

DESIRE LINES ANALYSIS

COUNTING & MAPPING CYCLISTS' TRAJECTORIES
AMSTERDAM - 10 INTERSECTIONS



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FOREWORD

Copenhagenize Design Co. is pleased to present our second application of the Desire Line Analysis Tool to a number of intersections in the cycling darling of Amsterdam. This analysis was pioneered by Copenhagenize Design Co. in 2012 as a practical and observable way to apply anthropology to bicycle urbanism and understand the connection between user behaviour and infrastructure. This methodology has already been deployed on more than a dozen projects in Europe and North America to date.

With an increasing focus on re-establishing the bicycle as legitimate transport in cities around the world, understanding the behaviour and, indeed, the basic anthropology of bicycle users is of utmost importance. Rethinking the car-centric design of intersections and infrastructure is necessary if we are to redesign our cities to suit the mobility patterns of the 21st century. Every day, street

users unknowingly send us valuable information about how they desire to move about their urban environments. Instead of merely expecting citizens to behave how many planners and engineers would hope they would, it is vital to attempt to understand their existing needs and build and adapt the environment from there.

In Amsterdam, for decades the infrastructure has shaped the behaviour of thousands of bicycle users riding through the city. As a flock of birds, they use all their senses to tactically cross intersections and communicate with other street users. They are an endless source of inspiration to improve travel conditions. If we stop and look, we find that a city is full of movement. If we pay attention to their choreography, we can promote smoother, easier and more life-sized movement.



Mikael Colville-Andersen, CEO

VISION & MISSION

OF COPENHAGENIZE DESIGN CO.

We're your multi-disciplinary "go-to team" for cities in all matters relating to bicycle culture, planning, traffic and communications. We approach every job from the human perspective - using design, anthropology, sociology and common sense as our points of departure.

Only a few generations ago, the bicycle was a main feature on the urban landscape of cities and towns around the world. There is little standing in the way of us advancing the evolution of Bicycle Culture 2.0. Modern urban planning is often singular in its focus on technical models and solutions, statistics, impact assessment and cost. Copenhagenize prefers to place the primary focus on human nature in our work. We think bicycle user first and design from there, whatever the city.

Our speciality is inspiring and advising both cities and organisations about how to re-establish the bicycle as a transport form and thereafter reap the wealth of benefits.

Reestablishing the bicycle on the urban landscape, for us, is designing and constructing a monument in each city we work in. A monument to human ingenuity and rationality and every brick of the monument is human-powered.



THE DESIRE LINES ANALYSIS

The concept of Desire Lines was built upon the work of many pioneering urban anthropologists in the field, employing observation tactics to understand the behaviour and thus the needs of urban citizens. One of said pioneers William H. Whyte, wrote in his 1980 text *The Social Life of Small Urban Spaces*: "Look hard, with a clean, clear mind, and then look again - and believe what you see... It is far easier, simpler to create spaces that work for people than those that do not — and a tremendous difference it can make to the life of a city."

Desire Lines represent the on-the-ground ways that urban citizens move through the landscape to get from point A (origin) to point B (destination). In spite of regional traffic laws and the constraints of the built form of parks, streets and other urban environments, Desire Lines are traces left over of intuitive citizen movement through a space and serve as a powerful guide to users' experience of a particular infrastructure design.

Following in the tradition of life-sized human-focused anthropological studies, Copenhagenize Design Co. pioneered the application of direct human observation on cyclist behaviour with the Desire Lines Analysis.

Even with the existence of the bicycle as transport in our cities for over 125 years, there has been very little serious study into user behaviour and its connection to the built environment. The Desire Lines Analysis offers a fresh perspective by documenting the volume of bicycles on observed routes, as well as the specific trajectories of each cyclist, including how they interact with the built environment. We analyse their behaviour in relation to infrastructure and regional traffic laws. As opposed to merely accepting the car-centric status quo in traffic planning, the Desire Lines Analysis was designed to research and help improve bicycle infrastructure in any intersection in cities across the world. The goal of these studies is to help legitimize the most efficient A-to-B route by assessing, designing and imagining the built environment for bicycle users based on how they are using it –not how a traffic engineer would like them to use it.



STUDY SUMMARY

Due to the increasing number of bicycles users, the City of Amsterdam suffers from cycling congestion on some main routes. This situation is especially noticeable at intersections.

The analysed intersections hosted between 2,078 to 4,361 bicycle users during the morning rush hour (from 8:15 to 9:15am).

Generally speaking, the design of an infrastructure influences the users' behaviour and trajectories. In Amsterdam, where the cycling infrastructure at junctions is under-pressure, cyclists determine the best tactical approach that makes their journey fast, smooth and safe. The design of the space is of course taken into account when determining this ideal trajectory.

The Desire Lines Analysis Tool offers analyses based on observations of particular trajectories and behaviours which are important when rethinking the design of a junction.

At all analysed intersections, too little space is offered for the high volume of cyclists, especially in the waiting boxes. This situation causes jams and inconvenience for cyclists who have to wait too long and too often on their way to work.

Consequently, the main behavioural patterns observed are:

- Cyclists turning right at red lights using the sidewalk when the bicycle track is full of waiting cyclists;

- Cyclists finding a path to the front row to be able to cross the junction on the first green traffic light and avoid waiting two red phases.

- Cyclists waiting at the red light invading the pedestrian crossing due to a crowded track in front of them. Generally, cyclists respect the perpendicular bicycle track, especially when a cross is drawn on the ground but usually stop on the space dedicated to pedestrians;

- Cyclists waiting outside the box while proceeding with a left-turn as it can not contain the amount of users.

Moreover, more than half of the bicycle users arrive at the intersection when the traffic light is red, increasing the 'impatient syndrome' observed at each intersection.

Finally, due to the lack of space and the high volume of cyclists, most of the tense situations between users were observed between cyclists themselves and with mopeds. To a lesser extent some uncomfortable situations arose with pedestrians, while bicycle users step on their crossing marks.

The cycling conditions in Amsterdam question the Dutch model of infrastructure and some adaptations must be investigated. Different sorts of design solutions can facilitate the flow of cyclists crossing a junction. They are based on a redesign of the space and/or on an adjustment of the traffic lights. In this report, the main ideas proposed are based on infrastructural changes. Nevertheless,



with a complementary study of the car traffic and of the tramways priority, other solutions based on the adjustment of traffic lights can be investigated.

Within the design solutions, two sorts of actions can be implemented. On the one hand, the redesign of details (size of the protecting islands, size of the waiting box, location of the stop and yield lines, etc.) can be conducted. Since bicycle users are extremely reactive to their environment, changing a detail can improve the comfort of cyclists and reduce some tensions between users. The main point is to offer more space to cyclists when they wait at the traffic light or to reduce the time cyclists have to wait. On the other hand, the width of the cycling infrastructure is not adapted to the increasing volume of cyclists. Due to the lack of available space to widen the infrastructure, a reduction of the space for cars, for instance by creating a bicycle street, is a serious option to accommodate cyclists.

Therefore, the main recommendations offering better cycling conditions during the rush hour are:

- reducing the number of cyclists having to stop at the red light.

This study shows that each intersection forces more than half of the bicycle users to stop with a traffic light. This does not respect the primary wish of a cyclist which is to stop the least amount of times during a trip. Therefore, the implementation of more green waves based on cyclists' speed or

experimenting with the removal of traffic lights -as it was done at Alexanderplein junction- must be considered.

- allowing cyclists to turn right when the traffic light is red. When the bicycle track is wide enough a lane for cyclists turning right should be created;

- widening the waiting boxes in order to allow more cyclists to get the green light and to legitimize the space where they wait;

- making the way to proceed clearer for a left-turn when no marking guides the cyclists.

Dutch cyclists are used to the two-step left turn, staying on the right of cars. It is a very safe way to organise the most complicated turn. Even if facilitating a direct left-turn could appear as a solution to ease the flow of cyclists – especially when the car traffic is low-, a consistency in the way to turn left in two-steps appears as a safer solution for the people of Amsterdam.

All these adaptations of the infrastructure's design must be tested in pilot-projects and evaluated.

To finish, on a more general picture, some bicycle tracks are too narrow compared to the high volume of users. Therefore, the City of Amsterdam should keep on prioritising routes where cyclists have more space to travel safely as they represent a major part of all road users.

Creation of an extra lane to accommodate different users' pace (Copenhagen)



Creation of an extra lane by slightly reducing a wide sidewalk (Copenhagen)



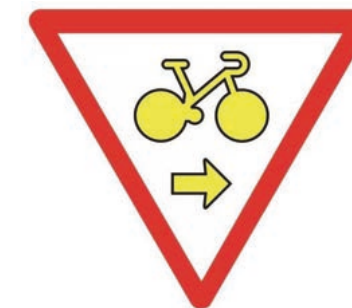
Guiding cyclists' right-turn with marking (Nijmegen) © SHIFT Gedragsverandering)



Creation of a right-turn lane with no traffic light (Copenhagen)



Allowing right-turn at the red light (France).



Guiding cyclists towards less frequented routes (Copenhagen)



Widening the space for cyclists at the junction (Mr. Treublaan - Amsterdam)



Implementing green wave based on cycling speed (Copenhagen)



Removing the traffic lights for all users (Alexanderplein - Amsterdam)



Collection of solutions designed to tackle the increase of cyclists in several cities.

A INTRODUCTION

The City of Amsterdam is leading the way in terms of urban cycling. Thanks to proactive policy and a comprehensive network of bicycle infrastructure, the number of bicycle users in Amsterdam is one of the highest in the world. 58% of the population cycle daily and there are more bicycles (881,000) in the city than inhabitants (834,713) (2016, iamsterdam.com).

Nonetheless, especially during the morning rush hour, some intersections are under pressure due to an intensive use of the road infrastructure by an ever-increasing number of cyclists. These users have found their own way to cope with the congestion. Every day, they draw their own paths in the streets. The City of Amsterdam acknowledges that changes to the spatial configuration of the intersections are required in order to accommodate the crowds of cyclists. Thus, in order to improve the flow of traffic, an anthropological approach has been used to understand how bicycle users behave and how they interact with other street users.

The city of Amsterdam acknowledged the issue of congestion and solicited the help of Copenhagenize Design Co in 2014 and again in 2017. The mission was to track, map and analyse the trajectories using the Desire Line Analysis Tool at 10 intersections in order to gain a deeper understanding of the main patterns. We could then suggest solutions and identify where additional space could be offered to cyclists.



STUDY OBJECTIVES

- » Obtain essential information about 10 intersections for in-depth behavioural analysis, including cyclists' trajectories and user conflicts.
- » Collecting data on the number of cyclists crossing the intersections.
- » Present design-based solutions to solve major traffic issues identified through the analysis and improve the travel conditions for cyclists - while respecting overall transportation needs.

B CITY PORTRAIT

Today, with 58% of their residents cycling daily, Amsterdam is in the top three of the world's most bicycle-friendly cities. However, this wasn't achieved overnight. The city has gone through several changes during the past decades. Cycling was a major means of transportation during the first part of the 20th century. In the 40's, 80% of trips were made by bicycle. After the war, cars started replacing bicycles and the city was modified accordingly. The percentage of trips made by bicycle decreased to 20% in the 70's. Many aspects pushed policy makers to reconsider the place of cars, mainly due to traffic casualties and the protests that followed them.

In this way, the City started pushing cars aside and built an intensive network of bicycle tracks, lanes, and high-quality services. Nowadays, the city counts a 767 km bicycle-only network including 513 km of dedicated tracks, of which 236 km are unidirectional and 275 km bidirectional. Furthermore, the Netherlands has its own intersection model, which is characterised by keeping cyclists to the right of cars and having a protecting island at each corner.

The bicycle is now the main means of transport in Amsterdam.

Some traffic rules guide the bicycle users. In the Netherlands, cyclists are allowed to use a mobile phone, listen to music or have passengers on their bicycle. At intersections, cyclists must stop at the red traffic light, except when the sign 'Rechtsaf voor fietsers vrij' allows them to turn right at the red

light. Nonetheless, they do have to give priority to pedestrians crossing the street. It is also forbidden to cycle on the sidewalk.

A feature of the Netherlands is that "light" mopeds, riding at a maximum speed of 25 km/h, are allowed to use the bicycle infrastructure. A report from the Cyclists' Union, published in 2012 showed that their average speed is actually 37 km/h. Furthermore, the number of these mopeds has increased in Amsterdam, creating a tense climate with common bicycle users who travel at slower speeds.

For this study, the City of Amsterdam chose ten intersections which seem to clearly show the discrepancies between design and use. These intersections are also liable for an upgrade in the years to come.

The 10 analysed intersections are:

1. Vrijheidslaan – Amsteldijk
2. Mr Visserplein – Waterloooplein
3. Vondelpark – Max Euweplein
4. Molukkenstraat – Carolina MacGillavrylaan – Oosterringdijk
5. Van Eesterenlaan – Fred Petterbaan
6. Ceintuurbaan – Amsteldijk
7. Tweede Hugo de Grootstraat – Nassaukade
8. Admiraal de Ruyterweg – Haarlemmerweg
9. De Clercqstraat – Nassaukade
10. Rozengracht – Marnixstraat



C THE METHODOLOGY

This study addresses the general research question: how do Amsterdam cyclists interact with the current infrastructure as well as with other cyclists and road users? There is also the question of urban design: how can the intersections be redesigned to reduce congestion for bicycle users?

In order to analyse the behaviour of thousands of cyclists, each intersection was filmed during one hour of the morning rush hour (8:15 to 9:15am) in May and in September 2017 by the company DTV. These recordings offer a way to conduct an extensive quantitative analysis, focusing on the various routes cyclists took to cross the intersections. These trajectories were mapped to clearly showcase the "choreography" of the intersections.

The interactions between cyclists and other street users were observed and are revealed in a "user conflicts" map. The word "conflict" is too strong to describe the reality of the interactions between these street users in Amsterdam. Situations can become tense or slightly uncomfortable. Yet no serious conflicts putting the most vulnerable users in any real danger were observed.

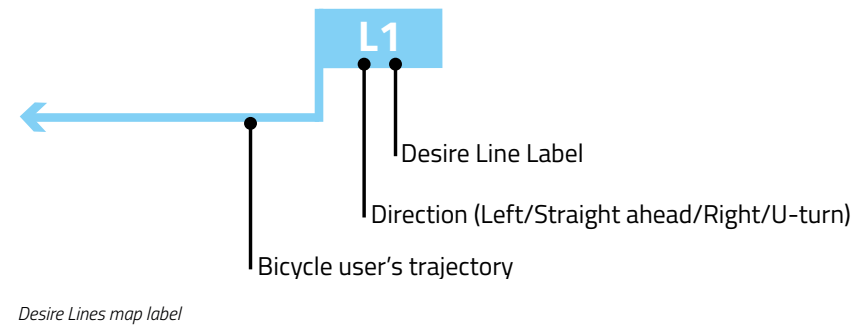
The research revealing cyclists' behaviour at these specific intersections can be used as an input to promote their redesign. Some proposals based on the observations are made for each intersection.

The study is composed of:

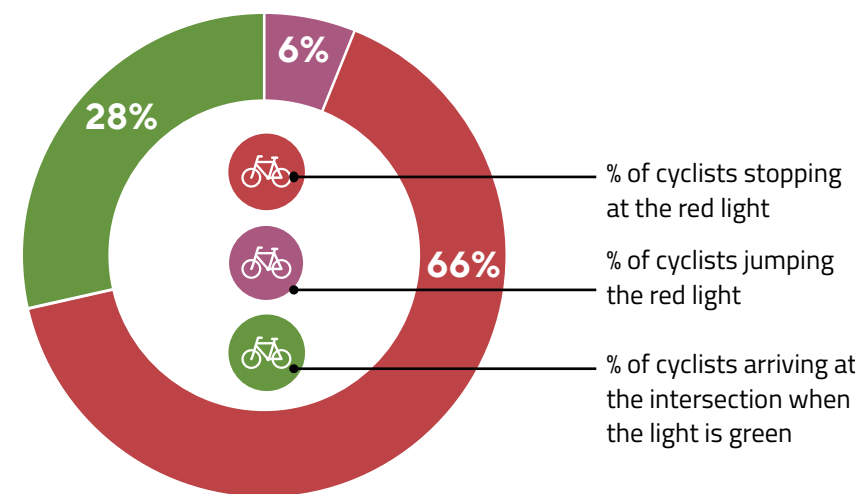
- The Desire Lines maps which provide an overview of all the trajectories of bicycle users crossing the intersection. A map is produced for each entry onto the intersection.
- When the film allowed a clear view of the traffic light, a traffic light graphic is produced for one entry of the intersection.
- A User Conflicts map pointing out the places where tense situations appeared between users was produced for each intersection.

Light-mopeds

Light-mopeds were not counted as cyclists; therefore they are not a part of the total number of users presented in the Desire Lines maps. Their behavior was analysed in the user conflicts section, along with their share in the total flow of users (cyclists + mopeds).



Desire Lines map label



Traffic light analysis

Type of conflicts

Pedestrians > < Cyclists

- Pa** JAM MANOEUVRE - Cyclist turning right on the sidewalk creating confusion for pedestrians
- Pb** CYCLISTS BLOCKING - Cyclists stopping on the pedestrian crossing forcing pedestrians to circumvent them
- Pc** CYCLISTS RUDENESS - Cyclists not giving way to pedestrians

Cyclists > < Cyclists

- Ca** ENTAILED BLOCKED TRACK - Cyclists stopping and blocking the perpendicular track
- Cb** IMPATIENT SYNDROME - Cyclists overtaking cyclists to be the first in line
- Cc** DISORIENTED SYNDROME - Cyclists using the pedestrian crossing or going on the sidewalk against the flow of traffic, encountering other cyclists
- Cd** SURPRISING COUNTERFLOW - Cyclists in counterflow surprising cyclists riding in the right direction
- Ce** FORCING SYNDROME - Cyclist not giving priority to another cyclist
- Cf** PRIORITY CONFUSION - Cyclists confused by the rules of priority

car / truck Drivers > < Cyclists

- Da** DRIVERS BLOCKING - Drivers stuck at the intersection and blocking the bicycle lane
- Db** UNDESIGNATED CAR PARKING - Drivers using the sidewalk as parking area obstructing the way for pedestrians and cyclists turning right

Mopeds > < Cyclists

- M** THE SHARING STRUGGLE - Mopeds overtaking and weaving between cyclists

Trams > < Cyclists

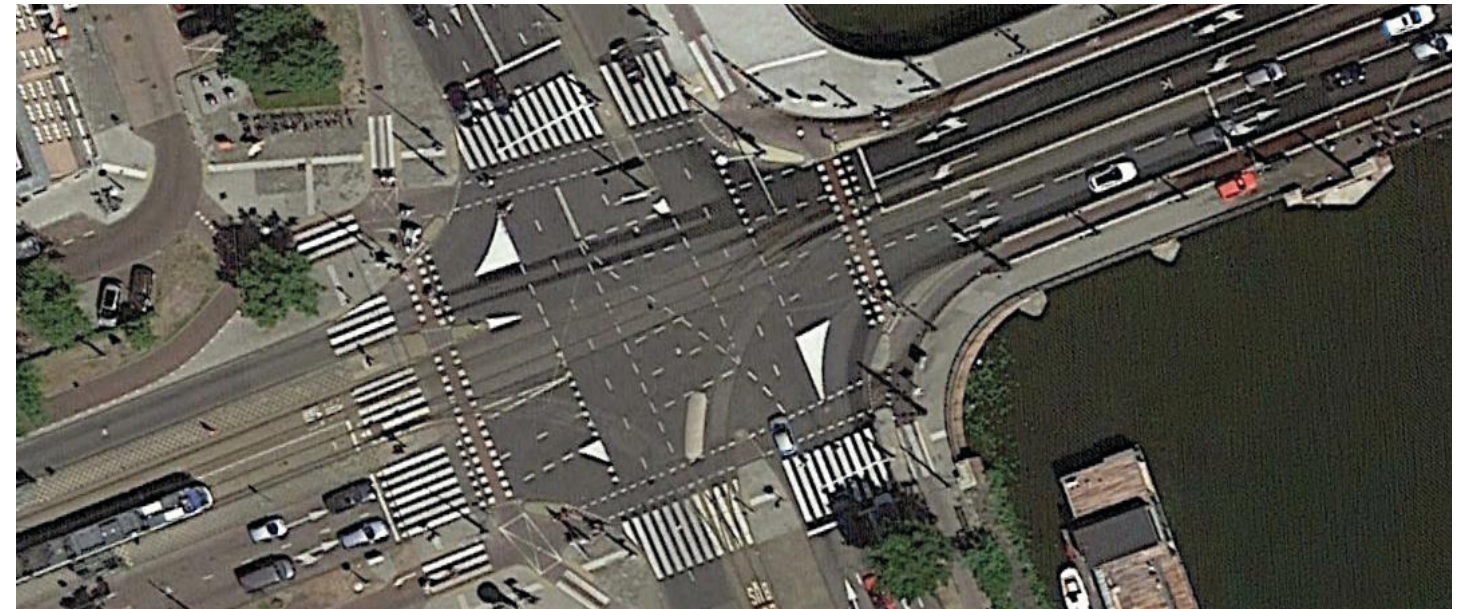
- T** PRIORITY CONFUSION - Cyclists wanting to turn left and having to slow down / stop in the middle of the crossroad due to the tramway passing

User Conflicts map legend

1 VRIJHEIDSLAAN - AMSTELDIJK

A. THE NEIGHBOURHOOD

The intersection Vrijheidslaan-Amsteldijk is located southeast of the city, by the Amstel river. This river is east of the intersection, flanked by the Amsteldijk boulevard. The west part of the intersection is occupied by residential buildings with active ground floors, inner-streets and parking areas. The bicycle tracks therefore have extra entries/exits leading to inner-streets which creates more cyclists' trajectories at the intersection.



Top view



Camera view

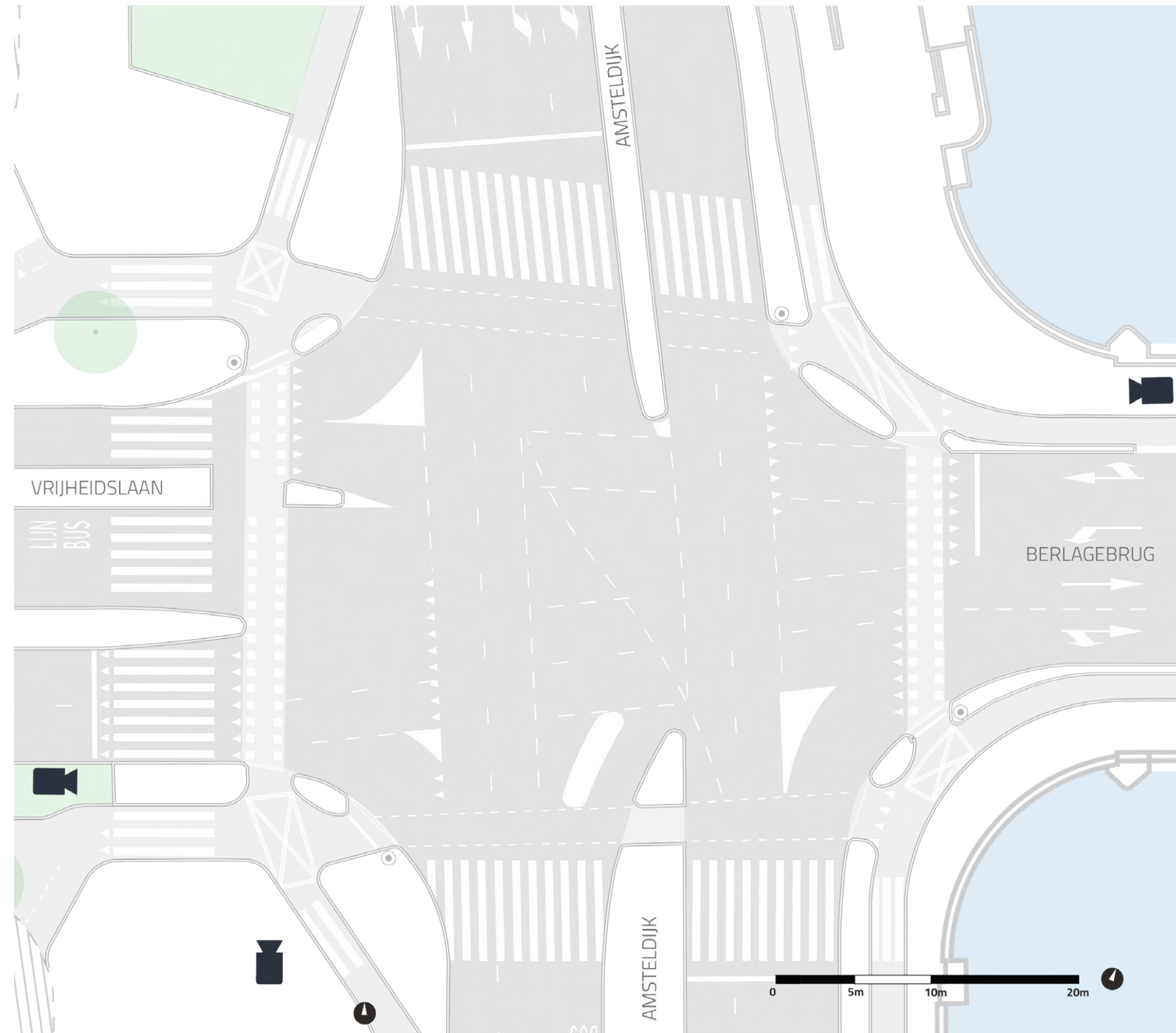
1. VRIJHEIDSLAAN - AMSTELDIJK

B. THE INTERSECTION

The intersection is equipped with variable bicycle infrastructure. **Amsteldijk** has bicycle tracks of 2.20 meters on both sides protected by a buffer zone made by an elevated curb. On the southern part of the junction, on the river side, a row of trees separates cyclists from cars.

Likewise, **Vrijheidslaan** has wide bicycle tracks of 4 and 3.50 meters on the north and south side, respectively, protected by a buffer zone from the car lanes. Nonetheless, when arriving at Berlagebrug the tracks width is reduced to 1.80m and 1.70m, respectively, creating a bottleneck where the buffer zone has disappeared. No pedestrian crossing allows walkers to cross Berlagebrug on the north-south axis. This also reduces the distance between the stop line for cars and the one for cyclists. Nevertheless, the 12 meters between the two stop lines still offer a good visibility to car drivers coming from the bridge and turning right. At the south west corner, the stop line for cars is 17 meters away from the cyclists' one due to the 6.5 meter wide pedestrian crossing. Elsewhere, all four corners have protecting islands.

Vrijheidslaan boulevard is comprised of two car lanes in the east to west direction and one in the opposite way. In the middle, there are two lanes exclusively for tramways going in both directions and turning south. Amsteldijk boulevard is made up of four lanes on the north side and is then reduced to two lanes on the south side. In the opposite direction, we find a two lane road on the south expanding into three lanes on the north side. In addition, the south side has a lane exclusively for tramways.



1. VRIJHEIDSLAAN - AMSTELDIJK



North entry



East entry



South entry



West entry

1. VRIJHEIDSLAAN - AMSTELDIJK

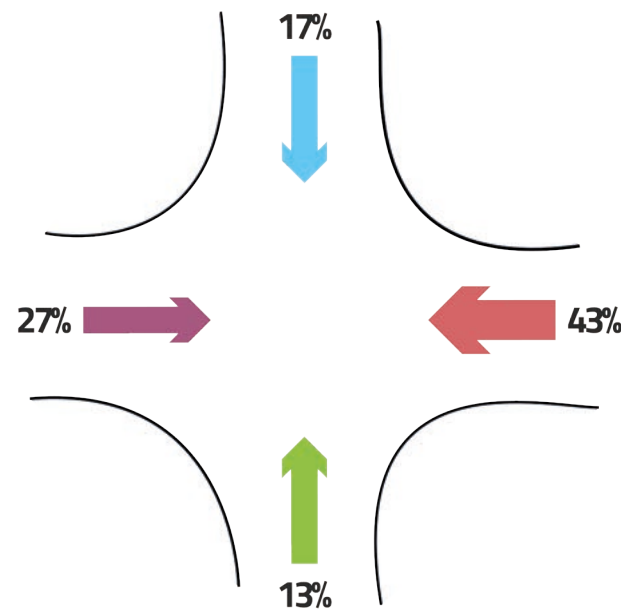
KEY FINDINGS I

C. THE DESIRE LINES

The Vrijheidslaan-Amsteldijk intersection was filmed on September 12th 2017 from 8:15 to 9:15am by three cameras, one located at the north-east and two at the south-west of the intersection. It is a highly active junction with **4,361 cyclists** crossing it during the rush hour. The average number of cars on Amsteldijk is X, while on Vrijheidslaan is X.

ENTRY POINTS

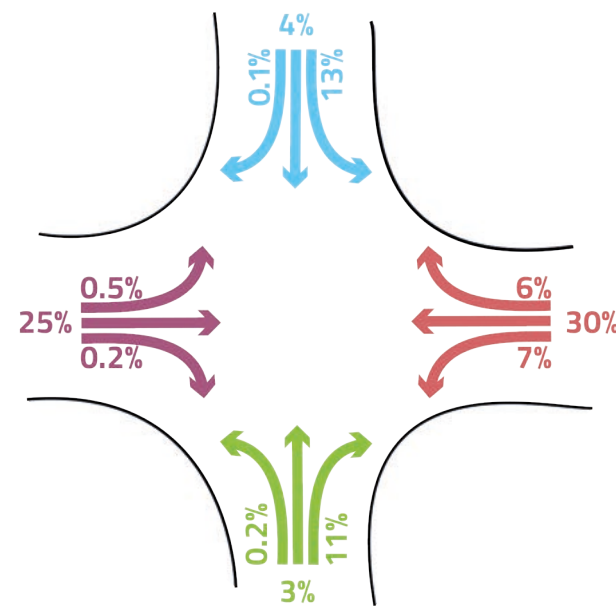
During the rush hour, Vrijheidslaan and Berlagebrug receive an important load of users, with 70% of the total number of cyclists travelling east-west. 43% of bicycle users arrive from the east, meaning from residential districts, and 27% of cyclists arrive from the opposite direction from Amsterdam Oud-Zuid. The South and North entries are less utilised with 13% and 17% of the total number of cyclists arriving from these directions.



MAIN DIRECTIONS

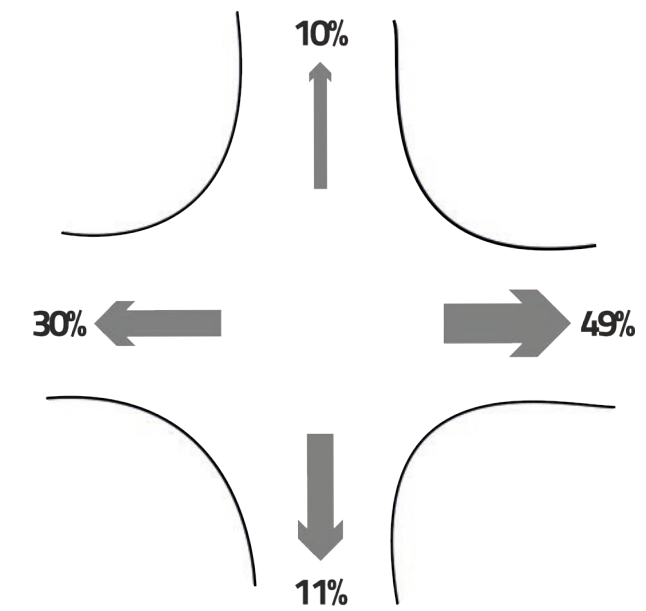
All entries added-up, the majority of bicycle users head straight. They represent 62% of the total number of cyclists crossing this intersection. Users turning left and right represent, respectively, 20.5% and 17.5% of the trajectories.

Furthermore, 24% of bicycle users arriving from the north and south head east. This scheme shows how busy the east-west axis is.



EXIT POINTS

Almost half of the total number of the bicycle users counted at this intersection cycle to the eastern districts, while 30% of them head west. Only 11% of the total number of cyclists at this intersection head south to the outskirts of the city, and 10% to the north towards the city-centre.



1. VRIJHEIDSLAAN - AMSTELDIJK

NORTH ENTRY POINT

The 2.20m width bicycle track is able to accommodate the **736 cyclists** coming from the north during the rush hour. However, the waiting box is not able to contain these cyclists plus the ones arriving from the east wanting to turn left. Moreover, it is usual to observe some cyclists overtaking others to go wait outside the bicycle track, between the protecting island and the white mark on the ground. This behaviour is fostered by the brief green phase, since a maximum of 25 cyclists are able to cross Vrijheidslaan at one time. Certain cyclists therefore rush to get the green light and overtake others not to wait twice. Yet some of those who rush remain trapped in the middle of the junction or at the entrance of the bicycle track on the other side of the intersection.

STRAIGHT

Bicycle users going straight represent less than a quarter of the cyclists arriving from the north.

S1 - Almost all of them respect the bicycle lane on the ground and leave space to cyclists arriving from the east. But they usually stop on the pedestrian crossing.

S3 - Only 10 cyclists used the counterflow lane in order to access the inner-street. Surprisingly, this design allowing cyclists to do this manoeuvre does not create conflicts with the high number of cyclists coming from the west.

LEFT TURN

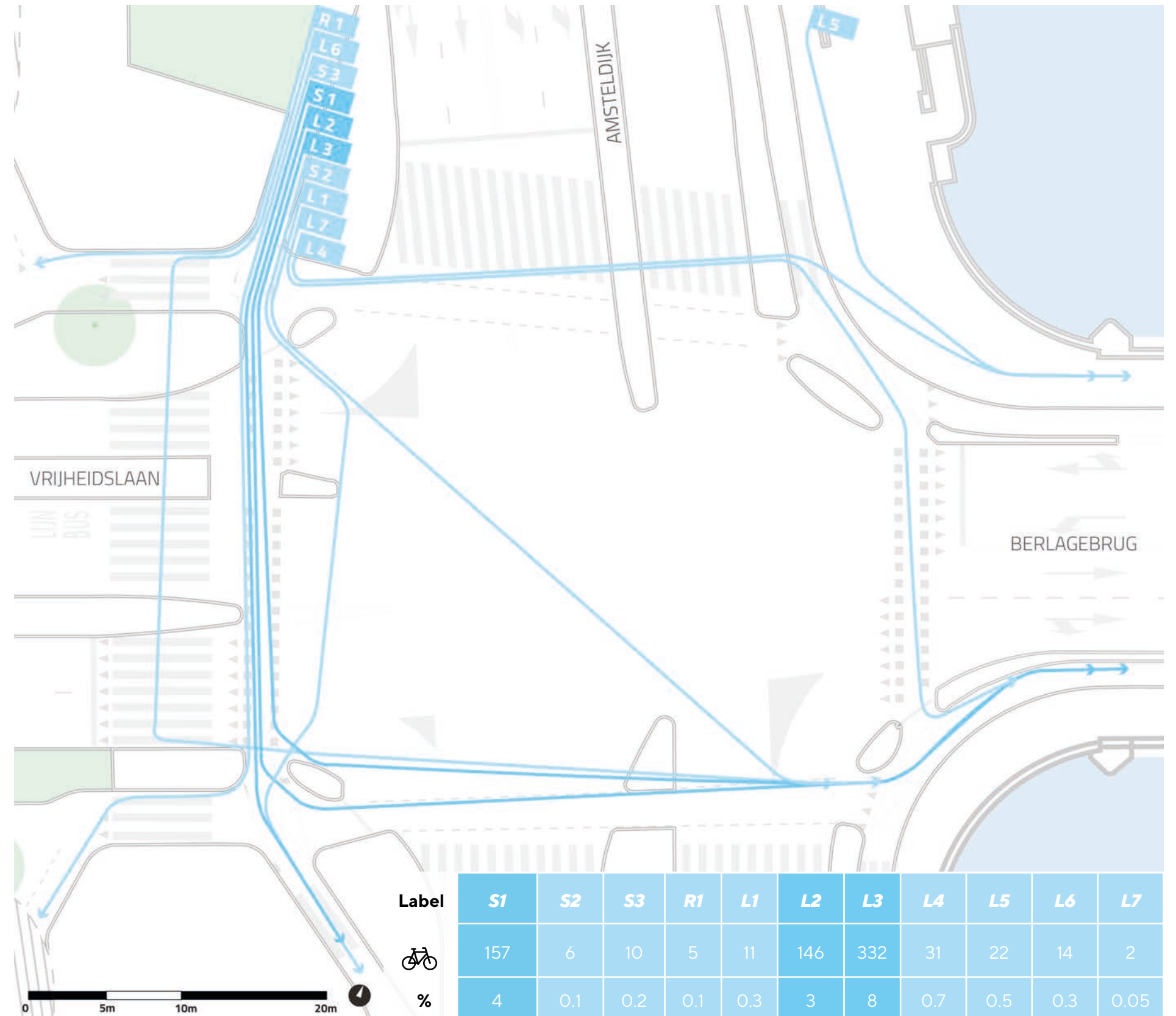
558 cyclists turn left towards the bridge. Almost all of them turn left in two steps.

L1 - Bicycle users turning in one step start pedalling a few seconds before the traffic light turns green.

L2 - A considerable number of cyclists (146) turning left use the dedicated waiting box that gets crowded fast.

L3 - A larger share of cyclists turning left stop outside the waiting box (332), between the pedestrian crossing and the yield line. There is plenty of space to wait and it is safe as cars stop 22 meters behind the yield line. Some of these cyclists jump the red light at the north-west corner to join the group of people cycling straight from west to east.

L4 & L7 - A fewer number prefer to turn left by cycling on the pedestrian crossing. They will then either continue to ride on the sidewalk on the bridge or cross again to reach the bicycle track on the appropriate side. The supposed reasons for this behaviour are to avoid the crowded waiting box or to be sure to pass during the green light phase.




1. VRIJHEIDSLAAN - AMSTELDIJK

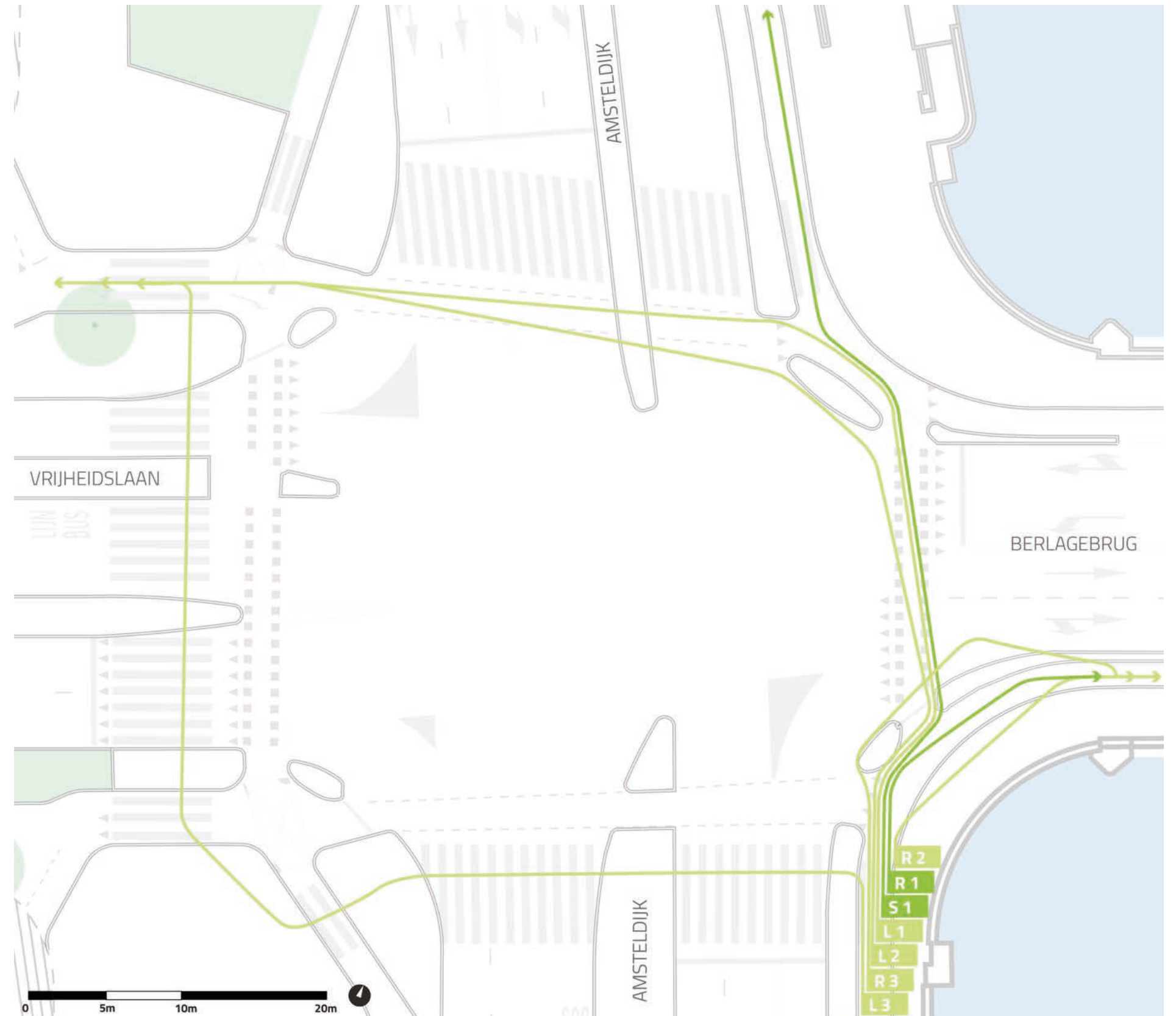
SOUTH ENTRY POINT

This access point has the smallest share of arriving bicycle users at this intersection. The **596 cyclists** have a 2.26 meter wide bicycle track. These users face some difficulties when they meet the ones arriving from the west. Indeed, about 2,136 cyclists reach the south-east corner, obstructing and slowing down cyclists arriving from the south. Furthermore, the waiting box at this corner is rather small, with a length of 1.41 meters it is not able to accommodate the length of a complete bicycle. Thus, some cyclists waiting in the box can block the way of oncoming traffic from the west.

RIGHT TURN

Most cyclists (459) coming from the south turn right on to the bridge. **R1** - The large majority of bicycle users turn right on the bicycle track. No traffic light or yield line forces these cyclists to stop. Since an important number of cyclists come from the west, they tend to find space in the horde of cyclists, with difficulty sometimes. **R2** - A small share of cyclists turning right use the sidewalk and then regain the bicycle track. This behaviour can be explained by the massive number of cyclists arriving from the west and a cramped waiting box pushing cyclists to occupy the white cross area.

Label	S1	R1	R2	R3	L1	L2	L3
	127	423	35	1	8	1	1
%	3	10	1	0.02	0.2	0.02	0.02



1. VRIJHEIDSLAAN - AMSTELDIJK

EAST ENTRY POINT

This entry has the largest share of users: **1,867 cyclists**. The majority of them head straight to the west. Cyclists arrive from a narrow bicycle track (1.80 m) and have a designated area to wait for the green traffic light. This area can host about 10 cyclists. Hence, the rest look for other places to wait trying not to obstruct cyclists arriving from the south. They often stop on the sidewalk, on the protecting island or before the cross, by the yield line. A maximum of 41 cyclists can cross the intersection on the green light. It's rare that a cyclist waits for more than one red phase.

RIGHT TURN

268 cyclists coming from the east turn right.


R2 - The majority of bicycle users prefer to turn right on the sidewalk. It happens mostly when the waiting box is crowded or when the traffic light is red. Sometimes, they run into pedestrians or other cyclists coming from the north and turning left. This behaviour is enabled by the abundance of space and the low number of pedestrians on the sidewalk.

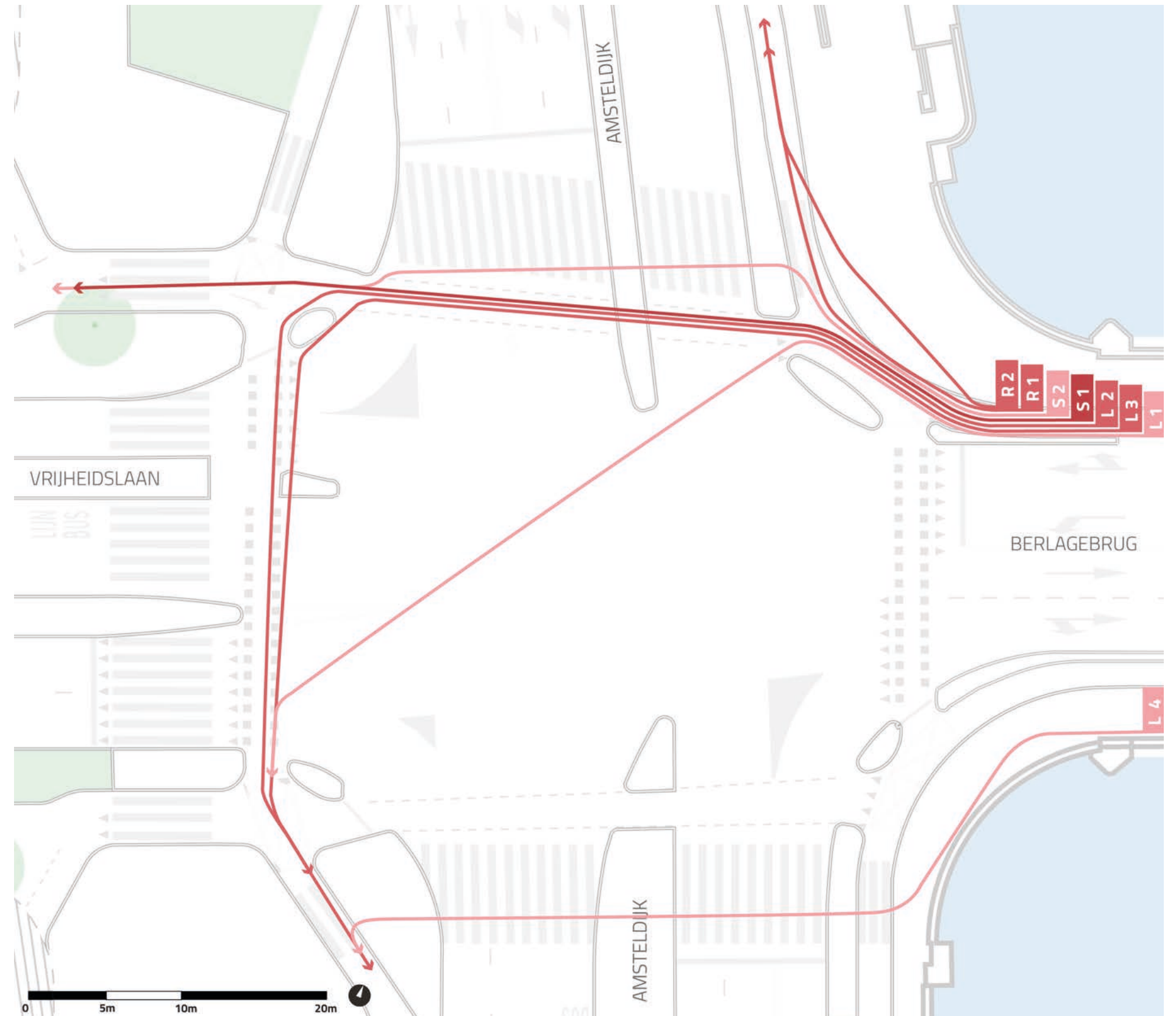
LEFT TURN

285 cyclists arriving from the east turn left to the south.

L3 - A considerable number of cyclists turn left in two steps. They stop outside the waiting box which is often overcrowded. This manoeuvre allows them to be at the front, giving them the impression of crossing the intersection faster.

L4 - 22 bicycle users cycle on the sidewalk, arriving in counterflow of the ones coming from south and west. They cycle on the pedestrian crossing to then proceed on the bicycle track heading south. The sidewalk at this corner is rather narrow, therefore causing a few conflicts with pedestrians and other cyclists, surprised by approaching unexpected traffic.

Label	S1	S2	R1	R2	L1	L2	L3	L4
	270	44	93	175	6	142	115	22
%	29	1	2	4	0.1	3	3	0.1



1. VRIJHEIDSLAAN - AMSTELDIJK

WEST ENTRY POINT


Cyclists arriving from the west use a 2.20 meter wide track. Whilst this entry does not have the highest volume of bicycle users (**1,162 cyclists**), it gets congested as cyclists from the north arrive and wait to turn left. The waiting box can host a maximum of 10 cyclists. The surplus wait before the white cross, therefore invading the pedestrian crossing, or outside the box, between the yield line and the pedestrian crossing. This space is highly used by bicycle users coming from the north willing to turn left, as it leaves a safe 22 meters between them and the cars behind.

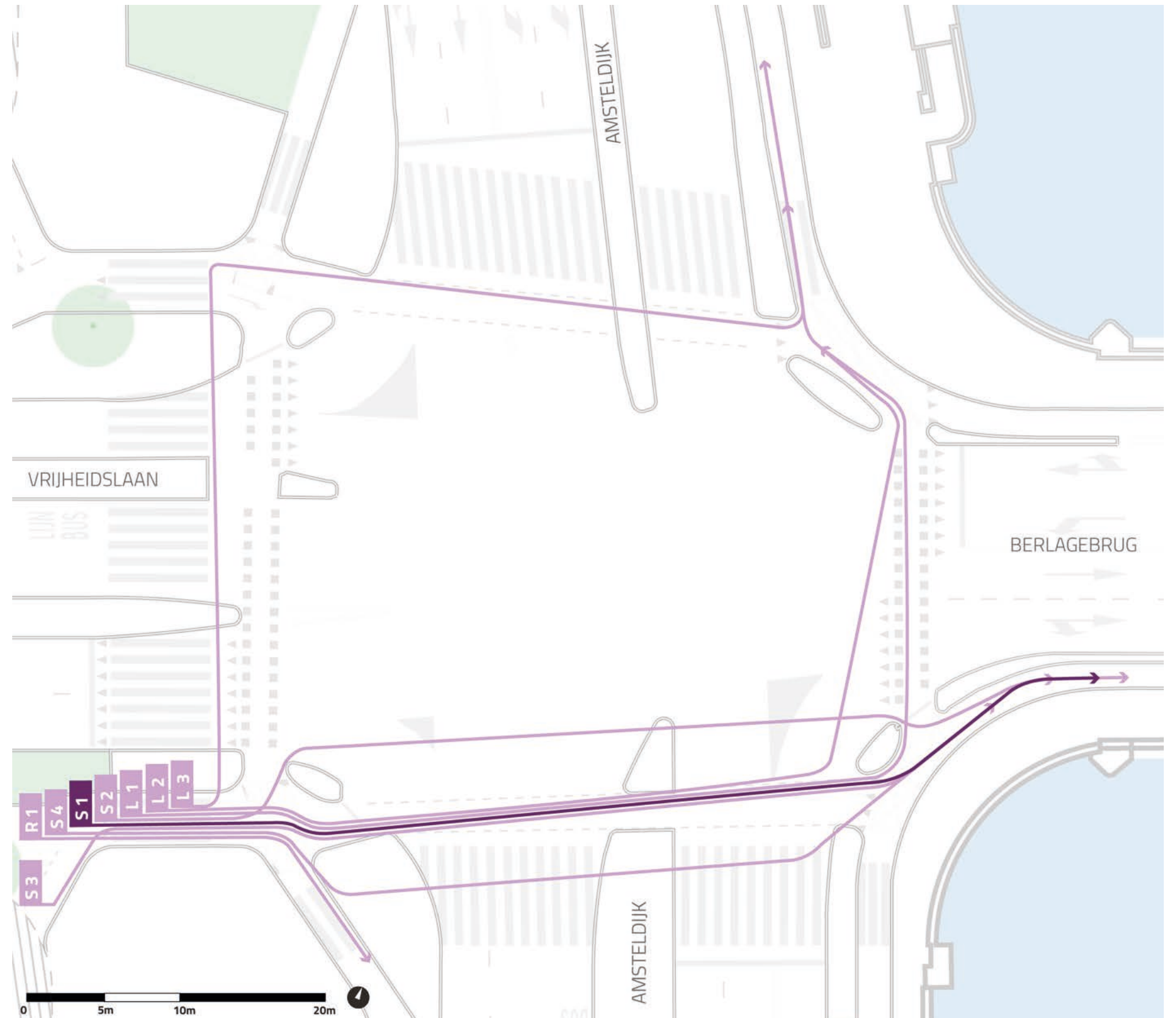
A maximum of 40 cyclists can cross the intersection on a green light. It does not seem to be enough considering the high number of cyclists waiting at the traffic light, especially during the first twenty minutes of the video (from 8:15 to 8:35 am). Some cyclists don't manage to cross the intersection during the green light and have to wait for the next one. Therefore, up to 2 or 3 cyclists jump the red light right after it turns.

STRAIGHT

98% (1,133) of the total number of cyclists arriving from the west entry head straight. Cyclists do respect the white cross painted on the pavement. However, they do not respect the pedestrian crossing.

The volume of bicycle users is so high that some have to ride outside the bicycle lane and continue cycling outside it after the intersection, thus mixing with cars. The ones riding on the bicycle lane face some difficulties due to a narrow access onto the bicycle track and are forced to slow down.

Label	S1	S2	S3	S4	R1	L1	L2	L3
	1007	48	41	37	7	7	2	13
%	23	1	0.9	0.8	0.2	0.2	0.05	0.3



1. VRIJHEIDSLAAN - AMSTELDIJK

S2 & S4 - A smaller share do not use the bicycle infrastructure as they are supposed to. They either leave the bicycle track to ride the car lane -usually overtaking other cyclists- and then regain the bicycle track further on. Or, in fewer numbers, ride on the sidewalk and cross the intersection using the pedestrian crossing. This behaviour is the reaction of cyclists to the congestion problem at the west entry.

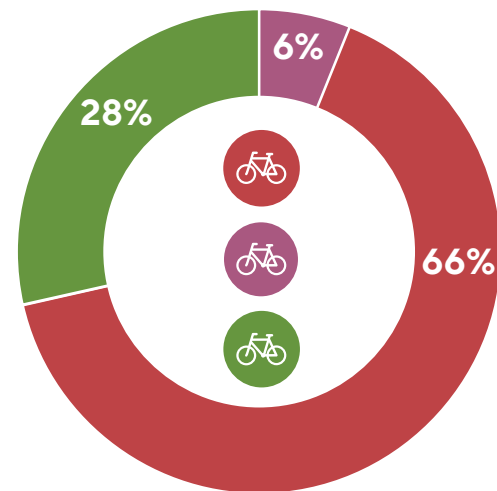
RIGHT TURN R1 - 6 out of 7 cyclists turn right while the traffic light is red, since they are allowed to do it.

LEFT TURN L1 - Cyclists turning left in two steps and stopping in the waiting box have trouble proceeding with this turn during the busiest periods since most cyclists go straight. They therefore wait for all cyclists going straight to proceed and then turn.

L3 - Due to an overcrowded bicycle track, 13 out of the 22 cyclists use the pedestrian crossings to arrive on the north west side before reaching the bicycle track on the north east side.

TRAFFIC LIGHT ANALYSIS

A majority of bicycle users arrive at a red light and only 28% of them arrive at the intersection when the traffic light is green.



Cyclists covering a large part of the corner waiting for the green light; stopped on the sidewalk and the car lane.



Cyclist jumping the red light.

1. VRIJHEIDSLAAN - AMSTELDIJK

KEY FINDINGS II

D. USER CONFLICTS

CYCLISTS > < PEDESTRIANS

THE JAM MANOEUVRE - Cyclist turning right on the sidewalk creating confusion for pedestrians (A)

South entry point - This access point is not as busy as the others and only 13 conflicts occurred. All of them happened between pedestrians and cyclists, when both users met on the sidewalk.

THE CYCLISTS BLOCKING - Cyclists stopping on the pedestrian crossing forcing pedestrians to circumvent them

West entry point - Generally, there is a long queue of waiting cyclists obstructing a part of the pedestrian crossing. However, the small number of pedestrians means conflicts don't happen often (B).



CYCLISTS > < CYCLISTS

South entry point - It is stressful for bicycle users coming from the south to access the bicycle track on the bridge with the important flow of bicycles coming from the west. This feeling is identified through the users reactions. They will either slow down coming up to the bridge and sometimes even stop to let the onslaught of bicycles from the west pass before accessing the bridge's bicycle track. Confusion is also identified by both cyclists from the south and west with the formation of a bottleneck at the intersection. The south sidewalk is therefore also used to avoid this jam. Though since this interaction can not be considered a conflict, it does not show up on the "user conflicts map".

THE IMPATIENT SYNDROME - Cyclists overtaking cyclists to be the first in line (C).

North entry point - Some cyclists overtake the crowd by going outside the bicycle lane or weaving among cyclists thus causing tension when re-entering the bicycle track.



1. VRIJHEIDSLAAN - AMSTELDIJK

West entry point - This access point is overcrowded and most conflicts are mainly due to impatience. Some cyclists ride outside the bicycle track and overtake the others to be in front of the group.

THE DISORIENTED SYNDROME - Cyclists using the pedestrian crossing or going on the sidewalk against the flow of traffic, encountering other cyclists

East entry point - The nature of the conflicts at this entry point is mainly between cyclists. A high number of them use the sidewalk, both the ones arriving from the north turning left (38 cyclists) and the ones arriving from the east turning right. This behaviour does not generate much conflict with pedestrians since there are few of them. (D)

CYCLISTS > < MOPEDS

THE SHARING STRUGGLE - Mopeds overtaking and weaving between cyclists

East entry point - Very often mopeds cross the intersection weaving between cyclists and behaving dangerously (E).

North entry: 7%

South entry: 8%

East entry: 4.5%

West entry: 6%

CYCLISTS > < DRIVERS

THE DRIVERS BLOCKING - Drivers stuck at the intersection and blocking the bicycle lane

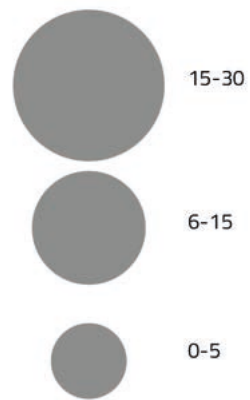
East entry point - In a few cases, car drivers block the bicycle lane. More often at the north-west corner, crowds of cyclists wait in the car lane blocking the drivers (F).

West entry point - While this access point is packed with cyclists, there is no conflict observed with drivers since a long pre-green allows many cyclists to cross the junction before cars start turning right.



1. VRIJHEIDSLAAN - AMSTELDIJK

Number of conflicts observed



Type of conflicts

Pedestrians > Cyclists

- P_a** Jam manoeuvre
- P_b** Cyclists blocking
- P_c** Cyclists rudeness

Cyclists > Cyclists

- C_a** Entailed blocked track
- C_b** Impatient syndrome
- C_c** Disoriented syndrome
- C_d** Surprising counterflow
- C_e** Forcing syndrome
- C_f** Priority confusion

car / truck Drivers > Cyclists

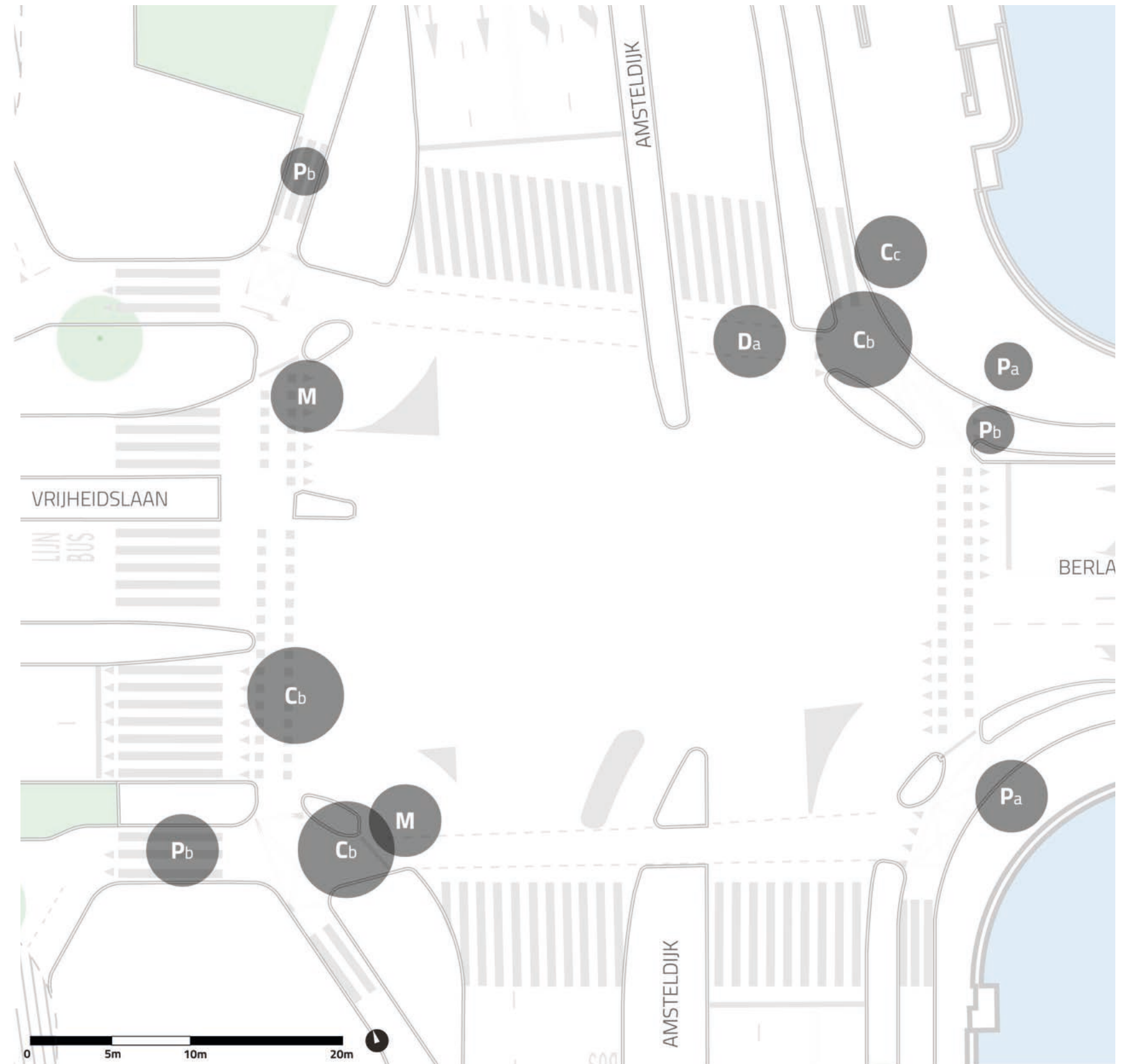
- D_a** Drivers blocking
- D_b** Undesignated car parking

Mopeds > Cyclists

- M** Sharing struggle

Trams > Cyclists

- T** Priority confusion



1. VRIJHEIDSLAAN - AMSTELDIJK

E. DESIGN PROPOSALS

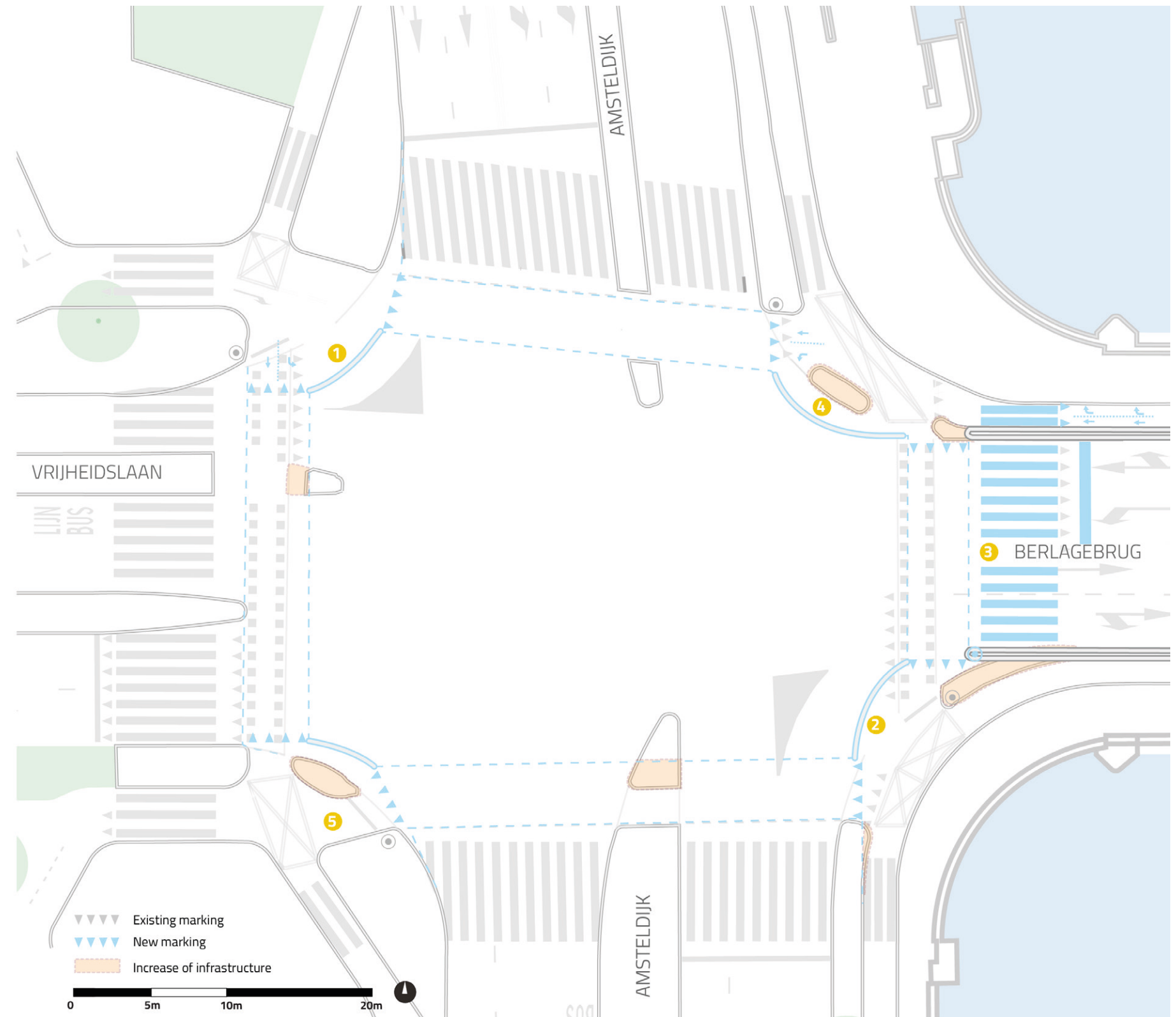
In general, in-between each entry point of the intersection a widening of the lane could ease the flow of cyclists. This is especially important at the southeast corner to tackle the occurring bottleneck effect. The bicycle lane is currently only 2 meters wide, being insufficient to accommodate the 1,789 cyclists per hour. Moreover, when an important number of cyclists turn left, a split of the waiting box into two lanes- one going straight and one turning left- could ease the flow of traffic.

North entry point - A waiting area (1) for the bicycle users coming from the east and willing to turn left could be created. This redesign must respect the car turning radius guidelines.

South entry point - The south-east corner has a really limited space. The bicycle track is squeezed between a narrow sidewalk and a row of trees which makes it difficult to widen. There is an empty space available between cars and the tram lanes. Nonetheless, assigning this extra space to cyclists would entail implementing radical changes to the street. Therefore, the creation of a right-turn lane is not an option. An alternative would be to create a wider waiting area (2) to make sure cyclists waiting don't block the ones turning right.

East entry point - There is no pedestrian crossing in the north-south direction. Implementing one (3) could push back cars providing more space behind the waiting box at the east entry and offer a more secure area for cyclists. Elsewhere, this crossing would offer pedestrians a legitimate trajectory for the north-south direction on the east side. Unfortunately, the track can not be split to create a right-turn lane before the intersection due to the width of the track. But the redesign of the waiting box (4) should provide more space for cyclists turning right.

West entry point - At the south-west corner, it is crucial to offer space to cyclists coming from the north and turning left as they stop and wait outside the waiting box. A wider waiting box (5) could be created but this extension is limited by the car turning radius and would not fit the expected number of cyclists. A wide waiting box could be created if the right-turn for cars was disallowed. Only 16 cars were counted turning right at this corner.



2 MR. VISSERPLEIN-WATERLOOPLEIN

A. THE NEIGHBOURHOOD

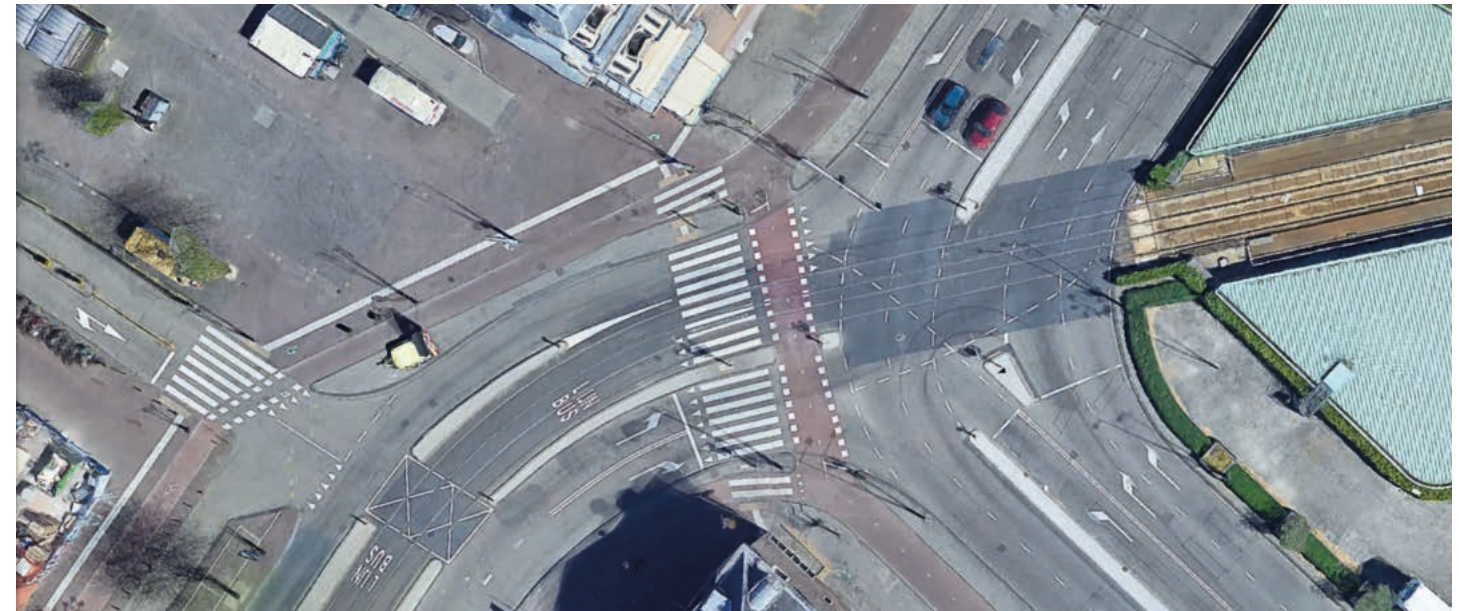
The intersection Mr. Visserplein - Waterlooplein is located in the city-centre of Amsterdam, in a busy district housing both touristic (museums, flea market, etc.) and local destinations (dwellings, offices, religious buildings, etc.).

Waterlooplein is a square hosting a daily flea market and is surrounded by the Stopera (housing both the city hall of Amsterdam and the Dutch National

Opera and Ballet) and a church, in addition to accommodations, offices and shops.

Mr. Visserplein is another main square surrounded by the Portuguese Synagogue and the Dutch Film Academy.

This area is a transport node counting three metro lines (51, 53, 54 - Waterlooplein station) and two tramway lines (9 and 14 - Waterlooplein and Mr. Visserplein stations).



Top view



Camera view

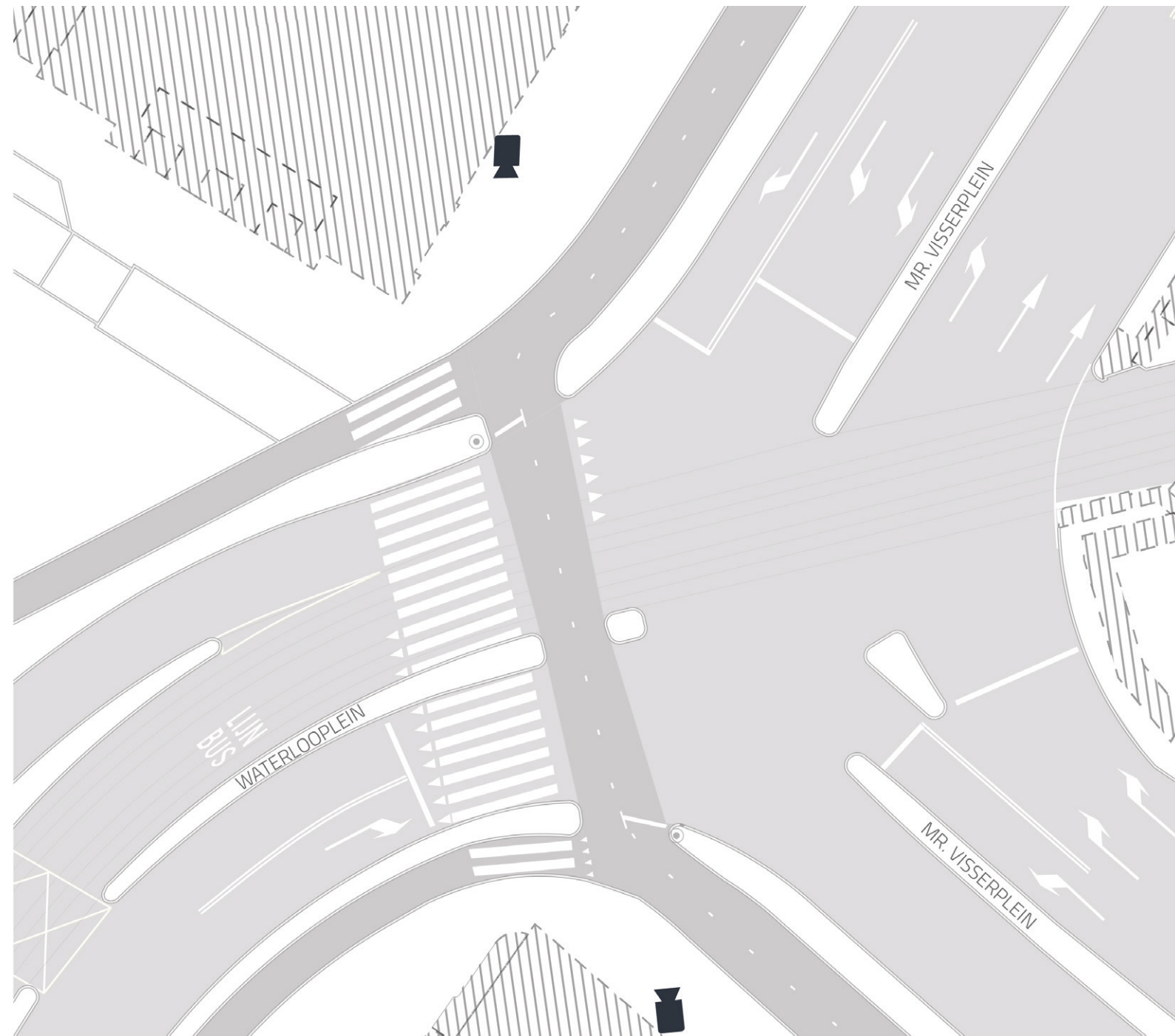
2. MR. VISSERPLEIN - WATERLOOPLEIN

B. THE INTERSECTION

Waterlooplein is comprised of two unidirectional bicycle tracks, tramway rails located in the middle of the street, and car lanes running in both directions.

In addition to being a square, **Mr. Visserplein** is a busy avenue comprised of a bidirectional cycle-track and three car lanes on either side.

On both sides of the intersection, cyclists can activate the green traffic light thanks to a push button. On the east side, the traffic light is equipped with a countdown system that indicates to users how much waiting-time is remaining to the next green light.



2. MR. VISSERPLEIN - WATERLOOPLEIN



North entry



East entry



South entry



West entry

2. MR. VISSERPLEIN - WATERLOOPLEIN

KEY FINDINGS I

C. THE DESIRE LINES

The intersection Mr. Visserplein - Waterlooplein was filmed on September 14th, 2017 from 8:15 to 9:15am by two cameras: one located on the east of the intersection and one in the north-west. A total of **1,386 cyclists** crossed the junction during the morning rush hour. The average volume of cars on Mr. Visserplein is X and X on Waterlooplein.

ENTRY POINTS

The flows arriving at the intersection are completely different. Whereas the north entry point channels three quarters of the total flow, the western one counts only 1% of it.

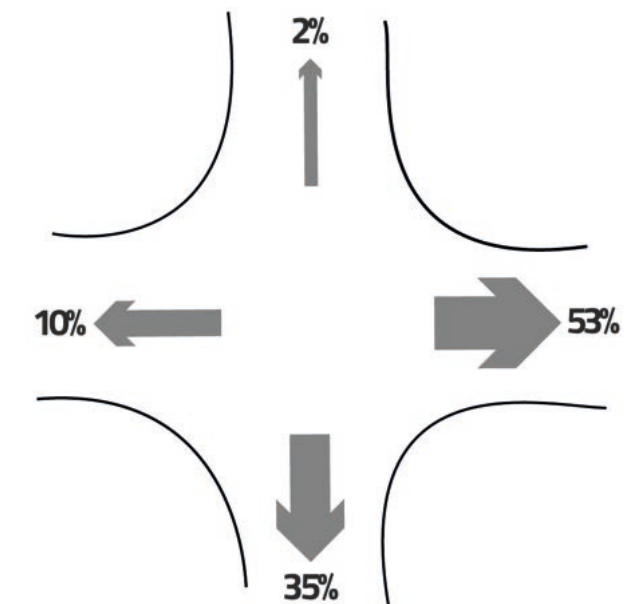
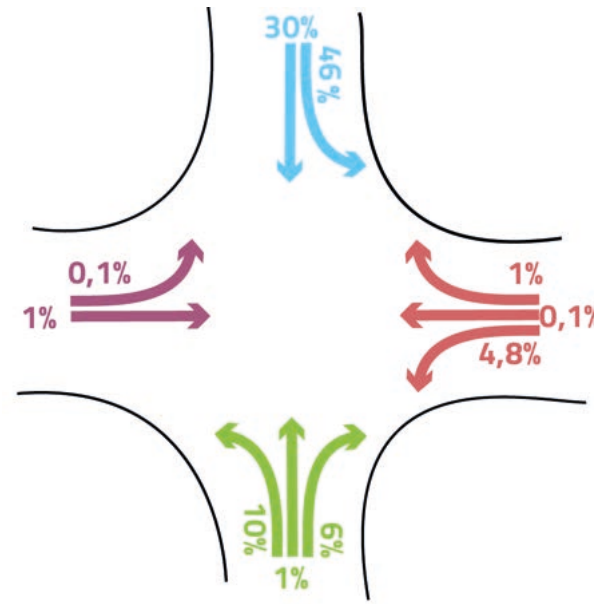
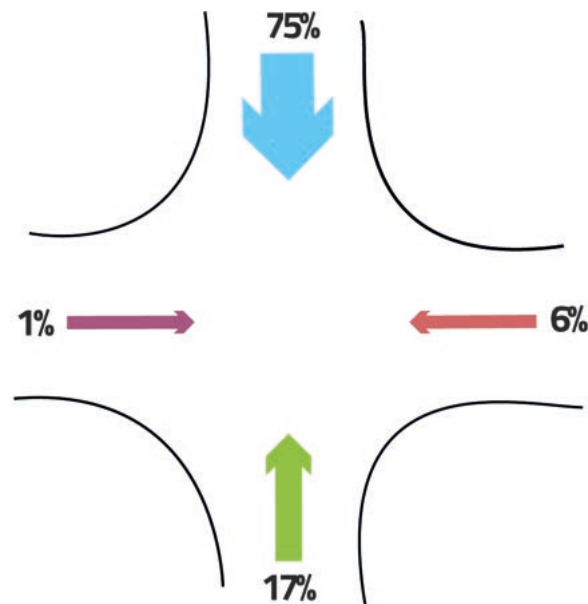
MAIN DIRECTIONS

Two directions - north to south and north to east - are by far the most used by the cyclists in the morning. In addition, 10% of cyclists arrive from the south and head west.

The U-turn manoeuvre (0.1%) does not appear on the scheme below.

EXIT POINTS

More than half of cyclists head east of the city, while almost two thirds head south, including 1% in counterflow.



2. MR. VISSERPLEIN - WATERLOOPLEIN

NORTH ENTRY POINT


With **1,045 cyclists** counted in an hour, the northern entry point is the busiest one. Up to 25 people wait at the traffic light to turn left (34:39), trying to leave space for the ones heading straight. Spontaneously, they use the whole width of the bidirectional track to wait at the traffic light.

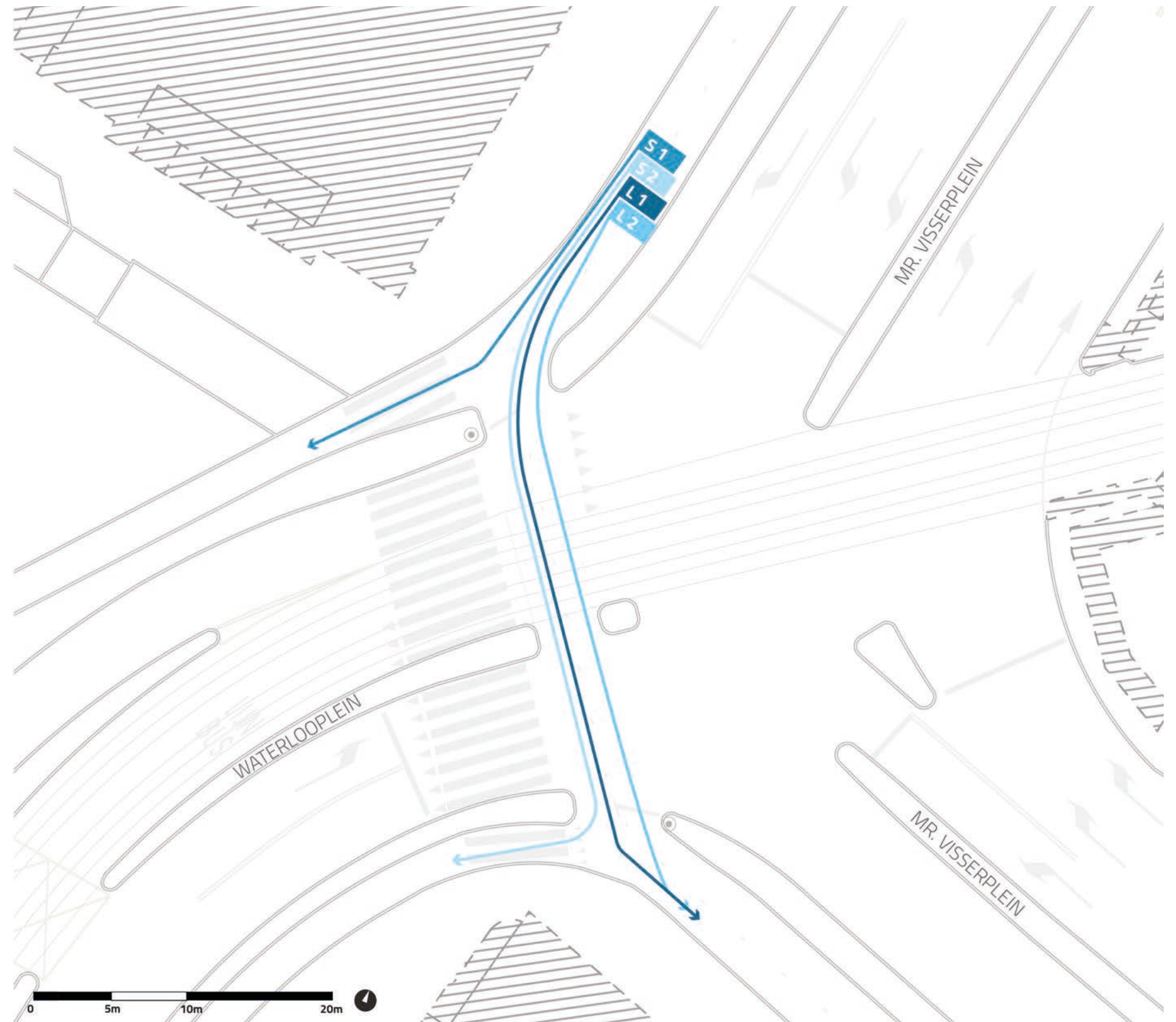
STRAIGHT 60% of cyclists arriving from the north head straight to Waterlooplein.

LEFT TURN 40% of cyclists arriving from the north turn left to keep on riding along Mr. Visserplein.

L1- These cyclists are considered as the ones respecting the bicycle track, even though an important part of them cut the corner while proceeding with the left turn, or stop on the counterflow lane, when crossing Waterlooplein. They rapidly reintegrate their dedicated lane, and then cut the corner on the other side of the intersection. It is common to see the full width of the lane being used by riders from one direction.

L2- These cyclists cross the total length -or almost- of the intersection riding on the counterflow lane. They are more likely to draw this trajectory when their own lane is crowded.

Label	S1	S2	L1	L2
	416	1	576	51
%	30	0.1	46	4



2. MR. VISSERPLEIN - WATERLOOPLEIN

SOUTH ENTRY POINT

239 cyclists arrive from the southern entry point on the unidirectional bicycle track.


STRAIGHT S1- Cyclists riding in counterflow to reach the bidirectional bicycle track and heading north were considered as going straight. During the busiest time of the rush hour, they must circumvent the group of cyclists waiting or ride on the sidewalk.

RIGHT TURN R1- More than two thirds of the cyclists proceed with a slight bend to turn right on Mr. Visserplein.

LEFT TURN L1- Most of the cyclists turning left respect the bicycle track. Nonetheless, we observed some users having difficulties to proceed with the 90° angle turn. Two users dismounted from their bicycle to position themselves correctly (47:59 & 59:47), one bumped into the curb (58:51), many repositioned themselves several times while waiting at the traffic light. Some users prefer to proceed with a large bend to arrive right in front of the stop line. They wait at the traffic light using the full width of the bidirectional bicycle track but quickly get back to their own lane due to the high volume of users arriving from the north.

L2- Even though some users arriving from the south cut the corner to turn left, they reintegrate their dedicated lane after a few meters.

L3- Actually, cyclists annoyed by this crowded corner and the difficulty to proceed with the left turn get out of the track earlier and ride on the pedestrian crossing, ignoring the busy bicycle lane. It happens especially when cyclists from the south notice that the ones arriving from the north are still crossing the intersection while their own traffic light is already red. Thus, by the time they reach the opposite side of the street, the northwest corner is empty of cyclists.

Label	S1	R1	L1	L2	L3	L4	L5	U1
	19	85	104	6	21	1	2	1
%	1	6	8	0.4	2	0.1	0.1	0.1



2. MR. VISSERPLEIN - WATERLOOPLEIN

EAST ENTRY POINT


82 cyclists arrive from the east riding on the bidirectional bicycle track of Mr. Visserplein.

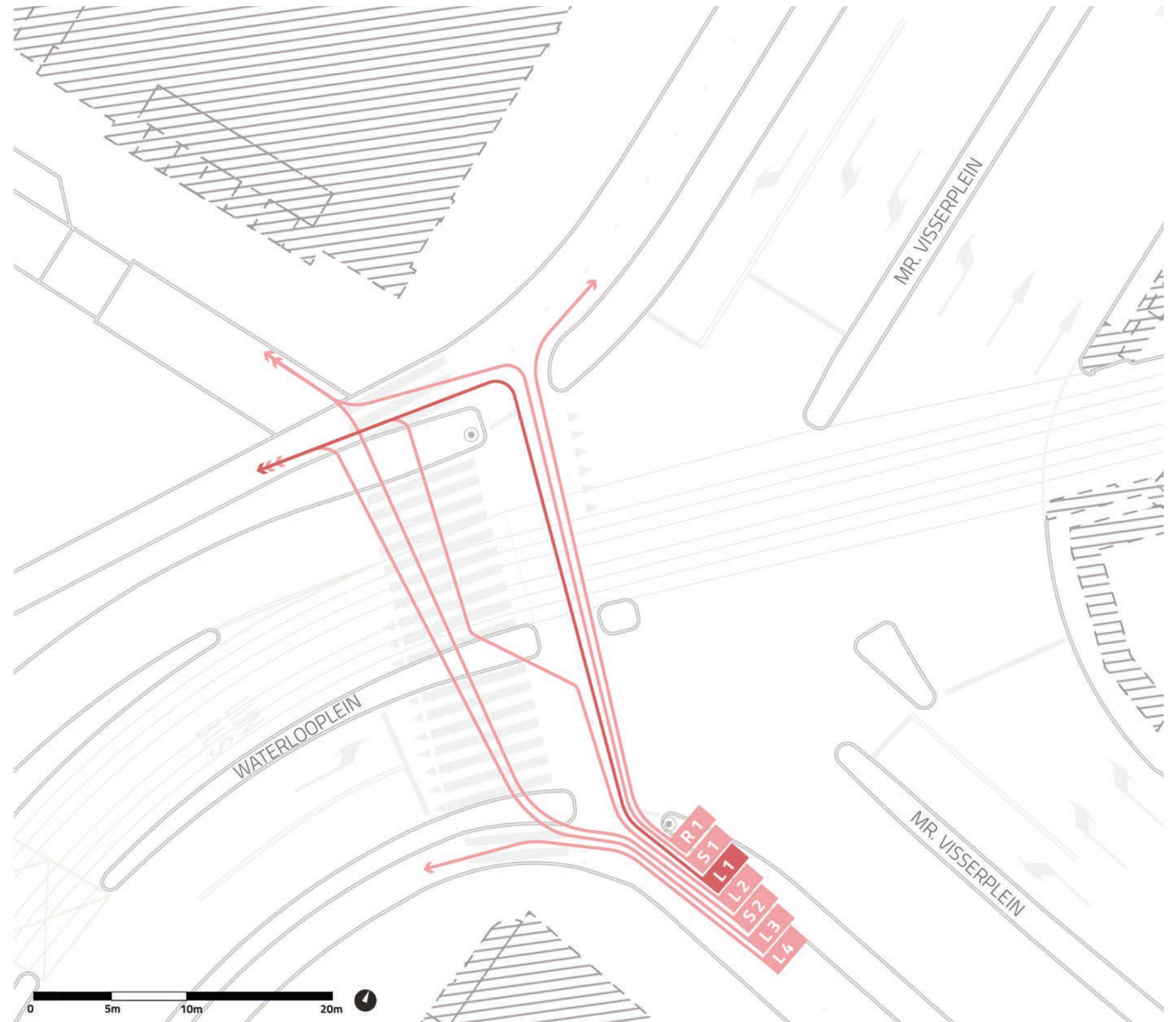
RIGHT TURN 10 cyclists arriving from the east turn right keeping their way along Mr. Visserplein and then probably heading west to the city-center.

LEFT TURN 85% of the cyclists arriving from the east turn left to the south. They must proceed with a tight bend at the busy eastern corner. They often have to reduce their speed or stop to give priority to cyclists arriving from the north.

L2- L3- This difficult left-turn entices some cyclists to ignore the eastern corner by riding on the pedestrian crossing totally or partly.

L4- In order to completely skip the western corner, 20 cyclists turn left riding in counterflow. They often check this corner first, then decide to bend the rules.

Label	S1	S2	R1	L1	L2	L3	L4
	1	1	10	39	5	6	20
%	0.1	0.1	1	3	0.4	0.4	1




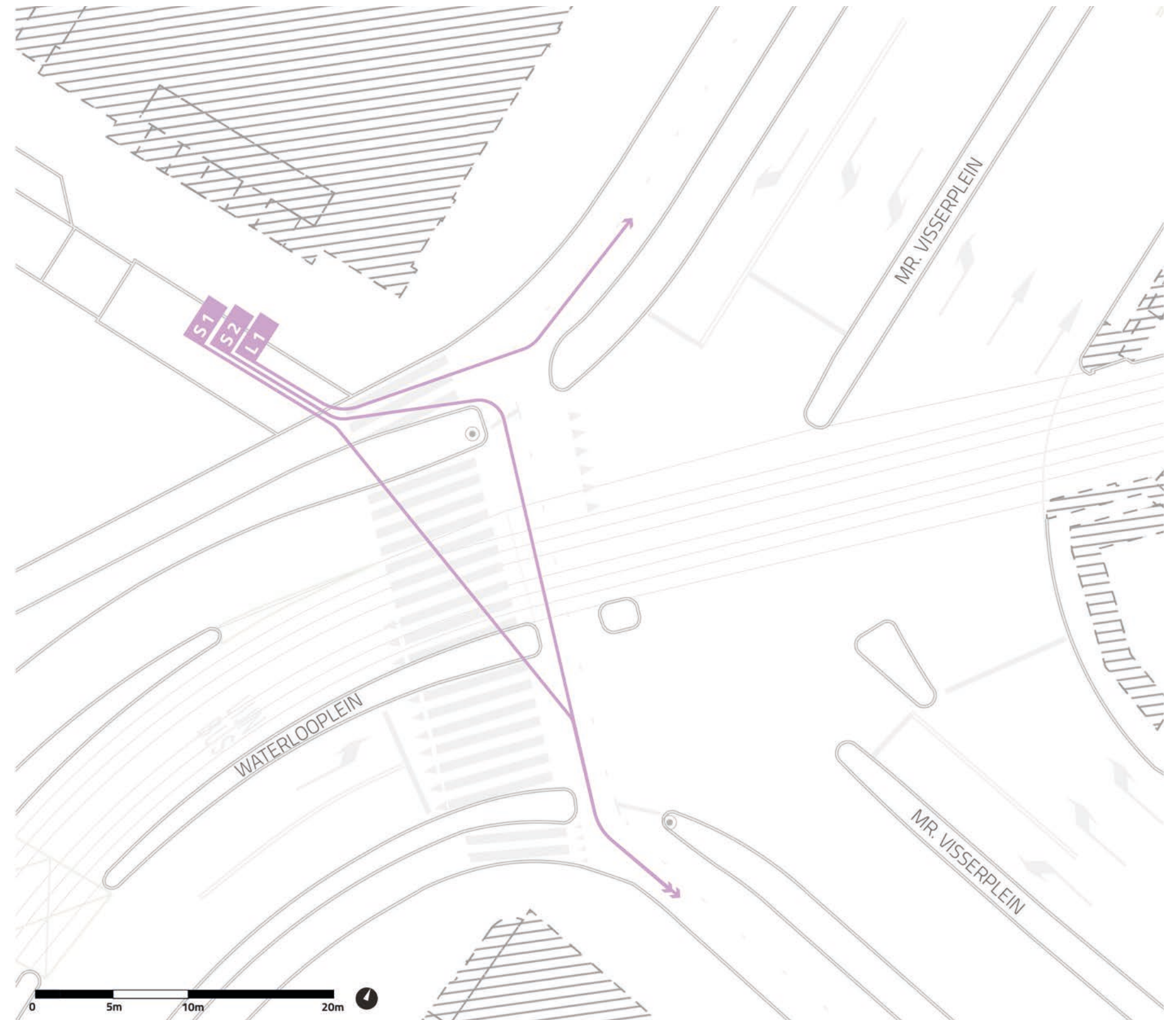
2. MR. VISSERPLEIN - WATERLOOPLEIN

WEST ENTRY POINT

Only **20 cyclists** arriving from the west, from the alley along Waterloooplein (the square), head straight to the east or turn left to the north. Since they don't benefit from a designated space, these users ride on the pedestrian crossing in counterflow before reaching the traffic light or use the bidirectional bicycle track.

Users turning right were not counted as they do not impact the intersection Mr. Visserplein - Waterloooplein.

Label	S1	S2	L1
	3	15	2
%	0.2	1	0.1



2. MR. VISSERPLEIN - WATERLOOPLEIN

TRAFFIC LIGHT ANALYSIS

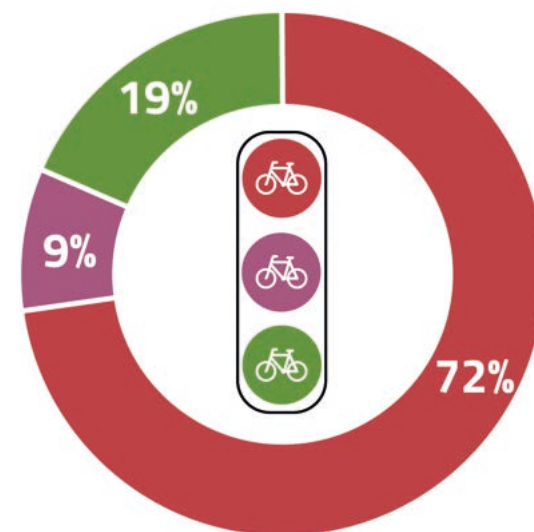
The traffic light analysed is the one equipped with a countdown system indicating to users how much waiting-time is remaining to the next green light (A). This equipment is supposed to instill cyclists with a greater respect towards the red light. Based on the results of this brief study, it is not possible to draw sure conclusions as a before/after analysis would have been more accurate. **The 9% of cyclists jumping the red light can be considered as an average number compared with the other intersections analysed in this report (minimum: 5%, maximum :14%).**

The users jump the red light when cyclists arriving in the opposite direction are still crossing the junction or when the first car lanes are empty, so they cross the street in two times. Therefore, cyclists pay more attention to the ongoing situation at the junction than at the countdown. At 28:38 (B) a typical "follow the leader" effect happened when a cyclist arriving at the stop line decided to jump the red light and the two users waiting took this opportunity to follow him.

It is worth noticing that many cyclists getting the green light (or amber light) hurry up and ride on the pedestrian crossing. Moreover, many cyclists ride in counterflow in order to skip this intersection and not to wait at the red light.



SOUTH & EAST ENTRY POINTS



2. MR. VISSERPLEIN - WATERLOOPLEIN

KEY FINDINGS II

D. USER CONFLICTS

The number of conflicts is rather low at this intersection. Nonetheless, crossing Mr. Visserplein – Waterlooplein is not a smooth trip for the users having to proceed with a turn. This slight impact on the quality of the journey is due to the core features in the design of the infrastructure:

- The bidirectional bicycle track challenging some turns and forcing users to interlace their trajectories;
- The sharp angles at both corners;
- The lack of space to wait at the traffic light.
- These elements force cyclists to adapt their pace, sometimes stop to give priority before proceeding with a turn, or manoeuvre through a group of waiting cyclists.
- As often noticed when the intersections seem to be more complicated for users, they refer back to hand signaling to express their desire to turn. This phenomenon also occurs at this intersection (A-15:25).
- The low number of conflicts is also the result of the cyclists skipping the busy corners and riding on the pedestrian crossing.

In addition to the design elements, the important difference in flow size creates an unequal balance of power making the main flow (from north to east) dominate the space.

CYCLISTS > < CYCLISTS

THE ENTAILED BLOCKED TRACK - Cyclists stopping and blocking the perpendicular track

Northwest corner - The bicycle track is blocked by cyclists coming from the north (46% of the total flow) and waiting at the traffic light (B-46:22).

This situation is disturbing :

- for cyclists arriving from the east and proceeding with a left turn to head south (5% of the flow) (C-34:48).



2. MR. VISSERPLEIN - WATERLOOPLEIN

- for cyclists arriving from the north heading straight to the south (10% of the flow).

Even though no marks guide cyclists, they naturally position themselves in a logical way, trying to create a line right in the middle of the double bicycle track, to leave space for cyclists heading straight to the south (A-19:43). When this line gets thicker, the space for those cyclists decreases and they must seriously reduce their speed to find a way through the group (A-37:31; A-46:22).

THE IMPATIENT SYNDROME - Cyclists overtaking cyclists to be the first on the line

As usual, some cyclists try to reach the stop line to cross the intersection faster.

THE SURPRISING COUNTERFLOW - Cyclists going on the pedestrian crossing or in the wrong direction, stepping with other cyclists

Northwest corner - The "surprising counterflow" happens in three situations:

When a cyclist arriving from the west and reaching the bidirectional bicycle track must go through the group of waiting cyclists. They don't benefit from a legitimate space and are forced to ride on the opposite lane to avoid the group (F-52:45) or to ride on the sidewalk.

When a cyclist arriving from the south and turning left on the pedestrian crossing bothers the ones arriving from the east and turning left towards the south (G-43:04).

This situation happens in the middle of the intersection when an important flow of cyclists from the north use almost the full width and "push" the ones arriving in the opposite direction on the edge of the lane (H- 54:00).

Southwest corner - Some cyclists arrive from the south and proceed



2. MR. VISSERPLEIN - WATERLOOPLEIN

with a sharp bend to arrive at the intersection faster, using the counterflow lane and therefore surprising other cyclists.

THE FORCING SYNDROME - Cyclist not giving priority to another cyclist

Southwest corner - Cyclists arriving from the south must give priority to the ones coming from the west. Yet some cyclists tend to speed up to turn and avoid stopping (I- 12:36).

CYCLISTS > < DRIVERS

THE DRIVERS BLOCKING - Drivers stuck at the intersection and blocking the bicycle lane

Northwest corner - Only one car waiting at the traffic light blocked the bicycle track and forced cyclists to manoeuvre around to cross the intersection (J- 49:53).



CYCLISTS > < MOPEDS

THE SHARING STRUGGLE - Mopeds overtaking and weaving between cyclists

The number of conflicts with mopeds is lower than usual at this intersection. Less moped drivers try to gain access to the front row at the traffic light and be first to start when it turns green.

Share of mopeds in relation to the total number of cycling infrastructure users:

North entry: 6% (67 units)

South entry: 8% (20 units)

East entry: 7% (6 units)

West entry: / (1 unit)



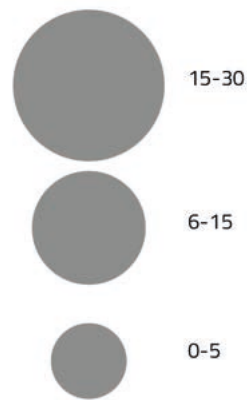
CYCLISTS > < TRAMS

THE PRIORITY CONFUSION - Cyclists having to slow down / stop in the middle of the crossroad due to the tramway passing

Once at each corner, a cyclist jumped the red light, then realised that he has to give priority to the tramway and he is forced to stop in the middle of the intersection (K-25:31).

2. MR. VISSERPLEIN - WATERLOOPLEIN

Number of conflicts observed



Type of conflicts

Pedestrians > < Cyclists

- Pa** Jam manoeuvre
- Pb** Cyclists blocking
- Pc** Cyclists rudeness

Cyclists > < Cyclists

- Ca** Entailed blocked track
- Cb** Impatient syndrome
- Cc** Disoriented syndrome
- Cd** Surprising counterflow
- Ce** Forcing syndrome
- Cf** Priority confusion

car / truck Drivers > < Cyclists

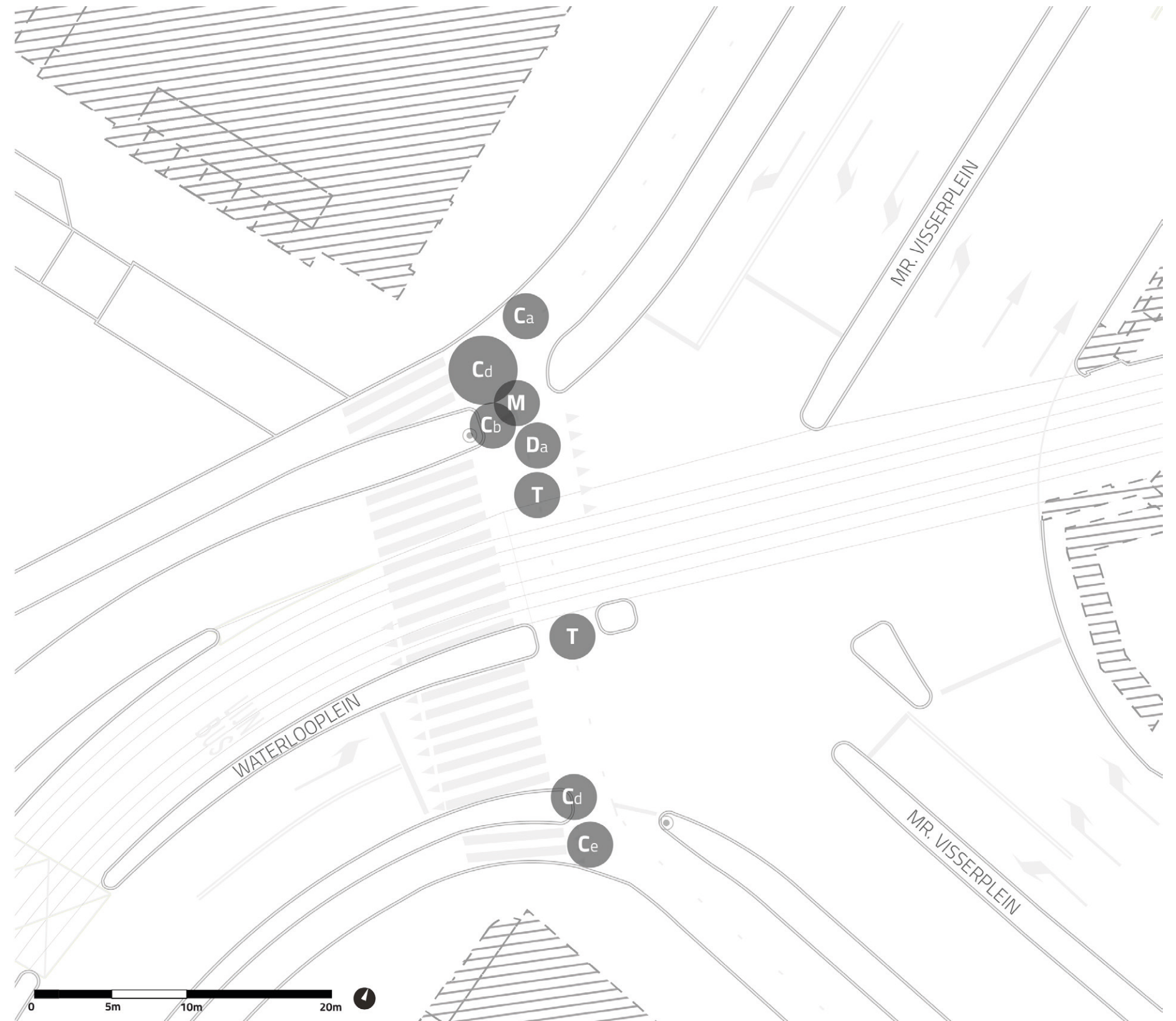
- Da** Drivers blocking
- Db** Undesignated car parking

Mopeds > < Cyclists

- M** Sharing struggle

Trams > < Cyclists

- T** Priority confusion



2. MR. VISSERPLEIN - WATERLOOPLEIN

E. DESIGN PROPOSALS

At this intersection, serious user conflicts are rather low. Nonetheless, the design makes some turns uncomfortable. A redesign of the junction should facilitate the left turn at each corner and offer more space to wait at traffic lights.

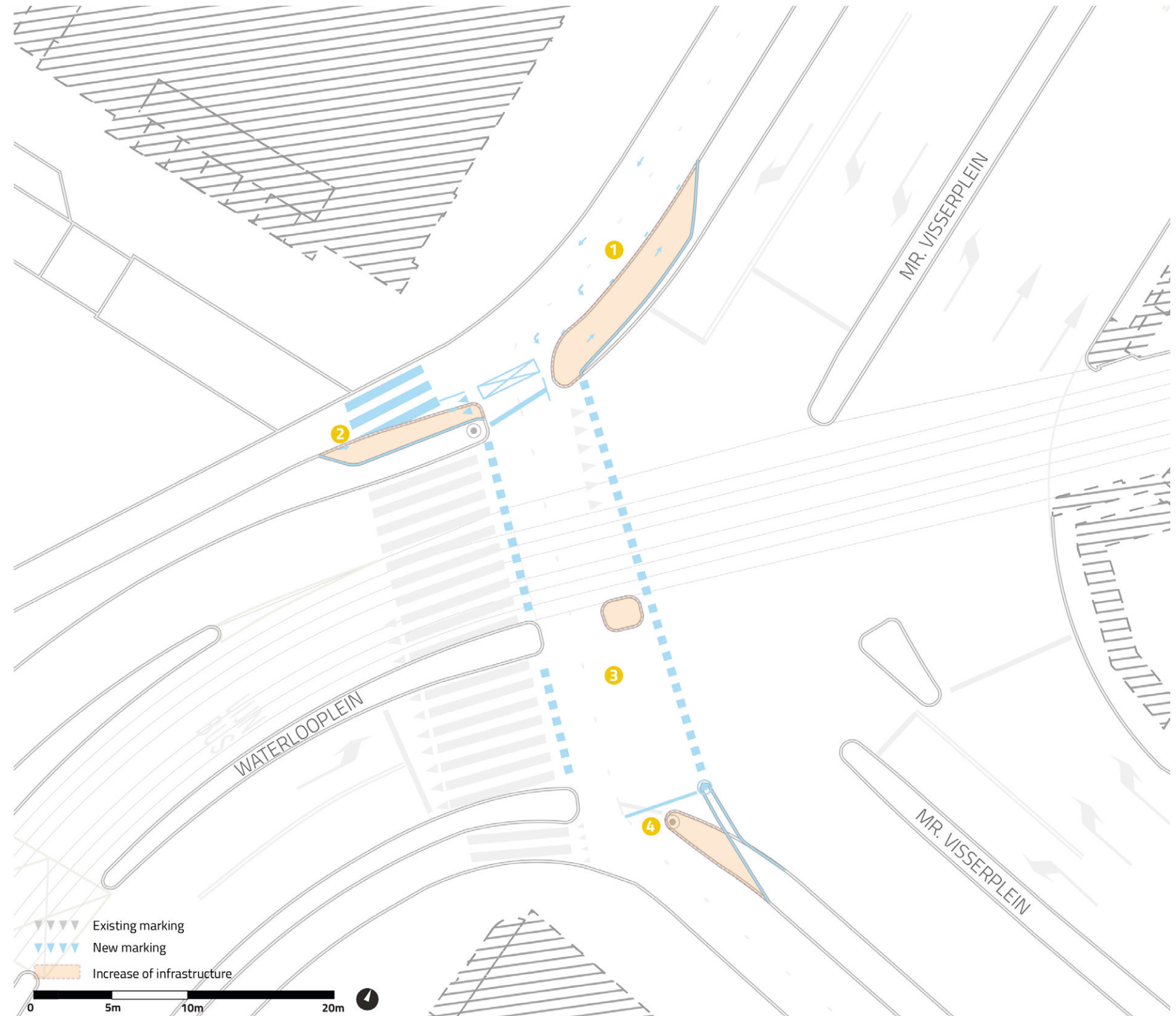
According to the City of Amsterdam, it's not an option to create a new unidirectional bicycle track along Mr. Visserplein. This solution would have eased the left turn at this crossing, but the same uncomfortable situation would have been created at the next one.

Northwest corner - A wider waiting area (1) should be created and an extra lane added for waiting cyclists. A dedicated lane (2) could be added to help cyclists arriving from the west to remain on the right side of the bicycle track.

At this crossing, the bicycle lane is widened (3).

Adjustment of the traffic lights - Sometimes, the traffic light at the southeast corner turns green before the northwest one, offering a head-start to the lower flow of cyclists. For instance, at 34:35, a cyclist is crossing the junction while the traffic light is red at the northwest corner. Therefore, at 34:48, this woman has to stop to let the flow of cyclists pass before being able to proceed with a left turn and head south. This situation should be switched to offer a head-start to users arriving from the north. With this change, cyclists from the east would have more chance to arrive at the northwest corner when it is empty.

Southeast corner - A wider waiting box (4) could be created to keep cyclists waiting at the traffic light. This measure would be especially important if a head-start is given to cyclists arriving from the north. This redesign must respect the car turning radius guidelines.



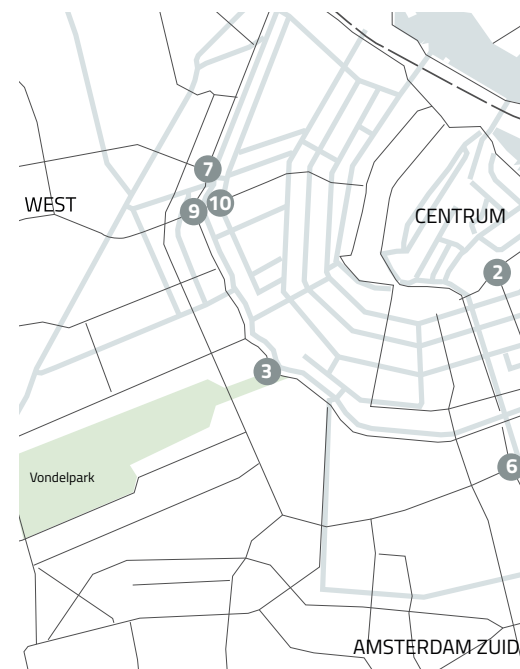
3 VONDELPARK – MAX EUWEPLEIN

A. THE NEIGHBOURHOOD

The intersection Vondelpark – Max Euweplein, part of Amsterdam-West, is located in the heart of the city, at the northern border of Vondelbuurt district, which is a dense and wealthy residential area.

To be more precise, the junction is located between the northern entrance of Vondelpark and Max Euweplein. Vondelpark is the largest city park in

Amsterdam. With 10 million visitors every year, it attracts both locals and tourists. Cycling is allowed in the park, and several bicycle routes are used daily by thousands of inhabitants. Max Euweplein is a dense car-free block of buildings hosting entertaining and cultural venues (casino, theatre, museums, clubs, etc.) and touristic restaurants. A bicycle route goes through the main square and connects the historical city-centre to Vondelpark and the residential districts surrounding it.



Top view



Camera view

3. VONDELPARK – MAX EUWEPLEIN

B. THE INTERSECTION

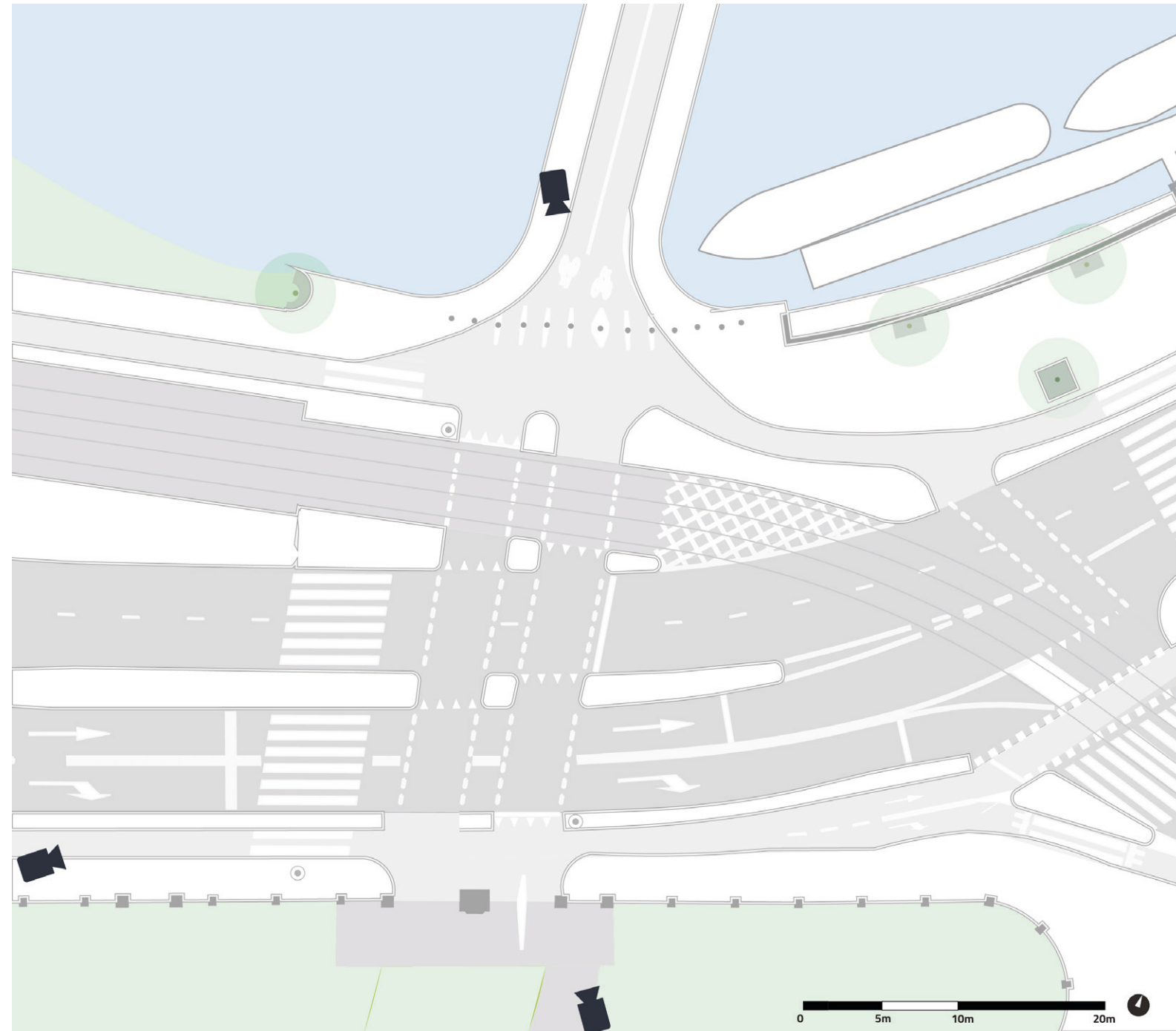
This unusual intersection is composed of a pedestrian and cyclist path located in a park, an active-mobility only bridge and a main boulevard.

At the northern entrance of Vondelpark, the north-south bicycle path meets Stadhouderskade, a two-way street for cars and tramways (lines 2, 5 and 578). This avenue has bicycle tracks on both sides, measuring around 2 metres wide.

The bridge Hein Donner is car-free, allowing only pedestrians and cyclists to access Max Euweplein.

Therefore, this junction is the crossing point of two unidirectional bicycle tracks and a bidirectional bicycle route.

The flows of users are channelled by traffic lights.



3. VONDELPARK - MAX EUWEPLEIN



North entry



East entry



South entry



West entry

3. VONDELPARK - MAX EUWEPLEIN

KEY FINDINGS I

C. THE DESIRE LINES

The intersection Vondelpark - Max Euweplein was filmed on May 30th, 2017 from 8:15 to 9:15am by three cameras: one located in the north (on the bridge), one in the west (on Stadhouderskade) and one in the south of the intersection (in the park). **3,308 cyclists** crossed the junction during the morning rush hour. The average volume of cars on Stadhouderskade is X.

ENTRY POINTS

Most of the flow arrives from the west – meaning from the main boulevard surrounding the city-centre, and from the south, through Vondelpark. The other entry flows are distributed rather equally and vary between 11% and 17% of the total flow of users.

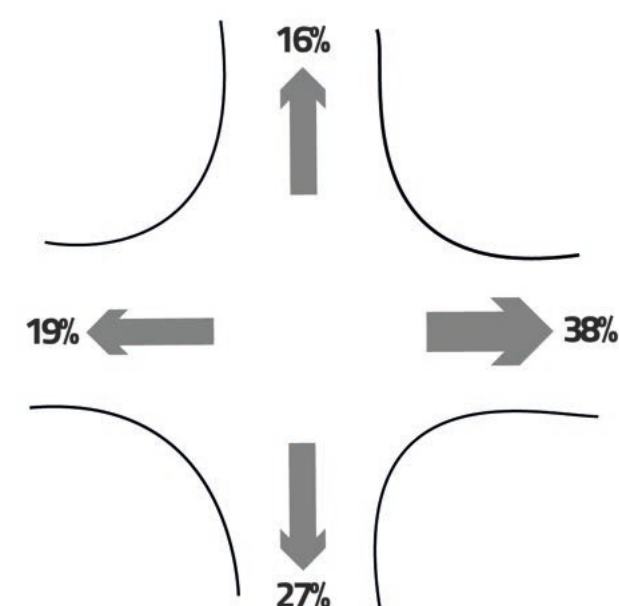
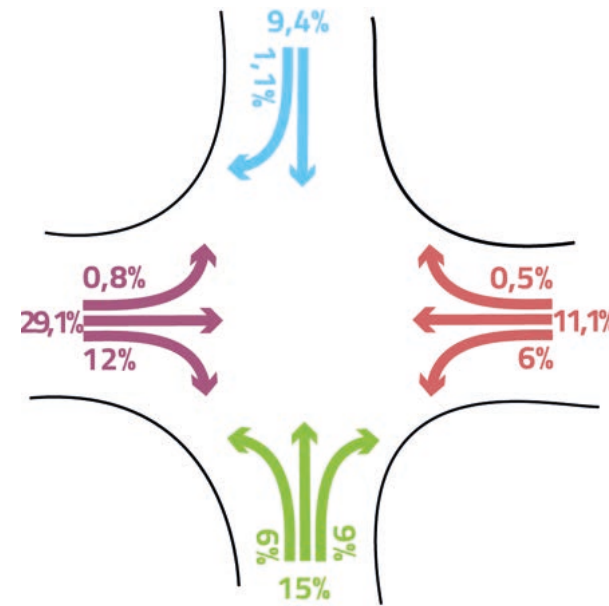
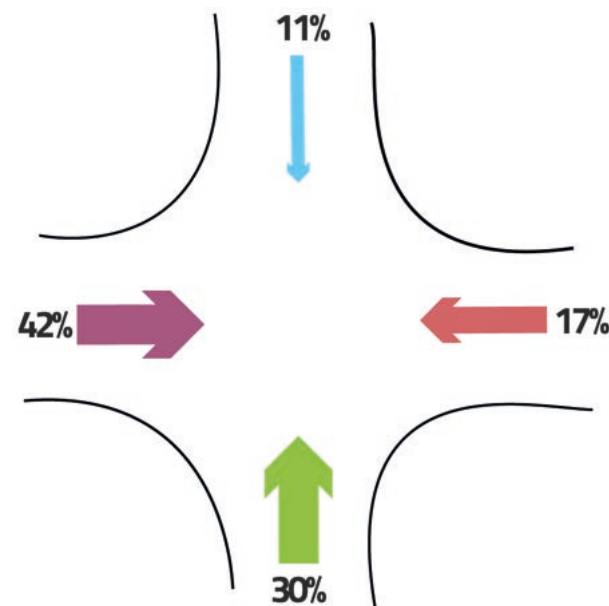
MAIN DIRECTIONS

During the morning rush hour, the west-east cycling route on Stadhouderskade is the main one.

Moreover, the green path through the park channels an important part of the flows no matter the direction the cyclists come from. At this intersection, a few directions were almost not used, such as the left turn from the northern and western entries and the right turn from the eastern entry.

EXIT POINTS

More than a third of the flow of cyclists crossing this junction head east by using the main boulevard surrounding the city-centre or maybe turn right on Hobbemastraat. Around a quarter of the flow head south through the park. The less used direction is the northern one through Max Euweplein.



3. VONDELPARK – MAX EUWEPLEIN

NORTH ENTRY POINT

The smallest volume of cyclists arriving at this junction comes from the northern entry, with **357 bicycle users** in an hour. They use a bidirectional cycle track. During the busiest moment of the rush hour, cyclists have difficulties accessing the intersection and must wait for the flow of cyclists arriving from the south and the east to pass.

Most of the cyclists (305 cyclists) head straight to Vondelpark.


STRAIGHT The exit is pretty wide and cyclists are used to waiting at the traffic light using the whole width. 4 to 5 cyclists fit in line with the width of the exit. A pattern was observed: the first two cyclists arriving at the intersection stop by the push buttons on both sides of the exit -they usually push the button, hoping to activate the green light- and then other users stop in the middle. The bicycle lane and the entrance of the park are wide and allow an important group of users to cross the intersection quickly instead of queuing in line.

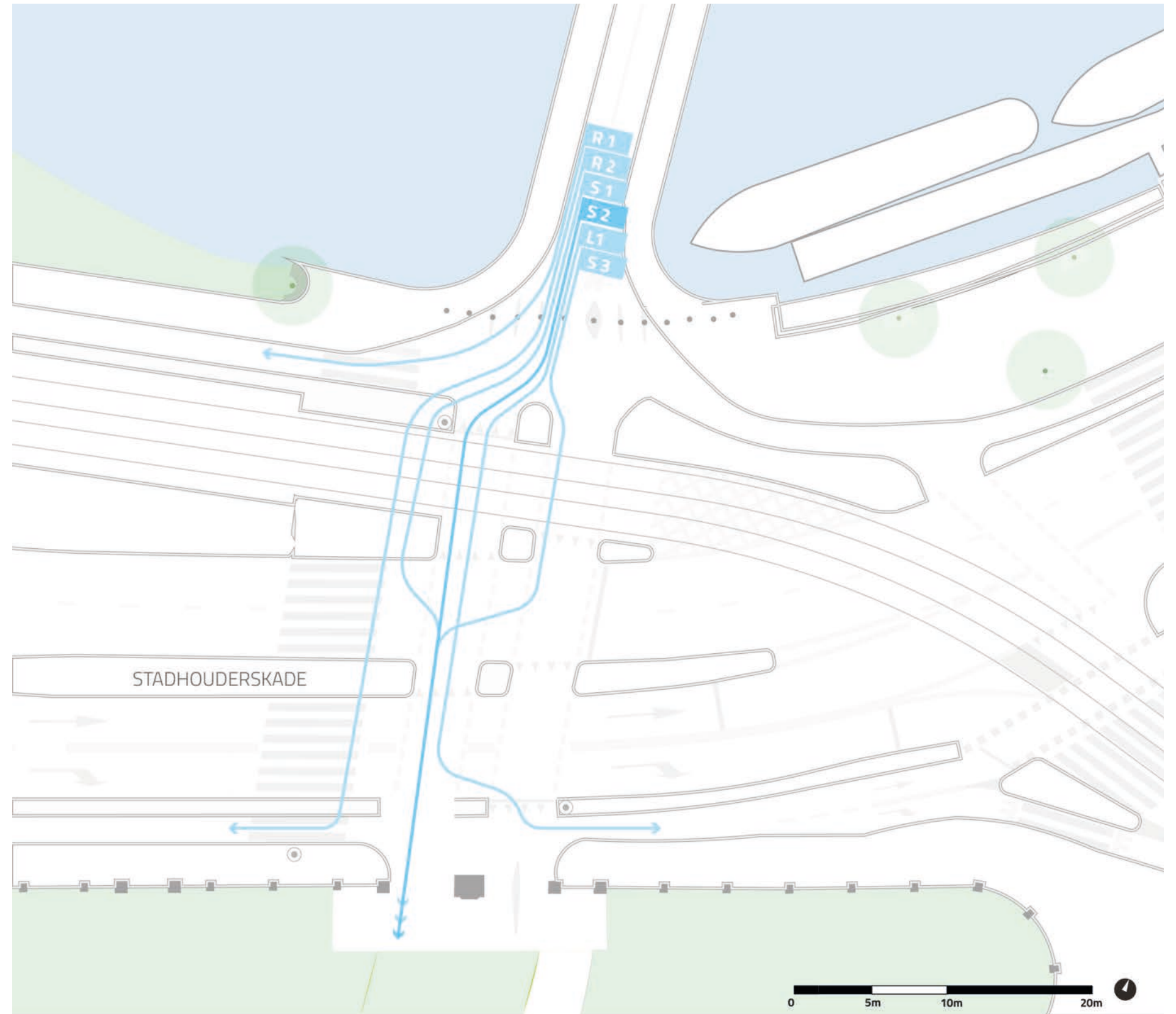
When the waiting area is full, some cyclists (21 during this hour of observation) stop by the bollards to wait for the green light in order to leave space for cyclists riding on the perpendicular bicycle track.

S1 & S3 - When many people are waiting at the traffic light, some cyclists use the entrance of the bridge or the pedestrian crossing before reintegrating into the bicycle lane. These cyclists are more likely to jump the red light to cross the boulevard.

Only one cyclist is counted turning left.

LEFT TURN

Label	S1	S2	S3	R1	R2	L1
	8	289	8	49	2	1
%	0.2	9	0.2	1	0.1	0.1



3. VONDELPARK - MAX EUWEPLEIN

SOUTH ENTRY POINT

1,014 cyclists arrive from the bicycle route through Vondelpark.

The different entrances/exits of the park work as dedicated cycle lanes to turn left/right. Depending of their directions, cyclists coming from the south use different exits. This pattern shows how much Amsterdam's inhabitants are used to anticipate their turn before an intersection and choose the shorter trajectory as well as the one making them stop or wait the least.

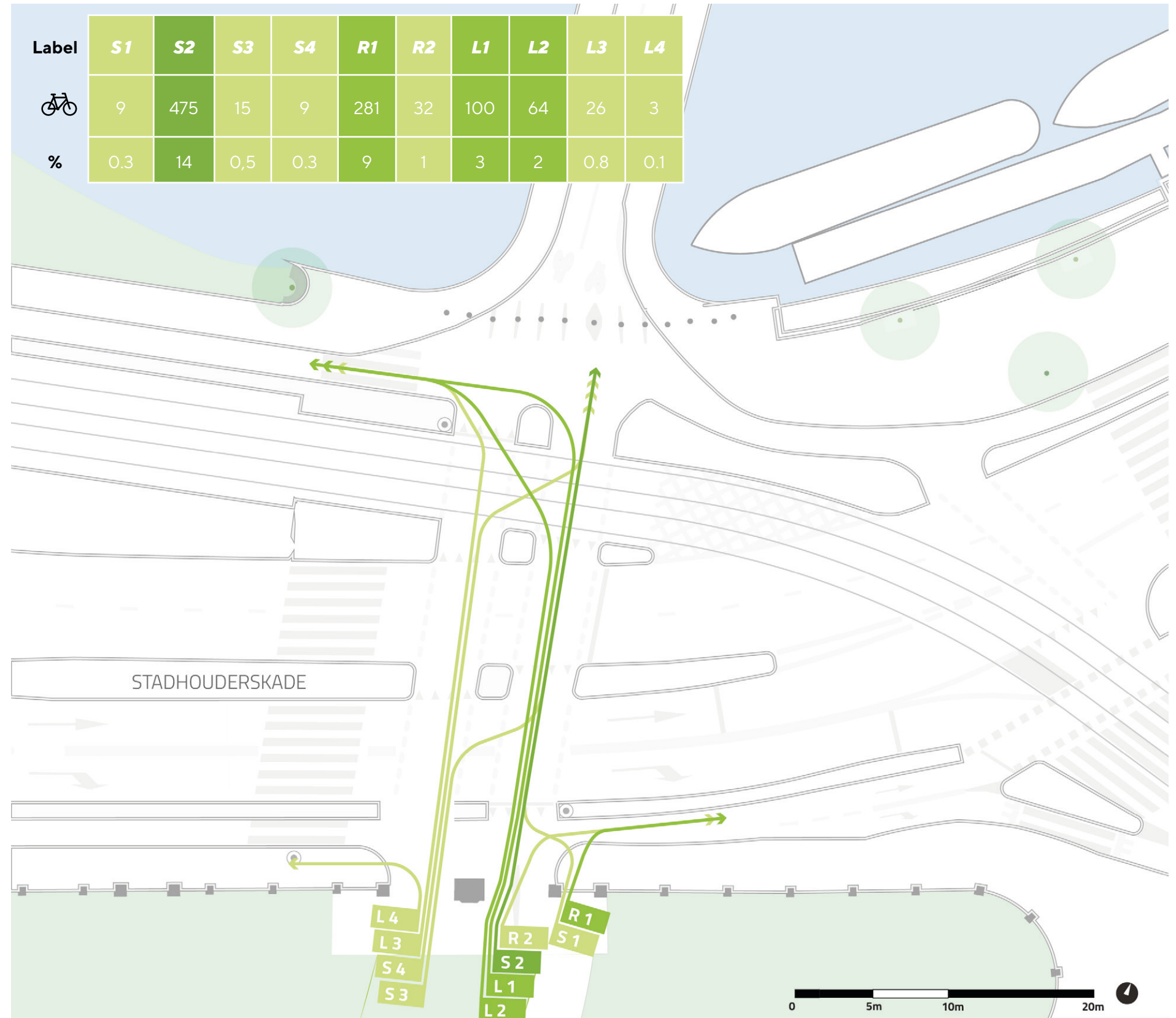
STRAIGHT At this intersection, users wait for the green light inside the park and can use a wide exit, which allows 4 to 5 cyclists to fit in a row. Sometimes, more than 20 cyclists are waiting at the traffic light. The green light is long enough to allow all of them to cross the intersection. We did not observe a specific pressure from cyclists rushing to get the green light. Even though cyclists are riding on a very safe route, most of them don't arrive at a high speed. This may be due to the reduced visibility on the left, which does not allow people to anticipate whether they can go through the amber/red light and, therefore, they don't rush on the last metres before the intersection.

S2 - 94% of cyclists heading straight respect the bicycle lane.

S1 - S3 - S4 - A few cyclists stop the closest to the intersection by using the exits located on the right and the left of the main one. These users are more likely to jump the red light.

RIGHT TURN Even though there is no dedicated lane on the ground, 90% of people turning right use the right exit. This allows cyclists to proceed to a direct turn without waiting at the traffic light. Nonetheless, the exit is sometimes too narrow for the high number of cyclists and the visibility on the left is reduced by the massive pole. Therefore, cyclists slow down, or use the sidewalk to get access to the bicycle track, or stop. With the west-east flow being dense and not well regulated by the traffic light, they regularly stop to give priority to cyclists arriving from their left.

LEFT TURN **L2 - L3** - Almost 50% of cyclists turning left manage to find a more direct trajectory to proceed to this bend.



3. VONDELPARK - MAX EUWEPLEIN

EAST ENTRY POINT

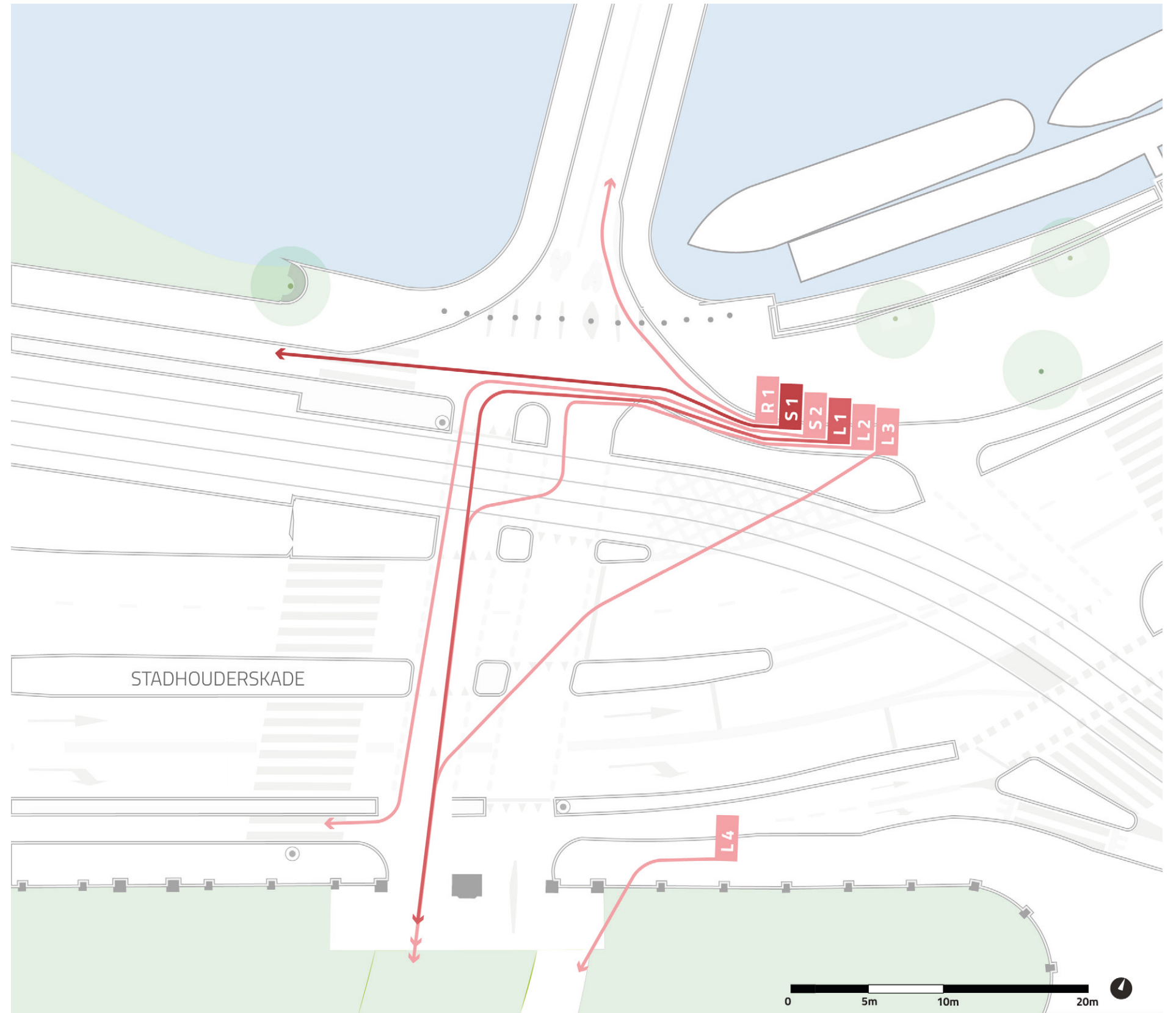
579 bicycle users arrive from the eastern entry on a unidirectional bicycle track. This one crosses the north-south bidirectional bicycle route. Most of the cyclists arrive from Stadhouderskade and a few from Hobbemastraat, especially some who turn right at this intersection.

About 2/3 of users cycle straight, whereas 1/3 turns left to head south to Vondelpark. There is no yield mark on the ground and a balance of power is observed between cyclists arriving from the south and the east. When a dense flow of cyclists arrives from the south, cyclists from the east stop to give them priority (30:26 and 37:50). In contrast, it happens that cyclists from the east take their priority when some arrive from the south (25:29, 56:28, 57:43).

STRAIGHT The convex shape of the sidewalk/island gently channels users to the right and enlarges the space where cyclists wait at the red light. This design has a positive behavioural effect. Only a few cyclists cut the corner of the sidewalk.

LEFT TURN **L2** - Only 22 users are counted using the entrance of the track to turn left before reintegrating into the bicycle lane. Nonetheless, cyclists naturally use the space in front of the entrance to wait.
L3 - This trajectory appears only during the last ten minutes of the rush hour and is made by cyclists in a rush.

Label	S1	S2	R1	L1	L2	L3	L4
	378	4	6	151	22	3	3
%	11	0.1	0.2	5	0.7	0.1	0.1



3. VONDELPARK – MAX EUWEPLEIN

WEST ENTRY POINT


The highest number of cyclists – **1,358** – crossing the intersection arrive from the western entry. A high number of children, teenagers and families are observed on this route. This profile of users has consequences on the traffic, since they cycle slower and in groups.

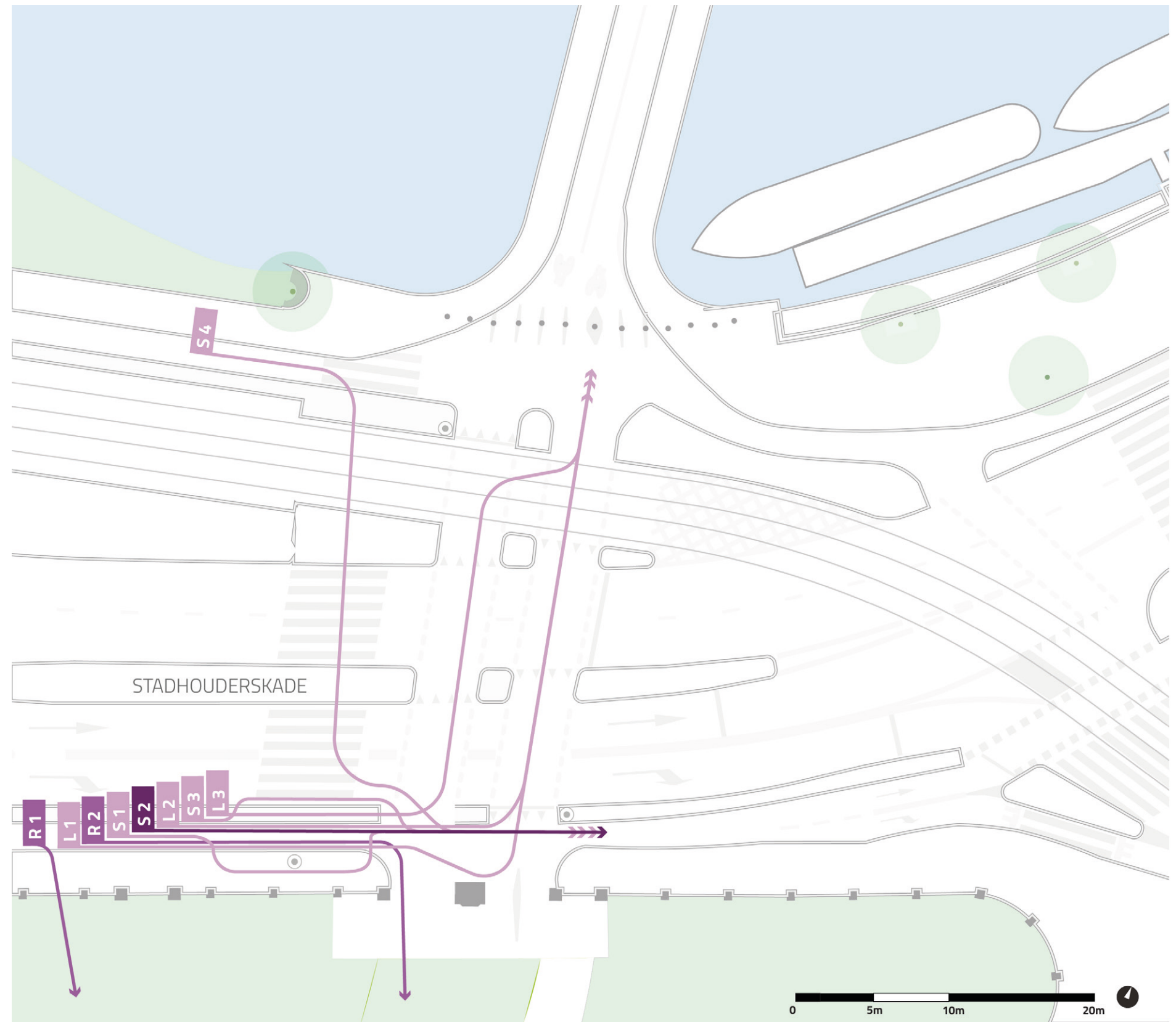
The traffic light located in the middle of the pedestrian crossing is not often respected; cyclists stop further if they have to give priority to cyclists riding in a perpendicular way. When the tramway is passing, this traffic light is sometimes red, whereas there is no danger for cyclists heading straight and turning right to cross the junction.

Compared with other intersections, it has been observed that cyclists more frequently use their arm to indicate the direction of their turn. This may be explained by the density of the flow and the access to a green route through a park, which can be considered as surprising.

STRAIGHT **S1 - S3** - With the bicycle track being rather narrow, when cyclists stop at the red light, a long line of users (up to 18-20 users) are rapidly queuing and entail impatient behaviour: cyclists overtaking the group waiting by riding on the sidewalk or the car lane.

RIGHT TURN 76% of cyclists turning right proceed to this move by using the first – but narrower one that is not connected to the bicycle route – by the entrance to the park, instead of the main one. Cyclists proceed this way even when the traffic light giving access to the main entrance is green.

Label	S1	S2	S3	S4	R1	R2	L1	L2	L3
	25	924	7	2	284	90	12	10	4
%	0.8	28	0.2	0,1	9	3	0.4	0.3	0.1



3. VONDELPARK – MAX EUWEPLEIN

TRAFFIC LIGHT ANALYSIS

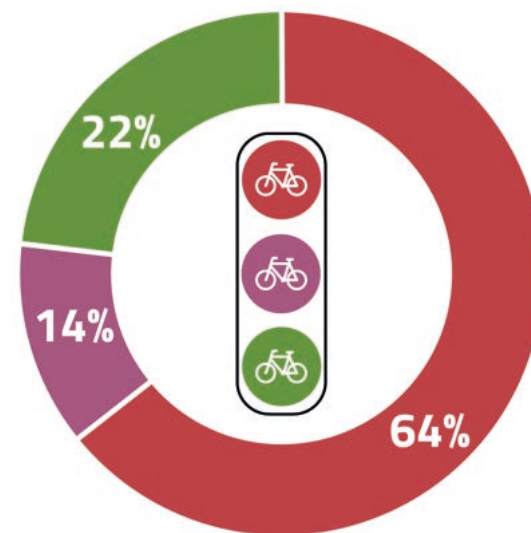
The analysis focuses on the traffic light allowing cyclists arriving from the north and the east to cross Stadhouderskade and head south. The synchronisation of the traffic lights is very dynamic due to tramway priority and cyclists pushing the button.

64% of cyclists arrive at the intersection when the traffic light is red, whereas 22% arrive while it is green. This last number is higher than most of the other intersections analysed in this report. Moreover, the number of cyclists jumping the red light – 14% – can be considered as rather high. Cyclists skip the red light in various situations:

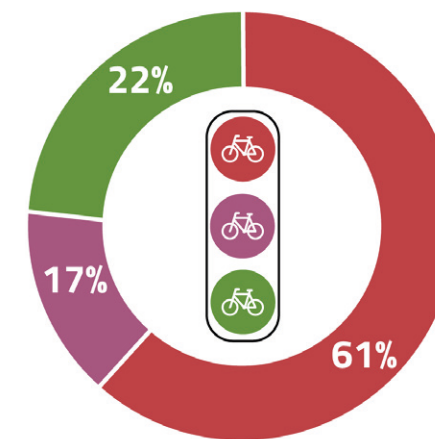
- When the light is red for cyclists but green for pedestrians crossing the tramway and the car lanes (0:30);
- When the light is red for cyclists but green for pedestrians crossing the tramway rail and red for the one crossing the car lanes;
- When the light is red for cyclists, red for pedestrians crossing the tramway rail but green for the ones crossing the car lanes (A- 19:23);
- When the light is red for cyclists and for pedestrians but all cars are stopped (8:57).

Moreover, as always, some cyclists speed up, run the amber/red light and cross the intersection just in time before cars start driving. They are more likely to behave this way when there are still cyclists coming from the south finishing to cross the intersection.

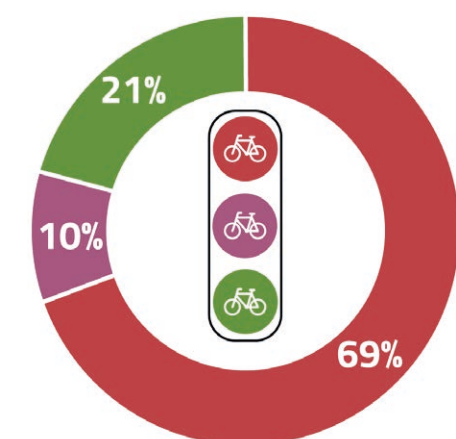
Often, cyclists disrespecting the red light must cross the street two times. The east-west car lanes seem to be empty more often and easier to cross than the busy west-east ones.



NORTH ENTRY POINT



EAST ENTRY POINT



3. VONDELPARK – MAX EUWEPLEIN

KEY FINDINGS II

D. USER CONFLICTS

The northern part of the intersection is the location of turns in several directions and users are rather confused by the priority rules. If we compare cyclists' behaviours here and the ones using the "bicycle corner" at Admiraal de Ruyterweg-Haarlemmerweg, this intersection seems to be more confusing and more stressful due to the speed of the users. Indeed, cyclists arriving from the east and the south and heading straight ride pretty fast. They don't slow down when they arrive at the crossing point, meaning that they don't identify it as a specific location of attention.

In the southern part of the intersection, since cyclists enter/exit the park through all the gates, conflicts occur with pedestrians sometimes surprised by cyclists riding in unexpected places. Moreover, the capacity of the bicycle track for cyclists arriving from the west is under pressure during the rush hour entailing impatient behaviour.



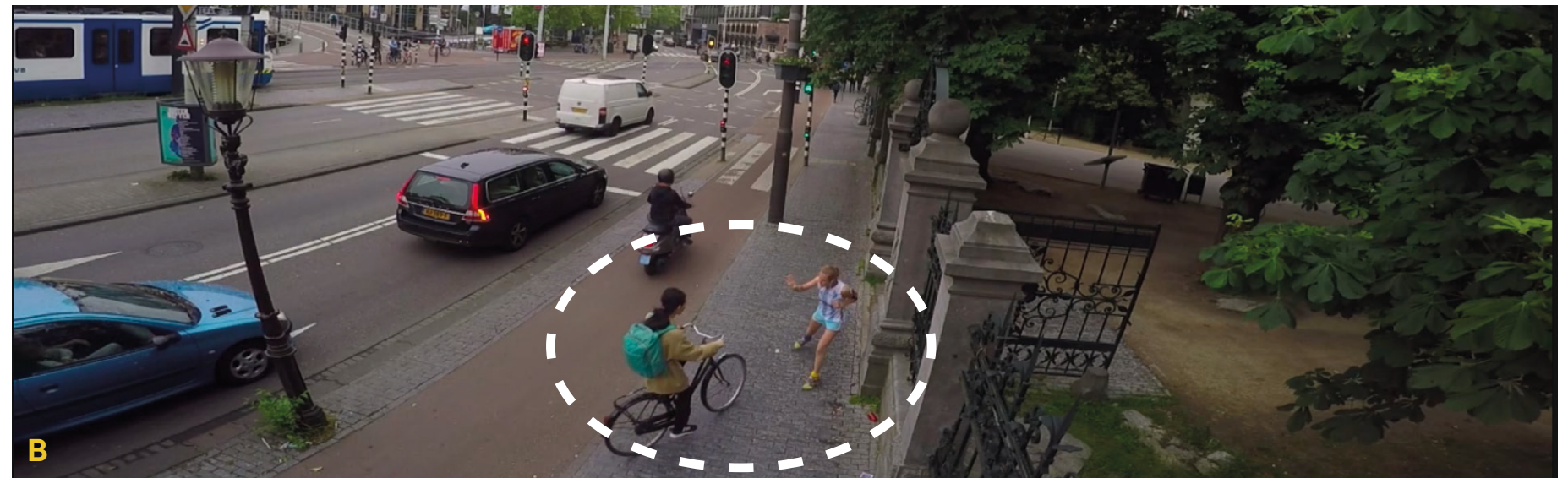
CYCLISTS > < PEDESTRIANS

North entry - No specific conflict was observed with pedestrians even though there is no pedestrian crossing on the bridge. Usually, they cross next to the bollards.

THE CYCLIST RUDENESS - Cyclists not giving way to pedestrians

South entry - Some cyclists wait on the sidewalk and bother pedestrians. A conflict is being considered only when a cyclist does not obviously give way to a pedestrian (A - 40:04) or when a pedestrian has difficulty to enter the park through the narrow door on the right.

West entry - Cyclists entering the park by the narrow entrance surprise pedestrians (A - 40:34) and they don't always give priority to pedestrians walking on the sidewalk. In the afternoon, when more pedestrians enjoy the park, this situation is likely to happen more often.



3. VONDELPARK – MAX EUWEPLEIN

CYCLISTS > < CYCLISTS

At this intersection, no “blocking syndrome” is observed. In contrast, cyclists arriving from the north are respectful of the ones cycling in a perpendicular way and leave some space by stopping by the bollards (C- 31:42).

THE IMPATIENT SYNDROME - Cyclists overtaking cyclists to be the first in line.

West entry - The behaviour is mostly observed at the western entry, where the cycle track is too narrow for the number of cyclists and where the traffic light is often disrespected.

THE FORCING SYNDROME - Cyclists not giving priority to another cyclist

West entry - Many cyclists disrespect the red light and sometimes don't give priority to cyclists arriving in the perpendicular direction from the north.

THE PRIORITY CONFUSION - Cyclists confused by the rules of priority

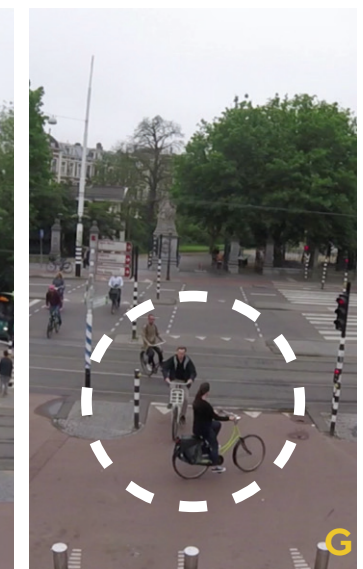
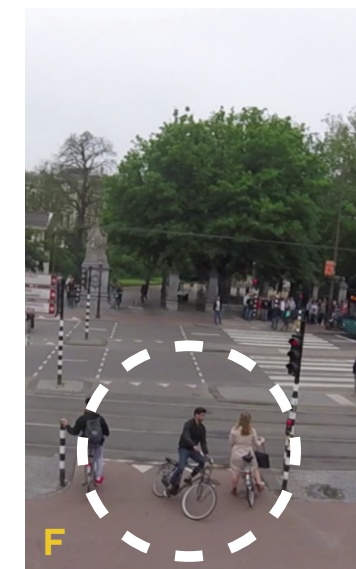
South and east entries - No marks on the ground guide cyclists on the priority rules. Therefore, depending on the density of the flow of cyclists, the ones arriving from the east or the south give priority to each other (D- 56:35; E- 30:25) in a rather confused manner.

West entry - Cyclists jumping the red light are forced to stop by the park entrance to give priority to cyclists crossing the boulevard.

THE SURPRISING COUNTERFLOW - Cyclists in counterflow and surprising cyclists riding in the right way

South entry - The waiting area is often empty when cyclists proceed to a left turn by using the exit and doing a shorter trajectory. But it happens that some cyclists turns left by using the exit while cyclists are arriving from the bridge. This situation is likely to entail small bumps (F- 16:36; G- 53:23).

East entry - Surprising encounters also happened when some cyclists arriving from the east turn left in counterflow.



3. VONDELPARK - MAX EUWEPLEIN

CYCLISTS > < MOPEDS

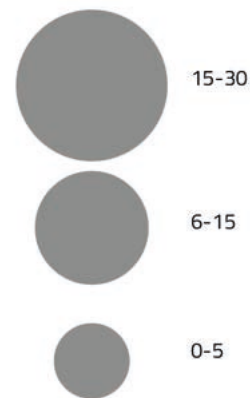
THE SHARING STRUGGLE - Mopeds overtaking and weaving between cyclists

The number of mopeds is limited such as the conflicts with cyclists. Mopeds arriving from the east have enough space not to bother cyclists. Nonetheless, the correlation of their higher speed and the confusing situation in the northern part of the intersection can entail tense situations between users. Share of mopeds in relation to the total number of cycling infrastructure users:

North entry: 3% **South entry:** 0%

East entry: 11% **West entry:** 6%

Number of conflicts observed



Type of conflicts

Pedestrians > < Cyclists

- Pa** Jam manoeuvre
- Pb** Cyclists blocking
- Pc** Cyclists rudeness

Cyclists > < Cyclists

- Ca** Entailed blocked track
- Cb** Impatient syndrome
- Cc** Disoriented syndrome
- Cd** Surprising counterflow
- Ce** Forcing syndrome
- Cf** Priority confusion

car / truck Drivers > < Cyclists

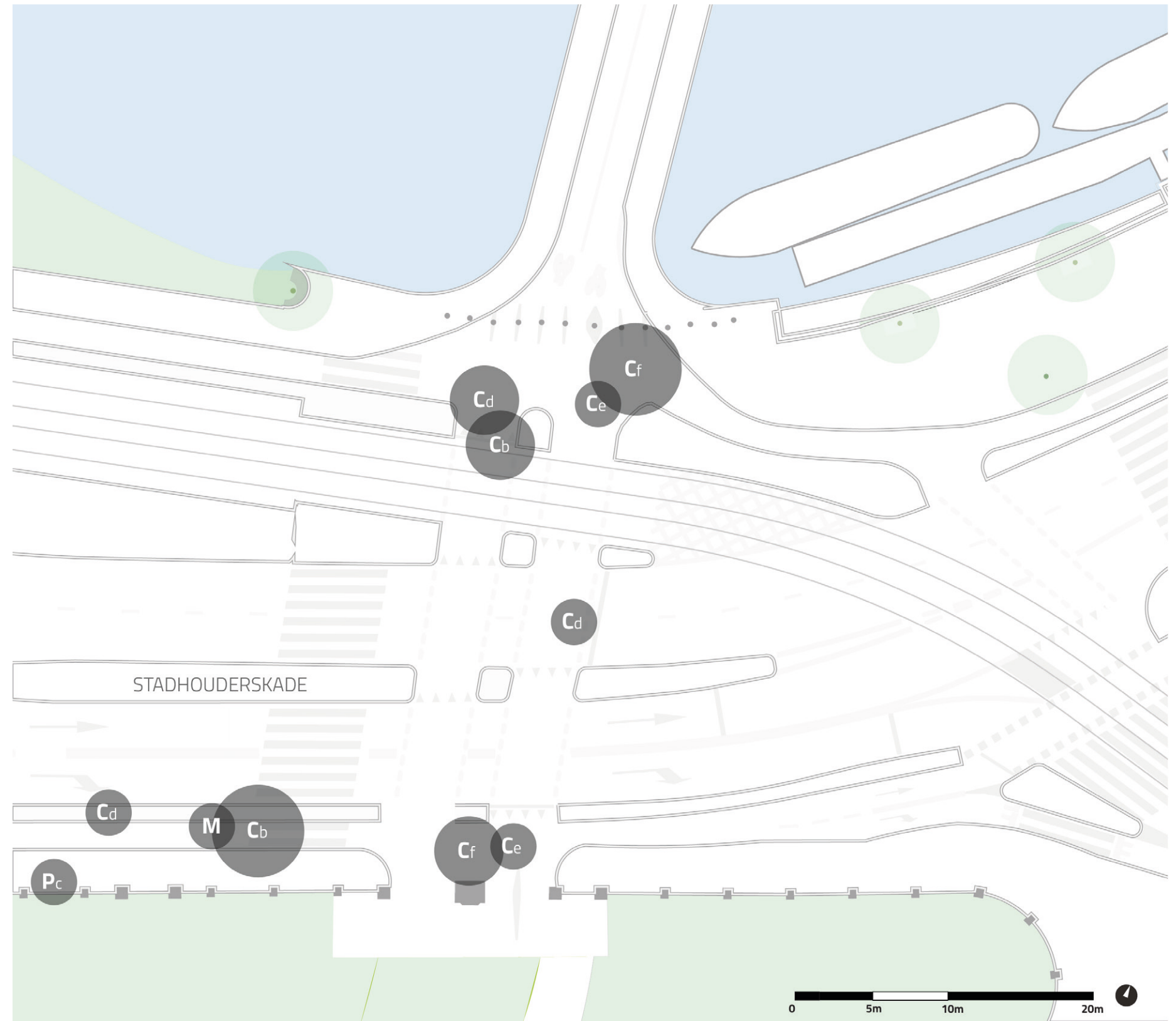
- Da** Drivers blocking
- Db** Undesignated car parking

Mopeds > < Cyclists

- M** Sharing struggle

Trams > < Cyclists

- T** Priority confusion



3. VONDELPARK – MAX EUWEPLEIN

E. DESIGN PROPOSALS

1. Extension of the bicycle track

On this stretch, the boulevard surrounding the centre of Amsterdam is a major cycling route, busier than the De Clercqstraat & Nassaukade and Hugo de Grootstraat & Nassaukade intersections. Since the avenue can not be turned into a bicycle street due to a high volume of cars, the width of the bicycle track should be increased (1a) to fit the flow of bicycle users. Moreover, the extension should help create a larger waiting area (1b) in front of the park. The waiting area will not be large enough to match the rush hour peak of users, but could fit during the period when the flow of cyclists is more limited. These cyclists will benefit from a better visibility on the intersection.

2. Marking

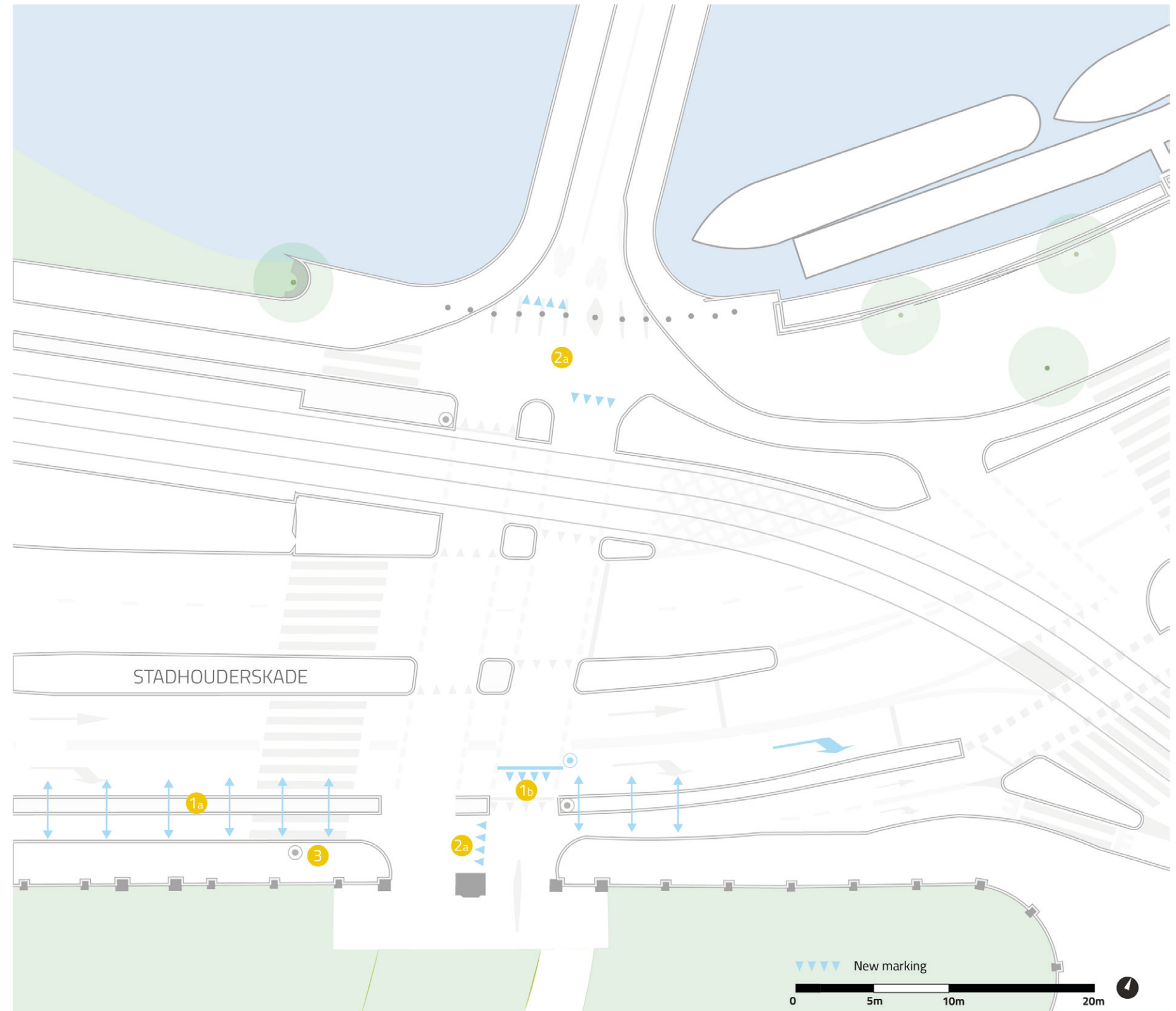
In order to guide cyclists on priority rules, yield marks should be added on the northern (2a) and southern (2b) part of the intersection.

3. Traffic lights

An adjustment of the traffic lights could ease the flow arriving from the west. Indeed, these cyclists should not get a red light when the tramway is passing.

Scenario + : A redesign of the connection between Vondelpark and Max Euweplein

Since the intersection connects two pedestrian and cyclist destinations - a park and a car-free block -, a new design offering priority to these users could be considered. In the afternoon the number of pedestrians, including tourists, is probably much higher than during the morning rush hour. A new design, as a raised-crossing or a new surface treatment, could support to reduce the barrier-effect of the boulevard and trigger cars to slow down while crossing this section of the avenue.

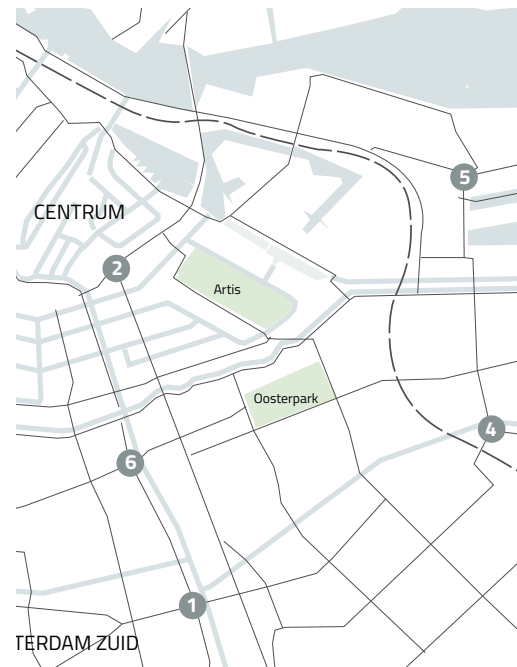


4 MOLUKKENSTRAAT-CAROLINA MACGILLAVRYLAAN-OOSTERRINGDIJK

A. THE NEIGHBOURHOOD

The intersection Molukkenstraat - Carolina MacGillavrylaan - Oosterringdijk is located on the east side of the city and lies amongst some residential districts, office areas and the university of Amsterdam.

The north part of the crossing is flanked by a canal and no building is located in the immediate surroundings.



Top view



Camera view

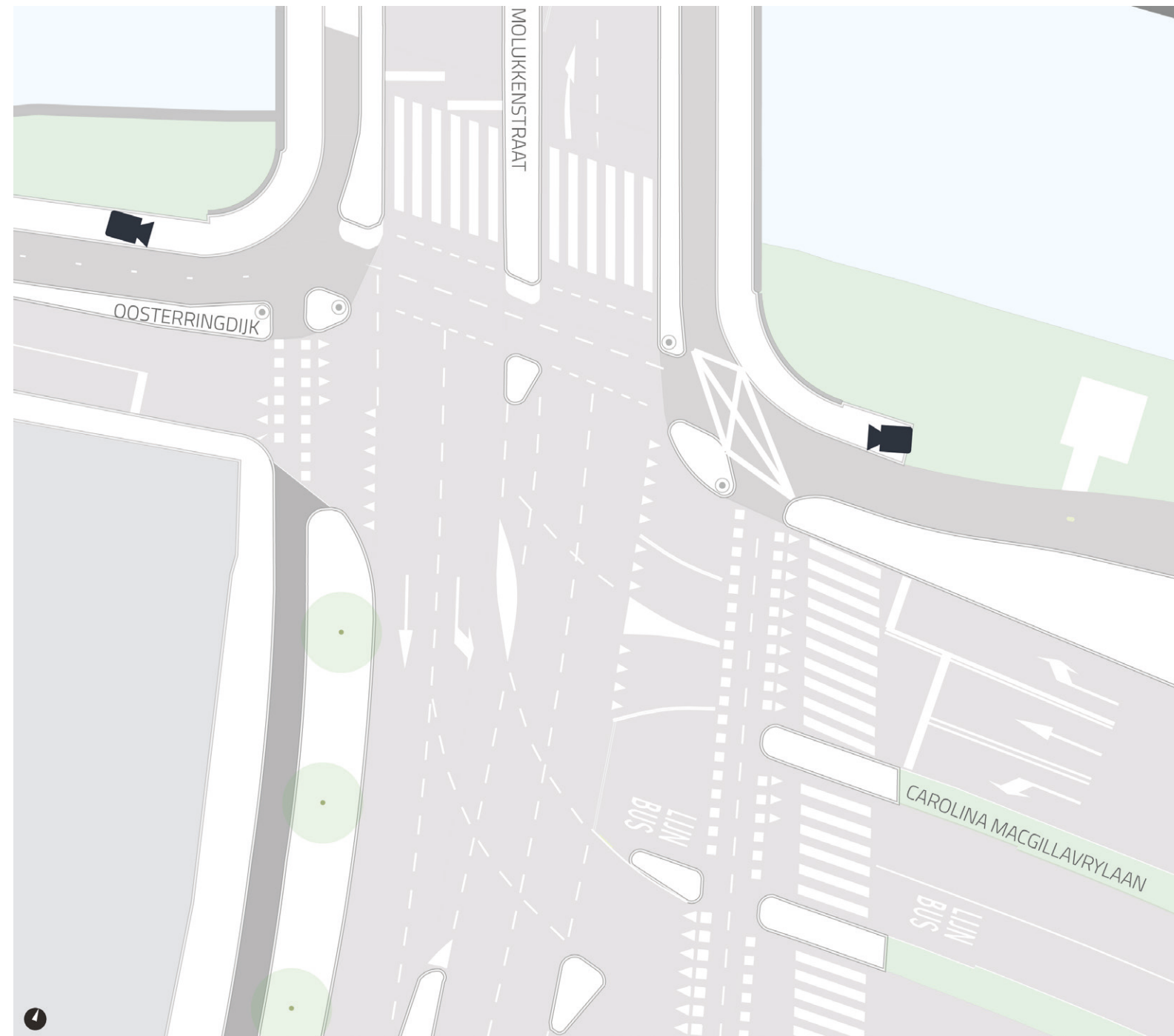
4. MOLUKKENSTRAAT-CAROLINA MAC GILLAVRYLAAN-OOSTERRINGDIJK

B. THE INTERSECTION

The intersection Molukkenstraat - Carolina MacGillavrylaan - Oosterringdijk is comprised of two main routes and a local street.

Carolina MacGillavrylaan is a two-way street for cars, with extra turn-lanes at the intersection. Two lanes dedicated to buses run in the middle of the street. **Molukkenstraat** is a main boulevard made -up of several car lanes running in both directions. **Oosterringdijk** is a local two-way street for cars.

This intersection is composed of a bidirectional bicycle track crossing two unidirectional ones. The bidirectional bicycle track follows the canal on the north of Carolina MacGillavrylaan and Oosterringdijk. Another bidirectional bicycle track is located on the southern part of Carolina MacGillavrylaan, but it has not been considered for this study. On Oosterringdijk, the bicycle track merges with the car lanes a few meters after the intersection. To finish, Molukkenstraat incorporates two bicycle tracks located on both sides of the street.



4. MOLUKKENSTRAAT-CAROLINA MAC GILLAVRYLAAN-OOSTERRINGDIJK



North entry



East entry



South entry



West entry

4. MOLUKKENSTRAAT-CAROLINA MAC GILLAVRYLAAN-OOSTERRINGDIJK

KEY FINDINGS I

C. THE DESIRE LINES

The intersection Molukkenstraat - Carolina MacGillavrylaan - Oosterringdijk was filmed on September 21st, 2017 from 8:15 to 9:15am by two cameras: one located on the east and one on the west side of the crossing. **2,185 cyclists** crossed the junction during the morning rush hour. The average volume of cars on Molukkenstraat is X and X on Carolina MacGillavrylaan.

ENTRY POINTS

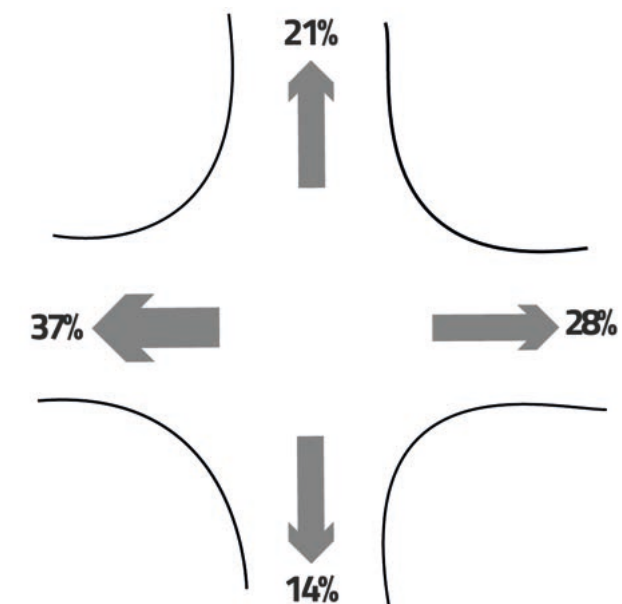
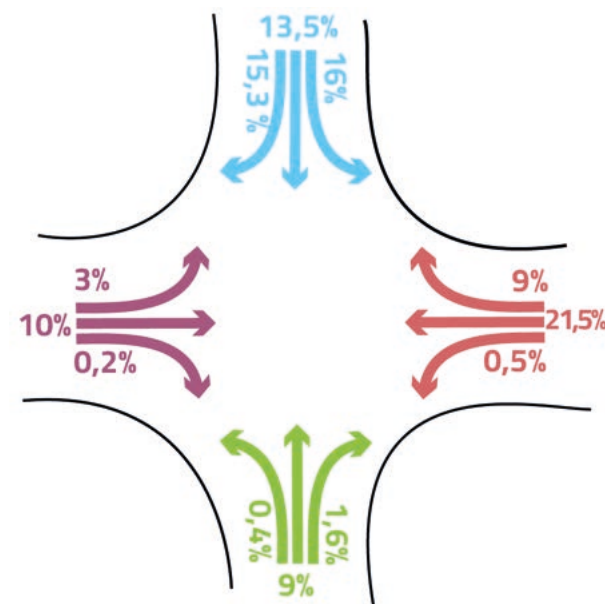
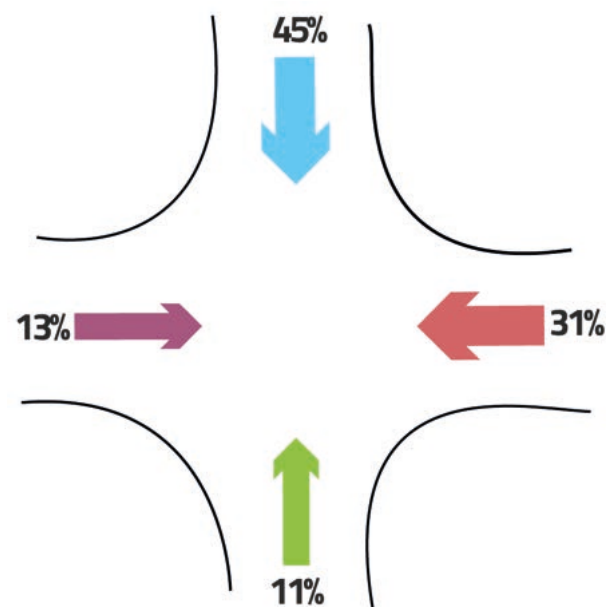
The high majority of bicycle users arrive from the north and east, meaning the city-center and the residential districts. It is very likely that the flows are in the opposite direction during the afternoon rush hour.

MAIN DIRECTIONS

The main flow of cyclists is that of those coming from the east and heading west. For once, the flow arriving from the north splits in a rather equal manner towards all directions.

EXIT POINTS

Most of the cyclists head north towards the city.



4. MOLUKKENSTRAAT-CAROLINA MAC GILLAVRYLAAN-OOSTERRINGDIJK

NORTH ENTRY POINT

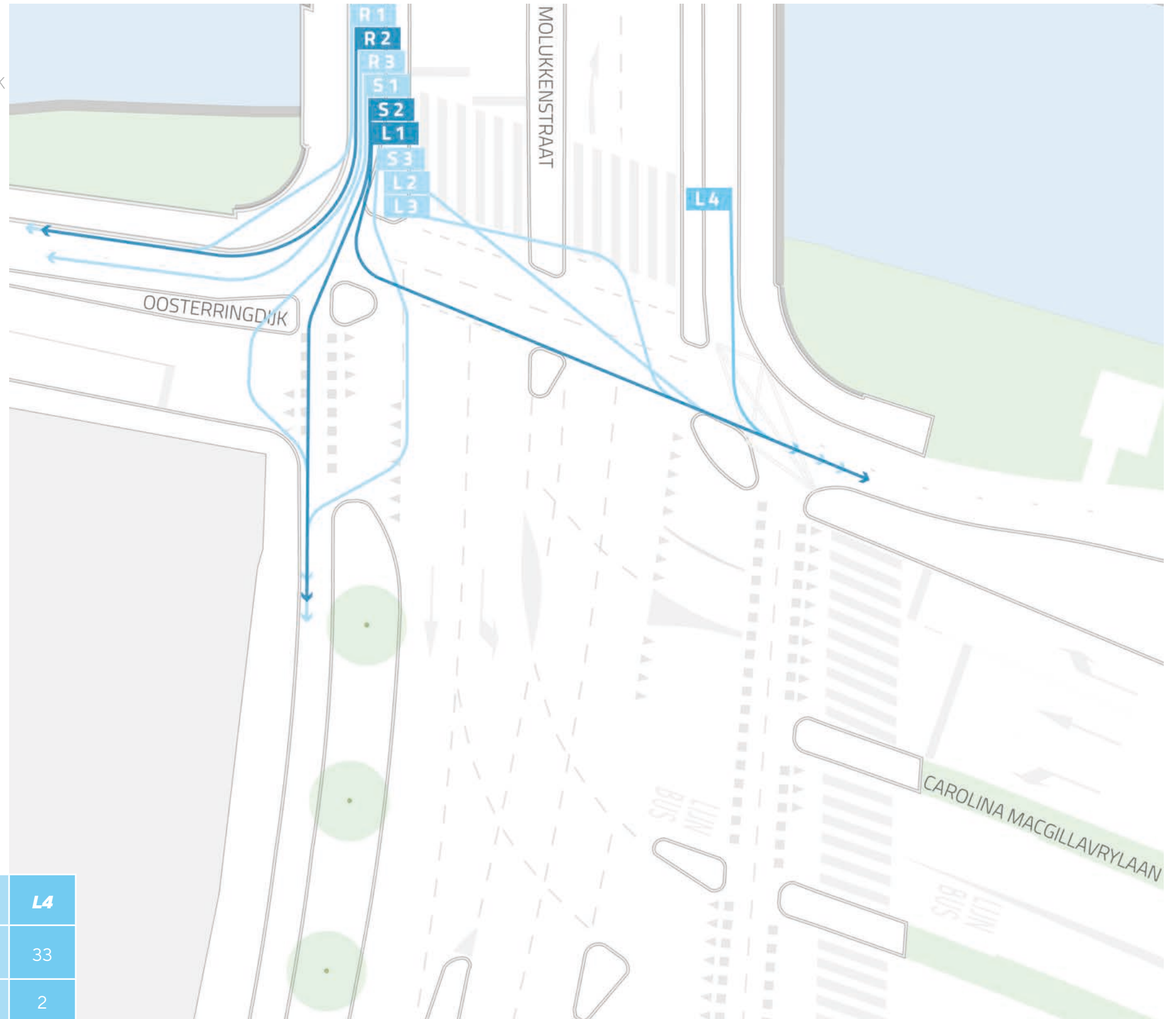
978 cyclists arrive from the north using the bridge. The proportion of cyclists turning right, left or going straight is almost equal.

STRAIGHT Nearly all users respect the bicycle track. Even though these users arrive on the right side of the cyclists coming from the east, and therefore have the priority, they still stop to give way.

RIGHT TURN More than a third of the bicycle users turn right on Oosterringdijk.
R1 - Some cyclists ride on the sidewalk when the waiting area is packed.
R3 - When cyclists arrive too fast at the intersection, they tend to use the counterflow lane before reintegrating their own one.

LEFT TURN 36% of bicycle users arriving from the north turn left on the bidirectional bicycle track along the canal.
 The majority of them respect the bicycle track, yet 33 shortcut the bend by partly or totally using the pedestrian crossing. This situation happens when cyclists arriving from the east are passing and block the bicycle track. As the waiting area is small, cyclists wait on the bicycle track obstructing almost 2/3 of cyclists turning right or heading straight.

L2-L3 - 30 cyclists skip the northwest corner for a faster left turn.
L4 - 33 cyclists arrive in counterflow on the bridge and turn left creating more confusion at this corner.



Label	S1	S2	S3	R1	R2	R3	L1	L2	L3	L4
	3	289	4	8	316	10	282	20	10	33
%	0.1	14	0.2	0.4	15	0.5	13	0.9	0.5	2


4. MOLUKKENSTRAAT-CAROLINA MAC GILLAVRYLAAN-OOSTERRINGDIJK

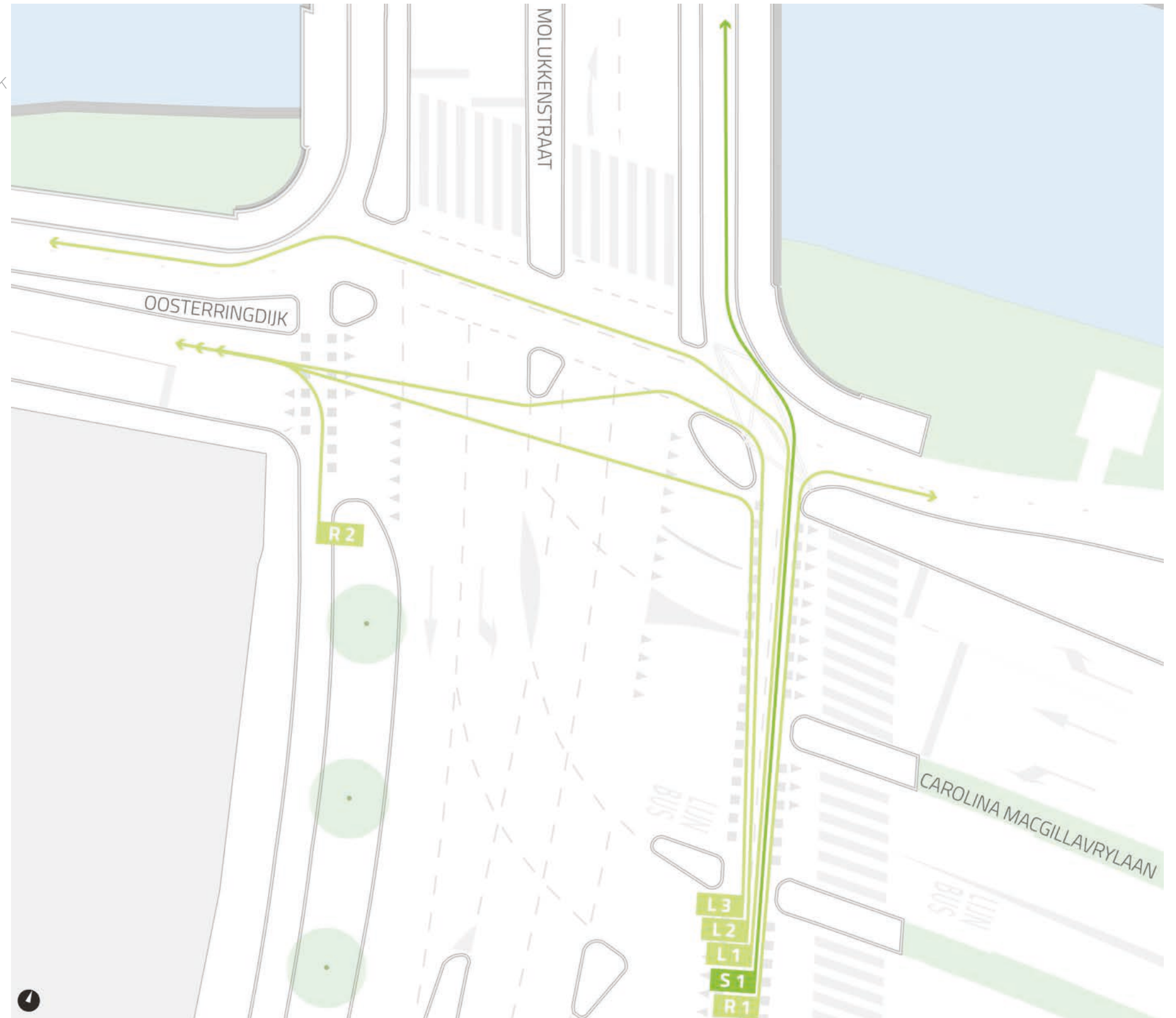
SOUTH ENTRY POINT

During the morning rush hour, **236 cyclists** arrive from the south entry. They mostly head straight to the north and respect the bicycle infrastructure. These cyclists seriously struggle with accessing the bicycle track and crossing it due to high number of cyclists arriving at the same moment from the west and the east. They stop to let them pass or speed up. Sometimes, they get off their bicycle to cross it walking. It is anyway a moment of stress for these cyclists.

LEFT TURN L2 - L3 - Some cyclists turn left outside the bicycle track and reach the car lane of the local street in order to skip the busy corner.

RIGHT TURN Cyclists turn right respecting the bicycle track or using the pedestrian crossing in order to shortcut the bend.

Label	S1	R1	R2	L1	L2	L3
	151	5	4	27	1	9
%	7	0.2	0.2	1	0.05	0.4



4. MOLUKKENSTRAAT-CAROLINA MAC GILLAVRYLAAN-OOSTERRINGDIJK

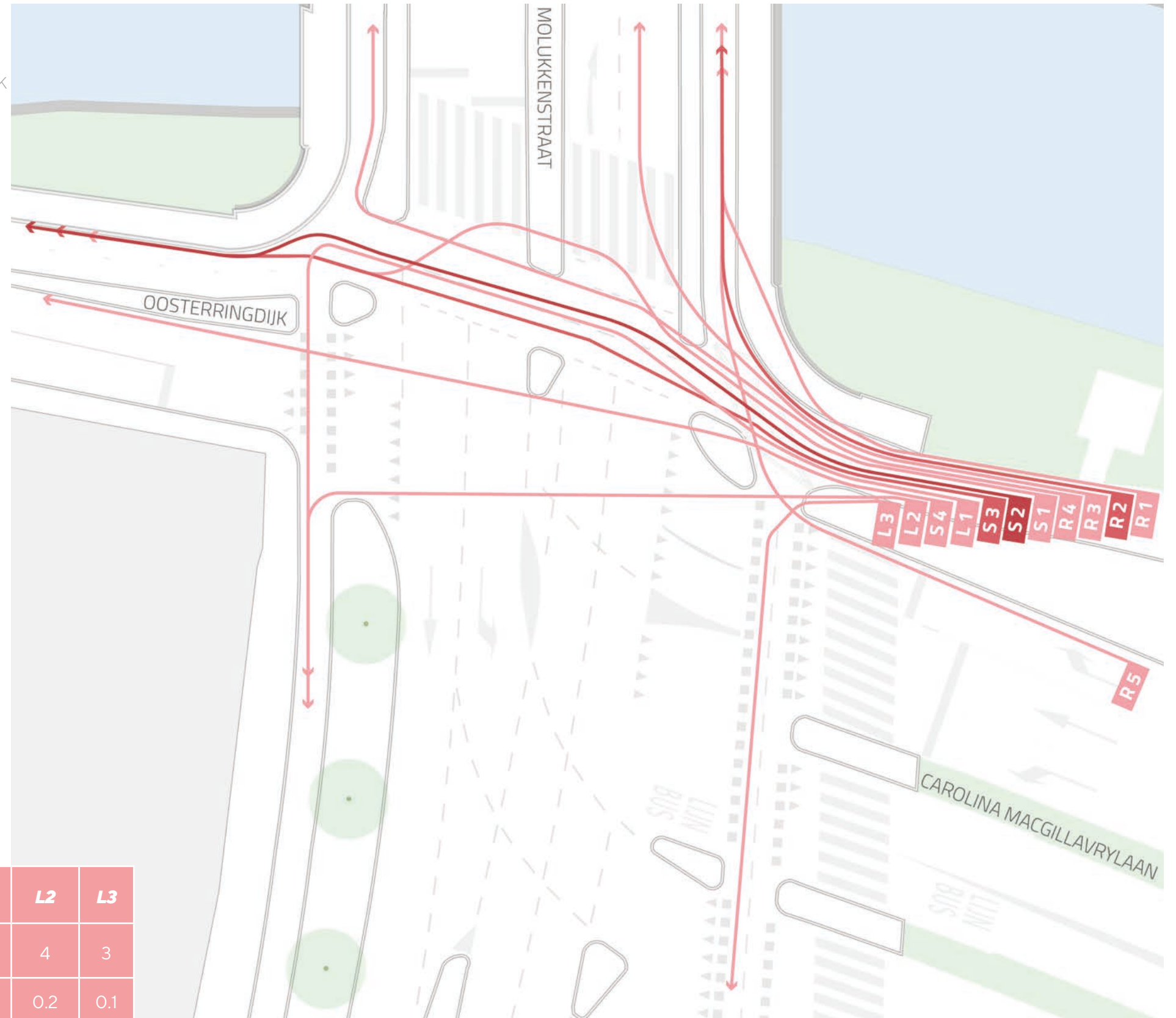
EAST ENTRY POINT

685 bicycle users arrive from the east entry, meaning the bidirectional bicycle track running along the canal. They use the entire width of the track while waiting at the traffic light and some also use the counterflow lane to cross the junction. They block the perpendicular bicycle track and force cyclists arriving from the south to stop.

STRAIGHT The high majority of users head straight towards Oosterringdijk.
S3- These cyclists use the counterflow lane to cross the junction as their own lane is full.
S4- Since the entrance of the bicycle track is packed and the street does have much car traffic, 10 cyclists ride outside the bicycle track.

RIGHT TURN As this entry point is often packed with cyclists waiting at the traffic light, some turn right on the sidewalk.

LEFT TURN Only 12 people turn left towards the south of the city.



Label	S1	S2	S3	S4	R1	R2	R3	R4	R5	L1	L2	L3
	3	421	33	10	18	181	3	2	2	5	4	3
%	0.1	20	2	0.5	1	9	0.1	0.1	0.1	0.2	0.2	0.1

4. MOLUKKENSTRAAT-CAROLINA MAC GILLAVRYLAAN-OOSTERRINGDIJK

WEST ENTRY POINT

281 cyclists arrive from the west of the city riding on Oosterringdijk.

STRAIGHT The high majority of users head straight towards the offices and the university.

S1- Since the bicycle track is short on this street, a few users keep on riding on the car lane. This group is mostly made-up of young and fast cyclists.

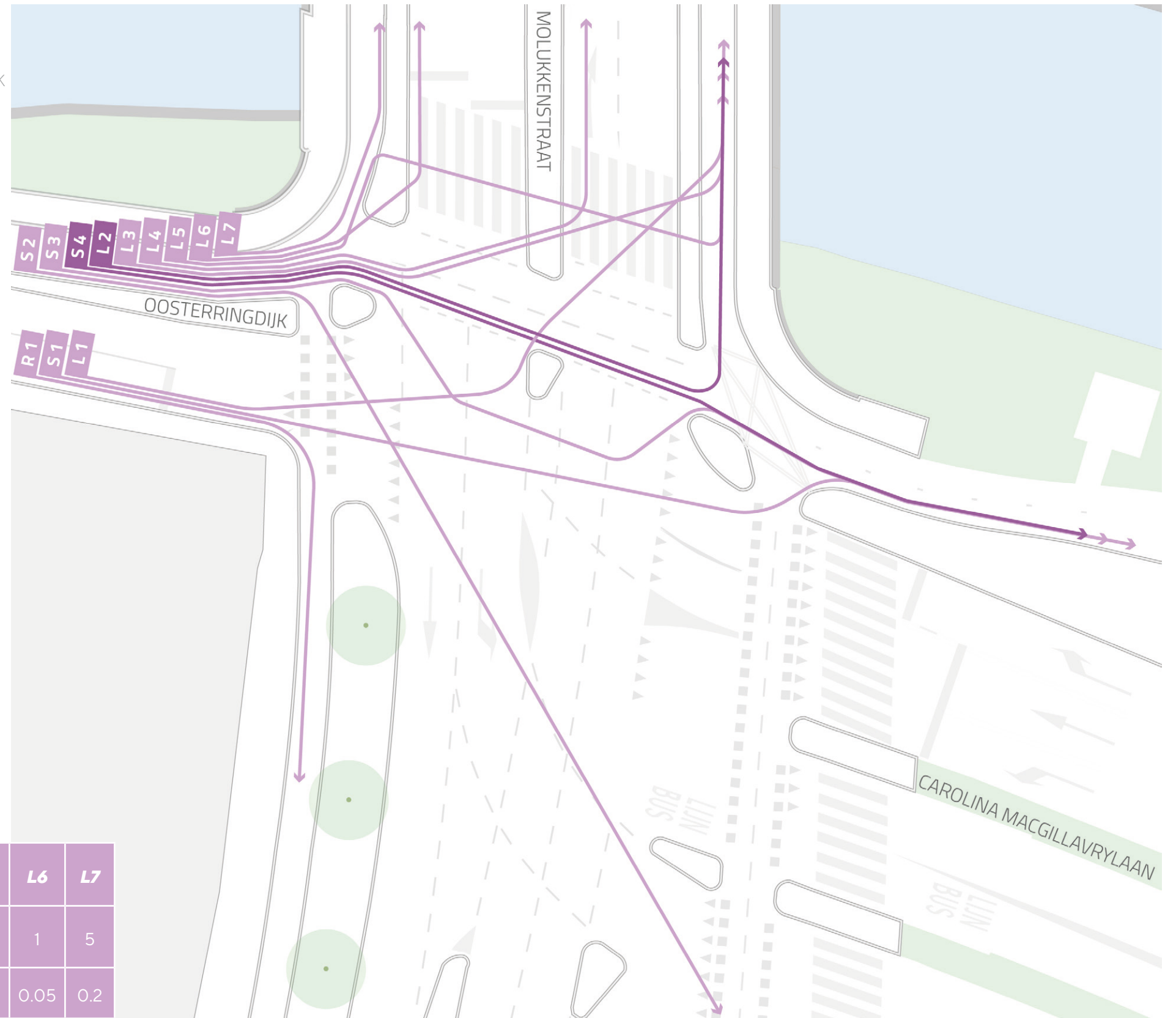
RIGHT TURN Only 4 cyclists turn right, all of them keep on riding on the street and do not use the bicycle track.

LEFT TURN A large proportion of bicycle users draw their own trajectories to turn left. Since they have difficulties to turn left when groups of cyclists arrive from the east, some users skip the crowded corner and shorten the left bend.

L1 - Cyclists turning left and arriving from the car lane.

L3 - L5 - Cyclists turning left partly or totally using the pedestrian crossing.

L7 - Cyclists turning left on the counterflow track.



Label	S1	S2	S3	S4	R1	L1	L2	L3	L4	L5	L6	L7
	3	1	1	209	4	2	39	13	1	2	1	5
%	0.1	0.05	0.05	10	0.2	0.1	2	1	0.05	0.1	0.05	0.2

4. MOLUKKENSTRAAT-CAROLINA MAC GILLAVRYLAAN-OOSTERRINGDIJK

KEY FINDINGS II

D. USER CONFLICTS

At the southeast corner of the intersection Molukkenstraat - Carolina MacGillavrylaan - Oosterringdijk, a very high number of conflicts were observed between cyclists. For once, conflicts are rather serious as users almost bump into each other (A-36:21). The fact that several cyclists get off their bicycle to cross the bicycle track (B-31:23, C-58:29) also shows the stress felt by users at this intersection.

The northwest corner shows a similar situation in reverse, opposite flow, but less conflicts and tense situations were observed. This is due to a smaller number of cyclists arriving from Oosterringdijk. Conflicts happen most of all during the busiest moment of the rush hour, and are related to the priority confusion from cyclists arriving from the north and the east.

CYCLISTS > < PEDESTRIANS

The flow of pedestrians being extremely low, no conflict was observed.

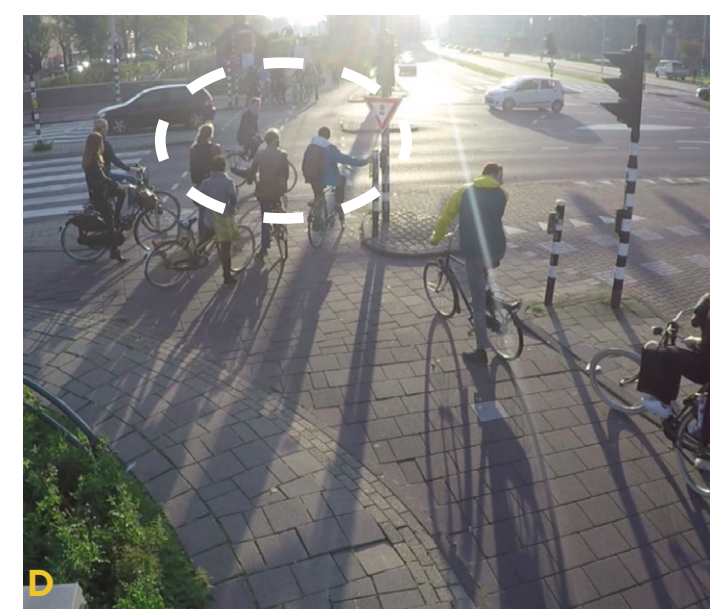
CYCLISTS > < CYCLISTS

THE IMPATIENT SYNDROME - Cyclists overtaking cyclists to be the first in line.

Compared with other intersections, a rather low number of impatient cyclists were counted.

THE ENTAILED BLOCKED TRACK - Cyclists stopping and blocking the perpendicular track

Northwest corner - During the busiest moment of the rush hour, as the waiting area at the traffic light is too narrow, cyclists block the bicycle track and force cyclists arriving from the north and the east to stop or to slowly find a narrow path between waiting cyclists (28:26; 34:20) or even to cycle on the car lane (D-26:15).



4. MOLUKKENSTRAAT-CAROLINA MAC GILLAVRYLAAN-OOSTERRINGDIJK

THE PRIORITY CONFUSION - Cyclists confused by the rules of priority

Northwest corner - Cyclists arriving from the north usually give way to the ones entering the bicycle track from the east. But some cyclists are confused by the priority rules (E-34:45).

Southeast corner - This corner is very chaotic and users are confused when it comes to the question of priority (F-37:58). Cyclists don't have enough space to wait at the traffic light and block the way for the ones coming from the west wishing to turn left. Too many cyclists arrive at the same time at this over-crowded corner.

THE SURPRISING COUNTERFLOW - Cyclists in contraflow and surprising cyclists riding in the right way

Southeast corner - As a lot of cyclists arrive in counterflow from the north (from the bridge, or from the pedestrian crossing as they skip the bicycle lane), they often take the cyclists arriving from the east by surprise. This kind of conflict also appears when cyclists from the east ride on the counterflow lane and bump into the ones arriving from the west at high speed (G- 2:26, H- 4:34, I- 23:14).

CYCLISTS > MOPEDS

THE SHARING STRUGGLE - Mopeds overtaking and weaving between cyclists

Southeast corner - Conflicts between cyclists and mopeds are rather rare but when the "priority confusion" happens at high speeds, the stress factor for the most vulnerable users is even higher than between two cyclists.

Share of mopeds in relation to the total number of cycling infrastructure users:

North entry: 18% (63 units)

South entry: 7% (16 units)

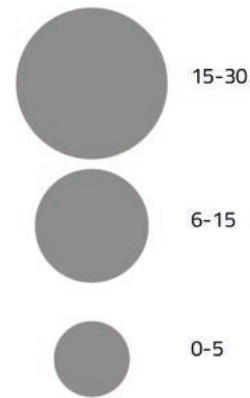
East entry: 8% (54 units)

West entry: 4% (12 units)



4. MOLUKKENSTRAAT-CAROLINA MAC GILLAVRYLAAN-OOSTERRINGDIJK

Number of conflicts observed



Type of conflicts

Pedestrians > Cyclists

- P_a** Jam manoeuvre
- P_b** Cyclists blocking
- P_c** Cyclists rudeness

Cyclists > Cyclists

- C_a** Entailed blocked track
- C_b** Impatient syndrome
- C_c** Disoriented syndrome
- C_d** Surprising counterflow
- C_e** Forcing syndrome
- C_f** Priority confusion

car / truck Drivers > Cyclists

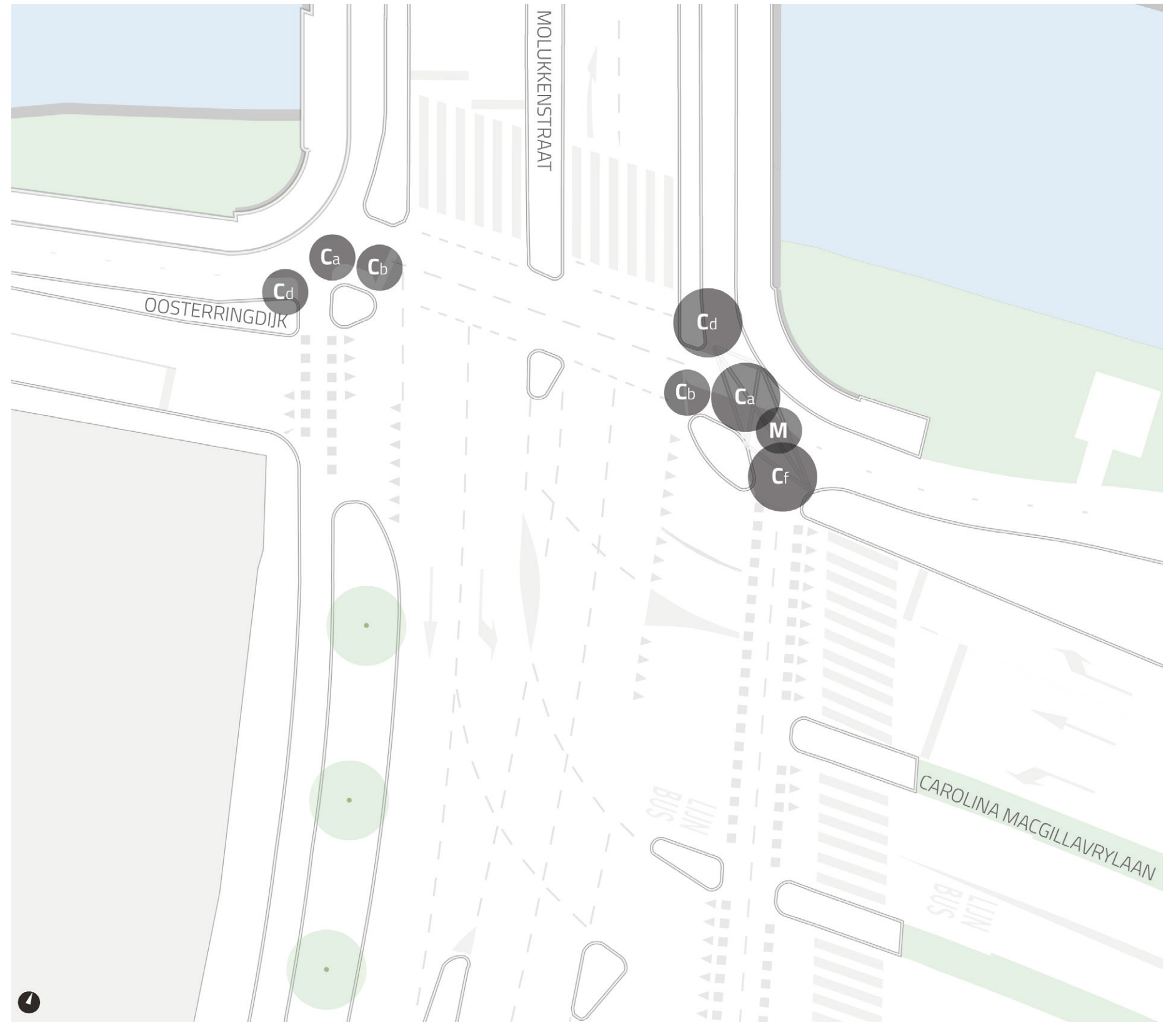
- D_a** Drivers blocking
- D_b** Undesignated car parking

Mopeds > Cyclists

- M** Sharing struggle

Trams > Cyclists

- T** Priority confusion



4. MOLUKKENSTRAAT-CAROLINA MAC GILLAVRYLAAN-OOSTERRINGDIJK

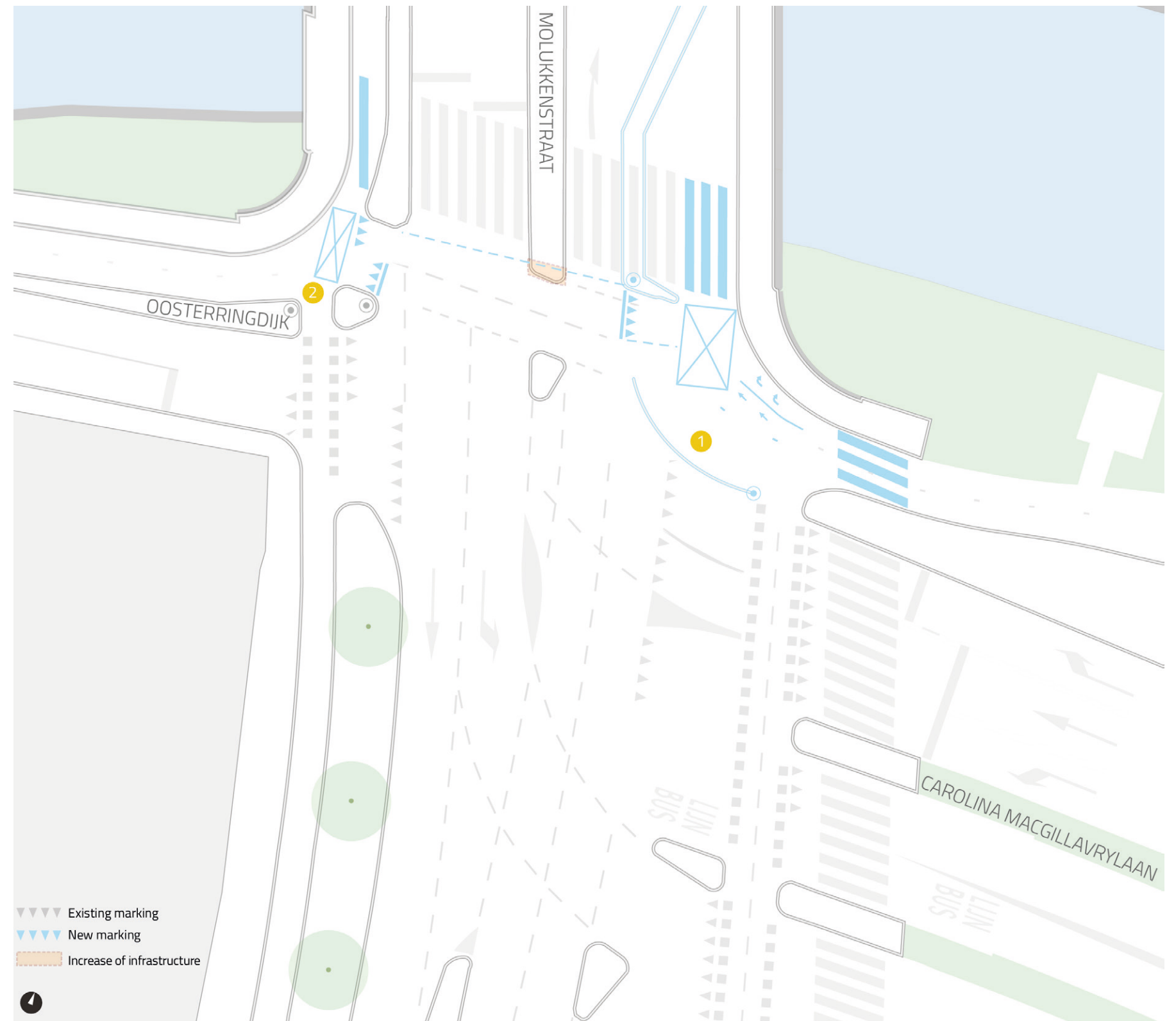
E. DESIGN PROPOSALS

As serious conflicts were observed at the southeast corner, a redesign is mandatory. Cycling conditions could be improved by widening the corner and removing the extra car lane on the bridge.

The “banana style” corner (1) is not the most appropriate here as a few cyclists turn right or left to head south. Nonetheless, this design is a way to enlarge the waiting area and can accommodate cyclists arriving from the west and turning left towards the north. Moreover, it should allow the ones arriving from the east to get more space to turn right if the westbound bicycle track is widened at the corner. To finish, a synchronisation of the traffic lights should make sure cyclists from the south and the west do not get access to the southeast corner at the same time.

Even though conflicts are less frequent at the northwest corner, ideally it should also be widened to limit the number of cyclists waiting on the bicycle track on the bridge (2). There is less space to proceed with this redesign if car lanes are not removed.

Even though from a user perspective the cycle track along the canal seems to be a nice and quiet place to ride, an analysis of the cycling infrastructure on the southern side of Carolina MacGillavrylaan could be conducted to understand if part of the traffic could be transferred there.



5 VAN EESTERENLAAN-FRED PETTERBAAN

A. THE NEIGHBOURHOOD

The intersection Van Eesterenlaan-Fred Petterbaan, part of the borough Amsterdam-Oost, is located in the Eastern Docklands neighborhood. After serving as a space for harbor activities, this area was transformed into a residential space. It hosts mostly families with young children who would like to stay in the city-centre. This area is also well-known for its new buildings showcasing modern architecture.



To be more precise, the intersection is located in the Rietlanden area. This name is a heritage to the former railway yard. Despite the fact that this yard was decommissioned some decades ago, it's positioning retains some importance to this day. The studied intersection is located not very far from the railways - a strong barrier in the urban landscape - and some peninsulas connected by car, tramway and active-mobility through the means of bridges. Moreover, Van Hengelstraat leads to the boat-bus station Azartplein allowing pedestrians and cyclists to gain access onto Amsterdam North.

The intersection is mostly surrounded by residential buildings, a supermarket and other stores attracting many pedestrians and cyclists.



Top view



Camera view

5. VAN EESTERENLAAN-FRED PETERBAAN

B. THE INTERSECTION

Van Eesterenlaan-Fred Petterbaan is a rather small but complex junction.

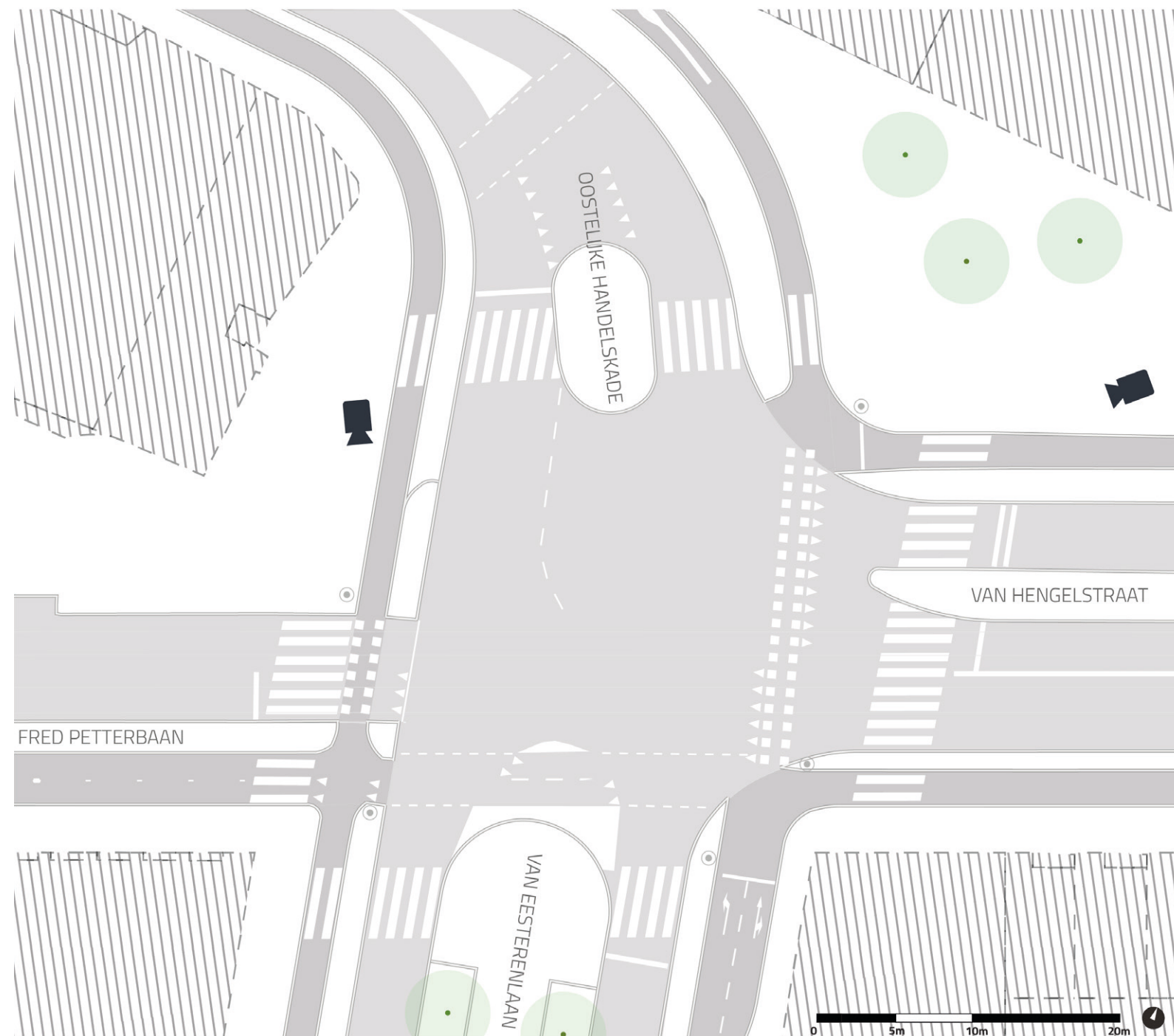
On the eastern side of the intersection, Van Hengselstraat is comprised of one lane for cars, coming from the Java and Sporenburg peninsulas. Drivers have the possibility to head northwest on Oostelijke Handelskade or south on Van Eesterenlaan. Van Hengselstraat is also made up of a double lane for the tramway line n° 10 and the buses n° 48 and 65. In addition, bicycle tracks can be found on both sides of the street. On either sides of the intersection, Oostelijke Handelskade and Van Eesterenlaan have two bicycle tracks.

Fred Petterbaan, located on the west side of the junction, is composed of a bidirectional bicycle track located along the buildings and tramway rails.

While cyclists are not allowed to ride on the sidewalk, some arrive from the pedestrian-only path running through Rietlandpark.

In general, at this intersection, cyclists and cars don't have the green light at the same moment which seems to make the waiting time at the red lights longer for cyclists.

Cyclists arriving from the south and turning left on a bidirectional bicycle track have their own traffic light and their own lane to wait. At this entry point, in addition to the traffic light, a sign warns car drivers turning right to pay attention to cyclists, even though they are stopped while drivers proceed with the turn.



5. VAN EESTERENLAAN-FRED PETERBAAN



North entry



East entry



South entry



West entry

5. VAN EESTERENLAAN-FRED PETERBAAN

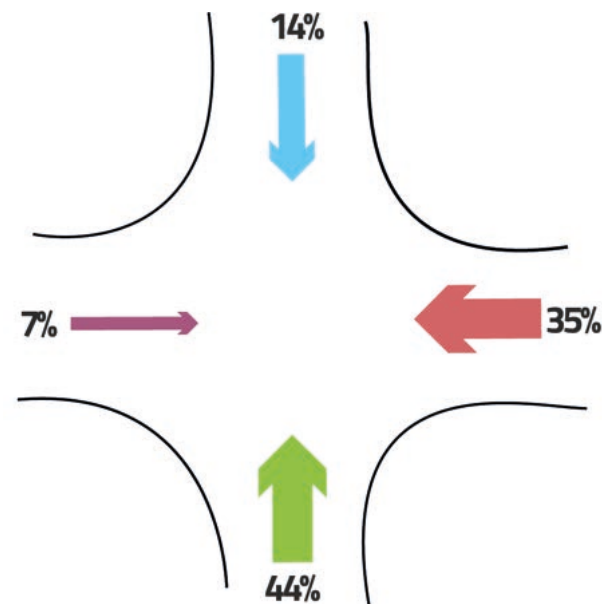
KEY FINDINGS I

C. THE DESIRE LINES

The intersection Van Eesterenlaan-Fred Petterbaan was filmed on September 21st, 2017 from 8:15 to 9:15am by two cameras, located at the north-east and north-west corners. **1,440 cyclists** crossed the junction during the morning rush hour. The average volume of cars on Van Eesterenlaan is X and X on Van Hengselstraat.

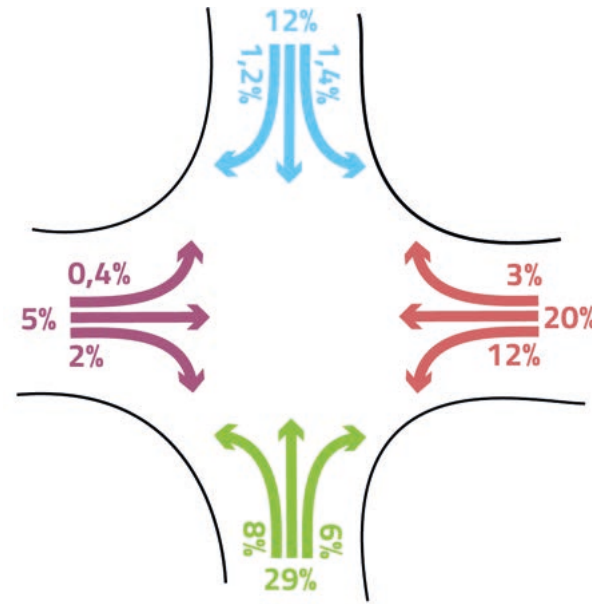
ENTRY POINTS

Cyclists arrive mostly from the south and from the east sides (the residential peninsulas and the bus-boat line). A very limited flow arrives from the west, that is to say from the bidirectional bicycle track. Nonetheless, this entry point is likely more crowded in the afternoon, especially at school time.



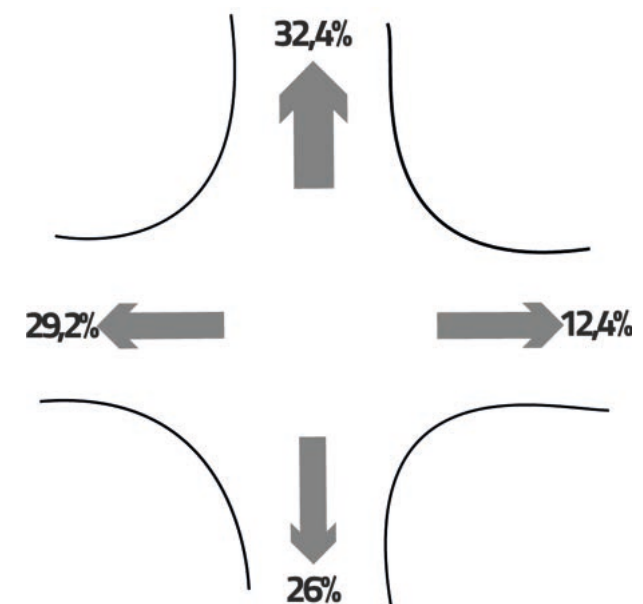
MAIN DIRECTIONS

The flows of bicycle traffic at this intersection vary a considerable amount from one direction to another. The two main trajectories are drawn by cyclists arriving from the south and heading straight, and cyclists arriving from the east and heading straight, but having to cross a chicane to get to Fred Petterbaan. The infrastructure does not allow cyclists to proceed with a left-turn in a classical manner; yet this move represents a rather important part of the total flow (12 and 8%). The u-turns (0.2%) have not been represented on the scheme.



EXIT POINTS

Only a few cyclists head east. Indeed, the peninsulas-residential areas- and this part of Amsterdam-North do not represent a destination during the morning commute. It would likely be a more attractive destination in the evening. The three other directions attract cyclists in a comparable manner, from 26% to 32% of the total number of cyclists crossing the intersection. It is worth noticing that many users do not really head north, but reach the supermarket located on the northern side of the junction.



5. VAN EESTERENLAAN-FRED PETERBAAN

NORTH ENTRY POINT

A rather low total number of **195 cyclists** arrive from Oostelijke Handelskade or from the supermarket. Without a clear view of the supermarket's parking, it is estimated that 40% of this flow arrives from this place (S3, S4, S5, R2, L3, L4, U1). Most of these bicycle users cross Oostelijke Handelskade on the dedicated lane and keep on heading straight (S3).

From the north, the only elements noticed are:


- Some cyclists must slow down to cross the perpendicular busy bidirectional track,
- Cyclists turning left block the track, especially when they ride a cargo bike,
- The lane to access the cycle track from the supermarket is sometimes blocked by cars, forcing cyclists to manoeuvre around to find a way onto the track.
- The unusual trajectories (S4, S5, L4, U1) -used only by a few cyclists- can be explained by the location of the supermarket which represents a destination for many cyclists crossing this intersection.

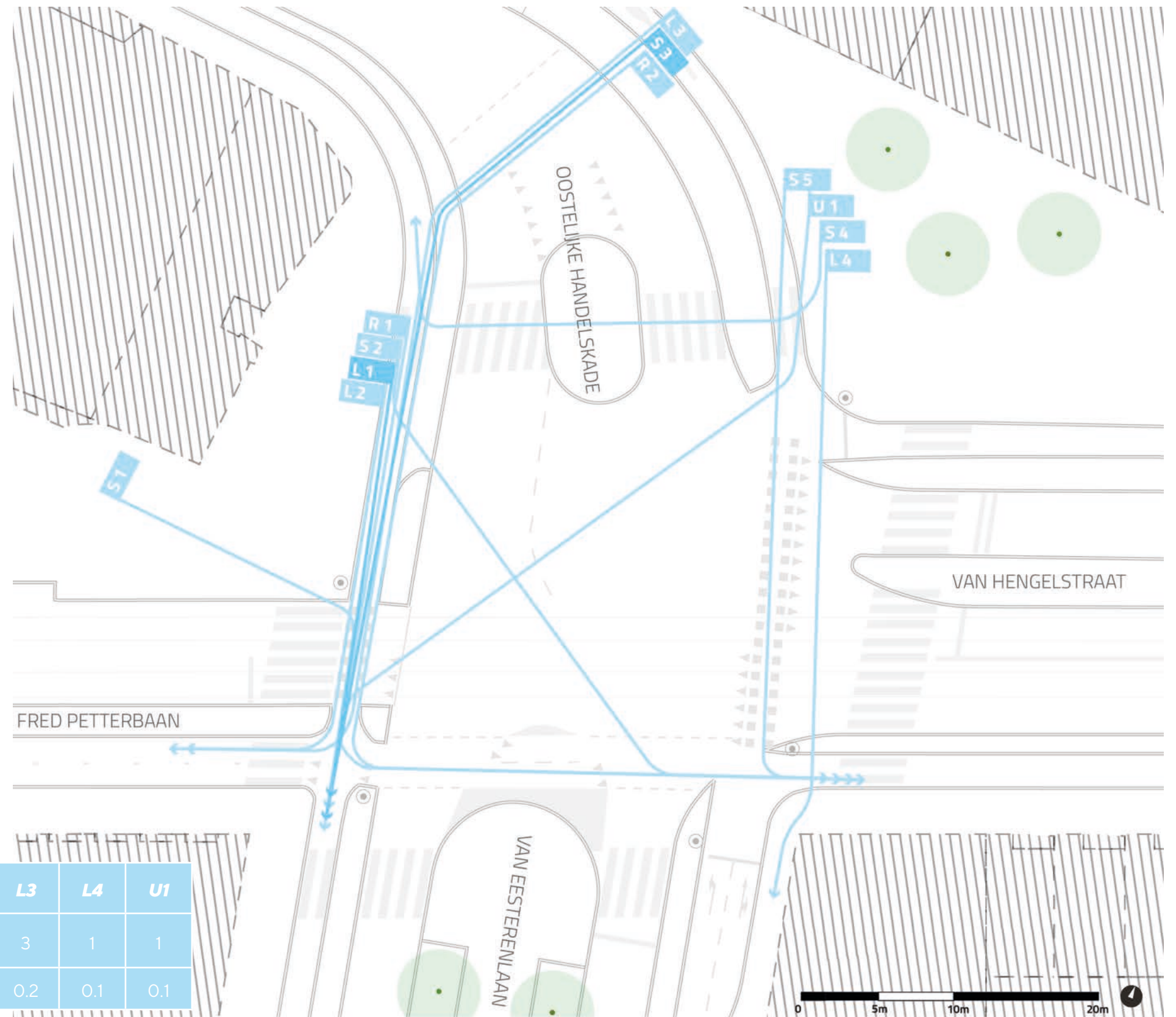
STRAIGHT 83% of cyclists arriving from the north head straight. They usually respect the bicycle track.

S1- These cyclists come from Rietlandpark and are considered as arriving from the north.

S5- Cyclists riding in counterflow on the bicycle track or on the sidewalk.

RIGHT TURN **R1-** Cyclists turning right and respecting the bicycle track or proceeding with a shortcut on the pedestrian crossing.

Label	S1	S2	S3	S4	S5	R1	R2	L1	L2	L3	L4	U1
	2	103	53	4	2	3	12	1	12	3	1	1
%	0.1	7	4	0.3	0.1	0.2	0.8	0.1	0.8	0.2	0.1	0.1



5. VAN EESTERENLAAN-FRED PETERBAAN

SOUTH ENTRY POINT

641 cyclists arrive from the south of the junction drawing a high number of Desire Lines in the space. The split in the lane before the traffic light helps cyclists to navigate. However, cyclists turning right must overtake the group waiting by riding on the sidewalk or by finding their way through the group.


STRAIGHT Two thirds of cyclists head straight to the north or to the supermarket.

S5- S6- 8 cyclists head straight while riding in conterflow on the other bicycle track. Some of them ride on the sidewalk, but the majority use the bicycle track.

RIGHT TURN **R1-** The majority of cyclists turn right by riding on the sidewalk. Yet an almost similar amount of cyclists use the bicycle track. They do this to shorten their bend or to overtake the group of cyclists waiting at the traffic light to head straight.

R3- 5 cyclists arriving from Van Aalstraat do not have the possibility to cross C. van Eesterenlaan. Therefore, they ride in counterflow on the bicycle track and turn right at this intersection to reach Van Hengselstraat.

LEFT TURN Cyclists have a dedicated lane and a traffic light to turn left directly on the bidirectional bicycle track. A number of the users ignore the red light to cross at least the first car lane and wait in the middle of the street as to let cars arriving from the east and turning left pass.

Label	S1	S2	S3	S4	S5	S6	R1	R2
	406	1	1	3	2	5	50	46
%	28	0.1	0.1	0.2	0.1	0.3	3	3

Label	R3	L1	L2	L3	L4	L5	L6	U1
	5	1	9	99	5	2	1	2
	0.3	0.1	0.6	7	0.3	0.1	0.1	0.1



5. VAN EESTERENLAAN-FRED PETERBAAN


506 cyclists arrive from the eastern entry point of the junction and draw a high number of Desire Lines. This is explained by the numerous ways cyclists cross the intersection to head straight or turn left. Some of them respect the design of the infrastructure and proceed twice with an 90° angle bend to join Fred Petterbaan. Others create smoother trajectories to maintain speed and shorten their bend while crossing the junction.

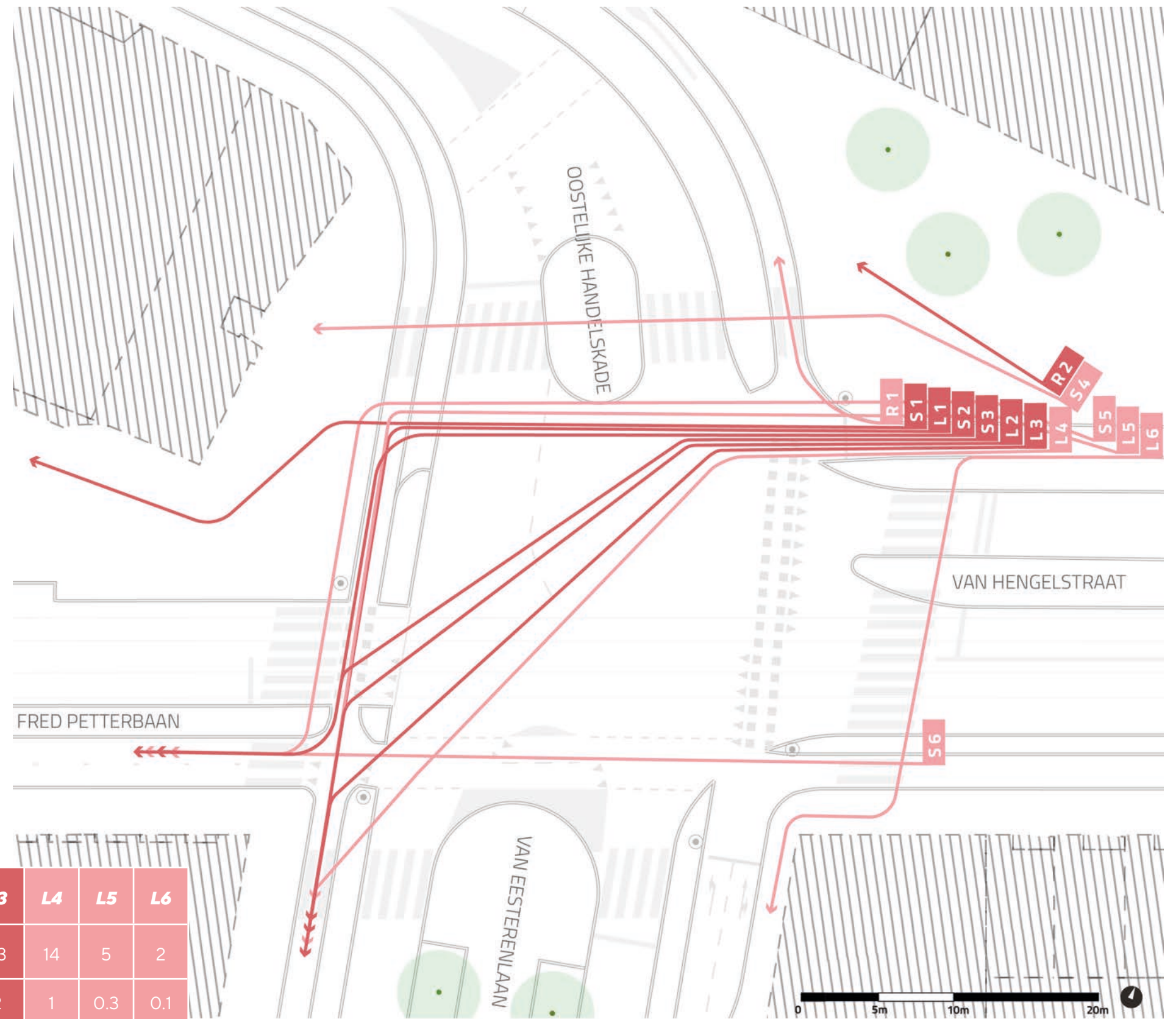
The main issue for these cyclists is to enter Fred Petterbaan. The entrance is narrow and this corner is a complex node with cyclists arriving from a total of five directions. When they arrive at the same moment as cyclists from the south and see additional cyclists coming from the north, some users must seriously reduce their speed. To avoid stopping, people manoeuvre and use the full width of the track - including the one in counterflow which is not used much - and the pedestrian crossing to gain Fred Petterbaan.

Moreover, at the eastern entry, the waiting box allows around four cyclists to wait before the pedestrian crossing. But during the rush hour, up to 28 cyclists are waiting at the traffic light. As a result, cyclists are stepping on the pedestrian crossing and have difficulties accessing the track on the other side of the junction.

STRAIGHT S5- These people use the sidewalk as an extension of the bicycle track to overtake the group of cyclists waiting to be the first at the red light or to jump it.

RIGHT TURN R2- Almost all of the cyclists turning right use the sidewalk as they reach the supermarket or they get back onto the bicycle track. In this circumstance, some cyclists may have not been counted as they did not show up on camera footage.

Label	S1	S2	S3	S4	S5	S6	R1	R2	L1	L2	L3	L4	L5	L6
	22	119	110	1	18	16	4	48	39	75	33	14	5	2
%	2	8	8	0.1	1	1	0.3	3	3	5	2	1	0.3	0.1



5. VAN EESTERENLAAN-FRED PETERBAAN

WEST ENTRY POINT

Only **98 bicycle users** arrive from the west, using the bidirectional bicycle track, which makes it the least busy entry point of the intersection.

Cyclists often jump the red light and cross at least the first car lane. They then have space to wait in the middle of the intersection before crossing the second one. The length of the red light varies according to the tramway priority and the activation of the green light by the cyclists. Some adjustments seem to be needed to reduce the waiting time and ease the flow of traffic. Indeed, at 6:33 a cyclist is waiting 1min. 19, whereas his green light could have started at the same moment as the tramway's one. This would have reduced the waiting time to a more acceptable 40 seconds. Moreover, it is surprising to see the light for cyclists coming from the west turning green at the same moment as the one for cyclists arriving from the south (09:28 & 12:14). This synchronisation forces cyclists from the west to wait in the intersection for cyclists from the south to pass. At the opposite end, at 28:07, a cyclist has just enough time to cross the intersection before the light for cyclists from the south turns green.

STRAIGHT 72% of these cyclists head straight towards the peninsulas.

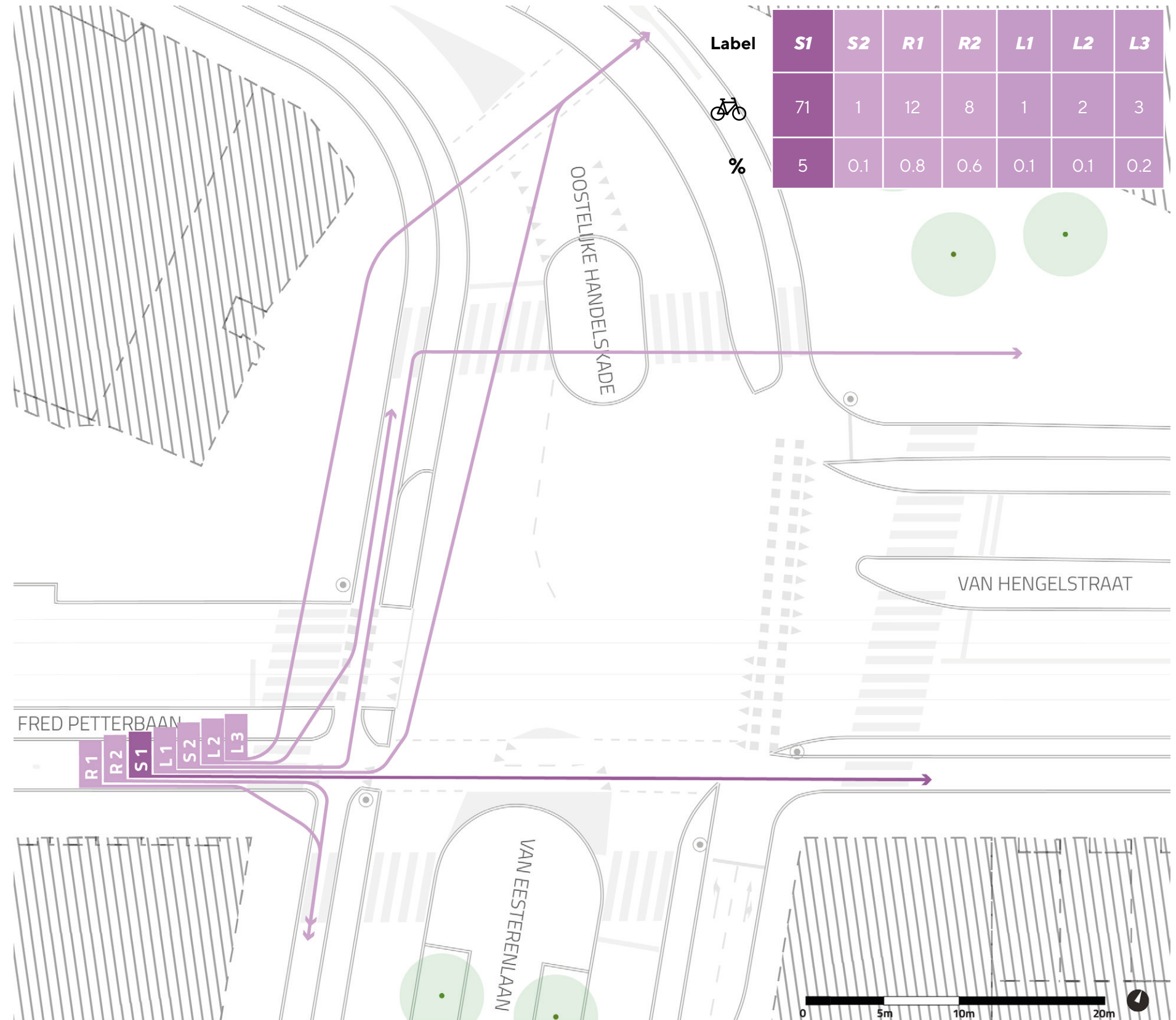
RIGHT TURN **R1-** The majority of cyclists turning right cut the corner of the sidewalk whether the track is empty or not. The level 0 of the sidewalk eases this trajectory.

LEFT TURN Two out of the three Desire Lines of cyclists turning left have the supermarket as their destination. Moreover, no cyclist turns left in two steps.

L1- Cyclists turning left, riding in counterflow on the bicycle track and stopping at the bicycle parking.

L2- Cyclists turning left in the middle of the intersection to reach the supermarket.

L3- Cyclists turning left on the sidewalk and reaching the supermarket by using the dedicated lane in counterflow.



5. VAN EESTERENLAAN-FRED PETERBAAN

USERS' PROFILE

For once, a section is dedicated to the profile of cyclists crossing Van Eesterenlaan-Fred Petterbaan. These additional elements should help the City of Amsterdam to better consider users' behaviour when redesigning the intersection. Moreover, these various profiles explain the appearance of chaos and the higher number of Desire Lines than at other intersections.

Three different types of cyclists use this junction: a high number of families riding with children, people heading to the supermarket and some regular commuters, partly arriving from the bus-boat.

The **family category** is comprised of:

- Parents riding with one or two children on their regular bicycle,
- Parents riding with one or two children in a cargo bike,
- Parents riding next to a child on his/her own bicycle,
- Families or children riding in a group.

The behavioural consequences are the following:

- Some bicycle users are more focused on their children than on the surrounding environment (A- 13:23) and ride slower;
- Cargo bikes take up more space on the track and at the waiting areas;
- Children ride at a slower pace and sometimes have difficulties to proceed with a turn or mounting and dismounting their bicycle (C- 24:50, also a boy at 7:12 and a girl at 11:36);
- Users riding in groups as the cycling commute is an enjoyable social activity. Yet the size of the groups can quickly put the bicycle infrastructure under pressure (B-22:51).

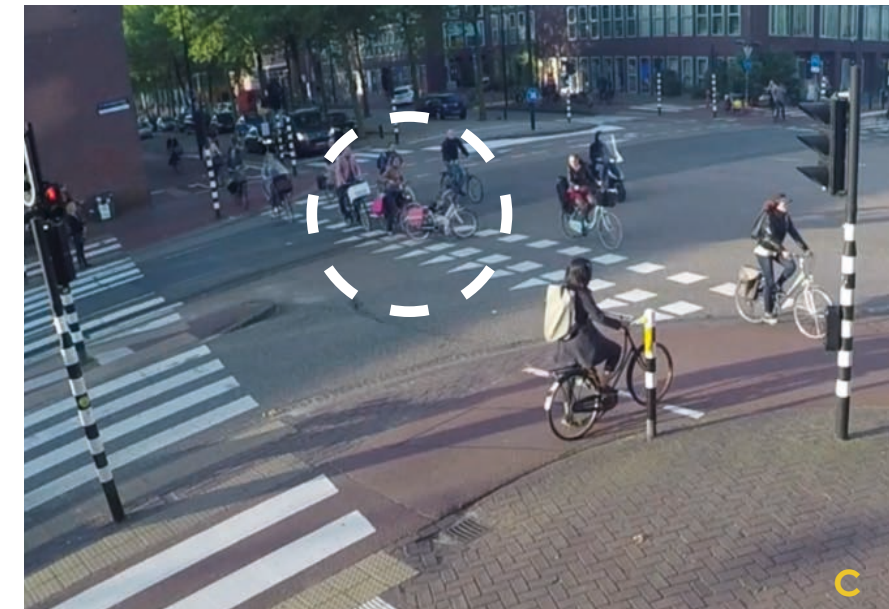
People cycling to the supermarket

These cyclists cross the junction for the purpose of reaching the shop located at the north-east. 11 trajectories - plus some people arriving

from the south and heading straight and maybe ending their trip at the supermarket - have the grocery store parking as a point of departure or arrival. Most of all, 7 trajectories (north S4, S5, 4; south S5; east R2; west L1, L3) include a ride in counterflow or on the sidewalk. Even if the number of users proceeding with this manoeuvre is rather reasonable (131 users) compared with the total number of cyclists, these bicycle users contribute to creating the impression of chaotic flow. It seems that for some users, the trip to the supermarket is a slow ride which can happen on the sidewalk.

Regular commuters

This category of users is likely to want to cross the intersection faster, overtaking people by riding on the sidewalk or, for instance, reducing the bend as much as possible to go from the eastern entry point to the southern exit point. Indeed, this intersection is a part of a bicycle route coming from the bus-boat station and heading to the western part of Amsterdam.



5. VAN EESTERENLAAN-FRED PETERBAAN

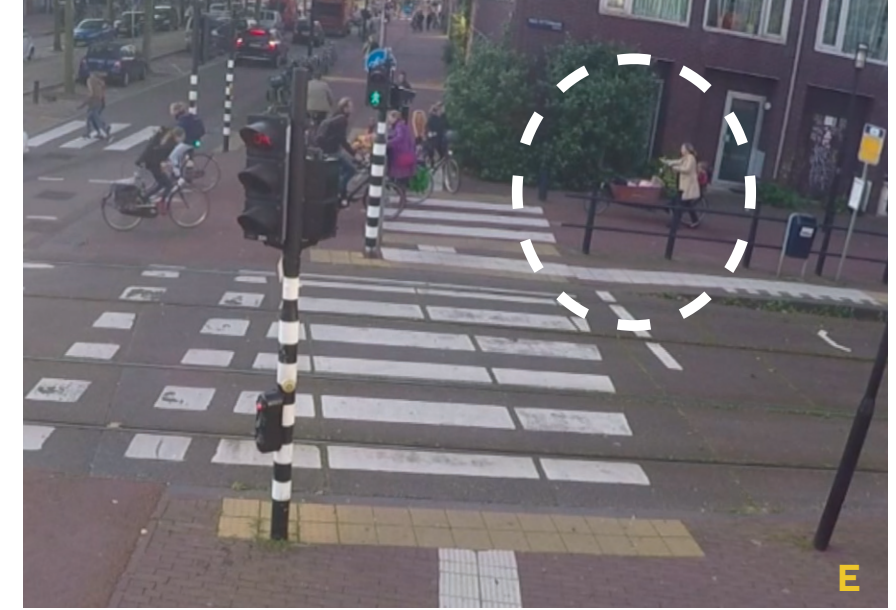
In opposition to the regular commuters, the families and the people heading to the supermarket are likely to be from the neighbourhood. Some wave at each other and stop to talk, showing the social dimension of this means of transportation (D-38:21). The atmosphere on the bicycle tracks here differ from other intersections located on the boulevards surrounding the city-centre. As a result, the streets seem to exhibit a more local scale pace of life. Nonetheless, while it can not be considered as a major and complex junction, some cyclists were observed dismounting their bicycle to cross it (E-24:35, F 23:14 - both riding with children). Therefore, it could be interesting to interview the users on their perception of the junction.

It is not the flow of cars, which is relatively low at this junction, that could make users feel anxious but rather the regular passing of the tramway (B-22:51) and the crowded access to the bidirectional bicycle track.

The chaotic situation mostly happens during a few minutes in the morning but may be more present at the end of the schools in the afternoon.

In summary, the impression of chaos is the result of:

- cyclists riding in counterflow,
- cyclists heading to some destinations nearby the junction, like the supermarket or some parking areas,
- cyclists heading to the park using the pedestrian path,
- cyclists heading straight but not riding in line and following different trajectories to go from the eastern entry point to the southern and western exit points (G-18:34),
- the bidirectional lane on the southern part of the intersection,
- the complex synchronisation of the traffic lights making some cyclists wait a long time and pushing them to jump the red light,
- the rather low car traffic allowing some cyclists to feel comfortable enough to cross the intersection in one manoeuvre, sometimes jumping the red light,
- cyclists stopping to chat with friends on or along the bicycle track.



5. VAN EESTERENLAAN-FRED PETERBAAN

KEY FINDINGS II

D. USER CONFLICTS

Northwest corner - Few conflicts were observed at this corner. There are no lanes that guide cyclists through the intersection. Nonetheless, cyclists don't appreciate the 90° angle to turn and would likely still proceed with a smoother bend to get access to Fred Petterbaan. Users do not feel the need to check the traffic light by the rails since they have a clear view on the tramway approaching. Users obviously always stop when the tramway crosses the intersection, but do not wait for the light to turn green again to cross the rails. This behaviour, meaning stopping the least amount of times as possible, leads to the bicycle track never being overcrowded while a tramway is passing (11:31). It is worth noticing that sometimes the traffic light is red a few seconds without any tramway approaching; this red light is not respected by users.

CYCLISTS > PEDESTRIANS

JAM MANOEUVRE - Cyclist turning right on the sidewalk creating confusion for pedestrians

Southwest corner.

THE CYCLISTS BLOCKING - Cyclists stopping on the pedestrian crossing forcing pedestrians to circumvent them

Northeast corner - Cyclists stop sometimes on the pedestrian crossing (A-19:26) forcing walkers to circumvent them. Even though a high number of cyclists turning right use the sidewalk, the space is wide enough and is shared respectfully with pedestrians (A).

CYCLISTS > CYCLISTS

THE ENTAILED BLOCKED TRACK - Cyclists stopping and blocking the perpendicular track

Southwest corner - Cyclists arriving from the west either stop on the shark teeth and block the track, or on the pedestrian crossing. The ones arriving from the north and turning left do not have a designated



5. VAN EESTERENLAAN-FRED PETERBAAN

space to wait. This situation makes people slow down to cross this corner or entails the entry onto the track from the east through the means of the pedestrian crossing (B- 39:21). Those arriving from the south cycle on the sidewalk in response to this situation (C-39:42).

THE IMPATIENT SYNDROME - Cyclists overtaking cyclists to be the first in line

Northeast corner - The over-use of the bicycle track and the low flow of cars entails an impatient syndrome, meaning that cyclists use the sidewalk to overtake other cyclists and then jump the red light. Moreover, the size of the intersection may appear to be small making it seem easier to cross rapidly. To a lesser extent, this syndrome happens also at the southeast corner.

THE PRIORITY CONFUSION - Cyclists confused by the rules of priority

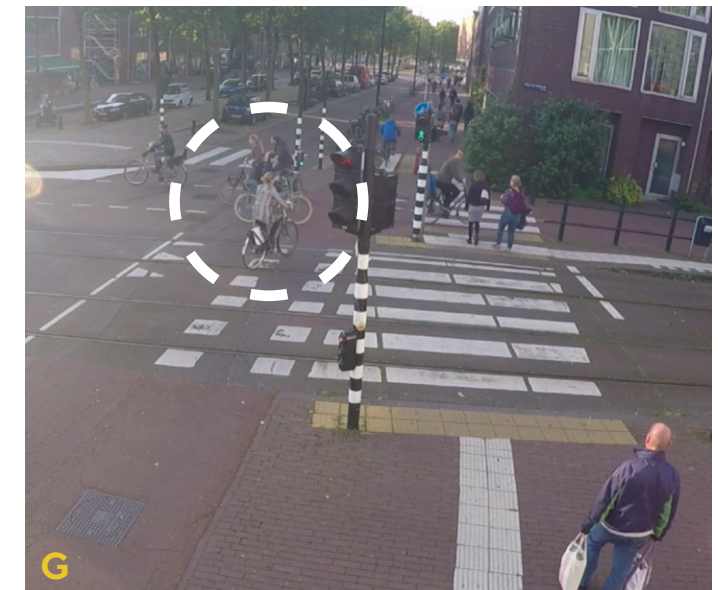
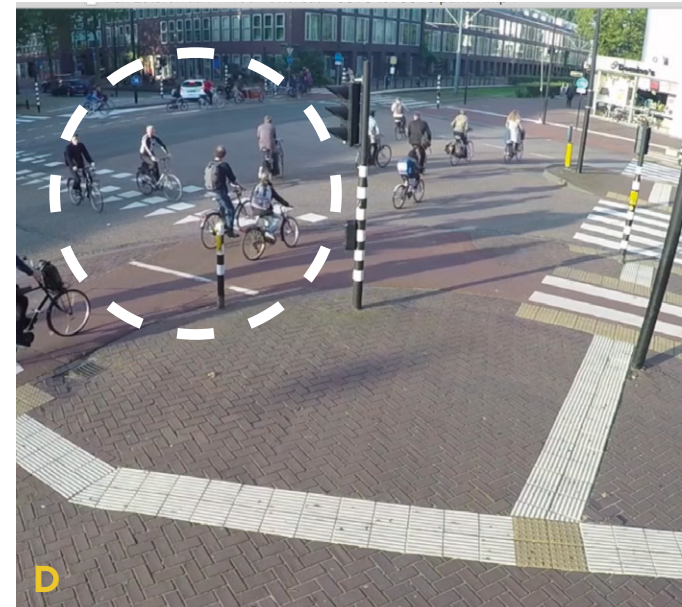
Northeast corner - The light being green at the southeast corner for cyclists turning left prompts some users heading straight to jump the red light, knowing cars are stopped at that moment. Therefore, they arrive at the northeast corner while cyclists are starting to cycle, creating a priority confusion (D-24:35 - also at 25:50).

Southwest corner - Cyclists arriving at the entrance of Fred Petterbaan from the south and the east at the same time don't know who should give the priority (E-24:47). This corner is a bottleneck forcing cyclists to stay aware of their pace, other users and their balance.

Southeast corner - Cyclists from the west are confused by the rules of priority as the ones from the south start pedalling.

THE FORCING SYNDROME - Cyclist not giving priority to another cyclist

Southwest corner - At this corner we observed cyclists speeding up (or slowing down) to find their way through the crowd of users. This behaviour sometimes entails a forcing syndrome. This happens when cyclists arriving from the east and heading west on Fred Petterbaan do not give priority to the ones arriving from the north or the east



5. VAN EESTERENLAAN-FRED PETERBAAN

and heading south towards van Eesterenlaan (F-15:02). It also happens when cyclists arriving from the south and turning left to Fred Petterbaan do not give priority to the ones on their right (G-33:48).

CYCLISTS > < DRIVERS

THE DRIVERS BLOCKING - Drivers stuck at the intersection and blocking the bicycle lane

Northwest corner - On the northern part of the intersection, cars occasionally block the bicycle lane connecting the supermarket to the bicycle track, forcing impatient cyclists to manoeuvre in-between cars.

CYCLISTS > < MOPEDS

THE SHARING STRUGGLE - Mopeds overtaking and weaving between cyclists

The number of mopeds is quite small and is in correlation with the number of conflicts with cyclists, even though some moped users were observed overtaking cyclists to be first at the green light.

Share of mopeds in relation to the total number of cycling infrastructure users:

North entry: 2.5% (5 units)

South entry: 4% (26 units)

East entry: 3% (16 units)

West entry: 5% (5 units)

CYCLISTS > < TRAMS

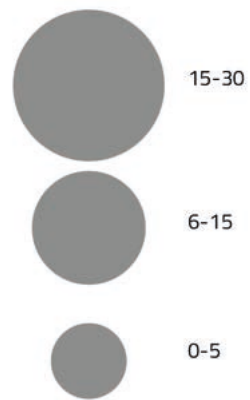
THE PRIORITY CONFUSION - Cyclists having to slow down / stop in the middle of the crossroad due to the tramway passing

Southwest corner - At 22 minutes of the video, the specific Desire Lines of cyclists arriving from the south and turning left to reach the pedestrian path into the park creates a clear conflict with the tramway (H-22:52). Indeed, both cyclists turning left to ride along the rails and the ongoing tramway have a green light. This situation happened only once during the observation.



5. VAN EESTERENLAAN-FRED PETERBAAN

Number of conflicts observed



Type of conflicts

Pedestrians > Cyclists

- Pa** Jam manoeuvre
- Pb** Cyclists blocking
- Pc** Cyclists rudeness

Cyclists > Cyclists

- Ca** Entailed blocked track
- Cb** Impatient syndrome
- Cc** Disoriented syndrome
- Cd** Surprising counterflow
- Ce** Forcing syndrome
- Cf** Priority confusion

car / truck Drivers > Cyclists

- Da** Drivers blocking
- Db** Undesignated car parking

Mopeds > Cyclists

- M** Sharing struggle

Trams > Cyclists

- T** Priority confusion



5. VAN EESTERENLAAN-FRED PETERBAAN

E. DESIGN PROPOSALS

At this intersection, the main element making the crossing for cyclists more complicated is the chicane. This can not be fixed easily due to the lack of space on the north part of the tramway rails. Indeed, the space is too narrow to create a unidirectional bicycle track all along the tramway. Therefore, the main challenge remains to facilitate the access to the bidirectional bicycle track, while not taking space from pedestrians. As the design can not easily be modified, revising the synchronisation of the traffic lights could be an option to tackle this issue. This would make sure cyclists do not arrive at the same time at this bottle neck.

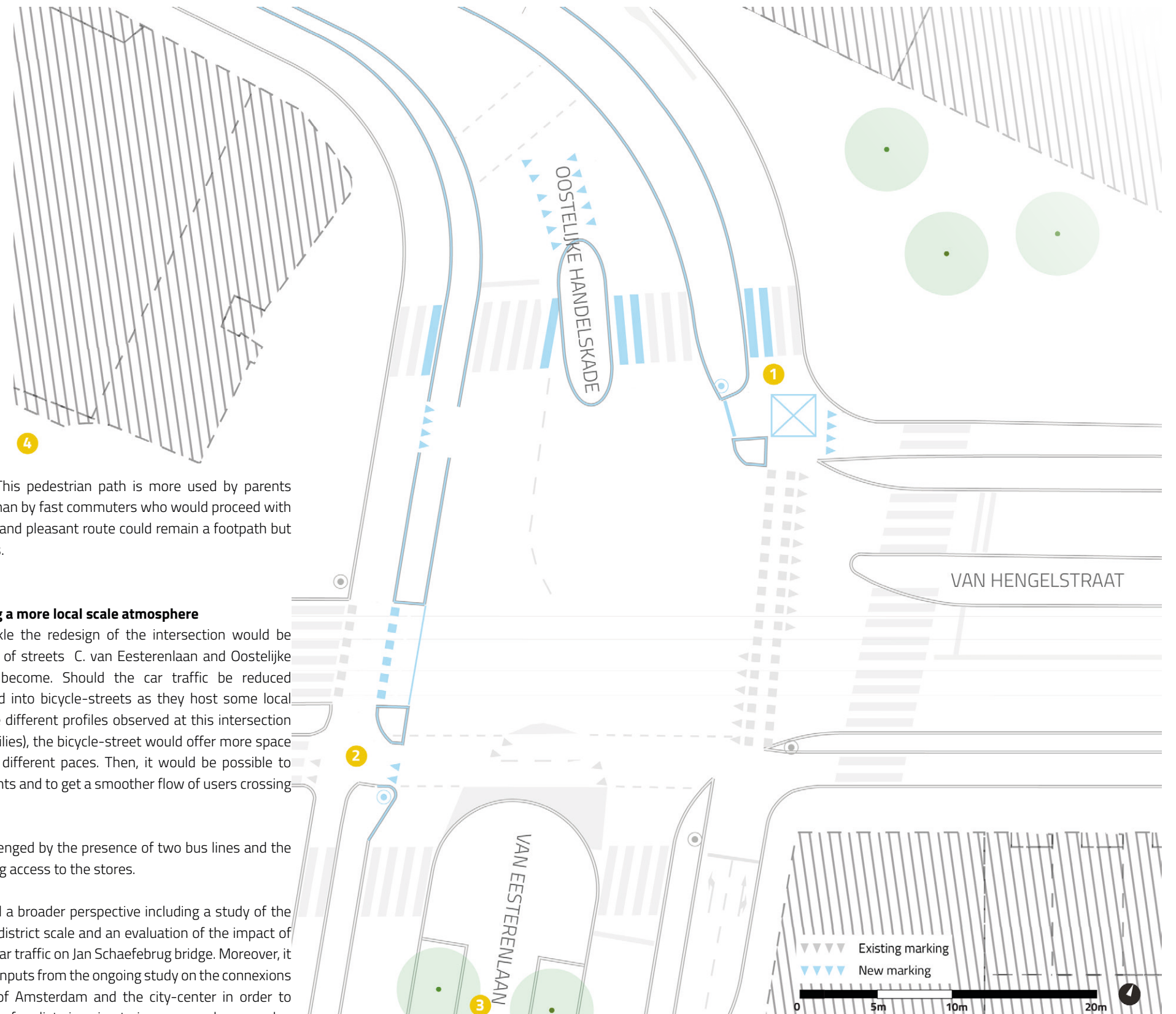
The City of Amsterdam should not channel the flow of cyclists arriving from the east to force them to head straight by drawing a clear bicycle lane in the junction. Indeed, this chicane is not natural for cyclists and the numerous trajectories through the junction do not create conflicts between users.

Scenario 1 - Redesign options

Northeast corner (1) - A waiting area can be created for cyclists waiting at the traffic light by reducing the unused space in the middle of Oostelijke Handelskade. Moreover, the new design will allow cyclists turning right not to have to wait at the traffic light. It should reduce the number of cyclists riding on the sidewalk. Nonetheless, this new design implies the removal of the lane granting access to the car park.

Southwest corner (2) - It is challenging to open up the entrance/exit of the Fred Petterbaan track to facilitate the flow of cyclists due to the tramway rails. Yet the waiting area can be slightly extended due to the new design in the north of the junction.

Van Eesterenlaan (3) - Today, the central reservation running through the middle of Van Eesterenlaan represents a barrier for cyclists arriving from the side streets. This explains the number of bicycle users riding in counterflow. Therefore, an access for cyclists-only could be opened in front of C.J.K Van Aalststraat and D.L. Hudigstraat. Some speed bumps should be added before the crossings to reduce car speed.



Rietlandpark (4) - This pedestrian path is more used by parents riding with children than by fast commuters who would proceed with a shortcut. This safe and pleasant route could remain a footpath but be tolerant to cyclists.

Scenario 2 - Creating a more local scale atmosphere

Another way to tackle the redesign of the intersection would be to question the type of streets. C. van Eesterenlaan and Oostelijke Handelskade could become. Should the car traffic be reduced and the roads turned into bicycle-streets as they host some local traffic? Based on the different profiles observed at this intersection (commuters and families), the bicycle-street would offer more space to cyclists riding at different paces. Then, it would be possible to remove the traffic lights and to get a smoother flow of users crossing the junction.

This scenario is challenged by the presence of two bus lines and the delivery trucks gaining access to the stores.

This idea would need a broader perspective including a study of the circulation plan on a district scale and an evaluation of the impact of this redesign on the car traffic on Jan Schaeferbrug bridge. Moreover, it should include some inputs from the ongoing study on the connexions between the north of Amsterdam and the city-center in order to reckon if the number of cyclists is going to increase or decrease due to possible forthcoming bridges.

6 CEINTURBAAN – AMSTELDIJK

A. THE NEIGHBOURHOOD

The intersection Ceintuurbaan – Amsteldijk is located southeast of the city, by the Amstel river. This residential area belongs to the Amsterdam-South district. The crossing of Amsteldijk boulevard with Ceintuurbaan is a major one along this route.

The west part of the intersection is occupied by residential buildings with active ground floors (shops, restaurants, cafés, etc.).

The east part of it is flanked by the Amstel river and a bridge allowing inhabitants to reach another residential area, Oosterpark and further east lies the railway station, Amsterdam Muiderpoort.



Top view



Camera view

6. CEINTURBAAN - AMSTELDIJK

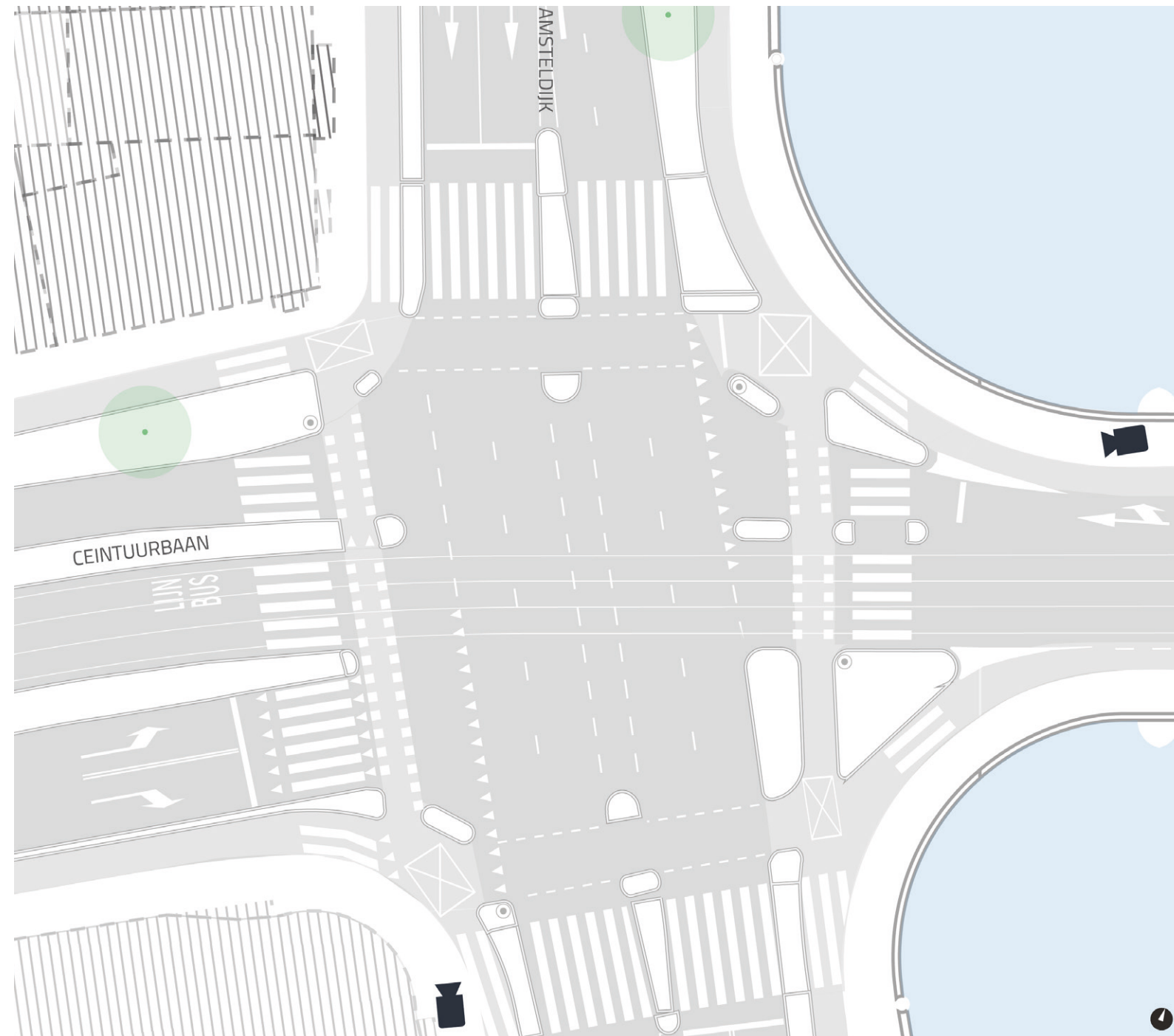
B. THE INTERSECTION

Ceintuurbaan – Amsteldijk is a typical Dutch intersection between two main boulevards.

Amsteldijk has bicycle tracks on both sides protected by a buffer zone made by an elevated curb. On the river side, a row of trees separates cyclists from cars. Likewise, Ceintuurbaan has bicycle tracks on both sides while Nieuwe Amstelbrug has two bicycle lanes. All four corners have an area for cyclists waiting at the traffic light and are equipped with push button mechanisms to activate the green light. The size of these areas differ from one corner to another. Indeed, as cars arriving from the south are not allowed to turn right on the bridge, a vast waiting area was built into the design of the southeast corner.

Ceintuurbaan is made up of car lanes and two lanes exclusively for tramways and buses, located in the middle of the street. On the bridge, only one car lane allows drivers to arrive from the east.

Amsteldijk boulevard is made up of four lanes on both sides of the intersection.



6. CEINTUURBAAN - AMSTELDIJK



North entry



East entry



South entry



West entry

6. CEINTUURBAAN - AMSTELDIJK

KEY FINDINGS I

C. THE DESIRE LINES

The intersection Ceintuurbaan – Amsteldijk was filmed on September 12th, 2017 from 8:15 to 9:15am by two cameras: one located at the southwest corner and at the northeast one (on the bridge). **3,514 cyclists** crossed the junction during the morning rush hour. The average volume of cars on Ceintuurbaan is X and X on Amsteldijk.

ENTRY POINTS

During the morning rush hour, the east-west axis receives 67% of the total number of cyclists crossing this junction. South and north entries are less utilised with 20 and 13% of the flow.

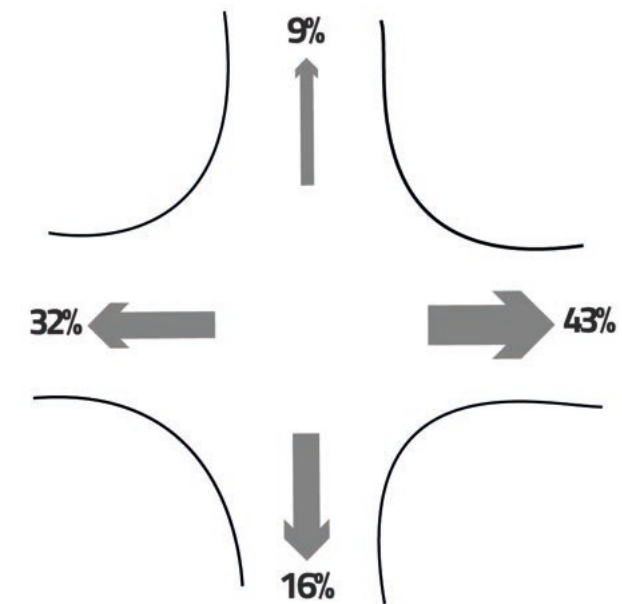
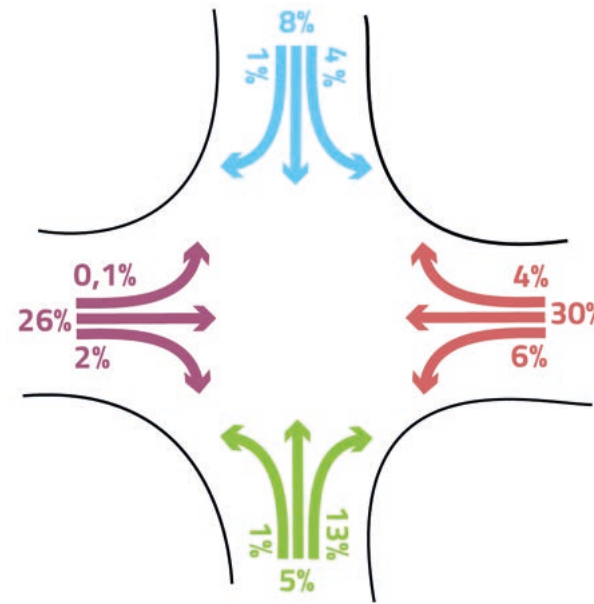
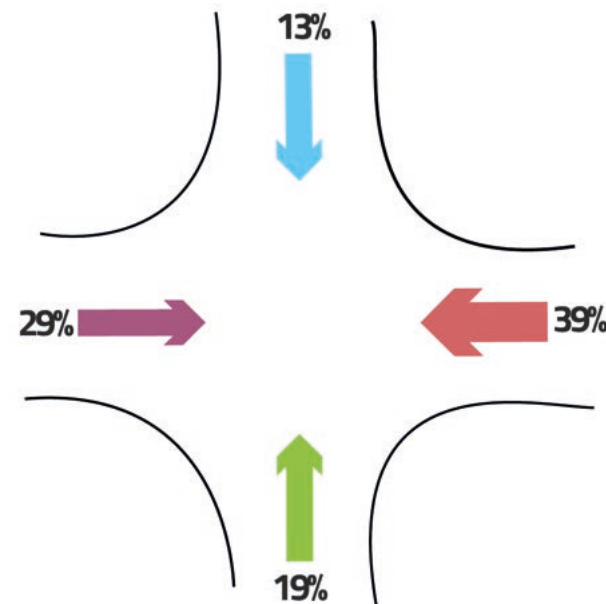
MAIN DIRECTIONS

Cyclists heading straight on the east-west axis put aside (55% of all users), a noticeable part of cyclists arrive from the south and head east.

The most observed left turn is made by cyclists arriving from the east and heading south, meaning waiting at the north-west corner.

EXIT POINTS

The eastern and western exits are the busiest ones while the north exit heading towards the city center is quieter.



6. CEINTUURBAAN - AMSTELDIJK

NORTH ENTRY POINT

466 bicycle users arrive by the north entry.

STRAIGHT Around 60% head straight.

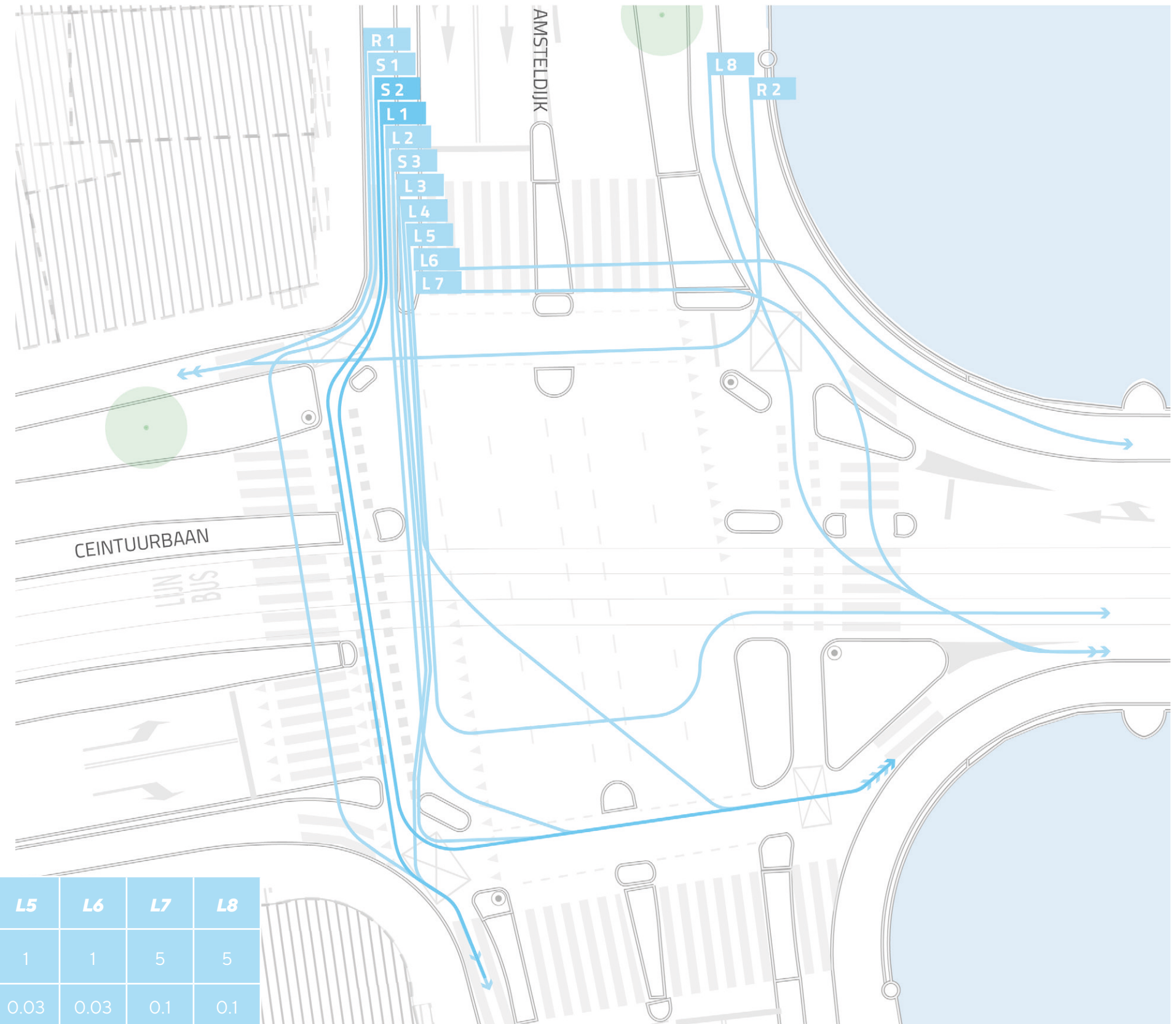
LEFT TURN 158 users turn left using eight different trajectories.

If the majority of users respect the bicycle track, 66 cyclists - meaning 42% of them - were seen riding outside the bicycle lane, waiting outside the box or cycling on the sidewalk.

L2 - These cyclists ride outside the bicycle lane but reintegrate the traffic flow at the waiting box.

L3 - L4 - L5 - 44 cyclists turn left by skipping the waiting area at the opposite corner.

L6 - L7 - These cyclists skip the opposite corner by turning left directly on the pedestrian crossings.



Label	S1	S2	S3	R1	R2	L1	L2	L3	L4	L5	L6	L7	L8
	5	272	7	20	4	92	11	33	10	1	1	5	5
%	0.1	8	0.2	1	0.1	3	0.3	0.9	0.3	0.03	0.03	0.1	0.1

6. CEINTUURBAAN - AMSTELDIJK


SOUTH ENTRY POINT

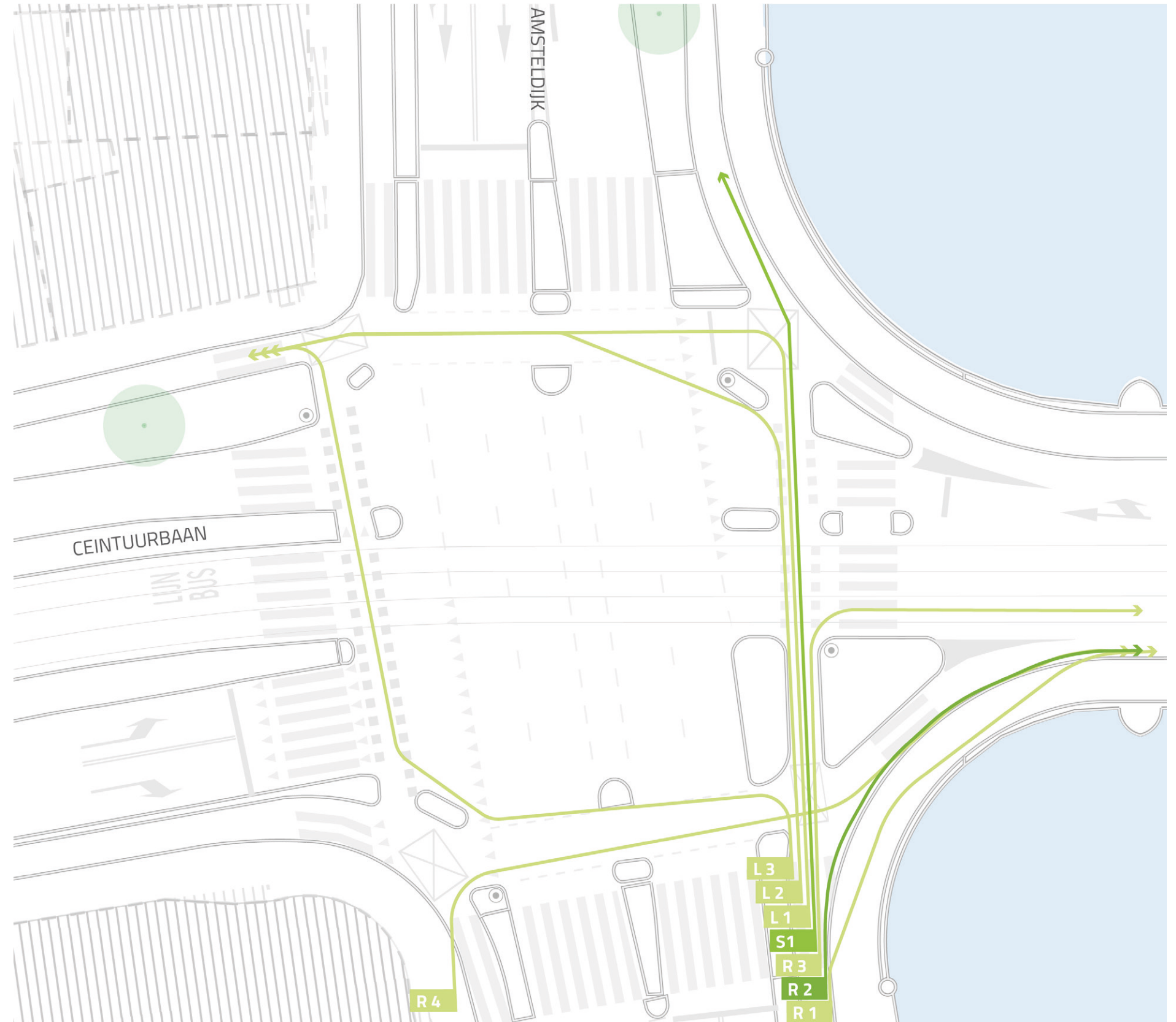
691 bicycle users arrive from the south entry.

STRAIGHT A bit less than a third of cyclists head straight to the north towards the city-centre. As there is no right turn for cars heading to the bridge, cyclists are allowed more space. The waiting area is large enough to host all cyclists waiting at the traffic light. The red light is short and never more than four people wait at the same time. Compared with intersection n° 1 located on the same boulevard, the entrance of the southeast corner does not really entail a bottleneck. Moreover, if the total number of cyclists is, here, fewer than at intersection n° 1, the bicycle track is not used to wait and the flow of cyclists is therefore not obstructed.

RIGHT TURN Two thirds of bicycle users arriving from the south turn right. Almost all of them respect the bicycle track. A few users have difficulties accessing the track while the important flow of cyclists arriving from the west is passing.

LEFT TURN A few cyclists proceed with a left turn. They mostly respect the design of the waiting area, even though a few skip it in order to save time and make sure they have time to cross the intersection.

Label	S1	R1	R2	R3	R4	L1	L2	L3
	188	3	453	1	4	36	5	1
%	5	0.1	13	0.03	0.1	1	0.1	0.03



6. CEINTUURBAAN - AMSTELDIJK

EAST ENTRY POINT


1,334 cyclists arrive from the east, on the bridge, making this entry point the busiest of the intersection and putting pressure on the infrastructure. An extremely high number of trajectories – 18 in total – are drawn by cyclists heading in all directions and using their dedicated space as well as the space of the tramways, car lanes and pedestrian zones. These users' behaviour shows a will to avoid the crowded north-east and north-west corners.

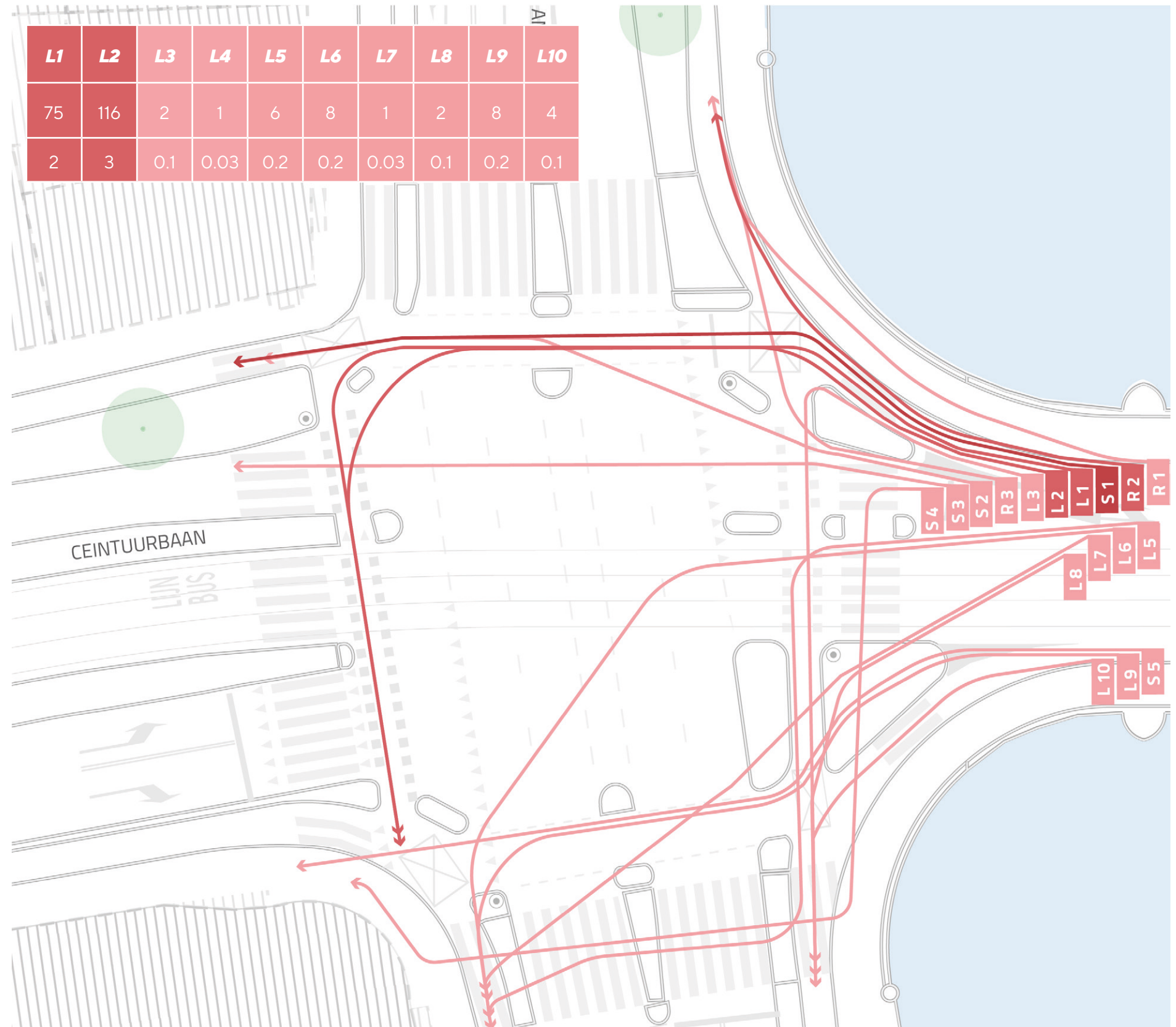
STRAIGHT Three quarters of cyclists head straight on Ceintuurbaan.
S3 - S4 - If a high majority of users respect the bicycle track, some tend to look outside the overcrowded waiting area to find some space.

LEFT TURN 10 different trajectories were counted for cyclists proceeding with a left turn. The majority of these users wait at the north-west corner outside the already crowded waiting area. A total of 31 cyclists completely skip this corner by turning left directly when they are still on the bridge.

L3 - L8 - L10 - These eight cyclists turn left to reach the south-east corner and ride in counterflow.

L5 - L6 - These cyclists go off the track and turn left directly either on the pedestrian crossing or the bicycle lane. Some ride on the protected island or on the sidewalk.

Label	S1	S2	S3	S4	S5	R1	R2	R3
	995	52	10	1	2	24	100	2
%	28	1	0.3	0.03	0.1	1	3	0.1



6. CEINTUURBAAN - AMSTELDIJK


WEST ENTRY POINT

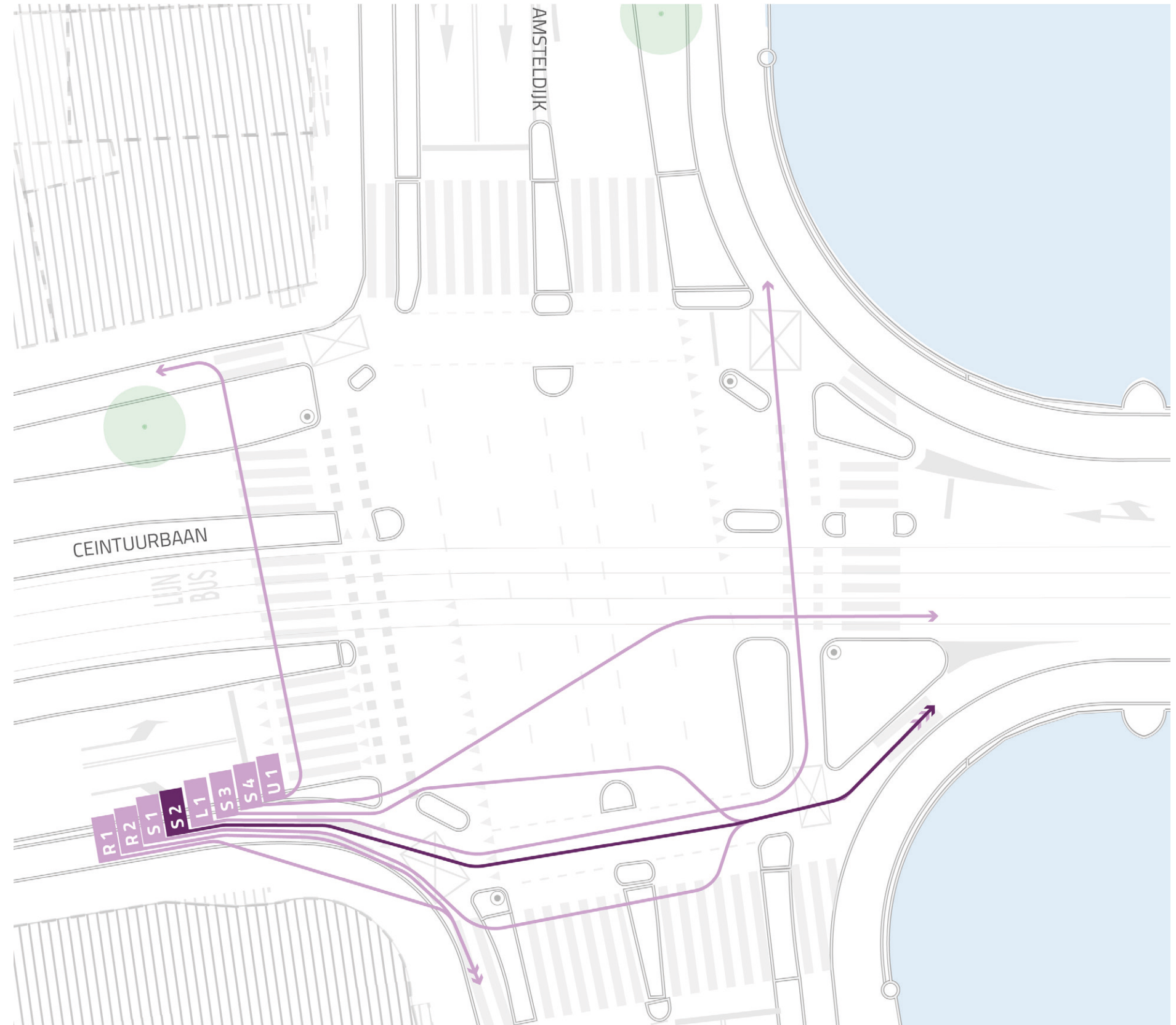
1,023 cyclists arrive from the west entry point. 92% of them head straight and most of them respect the infrastructure.

STRAIGHT S1- S3 - S4- These cyclists leave the bicycle infrastructure since it is under pressure due to a high number of users.

RIGHT TURN Slightly more than half of the users respect the bicycle track, while the rest ride on the sidewalk to avoid the group waiting at the traffic light.

LEFT TURN Only three people turn left using the vast waiting area. One had difficulties to access the waiting box (9:20) as the flow of cyclists is extremely dense. She had not anticipated her bend and had been taken by the flow with no possibility to turn left on time.

Label	S1	S2	S3	S4	R1	R2	L1	U1
	16	880	37	4	34	48	3	1
%	0.4	25	1	0.1	1	1	0.1	0.03



6. CEINTUURBAAN - AMSTELDIJK

KEY FINDINGS II

D. USER CONFLICTS

The main conflicts occur at the northeast corner where the high number of users puts pressure on the infrastructure, here, the narrow bicycle lane on the bridge. This design and this situation entail a high "impatient syndrome". Moreover, at the southeast corner an important "surprising counterflow" was observed.

CYCLISTS > PEDESTRIANS

The flow of pedestrians being low, no conflict was observed.

CYCLISTS > CYCLISTS

THE IMPATIENT SYNDROME - Cyclists overtaking cyclists to be the first in line

Northeast corner - On the bridge the number of cyclists overtaking the group of cyclists waiting at the red light is extremely high. Sometimes, confusion arises when these cyclists reintegrate the bicycle lane and find themselves in the way of the ones slowing down to get into position for a left turn at the northwest corner. Cyclists turning left on the bridge have not been taken into account on the matter of this "impatient syndrome".

Southwest corner - Cyclists overtaking the group of waiting cyclists at the traffic light leave the track and speed up to reintegrate the bicycle lane before accessing the southeast corner. Cyclists leaving the bicycle track and reaching the tramway track have not been counted.

THE FORCING SYNDROME - Cyclists not giving priority to another cyclist

Southwest corner - Twice, cyclists arriving rapidly from the north bumped into cyclists proceeding with a left turn and positioning themselves correctly in the waiting area (A- 2:31, B- 5:52).

THE PRIORITY CONFUSION - Cyclists confused by the rules of priority

Southeast corner - Cyclists from the south are confused by the rules of priority as the crowd arriving from the west is passing without giving way to them.



6. CEINTUURBAAN - AMSTELDIJK

THE SURPRISING CONTRAFLOW - Cyclists in contraflow and surprising cyclists riding in the right direction

Northeast corner - 6 bicycle users arrive in counterflow from the north and surprise the other cyclists (C- 5:26).

Southeast corner - The number of cyclists arriving in counterflow from the bridge is the highest among the different intersections in this study. Even though some ride on the protecting islands, they sometimes disturb the dense flow arriving from the south and the west. Some of these bicycle users are the ones turning left directly to skip the busy north corners. Others, riding in counterflow on the bicycle track, may arrive from Blasiusstraat or Weesperzijde and do not cross the tramway rails on the east side of the bridge.

CYCLISTS > MOPEDS

THE SHARING STRUGGLE - Mopeds overtaking and weaving between cyclists

Share of mopeds in relation to the total number of cycling infrastructure users:

North entry: 5% (25 units)

South entry: 9% (61 units)

East entry: 4% (61 units)

West entry: 8% (78 units)

Mopeds riding completely outside the bicycle track were not counted as they use the car and tramway lanes.

CYCLISTS > DRIVERS

At the northeast corner several car drivers were spotted forcing the priority while cyclists heading straight had the green light (D- 2:19).

At the southwest corner, a coach can not properly proceed with the right turn without disturbing cyclists waiting outside the waiting box (E-31:24).

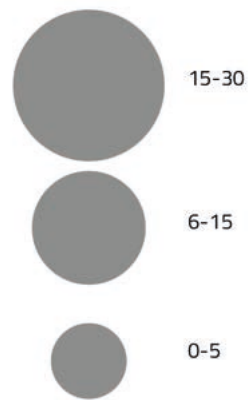
THE DRIVERS BLOCKING - Drivers stuck at the intersection and blocking the bicycle lane

Southwest corner - Several times, on both sides of the corner, cars heading south blocked the bicycle lanes (F-15:25).



6. CEINTUURBAAN - AMSTELDIJK

Number of conflicts observed



Type of conflicts

Pedestrians > Cyclists

- Pa** Jam manoeuvre
- Pb** Cyclists blocking
- Pc** Cyclists rudeness

Cyclists > Cyclists

- Ca** Entailed blocked track
- Cb** Impatient syndrome
- Cc** Disoriented syndrome
- Cd** Surprising counterflow
- Ce** Forcing syndrome
- Cf** Priority confusion

car / truck Drivers > Cyclists

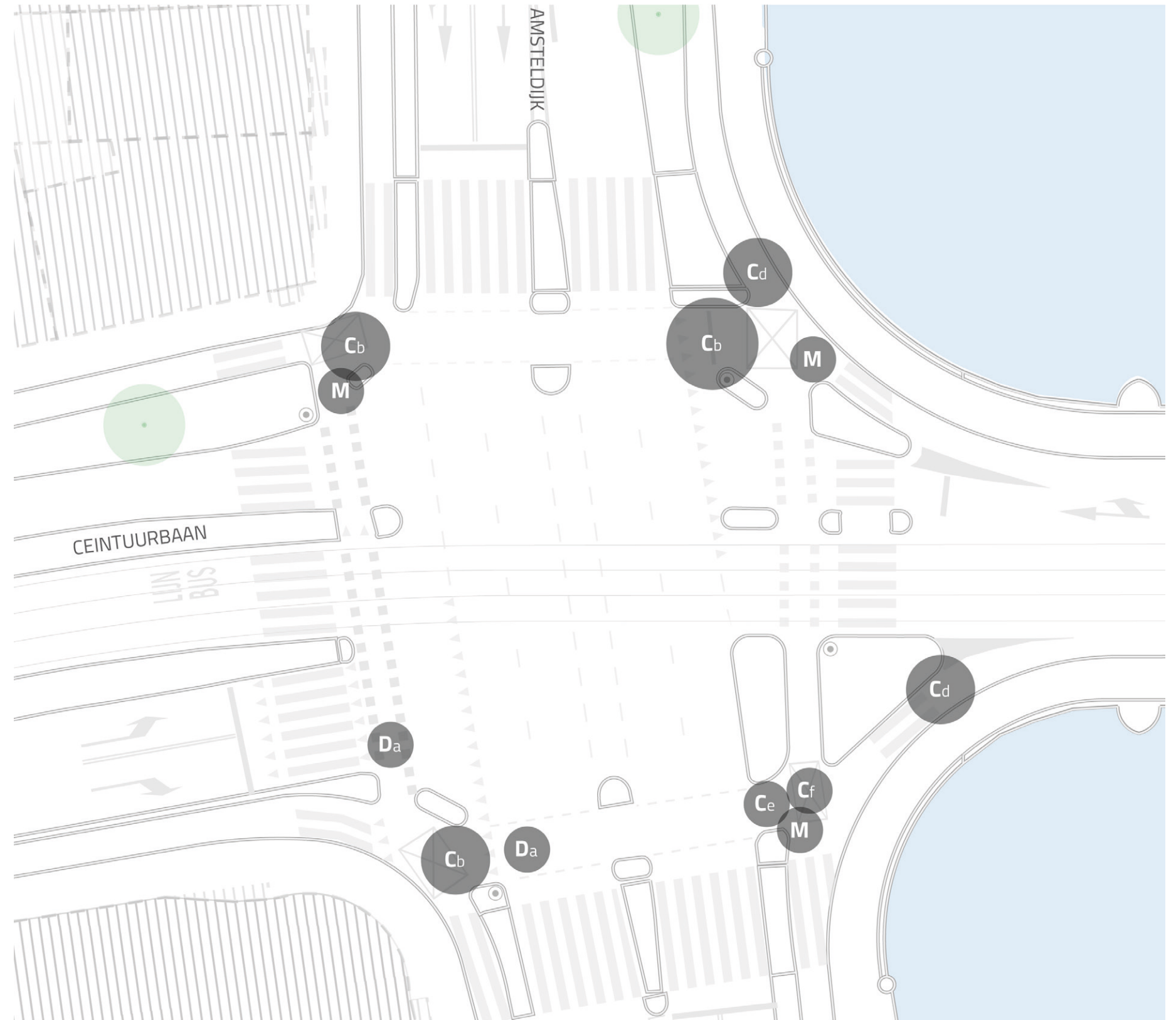
- Da** Drivers blocking
- Db** Undesignated car parking

Mopeds > Cyclists

- M** Sharing struggle

Trams > Cyclists

- T** Priority confusion



6. CEINTUURBAAN - AMSTELDIJK

E. DESIGN PROPOSALS

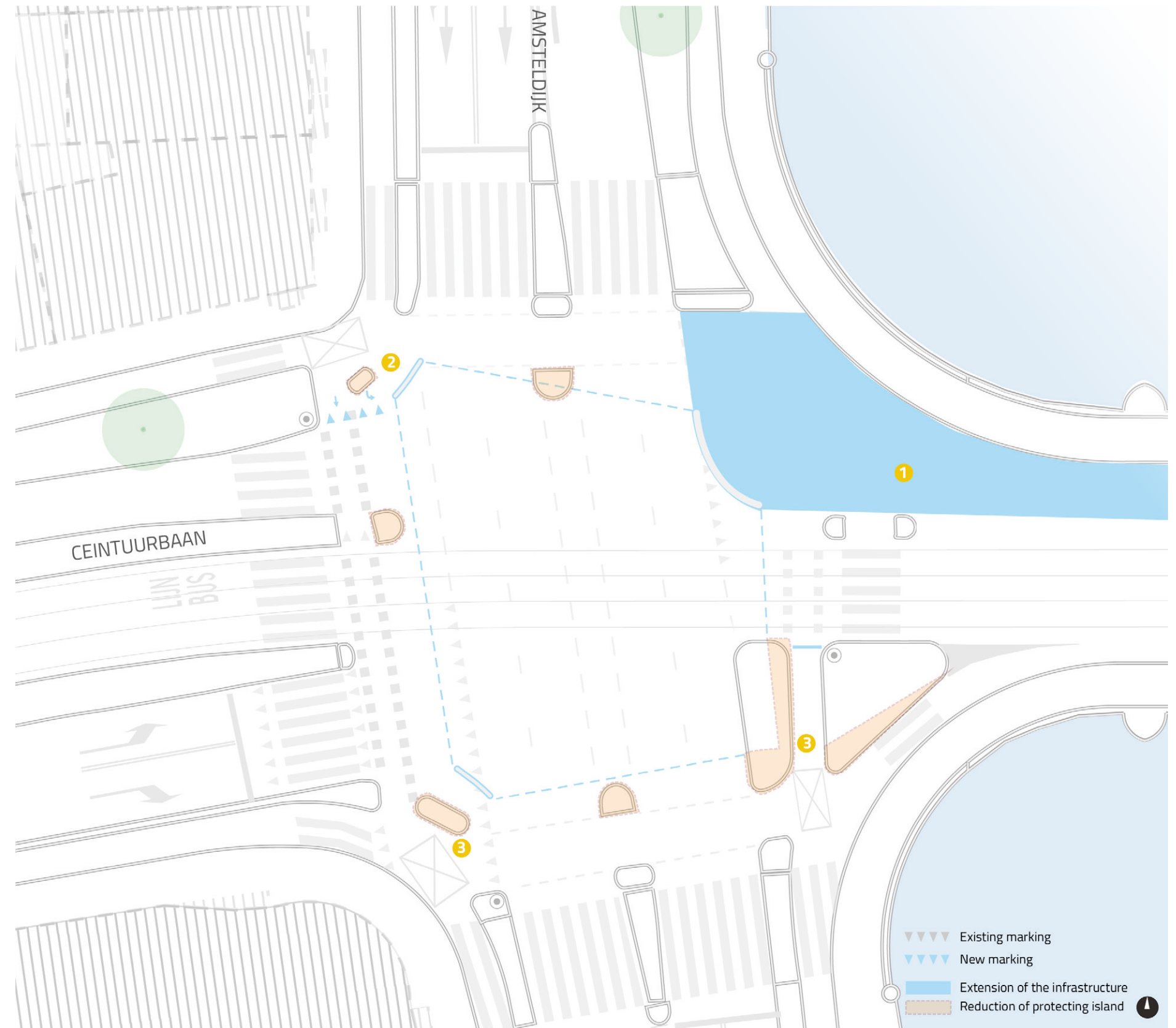
In general, the space for cyclists must be increased by reducing the protecting islands and extending the bicycle lane in-between each entry point.

Northeast corner - 1,334 cyclists arrive by the east entry point on the narrow bicycle lane which can not accomodate all of them. If a traffic analysis shows that the car traffic could be transferred on to another bridge, it would ease the cyclist flow(1). Unfortunately, this redesign could create unintended consequences and lead more cyclists to turn left directly on the bridge or in the middle of the intersection.

Northwest corner - The waiting area should be enlarged (2).

Southeast corner - The waiting area for cyclists heading straight could be slightly reduced to limit the bottleneck effect and facilitate the turn for cyclists arriving from the south and turning right on to the bridge (3).

Southwest corner - It is crucial to offer space to cyclists coming from the north and turning left as some stop and wait outside of the waiting box (4).



7 HUGO DE GROOTSTRAAT- NASSAUKADE

A. THE NEIGHBOURHOOD

The intersection Hugo de Grootstraat – Nassaukade is located west of Amsterdam, in the Frederik Hendrikbuurt residential neighbourhood, close to the crowded Jordan district. To be more precise, the junction is on the main boulevard delimiting the city-centre and running along the Singelgracht. A school is located by the intersection.



Top view



Camera view

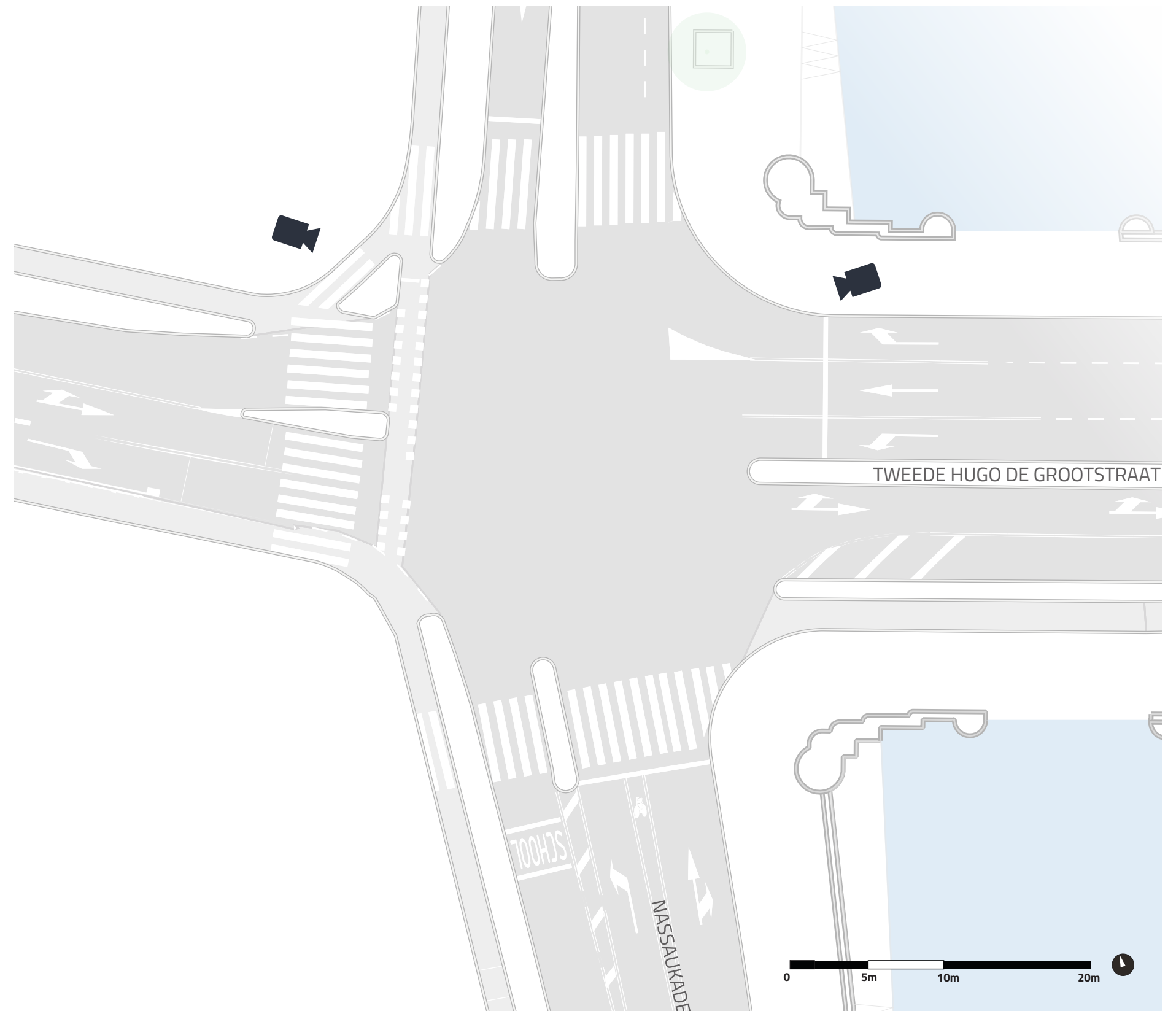
7. HUGO DE GROOTSTRAAT- NASSAUKADE

B. THE INTERSECTION

Tweede Hugo de Grootstraat is a two-way street for cars. On the west side of the intersection, there is a bicycle track on each side of the boulevard. They measure around 1.75 meters. The north track is protected by a buffer zone used as a bicycle and car parking. Whereas the south track is no longer protected before the intersection with the parking area becomes a right-turn lane for cars. On the other side of the junction -on the bridge- there is a 1.90 meter bicycle track only on the south side, as well as a bus lane (line 18). The north side has three lanes for cars and no bicycle infrastructure.

Nassaukade is also a two-way street for cars, with cycling infrastructure on both sides of it. However, on the south side of the junction, in the south-north direction, the track disappears before the intersection and is turned into a one meter bicycle lane to facilitate the left-turn in one-step. This bicycle lane is located in-between two car lanes. After the intersection, there is a 1.50 meter wide bicycle lane.

In the north-south direction, a 1.80 meter wide bicycle track, lined by bicycle and car parking spots, facilitates cyclists' trips on both side of the intersection.



7. HUGO DE GROOTSTRAAT- NASSAUKADE



North entry



East entry



South entry



West entry

7. HUGO DE GROOTSTRAAT- NASSAUKADE

KEY FINDINGS I

C. THE DESIRE LINES

The intersection Hugo de Grootstraat –was filmed on May 30th, 2017 from 8:15 to 9:15am by two cameras, located at the north-east and north-west corners. A total of 2,078 cyclists were counted during this morning rush hour. The average volume of cars on Hugo de Grootstraat is X and X on Nassaukade.

ENTRY POINTS

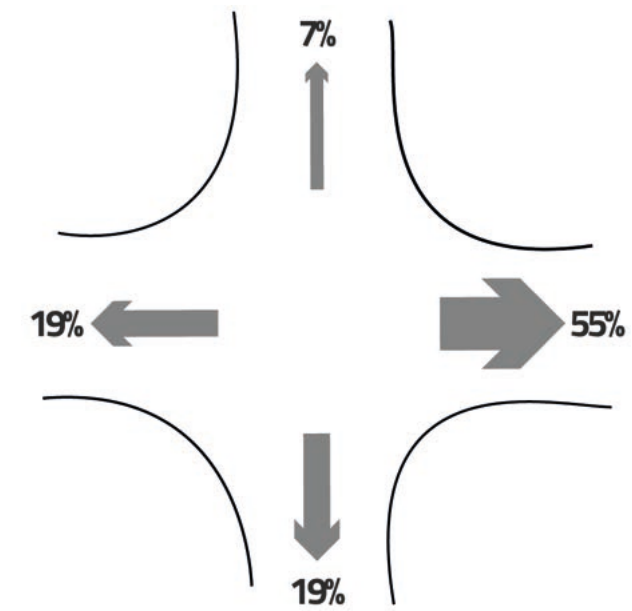
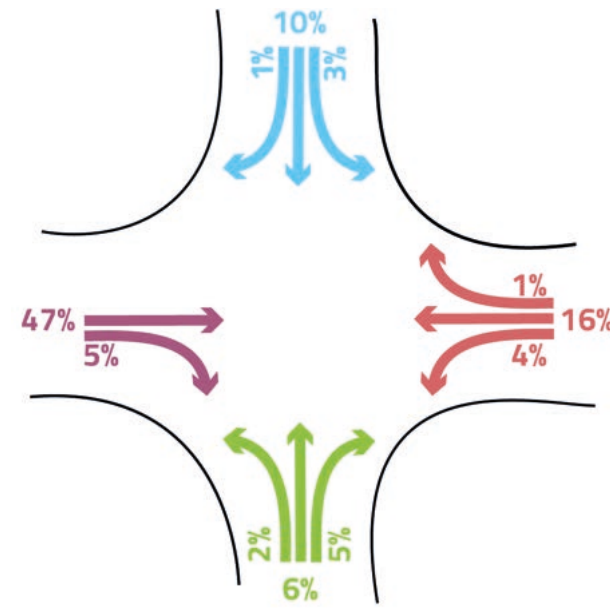
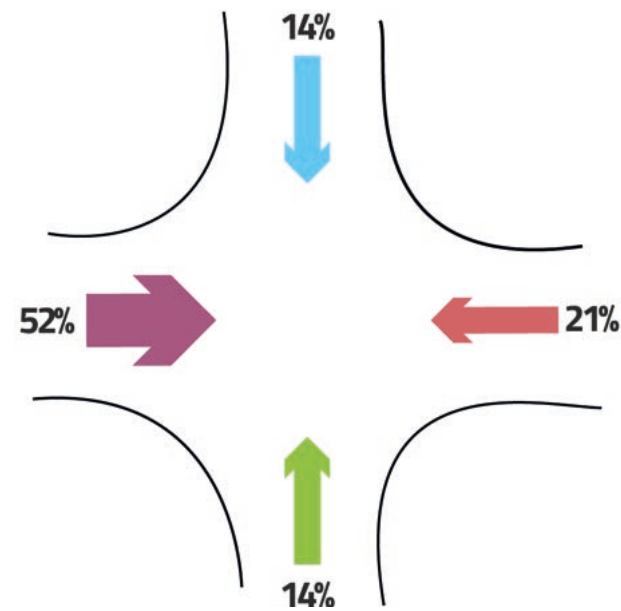
More than half of cyclists arrive at the intersection from the west, meaning from the outskirts of the city-centre. The other entries are less active and count for 14 to 21% of the flow of bicycle users.

MAIN DIRECTIONS

More than half of cyclists head east, toward the city-centre, whereas very few head north.

EXIT POINTS

Whatever the entry of the intersection, 89% of cyclists ride straight. Only 9% of cyclists turn left, with none of them coming from the west and going north.



7. HUGO DE GROOTSTRAAT- NASSAUKADE

NORTH ENTRY POINT

288 cyclists arrive from the north entry. The design of this corner fits pretty well the users' behaviour. It allows them to turn right directly on a specific lane. Elsewhere, cyclists heading south and arriving first at the red light usually push the button hoping to activate the green light not to be waiting too long.

STRAIGHT

S1 & S2 - The high majority of cyclists ride straight (204). A few cyclists in a hurry ride slightly outside the bicycle lane in order to overtake other cyclists and be the first to enter the rather narrow bicycle track. Since the waiting box can not fit more than 3 to 4 cyclists, some of them stop on the pedestrian crossing while waiting for the green light. Coming from the east entry, only one cyclist uses the waiting box at this corner to turn left in two steps. Therefore, they do not contribute to the issue of narrow space.

RIGHT TURN

R1 - The design of this corner allows cyclists to turn right directly without waiting at the traffic light. Due to a really low number of bicycle users turning right, they can turn without any trouble even when a queue of cyclists builds at the red traffic light.


LEFT TURN

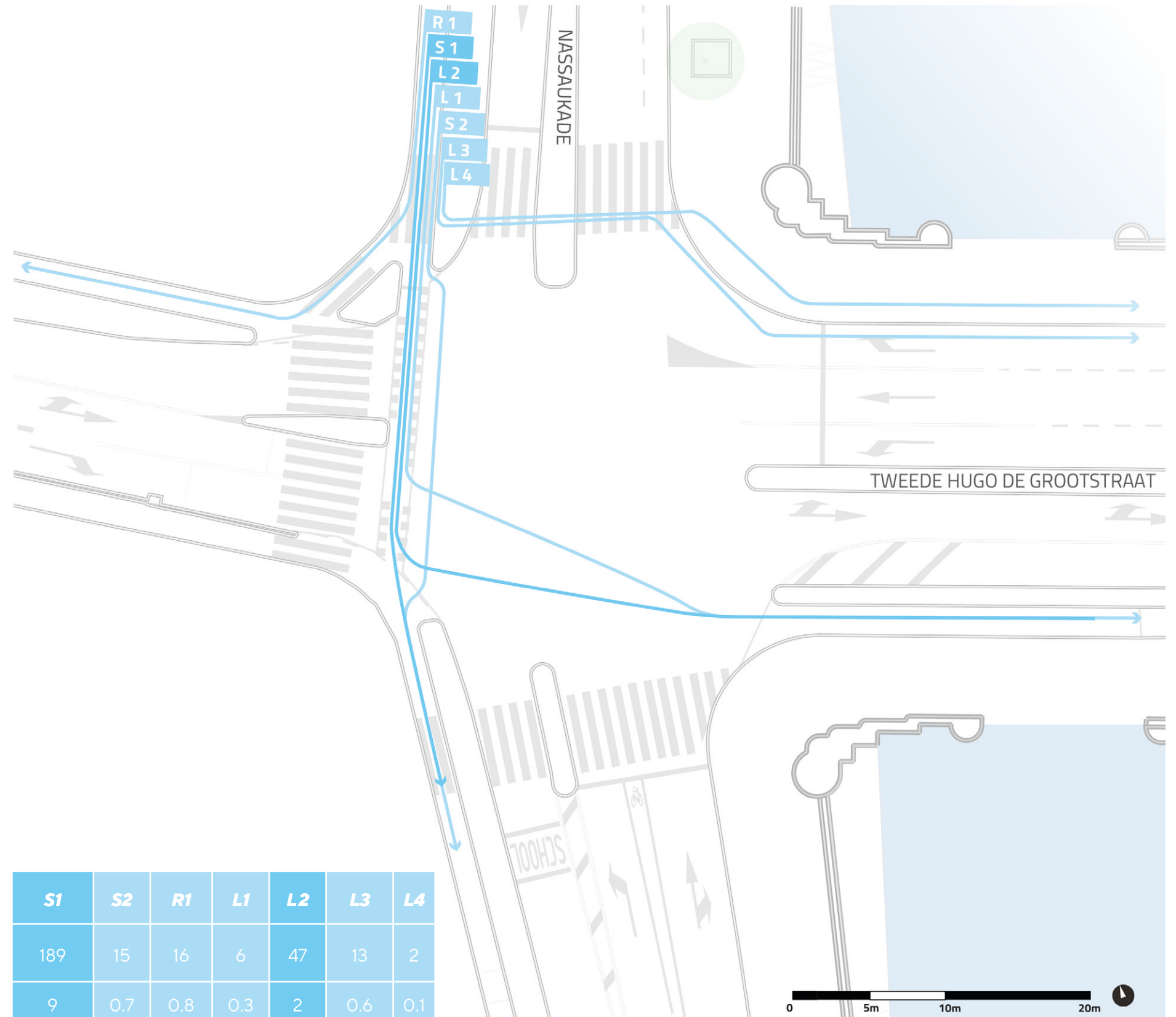
L2 - The number of cyclists turning left is rather low (68). The ones turning in two steps wait between the bicycle lane and the yield line at the southwest corner. There are rarely more than a couple of cyclists waiting. During the peak of the rush hour when 5-6 cyclists turn left this way, the space is large enough to allow them to wait safely. At times, cyclists coming from the west and going straight slowly move ahead during the red phase blocking the north-south bicycle track.

L3 - It is hard to explain the reasons for this trajectory. It could be the cyclist's destination on the other side of the bridge, the "impatient syndrome" or the absence of a waiting box to turn left at the southwest corner. The observation was that 13 bicycle users prefer turning left on the pedestrian crossing and riding on the sidewalk than waiting at the traffic light.

L4 - This surprising and dangerous trajectory is done by two cyclists riding in counterflow on the car lanes. Nonetheless, neither cars, nor cyclists, were on the bridge at that moment.

L5 - This one-step left turn is done by cyclists in a hurry during the peak of the rush hour.

Label	S1	S2	R1	L1	L2	L3	L4
	189	15	16	6	47	13	2
%	9	0.7	0.8	0.3	2	0.6	0.1



7. HUGO DE GROOTSTRAAT- NASSAUKADE


SOUTH ENTRY POINT

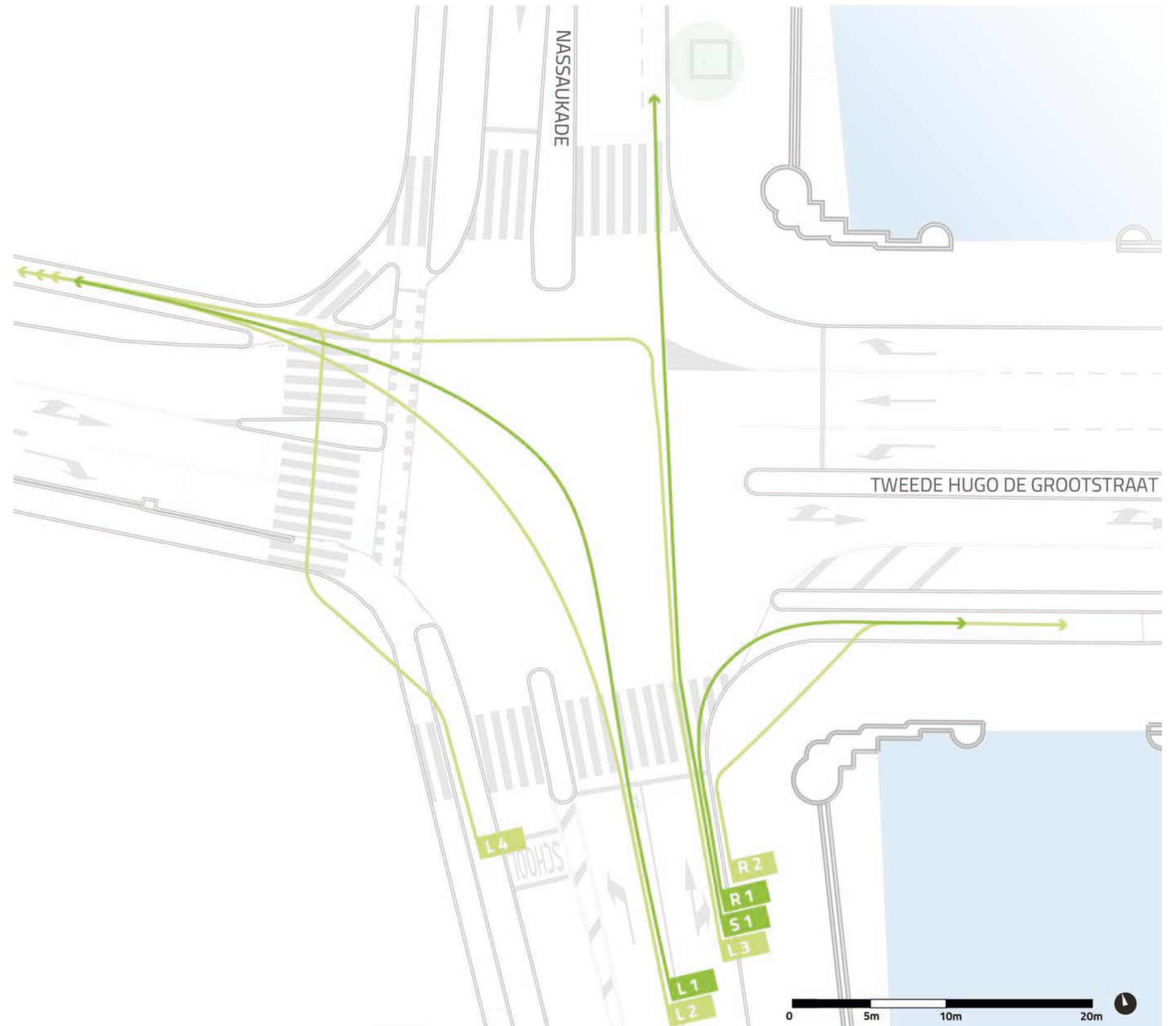
On Nassaukade, a bicycle track keeps bicycle users and car drivers separated. Nevertheless, about 60 meters before the intersection the bicycle track disappears and cyclists share the space with cars going straight and turning right. About 20 meters before the intersection, a bicycle lane is dedicated to users turning left. This lane is located in-between the straight and right-turn lanes for car drivers. In total, **282 cyclists** arrive from the south entry point.

STRAIGHT S1- Almost half of bicycle users coming from the southern access point keep on cycling straight. While they share the lane with car drivers they stick to the edge of the lane along the curb. In the intersection, where no lane is drawn, they strictly stick to the right. A few users only cycle side by side or overtake other cyclists while crossing the intersection.

RIGHT TURN R1 - R2 - More than a third of bicycle users coming from the south turn right towards the city-centre. All cyclists arriving at the intersection when the traffic light is red disregard it and proceed with the turn, even when a crowd of cyclists coming from the west is crossing the intersection. They give way to these cyclists and slowly integrate the massive group heading east.

LEFT TURN L1 - L2 - L3 - The intersection is designed to facilitate a direct left-turn, which is rather unusual in Amsterdam. Except for one, all cyclists use this lane. They respect the lane drawn on the intersection or cycle outside of it to get a tighter bend. On this part of Nassaukade, the volume of cars is rather low which allows cyclists to integrate the left-turn lane many meters before the intersection. Very few cyclists integrate it by passing in front of cars waiting at the traffic light.

Label	S1	R1	R2	L1	L2	L3	L4
	129	98	8	34	10	1	2
%	6	5	0.4	2	0.5	0.05	0.1



7. HUGO DE GROOTSTRAAT- NASSAUKADE

EAST ENTRY POINT

The bridge does not have any bicycle infrastructure to accommodate the **437 bicycles users** arriving from there. Therefore, bicycle users share the space with cars throughout the three lanes. They anticipate their turn by cycling or waiting at the traffic light on the dedicated car lane. Due to the low volume of cars, no stress from bicycle users was observed. Moreover, there is a trend to stop on the stop line or slightly in front of it. Nevertheless, rare are the bicycle users that wait by the yield line. Thus, the vast space between the stop and yield lines is not fully used.

STRAIGHT S1 - Three quarters of bicycle users coming from the east keep on cycling straight on Tweede Hugo de Grootstraat. They wait at the traffic light using the middle lane dedicated to go straight with a tendency to cycle on or to stop on the right part of this lane. Some bicycle users use the left part of the car right-turn lane. When several cyclists wait at the traffic light, they position themselves in a row all along the stop line. There are up to three in a row. Cyclists then form a line while crossing the intersection and enter the bicycle track on the opposite side of the intersection one by one due to a narrow access point. The width of the bicycle track on the other side of the intersection fits the volume of cyclists, even during the peak of the rush hour.


RIGHT TURN A minority of bicycle users coming from the east turn right. No cyclists used the sidewalk to proceed with this turn since the bicycle path was clear of other users. They turn right to the bicycle track using the right part of the right-turn lane.

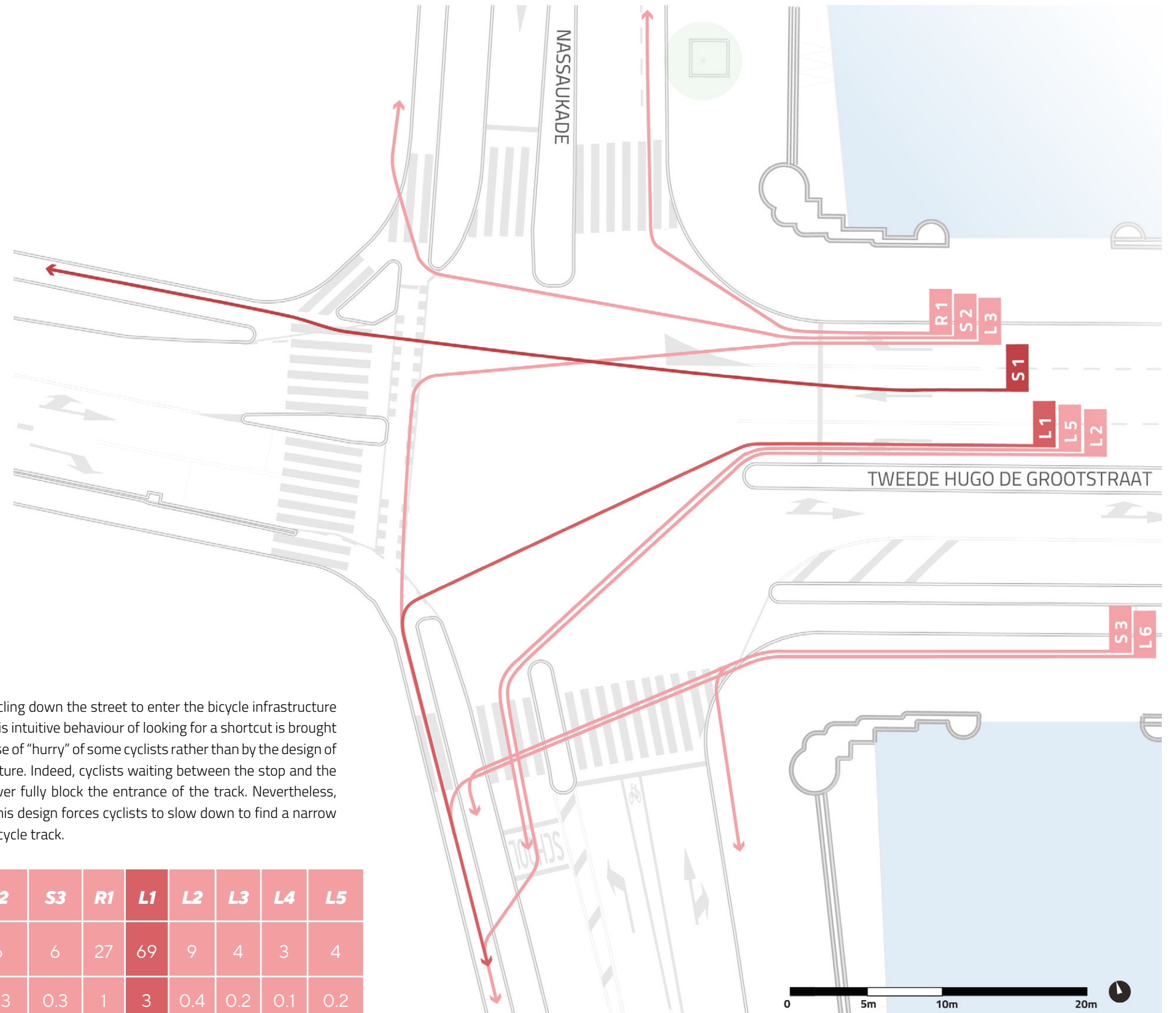
LEFT TURN Almost a quarter of bicycle users coming from the east turn left. People turning left must wait several traffic phases. Some cyclists jump it when the traffic light is green for the users coming from the east entry.

L1 - They mostly turn in one step and position themselves in the left-turn lane. They stand in the middle or on left part of it, along the curb. While it's a main street, this boulevard has no tramway lines and may be perceived as easier to cross in one-step than others junctions.

L2 - L4- L5 - L6 - During the peak of the rush hour (from 8:55 to 9:15am), three new trajectories appear. Some bicycle users access the bicycle track by the pedestrians crossing, after the bicycle parking,

or keep on cycling down the street to enter the bicycle infrastructure further on. This intuitive behaviour of looking for a shortcut is brought on by the sense of "hurry" of some cyclists rather than by the design of the infrastructure. Indeed, cyclists waiting between the stop and the yield lines never fully block the entrance of the track. Nevertheless, sometimes, this design forces cyclists to slow down to find a narrow path to the bicycle track.

Label	S1	S2	S3	R1	L1	L2	L3	L4	L5
	308	6	6	27	69	9	4	3	4
%	15	0.3	0.3	1	3	0.4	0.2	0.1	0.2




7. HUGO DE GROOTSTRAAT- NASSAUKADE

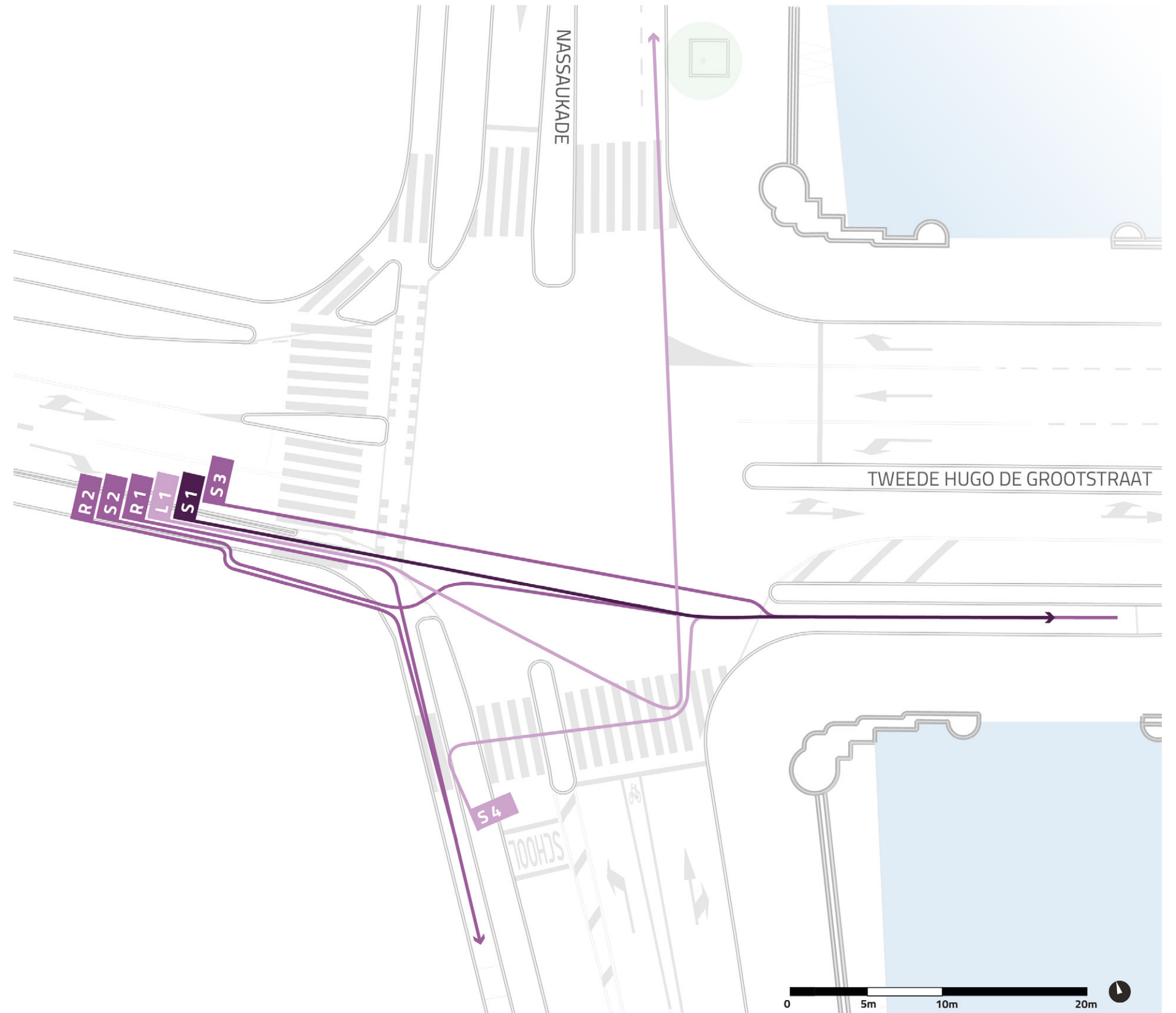
WEST ENTRY POINT

1,071 cyclists arrive from the west of the city. During the rush hour, this bicycle track can not really fit the high volume of cyclists. During the red light, the queue is almost as long as the block.

STRAIGHT 979 cyclists ride straight on Tweede Hugo de Grootstraat.
S2 – S3 – Bicycle users riding out of the crowded track -on to the car lane or on the sidewalk- represent 17% of the cyclists heading straight. Some cyclists hurry up to reintegrate the bicycle track correctly on the bridge, while others are forced to remain out of the overly crowded bicycle track or use the sidewalk. In this situation, cyclists are a little tense which makes them speed up.

RIGHT TURN 90 cyclists turn right.
R2 – Almost half of cyclists turning right use the sidewalk in order to overtake the crowd of cyclists waiting at the traffic light.

Label	S1	S2	S3	S4	R1	R2	L1
	836	57	82	4	52	38	2
%	40	3	4	0.2	3	2	0.1



7. HUGO DE GROOTSTRAAT- NASSAUKADE

KEYFINDINGS II

D. USER CONFLICTS

At the intersection Hugo de Grootstraat – Nassaukade, the most tense situations happen at the west entry point.

At the south-east corner, on the bridge, the situation is not ideal for cyclists who can not integrate the excessively narrow bicycle track and therefore ride on the pavement or on -the rarely used- bus lane.

At the east entry point, conflicts between users are also limited due to the low volume of motorists and the three lanes offering space to users (A). Nonetheless, cyclist are in direct contact with cars and buses which is not usual on a main street in Amsterdam.

CYCLISTS > < PEDESTRIANS

In general, conflicts with pedestrians are really scarce due to their low numbers. At the west entry point, cyclists respect the pedestrian crossing even though it is not really used. This behaviour is also observed when the waiting box is not fully occupied (B). The presence of the stop line and the traffic light button may explain this behaviour.

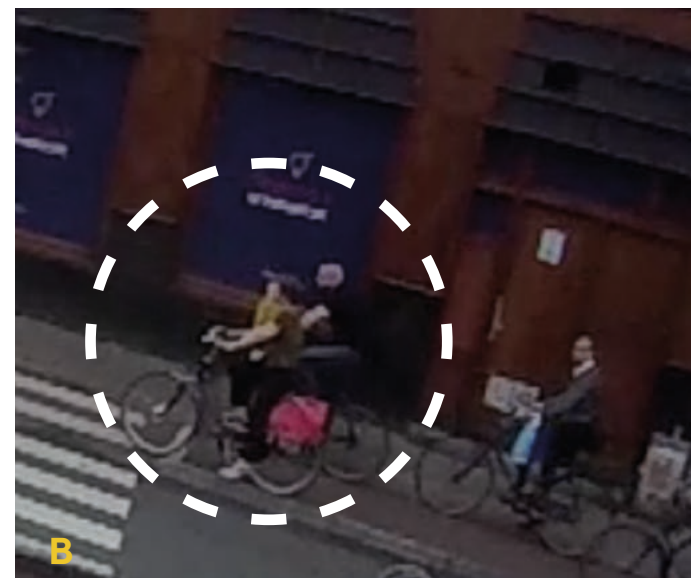
CYCLISTS > < CYCLISTS

THE ENTAILED BLOCKED TRACK - Cyclists stopping and blocking the perpendicular track

West entry point – During the peak of rush hour, the lack of space for cyclists force the ones arriving from the south-west corner to slow down to find a path through the group waiting at the red light (C).

THE IMPATIENT SYNDROME - Cyclists overtaking cyclists to be the first in line

West entry point – Even though cyclists turning right on the sidewalk or riding on the car lane have not been counted, the number of people overtaking the group of cyclists waiting at the traffic light is really important.



7. HUGO DE GROOTSTRAAT- NASSAUKADE

CYCLISTS > < MOPEDS

THE SHARING STRUGGLE - Mopeds overtaking and weaving between cyclists

At this intersection, the most tense interactions between cyclists and mopeds happen when mopeds speed up to enter the bicycle track first (D). At the west entry point, the conflicts are not as important as they could be since many mopeds use the car and the bus lanes.

Share of moped in relation to total number of cycling infrastructure users:

- North:** 5%
- South:** 11%
- East:** 10%
- West:** 3%

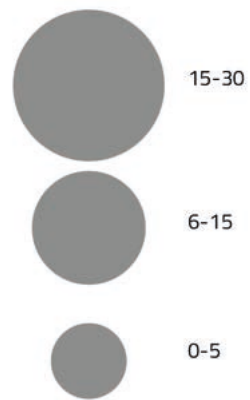
CYCLISTS > < DRIVERS

No serious conflicts were observed between drivers and cyclists. At the south entry point, even if the left-turn lane can not be considered the most appropriate infrastructure, no real conflicts were recorded.



7. HUGO DE GROOTSTRAAT- NASSAUKADE

Number of conflicts observed



Type of conflicts

Pedestrians > Cyclists

- Pa** Jam manoeuvre
- Pb** Cyclists blocking
- Pc** Cyclists rudeness

Cyclists > Cyclists

- Ca** Entailed blocked track
- Cb** Impatient syndrome
- Cc** Disoriented syndrome
- Cd** Surprising counterflow
- Ce** Forcing syndrome
- Cf** Priority confusion

car / truck Drivers > Cyclists

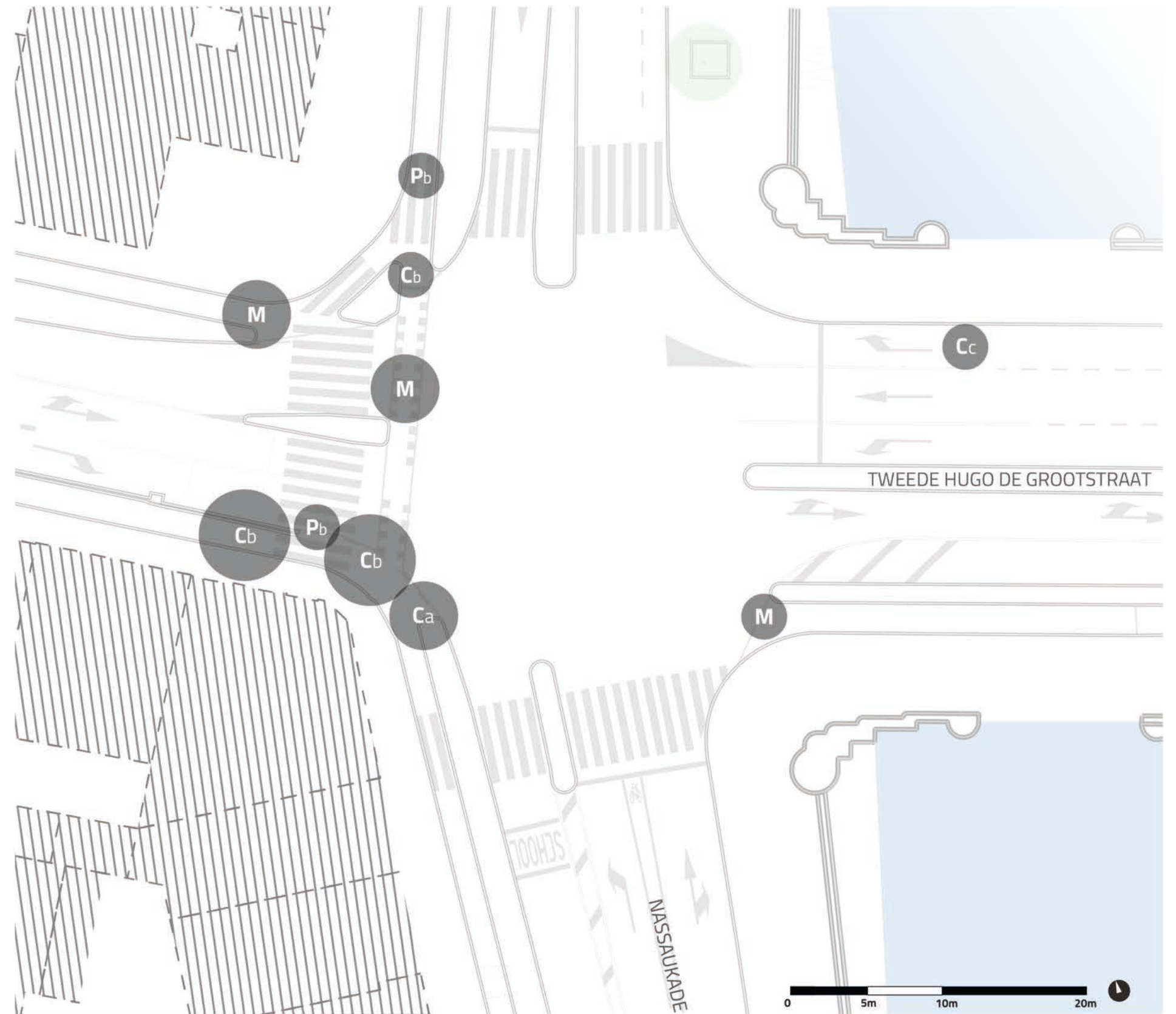
- Da** Drivers blocking
- Db** Undesignated car parking

Mopeds > Cyclists

- M** Sharing struggle

Trams > Cyclists

- T** Priority confusion



7. HUGO DE GROOTSTRAAT- NASSAUKADE

E. DESIGN PROPOSALS

North entry point – No redesign is suggested at this corner. Nonetheless, the creation of the bicycle track on the bridge will force cyclists to turn left in two steps and wait at the north-west corner. The waiting box on this corner will not be able to host these new users.

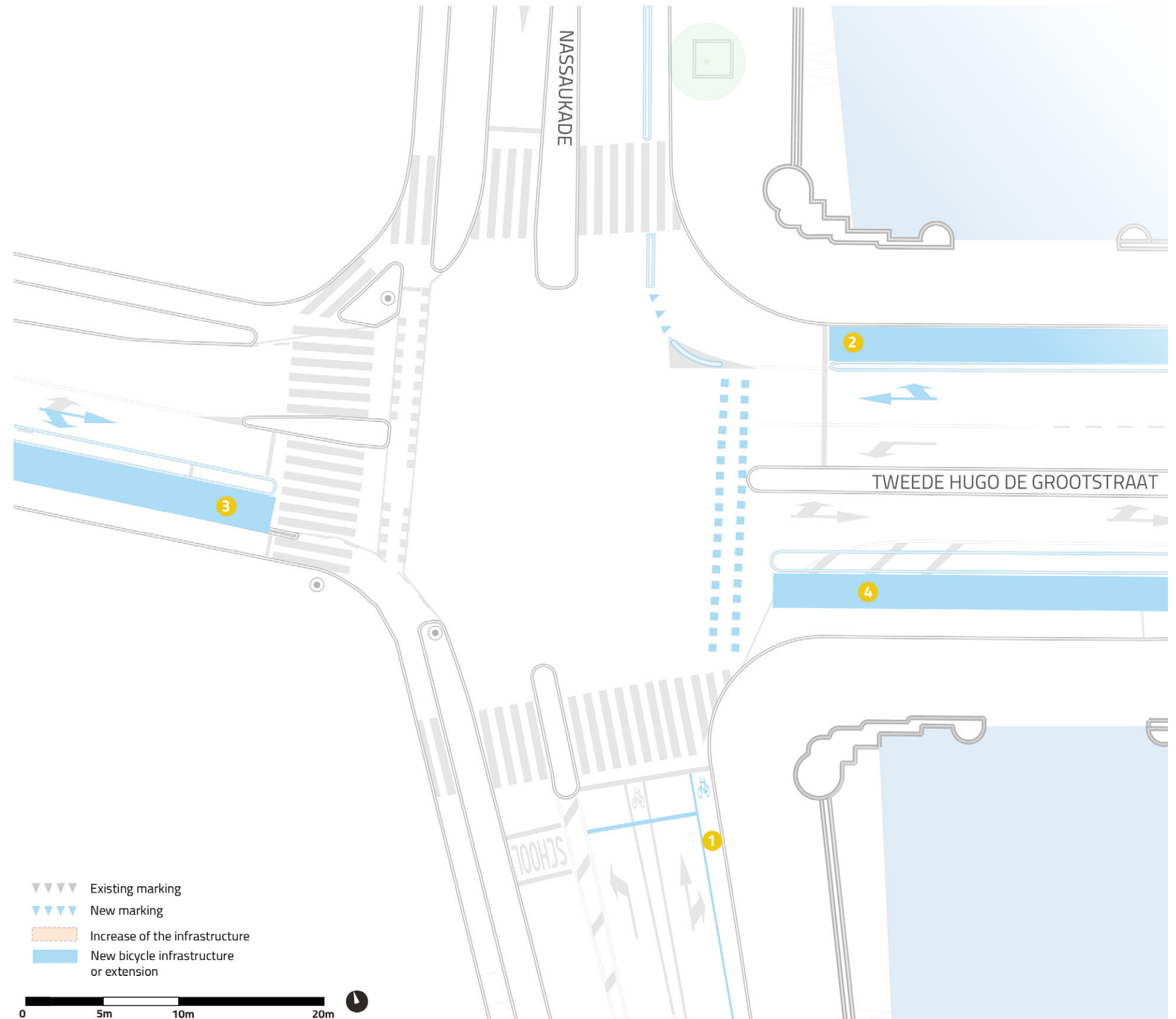
South entry point – In order to be consistent in the design of the left-turn, the bicycle lane (1) should be placed between the sidewalk and the car lane.

East entry point – For a better consistency of Amsterdam’s cycling infrastructure, a bicycle track (2) should be created on the right side of the bridge. A car traffic study would confirm if two lanes could be merged in order to create a 2.5 meter bicycle track and a 0.5 meter buffer zone.

West entry point – The bicycle track is too confining for the 1,071 cyclists. A car traffic study could bring elements on the impact of removing the right-turn car lane (3). This space could be allocated to bicycle users and a right-turn lane could be created for the 90 cyclists.

Moreover, on the bridge, the presence of a bus lane can be questioned. Indeed, 3 buses were counted during this rush hour and no motorised traffic congestion was observed in the car lane. Therefore, the bus travel speed should not be slowed down if it was to be assimilated on a car lane. The use of this space to widen the bicycle track (4) would seriously improve cyclists’ comfort and security.

Generally speaking, the City of Amsterdam should determine if this route should be prioritised for cyclists, over motorised traffic.



8 ADMIRAAL DE RUIJTERWEG-HAARLEMMERWEG

A. THE NEIGHBOURHOOD

The Admiraal de Ruijterweg-Haarlemmerweg intersection is located in the northwest of the city in the former borough Westerpark, newly included in the vast district Amsterdam-West. To be more precise, the junction is located in the south-west corner of Westerpark. This large public park hosts several east-west green cycling routes, far from the noisy Haarlemmerweg.



Haarlemmerweg is a main boulevard leading to the city of Haarlem and used as an entry/exit of Amsterdam by car drivers. The road was widened several times and the new plan for the section named N200 will reduce the car speed to 50 km/h, to offer more connections to cyclists and pedestrians, and to plant trees along it.

This vast intersection is surrounded by residential buildings on the southern side and some vast office buildings and a 257-room hotel on the northern side.

The intersection is located a few blocks from the metro and train station "Sloterdijk" running intercity trains.



Top view



Camera view

8. ADMIRAAL DE RUIJTERWEG-HAARLEMMERWEG

B. THE INTERSECTION

The analysis is carried out on the eastern side of the intersection only.

Haarlemmerweg is a main motorised boulevard that is composed of two to four car lanes. A bi-directional bicycle track is located on the southern part of the avenue, separated from the fast traffic by a buffer zone and a row of trees.

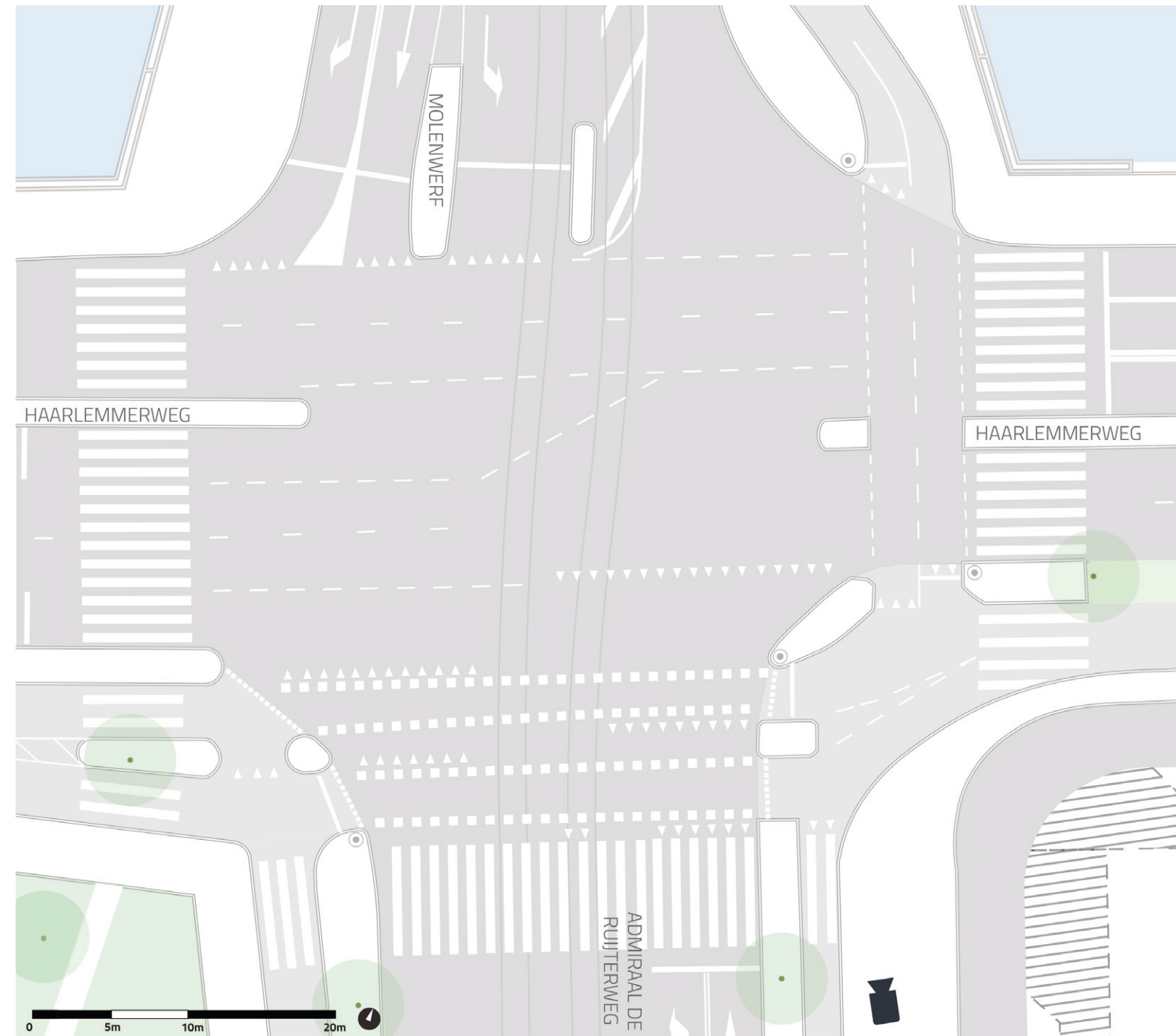
Molenwerf and Admiraal de Ruijterweg are two-way streets for cars and a tramway-line running in both directions is implemented in the middle of the boulevards.

On the northern side of the intersection, on Molenwerf, the bicycle track is bidirectional and is located on the eastern side of the street. On Admiraal de Ruijterweg, tracks are unidirectional and located on both side of the street, except on the western side, from the intersection to the local street Willem Leevendstraat, the track is bidirectional.

Right in front of the traffic light is a button where cyclists can stop by and push to activate it.

Cyclists coming from Admiraal de Ruijterweg must give priority to cyclists coming from the west and can turn right directly on Haarlemmerweg.

Recently, the unidirectional cycle track on the western side of Molenwerf was removed and the opposite one was made bidirectional. Therefore, the south-east corner is the crucial node of the intersection. Apart from cyclists coming from Haarlemmerweg and turning right on to Admiraal de Ruijterweg, all cyclists use this corner to turn left, or right or to keep going straight.



8. ADMIRAAL DE RUIJTERWEG-HAARLEMMERWEG



North entry



East entry



South entry



West entry

8. ADMIRAAL DE RUIJTERWEG-HAARLEMMERWEG

KEY FINDINGS I

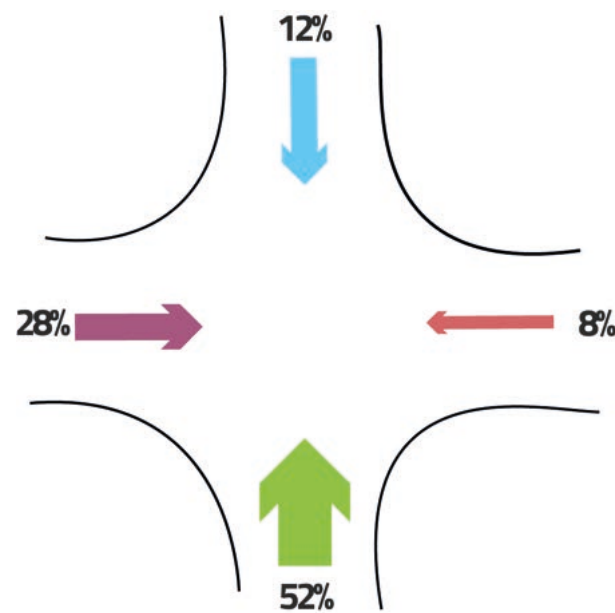
C. THE DESIRE LINES

The Admiraal de Ruijterweg-Haarlemmerweg intersection was filmed on September 14th, 2017 from 8:15 to 9:15 am by two cameras, one located at the south-east corner and the other on the eastern side of Admiraal de Ruijterweg. It is a fairly active junction with **972** cyclists crossing it during the rush hour. The average number of cars on Admiraal de Ruijterweg is X, while on Haarlemmerweg it is X. The peak of the rush arrives slightly before the one observed at the intersections located closer to the city-centre.

Even though it is not the focus of this analysis, some cyclists were spotted on the north-west part of the intersection, cycling on the sidewalk where the cycle track was removed.

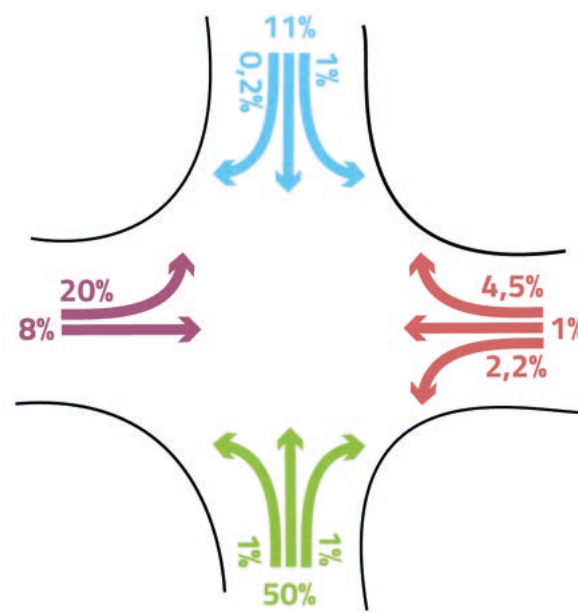
ENTRY POINTS

The flow arriving from the four entry points are absolutely different. The flow on the north-south axis is asymmetrical, with majority of cyclists arriving from the south on the Admiraal de Ruijterweg. This proportion is likely to be the opposite in the evening. 28% of cyclists arrive from the west of Haarlemmerweg, and most likely from the residential district nearby the intersection.



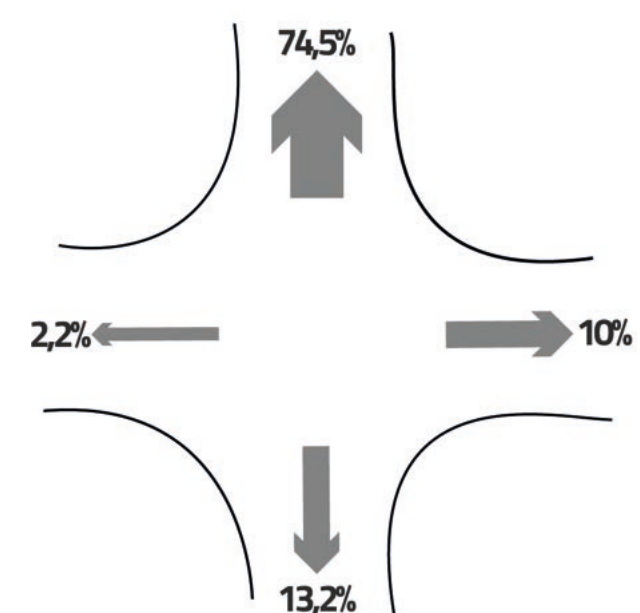
MAIN DIRECTIONS

Three-quarters of cyclists head north. They may reach the train station, some working places located around Sloterdijk or the green cycling route going through Westerpark. The rather low number of cyclists heading east to the city-centre on Haarlemmerweg may be explained by the attractivity of the parallel route through the park. Despite the separated bicycle track, a noticeably small number of cyclists head west, out of the city.



EXIT POINTS

The south-east corner of the intersection contains a cyclist flow in a fairly generous space of less than 1,000 cyclists per hour. Nonetheless, some of the cyclists from the south (50%), the west (20%) and the east (4.5%), arrive almost at the same time and they have difficulties finding a spot to wait. Due to the bidirectional track on the northern part of the intersection, even cyclists heading straight must wait in this area and occupy some space.



8. ADMIRAAL DE RUIJTERWEG-HAARLEMMERWEG

NORTH ENTRY POINT

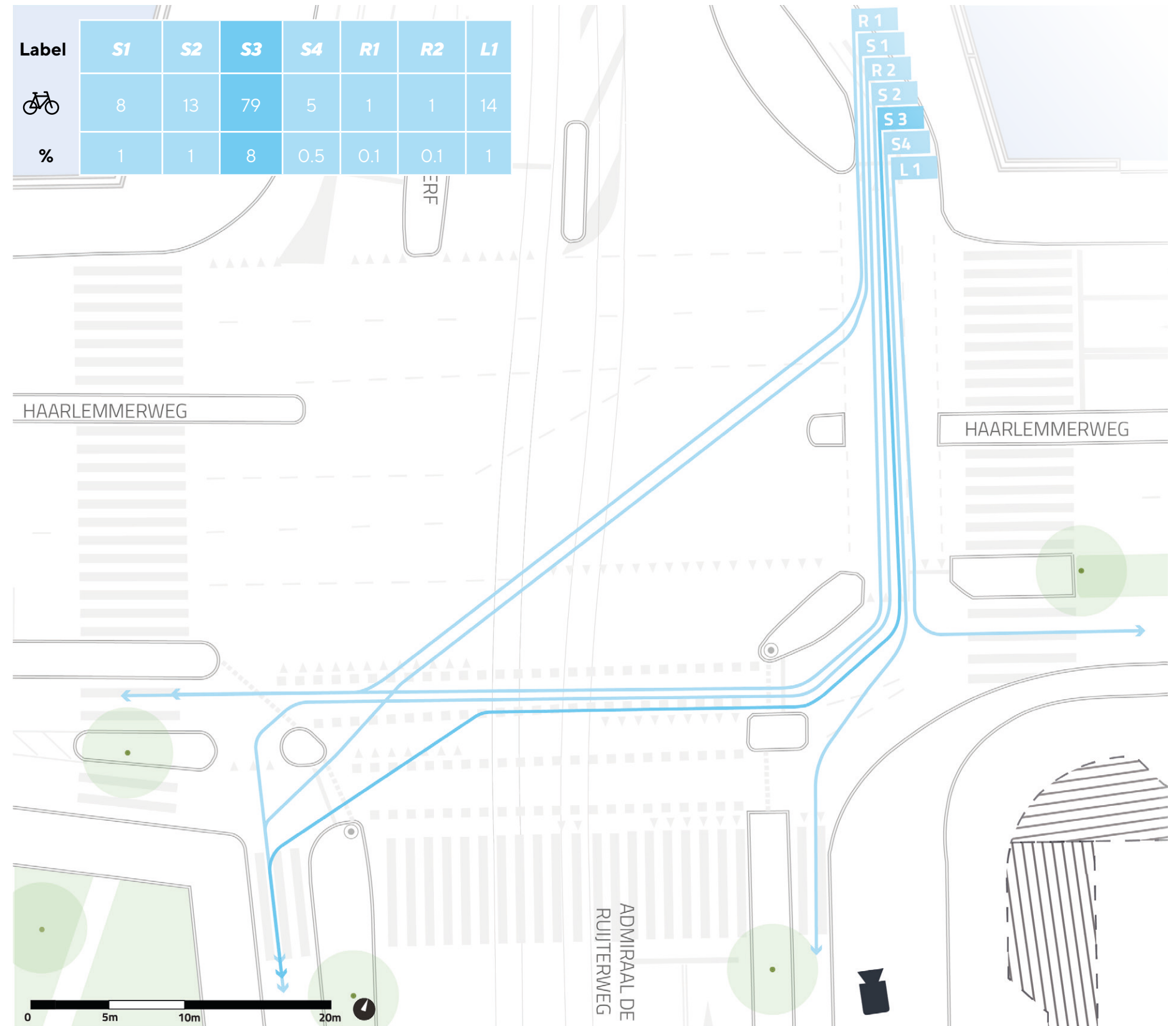
A total of **121 cyclists** arrive at the intersection from the northern entry point. They mostly cycle straight on Admiraal de Ruijterweg.

Cyclists arriving from the north have a head-start to cross Haarlemmerweg. Therefore, they are almost reaching the other side of the boulevard when the massive crowd of cyclists waiting are slowly starting to leave the corner, sometimes using the counterflow lane. This situation creates a discomfort and the head-start should be given to cyclists waiting at the corner. Thus, it would likely be empty when the ones from the north arrive and proceed to the left turn or just stop by the traffic light.

In order to keep on cycling straight, cyclists must first cross Haarlemmerweg, turn right, potentially wait for the traffic light, and then turn left to cross the bicycle track on the opposite side of Admiraal de Ruijterweg. The synchronisation of the traffic lights allows some cyclists to cross both streets without waiting or with only a short stop at the south-east corner. Nonetheless, around 9 am during the morning rush hour, a total of 26 cyclists had to wait twice for a long time to reach the cycle track on Admiraal de Ruijterweg. Sometimes, they wait for several traffic light phases since they are joined by new cyclists coming from the north. The tramway priority has an impact on this traffic light.

- STRAIGHT**
- S1-** These users skip the south-east corner when the space is full of cyclists or when they see people waiting at the traffic light to cross Admiraal de Ruijterweg.
 - S2-** This trajectory is not the most natural and happens mostly when cyclists are forced to do it.
 - S3-** Most of the cyclists heading straight enter the bicycle track by the exit in order to shorten their trajectory.
 - S4-** A few cyclists ride straight in counterflow. They may be more numerous out of the rush hour.

- LEFT TURN**
- L1-** Only 14 cyclists turn left on Haarlemmerweg. The left turn is not comfortable when the north-east corner is full of people waiting to head straight. Cyclists coming from the north are forced to seriously slow down to proceed to this manoeuvre.



8. ADMIRAAL DE RUIJTERWEG-HAARLEMMERWEG

SOUTH ENTRY POINT

With **505 cyclists**, the south entry point is far from the one hosting the most users.


STRAIGHT 490 cyclists head straight to the north. The line of cyclists waiting at the traffic line forms a large group, stretching occasionally until the pedestrian crossing on Admiraal de Ruijterweg (video: 23:29).

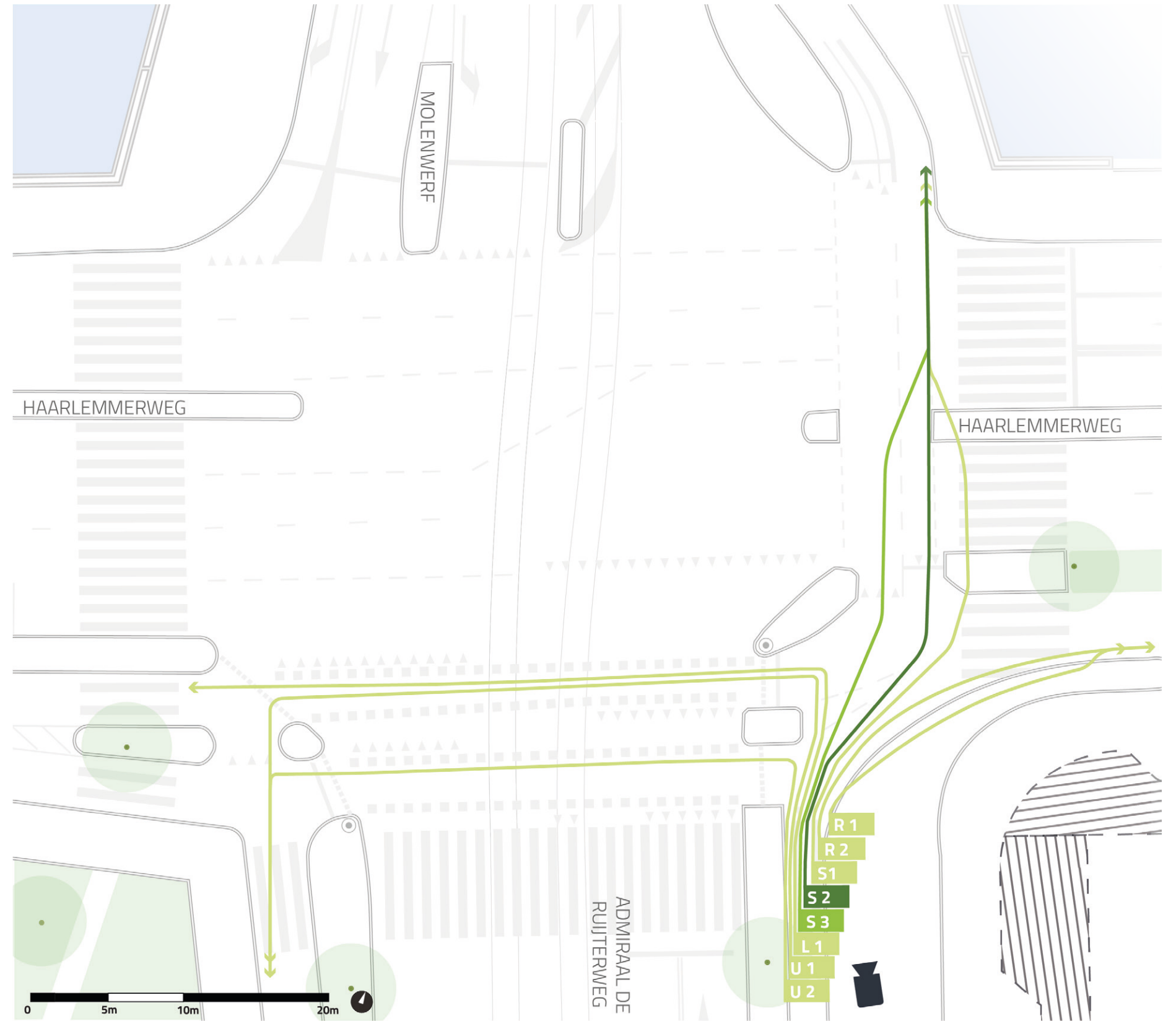
S2- This trajectory represents cyclists stopping by the traffic light in front of their own lane, by the curb or before the yield mark. In other words, they tend to respect their dedicated space as much as possible, to allow users coming in the perpendicular way to go through the group. In other words, they are aware of the design of the intersection and position themselves to wait in a way to respect other cyclists.

S3- This trajectory represents cyclists stopping in front of the counterflow lane. When the light turns green, they cycle partly or totally on this lane disregarding if cyclists ride in the opposite direction or not. Thus, they overtake slower cyclists.

RIGHT TURN **R1-** Cyclists riding on the sidewalk and then reaching the track or reaching the local street by the sidewalk.

U-TURN 5 cyclists proceed to a U-turn to head south on Admiraal de Ruijterweg on the dedicated bicycle track.

Label	S1	S2	S3	R1	R2	L1	U1	U2
	10	383	97	3	3	4	2	3
%	1	39	10	0.3	0.3	0.4	0.2	0.3



8. ADMIRAAL DE RUIJTERWEG-HAARLEMMERWEG


EAST ENTRY POINT

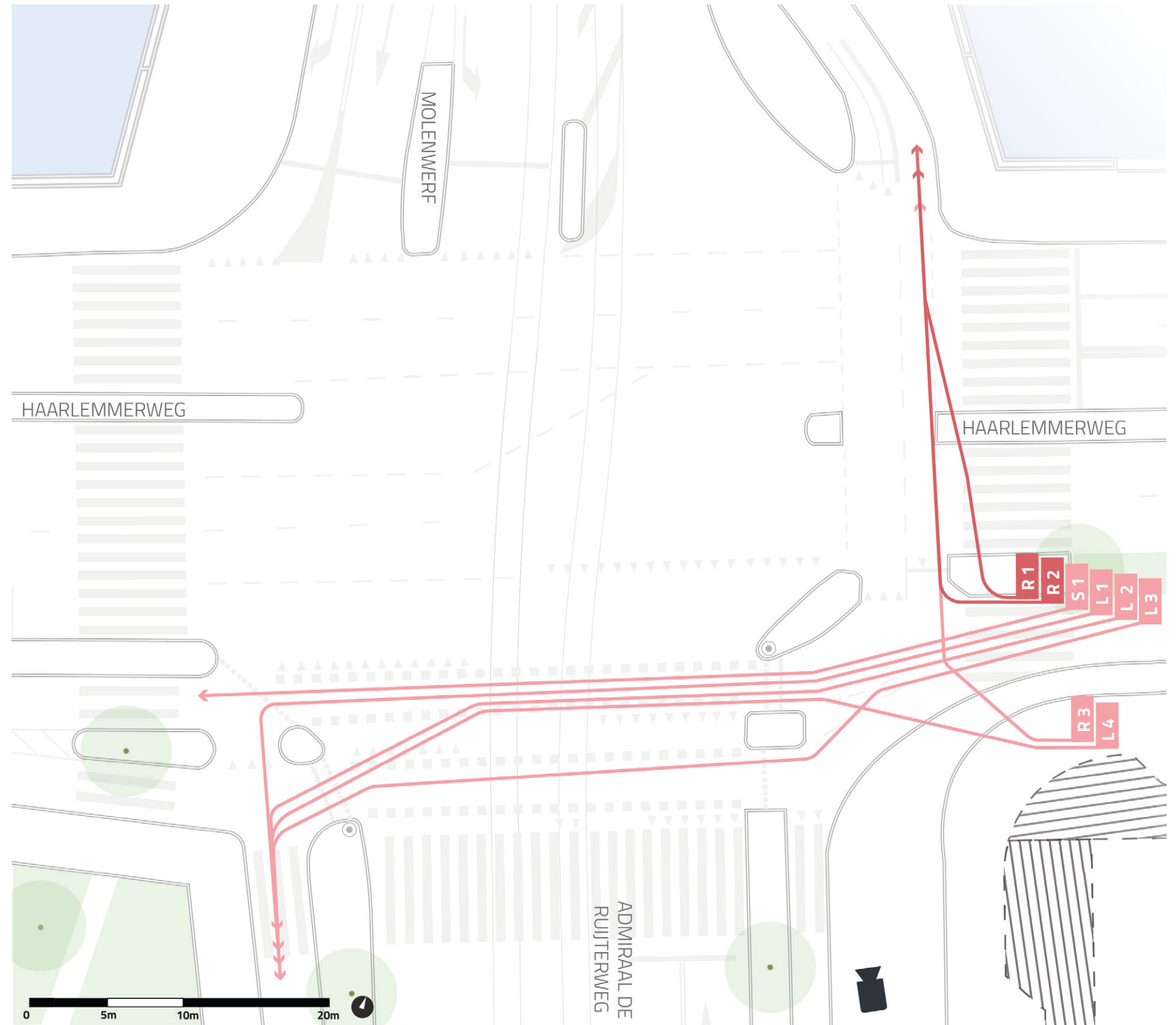
With **74 cyclists**, the east entry point is the least frequented of the intersection. Nonetheless, the number of mopeds -82- is higher than the one of cyclists. Most of the bicycle users turn right. They likely head north to reach the station or the offices around Sloterdijk.

STRAIGHT The 10 cyclists heading straight must often find a path through the crowd of cyclists waiting at the traffic light and blocking the perpendicular bicycle track.

RIGHT TURN 46 cyclists turn right. The split is pretty equal between the ones respecting the bicycle lane and the ones riding on the pedestrian crossing before accessing the bicycle lane. This behaviour mostly happens when the waiting area is full of cyclists heading straight to the north. Nonetheless, this exact trajectory is also observed when the corner is free of users and cyclists create their own shortcut to cross faster. A few pedestrians cross Haarlemmerweg at this location.

LEFT TURN 21 cyclists turn left. They mostly respect the bicycle lane but cut the end of it and enter the cycle track by the exit.

Label	S1	R1	R2	R3	L1	L2	L3	L4
	10	21	20	2	2	12	4	3
%	1	2	2	0.2	0.2	1	0.4	0.3



8. ADMIRAAL DE RUIJTERWEG-HAARLEMMERWEG

WEST ENTRY POINT

With **272 cyclists**, the west entry point is the second most active one. Most of the bicycle users turn left to head north, while slightly less than a third ride straight on Haarlemmerweg.

The video does not allow us to see the real entry point of cyclists, meaning if these cyclists arrive from Haarlemmerweg or from the short section of Admiraal de Ruijterweg being bidirectional, cyclists arriving in the field of vision of the camera riding on the pedestrian crossing are likely to arrive from the local street Willem Leevendstraat and not using the bicycle track to reach the other side of the boulevard faster. While it is not the focus of this analysis, it seems that a rather high number of cyclists proceed this way and likely jump the red light.


LEFT TURN

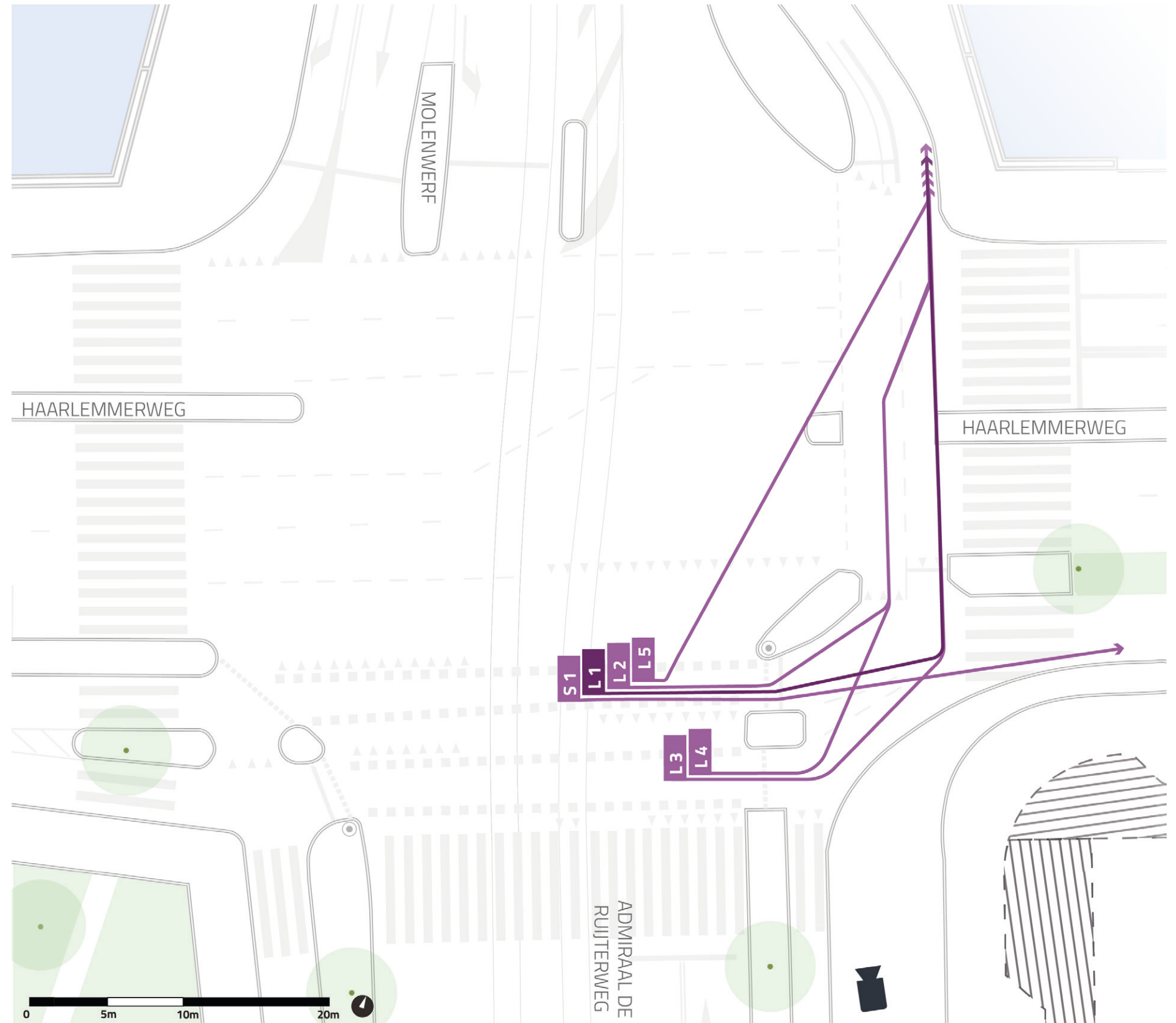
L1- These cyclists turn left respecting the infrastructure.

L2 & L4- L2 represents cyclists turning left and respecting the entry of the corner while L4 represents the ones entering the track by the exit. Then, both wait in front of the counterflow lane since they do not have enough space to position themselves right in front of their lane. Cyclists coming from the west often arrive at the traffic light when cyclists from the south are already waiting and have a higher tendency to wait in front of the counterflow lane.

L3- The trajectory represents cyclists entering the corner by the exit and waiting as much as possible in front of their own lane.

L5- 17 cyclists cross the intersection without respecting the bicycle corner. They often proceed this way when they see that the cyclists who are waiting at the traffic have already started crossing Haarlemmerweg. They always hurry up and shorten their trajectory to make sure that they get enough time to arrive on the other side of the boulevard before cars start.

Label	S1	L1	L2	L3	L4	L5
	78	111	20	20	26	17
%	8	11	2	2	3	2



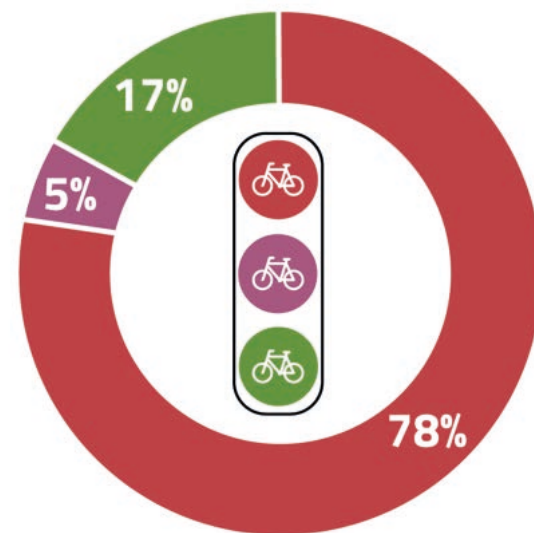
8. ADMIRAAL DE RUIJTERWEG-HAARLEMMERWEG

TRAFFIC LIGHT ANALYSIS

In general, at the intersection, the synchronisation of the traffic lights is very dynamic and the tramway priority and cyclists pushing the button are taken into consideration.

The analysis focuses only on the traffic light, allowing cyclists arriving from the south, the east and the west to cross Haarlemmerweg and head north. The red light is long and forces 78% of users reaching the intersection to stop. The green light is rather brief and allows only the group of cyclists to pass through the green light, including a few cyclists that just arrive during the green phase. Coming from the south, these cyclists always speed up and very often, jump the yellow or red light. In this situation, they take a rather direct trajectory to be sure to cross the intersection while cars are still stopped. It is likely that they know the green phase is short and they may have some pressure due to the busy car traffic of this avenue.

The numerous mopeds jumping the red light have not been counted.

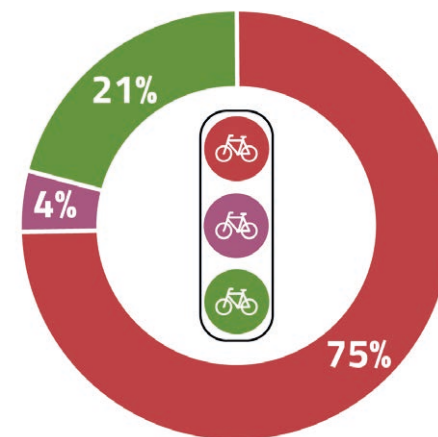


SOUTH ENTRY POINT

Two main categories of cyclists jump the yellow/red light: the ones seeing the green light, rushing up and finally crossing even though the light has changed back to red; the ones stopping at the red light on the front row and finally being impatient and significantly anticipating the green light. Those anticipating it slightly have not been counted in this category. Only one cyclist fully jumps the red light while a large number of cyclists is waiting (A - video: 38:53).

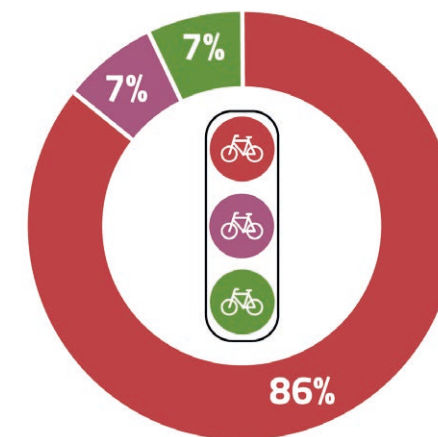


Cyclists arriving from the south are less numerous to jump the red light, than the ones arriving from the west and the east. This can be explained by the fact that a group of cyclists is blocking the access to the intersection and waiting at the back of the corner.



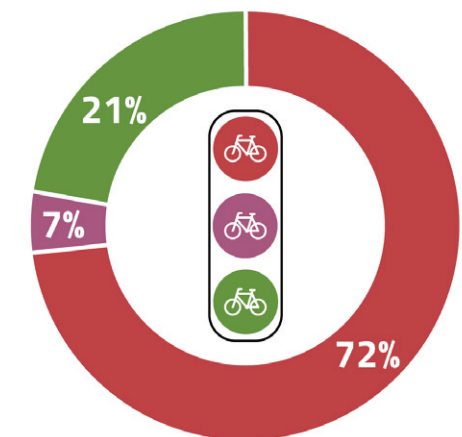
EAST ENTRY POINT

The position of these cyclists often waiting by the pedestrian crossing enables them to have a good vision of the car traffic and anticipate the green light.



WEST ENTRY POINT

7 out of the 13 cyclists arriving at the green light skip the bicycle corner and cross the intersection using the car space, knowing that the legal trajectory will make them miss the green light.



8. ADMIRAAL DE RUIJTERWEG-HAARLEMMERWEG

KEYFINDINGS II

D. USER CONFLICTS

Even though cyclists bend many rules at this intersection, the number and the type of conflicts are rather low. Indeed, the only conflicts that occur are between the cyclists themselves and the mopeds. It is an intersection working in two ways: 1) all cyclists slow down when the traffic light is red, using the space to ride slowly and avoid stopping, 2) when the traffic light is green, cyclists seriously hurry up to get it. The large avenue to cross may entail this last behaviour, putting pressure on cyclists, who want to make sure they have enough time to cross it.

A user survey could be interesting to carry out in order to get an idea of cyclists' opinion on this specific design, reducing the conflicts with other users, but creating a node where cyclists proceed to different manoeuvres and adjust their pace to give way to cyclists.

CYCLISTS > < PEDESTRIANS

No conflicts happen among the few pedestrians crossing these two avenues. Even though cyclists stop on the pedestrian crossing, they do not disturb the rare pedestrians (A - video 23:29). Nonetheless, it is worth noticing that it is pedestrians who often give way to cyclists before crossing the bicycle track on Admiraal de Ruijterweg.

CYCLISTS > < CYCLISTS

THE ENTAILED BLOCKED TRACK - Cyclists stopping and blocking the perpendicular track

The main conflict happening at this bicycle corner is due to cyclists arriving mainly from the south and then from the west, and using the whole space. Therefore, cyclists arriving from the north and turning left (B - video 1:14), and cyclists arriving from the east and heading straight have difficulties to find space to move forward (C- video 42:51).



8. ADMIRAAL DE RUIJTERWEG-HAARLEMMERWEG

Often, some cyclists arriving from the south understand that they must leave an empty space between the perpendicular flow, so they stop along the curb (D - video 31:19), but the ones arriving from the west fill in the gaps.

Even though many cyclists use the bicycle lane in counterflow (cf. desire lines maps), only when a cyclist coming from the north is blocked while trying to turn left on Haarlemmerweg will be counted as a conflict. Often, cyclists arriving from the north are squeezed and forced to ride on the edge of the bicycle lane but while this situation is not ideal, it has not been considered as a conflict.

The space at the traffic light dedicated to cyclists heading west is rarely full (E - video 20:10).

THE IMPATIENT SYNDROME - Cyclists overtaking cyclists to be the first in line

Some cyclists arriving from the south and the west overtake the group of cyclists waiting to access the front row and sometimes jump the red light.

THE SURPRISING COUNTERFLOW - Cyclists in counterflow surprising cyclists riding in the right direction

The situation happens when cyclists arriving from the west use the exit to enter the corner and surprise cyclists arriving from the north and head west or straight.

CYCLISTS > < MOPEDS

THE SHARING STRUGGLE - Mopeds overtaking and weaving between cyclists

The number of mopeds is higher than those observed at the intersections located closer to the city-centre. Moreover, it seems that the large width of the bicycle track allows them to drive faster. They often use the counterflow lane to overtake



8. ADMIRAAL DE RUIJTERWEG-HAARLEMMERWEG

cyclists with speed.

East entry point- Mopeds are more numerous than cyclists since they represent 52% of the total flow coming from this entry point. They often stop on the pedestrian crossing and start before cyclists. This situation has been counted as a conflict.

North entry point- Mopeds benefit from a head-start and arrive on this other side of Haarlemmerweg whereas cyclists - using the whole space of the bicycle corner - are still waiting at the traffic light (F- video 9:55).

From the south, mopeds often use the counterflow lane even when both lanes are empty, in order to shorten their trajectory.

Share of mopeds in relation to the total number of cycling infrastructure users:

North: 12%

South: 9%

East: 52%

West: 13%

In addition to mopeds, five small cars -allowed on bicycle tracks- arrive from the east (1), the west (3) and the north (1) during this rush hour.

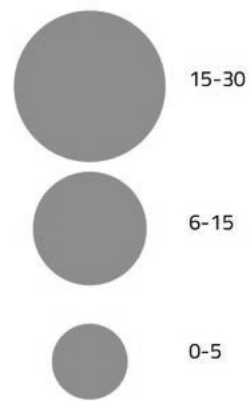
CYCLISTS > < DRIVERS

No conflict is observed with cars. There are very few cars turning right from Admiraal de Ruijterweg to Haarlemmerweg and due to the synchronisation of traffic lights they proceed to this movement when cyclists wait at the red traffic light.



8. ADMIRAAL DE RUIJTERWEG-HAARLEMMERWEG

Number of conflicts observed



Type of conflicts

Pedestrians > < Cyclists

- P_a** Jam manoeuvre
- P_b** Cyclists blocking
- P_c** Cyclists rudeness

Cyclists > < Cyclists

- C_a** Entailed blocked track
- C_b** Impatient syndrome
- C_c** Disoriented syndrome
- C_d** Surprising counterflow
- C_e** Forcing syndrome
- C_f** Priority confusion

car / truck Drivers > < Cyclists

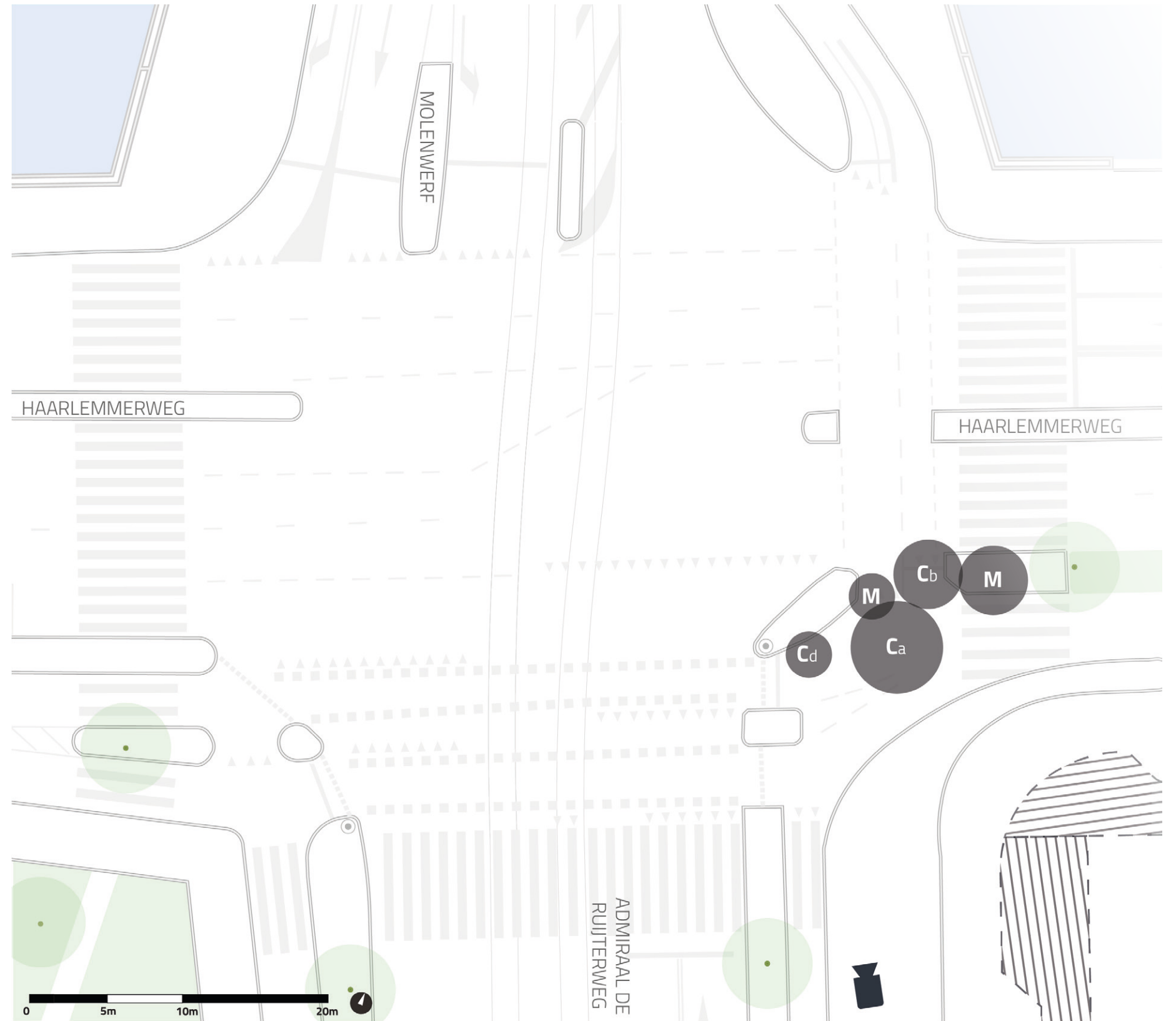
- D_a** Drivers blocking
- D_b** Undesignated car parking

Mopeds > < Cyclists

- M** Sharing struggle

Trams > < Cyclists

- T** Priority confusion



8. ADMIRAAL DE RUIJTERWEG-HAARLEMMERWEG

E. DESIGN PROPOSALS

At this intersection, cyclists spontaneously use the whole space of the bicycle corner, disregarding the counterflow.

1. Bidirectional bicycle tracks

Without redesigning the bicycle corner, two simple changes can ease the flow of some users:

1a. A pre-green should be created for cyclists arriving from the south, the west and the east of the intersection, instead of cyclists arriving from the north. Indeed, cyclists from the south will empty the bicycle corner when the ones from the north reach the other side of the boulevard. This should also ease a one-step maneuver to head straight - but on the other side of Admiraal de Ruijterweg - and limit the number of bicycle users skipping the bicycle corner. Moreover, it will enable the mopeds to avoid arriving at the bicycle corner when cyclists are still waiting. This pre-green can be switched to the northern side during the evening rush hour.

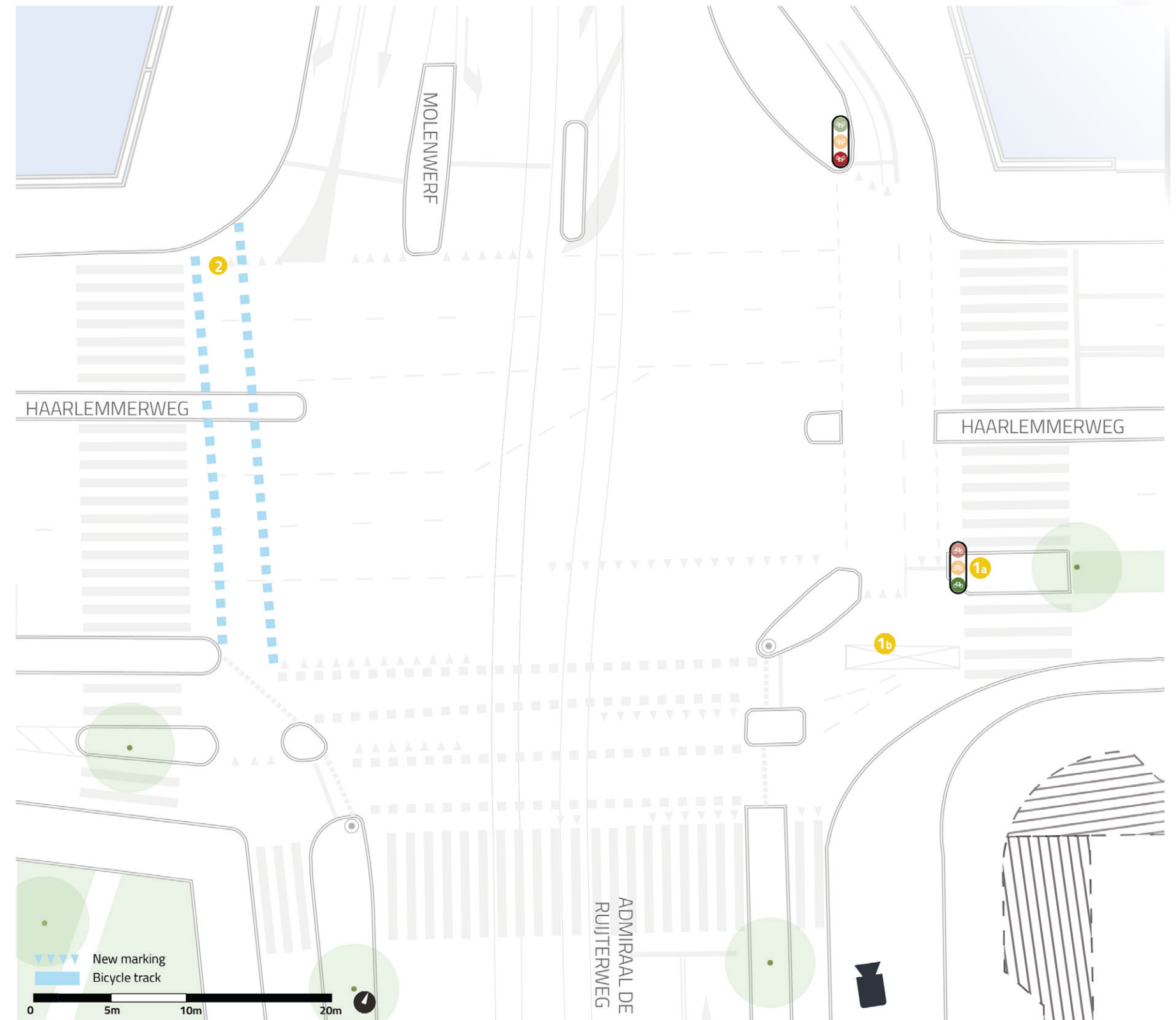
1b. The creation of a white cross can bring attention to the perpendicular flow of cyclists arriving from east and west.

2. Unidirectional bicycle tracks

By recreating the unidirectional bicycle track on the west side of Molenwerf, most of the conflicts between cyclists will disappear. The bicycle corner will have a generous waiting area, fitting all cyclists and leaving comfortable space to cyclists turning right. The few cyclists arriving from the east will keep on having difficulties to access their traffic light.

Cyclists arriving from the north and turning left on Haarlemmerweg are only 14 during this morning rush hour. Therefore, they should fit a normal waiting box. Nonetheless, a study during the evening rush should be carried out to get precise knowledge of this flow.

At this intersection, a user-survey could help in understanding the perception of cyclists using this route daily and to understand if they prefer benefiting from a vast node that is shared with users heading in all directions, but which make them less in contact with cars (less cyclists waiting outside the box, the cars turning right while their traffic light is green).



9 DE CLERCQSTRAAT & NASSAUKADE

A. THE NEIGHBOURHOOD

The intersection is located west of the city, on the main boulevard surrounding the city-centre. This dense district is comprised of residential buildings hosting local shops on the ground floor, especially on Clercqstraat.



Top view



Camera view

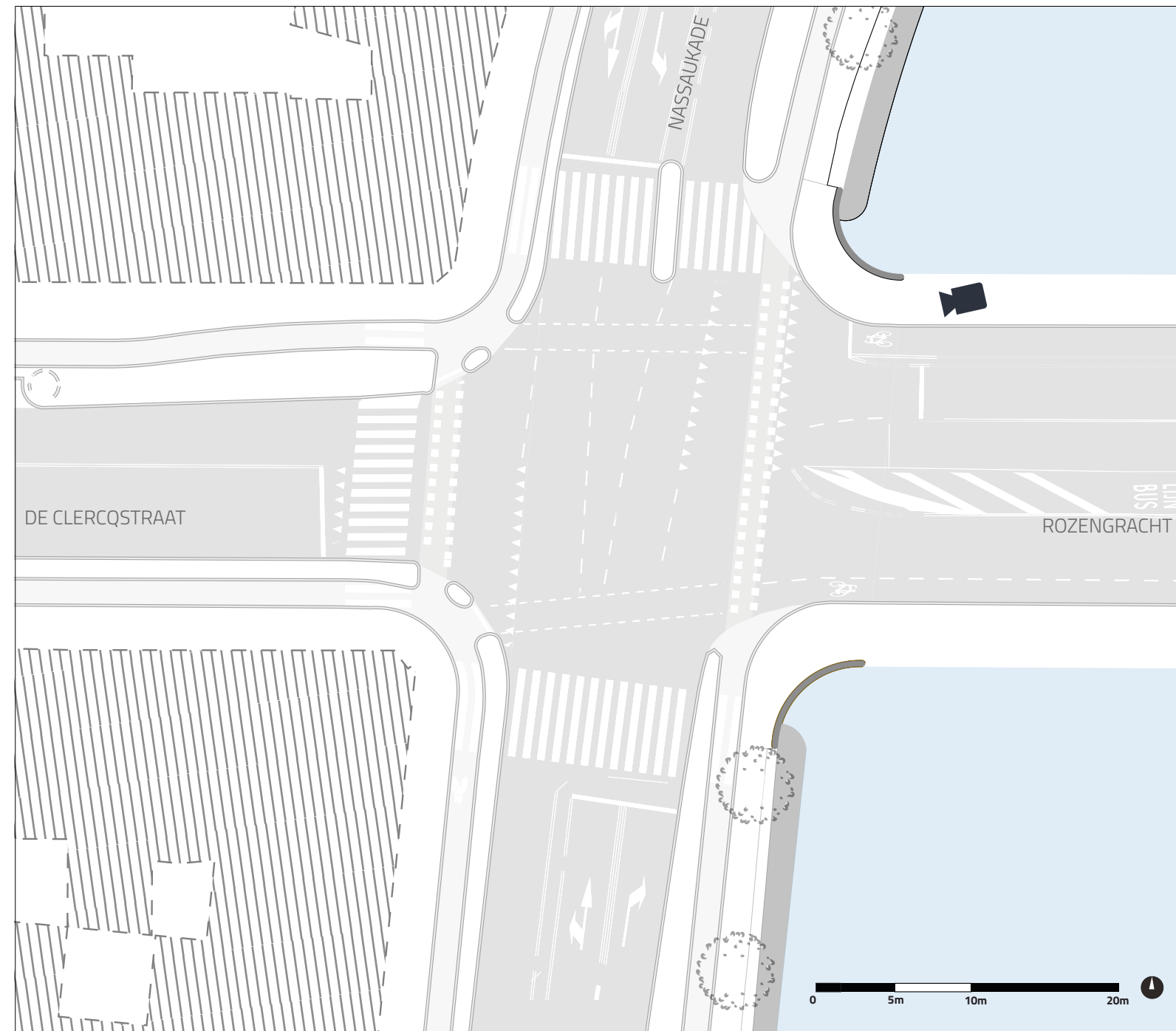
9. DE CLERCQSTRAAT & NASSAUKADE

B. THE INTERSECTION

Like many boulevards in Amsterdam, **Clercqstraat** and **Nassaukade** have bicycle tracks on both sides of the street. On the side of the intersection, on De Clercqstraat, they measure 1.80 to 1.85 meters and are protected by an elevated curb where some people park their bicycles. The western corners have protecting islands. The bicycle lane on the bridge - east of the intersection - turns into a bicycle track along De Clercqstraat. On the north part of the bridge, the bicycle track is protected by temporary bollards. The two eastern corners do not have specific infrastructure guiding cyclists who wish to turn left. On Rozengracht, the stop line for cyclists is 4.90 meters in front of drivers. This stop line is 6.65 meters behind the yield line, leaving a vast empty space used by cyclists turning left in two steps. On Rozengracht, there is no pedestrian crossing.

Two tramways running in both directions split Clercqstraat and Rozengracht down the middle.

All streets are two-way for cars with one or two lanes. On Nassaukade, two lanes are reduced to one from north to south. The same is true for the south to north way. There are therefore always three car lanes along Nassaukade.



9. DE CLERCQSTRAAT & NASSAUKADE



North entry



East entry



South entry



West entry

9. DE CLERCQSTRAAT & NASSAUKADE

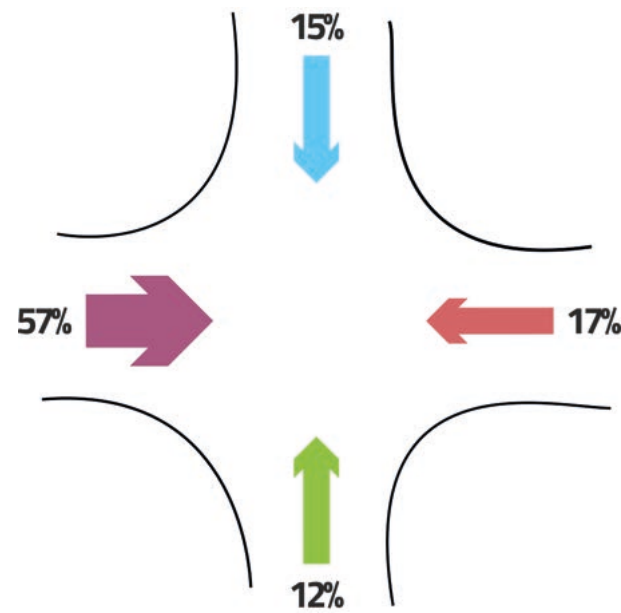
KEY FINDINGS I

C. THE DESIRE LINES

This intersection was filmed on May 29th 2017 from 8:15 to 9:15 am by one camera located at the north-east of the intersection. This intersection counts a heavy traffic of cyclists and motorists. During this morning rush hour, **2,087 cyclists** were counted. The hourly average number of cars during the morning rush hour is X on Clercqstraat and X on Nassaukade.

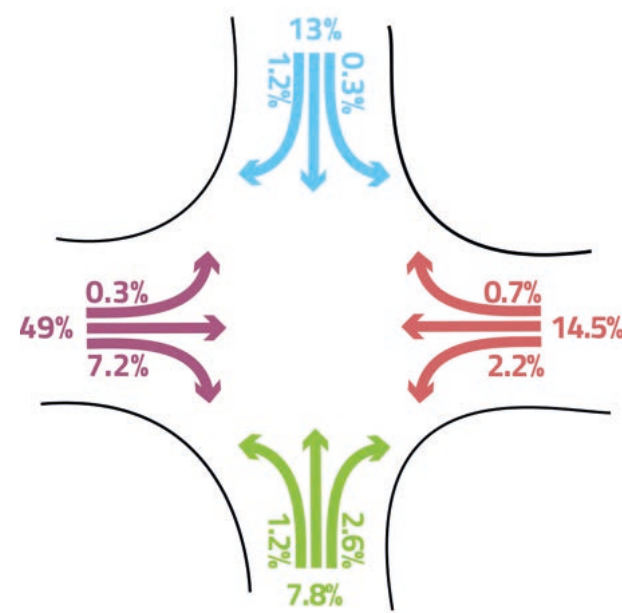
ENTRY POINTS

During the morning rush hour, the highest flow comes from the west, meaning from the outskirts of the city. It represents almost 60% of the number of bicycles coming onto the intersection. The other entry flows are distributed equally and vary between 12% and 17% of the total flow.



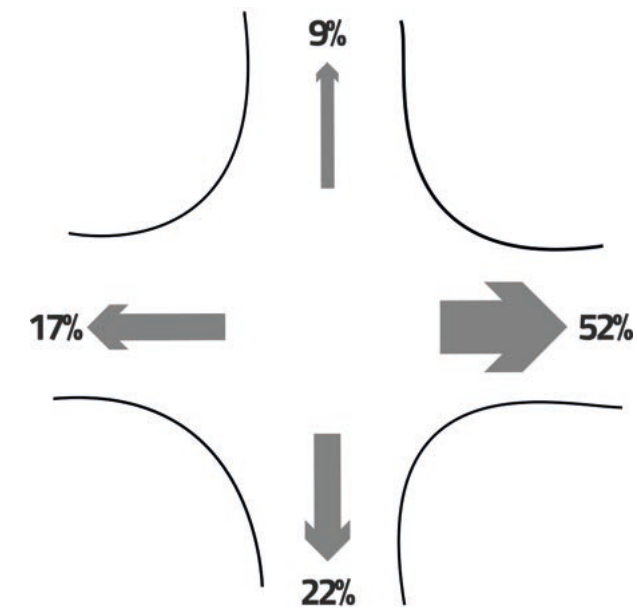
MAIN DIRECTIONS

The number of turning movements are rather limited since cyclists heading straight, no matter their entry, represent 84% of the total number of cyclists crossing this intersection. Users turning left represent only 4% of all the trajectories.



EXIT POINTS

Slightly more than half of bicycle users head east towards the centre and a little less than a quarter of them go southeast, using the main boulevard surrounding the city-centre (Nassaukade).



9. DE CLERCQSTRAAT & NASSAUKADE


NORTH ENTRY POINT

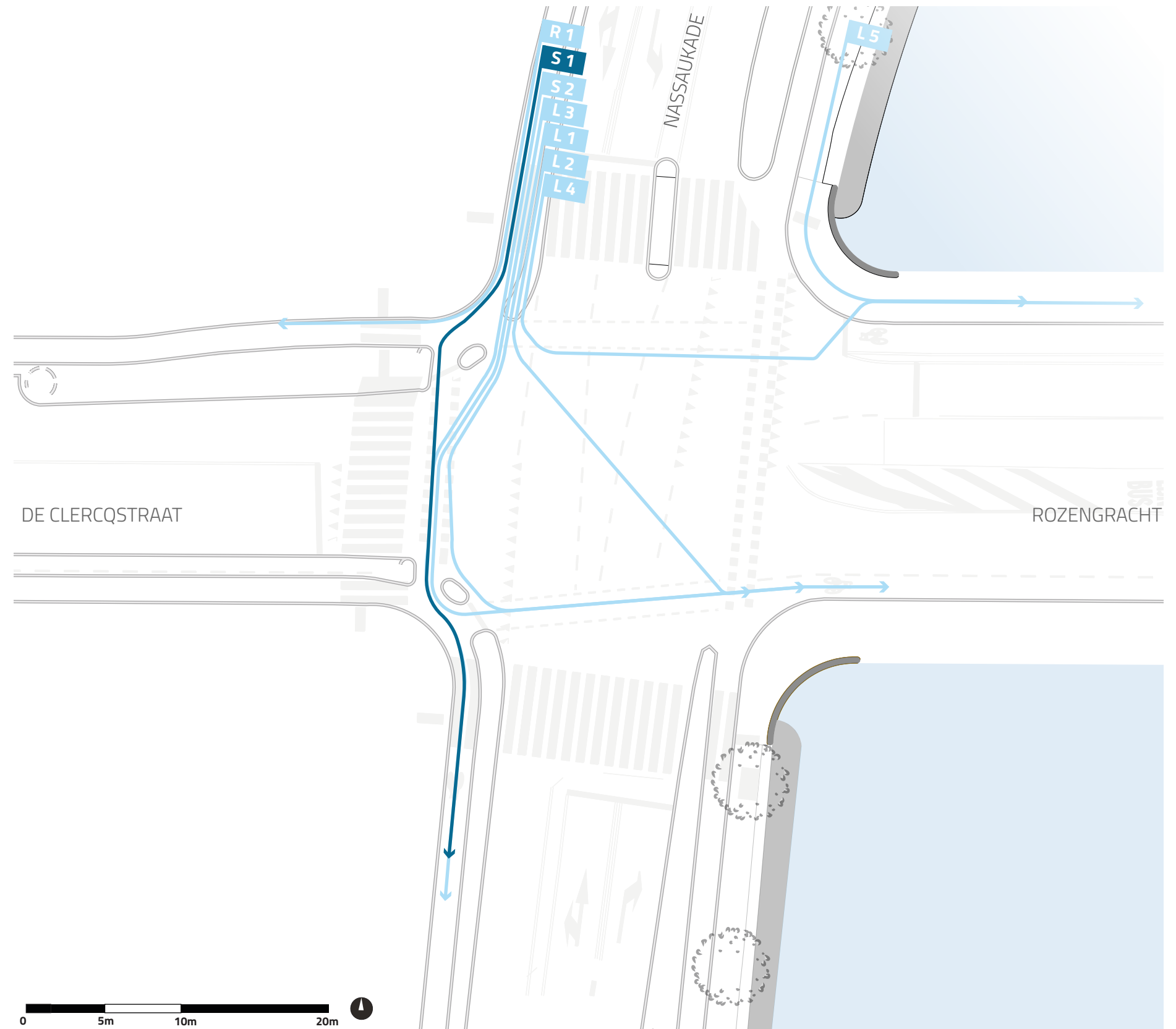
308 bicycle users come from the north.

STRAIGHT **S1** - 89% of cyclists coming from the north head straight respecting the bicycle lane drawn on the ground. They usually stop in the waiting box next to the protecting island. But with a limited waiting box, bicycle users back up which blocks traffic going west.
S2 - 22 cyclists of the 275 going straight ride outside the bicycle lane. Most of them circumvent the protecting island, stop outside the waiting box and integrate the bicycle track on the other side of the intersection.

RIGHT TURN **R1**- All the cyclists turn right following the bicycle lane. Since it is never crowded, there is always space for cyclists to turn according to the rules.

LEFT TURN Only 8 cyclists coming from the north turn left, using five different trajectories.
L1 - The most common way to turn left is in one step, by circumventing the protecting island, crossing the intersection and turning left next to the bicycle lane. Nonetheless, this left-turn is done by only 3 cyclists.
L2 - 2 turn left directly in the middle of the intersection without stopping.

Label	S1	S2	R1	L1	L2	L3	L4	L5
	253	22	25	3	2	1	1	1
%	12	1	1	0.1	0.1	0.05	0.05	0.05



9. DE CLERCQSTRAAT & NASSAUKADE

SOUTH ENTRY POINT

The lowest number of bicycle users come from the south entry (**246 cyclists**). Two thirds of them cycle straight; around a quarter turn right and the rest turn left.

RIGHT TURN R2 - 13 cyclists of the 58 turning right use the sidewalk in order to overtake the ones waiting at the red light and blocking the way.

LEFT TURN Only 26 cyclists turn left but they use six different ways which shows a lack of understanding of the infrastructure. Almost all of them turn left in two steps (L1, L2, L3 and L4).


L1 - The most common way to turn left in two steps is to stop between the yield line and the stop line and wait for the light to turn green.

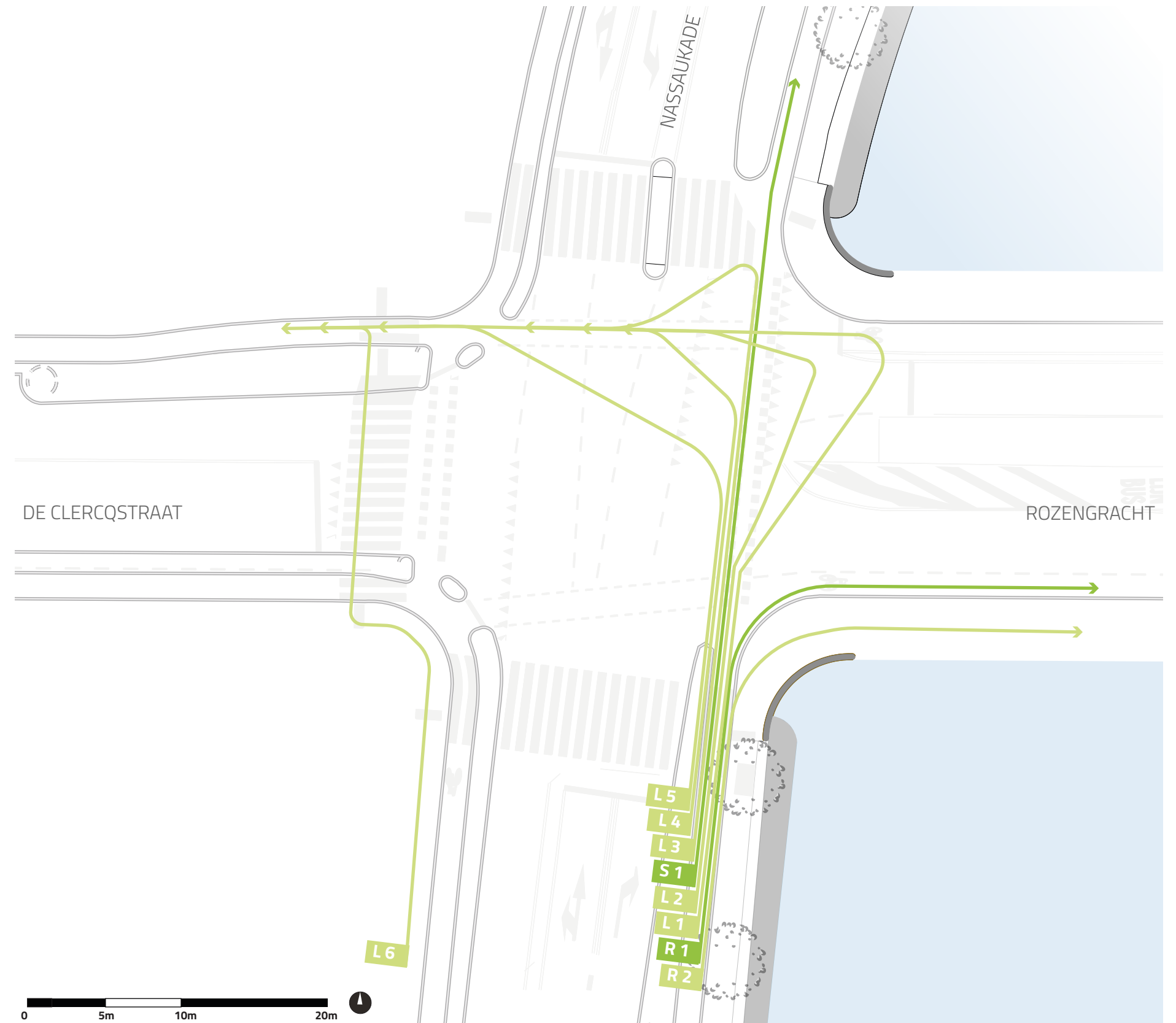
L2 - Only two bicycle users stop within the advanced part of the bicycle lane.

L3 - A few of them stop by the pedestrian crossing, then use it to integrate the bicycle lane in the middle of the crossroad. Since there is a small number of pedestrians crossing the street, no conflicts between users were observed.

L4 - A few cyclists slow down in the middle of the bicycle lane, and turn left when there are no cars in sight.

L5 - 4 cyclists turn left in the middle of the intersection without stopping.

Label	S1	R1	R2	L1	L2	L3	L4	L5	L6
	162	45	13	12	2	4	3	4	1
%	8	2	0.6	0.6	0.1	0.2	0.1	0.2	0.05



9. DE CLERCQSTRAAT & NASSAUKADE

EAST ENTRY POINT

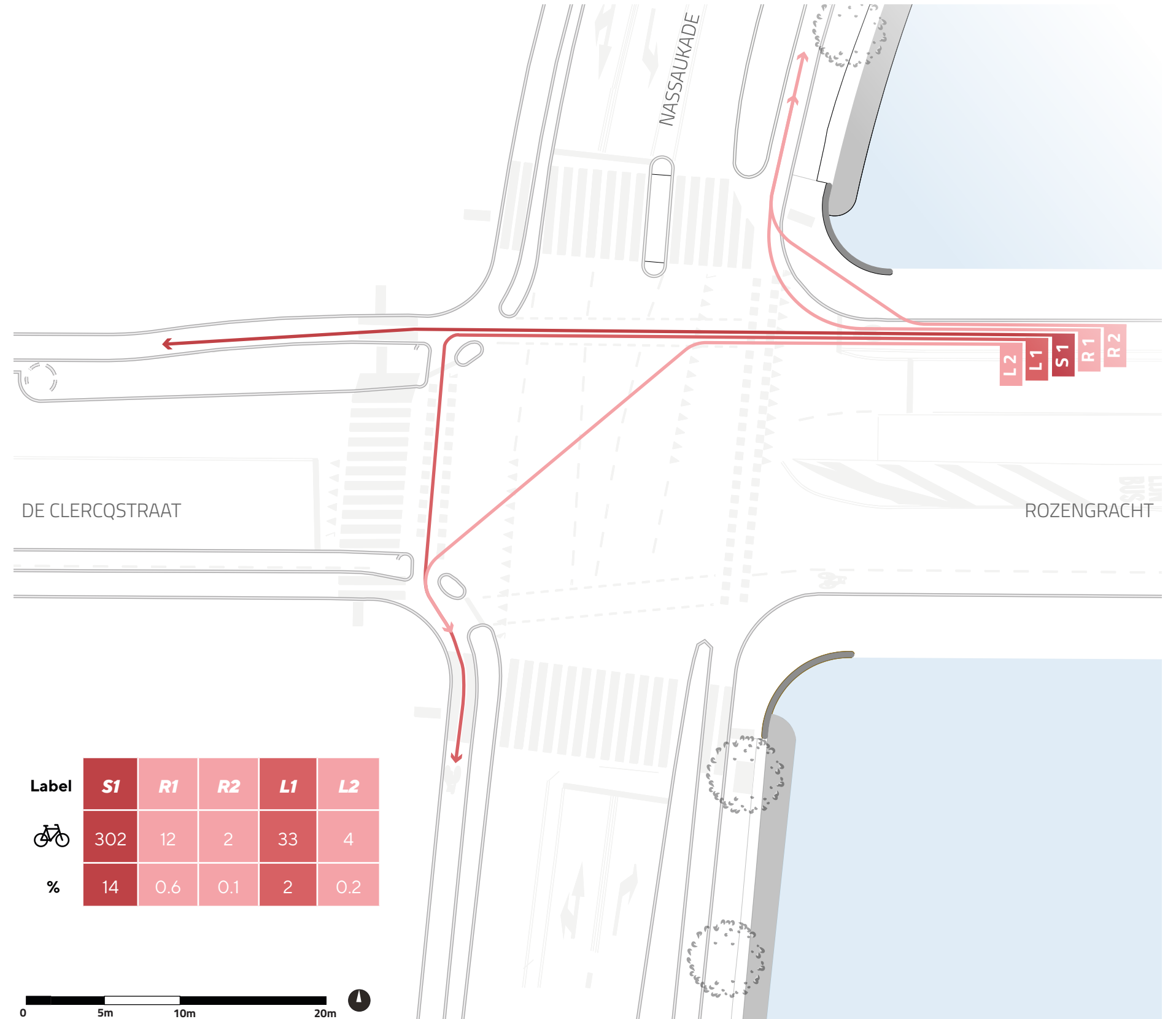
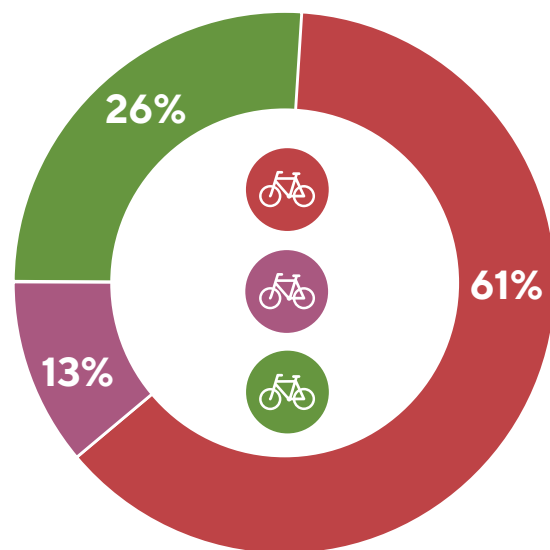
353 cyclists arrive from the east - by the bridge.

STRAIGHT S1 - 87% of cyclists arriving from the east head straight and respect the infrastructure. The road signs are confusing with two stop lines and two yield lines. There are no specific rules in this case and cyclists sometimes stop on the first faded stop line or at the newly painted one. Cyclists also stop at the yield line along with cyclists turning left.

LEFT TURN L1 - Most cyclists turn left in two steps. Only 2 or 3 people can fit in the waiting box on the north-west corner at one time, while there are usually at least 7 users waiting.
L2 - A few cyclists turn left in one step, crossing in the middle of the intersection. They usually have trouble integrating the bicycle track since cyclists from the west block their way while heading east.

TRAFFIC LIGHT ANALYSIS

61% of cyclists do not get the green light when they arrive at the intersection and have to stop. 13% of cyclists jump the red light, 70% of them turn right and do not benefit from a design allowing them to proceed to this manoeuvre while the light is red.



9. DE CLERCQSTRAAT & NASSAUKADE

WEST ENTRY POINT

The highest volume of bicycle users comes from the west. **1,180 cyclists** use a 1.85 meter wide track. The infrastructure suffers from congestion during the morning rush hour. At times, a queue of bicycles waiting at the traffic lights stretches down the block (roughly 40 meters). This congestion obstructs the flow of cyclists turning right on red. Nevertheless, no cyclists turned right using the sidewalk. Since the only stop line is drawn by the protecting island, cyclists tend to advance until the said line before performing a manoeuvre. It is relevant to note that cyclists coming from the north also pass by this corner.


A maximum of 40 cyclists can cross the intersection on a green light, which is a considerable amount, but not enough for the number of users. Some bicycle users wait two phases to get the green light. Moreover, only 2 to 3 cyclists can fit the waiting box. Therefore, cyclists find themselves blocking the way for the southbound users.

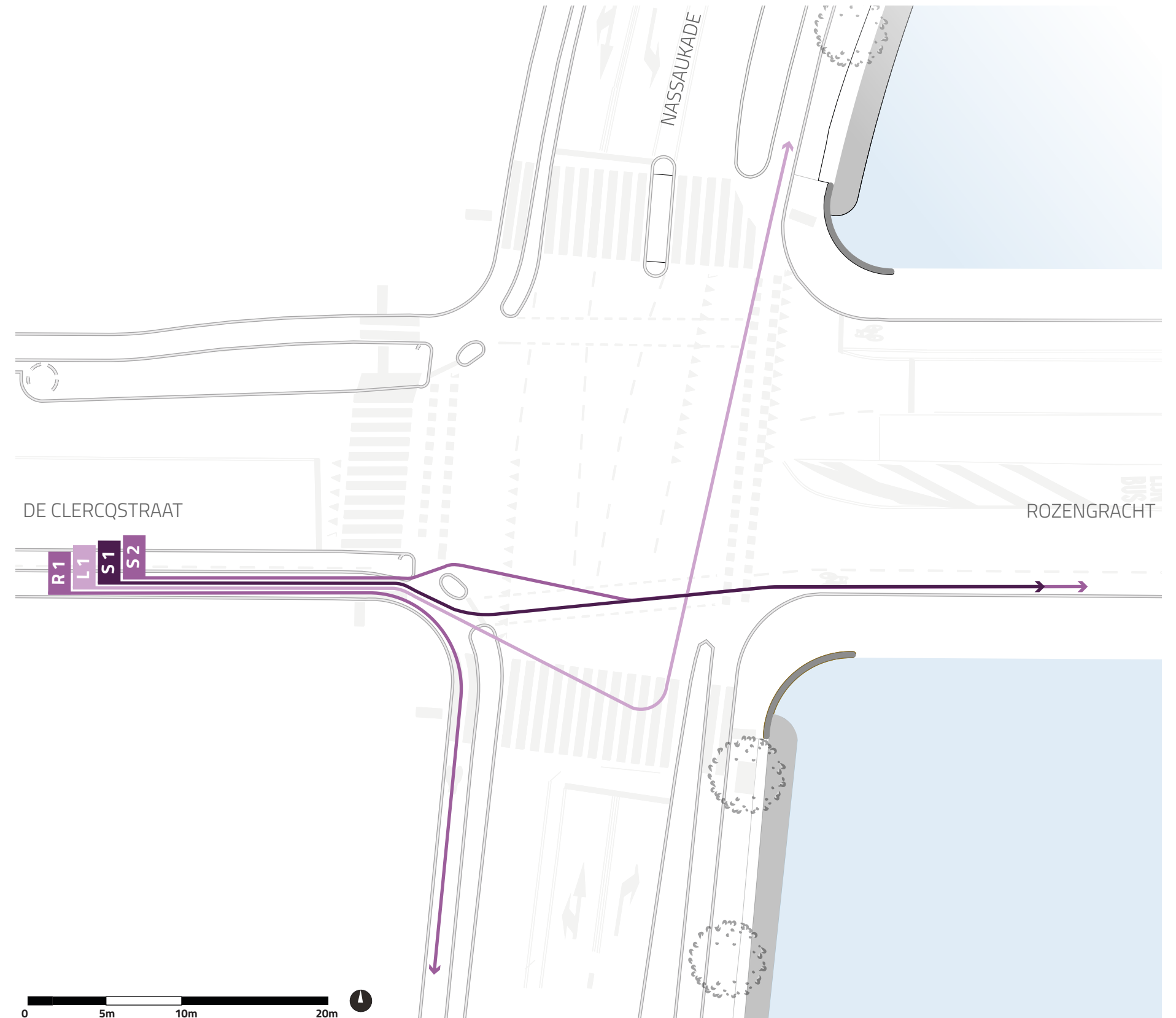
STRAIGHT

S2 - Even if the intersection is overcrowded, only 4% of cyclists going straight circumvent the protecting island and ride outside the bicycle lane to overtake other cyclists while crossing the intersection. This happens mostly during the busiest time of the rush hour.

LEFT TURN

L1 - Only 6 cyclists turn left, but all of them ride on the pedestrian crossing and turn in two steps.

Label	S1	S2	R1	L1
	984	40	150	6
%	47	2	7	0.3



9. DE CLERCQSTRAAT & NASSAUKADE

KEY FINDINGS II

D. USER CONFLICTS

The major conflicts happen at the south-west corner - the busiest bicycle track. The recurring conflicts happen between cyclists and mopeds or between cyclists and cyclists. Conflicts are related to both design and behaviour issues.

CYCLISTS > < PEDESTRIANS

In general, conflicts between cyclists and pedestrians are rare. Indeed, where a few cyclists ride on sidewalks, these are generally wide enough and the number of pedestrians is small (A).

THE JAM MANOEUVRE - Cyclist turning right on the sidewalk creating confusion for pedestrians

South entry point - This conflict happens due to a higher number of cyclists riding on the sidewalk.

THE CYCLISTS BLOCKING - Cyclists stopping on the pedestrian crossing forcing pedestrians to circumvent them

South entry point - A mass of cyclists blocking the pedestrian crossing was observed several times. As a consequence, pedestrians are forced to approach the sidewalk by the edge to circumvent cyclists.

CYCLISTS > < CYCLISTS

THE ENTAILED BLOCKED TRACK - Cyclists stopping and blocking the perpendicular track

North entry point - Cyclists frequently block the perpendicular bicycle track. There is also a lot of overtaking to be in the first row yet the waiting box can hold no more than 2-3 cyclists.

THE IMPATIENT SYNDROME - Cyclists overtaking cyclists to be the first in line.

West entry point - Most conflicts happen at this entry where the crowded bicycle track entails an "impatient syndrome" both from cyclists and mopeds. 12 cyclists overtook a group of cyclists to be the first at the stop line. Surprisingly, this does not happen during the peak of the rush hour.



9. DE CLERCQSTRAAT & NASSAUKADE

East entry point - Cyclists frequently overtake numerous cyclists waiting at the traffic light but the vast amount of space available eases these manoeuvres.

CYCLISTS > < MOPEDS

THE SHARING STRUGGLE - Mopeds overtaking and weaving between cyclists

Percentages of mopeds in the total flow of users on the bicycle track are:

East: 6%; **West:** 4%; **North:** 5%; **South:** 6%

West entry point - There is no correlation between the number of mopeds and the number of conflicts between their users and the bicycle users. The lack of space for users entails conflicts or unexpected behaviour. At this entry - where the percentage of mopeds is the lowest- the number of conflicts is the highest: 17 mopeds riding faster than cyclists overtook a group of cyclists, often weaving in-between them.

North entry point - 3 mopeds had a dangerous behaviour, weaving in-between cyclists and also switching from the bicycle track to the car lane to overtake as many cyclists as possible.

CYCLISTS > < DRIVERS

THE DRIVERS BLOCKING - Drivers stuck at the intersection and blocking the bicycle lane

A recurrent issue is due to motorists stuck at the intersection and blocking the bicycle tracks. It happens more frequently during the peak of rush hour. As a consequence cyclists tend to circumvent the cars (C & D).

South entry point - The major conflict is due to heavy car traffic. During this hour, 11 motorists block the way of cyclists. These motorists come from the right onto the bridge and block the intersection for bicycle users.

West entry point - During the peak of the morning rush hour, car drivers coming from the north and turning left on the bridge usually

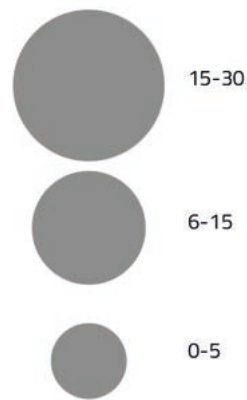


9. DE CLERCQSTRAAT & NASSAUKADE

get stuck in the middle of the intersection. During the last 20 minutes of video, a motorist blocks on average, every two minutes, the way of cyclists coming from De Clercqstraat.

East entry point - during the last 40 minutes of video, a car or truck blocks the bicycle users coming from the east every 5 minutes. Therefore, cyclists tend to circumvent them.

Number of conflicts observed



Type of conflicts

Pedestrians > < Cyclists

- P_a** Jam manoeuvre
- P_b** Cyclists blocking
- P_c** Cyclists rudeness

Cyclists > < Cyclists

- C_a** Entailed blocked track
- C_b** Impatient syndrome
- C_c** Disoriented syndrome
- C_d** Surprising counterflow
- C_e** Forcing syndrome
- C_f** Priority confusion

car / truck Drivers > < Cyclists

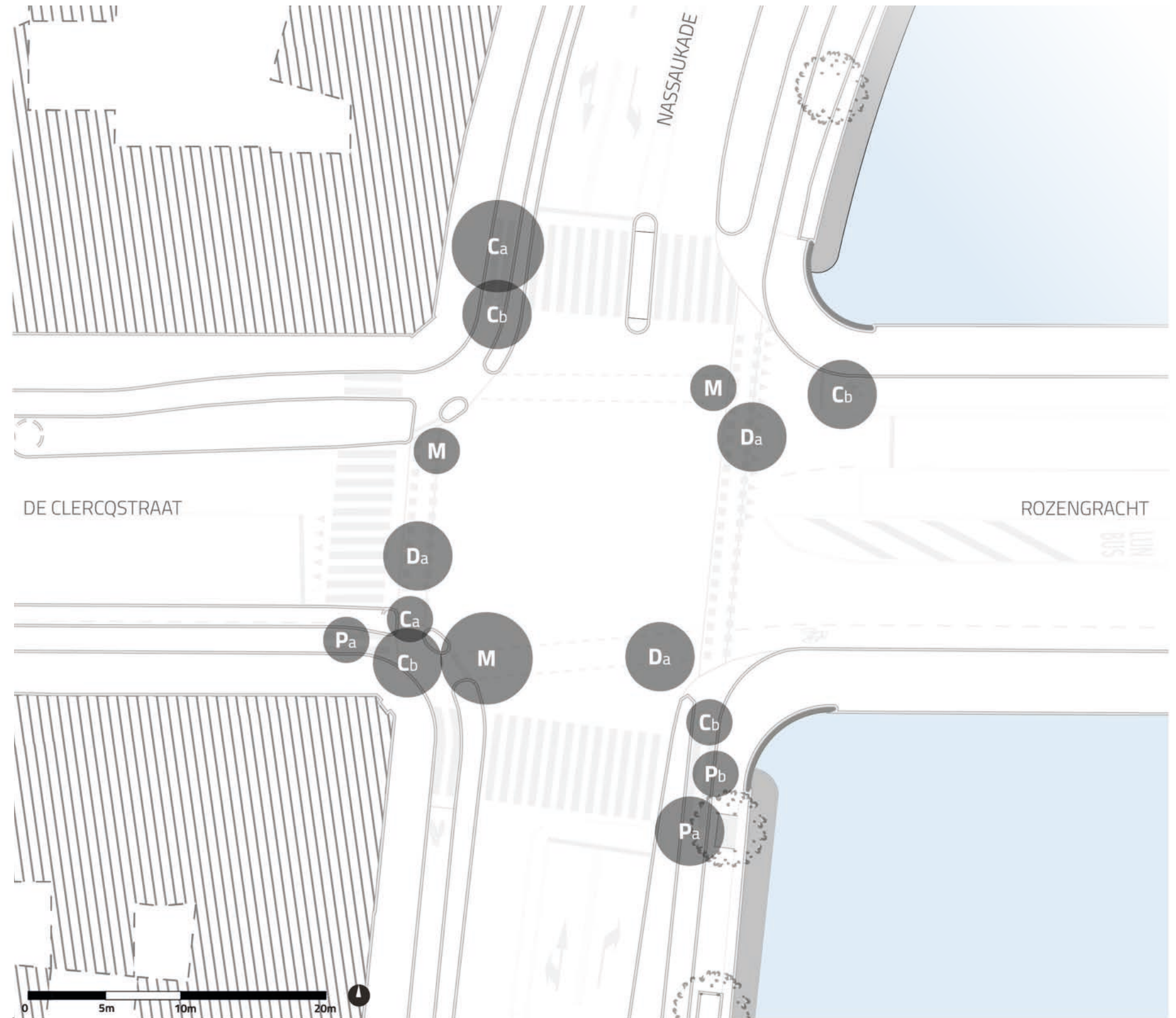
- D_a** Drivers blocking
- D_b** Undesignated car parking

Mopeds > < Cyclists

- M** Sharing struggle

Trams > < Cyclists

- T** Priority confusion



9. DE CLERCQSTRAAT & NASSAUKADE

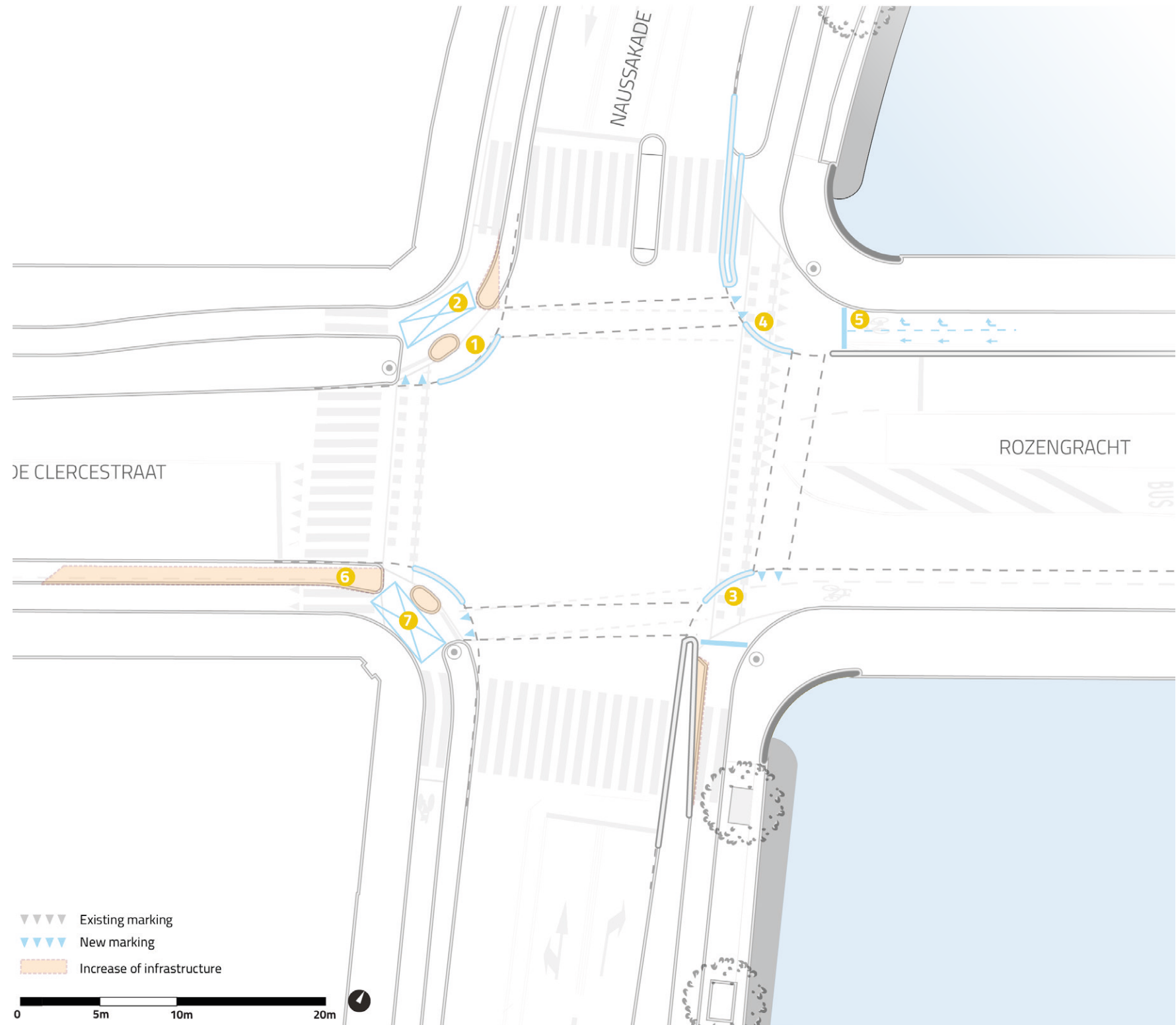
E. DESIGN PROPOSALS

North entry point - Creating a more open waiting box (1) to turn left instead of the island for cyclists coming from the east, and a white cross (2) for cyclists coming from north could reduce the number of cyclists stopping in unexpected places and blocking the bicycle track.

South entry point - This entry does not need a major redesign. Widening the track before the intersection could reduce the number of cyclists stopping on the pedestrian crossing and cycling on the sidewalk.

East entry point - Even if the eastern entry is not the most crowded in the morning and not the one which counted the most conflicts, a redesign is easy and can clarify the space for cyclists. A waiting box (4) can be created for bicycle users coming from the south and turning left toward De Clercqstraat. Moreover, cyclists should be allowed to turn right at the red light (5).

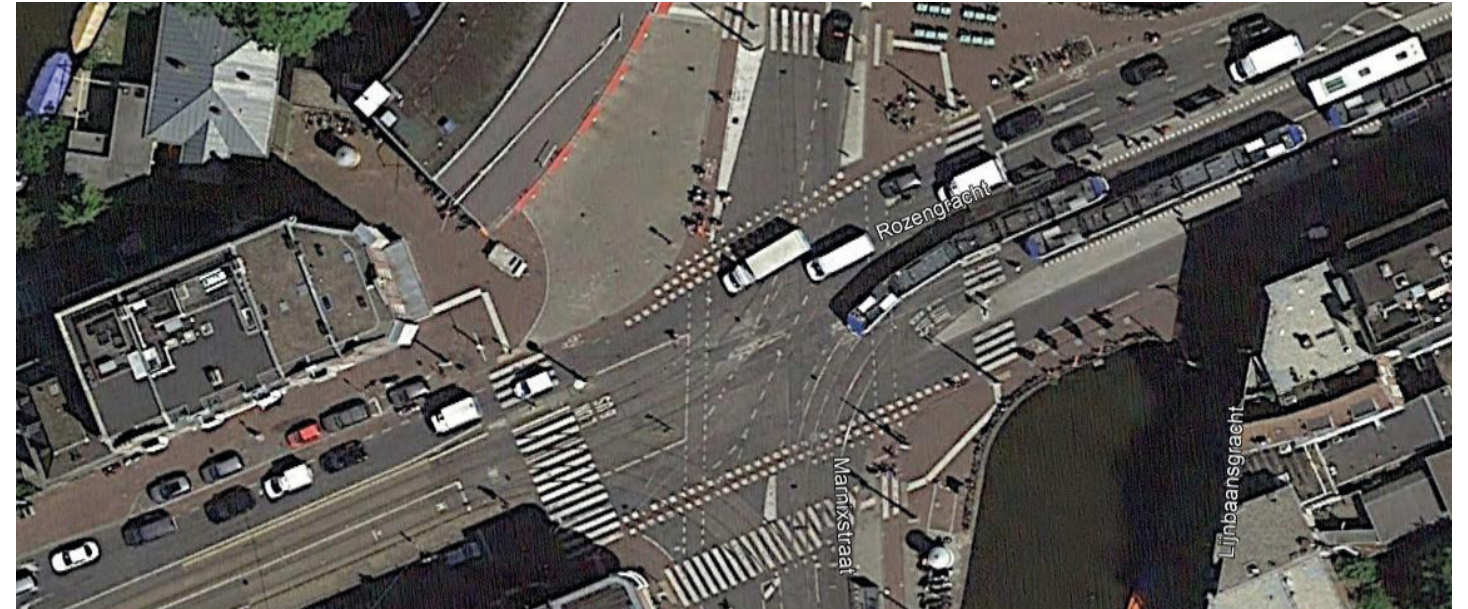
West entry point - The entry needing a redesign the most is the western one. Enlarging the 1.80 meter wide bicycle track a little (6) around 25 meters before the intersection could help improve fluidity and avoid congestion. Moreover, a "no stop" cross (7) and a stop line could raise awareness among cyclists on where stop.



10 ROZENGRACHT-MARNIXSTRAAT

A. THE NEIGHBOURHOOD

The intersection Rozengracht - Marnixstraat is located west of Amsterdam, on the ring around the city-centre. The district is comprised of a mix of residential and commercial activities. Moreover, a fire station is located at the junction.



Top view



Camera view

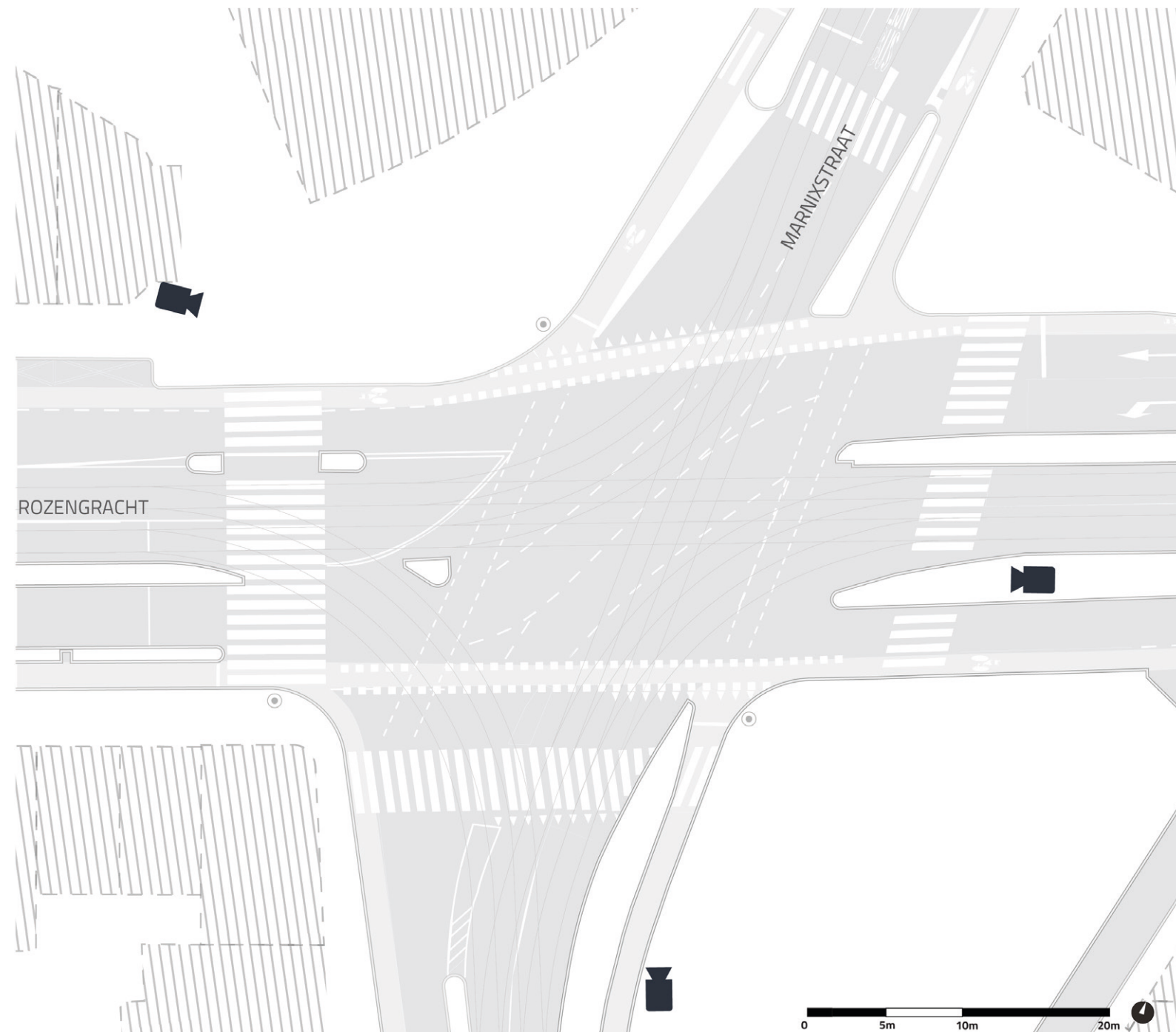
10. ROZENGRACHT-MARNIXSTRAAT

B. THE INTERSECTION

Rozengracht is a two-way street for cars. In the middle, there are two lanes exclusively for tramways and buses (lines 13,14, 17, 70, 752, 754 and 758). On the west side of the junction, there is a bicycle track measuring 1.70 meters and a bicycle lane of 1.33 meters. The cars' stop line is 4.40 meters away from the cyclists' one. On the east side, there are two bicycle lanes measuring 1.36 meters. The north side bicycle lane stretches only for 27 meters before the intersection. The stop line for cars is at the same level as the cyclist's one.

Marnixstraat is a two-way street for motorised traffic. It accommodates two lanes in the middle for buses and trams going in both directions (lines 80, 10, 170, 172 and 753). On the north side of the intersection, there are two car lanes and protected bicycle tracks on each side measuring 1.47 meters (east side) and 1.96 meters (west side). The cars' stop line is 24.33 meters away from the bicycle users' stop line. On the south side of the intersection, a car lane is removed (direction north-south) leaving one car lane. There are protected bicycle tracks on each side measuring 1.76 meters (east side) and 1.55 meters (west side). The cars' stop line is 10 meters away from cyclists' stop line.

No sign allows bicycle users to turn right on red.



10. ROZENGRACHT-MARNIXSTRAAT



North entry



East entry



South entry



West entry

10. ROZENGRACHT-MARNIXSTRAAT

KEY FINDINGS I

C. THE DESIRE LINES

The intersection was filmed on May 29th, 2017 from 8:15 to 9:15am by three cameras: one located at the south-east corner of the intersection, one at the north-west corner and one at the east of the intersection. **4,361 cyclists** crossed the junction during the morning rush hour. The average volume of cars on Marnixstraat is X, while on Rozengracht it is X.

ENTRY POINTS

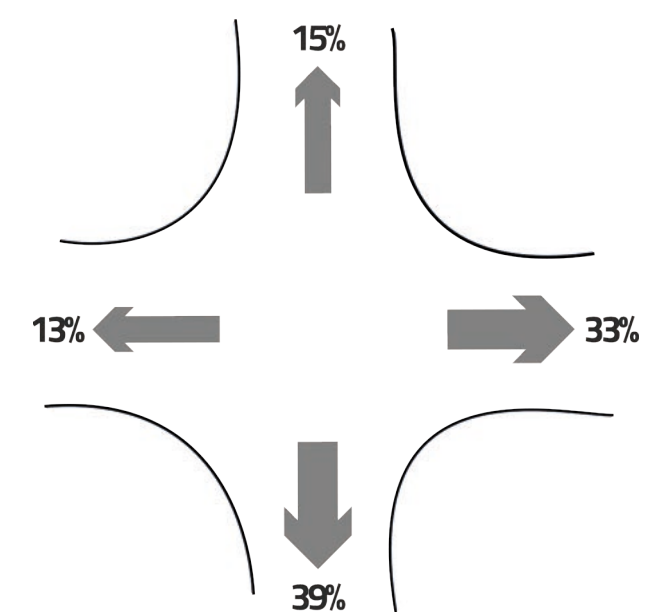
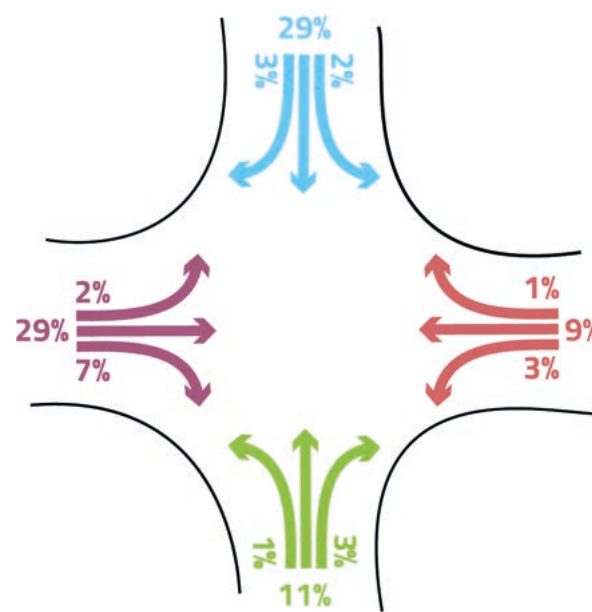
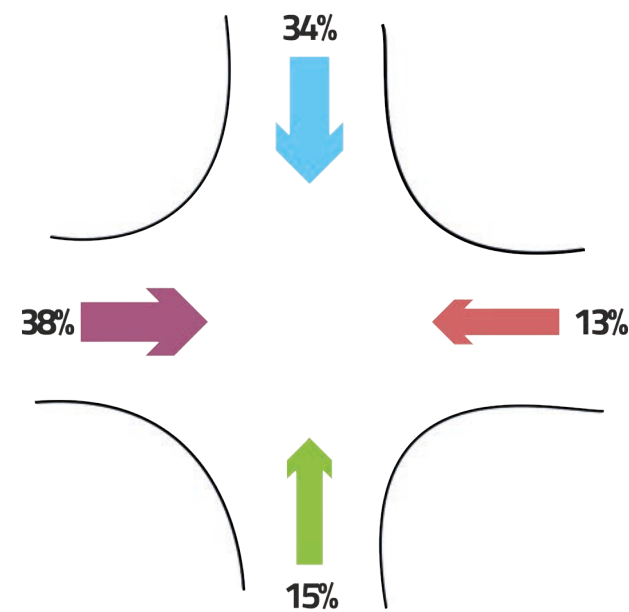
During the morning rush hour, most cyclists entered the intersection from the north and the west of the city. The south and the east entries are less active, with respectively 15% and 13% of the total of bicycle users crossing the junction.

MAIN DIRECTIONS

Most bicycle users ride straight (78%). However, from the eastern and western entries certain cyclists turn to head south of the city (10%).

EXIT POINTS

In the morning, most cyclists head south and east toward the historical city-centre. It is most likely the opposite in the evening.



10. ROZENGRACHT-MARNIXSTRAAT

NORTH ENTRY

980 cyclists crossing this intersection arrive from the north. Generally, the design of this narrow but long (18 meters) waiting box entices cyclists to respect their dedicated space. Yet a few users – especially the ones proceeding to a left turn- cycle outside the lane when it is crowded.

STRAIGHT 846 cyclists arriving from the north ride straight.

S2 - On the south side of the intersection, a small part of bicycle users ride outside the bicycle lane when they overtake other cyclists or ride with a friend. This situation is also due to the negative impact of the parking spots on the bicycle user's perception of safe distance from the vehicles. In any case, the lane appears to be too narrow to accommodate the large number of bicycle users, mostly coming from the north, but also from the east and west. They are not able to stay within the bicycle lane limits, thus invading the car lane.


RIGHT TURN 78 cyclists arriving from the north turn right.

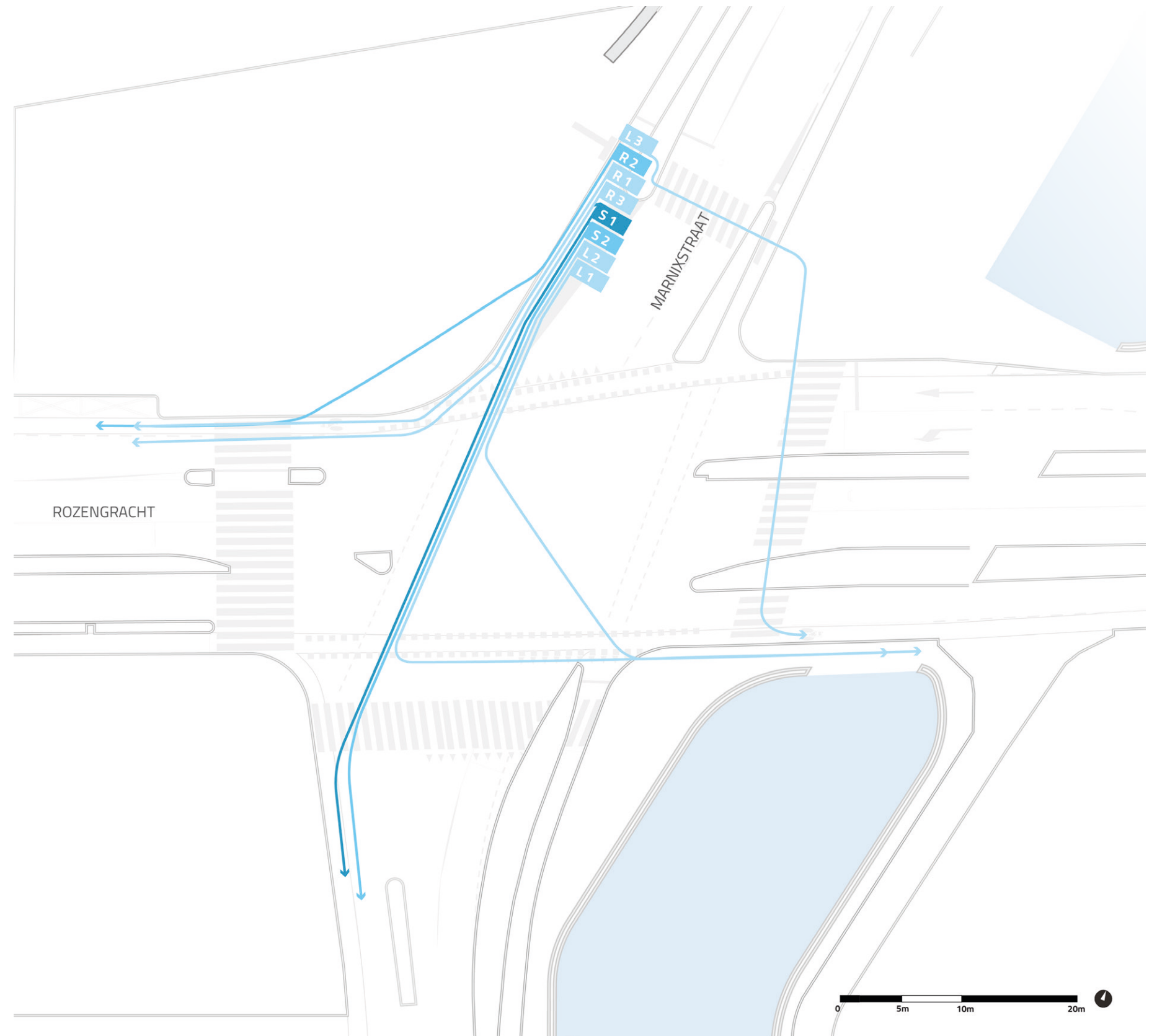
R2 - Most cyclists use the sidewalk not minding if the traffic light is red. At this corner, the sidewalk is wide and rather free of pedestrians. This design and use of the space has an influence on the way cyclists proceed with the turn. They use the entirety of the sidewalk as a shortcut when there is a group of cyclists at the red traffic light.

LEFT TURN 56 cyclists arriving from the north turn left.

L1 - Most cyclists willing to turn left in one-step come directly from the tramway lane, meaning that at some point they go out of the bicycle lane (based on the videos it is not possible to be more precise on the description).

L2 - A small part of bicycle users turn in two steps, stopping outside the crowded waiting box.

Label	S1	S2	R1	R2	R3	L1	L2	L3
	757	89	23	53	2	45	4	7
%	26	3	0.8	2	0.1	1.5	0.1	0.2



10. ROZENGRACHT-MARNIXSTRAAT


SOUTH ENTRY

This entry counts **451 cyclists** during the rush hour. The waiting area for cyclists arriving from the south is rather small (2.60 meters wide by 2 meters long), leaving no space there for the ones coming from the west willing to turn left.

STRAIGHT 330 cyclists arriving from the south go straight.
S1 - Even when a queue of cyclists appears, they all stay inside the designated area.

RIGHT TURN 76 cyclists arriving from the south turn right.
R2 - When cyclists notice that the waiting box is crowded they cycle on the sidewalk and continue on their way, disregarding the traffic light's color.

LEFT TURN 45 cyclists arriving from the south turn left.
L1 - The majority of cyclists turn left in one step by slowing down or widening the turning ratio if they see tramways or cars coming then continue on the bicycle lane.
L2 & L3 - A fewer number of them turn left in two steps -stopping at the north-east corner, either in the waiting box or outside- or using the pedestrian crossings.

Label	S1	R1	R2	L1	L2	L3
	330	47	29	29	11	5
%	11	2	1	1	0.4	0.2



10. ROZENGRACHT-MARNIXSTRAAT

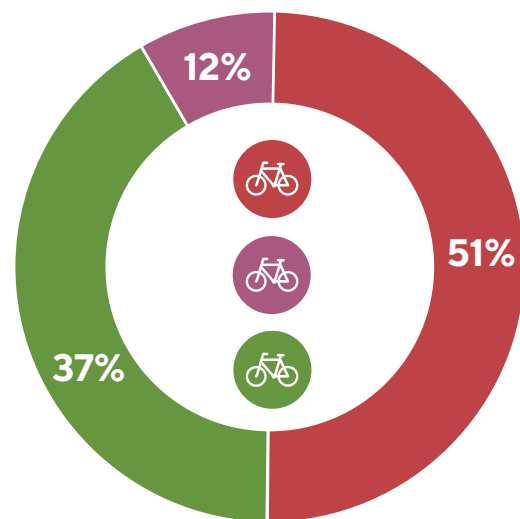
TRAFFIC LIGHT ANALYSIS

The southern entry's features -small waiting box and narrow lane-make cyclists bend some traffic rules. Therefore a more-in-detail analysis of the entry was carried out. By identifying the patterns and assessing the interactions with the space while focusing on the impact of the traffic lights, it is possible to understand cyclists' needs. Thus, the analysis focused on the waiting patterns, analysing cyclists during the different traffic phases and locating the areas where cyclists wait for the green light. It also tracked the ones who stop at the red light and the ones who jump it.

Straight - Most cyclists respected the red light, only 8 cyclists jumped it. Cyclists stop in the waiting box, but as the space is limited, 30 cyclists stopped on the pedestrian crossing while waiting for the traffic light to change, causing discomfort at times for pedestrians.

Right turn - 60% of cyclists turning right jump the red light. They overtake the waiting line of cyclists and use the sidewalk for the most part because of the lack of space on the bicycle lane. Generally, when the light is green, cyclists turn right respecting the bicycle lane.

Left turn - The large majority of cyclists willing to turn left do it cautiously and respect the traffic light. However, some of them overtake others to be at the front of the line.



Cyclists turning right during the red light.



Cyclists waiting for the green light outside the waiting box

10. ROZENGRACHT-MARNIXSTRAAT

EAST ENTRY

This entry counts **377 cyclists** and is not as crowded as the others. In general, the flow is constant and conflictless.


STRAIGHT 247 cyclists arriving from the east go straight.

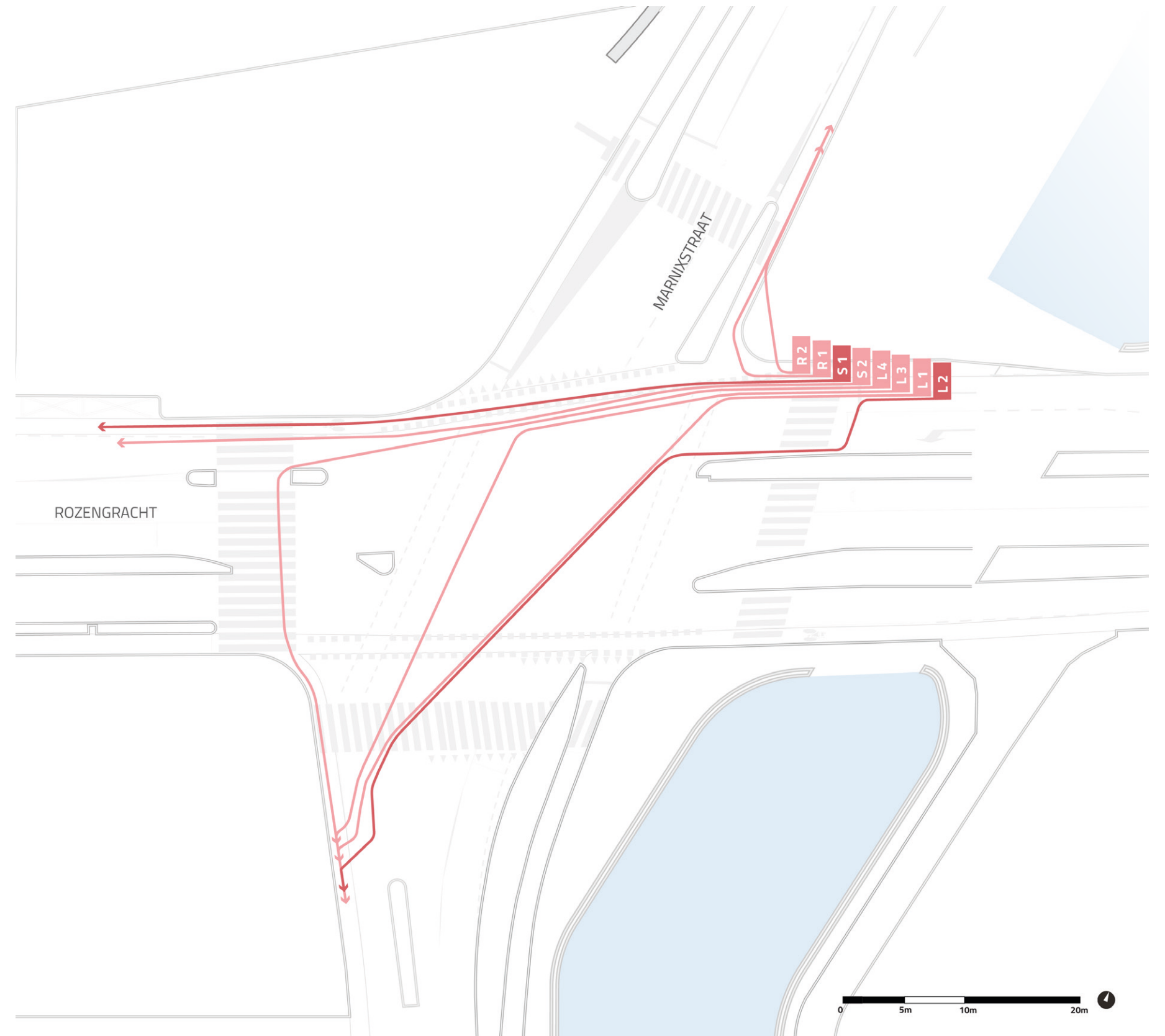
RIGHT TURN 38 cyclists arriving from the east turn right.

LEFT TURN 92 cyclists arriving from the east turn left.

L2 - 72 cyclists turning left in one-step use the car lane. Depending on the number of cyclists coming on the perpendicular lane, they use the car lane on Marnixstraat to finally incorporate the bicycle lane further down. This behaviour is encouraged by the bicycle lane's short length (27 meters) ahead of the junction. Indeed, due to the absence of a lane before the 27 meter stretch, cyclists willing to turn left anticipate their turn by keeping to the left of the street, occupying the car lane.

L3 - A smaller share of cyclists turn left in two steps, crossing straight and stopping in front of the tramway lane, next to the waiting box. They then continue outside the bicycle lane due to the high number of cyclists coming from the north until they can finally access it.

Label	S1	S2	R1	R2	L1	L2	L3	L4
	233	14	36	2	3	72	16	1
%	8	0.5	1	0.07	0.1	2	1	0.03



10. ROZENGRACHT-MARNIXSTRAAT

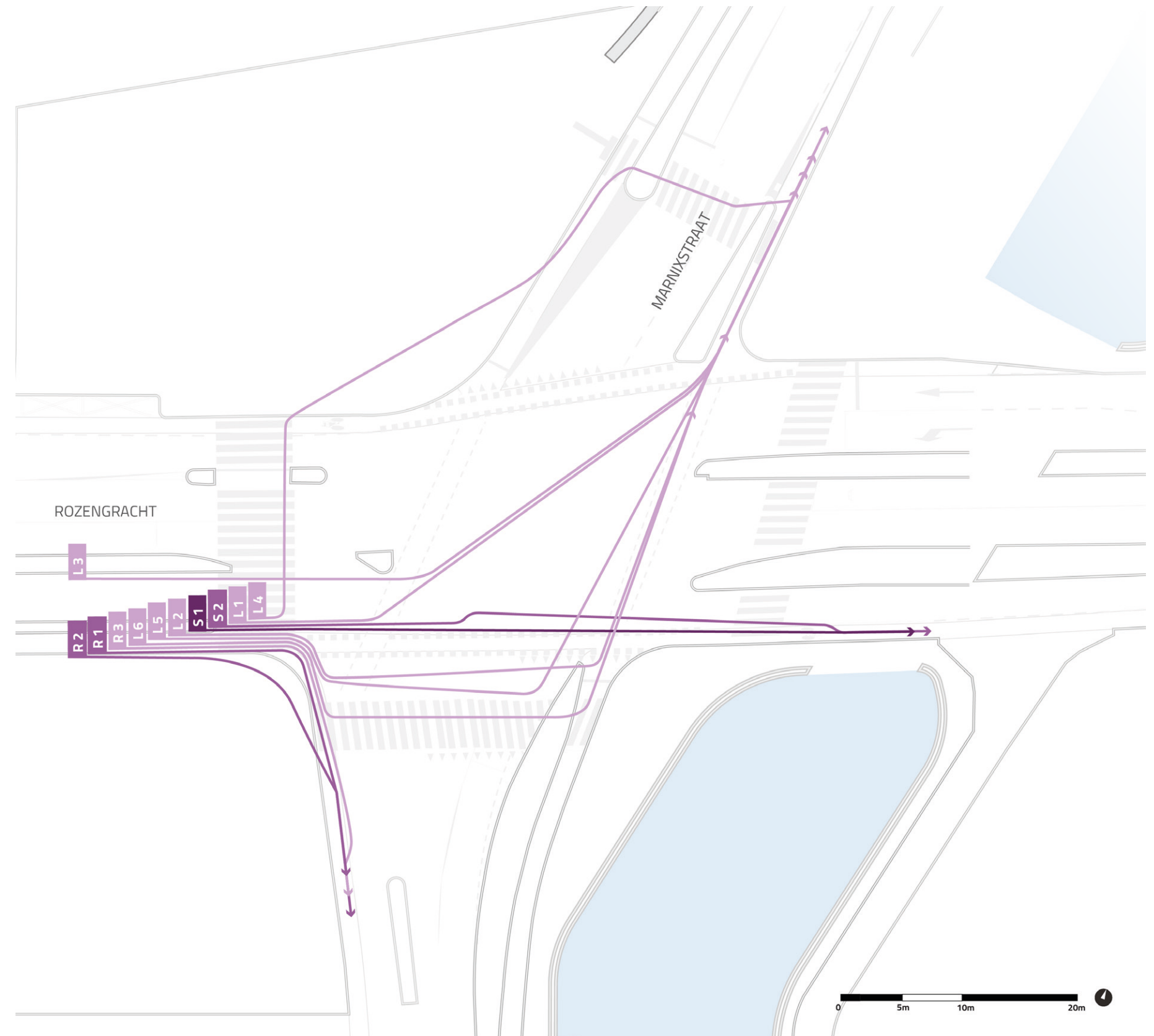
WEST ENTRY

With **1,106 cyclists** counted in an hour, the west entry has the highest cycling traffic. Three quarters of them go straight, heading towards the city-centre.

STRAIGHT 839 cyclists arriving from the west ride straight.
S2 - Roughly one fifth of cyclists ride outside the bicycle lane due to its narrowness (1.70 meters). They cycle comfortably when there are no cars, but seem to be tense otherwise.

RIGHT TURN 210 cyclists arriving from the west turn right.
R2 - Almost half of the bicycle users willing to turn right use the sidewalk disregarding the traffic light's color. Generally, this happens when many cyclists are waiting for the green light.
R3 - On Marnixstraat, the bicycle lane being narrow, certain cyclists ride on the car lane.

LEFT TURN Only 57 bicycle users turn left. They draw 6 different trajectories showing a lack of clarity in the way to proceed with this turn.
L1 - A few cyclists turn left in one step, slightly slowing down or stopping for a few seconds as cars and tramways pass.
L2 - Most cyclists turn left in two steps. They stop in the waiting box but when it is full, they block the pedestrian crossing.
L4 - 24 cyclists, which is the most important number at this entry point, turn left on the pedestrian crossing and then continue on the sidewalk. A few users dismount their bicycles while doing so. This manoeuvre may reflect the perception of danger due to the size of the intersection or the tramways.
L5 - Some bicycle users prefer to stop by the tramway lane to avoid the overcrowded waiting box.



Label	S1	S2	R1	R2	R3	L1	L2	L3	L4	L5	L6
	677	162	96	87	27	2	14	3	24	13	1
%	23	6	3	3	1	0.1	0.5	0.1	0.8	0.4	0.01

10. ROZENGRACHT-MARNIXSTRAAT

KEY FINDINGS II

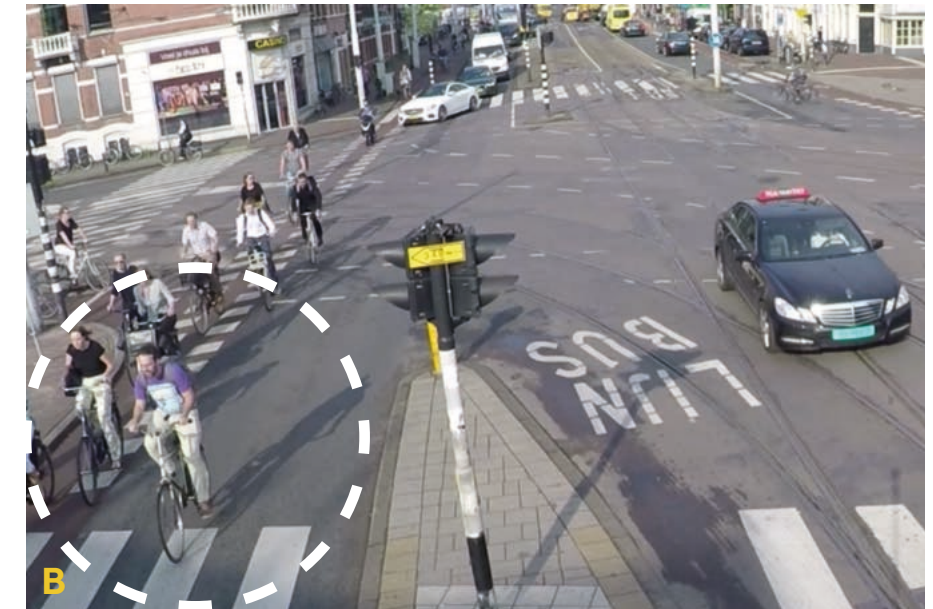
D. USER CONFLICTS

This section sees slightly uncomfortable situations arise between cyclists and the rest of the street users. Whatever the entry, the most recurring conflicts happen between cyclists and mopeds. The rest of the conflicts are rather different by nature and entail different reactions. They also differ from one entry to another.

CYCLISTS > < PEDESTRIANS

THE JAM MANOEUVRE - Cyclist turning right on the sidewalk creating confusion for pedestrians

West entry point - Due to the important number of users and the reduced space, cyclists behave impatiently. They disregard other cyclists and do not respect the space allocated to other street users. Cyclists willing to turn right tend to overtake the ones waiting at the red traffic light, and ride on the sidewalk. Sometimes, they even come across pedestrians who must circumvent them.



THE CYCLISTS BLOCKING - Cyclists stopping on the pedestrian crossing forcing pedestrians to circumvent them

South entry point - Most conflicts at this entry are related to the obstruction of the pedestrian crossing by cyclists. This conflict is brought on by both infrastructural problems (small waiting box, narrow bicycle track) and a long red phase from the traffic lights. Indeed, cyclists queuing leave no space for the ones coming from the west and willing to turn left (A).



CYCLISTS > < CYCLISTS

THE IMPATIENT SYNDROME - Cyclists overtaking cyclists to be the first in line.

West entry point - Cyclists overtake other cyclists using the car lane. They seem to be tense, looking over their shoulder to watch out for cars (B).

10. ROZENGRACHT-MARNIXSTRAAT

CYCLISTS > < MOPEDS

THE SHARING STRUGGLE - Mopeds overtaking and weaving between cyclists

The most recurring conflict at this intersection happens between cyclists and mopeds. Mopeds overtake cyclists, going in and out of the bicycle tracks indiscriminately, causing tensions with both car drivers and bicycle users. The number of conflicts is especially high at the west access point. This situation shows that the capacity of the existing bicycle infrastructure can not fit both the bicycle users and the mopeds (C).

Share of mopeds in the total number of users:

North: 7% ; **South:** 8% ; **East:** 13% ; **West:** 6%

CYCLISTS > < DRIVERS

THE DRIVERS BLOCKING - Drivers stuck in the intersection and blocking the bicycle lane

South entry point - A few incidents are related to motorists being stuck at the intersection, blocking the bicycle lane and making cyclists circumvent them. However, the cause seems to be more related to drivers accelerating at the last moment to get the green light, than the dense car traffic.

THE UNDESIGNATED CAR PARKING - Drivers using the sidewalk as parking area obstructing the way for pedestrians and cyclists turning right.

North entry point - Motorists use the wide sidewalk in front of the fire station as an express parking area. This behaviour causes discomfort to both pedestrians and cyclists when motorists cross the bicycle infrastructure to access and to exit the sidewalk (D).

CYCLISTS > < TRAMS

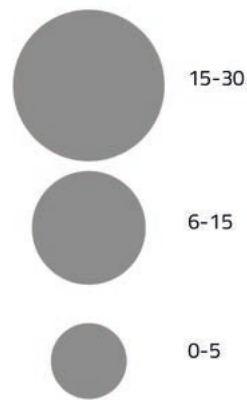
THE PRIORITY CONFUSION - Cyclists wanting to turn left and having to slow down / stop in the middle of the crossroad due to the tramway passing

North entry point - This intersection is complex due to the numerous tramway lines that either go straight or turn. It makes the left turn for cyclists coming from the north more complicated. Sometimes, they stay "trapped" in the middle of the crossroad while the tram passes (E).



10. ROZENGRACHT-MARNIXSTRAAT

Number of conflicts observed



Type of conflicts

Pedestrians > Cyclists

- P_a** Jam manoeuvre
- P_b** Cyclists blocking
- P_c** Cyclists rudeness

Cyclists > Cyclists

- C_a** Entailed blocked track
- C_b** Impatient syndrome
- C_c** Disoriented syndrome
- C_d** Surprising counterflow
- C_e** Forcing syndrome
- C_f** Priority confusion

car / truck Drivers > Cyclists

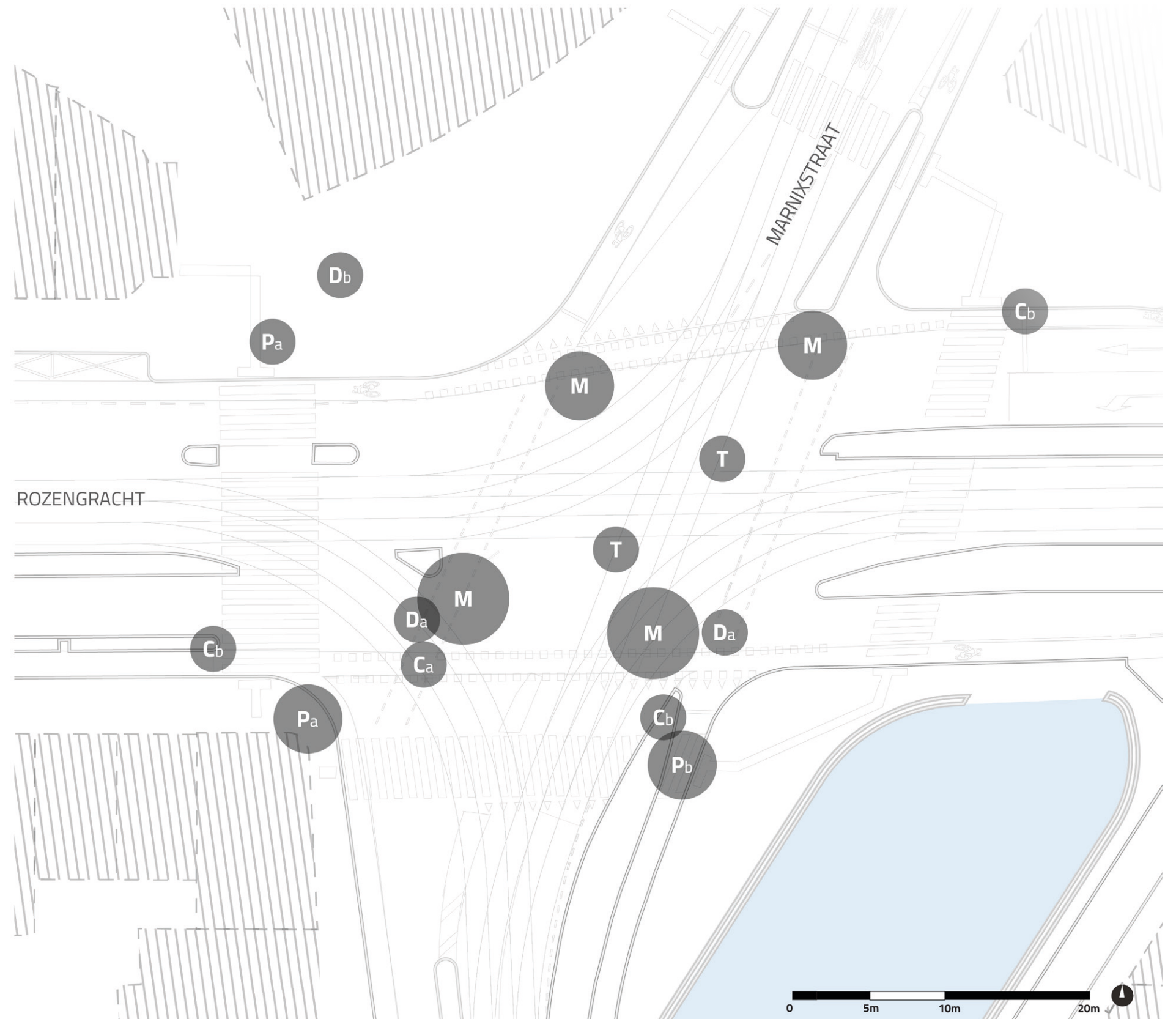
- D_a** Drivers blocking
- D_b** Undesignated car parking

Mopeds > Cyclists

- M** Sharing struggle

Trams > Cyclists

- T** Priority confusion



10. ROZENGRACHT-MARNIXSTRAAT

E. DESIGN PROPOSALS

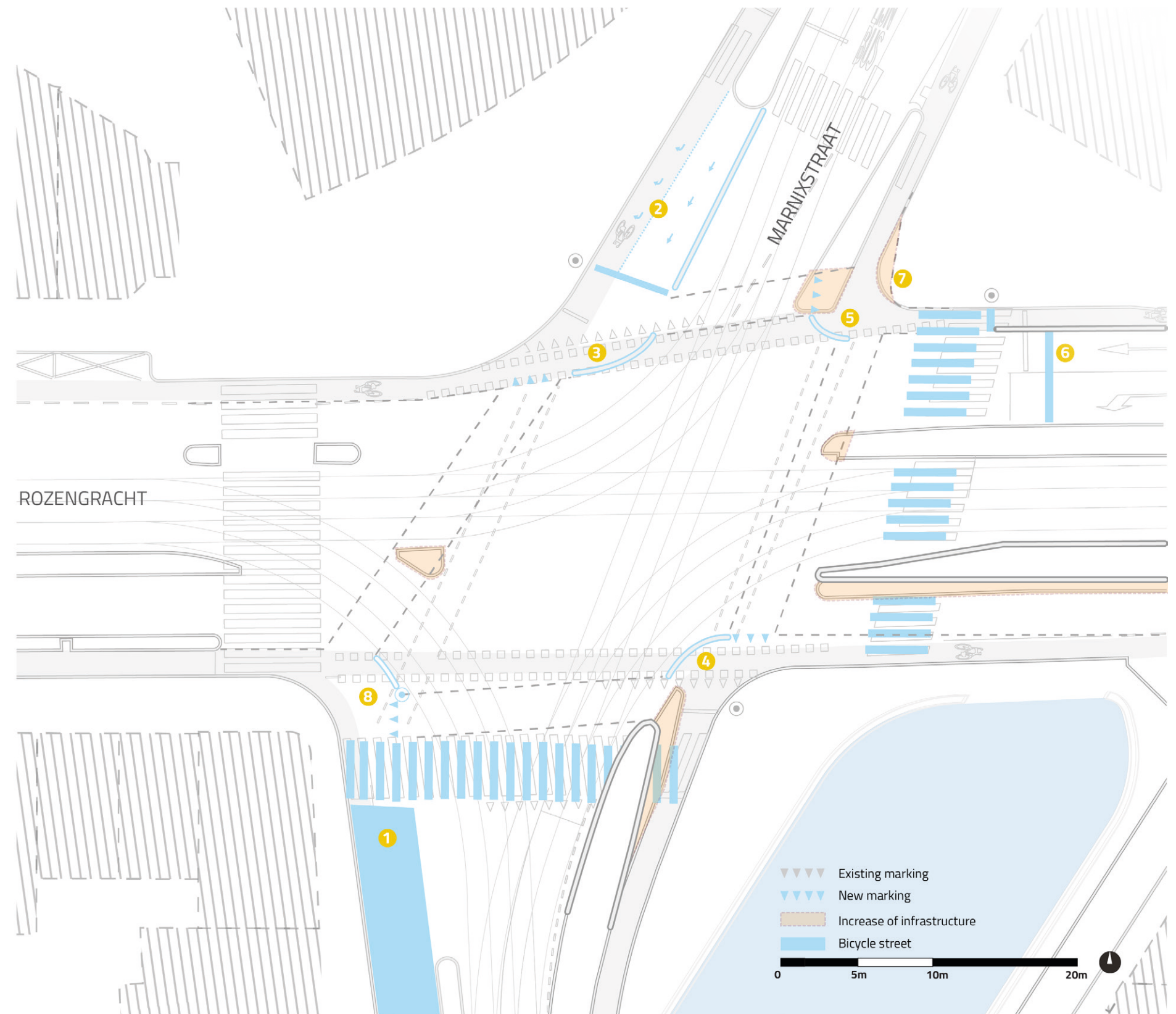
The capacity of the cycling infrastructure is surpassed, therefore it is necessary to consider measures to increase the space for bicycle users. The main proposal would be to turn the south part of Marnixstraat into a bicycle street (1). Indeed, it witnesses 1,148 cyclists during the rush hour and the existing infrastructure is unable to accommodate such a number, pushing users to cycle outside the bicycle lane. The existing narrow bicycle lane should be removed and the car speed reduced.

North entry point - A lane to turn right (2) could be created by widening the bicycle lane and using the empty space between the lane and the cars. This design should be accompanied by a sign allowing cyclists to turn right during the red light. Moreover, the waiting area (3) could be enlarged to offer more space to cyclists waiting to turn left. The unused space can be turned into an official waiting area. Of course, all these suggestions must be adjusted depending on the fire station's exit requirements.

South entry point - The capacity of the waiting box must be increased (4). A possibility could be to push back the pedestrian crossing a short distance, offering space for the cyclists coming from the south and the ones arriving from the west waiting to turn left. Further considerations have to be taken regarding the design of the infrastructure for the left turn from Marnixstraat to Rozengracht (5).

East entry point - During the morning rush hour, this lane is not overcrowded, but it may be the case in the evening. An upgrade of the bicycle lane could be considered. This could reduce the number of cyclists turning left in one step and mixing with cars. Like other intersections in Amsterdam, the car stop line (6) could be pushed back a few meters. Moreover, the waiting area (5) could be bigger and the corner's radius (7) could be adjusted to ease the access onto the cycle track.

West entry point - A Dutch style waiting area can be created to show the few cyclists turning left where they should stop (8). This new design would entail moving the traffic light for tramways.



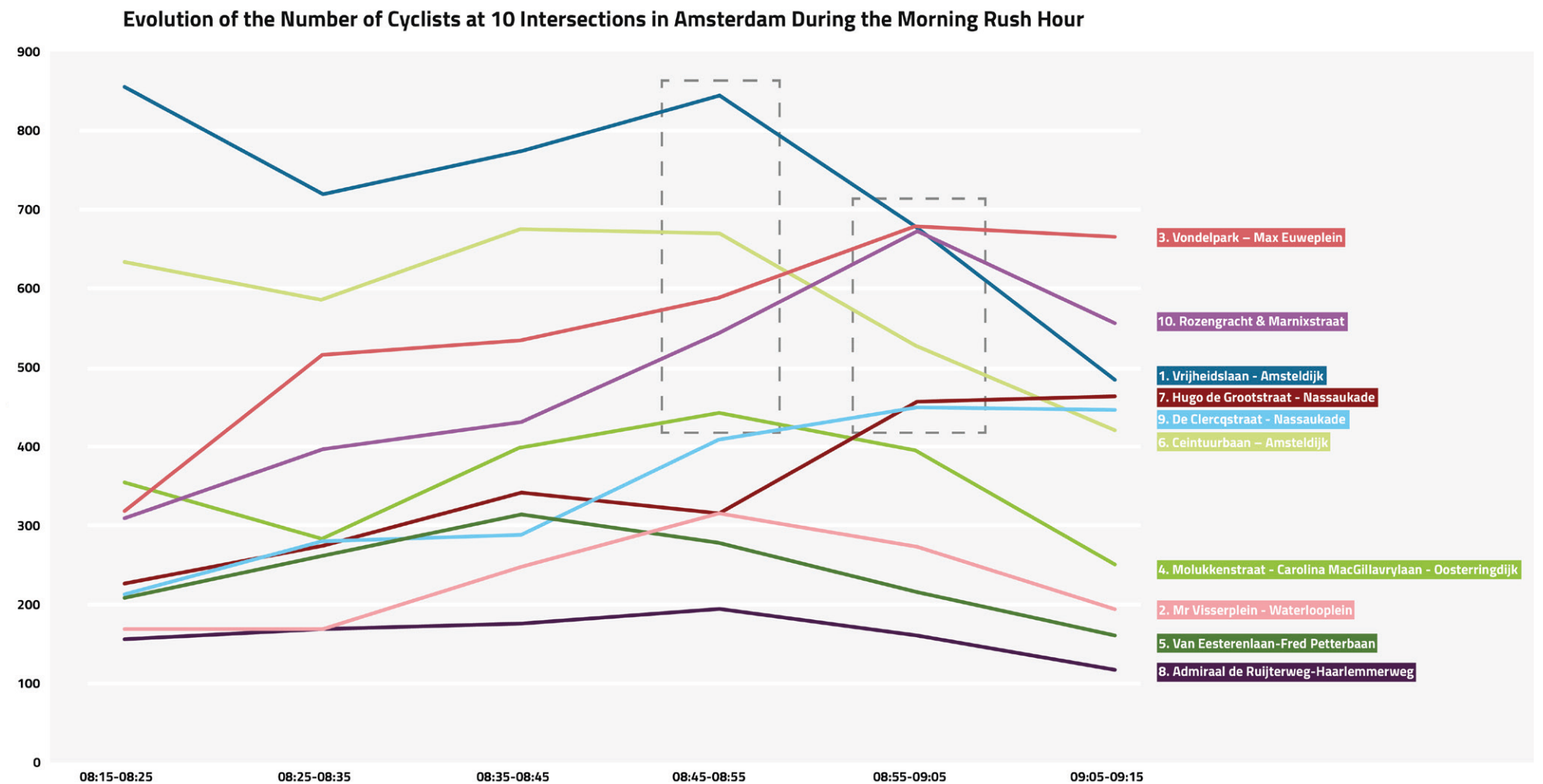
D CONCLUSION

A. EVOLUTION OF THE NUMBER OF CYCLISTS

This graph illustrates the evolution of the number of cyclists counted at 10 intersections during the morning rush hour, between 8:15 and 9:15. Cyclists were counted during time increments of 10 minutes.

For eight of the ten intersections, the number of cyclists peaked between 8:45 and 9:05. However, there is a slight variation in the peak time at these intersections, with two identifiable peak zones. At the intersections farther from the city centre (1, 4 and 6), the cyclist count peaked between 8:45 and 8:55. However, closer to the city centre (intersections 3, 7, 9 and 10), the peak time was closer to 9:00, between 8:55 and 9:05. Proximity to the city-centre could potentially explain this difference between seven of the intersections in these peak zones.

An outlying case is intersection 5 with an earlier peak time between 8:35 and 8:45. It is located in a residential area, with a significant number of families with children. This could potentially explain an earlier peak hour, if a lot of commuters are dropping off their children at school before going to work.



B. TOTAL NUMBER OF CYCLISTS PER INTERSECTION

Ranking from the busiest to the least busy intersection:

- 1. Vrijheidslaan – Amsteldijk : 4,361
- 6. Ceintuurbaan – Amsteldijk : 3,514
- 3. Vondelpark – Max Euweplein : 3,308
- 7. Tweede Hugo de Grootstraat – Nassaukade : 2,978
- 10. Rozengracht – Marnixstraat : 2,914
- 4. Molukkenstraat – Carolina MacGillavrylaan – Oosterringdijk : 2,185
- 9. De Clercqstraat – Nassaukade : 2,087
- 5. Van Eesterenlaan – Fred Petterbaan : 1,440
- 2. Mr Visserplein – Waterlooplein : 1,386
- 8. Admiraal de Ruijterweg – Haarlemmerweg : 972



C. RECOMMENDATIONS

Between 8 and 9 in the morning, cyclists are abundant on the streets of Amsterdam. Like a flock of birds, they form groups, which stretch out along the cycle tracks, crowd together at the intersections and assume an elongated form again past the junction. Over the 10 hours of observation, these 24,226 bicycle users appeared always agile, often in a hurry, and sometimes impatient. The cyclists of Amsterdam are accustomed to adjusting their speed constantly: they slow down and accelerate to adapt to their surrounding environment, and specifically the traffic lights and other cyclists who cross their paths. Their capacity to adjust shows the extent to which they are immersed in their environment and as they use all of their senses, can be precise in their trajectories and react to every small detail coming their way.

Shortcuts and impatience

While the majority respect the infrastructure dedicated to them, some draw their own desire lines, and, following the rhythm of the traffic lights, create a relatively coordinated street ballet. No significant conflicts were observed (except at intersection n°4), but tensions between the users arose at the major intersections and shortcuts, off the cycle tracks, were regularly used to avoid the mass of cyclists waiting at the traffic light.

Having to stop is one of the worst situations for a cyclist and in Amsterdam daily travel is defined by frequent stops. It would be interesting to conduct

a study on the average number of intersections at which cyclists have to stop and for how long. The red lights, coupled with waiting areas which cannot contain all the users, lead to peculiar behavior:

- circumventing of protecting islands;
- waiting outside of the dedicated zones;
- running red lights;
- use of pedestrian crossings;
- riding on the sidewalk.

Regulars of the premises, the cyclists know well how the traffic lights function, anticipate the changing signals for cars and pedestrians and - adjust their behavior to wait the least time possible.

Influential factors that determine cyclist behavior

Generally speaking, the behavior and trajectories of cyclists are guided by:

- the traffic lights, which make them slow down or speed up. The cyclists of Amsterdam are experts, despite it being quite dynamic, in the system of traffic lights of their city;
- the tramway, which has priority over the other modes of transport;
- the other cyclists: the principle of "follow the leader" applies, as well as strength in numbers, with priority granted to the larger group;
- the road markings, but these are sometimes insufficient to guide them.

The main recommendations: make space for cyclists and increase their safety



The City of Amsterdam should continue the work that began a few years ago: redesigning intersections to make more space for cyclists, increasing their safety and limiting interruptions in their travel. The main measures that should be taken are at traffic-light-regulated intersections:

- Expand the waiting zones to limit the "impatient syndrome" and desire lines;
- Widen the cycle tracks at the intersection and design the entry point on the other side appropriately to reduce the "bottleneck" effect;
- In certain cases, implementing turn restrictions for cars, specifically for right turns;
- Assist cyclists in anticipating upcoming turns by guiding them with road markings (arrows) indicating their appropriate place on the cycle track to avoid being trapped in the dense flow of cyclists;
- Enable direct right turns by keeping one accessible lane
- Educate cyclists not to stop on the pedestrian crossing and the white cross by a communication campaign.

Some cycle tracks are narrow and the successful test of the bike street at Sarphatistraat suggests that this model could be experimented with on other streets. This approach could also be adopted on some of the bridges where the width of the cycle tracks is even smaller.

Ban mopeds from the cycle tracks

According to the observations, most of the mopeds circulating with the bicycles adopt modes of behavior that engender tensions between users. Faster and noisier than cyclists, they force their way through to be the first ones waiting at the traffic light and start up rapidly to be the first to reach the cycle track on the other side of the intersection. Their behavior induces stress in other users and in certain cases is even dangerous. The space being already fully used by cyclists and the hazardous behavior of mopeds justify excluding them from the cycle tracks.

More comfort and safety for cargo bike users

When turning left on the bicycle track, many cargo bike users avoid the uncomfortable 90-degree turn and position themselves in front of the protecting island instead of behind it. Sometimes, those who manage the sharp turn pose an obstacle to the flow of cyclists going straight due to their length.

Although many cargo bikes were observed, during these peak hours, few of them were being used for urban logistics. Trucks pose risks for the more vulnerable users of the road. Policy efforts to reduce the number of these vehicles should be pursued. An incentive for the commercial use of cargo bikes could, at least, encourage a reduction of vans in the city.



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