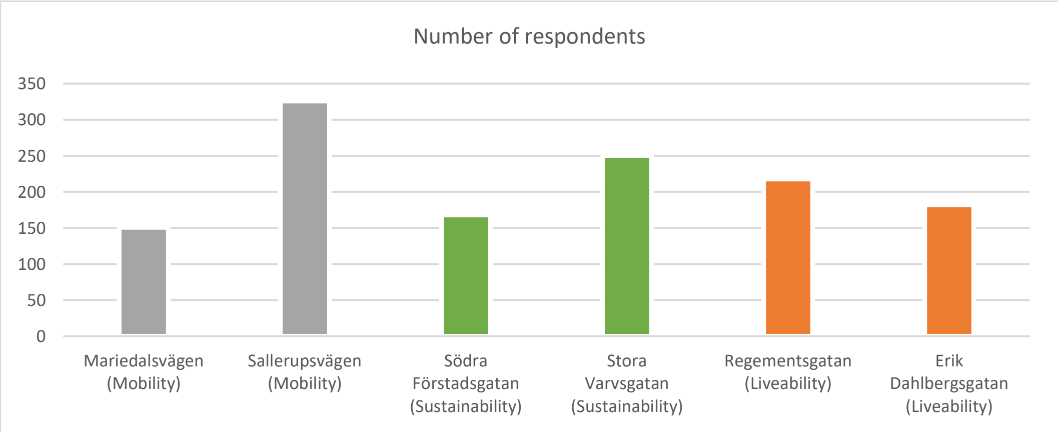


Figure 246. Number of respondents per reference street.

Key-value triangles

In the primary part of the survey, the respondents got to choose from the key-value words presented previously in this report. Results, shown in Figure 247 below, show that the reference streets that were initially classed as mobility and sustainability streets were perceived as similar in terms of the scenarios. This indicates that even though the streets varied in available infrastructure (mobility tending to more general traffic space versus dedicated lanes for public transport and bikes on sustainability), the streets both felt disordered and sometimes dangerous due to the traffic situation. The accessible and climate-smart qualities might be less evident directly for respondents on each street, as there were no larger differences in those shares between the mobility street of Mariedalsvägen and sustainability street of Stora Varvsgatan.

The experiences of the Liveability-streets, Regementsgatan especially, differ vastly from M- and S-streets of the dialogue project. Here, the qualities bound to Liveability are frequently chosen by the respondents on site. The traffic flow on this site is lower both in regard to general and bicycle traffic and along the street are trees planted. The street of Regementsgatan is generally experienced as pleasant and inviting with plenty of street life.

Table 51. Key-value words and index.

Mobility	Sustainability	Liveability
1. Convenient	5. Climate-smart	9. Pleasant
2. Dangerous	6. Smooth	10. Intimate
3. Fast	7. Ridesharing	11. Streetlife
4. Disordered	8. Accessible	12. Inviting

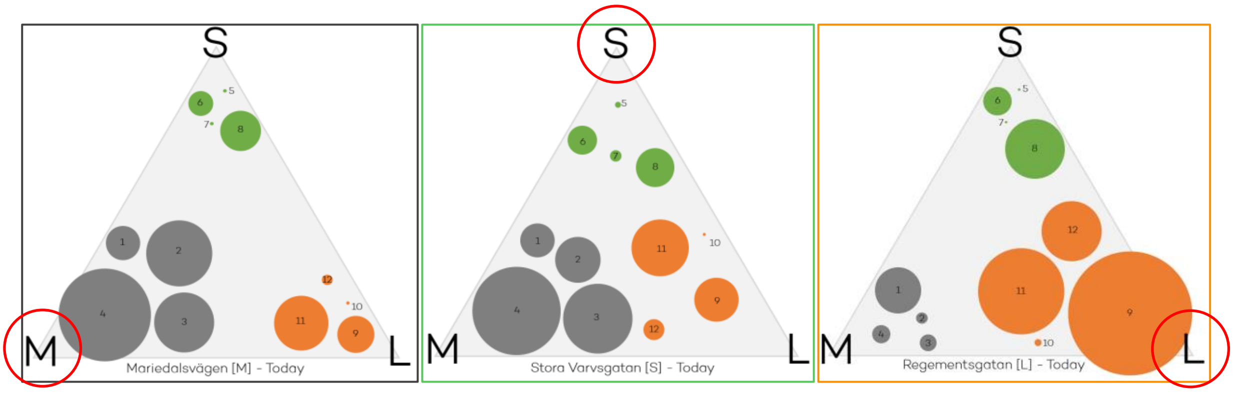


Figure 247. Examples of three present key-value word triangles of today's situation.

When the respondents instead were asked how the street should change, liveability qualities were predominantly asked for, as is shown in Figure 248. The mix of values that the respondents wished for was similar regardless of the current conditions of the reference streets.

When the places already had liveability characteristics (such as Regementsgatan, showing on the right-hand side of Figure 247 and Figure 248) there were little to almost no change asked for. According to this part of the study, the results clearly indicates that the inhabitants demand streets that represent liveability qualities. The citizens ask for streets that are including and pleasant to move along and in.

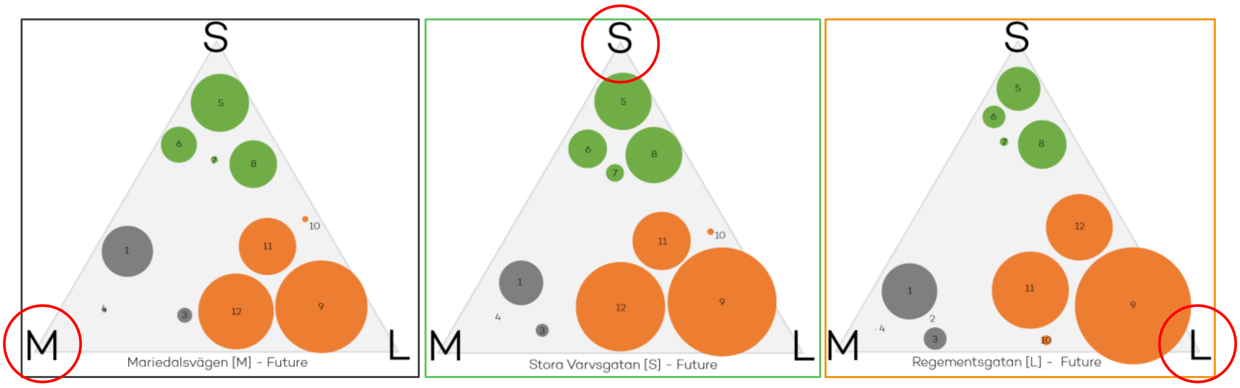


Figure 248. Examples of three key-value word triangles of the wished-for future situation of each street.

In Figure 249 below, the current situation of the reference street Sallerupsvägen is shown. The street was initially classed as a Mobility-street due to the high traffic flows along with it, as well as it is intersecting other main streets going through Malmö hence not contributing to a street where people spend time without having to. During the course of the dialogue activities, however, this perception proved to not be completely correct.

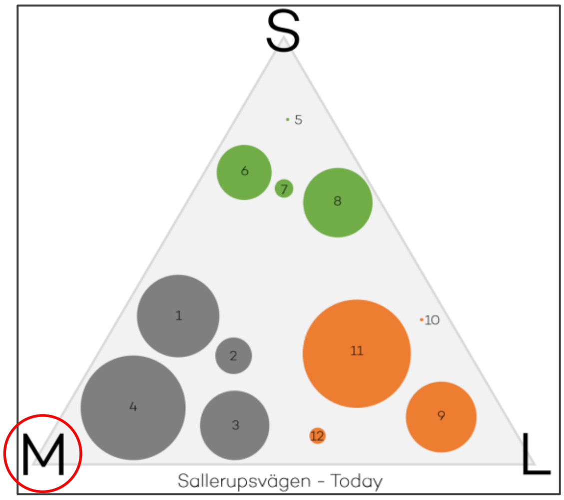


Figure 249. Experience of the current street Sallerupsvägen - classified as a Mobility-street.

While Sallerupsvägen still showed Mobility-attributes (e.g. *Convenient*, *Disordered*), plenty of Liveability-qualities occur. Especially *Streetlife* is said to be best descriptive of the place. The results could be skewed by the place of dialogue was close to the square *Värnhemstorget*, where plenty of activities are located. The square is also a big public transport node for the city and bus traffic going in and out of the city. The public transport node could rather add to a majority of Sustainability-attributes, but this is not the case.

Likert scale

The secondary part of the survey was based on a Likert scale, where respondents got several statements where they got to answer on a four-degree scale from “strongly disagree” to “strongly agree”. The statements could be about traffic safety, greenery, traffic users’ available space on the street, personal safety and noise. A selection of the Likert scale results is presented below.

In Figure 250 below the respondents’ answers to the statement “*I experience that this street is traffic safe”* is presented. The results indicate that Mobility-street Mariedalsvägen is the least traffic safe environment in the eyes of the respondents. The complete Likert-scale compilation (including all statements) is attached in the appendix of this report. Similar to the key-value words findings, the Sustainability-street Stora Varvsgatan (St.V) is experienced as less traffic safe than most other streets.

On the other end of the spectra is Regementsgatan, the most liveable street of today according to the key-value triangles. Here, only 13% strongly disagrees that the street is traffic safe – 4 times less than Mariedalsvägen which is just close by!

On Erik Dahlbergsgatan, represented by purple colours, the share of answers on the Likert scale is evenly distributed. 50% of the respondents disagree or strongly disagree regarding traffic safety. This is interesting, as a portion of the street is only 30 km/h, the rest being 40 km/h (which all of the other streets are). Apart from that, the motorized traffic flow is restricted from passing through the neighbourhood, meaning the flow is only a total of 2000 vehicles per day (see Table 50). Instead, the major flow consists of bicycles (4500 per day). The traffic safety issue is believed to be strongly contributed to the conflict between bicycle traffic, pedestrians and cars that park to drop kids off at school. As the bikes share the street with the cars, conflicts can easily arise.

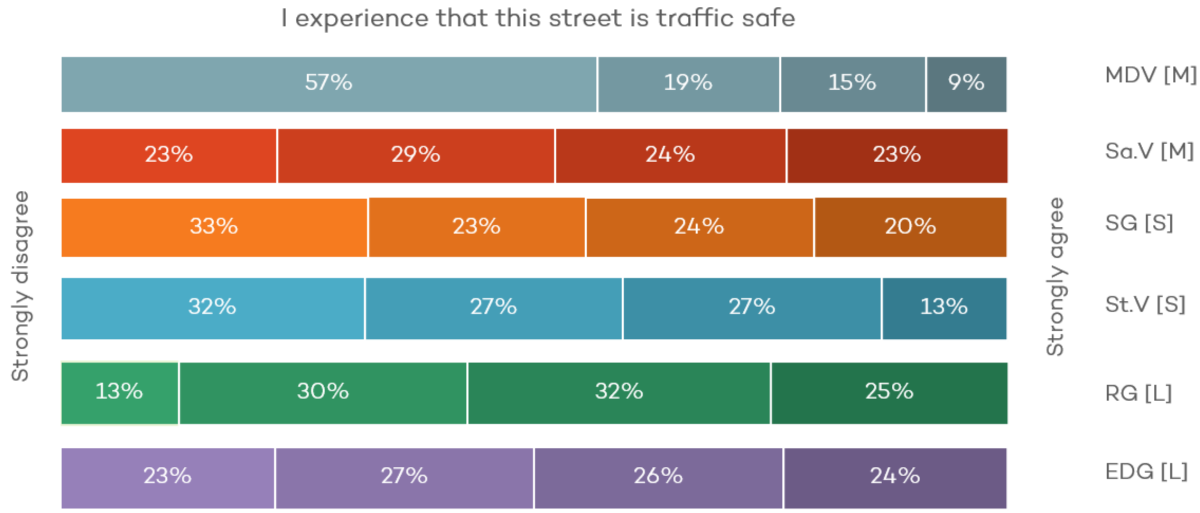


Figure 250. Likert-scale results of statement regarding traffic safety on each reference street.

In Figure 251, the Likert-scale results of available street space per street are shown. Negative results stand out on two streets: Mariedalsvägen (Mobility) and Stora Varvsgatan (Sustainability). Both have shares of almost 80% that disagree with the statement that all road users have enough street space on the street. While traffic flows of motorized cars are similar (circa 15 000 veh/day), the width of the street differ: Mariedalsvägen has 21 m of municipal street space, while Stora Varvsgatan has 32 m. Now, Mariedalsvägen's issues are not surprising as there are narrow footways and a complete lack of cycle paths along the chosen street section.

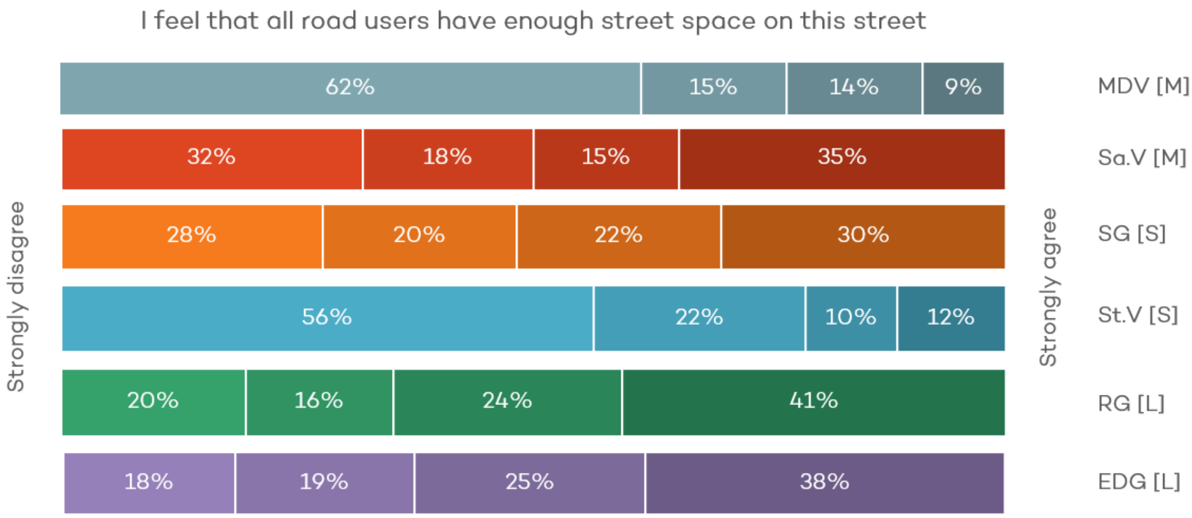


Figure 251. Likert-scale results of statement regarding street space on each reference street.

However, Stora Varvsgatan has dedicated lanes for bus traffic and bicycles respectively, while Mariedalsvägen lacks both – still the perception is similar. One reason could be the location of dialogue, where the Stora Varvsgatan activities were right next to *Klaffbron*, a bridge with a much narrower section (more similar to Mariedalsvägen). This could affect the respondents to answer.

A second reason could be the conflicts, especially between pedestrians and bicyclists, are put into effect. The bicycle path is rather narrow and tight when cycles pass or meet each other. The same applies for the pedestrians, that when in groups need to pass onto the parallel and in-level cycle path. On Stora Varvsgatan, around 70% per cent wishes that the modes that should have an increase in street space are pedestrians and cyclists. Other modes, such as cars and public transport, only have 10-15 per cent.

In Figure 252 below, the noise experience of each street. The noisiest street, according to the respondents, is Södra Förstadsgatan (SG). This coincides with noise measurements by the City of Malmö performed in 2017. Plenty of buses passes along the street today, where electrification of the bus fleet can play a positive role in the reduction of noise. The least noisy street is Erik Dahlbergsgatan (EDG), which also coincides with the measurements.

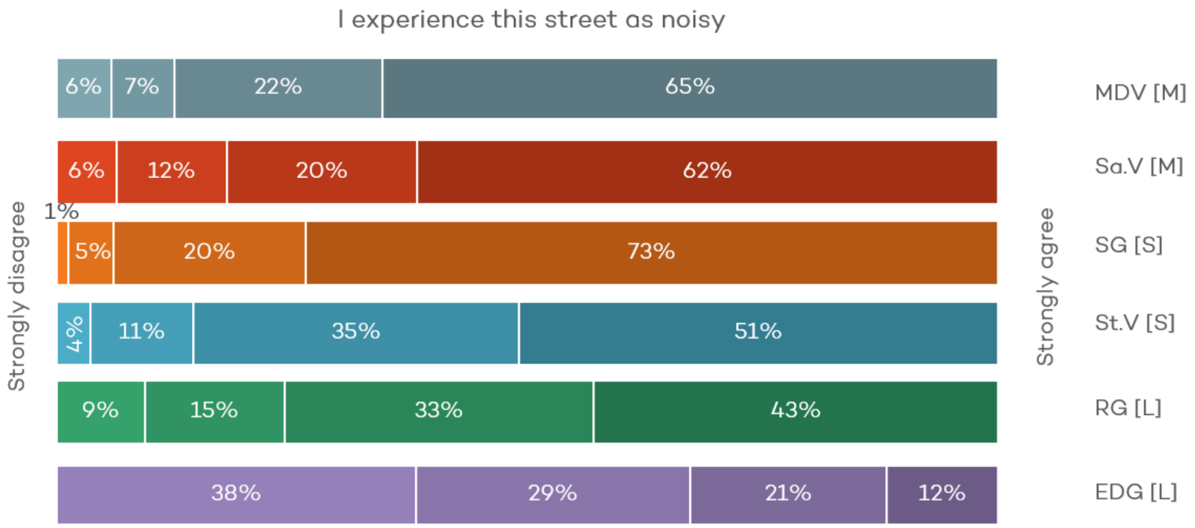


Figure 252. Likert-scale results of statement regarding noise on each reference street.

Open questions

Beyond the Likert scale-questions and the key-value triangle, the open questions have been categorized systematically and then analysed to see if there are any similarities or differences between user groups.

6.6.5 Discussion – tool

This type of citizen participation activity is a valuable way for the city clerks to get to know their city environments and citizens better. In this project, the scenario approach contributed to the dialogue sites varied greatly in character, highlighting similarities and differences between them.

Early in the planning process, it was rather evident that TraffWeb in its current form is not the most user-friendly tool to navigate through being an everyday man or woman. This could be one of the reasons that only a few citizens participated by putting in issues or answering the survey by themselves online.

Apart from the tool, a few potential enhancements of the citizen participation activity method are presented below. The main focus of the enhancement is increased participation of certain groups that were less represented than others:

- Working with illustrations/future pictures of the reference area/the city to improve the communication with citizens and overbridge language barriers.
- Finding methods to engage all street user groups. During the activities, pedestrians were by far the most common respondents. How can Malmö reach out more efficiently to e.g., car users and cyclists?
- Increase the children perspective to a higher degree. Since 2020, the UN Convention on the Rights of the Child is a legislative document in Sweden, which means that children's human rights must be guaranteed – not least when developing the city.

Regarding the methodology of the survey and analysis, assessment of the key-value words showed that words such as dangerous or noisy were viable options when describing the streets of today. However, when describing. If new key-value words were to be developed for a similar study, a new study could target to have words that work in both questions.

6.6.6 Discussion – results

Following the wider public engagement activities that have been gone through in detail in this chapter, some key findings can be topics for discussion.

Firstly, it has undoubtedly been challenging planning and carry out citizen participation activities during a pandemic. By having a flexible project group and working pro-actively with plan B and C for the activities, solutions were found to decrease and limit the risk of the virus spreading while still going through with the project. By pushing the timeline forward to when the spread was at a low in the region together with having physical distance and being thorough with e.g., cleaning the iPads, the potential spread was avoided.

An interesting aspect of the results, which could indicate how some of the modern urban development and traffic planning is perceived, is the results of the Sustainability-street. While many newly built areas are focusing on aspects such as improving sustainable mode accessibility and capacity, results from this study that the streets feel like a Mobility street for most everyday users. This indication needs reflection, as this means that street environments are being developed *today* while being seen as unsustainable by the public.

Regarding the open questions, it is overall not possible to see any major, neither general difference in opinion in perception in most categories between the defined groups (gender, age and mode). In some categories, one or two reference areas sticks out with bigger differences between certain groups, but this does not happen for all of the six reference areas.

In more detailed categories, such as parking and public transport, some differences can be seen. The results show that e.g., middle-aged persons and men demand better access to parking at the same time as younger people and women appreciate public transport more than other groups.

Looking at the reference sites, the open question analysis shows some interesting results: The mobility street Sallerupsvägen has a tension in the perception of the place. The respondents experience that the street is dirty and feel unsafe when being there. At the same time, a large portion of the over 300 respondents associate Sallerupsvägen with street life, supply of stores and public transport.

Finally, the choices of reference streets were made to resemble different types of environments of the entire Nyhamnen area. While traffic flows, the number of shops, offices and activities, as well as building characteristics, differ between the streets, volume in most of those categories are lacking compared to the future stress section. The Nyhamnen area will have even higher traffic flows and taller buildings while simultaneously aiming to be a place for visits and leisure – objectives that are unmatched in the current city of Malmö. The reference areas can therefore only be judged as an indication of the probable public perception of the future area, not showing how it actually will be.

6.6.7 Conclusions

From the results after the citizen participation activities, some conclusions can be drawn:

The results from the study indicate that streets with current qualities connected with Mobility and Sustainability tend to be perceived as noisy and constitutes a basis for cross-modal conflicts. At the same time, streets with Liveability-values are more liked in general. For the future situation, the public demands a mix of values, which favour Liveability, followed by Sustainability and Mobility, regardless of how the street is perceived today.

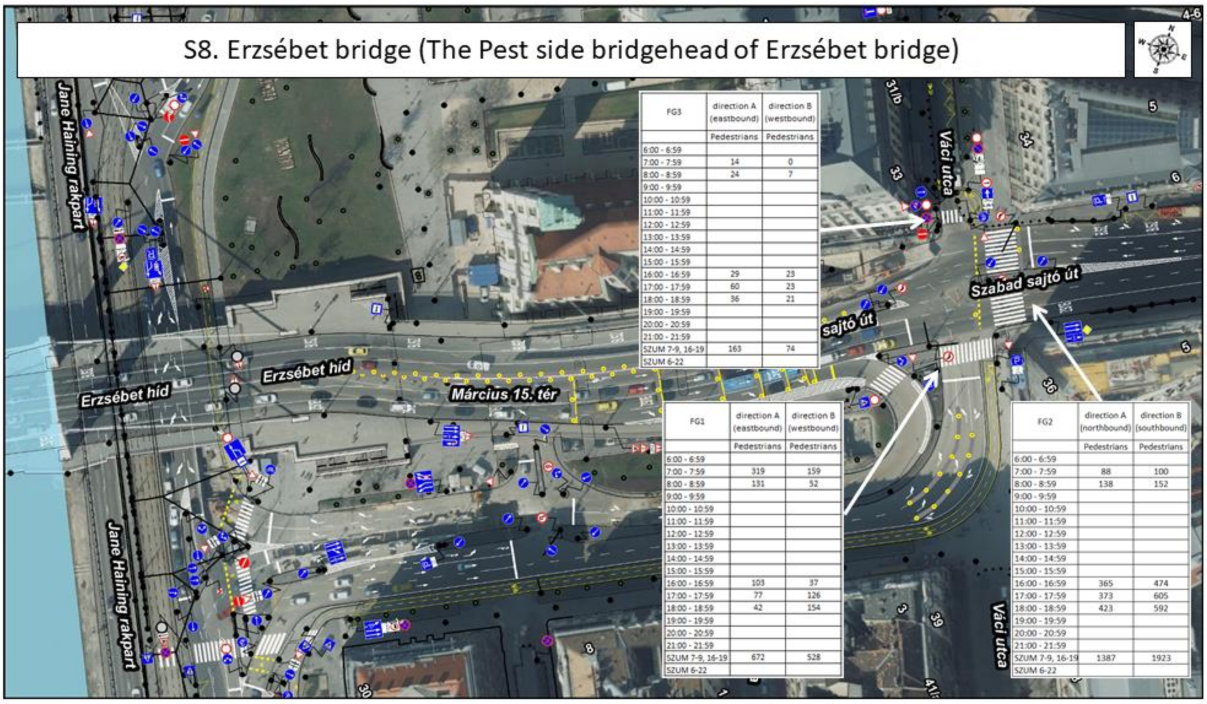
The process was educative for planners that came out and met the citizens, talking with them and listening to their thoughts and concerns of the street environment. It was also rather trying, due to the long days. However, the ambition to reach out to a large number of respondents was achieved, enabling the City of Malmö to gather plenty of data from the citizens.

This extension of the MORE project clarifies that the Malmö citizens care for their city and streets, especially in their own neighbourhoods. The study shows several learnings, where the positive focus of both civilians and business owners tend to be on the street life, number of activities and greenery. At the same time, the traffic is perceived as a disturbing element in regard to both traffic safety and other functions dedicated space. Even though the street traffic is essential to many of the city's inhabitants, visitors and businesses, many of the respondents, regardless of the user group, wish for it to decline.

The results of the extensive public engagement activities will be used as input to design exercises for future scenarios. The results have been documented in detail in a separate report in Swedish, making it accessible for other planners and employees of the city.

7 Appendices

Appendix 1 – Budapest: Pedestrian Flow and Volume – Budapest sections under stress



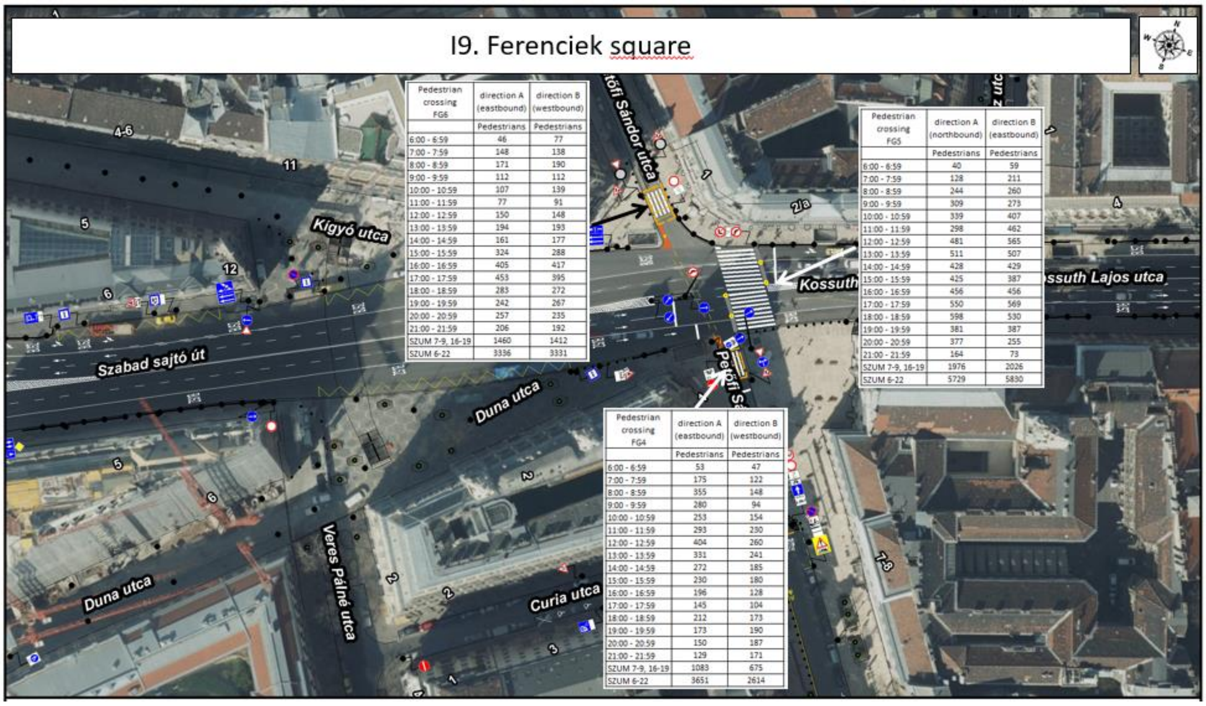
FG3	direction A (eastbound)	direction B (westbound)
	Pedestrians	Pedestrians
6:00 - 6:59		
7:00 - 7:59	14	0
8:00 - 8:59	24	7
9:00 - 9:59		
10:00 - 10:59		
11:00 - 11:59		
12:00 - 12:59		
13:00 - 13:59		
14:00 - 14:59		
15:00 - 15:59		
16:00 - 16:59	29	23
17:00 - 17:59	60	23
18:00 - 18:59	36	21
19:00 - 19:59		
20:00 - 20:59		
21:00 - 21:59		
SZUM 7-9, 16-19	163	74
SZUM 6-22		

FG1	direction A (eastbound)	direction B (westbound)
	Pedestrians	Pedestrians
6:00 - 6:59		
7:00 - 7:59	319	159
8:00 - 8:59	131	52
9:00 - 9:59		
10:00 - 10:59		
11:00 - 11:59		
12:00 - 12:59		
13:00 - 13:59		
14:00 - 14:59		
15:00 - 15:59		
16:00 - 16:59	103	37
17:00 - 17:59	77	126
18:00 - 18:59	42	154
19:00 - 19:59		
20:00 - 20:59		
21:00 - 21:59		
SZUM 7-9, 16-19	672	528
SZUM 6-22		

FG2	direction A (northbound)	direction B (southbound)
	Pedestrians	Pedestrians
6:00 - 6:59		
7:00 - 7:59	88	100
8:00 - 8:59	138	152
9:00 - 9:59		
10:00 - 10:59		
11:00 - 11:59		
12:00 - 12:59		
13:00 - 13:59		
14:00 - 14:59		
15:00 - 15:59		
16:00 - 16:59	365	474
17:00 - 17:59	373	605
18:00 - 18:59	423	592
19:00 - 19:59		
20:00 - 20:59		
21:00 - 21:59		
SZUM 7-9, 16-19	1387	1923
SZUM 6-22		

Figure 253. Daily pedestrian traffic at pedestrian crossings in pest side bridgehead of Erzsébet bridge

 Version: 3



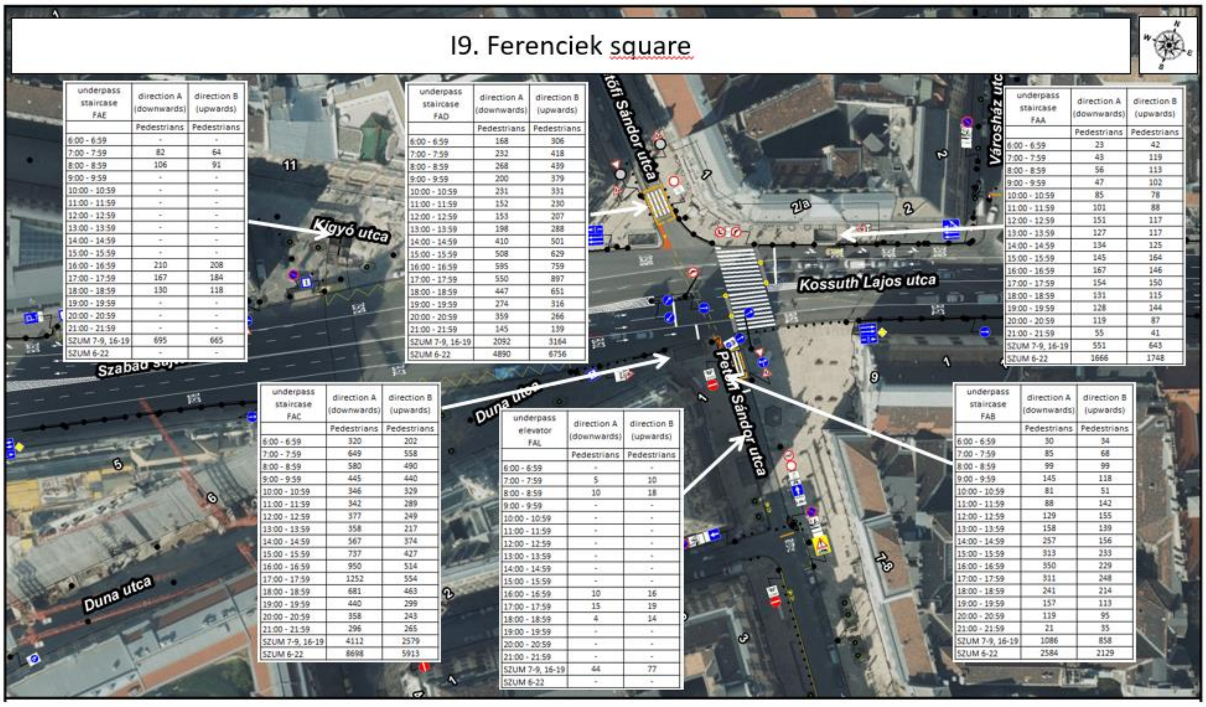
Pedestrian crossing FG6	direction A (eastbound)	direction B (westbound)
	Pedestrians	Pedestrians
6:00 - 6:59	46	77
7:00 - 7:59	148	138
8:00 - 8:59	171	190
9:00 - 9:59	112	112
10:00 - 10:59	107	139
11:00 - 11:59	77	91
12:00 - 12:59	150	148
13:00 - 13:59	194	193
14:00 - 14:59	161	177
15:00 - 15:59	324	288
16:00 - 16:59	405	417
17:00 - 17:59	453	395
18:00 - 18:59	283	272
19:00 - 19:59	242	267
20:00 - 20:59	257	235
21:00 - 21:59	206	192
SZUM 7-9, 16-19	1460	1412
SZUM 6-22	3336	3331

Pedestrian crossing FG5	direction A (northbound)	direction B (eastbound)
	Pedestrians	Pedestrians
6:00 - 6:59	40	59
7:00 - 7:59	128	211
8:00 - 8:59	244	260
9:00 - 9:59	309	273
10:00 - 10:59	339	407
11:00 - 11:59	298	462
12:00 - 12:59	481	565
13:00 - 13:59	511	507
14:00 - 14:59	428	429
15:00 - 15:59	425	387
16:00 - 16:59	456	456
17:00 - 17:59	550	569
18:00 - 18:59	598	530
19:00 - 19:59	381	387
20:00 - 20:59	377	255
21:00 - 21:59	164	73
SZUM 7-9, 16-19	1976	2026
SZUM 6-22	5729	5830

Pedestrian crossing FG4	direction A (eastbound)	direction B (westbound)
	Pedestrians	Pedestrians
6:00 - 6:59	53	47
7:00 - 7:59	175	122
8:00 - 8:59	355	148
9:00 - 9:59	280	94
10:00 - 10:59	253	154
11:00 - 11:59	293	230
12:00 - 12:59	404	260
13:00 - 13:59	331	241
14:00 - 14:59	272	185
15:00 - 15:59	230	180
16:00 - 16:59	196	128
17:00 - 17:59	145	104
18:00 - 18:59	212	173
19:00 - 19:59	173	190
20:00 - 20:59	150	187
21:00 - 21:59	129	171
SZUM 7-9, 16-19	1083	675
SZUM 6-22	3651	2614

Figure 254. Daily pedestrian traffic at pedestrian crossings in Ferenciek square

 Version: 3



underpass staircase FAE	direction A (downwards)	direction B (upwards)
	Pedestrians	Pedestrians
6:00 - 6:59	-	-
7:00 - 7:59	82	64
8:00 - 8:59	106	91
9:00 - 9:59	-	-
10:00 - 10:59	-	-
11:00 - 11:59	-	-
12:00 - 12:59	-	-
13:00 - 13:59	-	-
14:00 - 14:59	-	-
15:00 - 15:59	-	-
16:00 - 16:59	210	208
17:00 - 17:59	167	184
18:00 - 18:59	130	118
19:00 - 19:59	-	-
20:00 - 20:59	-	-
21:00 - 21:59	-	-
SZUM 7-9, 16-19	695	665
SZUM 6-22	-	-

underpass staircase FAD	direction A (downwards)	direction B (upwards)
	Pedestrians	Pedestrians
6:00 - 6:59	168	306
7:00 - 7:59	232	418
8:00 - 8:59	268	439
9:00 - 9:59	200	379
10:00 - 10:59	231	331
11:00 - 11:59	152	230
12:00 - 12:59	153	207
13:00 - 13:59	198	288
14:00 - 14:59	410	501
15:00 - 15:59	508	629
16:00 - 16:59	595	759
17:00 - 17:59	550	897
18:00 - 18:59	447	651
19:00 - 19:59	274	316
20:00 - 20:59	359	266
21:00 - 21:59	145	139
SZUM 7-9, 16-19	2092	3164
SZUM 6-22	4890	6756

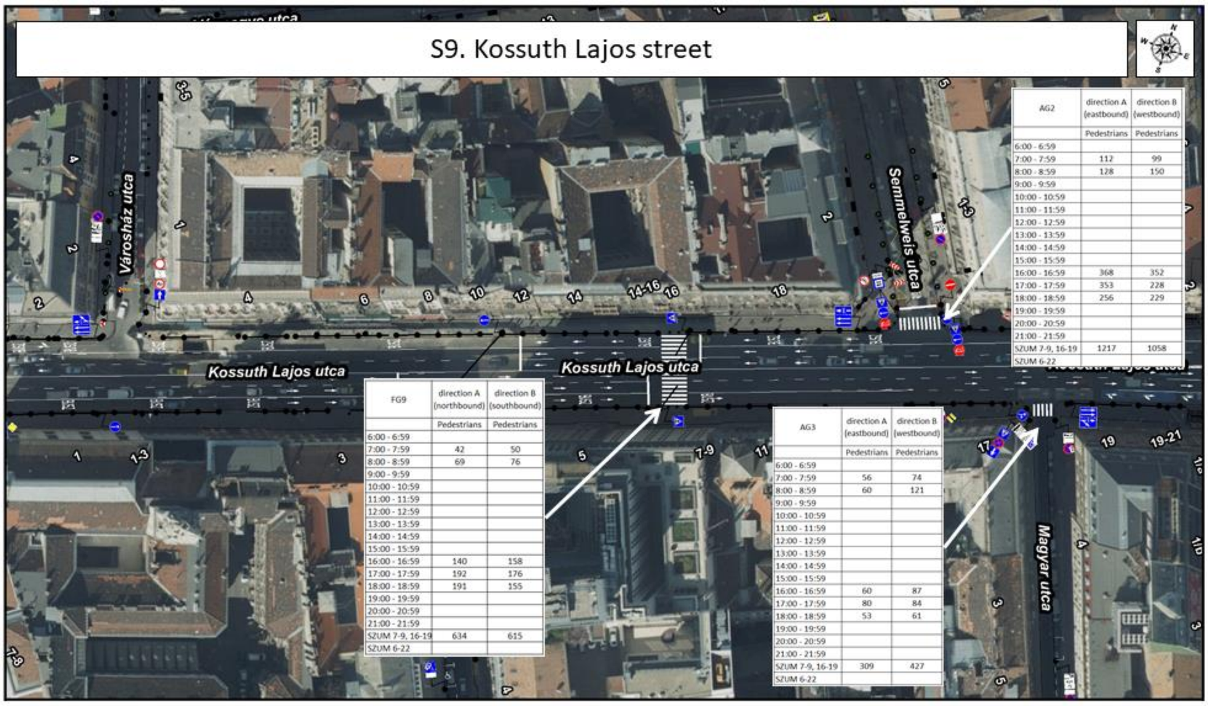
underpass staircase FAA	direction A (downwards)	direction B (upwards)
	Pedestrians	Pedestrians
6:00 - 6:59	23	42
7:00 - 7:59	43	119
8:00 - 8:59	56	113
9:00 - 9:59	47	102
10:00 - 10:59	85	78
11:00 - 11:59	101	88
12:00 - 12:59	151	117
13:00 - 13:59	127	117
14:00 - 14:59	134	125
15:00 - 15:59	145	164
16:00 - 16:59	167	146
17:00 - 17:59	154	150
18:00 - 18:59	131	115
19:00 - 19:59	128	144
20:00 - 20:59	119	87
21:00 - 21:59	55	41
SZUM 7-9, 16-19	551	643
SZUM 6-22	1666	1748

underpass staircase FAC	direction A (downwards)	direction B (upwards)
	Pedestrians	Pedestrians
6:00 - 6:59	320	202
7:00 - 7:59	649	558
8:00 - 8:59	580	490
9:00 - 9:59	445	440
10:00 - 10:59	346	329
11:00 - 11:59	342	289
12:00 - 12:59	377	249
13:00 - 13:59	358	217
14:00 - 14:59	567	374
15:00 - 15:59	737	427
16:00 - 16:59	950	514
17:00 - 17:59	1252	554
18:00 - 18:59	681	463
19:00 - 19:59	440	299
20:00 - 20:59	358	243
21:00 - 21:59	296	265
SZUM 7-9, 16-19	4112	2579
SZUM 6-22	8698	5913

underpass elevator FAL	direction A (downwards)	direction B (upwards)
	Pedestrians	Pedestrians
6:00 - 6:59	-	-
7:00 - 7:59	5	10
8:00 - 8:59	10	18
9:00 - 9:59	-	-
10:00 - 10:59	-	-
11:00 - 11:59	-	-
12:00 - 12:59	-	-
13:00 - 13:59	-	-
14:00 - 14:59	-	-
15:00 - 15:59	-	-
16:00 - 16:59	10	16
17:00 - 17:59	15	19
18:00 - 18:59	4	14
19:00 - 19:59	-	-
20:00 - 20:59	-	-
21:00 - 21:59	-	-
SZUM 7-9, 16-19	44	77
SZUM 6-22	-	-

underpass staircase FAB	direction A (downwards)	direction B (upwards)
	Pedestrians	Pedestrians
6:00 - 6:59	30	34
7:00 - 7:59	85	68
8:00 - 8:59	99	99
9:00 - 9:59	145	118
10:00 - 10:59	81	51
11:00 - 11:59	88	142
12:00 - 12:59	129	155
13:00 - 13:59	158	139
14:00 - 14:59	257	156
15:00 - 15:59	313	233
16:00 - 16:59	350	229
17:00 - 17:59	311	248
18:00 - 18:59	241	214
19:00 - 19:59	157	113
20:00 - 20:59	119	95
21:00 - 21:59	21	35
SZUM 7-9, 16-19	1086	858
SZUM 6-22	2584	2129

Figure 255. Daily pedestrian traffic at underpasses in Ferenciek square

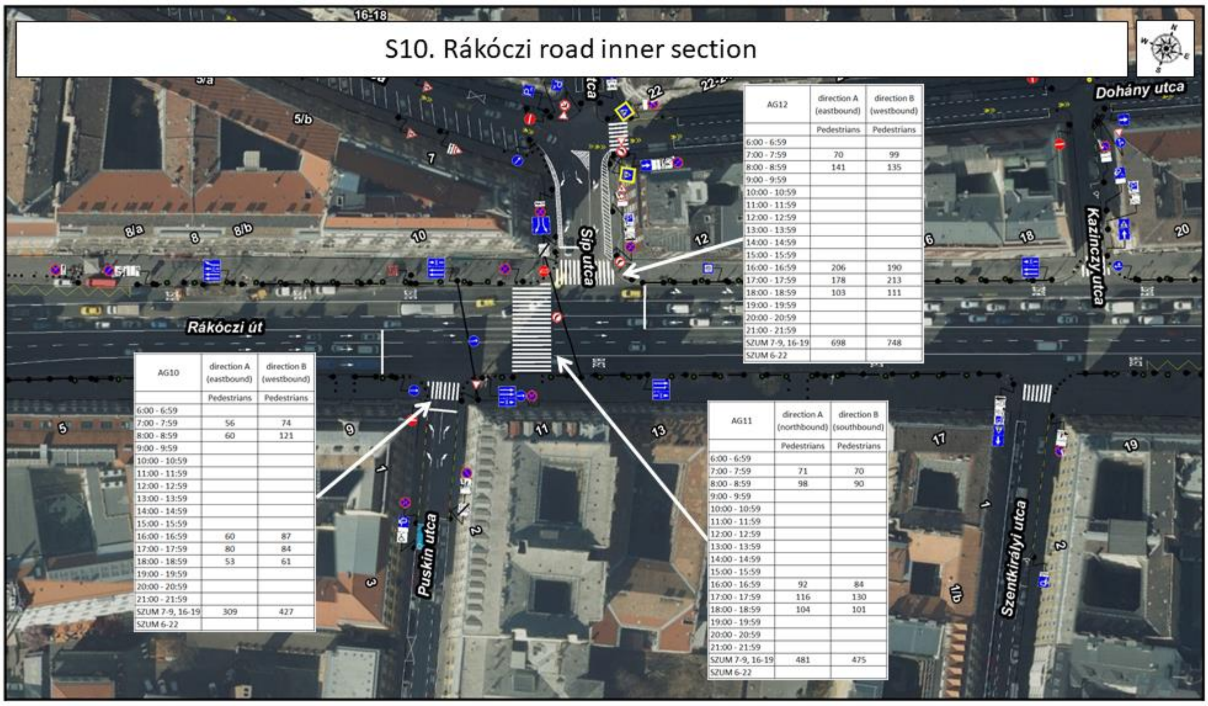


AG2	direction A (eastbound)	direction B (westbound)
	Pedestrians	Pedestrians
6:00 - 6:59		
7:00 - 7:59	112	99
8:00 - 8:59	128	150
9:00 - 9:59		
10:00 - 10:59		
11:00 - 11:59		
12:00 - 12:59		
13:00 - 13:59		
14:00 - 14:59		
15:00 - 15:59		
16:00 - 16:59	368	352
17:00 - 17:59	353	228
18:00 - 18:59	256	229
19:00 - 19:59		
20:00 - 20:59		
21:00 - 21:59		
SZUM 7-9, 16-19	1217	1058
SZUM 6-22		

FG9	direction A (northbound)	direction B (southbound)
	Pedestrians	Pedestrians
6:00 - 6:59		
7:00 - 7:59	42	50
8:00 - 8:59	69	76
9:00 - 9:59		
10:00 - 10:59		
11:00 - 11:59		
12:00 - 12:59		
13:00 - 13:59		
14:00 - 14:59		
15:00 - 15:59		
16:00 - 16:59	140	158
17:00 - 17:59	192	176
18:00 - 18:59	191	155
19:00 - 19:59		
20:00 - 20:59		
21:00 - 21:59		
SZUM 7-9, 16-19	634	615
SZUM 6-22		

AG3	direction A (eastbound)	direction B (westbound)
	Pedestrians	Pedestrians
6:00 - 6:59		
7:00 - 7:59	56	74
8:00 - 8:59	60	121
9:00 - 9:59		
10:00 - 10:59		
11:00 - 11:59		
12:00 - 12:59		
13:00 - 13:59		
14:00 - 14:59		
15:00 - 15:59		
16:00 - 16:59	60	87
17:00 - 17:59	80	84
18:00 - 18:59	53	61
19:00 - 19:59		
20:00 - 20:59		
21:00 - 21:59		
SZUM 7-9, 16-19	309	427
SZUM 6-22		

Figure 256. Daily pedestrian traffic at pedestrian crossings in Kossuth Lajos street



AG10	direction A (eastbound)	direction B (westbound)
	Pedestrians	Pedestrians
6:00 - 6:59		
7:00 - 7:59	56	74
8:00 - 8:59	60	121
9:00 - 9:59		
10:00 - 10:59		
11:00 - 11:59		
12:00 - 12:59		
13:00 - 13:59		
14:00 - 14:59		
15:00 - 15:59		
16:00 - 16:59	60	87
17:00 - 17:59	80	84
18:00 - 18:59	53	61
19:00 - 19:59		
20:00 - 20:59		
21:00 - 21:59		
SZUM 7-9, 16-19	309	427
SZUM 6-22		

AG11	direction A (northbound)	direction B (southbound)
	Pedestrians	Pedestrians
6:00 - 6:59		
7:00 - 7:59	71	70
8:00 - 8:59	98	90
9:00 - 9:59		
10:00 - 10:59		
11:00 - 11:59		
12:00 - 12:59		
13:00 - 13:59		
14:00 - 14:59		
15:00 - 15:59		
16:00 - 16:59	92	84
17:00 - 17:59	116	130
18:00 - 18:59	104	101
19:00 - 19:59		
20:00 - 20:59		
21:00 - 21:59		
SZUM 7-9, 16-19	481	475
SZUM 6-22		

AG12	direction A (eastbound)	direction B (westbound)
	Pedestrians	Pedestrians
6:00 - 6:59		
7:00 - 7:59	70	99
8:00 - 8:59	141	135
9:00 - 9:59		
10:00 - 10:59		
11:00 - 11:59		
12:00 - 12:59		
13:00 - 13:59		
14:00 - 14:59		
15:00 - 15:59		
16:00 - 16:59	206	190
17:00 - 17:59	178	213
18:00 - 18:59	103	111
19:00 - 19:59		
20:00 - 20:59		
21:00 - 21:59		
SZUM 7-9, 16-19	698	748
SZUM 6-22		

Figure 257. Daily pedestrian traffic at pedestrian crossings in Rákóczi road

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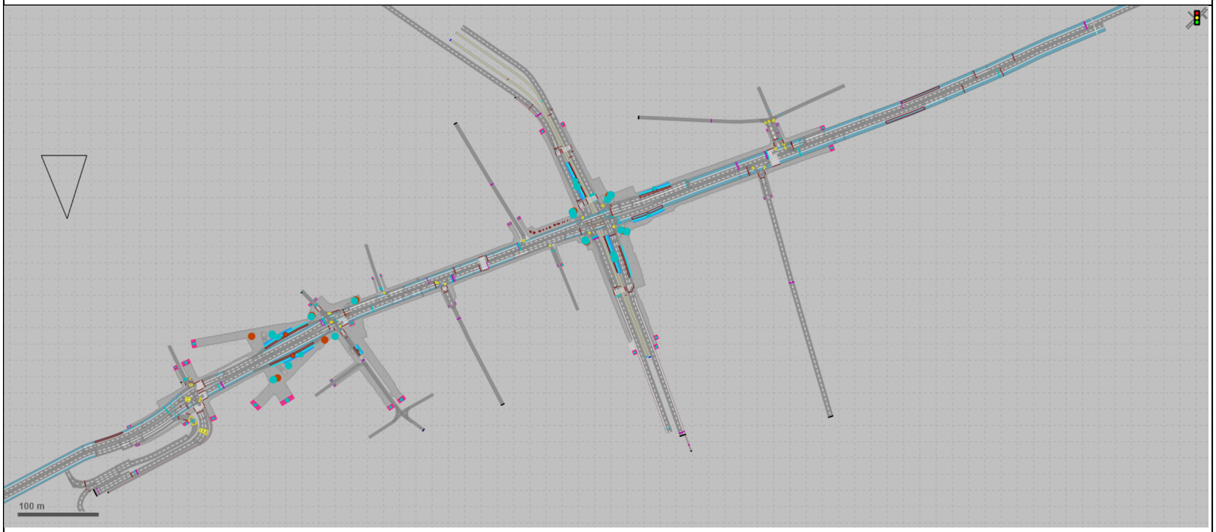
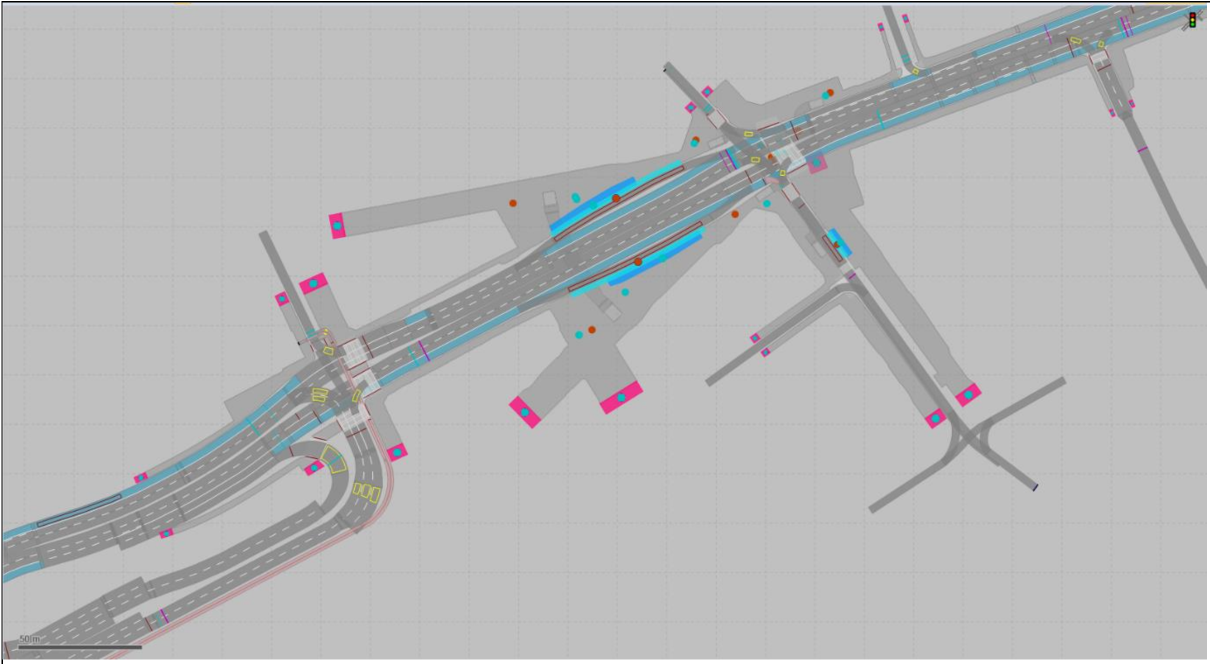
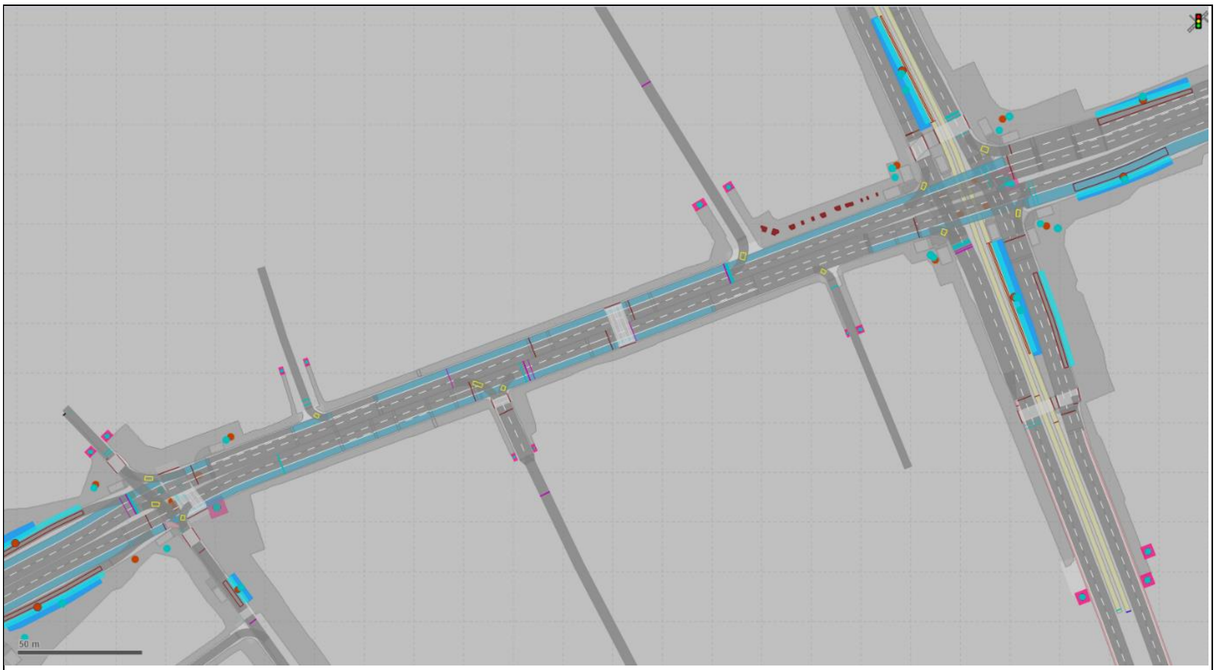
Appendix 2 – Budapest: Budapest modelling environment at the same size for all Scenarios

The entire VISSIM network of **Scenario 0**


Scenario 0 : Surrounds of Váczi street – Kossuth Lajos utca junction and Ferenciek square

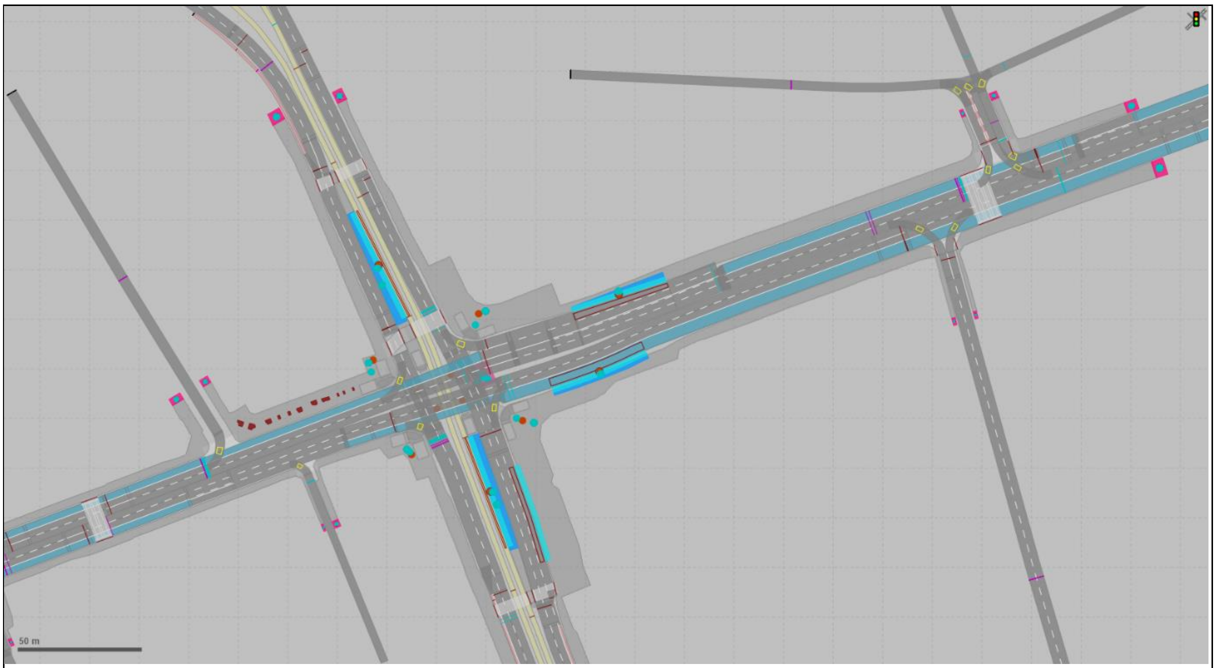


Scenario 0 : Surrounds of Kossuth Lajos street



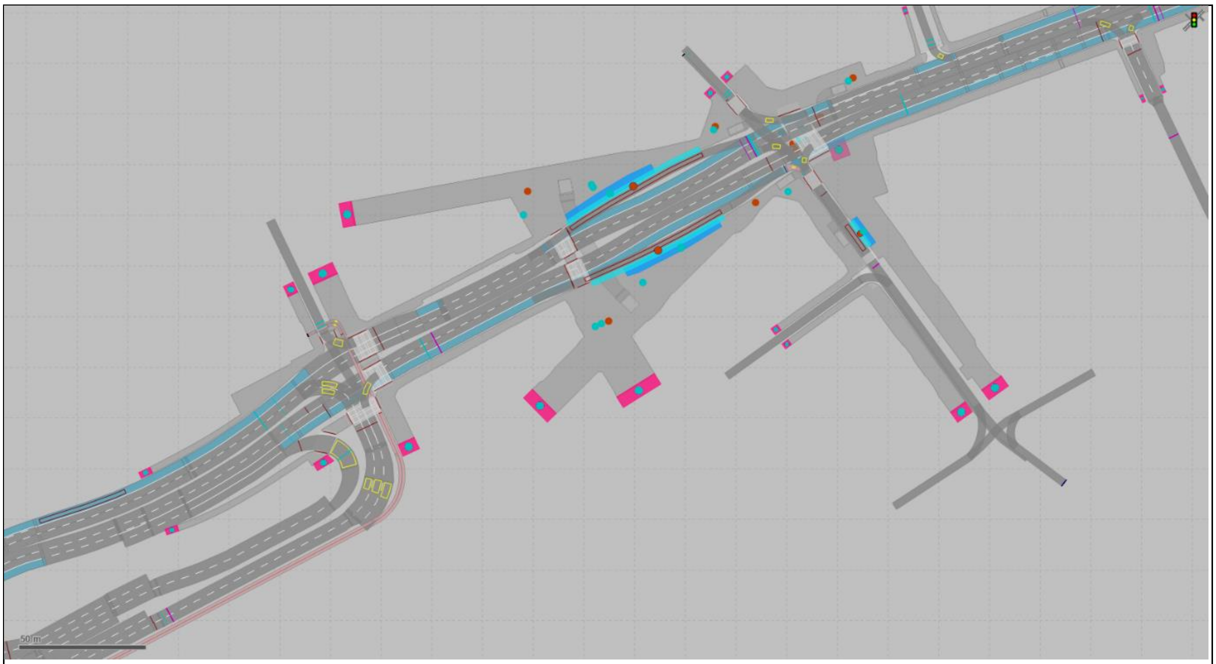
Scenario 0 : Surrounds of Astoria

 Version: 3

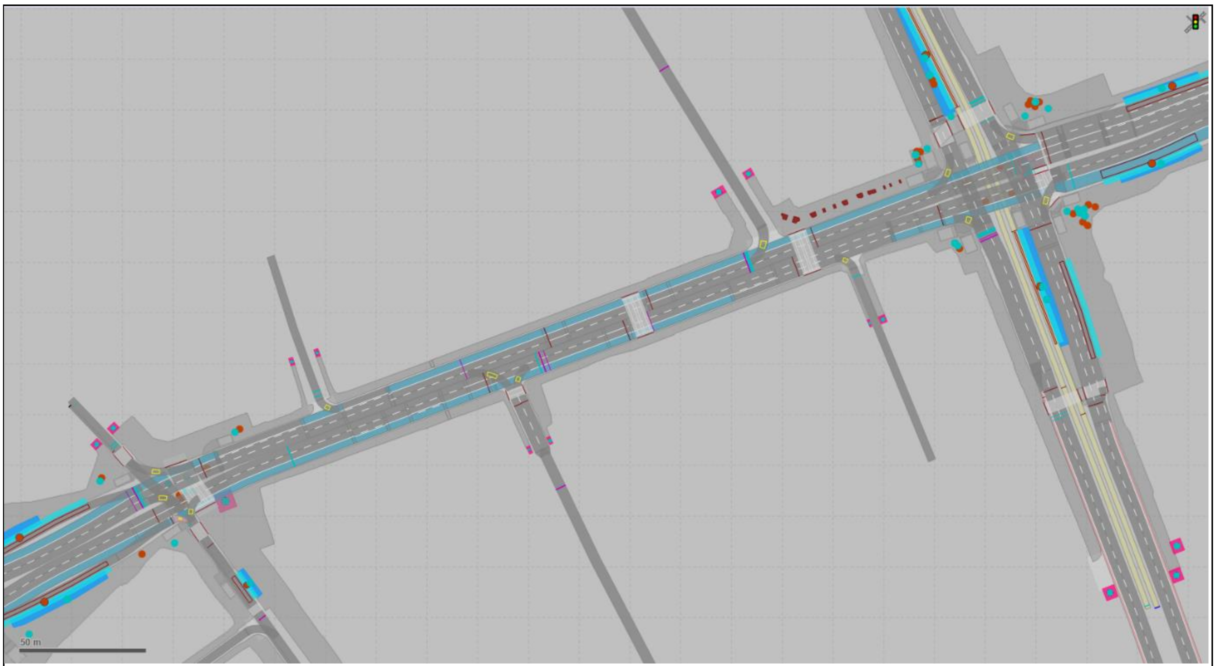


Scenario 1: The entire VISSIM network

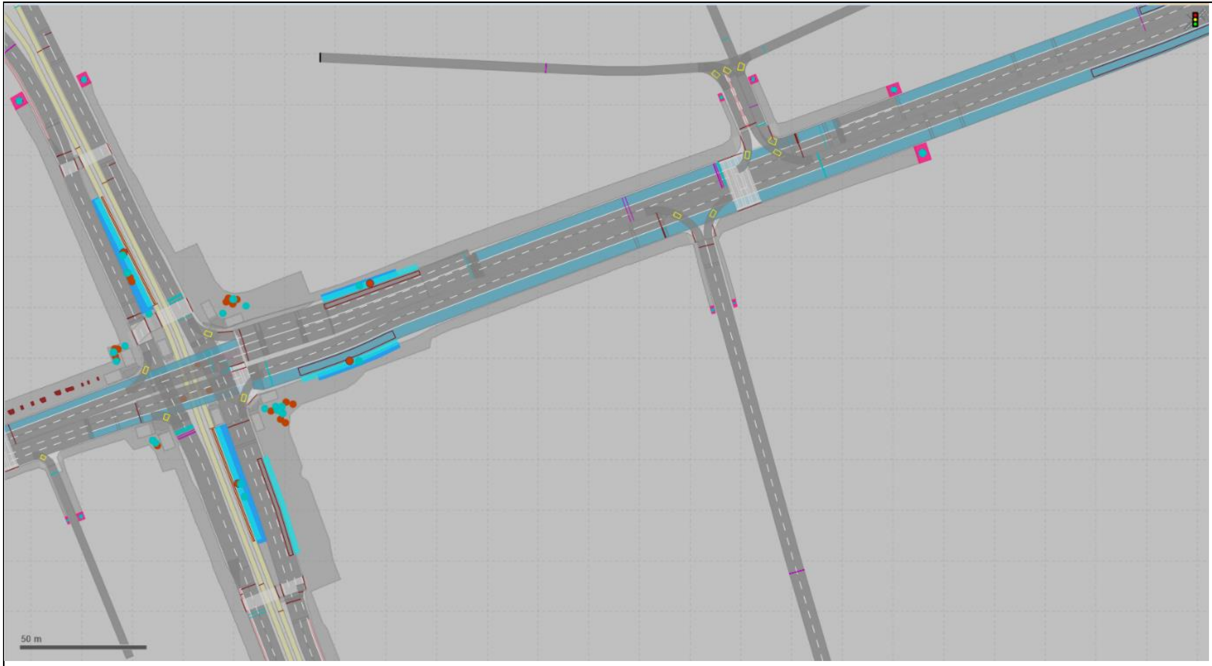
Scenario 1: Surrounds of Váczi street – Kossuth Lajos utca junction and Ferenciek square



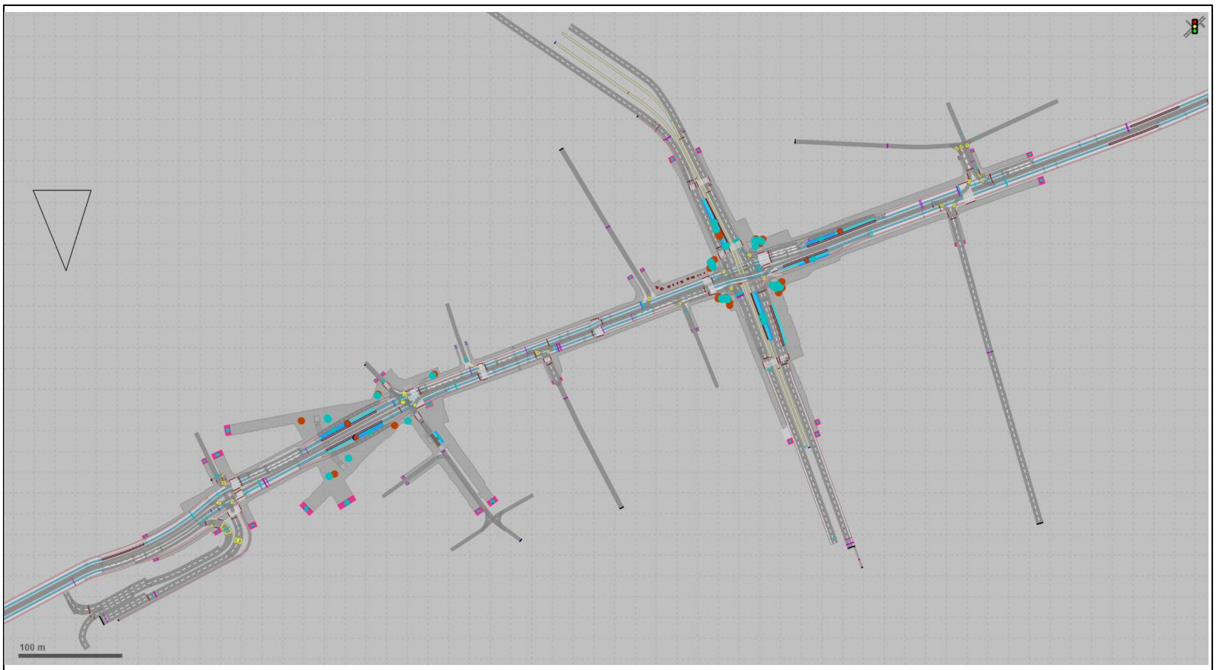
Scenario 1: Surrounds of Kossuth Lajos street



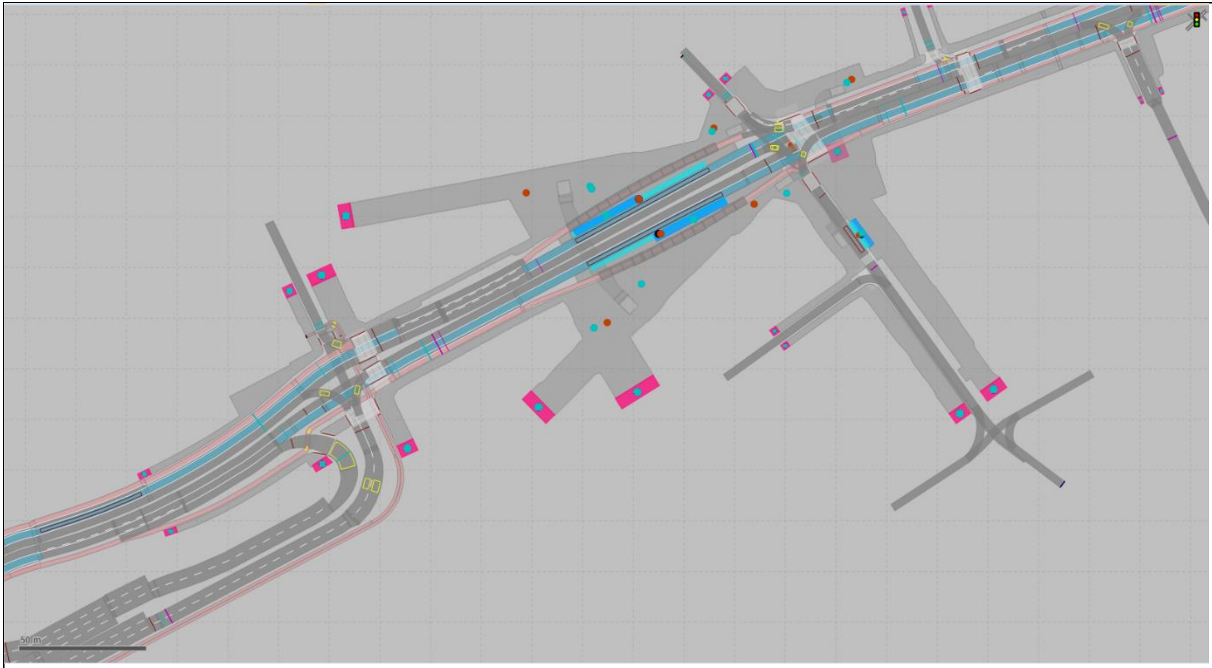
Scenario 1: Surrounds of Astoria



Scenario 2: The entire VISSIM network

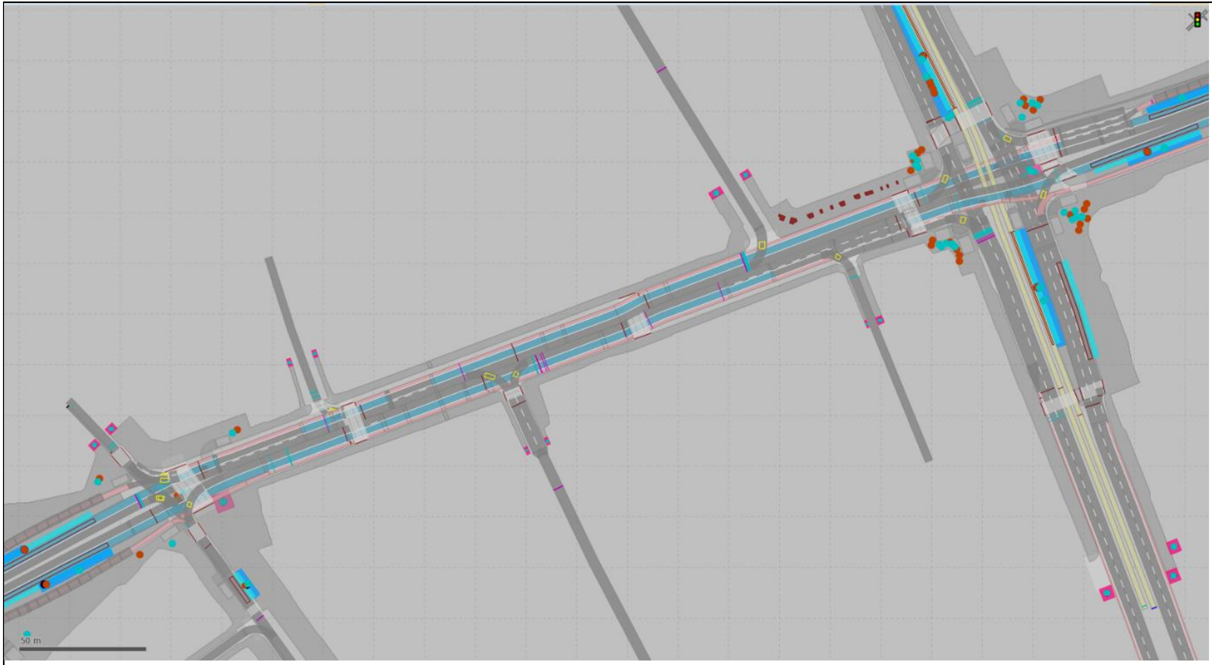


Scenario 2: Surrounds of Váczi street – Kossuth Lajos utca junction and Ferenciek square

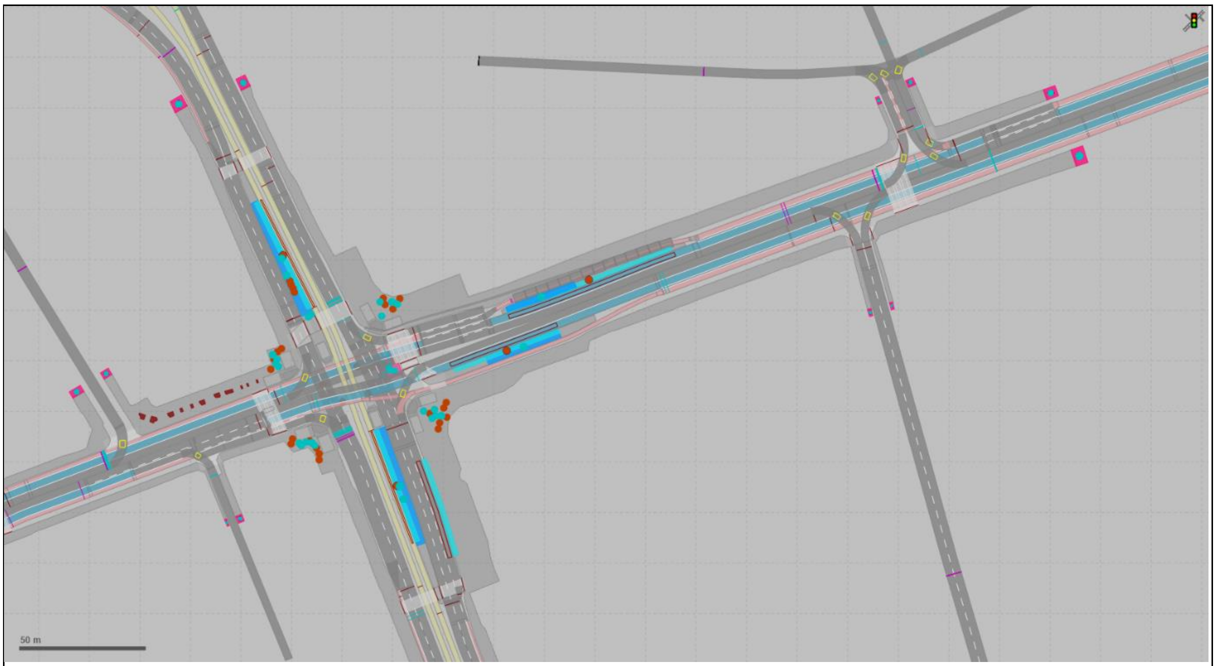


Scenario 2: Surrounds of Kossuth Lajos street

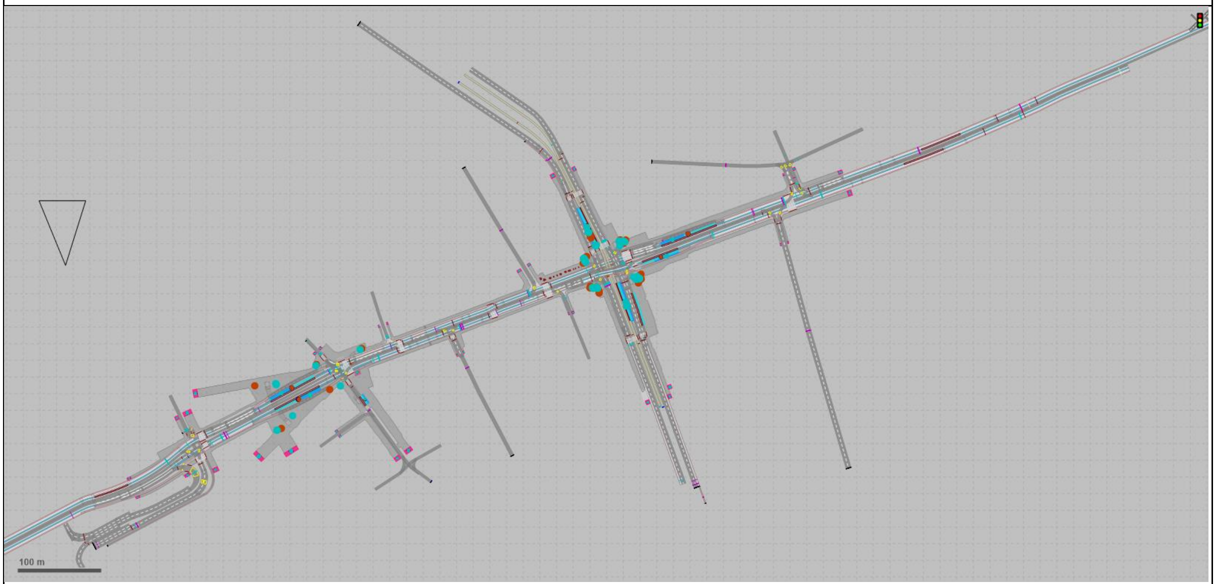
 Version: 3

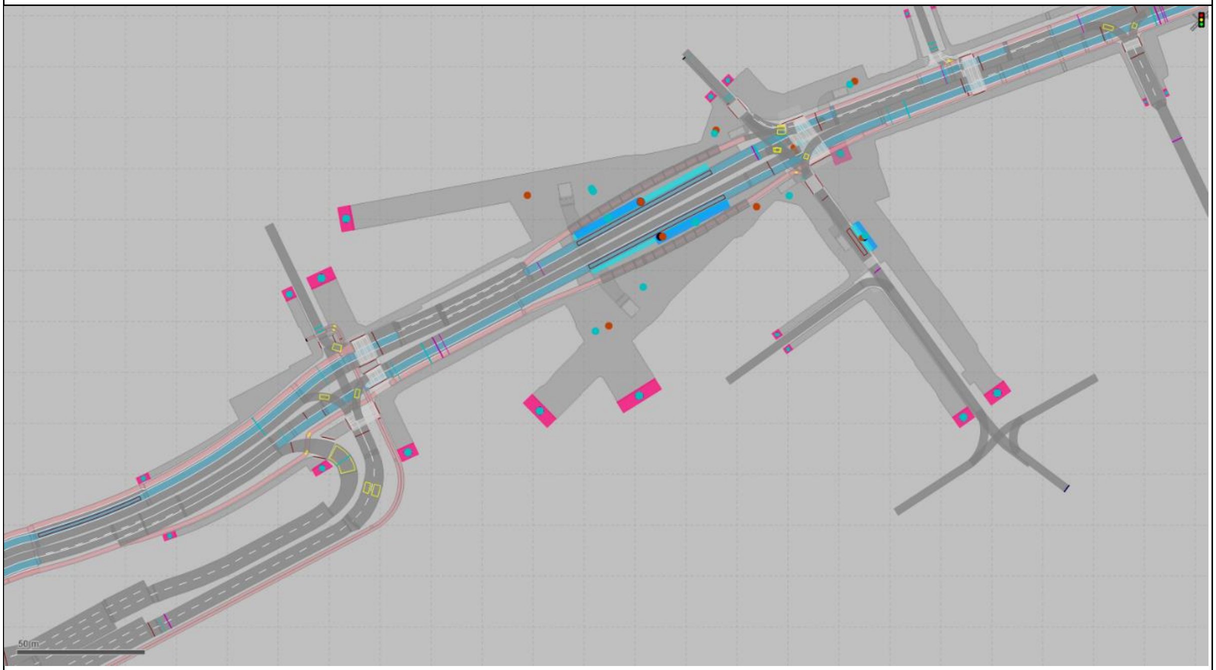


Scenario 2: Surrounds of Astoria

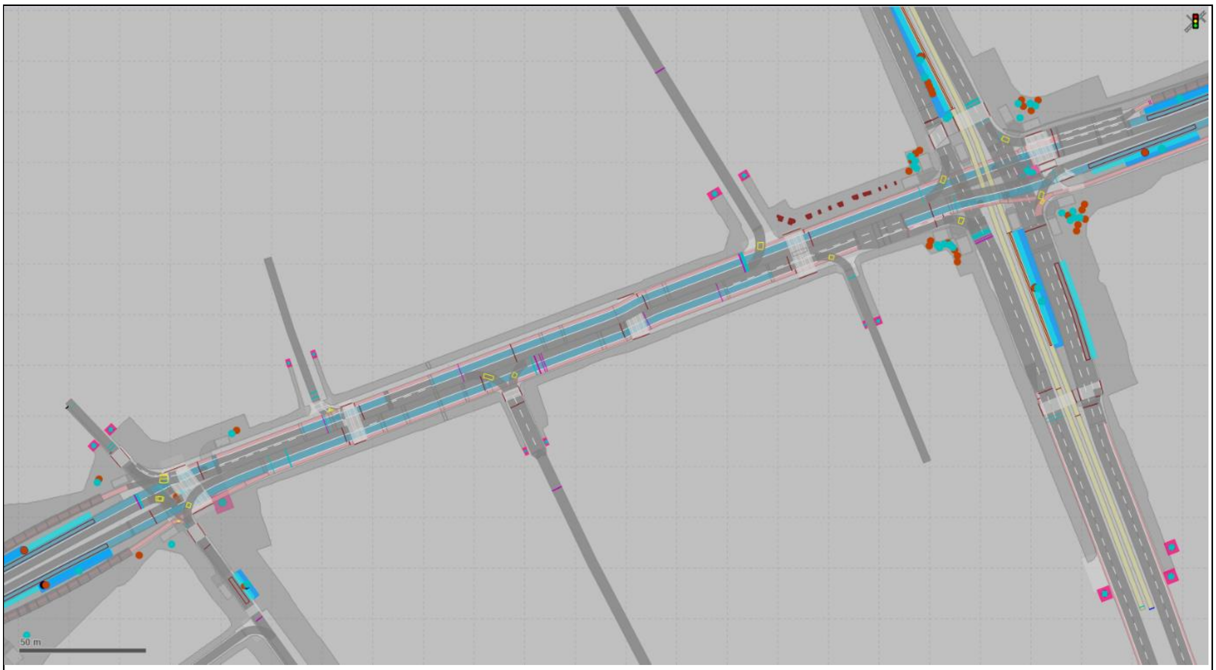


Scenario 3: The entire VISSIM network

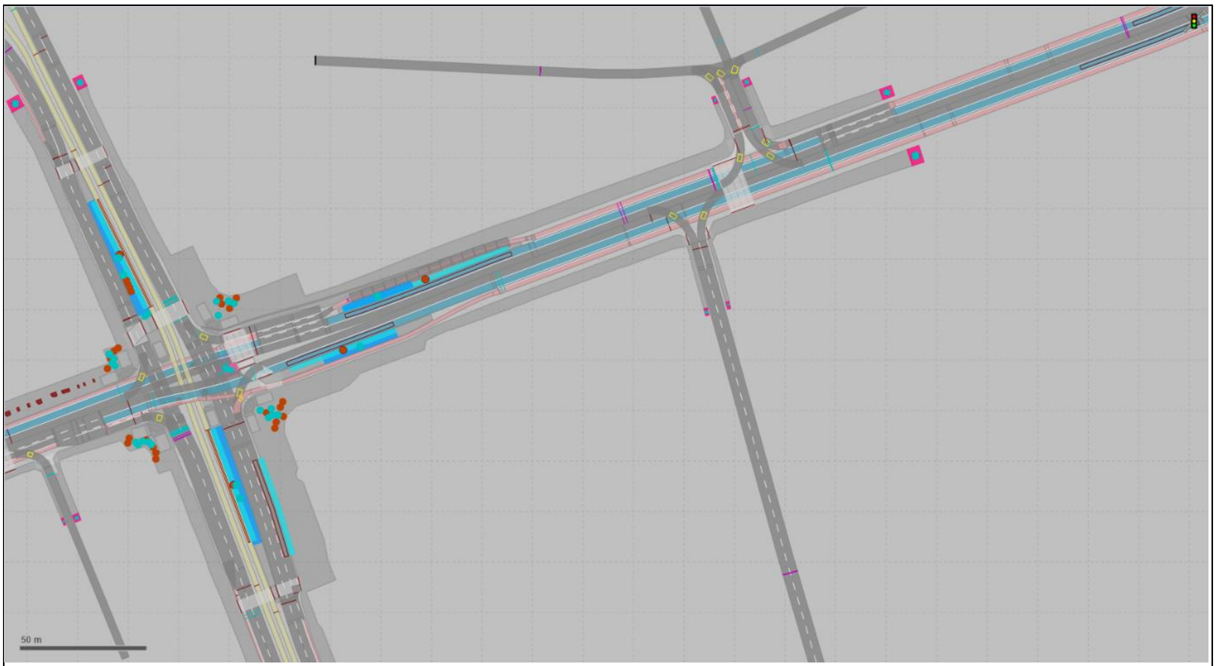


Scenario 3: Surrounds of Váczi street – Kossuth Lajos utca junction and Ferenciek square


Scenario 3: Surrounds of Kossuth Lajos street



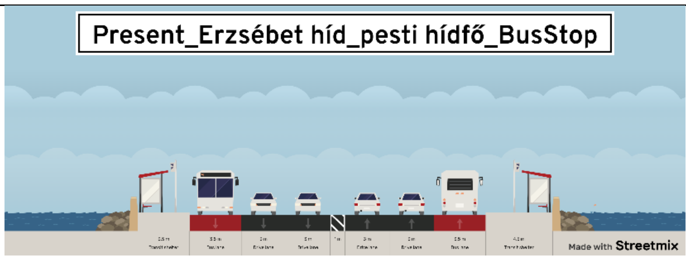
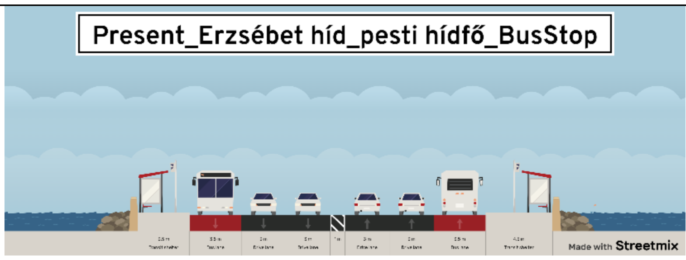
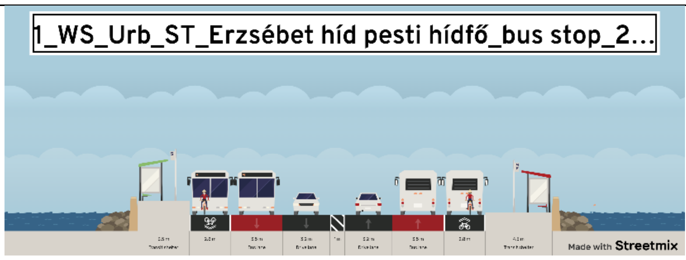
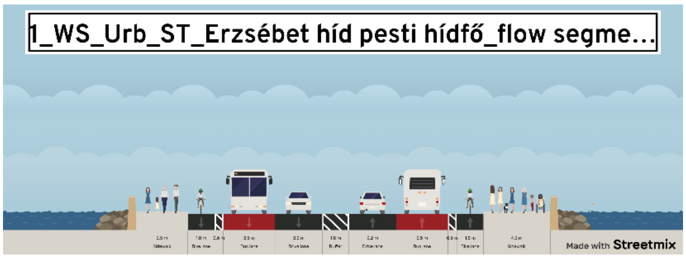
Scenario 3: Surrounds of Astoria


50 m

Appendix 3 – Budapest: Cross-section comparison of the different scenarios

The following tables compare the different scenarios with each other based on cross-sections.

Bridgehead of the Erzsébet-bridge (next to the Váczi street junction, the starting point of the Stress section)

Scenario 0 Current condition at the Stress section		Currently, the Erzsébet Bridge (Danube Bridge) at the western end of the section has two lanes for cars and one for public transport, with no separate bay open for stops.
Scenario 1 Minor modification at the current condition		Giving additional pedestrian crossings to the existing infrastructure to reduce the isolating effect of the axis.
Scenario 3 Urbanistic approach version	 	At the urbanistic approach version, on the Elisabeth Bridge (Danube Bridge) at the western end of the section, car traffic is reduced to one lane in each direction. The area freed up will be taken up by a cycle lane and buffer areas. At the bus stops at the Pest end of the bridge, cyclists give priority to buses arriving at the bus stops, waiting for the bus to change passengers or avoiding them.

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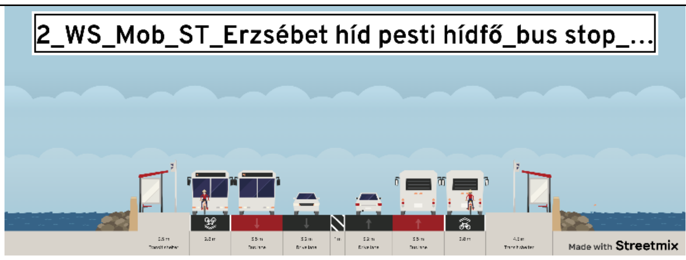
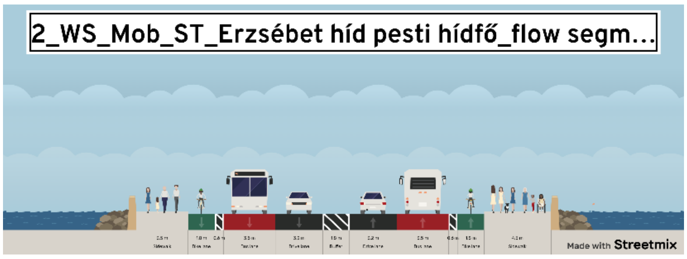
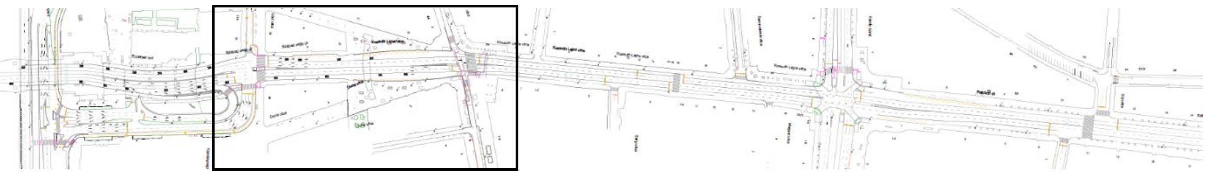
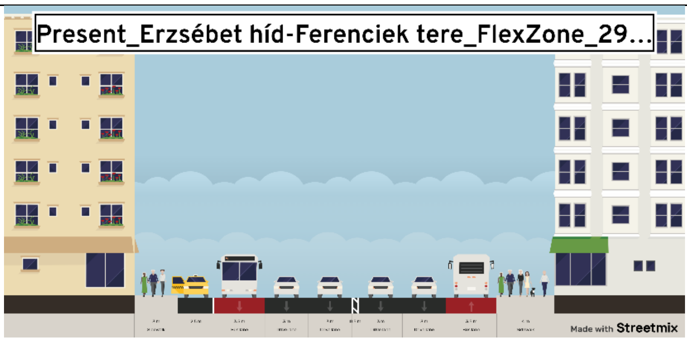
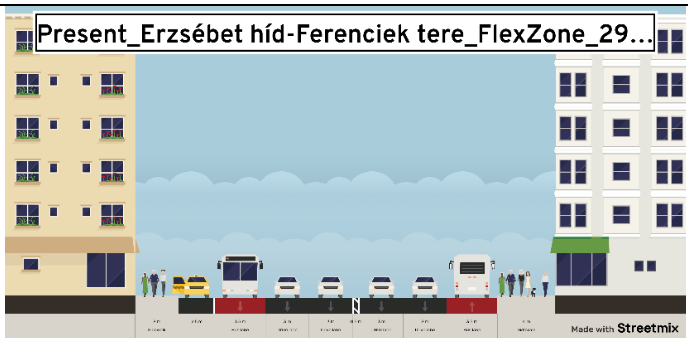
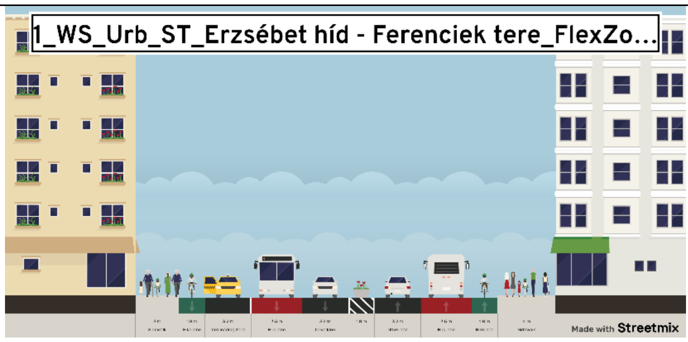
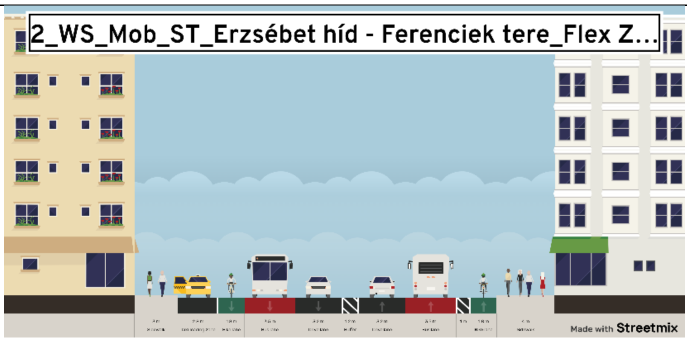
Scenario 4 Transport approach version	 	At the transport approach version, the cross-section of the bridge and the bridgehead is the same as in the urbanistic approach.

Ferenciek square

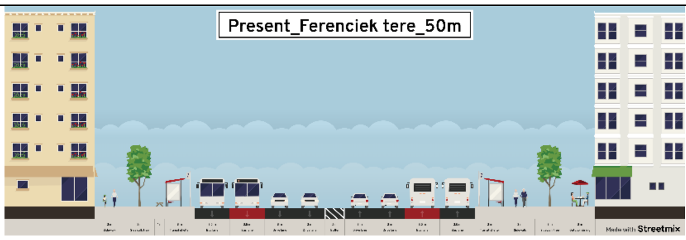


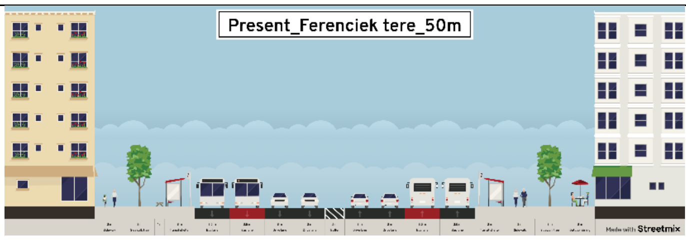
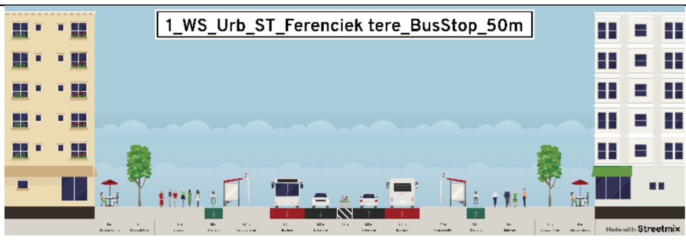
Scenario 0 Current condition at the Stress section		At the current condition, there are two traffic lane at each direction for private traffic, which place at the middle of the street. The bus lanes situate next to them, between the traffic lane and the sidewalk at each direction. Currently, there are spatially separated tourist bus and taxi stations on the section, which typically serve guests of nearby hotels.

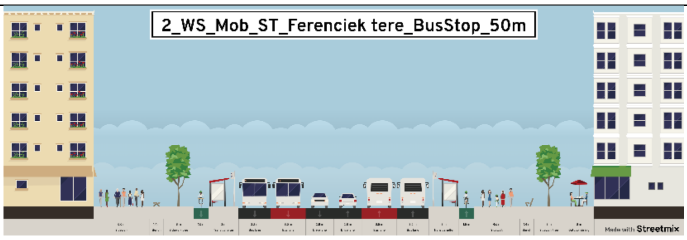
Scenario 1 Minor modification at the current condition		Giving additional pedestrian crossings to the existing infrastructure to reduce the isolating effect of the axis.
Scenario 2 Urbanistic approach version		To serve hotels and tourist sites, a taxi and coach park has been set up and is open all day. A daytime time slot is provided for sightseeing tourist buses to stop, thus avoiding disruption to public transport. The buffer zone will help to integrate cars arriving from the bridge into the Pest environment and will provide flexible space for the placement of new features in the future, while the wider cross-sections is allow for the installation of vegetation in the form of buffers

Scenario 3 Transport approach version		To serve hotels and tourist sites, a taxi and coach park has been set up and is open all day. A daytime time slot is provided for sightseeing tourist buses to stop, thus avoiding disruption to public transport. The distribution of the buffer zone increases the subjective sense of safety for cyclists in the cycle lane.

Ferenciek Square bus stop

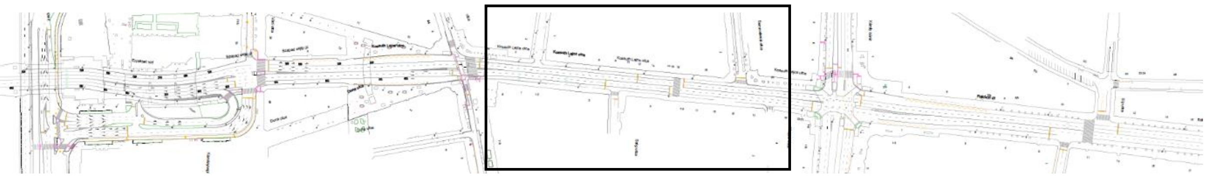
Scenario 0 Current condition at the Stress section		Currently, the road cross-section of the Ferenciek Square stop is made up of two car lanes and two bus lanes and a bus bay (8 lanes in total), flanked by a bus stop passenger platform and wide but underused pedestrian surfaces. The area is also home to high-end hotel shops and simple fast food restaurants.

Scenario 1 Minor modification at the current condition		Giving additional pedestrian crossings to the existing infrastructure to reduce the isolating effect of the axis.
Scenario 2 Urbanistic approach version		Without modifying the curbs, but with newly installed platform bus stops on the existing bus lanes in place of bus bays. The wide pedestrian surfaces on both sides play an important role in ensuring safe transfers between public transport modes and provide more favourable pedestrian conditions. New pedestrian surfaces and places for restaurant’s kiosk increase street activity and make the environment more attractive to pedestrians and users of micro mobility devices. The central buffer strip allows for the placement of planted beds.

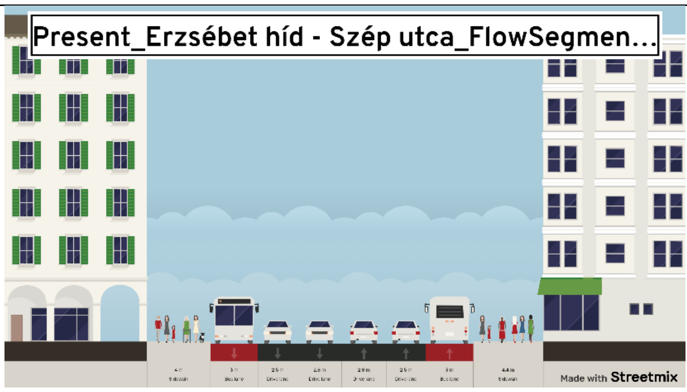
Scenario 3 Transport approach version		A separate bus bay is reducing the width of the other lanes, but it is allow for smoother public transport. Wide pedestrian spaces and street furniture is able to provide a favourable place for pedestrians. Bus stops are also placed on a newly built platform in this case, but are narrower than in the urban-focused version.

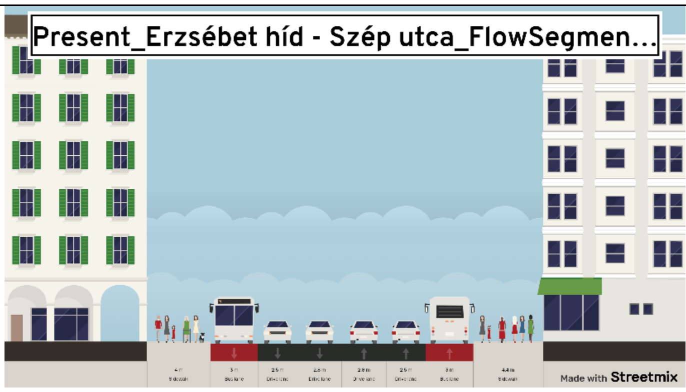
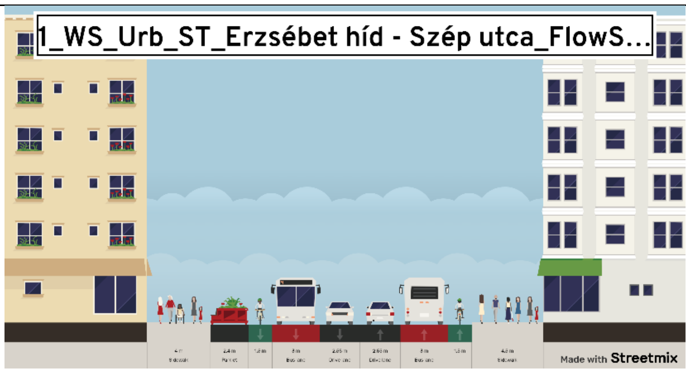
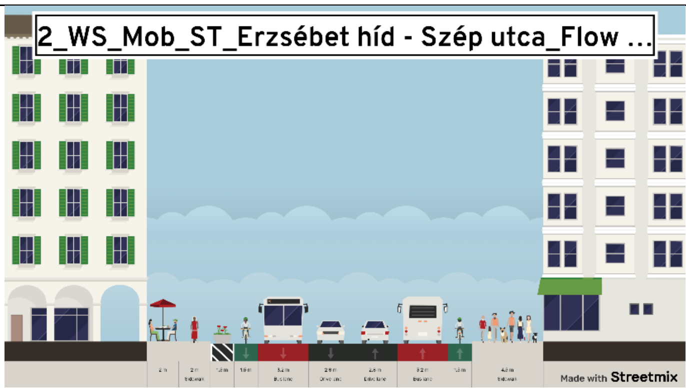
 Version: 3

Section between Ferenciek square and Astoria

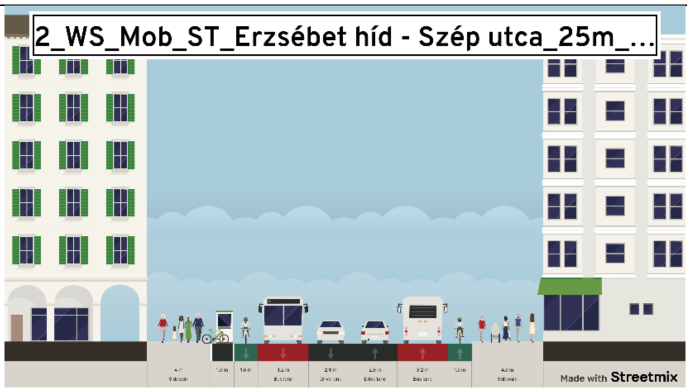


Stress section at Szép street

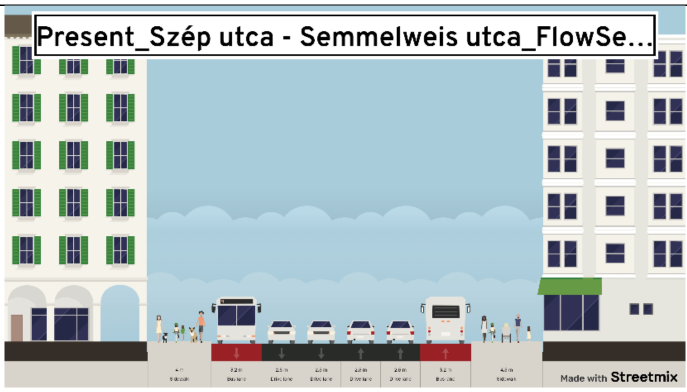
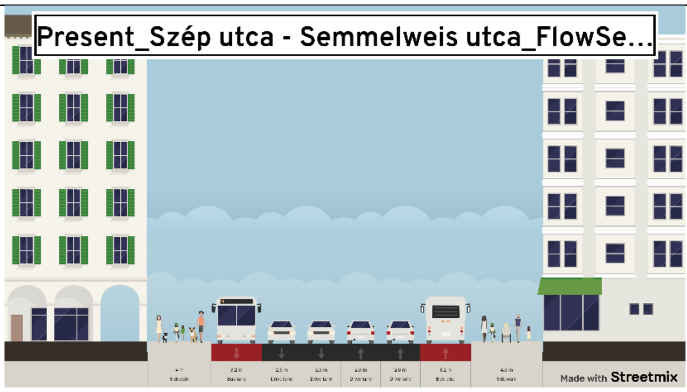
Scenario 0 Current condition at the Stress section		Currently, this section is divided into two lanes for cars and one lane for buses at each direction, with pedestrian areas of 4 and 4.5 m wide at the edges, complemented by a row of arcades on the north side. This is one of the narrowest parts of the section under study.

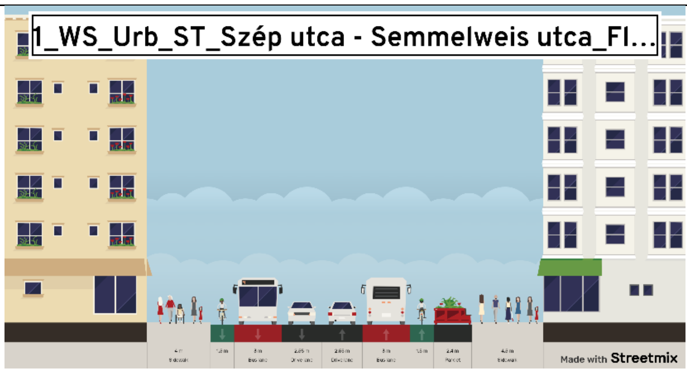
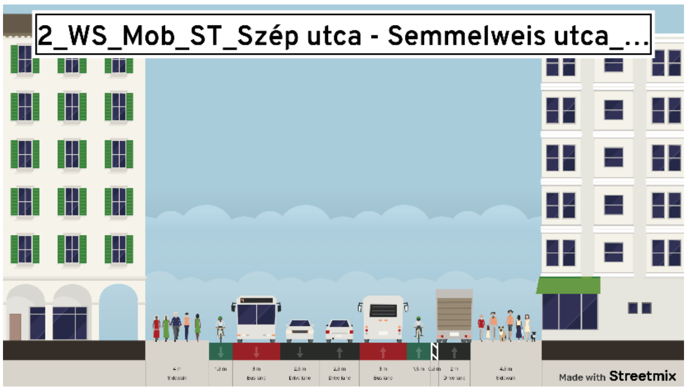
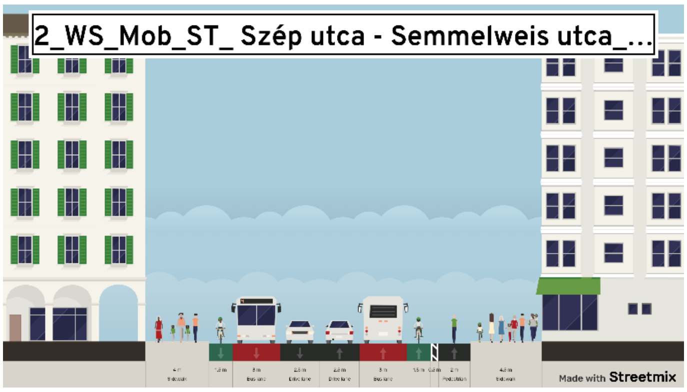
Scenario 1 Minor modification at the current condition		Giving additional pedestrian crossings to the existing infrastructure to reduce the isolating effect of the axis.
Scenario 2 Urbanistic approach version		The installation of parklets is a good alternative to green vegetation in an urban environment, which will be much more pleasant. In between these green areas, it is easy to set up a night-time goods kiosk to serve the needs of the shops and other establishments in the stretch.
Scenario 3 Transport approach version		Regarding the distribution of traffic lanes, the transport-focused version for this section is the same as the urban-focused version, but the use of the freed-up areas alternates between mixed transport and other urban functions,

 Version: 3

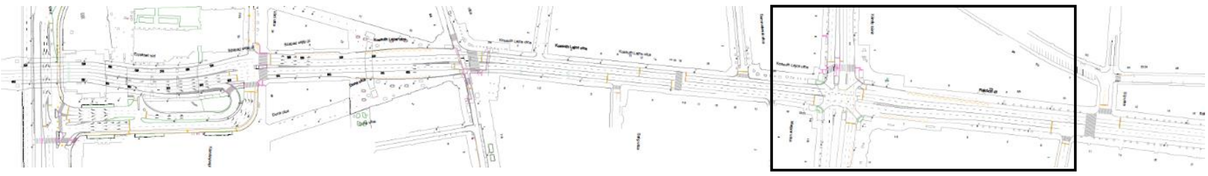
		temporary green surfaces, so that in the version above there is a green belt with a green basin and below it a micro mobility or mobility point.

Stress section at Semmelweis street

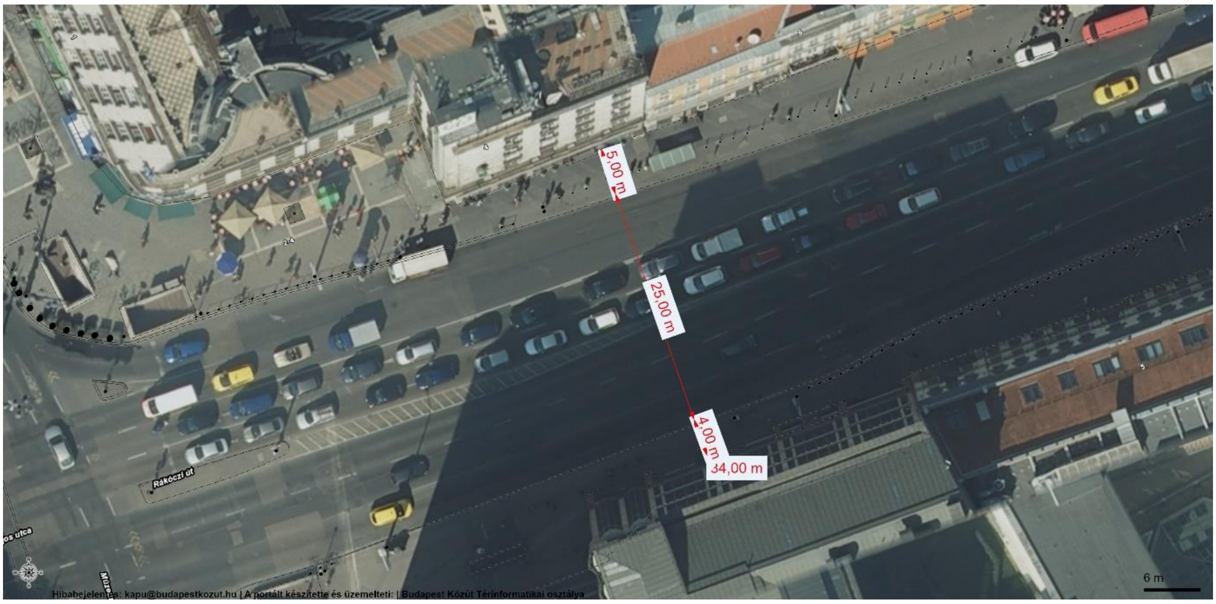
Scenario 0 Current condition at the Stress section		Currently, this section is divided into two lanes for cars and one lane for buses at each direction, with pedestrian areas of 4 and 4.5 m wide at the edges, complemented by a row of arcades on the north side. This is one of the narrowest parts of the section under study.
Scenario 1 Minor modification at the current condition		Giving additional pedestrian crossings to the existing infrastructure to reduce the isolating effect of the axis.

Scenario 2 Urbanistic approach version		The installation of parklets is a good alternative to green vegetation in an urban environment, which can be much more pleasant. In between these green areas, it is easy to set up a night-time goods kiosk to serve the needs of the shops and other establishments in the stretch.
Scenario 3 Transport approach version	 	In terms of traffic lane allocation, the transport-focused version for this section is the same as the urban-focused version, but in terms of the use of the space released, the section is given a heterogeneous function in time, with the existing grocery store being provided with a loading area at night (22:00-06:00) and a pedestrian area during the day, with safe use of traffic engineering devices.

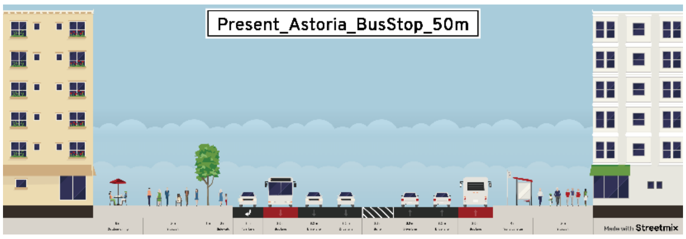
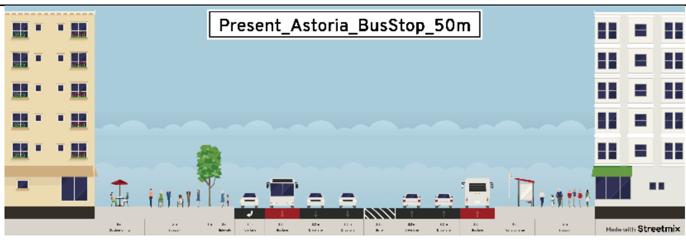
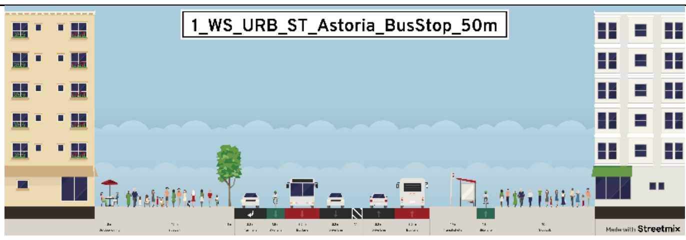
Astoria

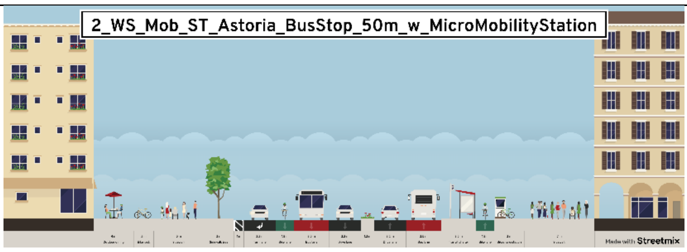


14,00 m
26,00 m
10,00 m
50,00 m
Rákóczi út
Kossuth Lajos utca
Múzeum körút
10 m



5,00 m
25,00 m
4,00 m
34,00 m
Rákóczi út
6 m

Scenario 0 Current condition at the Stress section		Currently, this section is divided into two lanes for cars and one lane for buses at each direction, and from eastbound direction the right turning lane at the bus lane, while from westbound direction, there is a dedicated turning lane for right turning traffic. The north-east corner of the intersection already has catering facilities and terraces.
Scenario 1 Minor modification at the current condition		The version's additional pedestrian crossings is located just on either side of the Astoria intersection (east and west), improving pedestrian crossing capacity between the two neighbouring districts.
Scenario 2 Urbanistic approach version		The urban focus results of the street allocation includes the reduction of the traffic to one lane at each direction and the creation of a cycle lane in the area freed up, as well as a bus stop on a new platform, allowing a wider cross-section of

		pedestrian traffic on the south side.
Scenario 3 Transport approach version		The transport-focused version's road-space allocation for this section is the same as the urban-focused version, but in this version, the free areas are allocated to micro mobility and mobility points on the north and south sides of the axis respectively.

Appendix 4 – Lisbon: Model Calibration

AM Peak

Table 52. Modelling calibration, AM Peak, Car

	Results from Vissim	Results from Visum	GEH
	Car	Car	Car
1	1 302	1 400	2,67
2	151	148	0,25
3	854	982	4,22
4	181	225	3,10
5	198	156	3,15
6	198	156	2,66
7	320	274	3,91
8	164	218	3,70
9	746	648	0,46
10	71	75	0,27
11	527	533	0,82
12	322	337	1,23
13 E--> O	322	344	3,40
13 O --> E	455	385	4,94
14 E--> O	220	300	2,12
14 O --> E	598	651	2,26
15 E--> O	129	156	0,01
15 O --> E	522	522	4,83
16 E--> O	240	321	3,98
16 O --> E	538	634	0,98
17	141	130	8,18
18	788	1 035	2,95

Table 53. Modelling calibration, AM Peak, Light Truck

Nodes	Results from Vissim	Results from Visum	GEH
	Light Truck	Light Truck	Light Truck
1	100	99	0,10
2	23	9	3,50
3	6	29	5,50
4	16	11	1,49
	13	16	0,88
6	15	9	1,73
7	6	46	7,88
8	64	72	0,93
9	0	2	1,99
10	52	37	2,28

11	14	19	1,24
12	48	62	1,85
13 E--> O	34	35	0,14
13 O --> E	18	16	0,36
14 E--> O	42	39	0,47
14 O --> E	22	11	2,71
15 E--> O	29	30	0,27
15 O --> E	33	25	1,41
16 E--> O	39	42	0,48
16 O --> E	22	11	2,63
17	75	129	5,39
18	53	54	0,18

Table 54. Modelling calibration, AM Peak, Heavy Truck

Nodes	Results from Vissim	Results from Visum	GEH
	Heavy Truck	Heavy Truck	Heavy Truck
1	16	18	0,49
2	4	4	-
3	10	6	1,41
4	3	4	0,73
	13	3	3,69
6	4	0	2,83
7	18	19	0,32
8	11	22	2,72
9	0	1	1,13
10	6	7	0,52
11	8	5	1,14
12	7	8	0,52
13 E--> O	9	7	0,54
13 O --> E	7	7	0,08
14 E--> O	18	10	2,14
14 O --> E	1	7	3,00
15 E--> O	7	5	0,75
15 O --> E	4	7	1,12
16 E--> O	17	11	1,52
16 O --> E	1	2	0,97
17	30	35	0,88
18	18	19	0,24

Table 55. Modelling calibration, AM Peak, Motorcycle

Nodes	Results from Vissim	Results from Visum	GEH
	Motorcycle	Motorcycle	Motorcycle
1	36	38	0,33
2	5	8	1,18

3	8	21	3,41
4	9	6	0,96
	20	4	4,55
6	30	23	1,42
7	2	11	3,50
8	27	38	1,90
9	2	3	0,62
10	17	18	0,28
11	4	5	0,41
12	32	35	0,54
13 E--> O	24	28	0,79
13 O --> E	18	16	0,48
14 E--> O	44	47	0,44
14 O --> E	1	21	6,03
15 E--> O	34	39	0,81
15 O --> E	18	19	0,16
16 E--> O	42	47	0,80
16 O --> E	1	9	3,55
17	38	51	1,96
18	33	34	0,10

Table 56. Modelling calibration, AM Peak, Bicycle

Nodes	Results from Vissim	Results from Visum	GEH
	Bicycle	Bicycle	Bicycle
1	0		-
2	2		2,00
3	0	4	2,83
4	0	0	-
	1	1	0,43
6	0	0	-
7	1	1	0,04
8	7	2	2,63
9	2	2	0,31
10	2	2	0,32
11	5	3	0,99
12	6	3	1,28
13 E--> O	8	5	1,29
13 O --> E	11	2	3,80
14 E--> O	7	5	0,82
14 O --> E	10	2	3,27
15 E--> O	7	5	0,94
15 O --> E	10	2	3,54
16 E--> O	8	7	0,52
16 O --> E	8	2	2,95
17	16	6	2,87
18	12	5	2,30

PM Peak

Table 57. Modelling calibration, PM Peak, Car

Nodes	Results from Vissim	Results from Visum	GEH
	Car	Car	Car
1	1.203	1.219	0,46
2	280	272	0,48
3	551	1.798	36,39[11]
4	166	190	1,80
5	339	312	1,50
6	309	223	5,27
7	129	207	6,02
8	571	684	4,51
9	64	63	0,13
10	468	475	0,32
11	318	335	0,94
12	347	373	1,37
13 E--> O	312	336	1,33
13 O --> E	288	376	4,83
14 E--> O	540	569	1,23
14 O --> E	244	278	2,10
15 E--> O	371	369	0,10
15 O --> E	360	456	4,75
16 E--> O	478	536	2,58
16 O --> E	244	240	0,26
17	670	1.035	12,50
18	697	898	7,12

Table 58. Modelling calibration, PM Peak, Light Truck

Nodes	Results from Vissim	Results from Visum	GEH
	Light Truck	Light Truck	Light Truck
1	55	51	0,55
2	11	9	0,63
3	95	75	2,17
4	31	21	1,96
	42	21	3,74
6	34	33	0,17
7	11	20	2,29
8	28	41	2,21
9	12	14	0,55
10	92	74	1,98
11	39	43	0,62
12	13	11	0,58

[11]The PTV Visum model calibration, was based in the counting made before the implementation of a cycle lane that removed one of the two lanes. The Vissim modeling considered the cycle lane, so it was impossible to be near the Visum results since road's capacity is much less. Due to this, the movements from west to east in Vissim simulation are generally less than the ones from Visum.

13 E--> O	26	26	-
13 O --> E	21	26	1,03
14 E--> O	7	14	2,16
14 O --> E	46	11	6,56
15 E--> O	31	37	1,03
15 O --> E	51	35	2,44
16 E--> O	43	46	0,45
16 O --> E	7	8	0,37
17	30	79	6,64
18	81	54	3,25

Table 59. Modelling calibration, PM Peak, Heavy Truck

Nodes	Results from Vissim	Results from Visum	GEH
	Heavy Truck	Heavy Truck	Heavy Truck
1	16	5	3,39
2	4	3	0,53
3	10	14	1,15
4	3	3	-
	13	2	4,02
6	1	2	0,82
7	15	3	4,00
8	16	10	1,66
9	0	1	1,13
10	6	3	1,41
11	8	3	2,13
12	7	3	1,79
13 E--> O	9	3	2,45
13 O --> E	4	8	1,63
14 E--> O	1	5	2,31
14 O --> E	18	6	3,46
15 E--> O	7	3	1,79
15 O --> E	4	7	1,28
16 E--> O	17	7	2,89
16 O --> E	1	3	1,41
17	26	35	1,63
18	16	19	0,73

Table 60. Modelling calibration, PM Peak, Motorcycle

Nodes	Results from Vissim	Results from Visum	GEH
	Motorcycle	Motorcycle	Motorcycle
1	27	26	0,19
2	18	21	0,68

3	59	52	0,94
4	8	4	1,63
	27	26	0,19
6	28	24	0,78
7	3	3	-
8	20	18	0,46
9	3	4	0,53
10	21	22	0,22
11	12	12	-
12	11	8	0,97
13 E--> O	20	20	-
13 O --> E	22	25	0,62
14 E--> O	8	44	7,06
14 O --> E	43	16	4,97
15 E--> O	38	34	0,67
15 O --> E	32	31	0,18
16 E--> O	43	46	0,45
16 O --> E	8	14	1,81
17	24	51	4,42
18	28	34	1,00

Table 61. Modelling calibration, PM Peak, Bicycle

Nodes	Results from Vissim	Results from Visum	GEH
	Bicycle	Bicycle	Bicycle
1	0	9	4,24
2	6	3	1,41
3	0	5	3,16
4	2	1	0,82
	7	3	1,79
6	0	0	-
7	0	0	-
8	15	9	1,73
9	0	0	-
10	1	0	1,41
11	5	3	1,00
12	8	6	0,76
13 E--> O	0	1	1,41
13 O --> E	4	7	1,28
14 E--> O	3	3	-
14 O --> E	10	5	1,83
15 E--> O	0	1	1,41
15 O --> E	3	7	1,79
16 E--> O	9	15	1,73
16 O --> E	2	5	1,60
17	18	6	3,32
18	6	5	0,32

AM Peak simulations

Scenario 0

According with the modelling simulation, the movements from east to west are clearly higher than the inverse one. While congestion situations and long queue lines in that direction exist, from west to east there is only congestion situation in the intersection with the square. However, despite good flow conditions for vehicles, it is in the access streets where higher congestion problems occur.

Figure 258. Simulation, intersection between near Praça Paiva Couceiro, Scenario 0, AM Peak

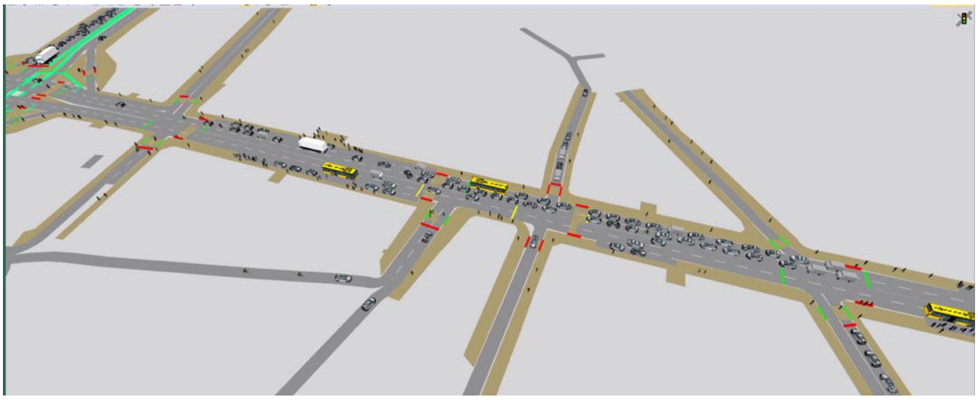


Figure 259. Simulation, intersection near Avenida Almirante Reis, Scenario 0, AM Peak

The following two images show some characteristics that resulted from PTV Vissim, as the measurements in the nodes, namely, number of vehicles, average number of stops and consequent delays.

The movements from west to east have few numbers of stops and low delay time than the inverse movement. However, the main delays occur in the intersections and not in the main street.

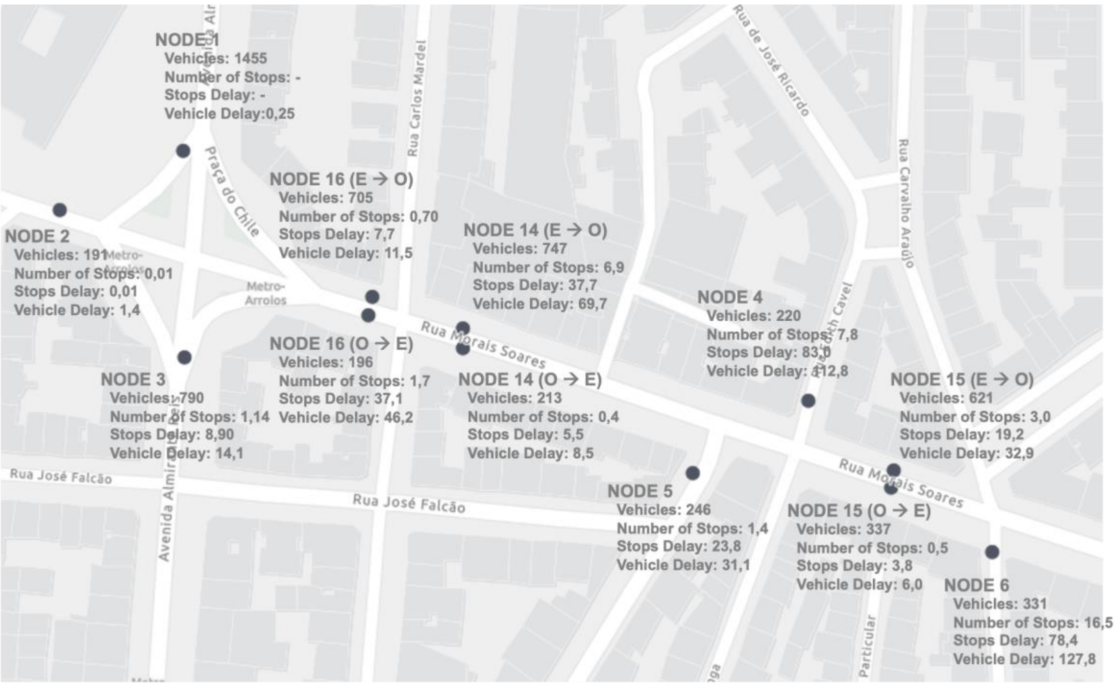


Figure 260. Nodes' results, Scenario 0, AM Peak, Section 1

Regarding Praça Paiva Couceiro, clearly the traffic flows with very few delays, even on the perpendicular streets, except in the southern road (Av. General Roçadas), where those values are clearly higher.

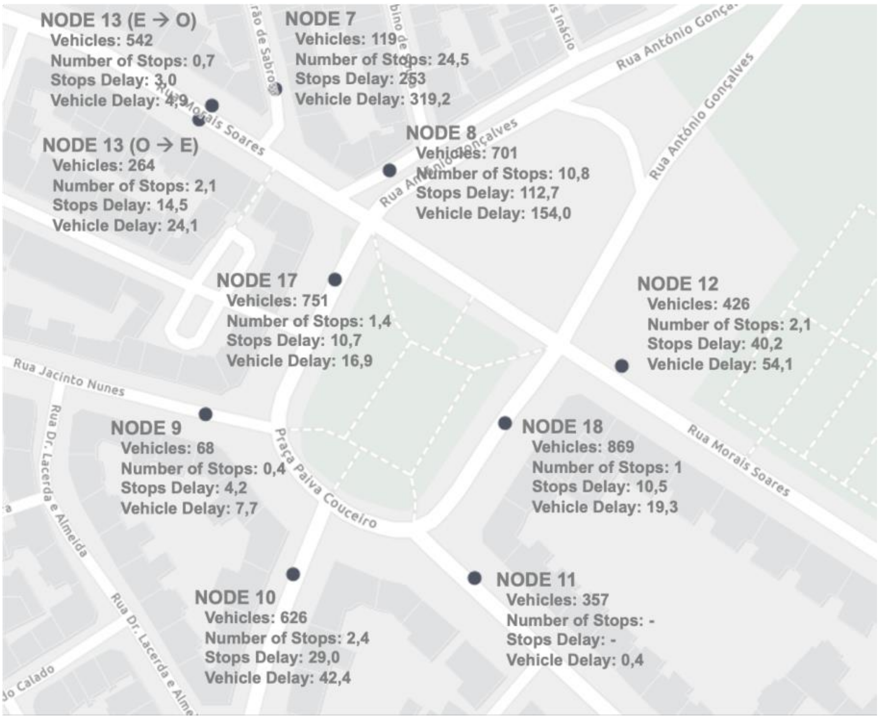


Figure 261. Nodes' results, Scenario 0, AM Peak, Section 2

Figure 262 shows the average queue length for this scenario that proves that most of the congestion situation are located in the perpendicular streets and not along the main road, especially in QC3 (Rua Barão de Sabrosa) and QC6 (Rua António Gonçalves). However, in the end of Morais Soares, in the east to west way, there is an average queue length of 171 meters, which is somehow relevant. Other characteristic easily identified is the lack of significant queues in the inverse direction.

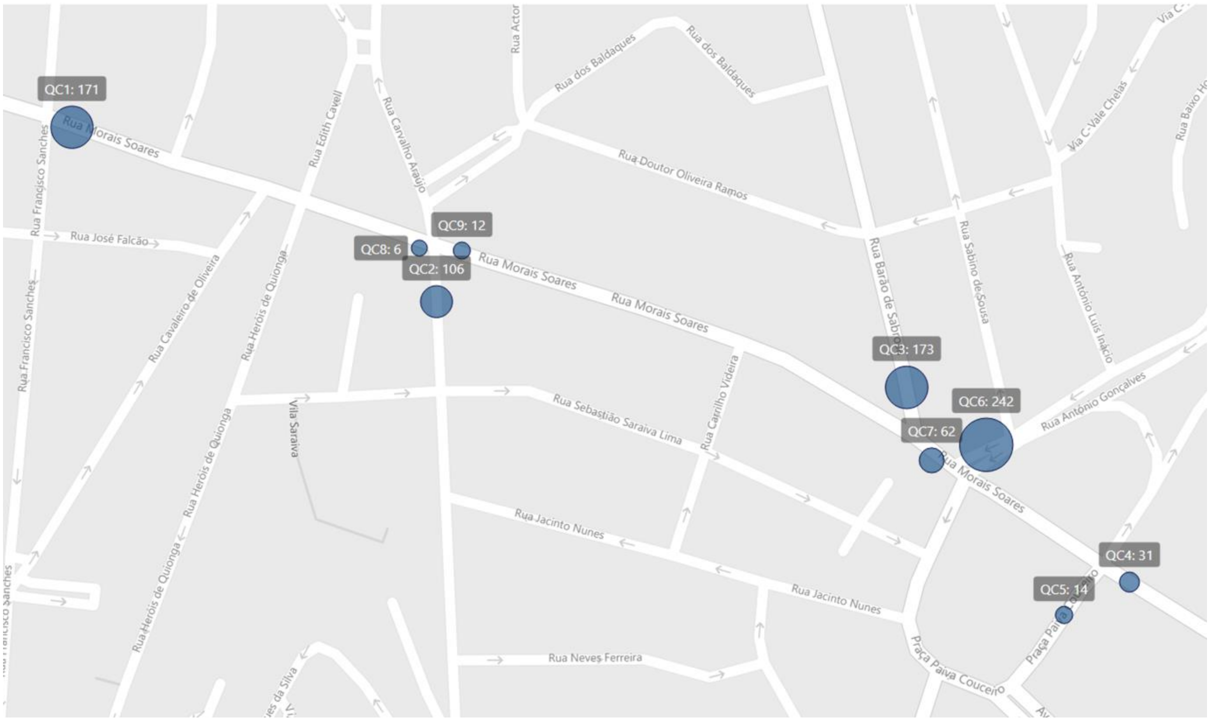


Figure 262. Average queue length (m), Scenario 0, AM Peak

Figure 263 shows the level of service in each node according with the data provided by Vissim and presented above. As long as the traffic goes from east to west, the level of service tends to get worse, mostly due to congestion situations created by double parking. In the east to west way, the level of service starts as a level D and finishes at level F, near the intersection with Avenida Almirante Reis. In the inverse way, the level of service is mainly good, almost always at level A, except nearer of Praça Paiva Couceiro, where due to the intersection, the available service gets relevantly worse and is transformed into level C.

Besides the conditions in Rua Morais Soares, the level of service in the main intersections is F, since the green traffic lights benefit the traffic flow in Morais Soares, instead of the perpendicular streets.

Regarding Praça Paiva Couceiro, the level of service is reasonable, except in the southern street (Avenida General Roçadas) where is level E.

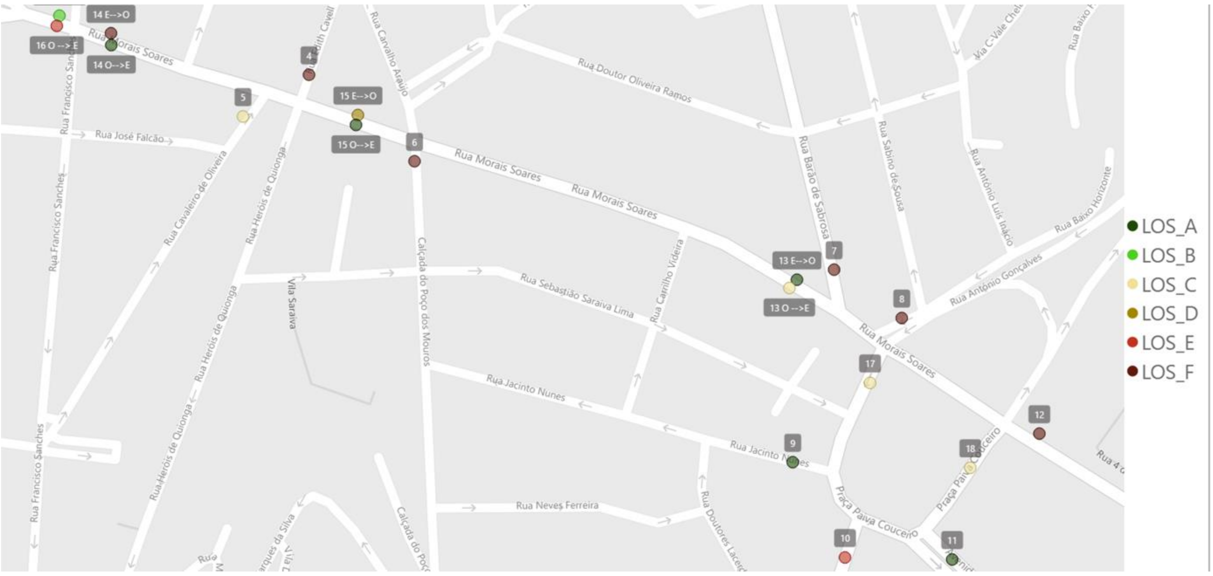


Figure 263. Vehicles' level of service, Scenario 0, AM Peak

Figure 264 shows some characteristics regarding pedestrian movement resulted from Vissim simulation measured on the sections mentioned from the Figure 100 and Figure 104, as the number of pedestrian per hour, average speed and maximum density.

Besides the quantitative evaluation, was also identified the level of service in each kerbside, which allow to identify that almost all the street has a Level E service, due to the high pedestrian flow, but with narrow sidewalks (sometimes with lot of obstacles) especially where parking spaces and bus stops are located.

In Praça Paiva Couceiro is totally different, since the existing sidewalks are very large. However, despite the square is very demanded for leisure purposes, the discontinuity created by the large roads on both sides reduces the quality of this public space.

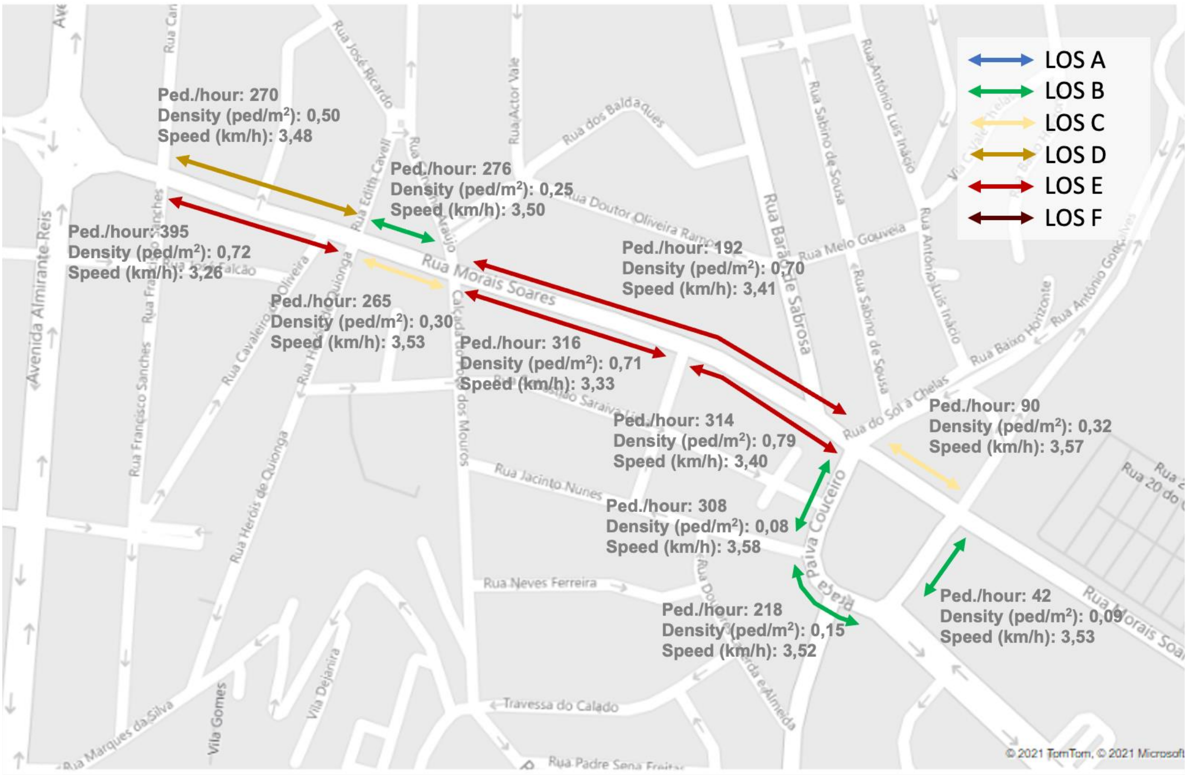


Figure 264. Pedestrian's characteristics and level of service, AM Peak, Scenario 0

Scenario 1

During AM Peak, this solution will create high congestion problems from east to west, which demonstrates that the reduction of capacity in that direction doesn't answer to current demand needs. Obviously, the parking entrance and exit contributes for the increase of number of stops and, consequently, delay time, but a characteristic that leads to a constrained traffic flow is the existence of bus stops along the road, which suggests an incompatibility between bus and the other transport modes regarding sharing a unique traffic lane.

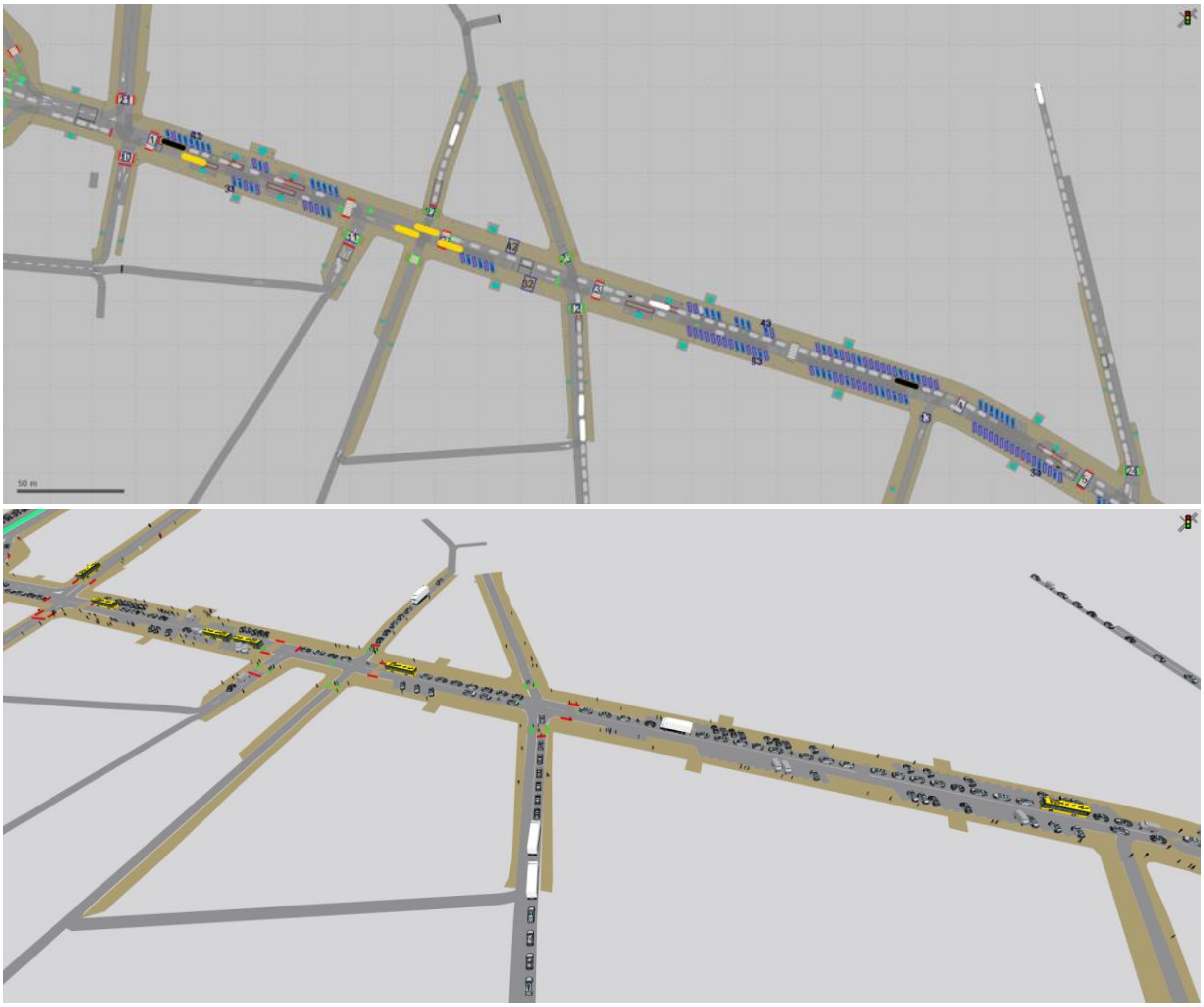


Figure 265. Simulation, Rua Morais Soares, Scenario 1, AM Peak

In the opposite direction, traffic movements are very similar, without being noted any significant impacts on the number of movements and even of delays or number of stops, which suggest that one lane, in this way, may be enough to answer to current demand. The only location with slight congestion is in the intersection with Praça Paiva Couceiro, due to traffic coming from Rua Barão de Sabrosa.

Figure 266. Simulation, Rua Morais Soares, near Praça Paiva Couceiro, Scenario 1, AM Peak

Comparing with scenario 0, occurs a very high reduction of the number of movements in the east to west direction, due to the capacity reduction, but in the inverse direction, the number of movements is very similar, without being noticed any significant delays, except near Praça Paiva Couceiro, where the number of stops and the delay time is expected to increase until the double of scenario 0.

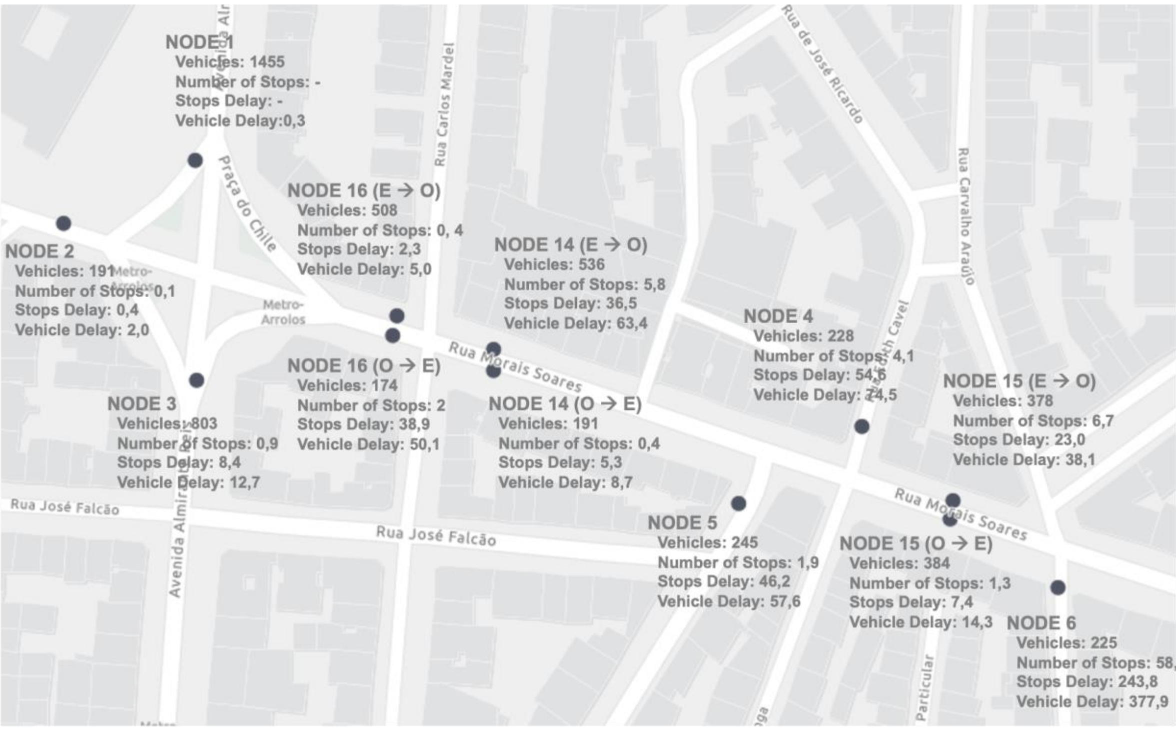
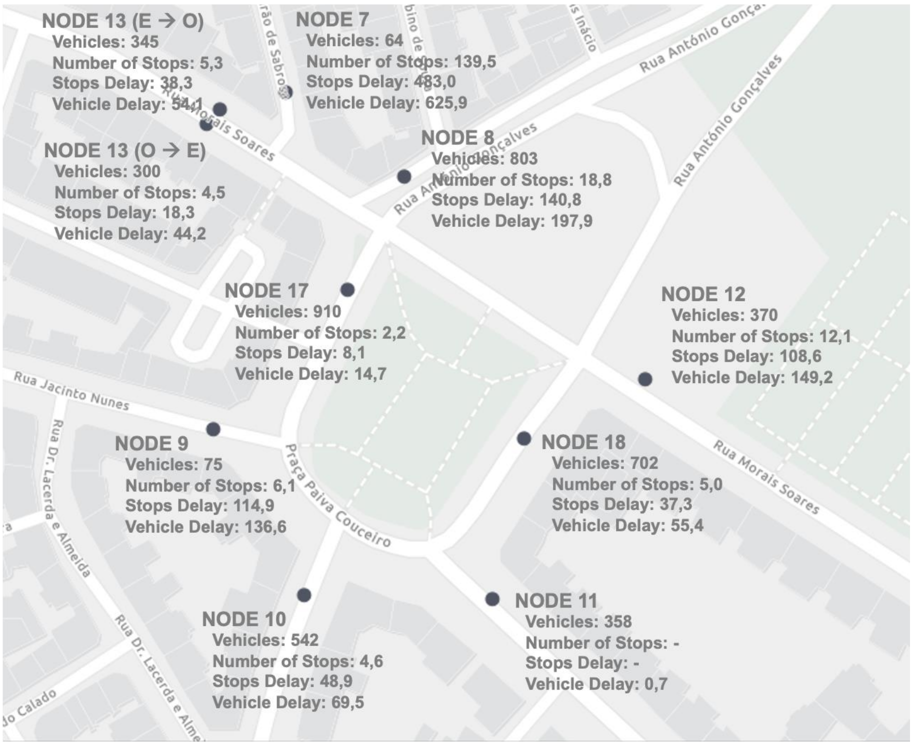


Figure 267. Nodes' results, Scenario 1, AM Peak, Section 1



 Version: 3

Figure 268. Nodes' results, Scenario 1, AM Peak, Section 2

Regarding queue length, there is a high increase in the QC9, where the average queue length should be around 322 meters, which demonstrates the impact of reducing the number of lanes in this direction. In the opposite direction, the queue lengths are expected to increase very slightly without significant impacts, as well as in the perpendicular streets, where the queue lengths won't have significant changes.

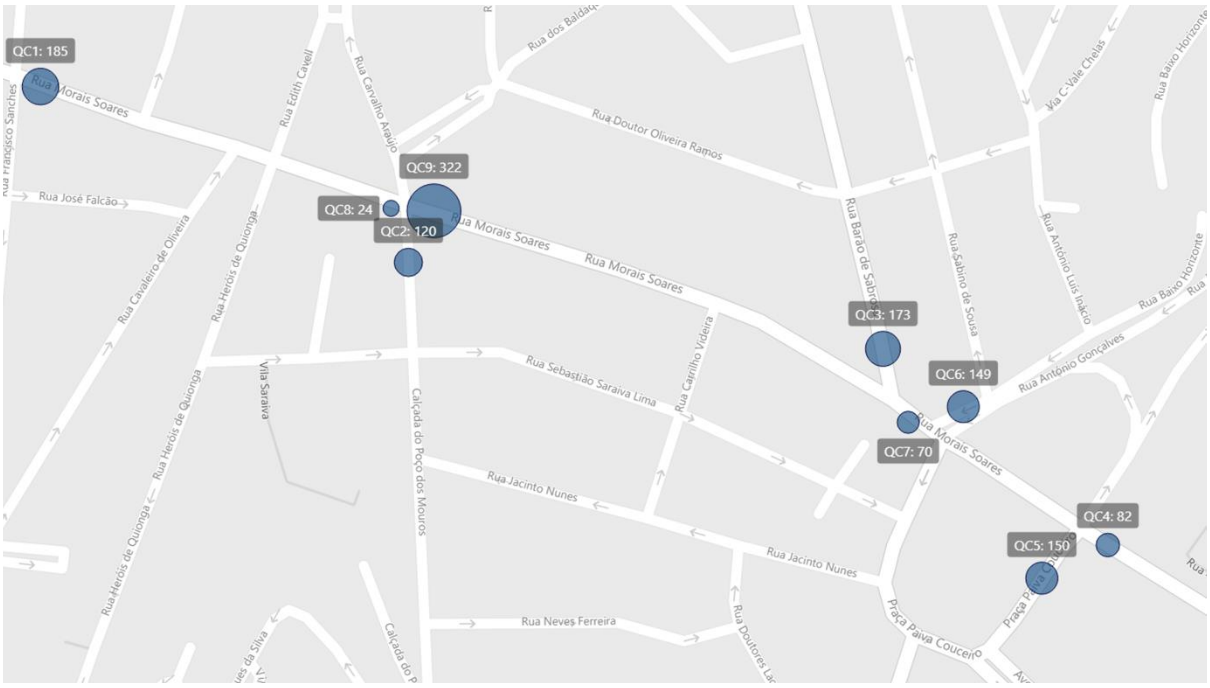


Figure 269. Average queue length (m), Scenario 1, AM Peak

Considering the vehicles' level of service, there was a substantial reduction of the quality of service, especially in the east to west direction, where the level of services varies between level E and F. In the inverse way, only near the intersection with Praça Paiva Couceiro, the level of service transforms from level B to F, leading into consideration if near this intersection shouldn't stay two lanes, instead of one.

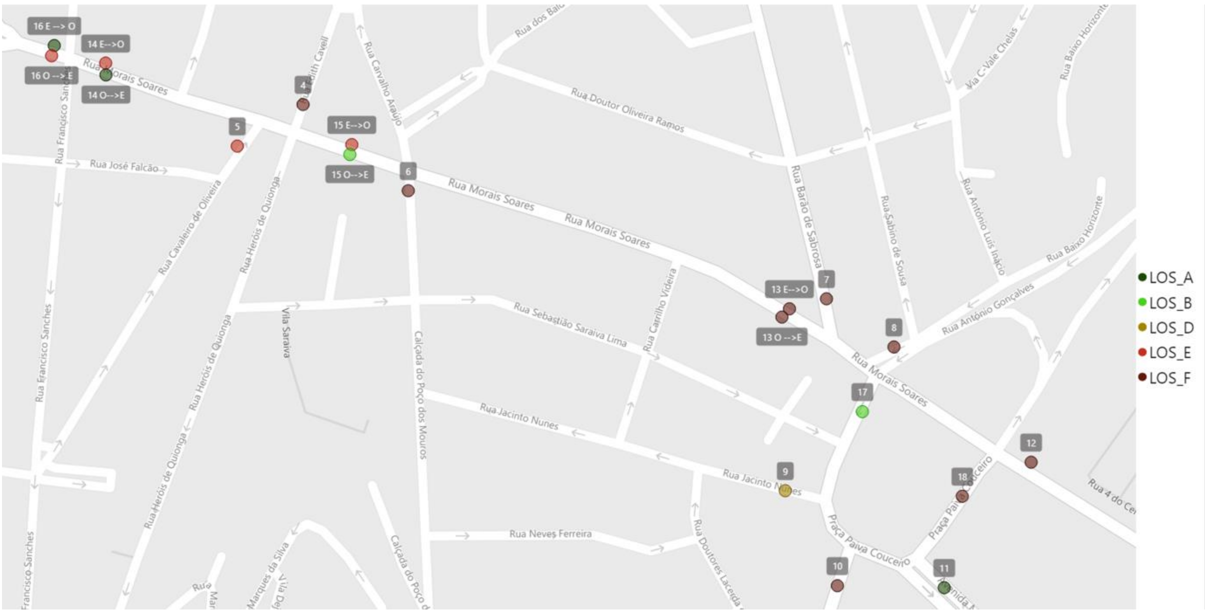


Figure 270. Vehicles' level of service, Scenario 1, AM Peak

Considering the sidewalks' enlargement foreseen for this scenario, it is expected to have a reduction in the pedestrian density and consequently, a better level of service provided. In fact, a tendency to increase one level in most of the sections was noted, however, several of them are still considered level E.

In Praça Paiva Couceiro, as in Scenario 0, the existing sidewalks are very large, so all the sidewalks have a level B service.

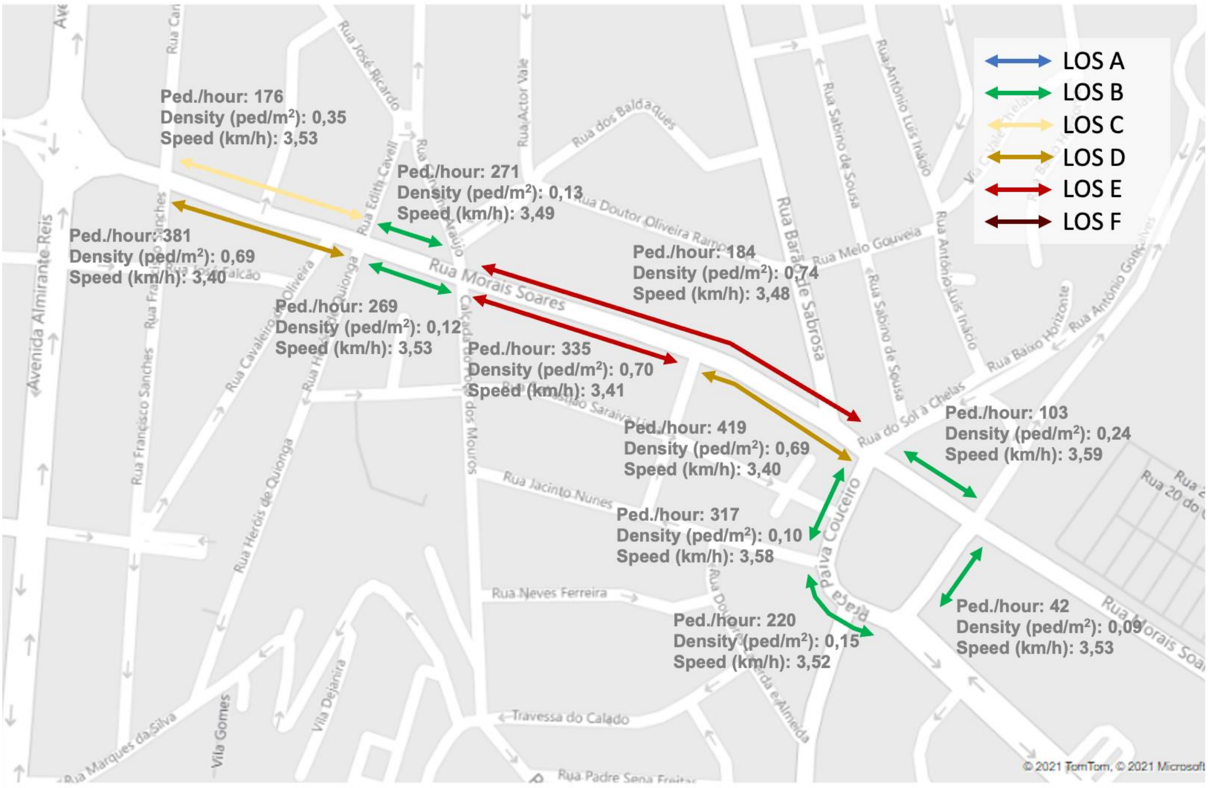


Figure 271. Pedestrian's characteristics and level of service, Scenario 1, AM Peak

Scenario 2

According with the software's output, traffic flows without significant restraints along the street, not being verified long congestion lines, and with a behaviour very similar in both direction to current situation. Of course, the bus circulation improves, considering that there aren't double parking occurrences.

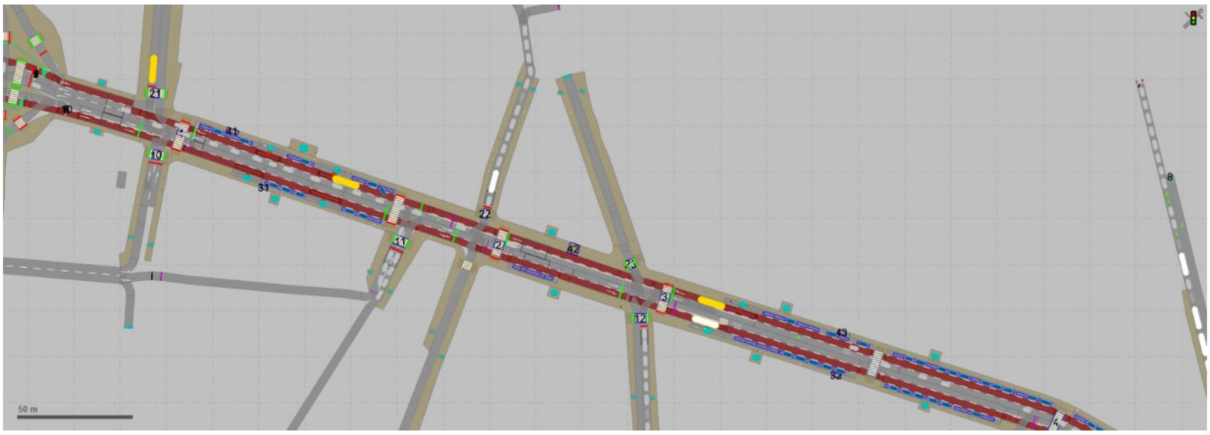


Figure 272. Simulation, Rua Morais Soares, Scenario 2, AM Peak

From west to east there is very slight improvements in traffic movements for all transport modes, although current conditions are already very reasonable without significant delays and number of stops. Despite that, is possible to verify that double parking is harmful for the traffic movement than the implementation of a bus lane.

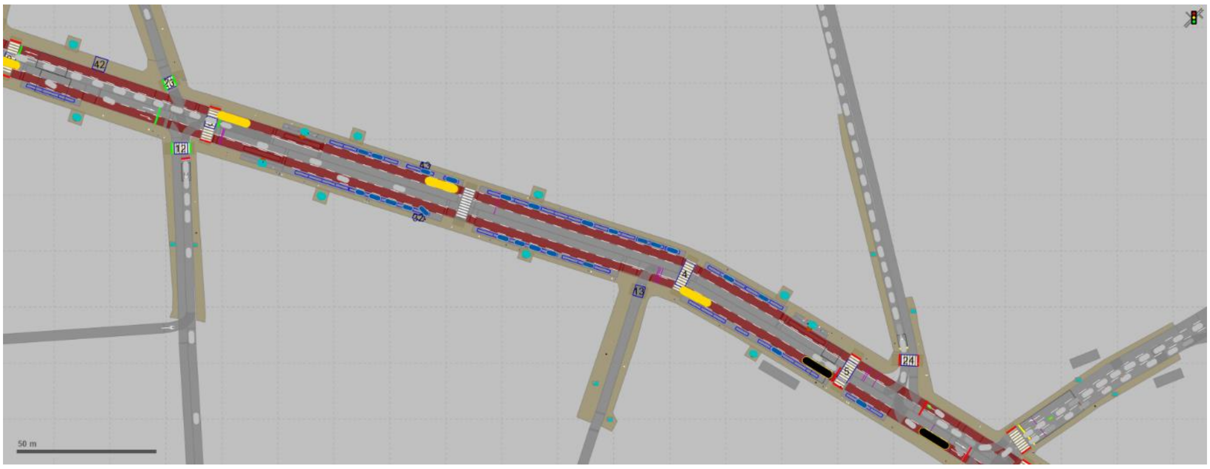


Figure 273. Simulation, Rua Morais Soares, near Praça Paiva Couceiro, Scenario 2, AM Peak

Comparing the nodes' results with current scenario, for this time period, generally there are small changes in terms of movements, number of stops and delays in both directions, which shows the implementation of a bus lane could be implemented without harm the other transport modes, benefiting public transport. However, is assumed that there isn't double parking in this scenario.

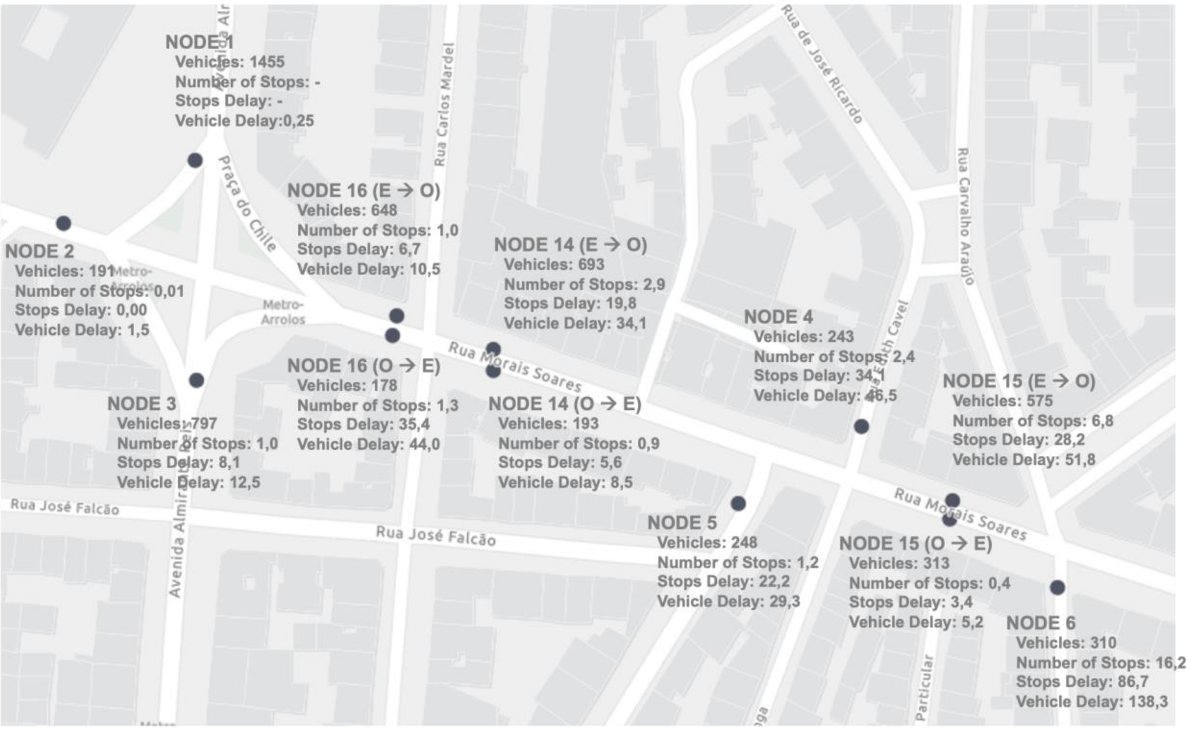


Figure 274. Nodes' results, Scenario 2, AM Peak, Section 1

As well as in Rua Morais Soares, also in Praça Paiva Couceiro there is not significant changes in the movements around the square after the implementation of this scenario.

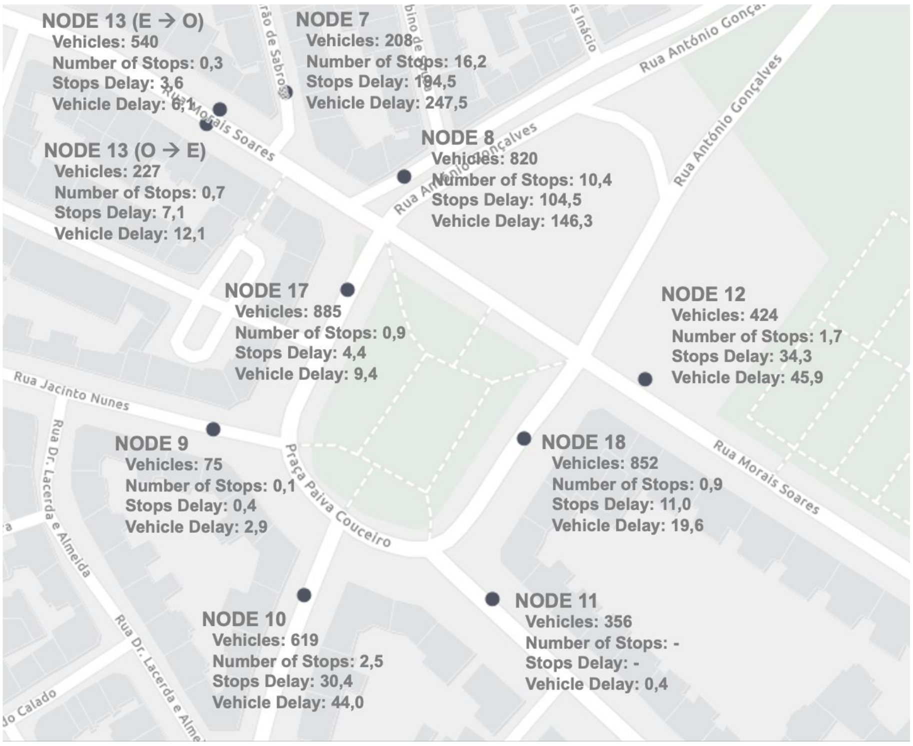


Figure 275. Nodes' results, Scenario 2, AM Peak, Section 2

Considering queue lengths, the highest congestion situations remain in the west section in the intersection with Avenida Almirante Reis and in the perpendicular streets. Queue length near Almirante Reis, in this scenario is slightly worse than the current situation.

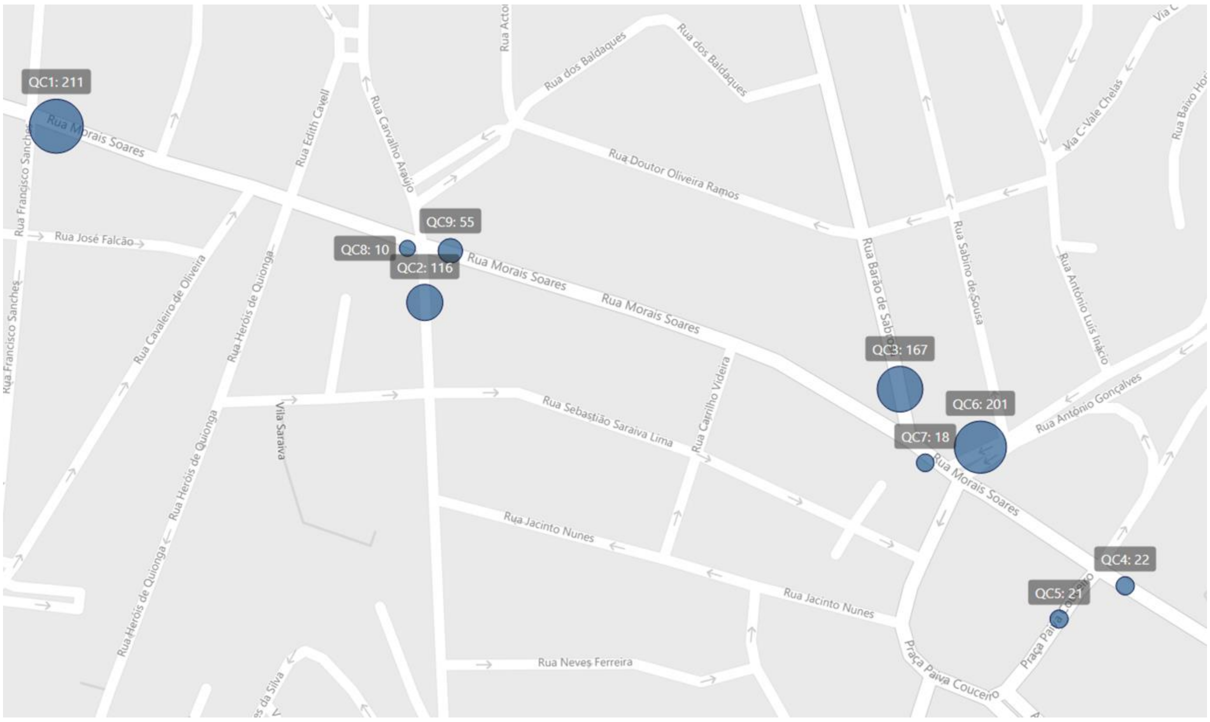


Figure 276. Average queue length (m), Scenario 2, AM Peak

Considering the vehicles' level of service, in general, the conditions are similar to the current situation but, there are punctual changes near the most important intersections, where this scenario shows better results.

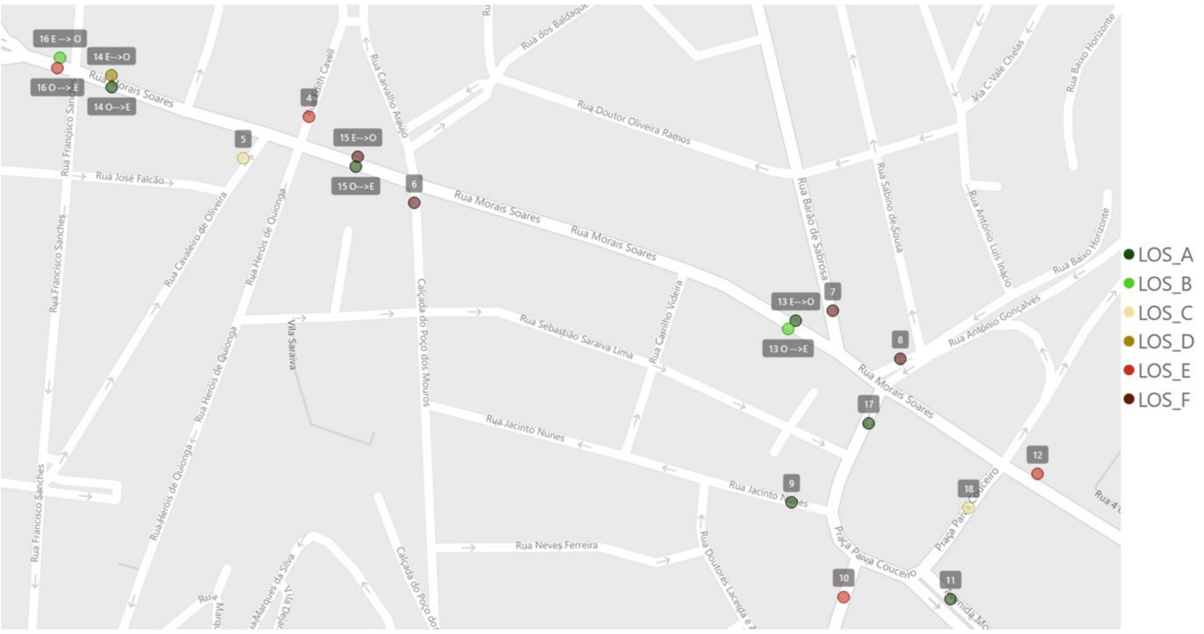


Figure 277. Vehicles' level of service, Scenario 2, AM Peak

Regarding the pedestrians' level of service, is very identical to scenario 0, since the assignment of general lanes into bus lanes, doesn't allow to change the sidewalks' width. As so, in this scenario, the infrastructure quality of service, in most of the sections, is level E, which denotes an insufficient space available for pedestrian circulation.

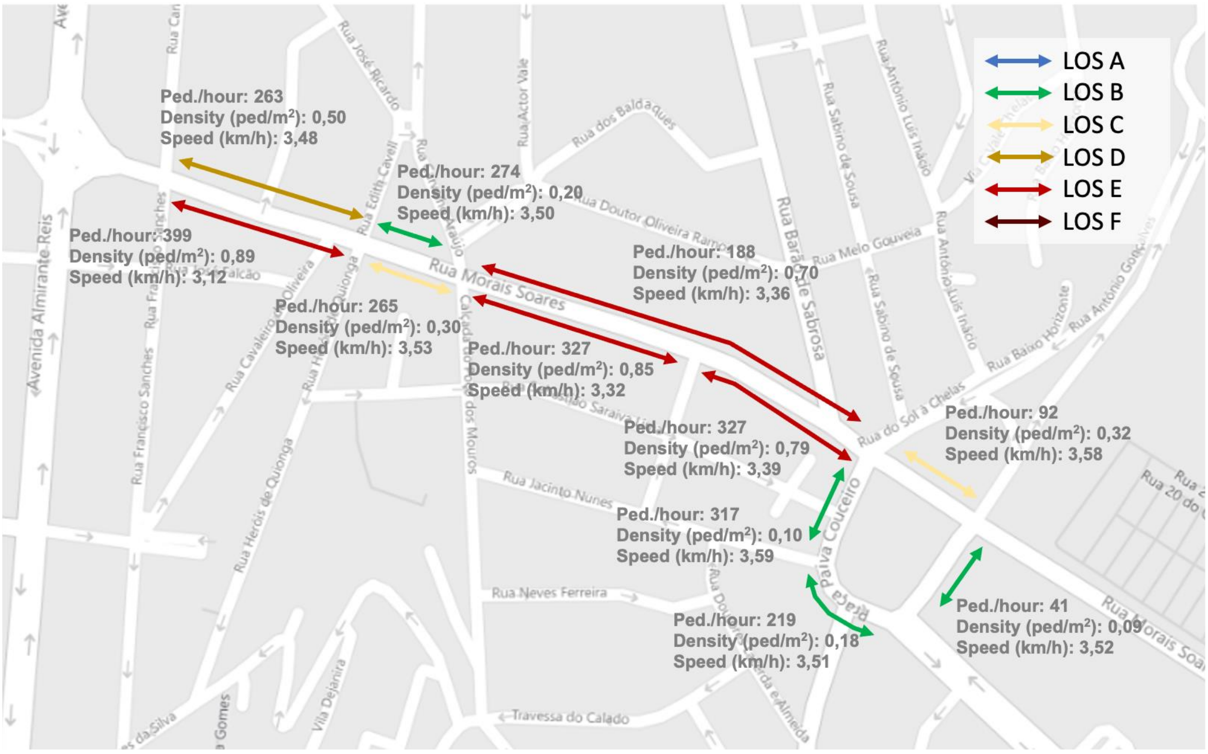


Figure 278. Pedestrian's characteristics and level of service, Scenario 2, AM Peak

Scenario 3

Considering the traffic movements at the AM Peak period, this scenario has very long queue lines from east to west direction, with substantial problems of having general traffic, bus and parking sharing the same space, creating a significant capacity problem. In fact, cycle lanes, considering current cycle demand, improving cycle conditions doesn't seem to be a priority in the street, despite the positive externalities that they could bring. As in the other scenarios, the congestion problems occur in the east to west direction, since in the opposite way, with less traffic, there aren't any relevant problems on traffic flow, which supports the analysis that one lane could be enough to correspond the demand, at least during AM Peak period.

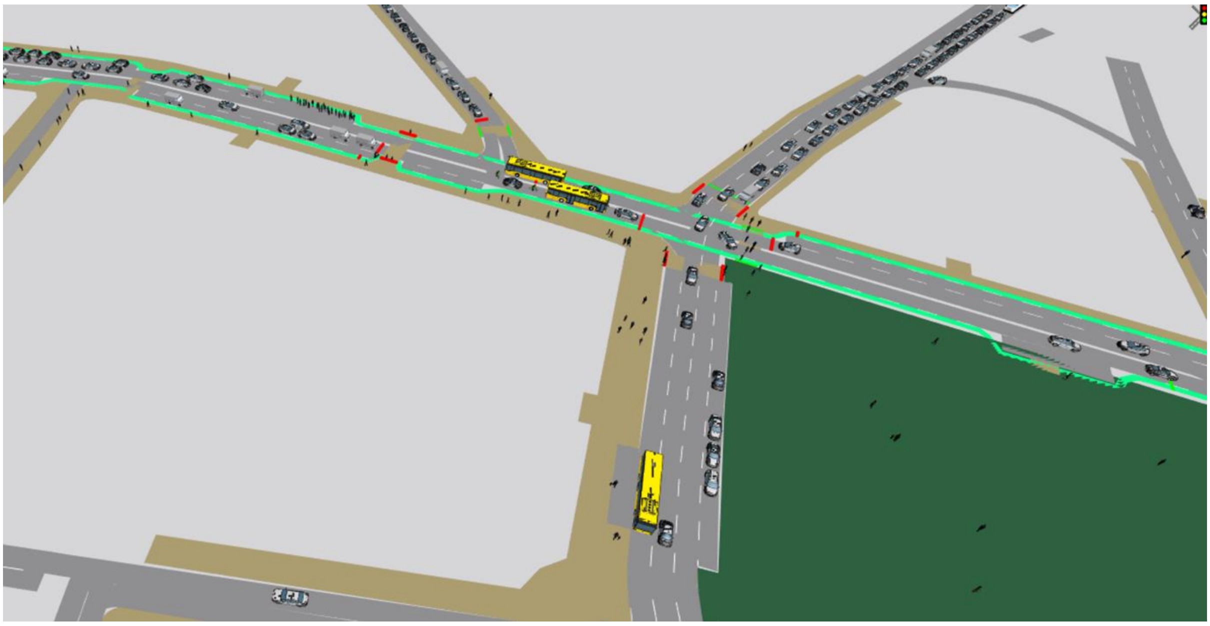


Figure 279. Simulation, Rua Morais Soares and Praça Paiva Couceiro, Scenario 2, AM Peak

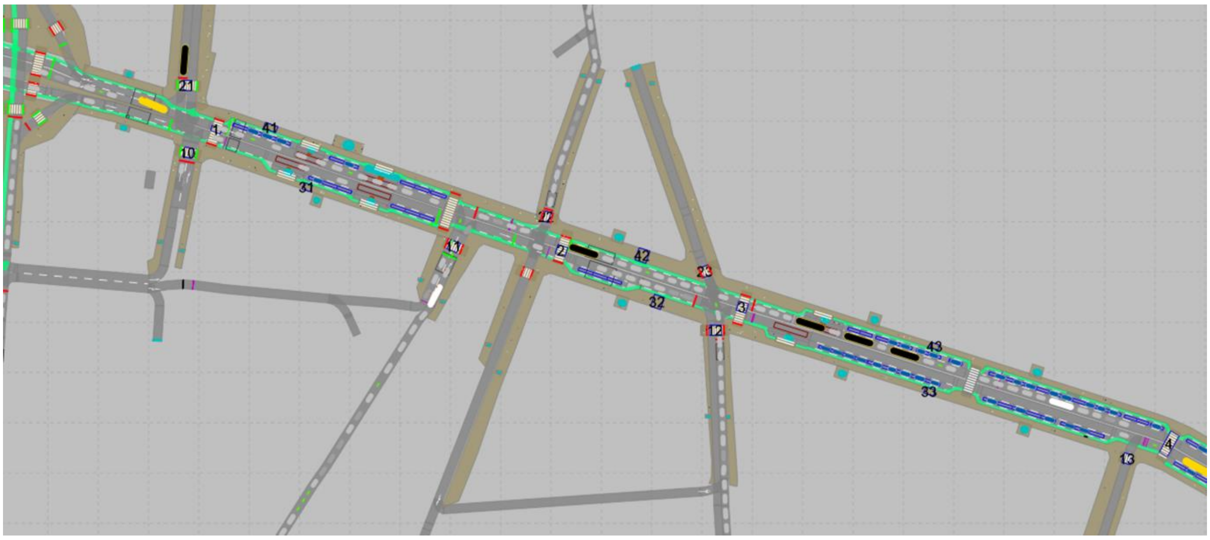


Figure 280. Simulation, Rua Morais Soares, Scenario 2, AM Peak

Analysis the nodes' data, the traffic conditions are clearly worse in the scenario than in the current situation, since besides average delay time that increase substantially, the number of vehicles is clearly less than in the current situation, not corresponding to the demand needs, which translates into longer queue lines. From west to east, there aren't significant differences with current scenario maintaining a fluid traffic flow.

One big negative aspect in this scenario is the negative impacts in the perpendicular streets that suffer a big reduction on the number of vehicles draining into the main street which denotes that this scenario has clearly much worse conditions in the intersections.

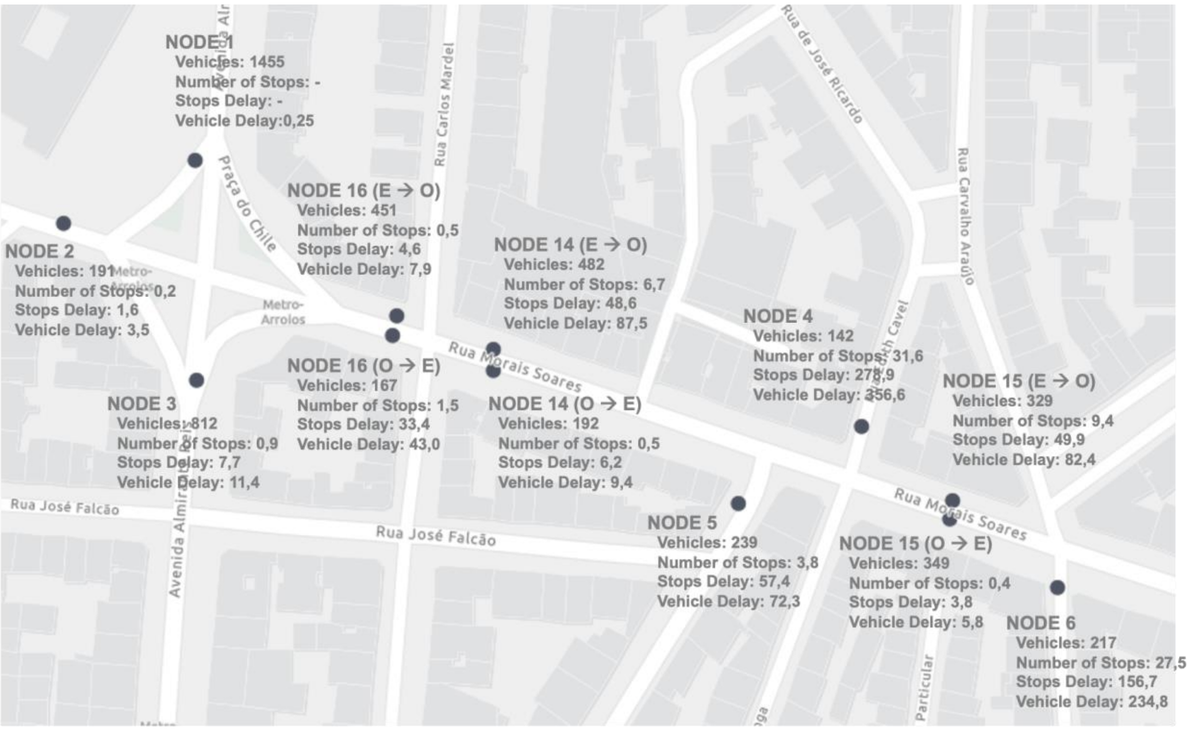


Figure 281. Nodes' results, Scenario 3, AM Peak, Section 1

In Praça Paiva Couceiro, the reduction of one lane in each way has clearly a negative impact, since it causes longer delay times and an increase of the number of stops, also influencing the number of vehicles in Node 10, that suffer a high reduction.

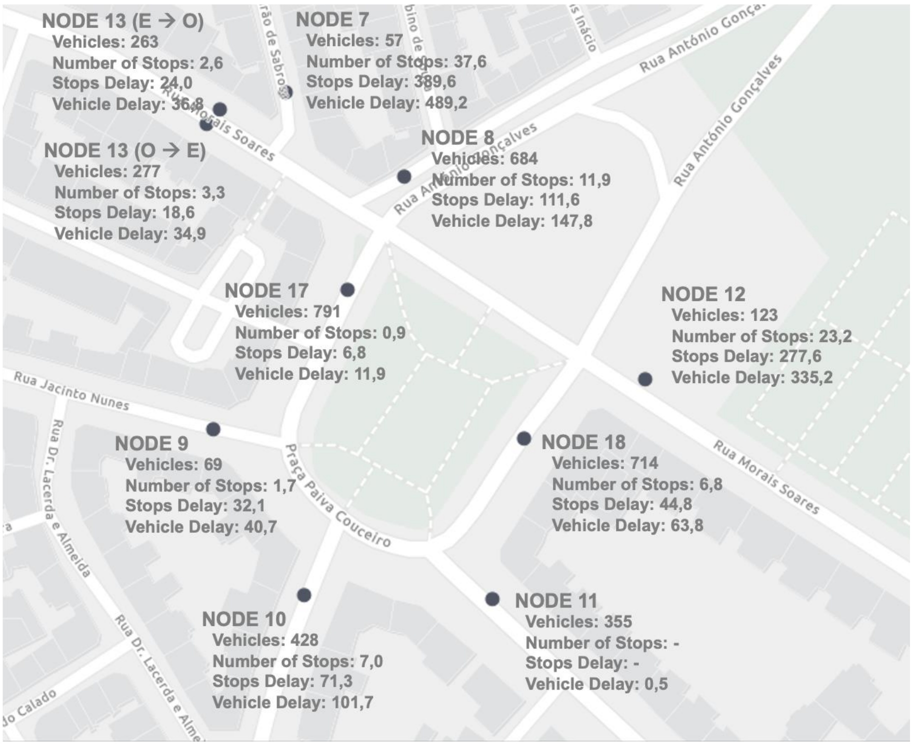


Figure 282. Nodes' results, Scenario 3, AM Peak, Section 2

Supporting the above-referred considerations, in Figure 283 the average queue length in some intersections is shown, being possible to observe that most of the congestions occur in the east to west way, having much longer queue lines that in the current situation, especially in the QC1, near the intersection with Av. Almirante Reis, where the queue line has an average length of 500 meters. In the opposite way, despite a slight increase in the queue length, that value is not that relevant for good circulation conditions.

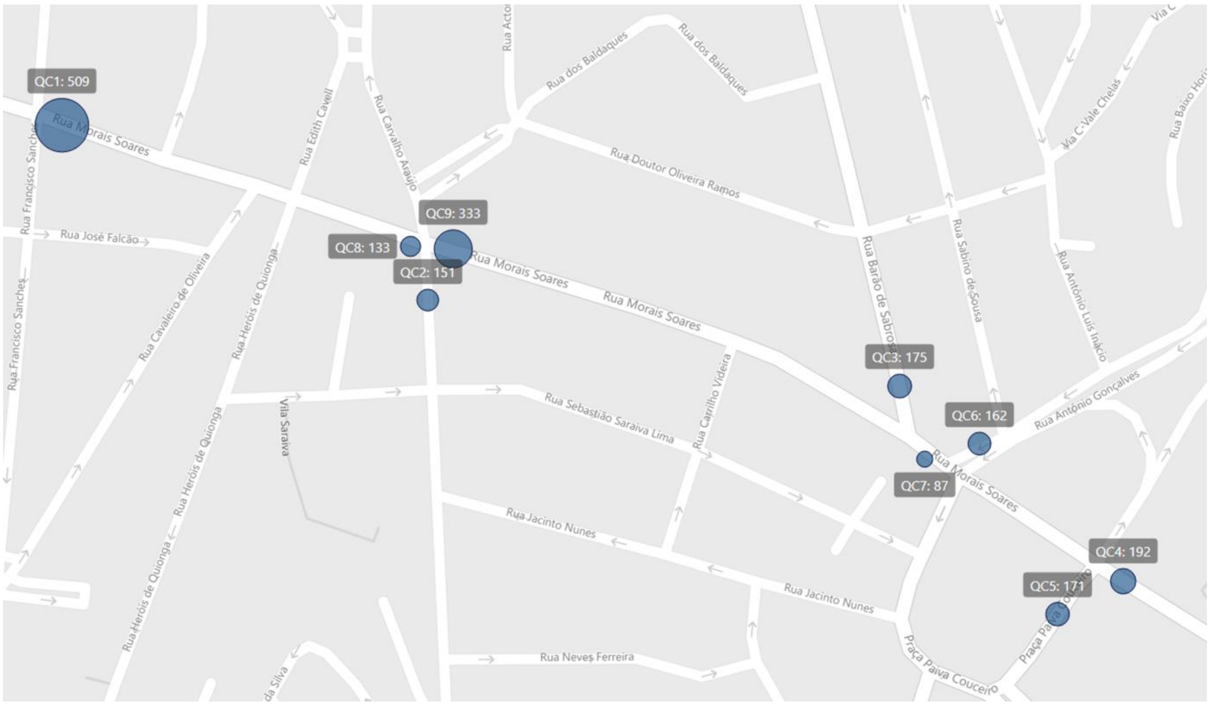


Figure 283. Average queue length (m), Scenario 3, AM Peak

As expected, taking into account the considerations in the previous points, the level of service in the east to west direction is of very poor quality, being level F as far as the vehicles are closer of the intersection with Av. Almirante Reis. In the opposite way, the flow conditions are very good, becoming slightly worse near Praça Paiva Couceiro (level C).

In Praça Paiva Couceiro the conditions are also worse that current conditions, since node 18, for instance, transforms from level C to level F, since it is harder to drain traffic into Rua Morais Soares.

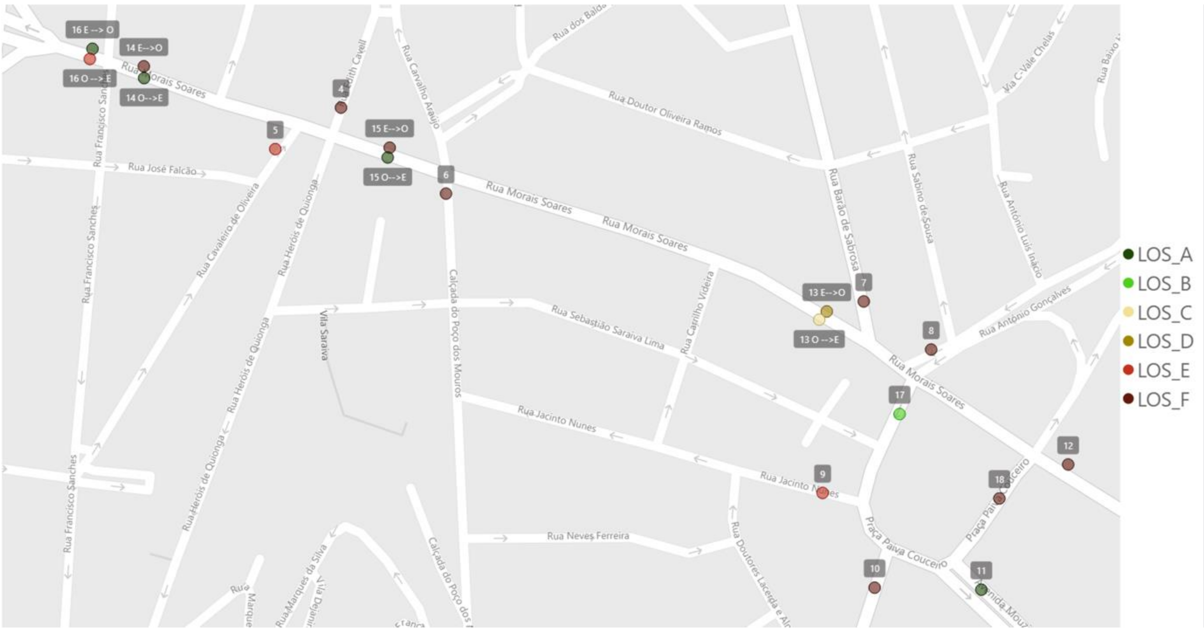


Figure 284. Vehicles' level of service, Scenario 3, AM Peak

Regarding the level of service offered by infrastructure to the pedestrians, there is a substantial improvement when compared with current scenario. Even so, most of the section along Rua Morais Soares offers a level D service, which, despite being better, doesn't promote existing street activities, since there isn't available space to create leisure areas that could be installed along the street, like terraces, benches, parklets.

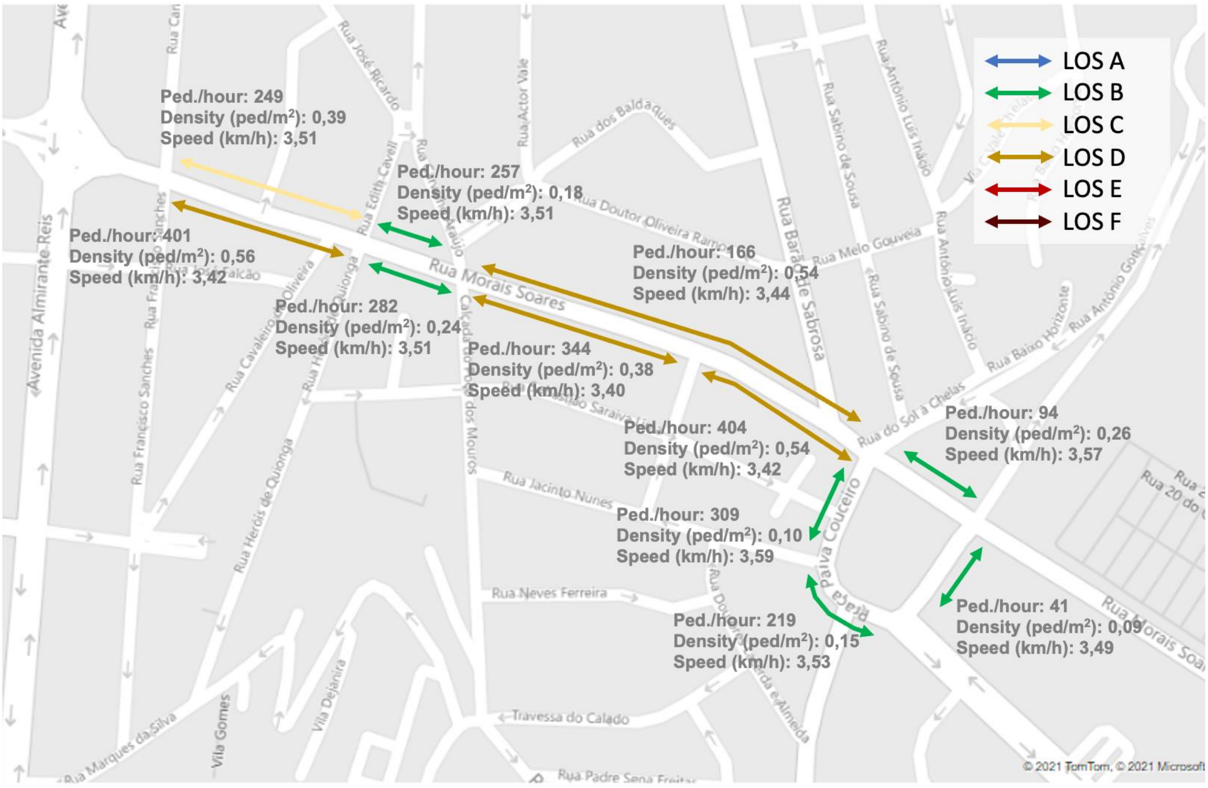


Figure 285. Pedestrian's characteristics and level of service, Scenario 3, AM Peak

Scenario 4

In this scenario, traffic flows in Rua Morais Soares with few delays, comparing with base scenario, having much higher congestion problems in the east to west direction, especially near the intersection with Praça do Chile than in the opposite direction. However, there aren't long queue lines and the bus circulation significantly improves than in the current situation.

From west to east, one lane proves to be enough to maintain a good service quality and a traffic flow without severe constraints.

Considering nodes' results there aren't significant delays in both directions along Rua Morais Soares, however, in the access streets the situation is worse with very significant delays, especially in nodes 4, 6 and 7.

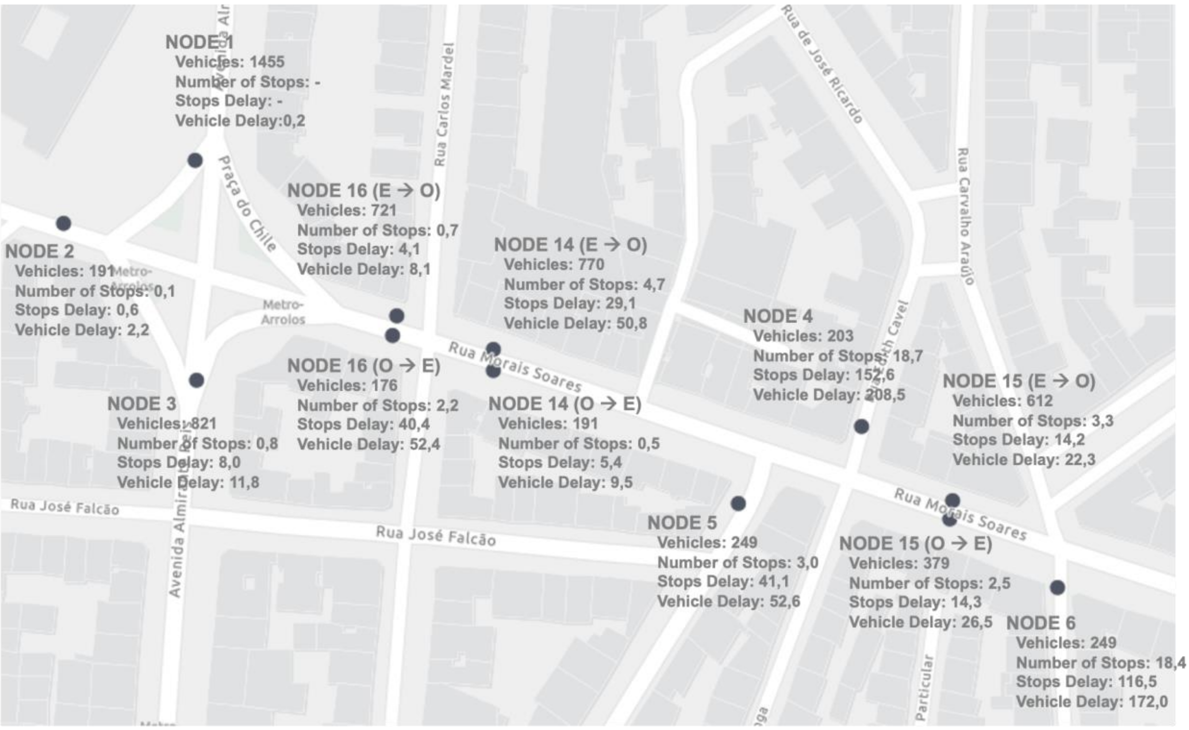


Figure 286. Nodes' results, Scenario 4, AM Peak, Section 1

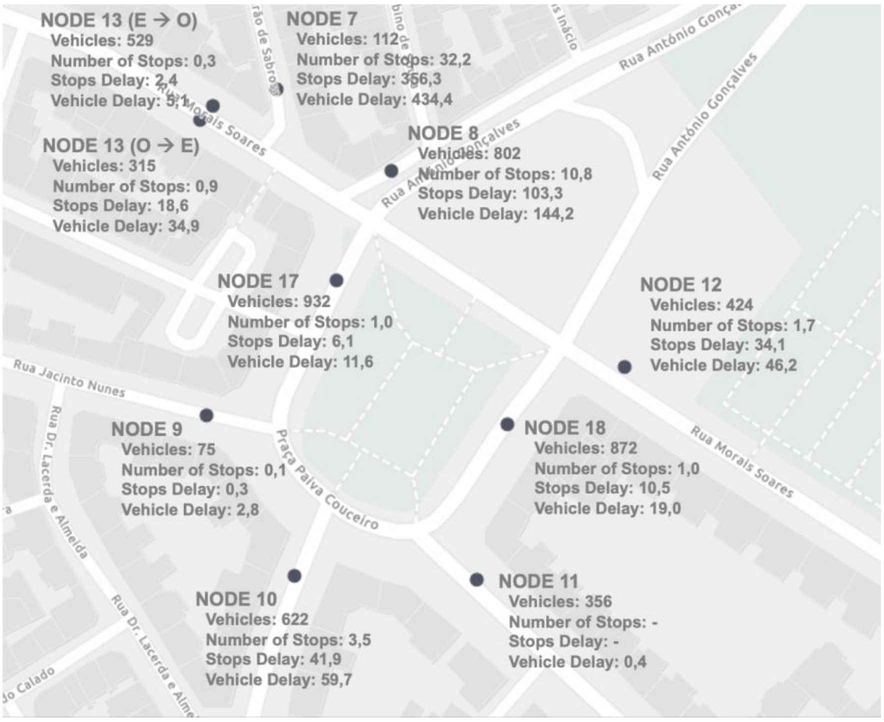


Figure 287. Nodes' results, Scenario 4, AM Peak, Section 2

Regarding queue lines, near Praça do Chile, in the west section, is the worst situation where the queue length reaches 250 meters. In the opposite direction in QC8 the line is 130 meters long but even so, the traffic flows without constraints.

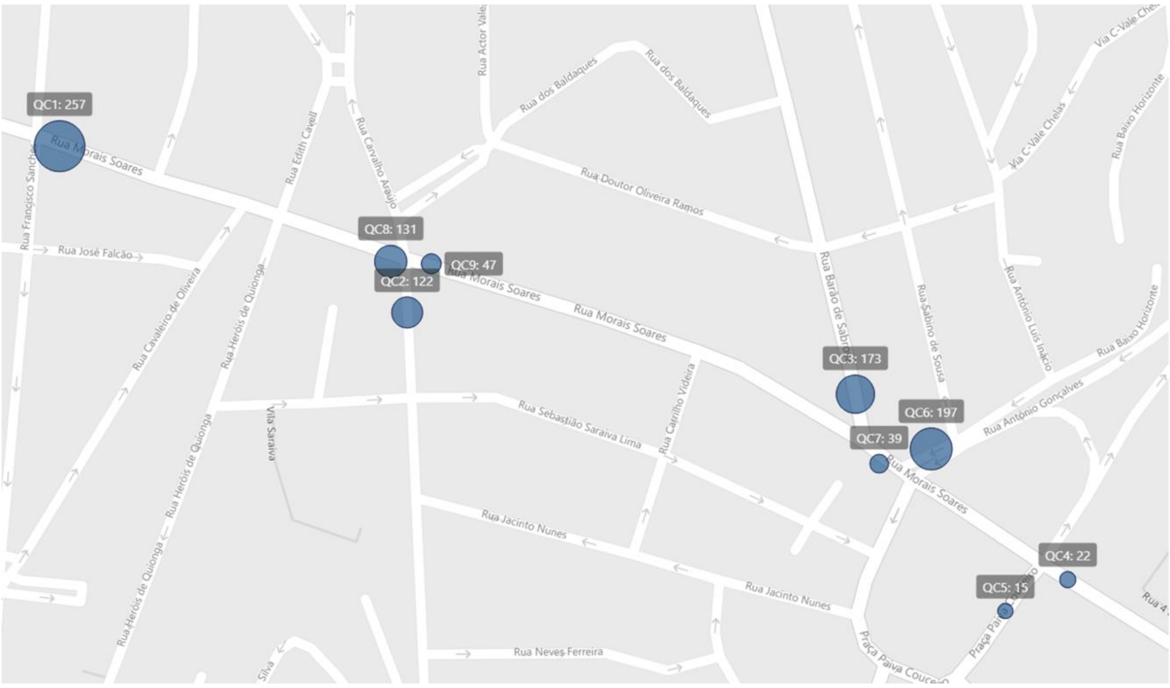


Figure 288. Average queue length (m), Scenario 4, AM Peak

Considering level of service, access streets have poor quality of service, but along the main street, from east to west, level of service tends to get worse, starting in level A to C and finishing at level D. In the inverse way the there is a small section with level D and then it improves and finishes at level C, near Praça Paiva Couceiro.

Besides the conditions in Rua Morais Soares, the level of service in the main intersections is F, since the green traffic lights benefit the traffic flow in Morais Soares, instead of the perpendicular streets.

Regarding Praça Paiva Couceiro, the level of service is reasonable, except in the southern street (Avenida General Roçadas) where it is level F.

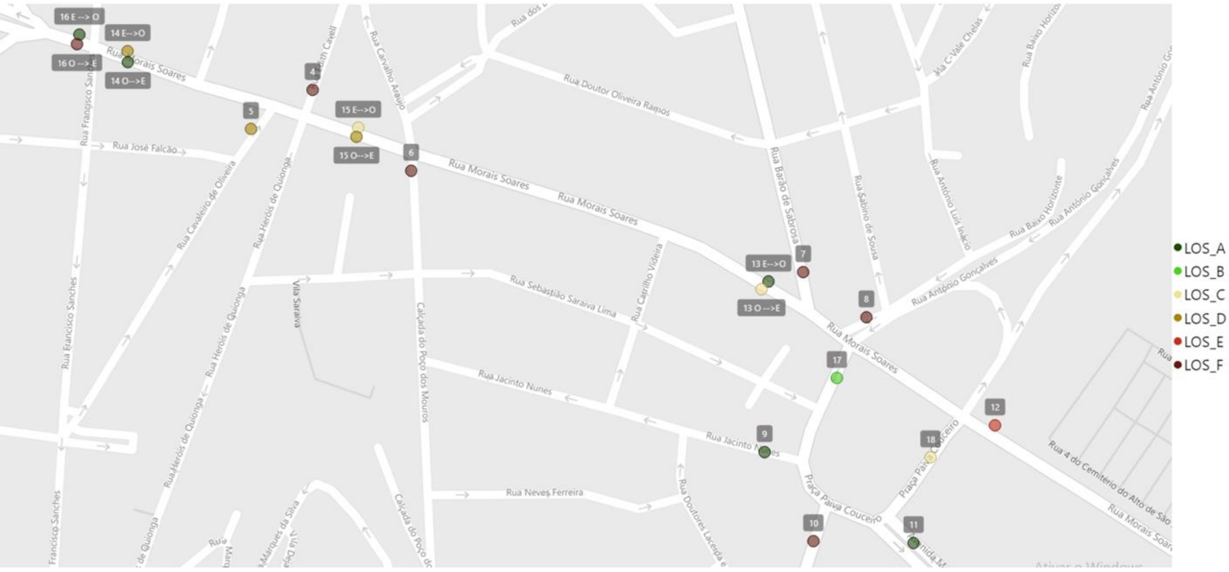


Figure 289. Vehicles' level of service, Scenario 4, AM Peak

For pedestrian movements, Scenario 4 is the one that presents better conditions for pedestrian circulation as well as spaces to promote street activities/urban equipment installation. Most of the Rua Morais Soares is level C or above, except the section near Praça Paiva Couceiro, which, since was opted to maintain the parking spaces there.

However, despite having tried to find a balance between the existing parking spaces and the proposed ones, to increase pedestrian areas a 20% reduction of parking places is needed.

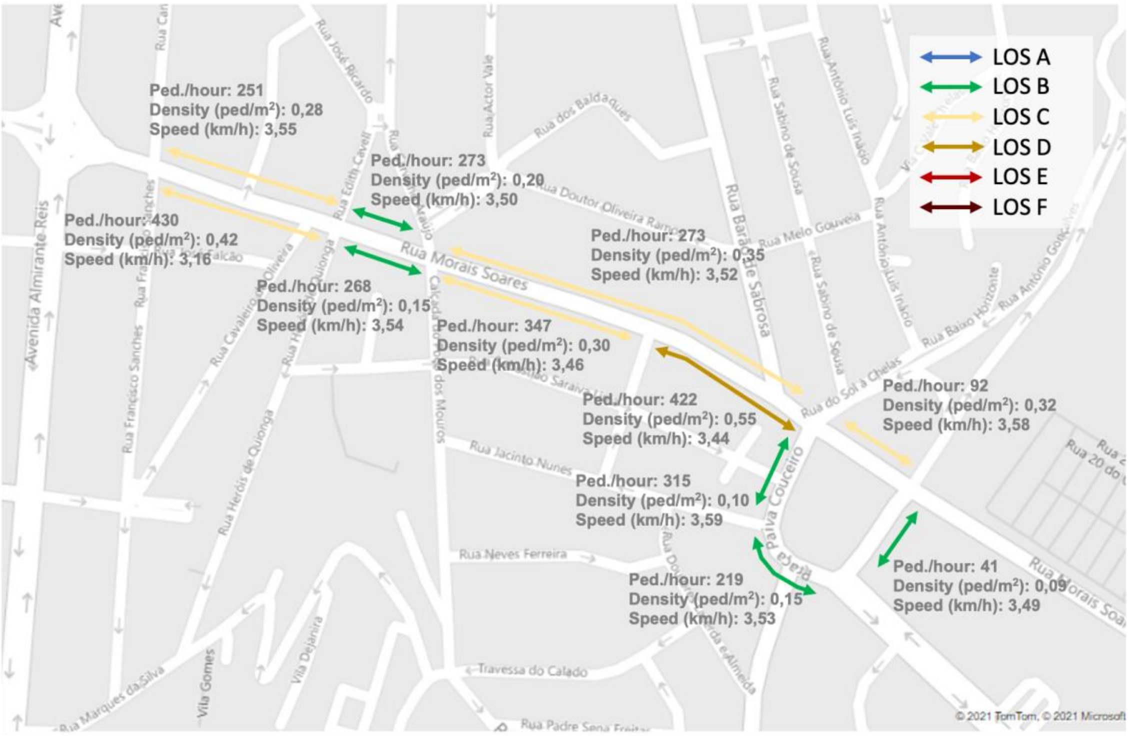


Figure 290. Pedestrian's characteristics and level of service, Scenario 4, AM Peak

Scenario Praça Paiva Couceiro

The following image shows the simulation, in this section, during AM Peak period, which shows some congestion situations in the traffic coming from Rua Morais Soares to turn to the square and also in Av. General Roçadas, at the south of Praça Paiva Couceiro.

Figure 291. Simulation, Praça Paiva Couceiro,AM Peak

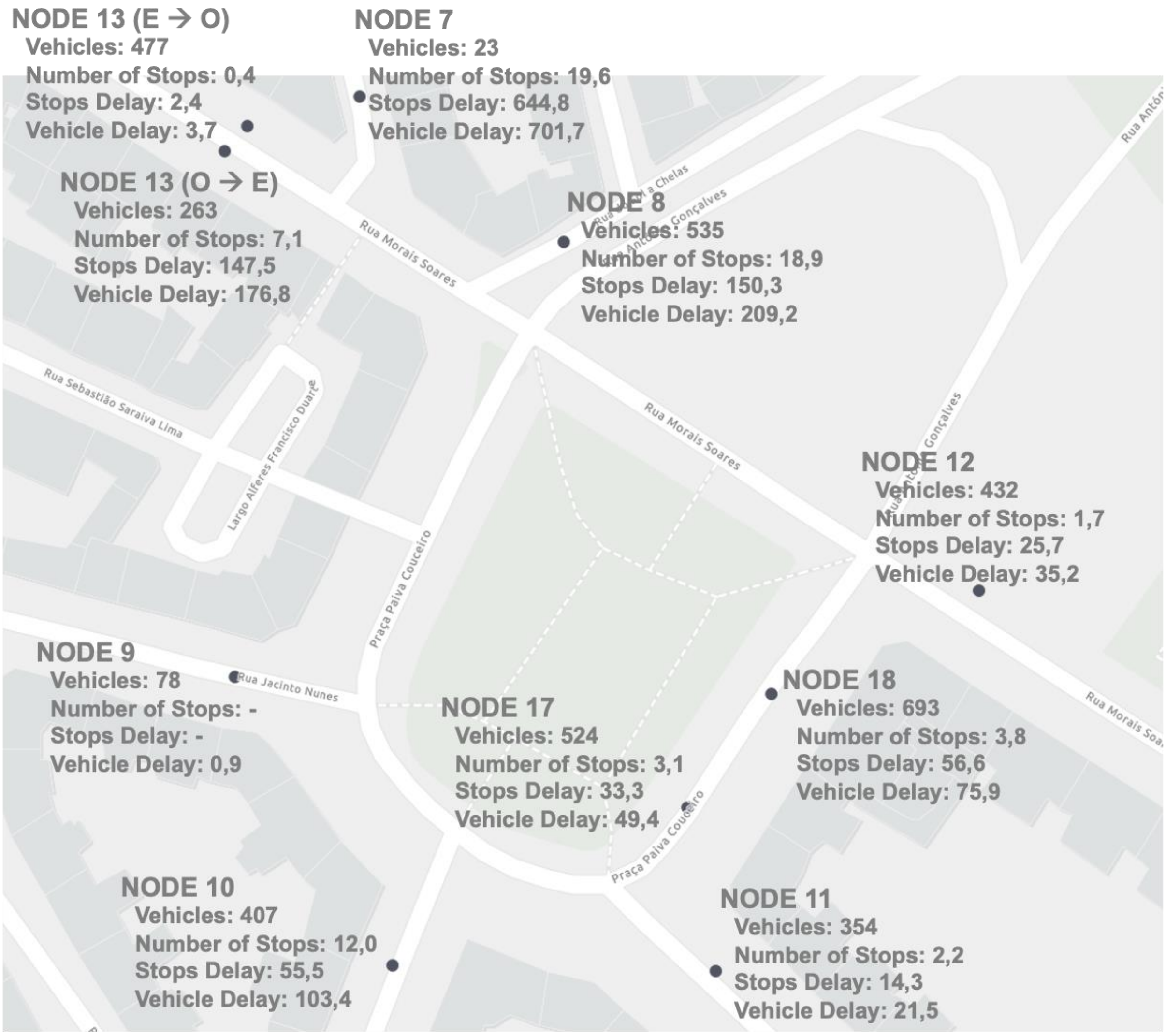


Figure 292. Nodes' results, Scenario Praça Paiva Couceiro, AM Peak

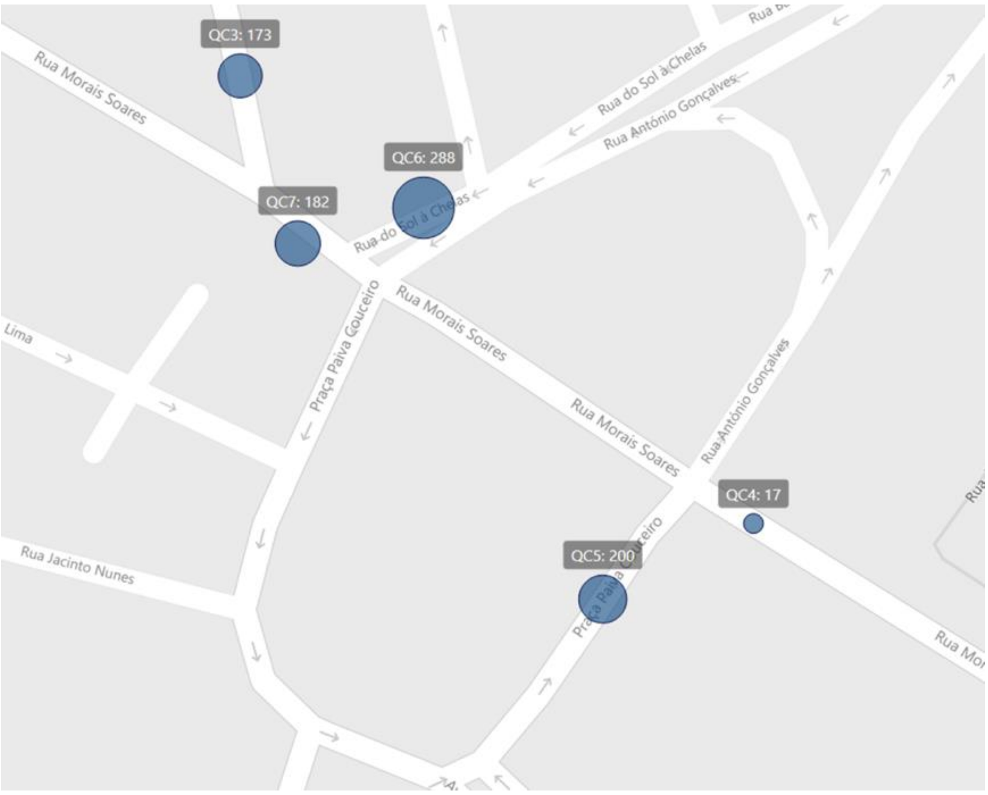


Figure 293. Average queue length (m), Scenario Praça Paiva Couceiro, AM Peak

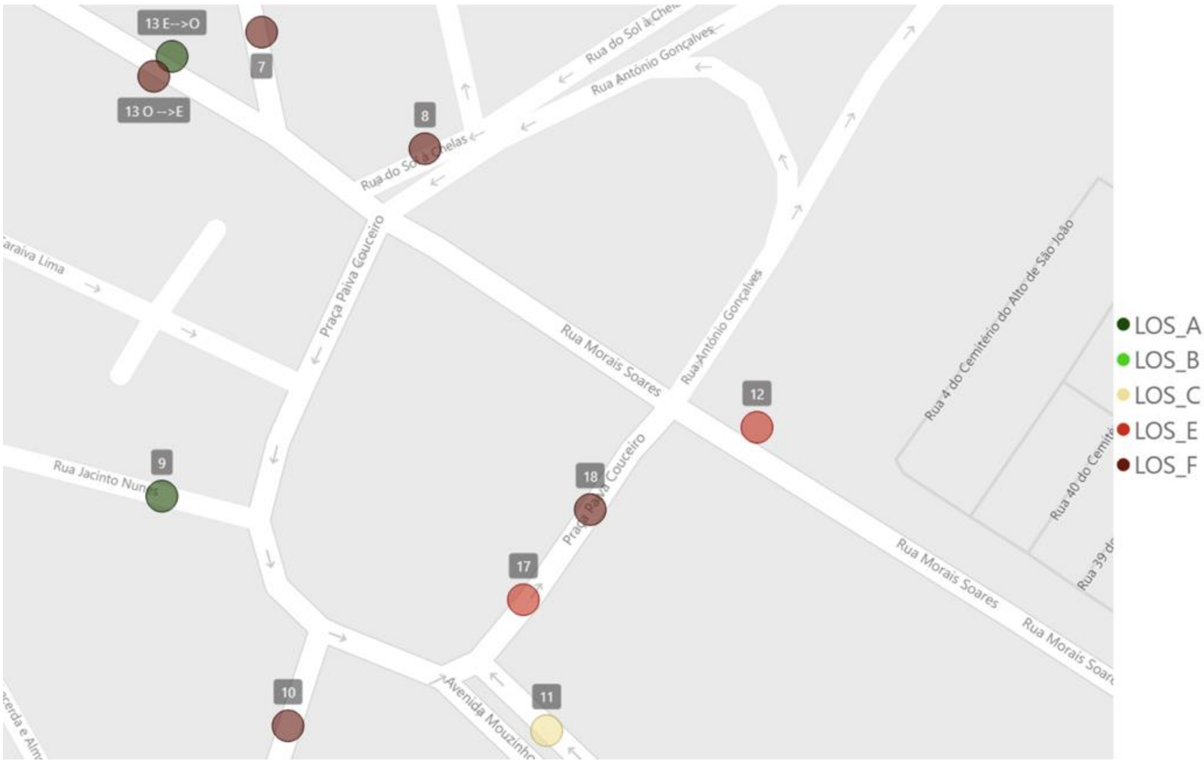


Figure 294. Vehicles' level of service, Scenario Praça Paiva Couceiro, AM Peak

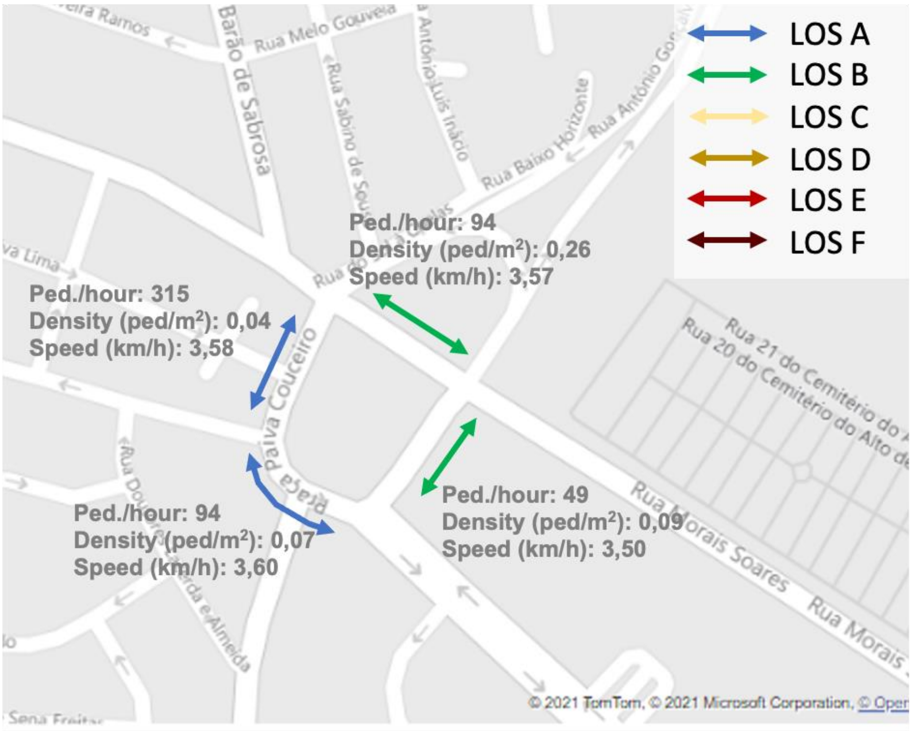


Figure 295. Pedestrian's characteristics and level of service, Scenario Praça Paiva Couceiro, AM Peak

Figure 296. Difference of the number of vehicles and delay time between current scenario and suggested scenario for Praça Paiva Couceiro, AM Peak

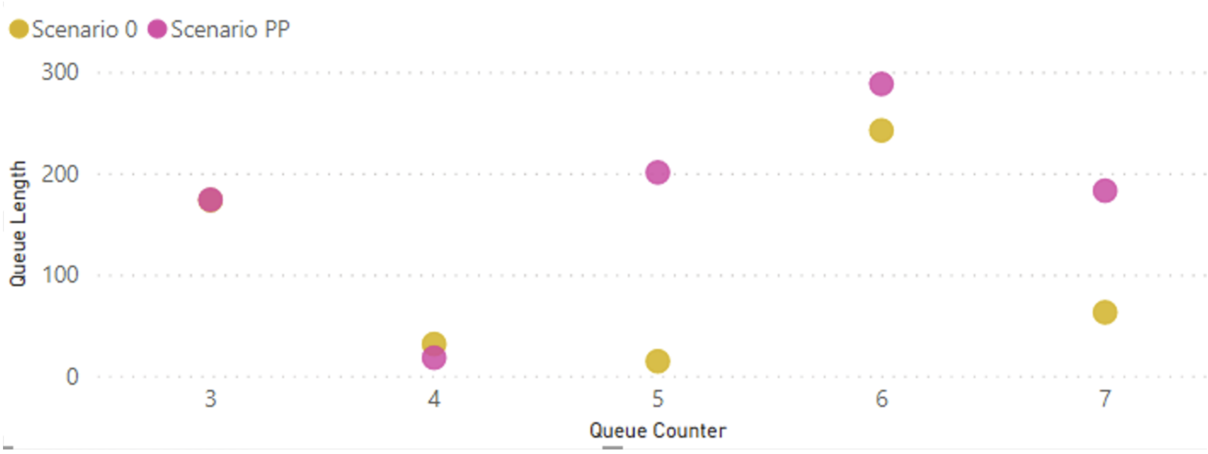


Figure 297. Compare of queue lengths between current scenario and suggested scenario for Praça Paiva Couceiro, AM Peak

Figure 298. Air emissions, AM Peak

Appraisal Tool – Multi-Criteria Analysis Inputs

Table 62. Level of importance for multi-criteria analysis, link function

Performanceindicators	*Insert name of each assessor in row 19 and then choose level of importance of each indicator from the dropdown menus*		
	Assessor 1	Assessor 2	Assessor 3
Implementation cost	3	3	3
Maintenance cost per year	2	2	2
Link function			
Pedestrians			
Space	3	3	3
Volume	2	3	2
Speed	2	1	1
Travel time	2	1	1
Delays		1	2
Reliability			
Trip quality	2	3	3
Cyclists			
Space	2	1	2
Volume	1	2	1
Speed	1		1
Travel time	1		1
Delays	1		2
Reliability			
Trip quality			1
Micromobility			
Space	1		1
Volume	1		1
Speed	1		1
Travel time	1		1
Delays	1		1
Reliability			
Trip quality			1
Buses			
Space	3	1	3
Volume	3	3	3
Speed	2	2	3
Travel time		3	
Delays	3	3	3
Reliability			
Trip quality			
Cars/taxis			
Space	2	1	2
Volume	1	2	1
Speed	1	1	1
Travel time	1	2	1
Delays	1	2	2
Reliability			
Trip quality	1		1
Motorcyclists			
Space	2	1	2
Volume	1	2	1
Speed	1	1	1
Travel time	1	2	1
Delays	1	1	2
Reliability			
Trip quality	1		1
Goods vehicles			
Space	3	2	3
Volume	2	1	2
Speed	1	1	2
Travel time	1	1	1
Delays	1	1	2
Reliability			
Trip quality			1

Table 63. Level of importance for multi-criteria analysis, place function

Place function			
Cycle parking			
Space	2	2	1
Number of activities	1	2	1
Duration			
Quality			1
Cycle parking (dock)			
Space	1		1
Number of activities			1
Duration			
Quality			1
Cycle parking (dockless)			
Space	2		1
Number of activities			1
Duration			
Quality			1
Car parking			
Space	3	1	1
Number of activities	2	1	1
Duration	1		2
Quality	2		1
Car/taxi stopping			
Space	2	2	2
Number of activities	1		1
Duration	1		1
Quality	1		1
Car share			
Space	1	1	
Number of activities	1	1	
Duration	1	1	
Quality	1	1	
Bus stopping			
Space	3	2	3
Number of activities	2	3	2
Duration	2		2
Quality	1		2
Loading (goods vehicle)			
Space	3	2	2
Number of activities	1	1	2
Duration			1
Quality			1
All people-based activities			
Space	2	3	2
Number of activities		3	2
Duration			
Quality			
Strolling			
Space	3	3	3
Number of activities	1	3	2
Duration			
Quality			
Sitting (street furniture)			
Space	2	2	2
Number of activities	2	2	2
Duration			
Quality			
Sitting (outdoor cafe)			
Space	3	3	2
Number of activities		2	2
Duration			2
Quality			

Table 64. Level of importance for multi-criteria analysis, wider impacts

Wider impacts			
Economic			
Costs of transport			2
Property values		2	
Visits to local businesses		2	
Expenditure in local businesses		3	
Social			
Traffic safety (fatalities)	3	3	3
Traffic safety (seriousinjuries)		3	3
Traffic safety (slight injuries)		3	2
Traffic safety (property damage)			2
Community severance		1	
Personal security	2	2	2
Physical activity		2	
Social interaction		2	
Inclusion (pedestrians with disabilities)	3	3	3
Wellbeing		3	1
Environmental			
Green space	2	3	2
Air pollution (PM10)	2	2	2
Air pollution (PM2.5)		2	2
Air pollution (No2)		2	2
Noise		2	2
Soil and water			2
Local climate			2
Energy			2
Co2 emissions		2	2

Appendix 5 – London: Street Designs Taken Forward for Modelling & Appraisal

The specific design elements can be found below for the public transport 2-way design options which include the following designs:

Design element	***Number***	***Total length of the element in the road segment (metres)***
Bus stops	13	641.7
Pedestrian crossing	30	286.2
Parking bay	51	309.3
Loading bay	29	286.2

- New cross-PT-(2-WAY)-AM PEAK-LON_S1_0810_2021_M_ABDEJKT0

Design element	***Number***	***Average width of the element in the road segment (metres)***
General traffic lane	2-3	2.75
Bus lanes	1	3

- New cross-PT-(2-WAY)-IP- LON_S1_0830_2021_M_ABDEJKRT
- New cross-PT-(2-WAY)-PM PEAK- LON_S1_0820_2021_M_ABDEJKT0

Carriageway design elements

The specific design elements can be found below for the Place Priority 2-way design options which include the following designs:

- New cross-PP-(2-way)-AM PEAK- LON_S1_0810_2021_M_ABCDERT0
- New cross-PP-(2-WAY)-IP- LON_S1_0830_2021_M_ABCDERT0
- New cross-PP-(2-WAY)-PM PEAK- LON_S1_0820_2021_M_ABCDET00

Footway and kerbside design elements

Design element	***Number***	***Total length of the element in the road segment (metres)***
Bus stops	13	576.2
Pedestrian crossing	35	339
Parking bay	66	397.5
Loading bay	10	110.6

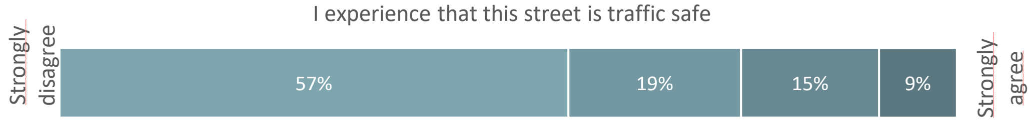
Carriageway design elements

Design element	***Number***	***Average width of the element in the road segment (metres)***
General traffic lane	2-3	2.75
Bus lanes	1	3

Appendix 6 – Malmo

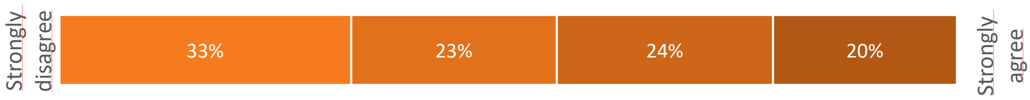
Traffic Safety

Mariedalsvägen [M]
I experience that this street is traffic safe

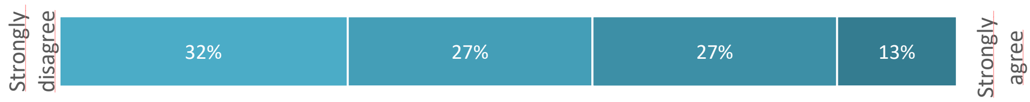


Sallerupsvägen [M]
I experience that this street is traffic safe

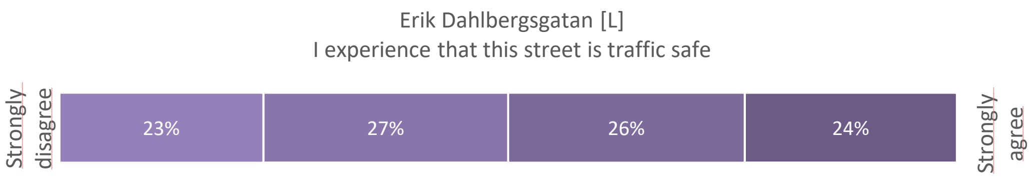
Södra Förstadsgatan [S]
I experience that this street is traffic safe



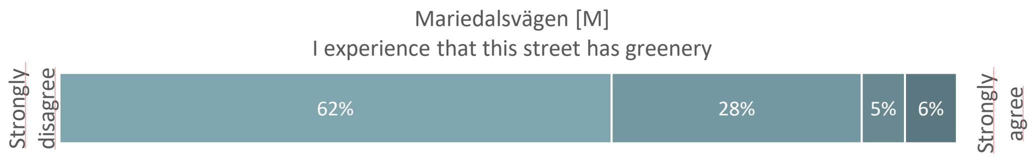
Stora Varvsgatan [S]
I experience that this street is traffic safe

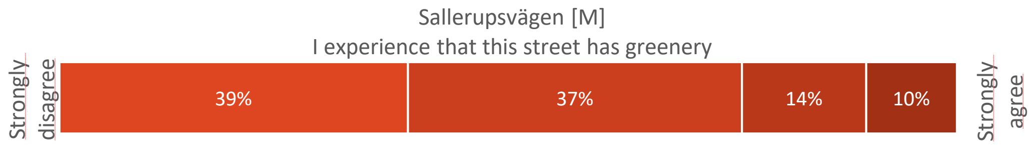


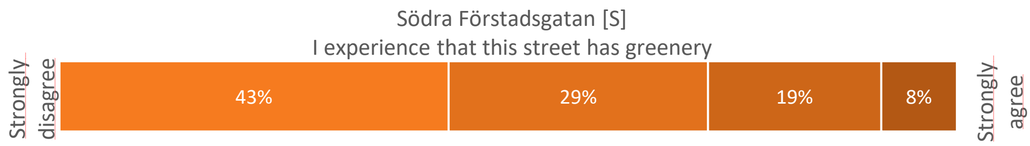
Regementsgatan [L]
I experience that this street is traffic safe

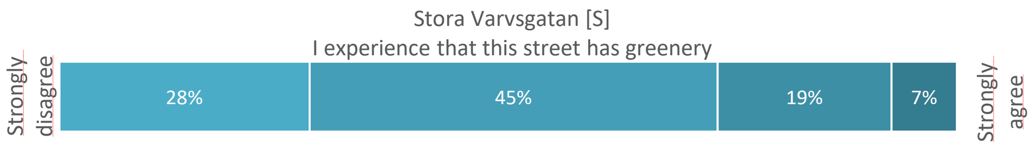

Erik Dahlbergsgatan [L]
I experience that this street is traffic safe
Strongly disagree
23%
27%
26%
24%
Strongly agree

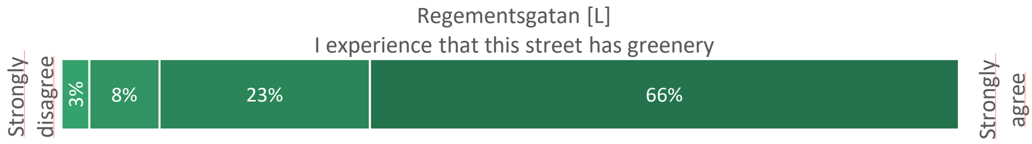
Greenery

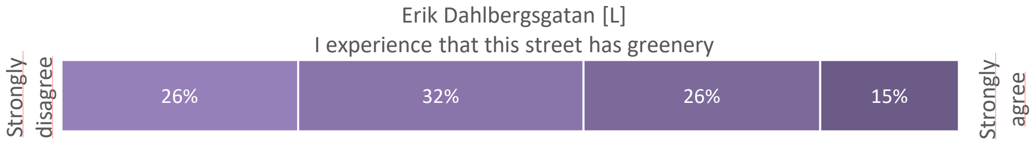

Mariedalsvägen [M]
I experience that this street has greenery
Strongly disagree
62%
28%
5%
6%
Strongly agree


Sallerupsvägen [M]
I experience that this street has greenery
Strongly disagree
39%
37%
14%
10%
Strongly agree

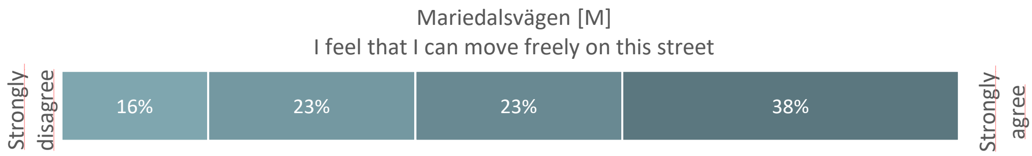

Södra Förstadsgatan [S]
I experience that this street has greenery
Strongly disagree
43%
29%
19%
8%
Strongly agree

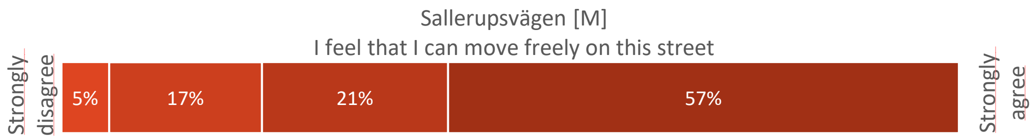

Stora Varvsgatan [S]
I experience that this street has greenery
Strongly disagree
28%
45%
19%
7%
Strongly agree

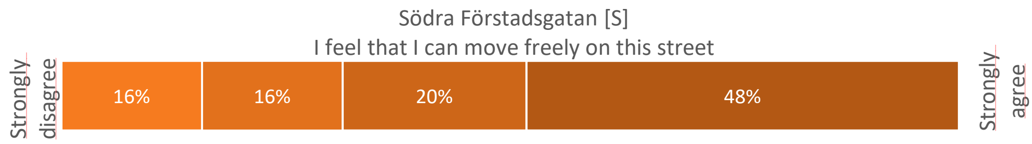


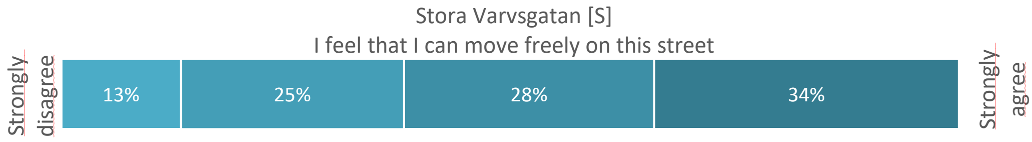


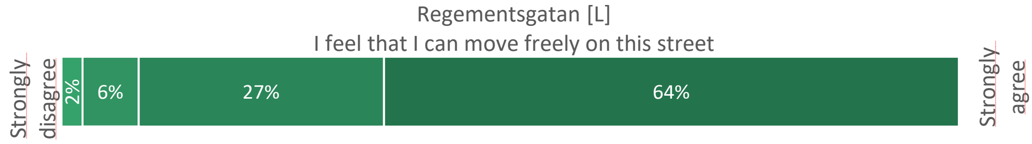
Freedom of movement





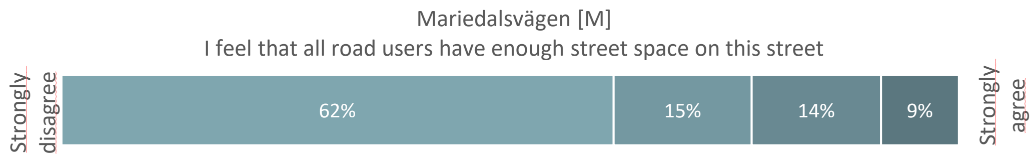


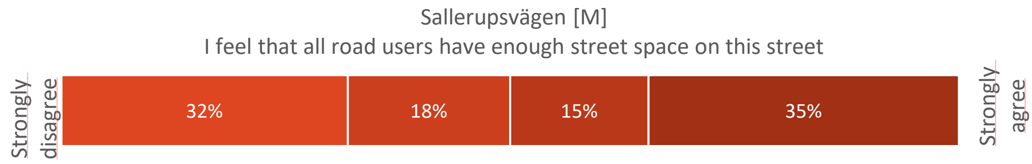

Stora Varvsgatan [S]
I feel that I can move freely on this street
Strongly disagree
13%
25%
28%
34%
Strongly agree

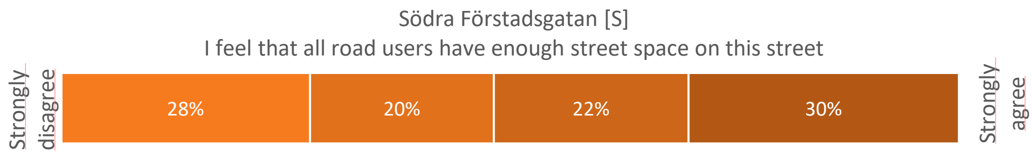

Regementsgatan [L]
I feel that I can move freely on this street
Strongly disagree
2%
6%
27%
64%
Strongly agree

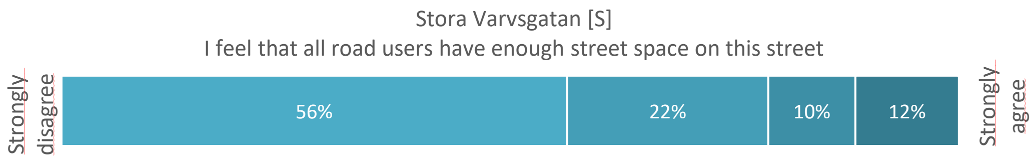

Erik Dahlbergsgatan [L]
I feel that I can move freely on this street
Strongly disagree
4%
7%
25%
64%
Strongly agree

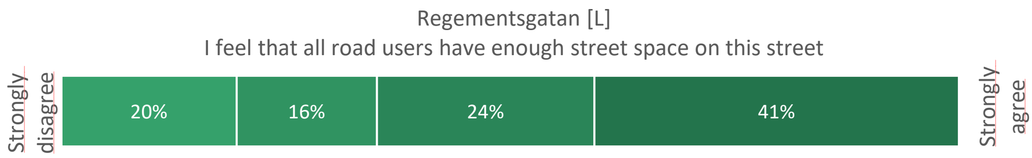
Street space

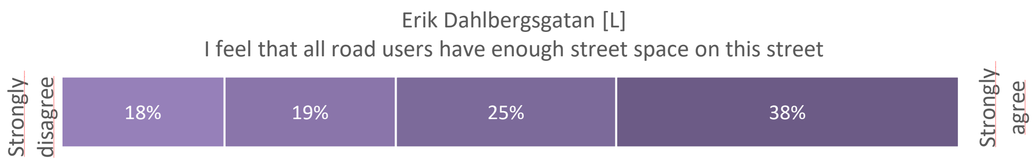




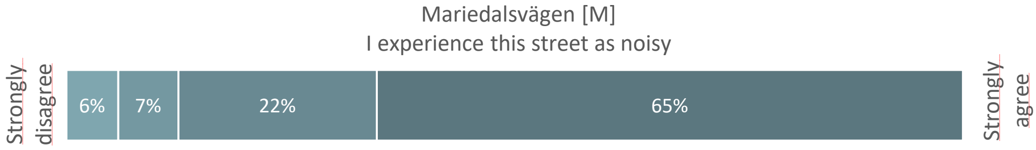


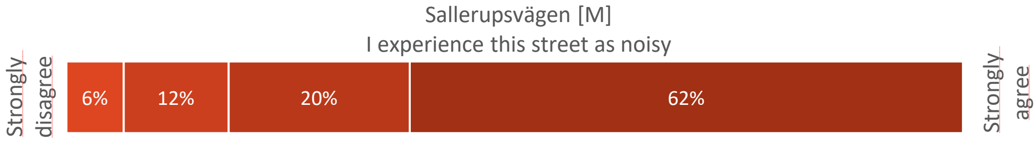


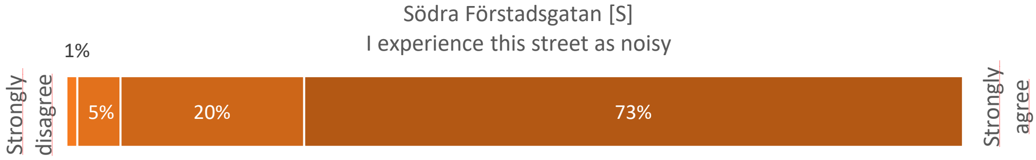




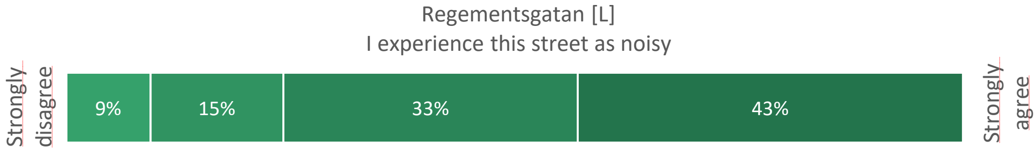
Noise

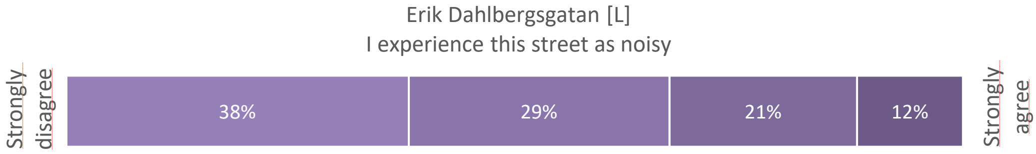

Mariedalsvägen [M]
I experience this street as noisy
Strongly disagree
6%
7%
22%
65%
Strongly agree


Sallerupsvägen [M]
I experience this street as noisy
Strongly disagree
6%
12%
20%
62%
Strongly agree

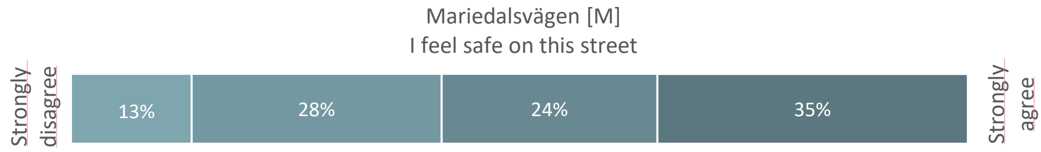

Södra Förstadsgatan [S]
I experience this street as noisy
1%
Strongly disagree
5%
20%
73%
Strongly agree

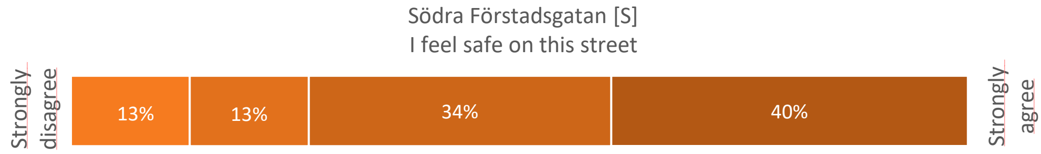

Stora Varvsgatan [S]
I experience this street as noisy
Strongly disagree
4%
11%
35%
51%
Strongly agree

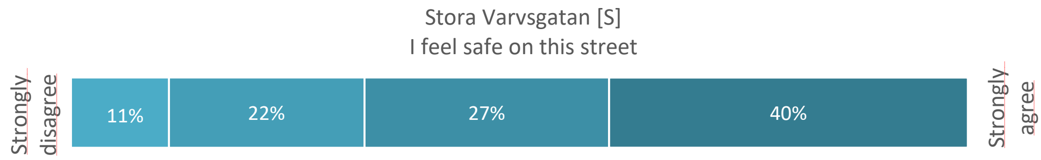

Regementsgatan [L]
I experience this street as noisy
Strongly disagree
9%
15%
33%
43%
Strongly agree

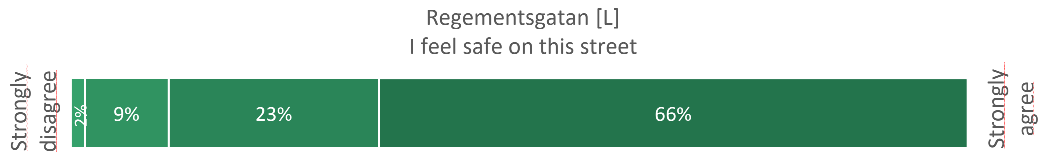

Erik Dahlbergsgatan [L]
I experience this street as noisy
Strongly disagree
38%
29%
21%
12%
Strongly agree

Security/Personal safety

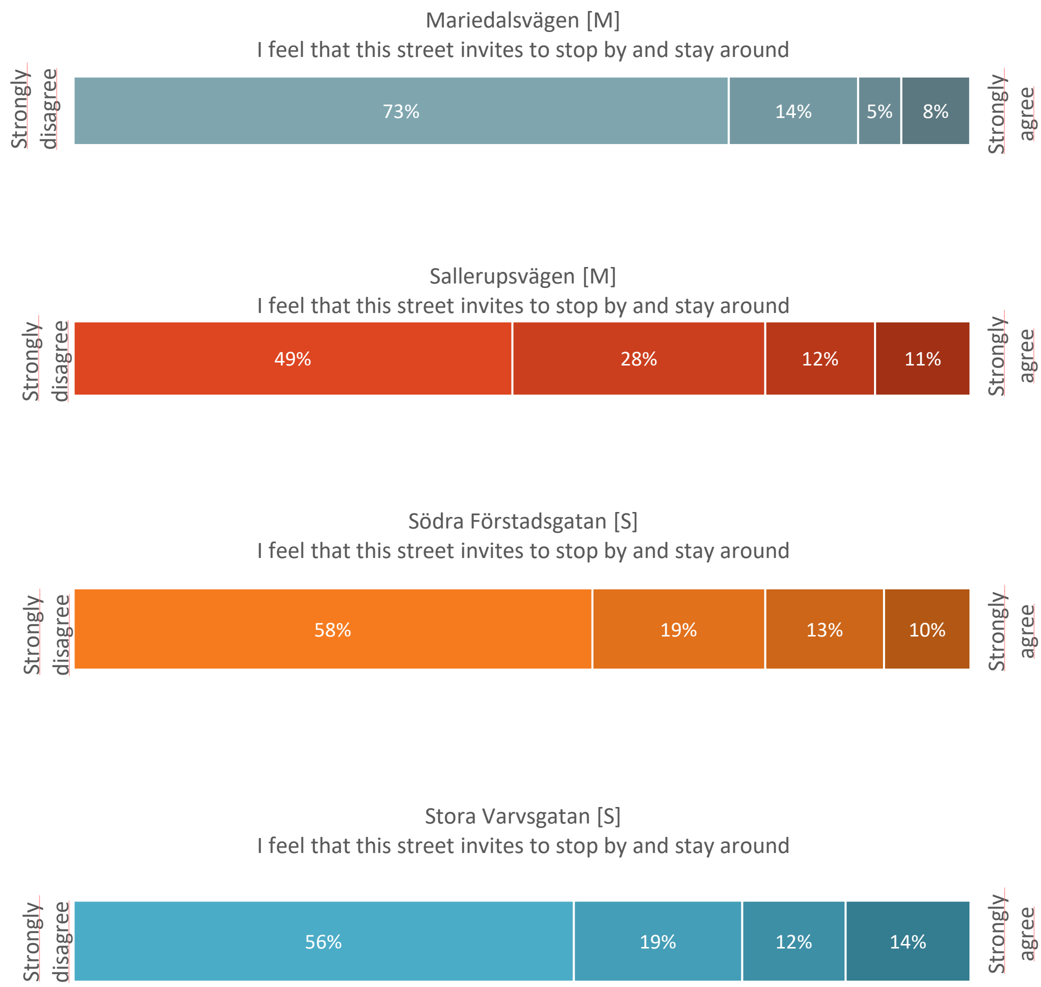


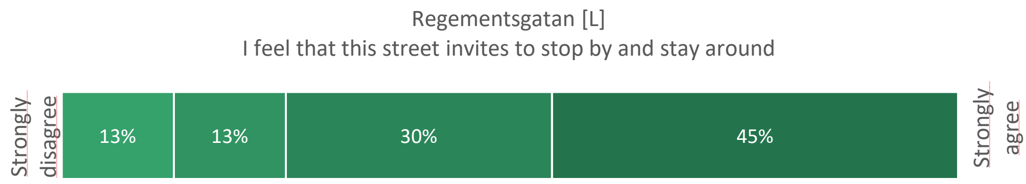


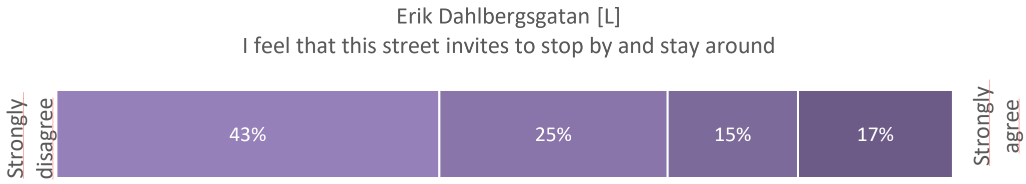




Stop by and stay around







Appendix 7 –The MORE cities' reflections on the MORE street design process

Each city experienced MORE in its own way, and here they share which were their initial challenges, how MORE supported them, and tips for the cities that want to engage in transforming their streets.

Budapest

Located in the centre of the city, Budapest stress section, the east-west Rákóczi street axis, is one of the most important boulevards in Budapest, not just in the aspect of traffic but also in a historical way. This axis provides the connection between the Buda (west) side and the Pest (east) side of the city across the Danube, carrying a lot of traffic from the TEN-T network. Due to public transportation, commercial, touristic and residential use, it also has dense pedestrian flow.

Main reasons for the selection of the section:

- Relatively narrow space for pedestrians, railings and bollards between carriageway and footways
- Heavy motorised traffic
- Insufficient pedestrian crossings (4 crossings)

- High noise levels
- Air pollution
- High flow
- Many different uses
- No dedicated cycle infrastructure
- Many accidents, mainly due to inappropriate pedestrian crossings

With its relevance to the city, BKK could outline the street uses and users' priorities of this stress section to correspond to the key priorities of the Budapest Mobility Plan.

- Improving walking conditions
- Providing safe and consistent cycle provision
- Improving air quality,
- Reducing private car trips
- Introducing measures to reduce street

How did MORE help Budapest stress section?

- It supported to assess and to reflect on the current conditions and regulations at the different levels of government
- It allowed public consultation
- It opened a discussion in an interactive way
- The Design Days were very popular and useful amongst practitioners with the use of blocks and acetates
- It helped to bring different professionals from the municipality to the discussion – urban planners, road designers, landscape designers, public space maintenance, public transport operators, etc
- It created greater engagement of the different professionals
- It produced common knowledge about the stress section
- It made the process richer
- It supported the city in creating different scenarios
- It allowed seeing the street as an ecosystem – including other factors in street design
- It is a valuable case to demonstrate to decision makers what streets could be
- The process and tools being transferred to other projects
- The holistic approach is one of the main legacies of the project

Constanta

The stress section, the CORA-Junction, is located in the Western part of Constanta and connects Bulevardul I. C. Brătianu with Strada Dezrobirii/Pasajul Cumpenei is an important distributor for traffic between the city and the TEN-T network with lots of motorised traffic. CORA-junction is also an important transfer point for public transport, but its large scale poses a major barrier for activities in the neighbourhood. The CORA Mall, located close to the intersection, has many retail shops. It is a popular destination, particularly for car drivers, and generates demand for public transport and thus pedestrian activities.

Main reasons for the selection of the section:

- Illegal crossings
- No bike infrastructure
- No dedicated lanes for public transport
- Low pedestrian safety
- Heavy private cars flow
- Illegal parking and stopping
- High particles and noise emission

Within the MORE process, the city of Constanta aimed to balance the street space allocation in this stress section to:

- Improve safety and security for pedestrians
- Increase the number of bicycle users
- Improve the Local Public Transport services
- Improve the quality of the urban environment inside the Stress Area
- Reduce air and noise pollution

How did MORE help Constanta's stress section?

- It allowed different ways of stakeholder involvement, especially for the citizens
- It allowed the understanding of how the public uses and sees the street space
- It increased the understanding of the importance of stakeholder engagement
- It created the possibility to open the dialogue with different stakeholders
- The interactive sessions made stakeholders' engagement more focused
- It helped to develop and adapt to different ways of communicating with different stakeholders, increasing engagement
- It showcased the process for other practitioners and NGO stakeholders
- It showcased new ways of working toward the street design

Lisbon

Lisbon's stress section, Rua Morais Soares, is one of the main streets connecting the Eastern part of the city with the TEN-T network. Together with Praça Paiva Couceiro, is at the junction of the two most inner ring roads defined in Lisbon's road network hierarchical scale. This section is a very dense commercial zone, with small businesses, retail and restaurants having high pedestrian flow.

Main reasons for the selection of the section:

- Important urban street connecting the eastern side of the city to the city centre;
- Very diversified place activity, with a very dense existence of commerce and services;
- High pedestrian activity, despite the lack of good walking conditions available;
- High pressure from private and public transport;
- High pressure for parking, with abusive parking in load/unload bays and general use of illegal second-line parking;
- Located on the axis of several public transport lines and planned cycle lanes;
- High ratio of accidents, especially pedestrian casualties.

Stakeholders involved: national authority, municipal departments and companies, local authorities, transport operators and citizen associations.

These characteristics show the pressure on the urban street section and enhance the necessity of finding solutions that could sustainably accommodate multimodal systems, reducing the impact of problems such as congestion, air pollution, noise, and accidents, among others.

How did MORE help Lisbon stress section?

- It required that practitioners look at the problem from other perspectives
- It increased public participation, learning many new different views from citizens. People want to use the street
- Citizens were also able to understand the limitations. Since it is a negotiation, not everything is possible
- It provided good, new and different ideas
- It allowed the city to address without hesitation a street of great importance and with a history full of contestation
- It provided technical support to make more accurate decisions
- The Interactive sessions, using blocks and acetate, brought good results
- Stakeholders could visualise better the problems, the tools, and the process allows that from different perspectives
- It is a solid showcase for the complexity of the problems and the possible solutions
- It created the possibility to influence future political decisions for the whole street and beyond
- Traffweb was one of the favourite tools, practitioners already used outside of MORE
- It opens the possibility to expand the process to other situations, and it could be a turning point for using the tools in the future and engaging the municipality

London

London Stress Section New Cross Road is located in the southeastern part of the city, in the borough of Lewisham, and it is part of the A2 corridor connecting the city to the TEN-T network. There is a great variety of land use, with residential buildings, multiple shops, gastronomy and other usages. Users and use conflicts are particularly high around the metro stations, and the volume of motorised vehicles and bicycles is also high. As a result, New Cross Road faces the challenge of the overall user requirements exceeding the available space.

Main reasons for the selection of the section:

- High pedestrian severance
- Crossing at informal locations
- Higher than average number of killed and seriously injured along New Cross Road, particularly affecting pedestrians, cyclists, and powered two-wheeler users
- No formal cycling routes, and high demand for cycling
- Insufficient bike parking infrastructure
- Poor air quality
- High freight flows
- Low journey time reliability
- Illegal parking

How did MORE help London's stress section?

- It allowed adapting the stakeholder engagement tools to their local context to attract more people
- It supported the process of listening to people, facilitating their involvement
- It brought different professionals to the discussion, using the right tools
- It allowed the studying of many different design options for the street, with further information to work it
- It brought new modelling priorities and possibilities by adding pedestrians to the modelling process
- It improved the modelling skills of the professionals
- It corroborated the importance of the policy objective of prioritising pedestrians and place functions
- It supported the need to start measuring the actual benefits of the improved place functions design
- It provided consistent evidence of the benefits of a holistic approach, with priority to the quality of life

Malmö

Malmö is developing a new urban district in the Nyhamnen area with mixed dense uses (e.g. dwellings, workplaces, schools and green areas). Mobility planning is one of the greatest challenges for the area in general, which will have dedicated space for pedestrians, bicycles, cars and a possible tramline. The study area is defined by the feeder route of Västkustvägen together with adjacent roads and streets, connecting the northern parts of the inner city with the TEN-T corridor. Reference streets were used to understand the current conditions as input for planning new streets in the Nyhamnen area.

In these Reference streets, scenarios were assigned based on street characteristics (liveability, mobility, sustainability). Then, they were used for indicators, citizen participation activities, and results applied to the case study area.

How did MORE help Malmö's stress section?

- It allowed rethinking the traditional approach to street design and traffic planning
- It merged citizens' participation input into the design process, making it integrated
- It provided the right tools that support this holistic and integrated approach
- It balanced the different users' impact on the design process
- It increased the priority for pedestrians and place functions
- It improved the cooperation between the different departments and professionals
- It allowed using the tools also to educate other professionals about the various possibilities for streets (e.g. shifting mode priorities)
- It showcases the benefits of shifting mode priorities and place functions
- The interactive sessions between professionals instigated creativity
- It allowed the improvement and adaptation to the local needs, incorporating new elements for the blocks and acetates (e.g. trees, benches)
- It created different future scenarios for the city
- It shows that it is possible to question the current standards of traffic planning and to change to new and future realities
- It created the understanding that it is possible to be more flexible in street design
- It inspired a handbook for urban planners adapted to the Malmö context
- It sparked the interest of other professionals
- The project was a catalyst for change within the city