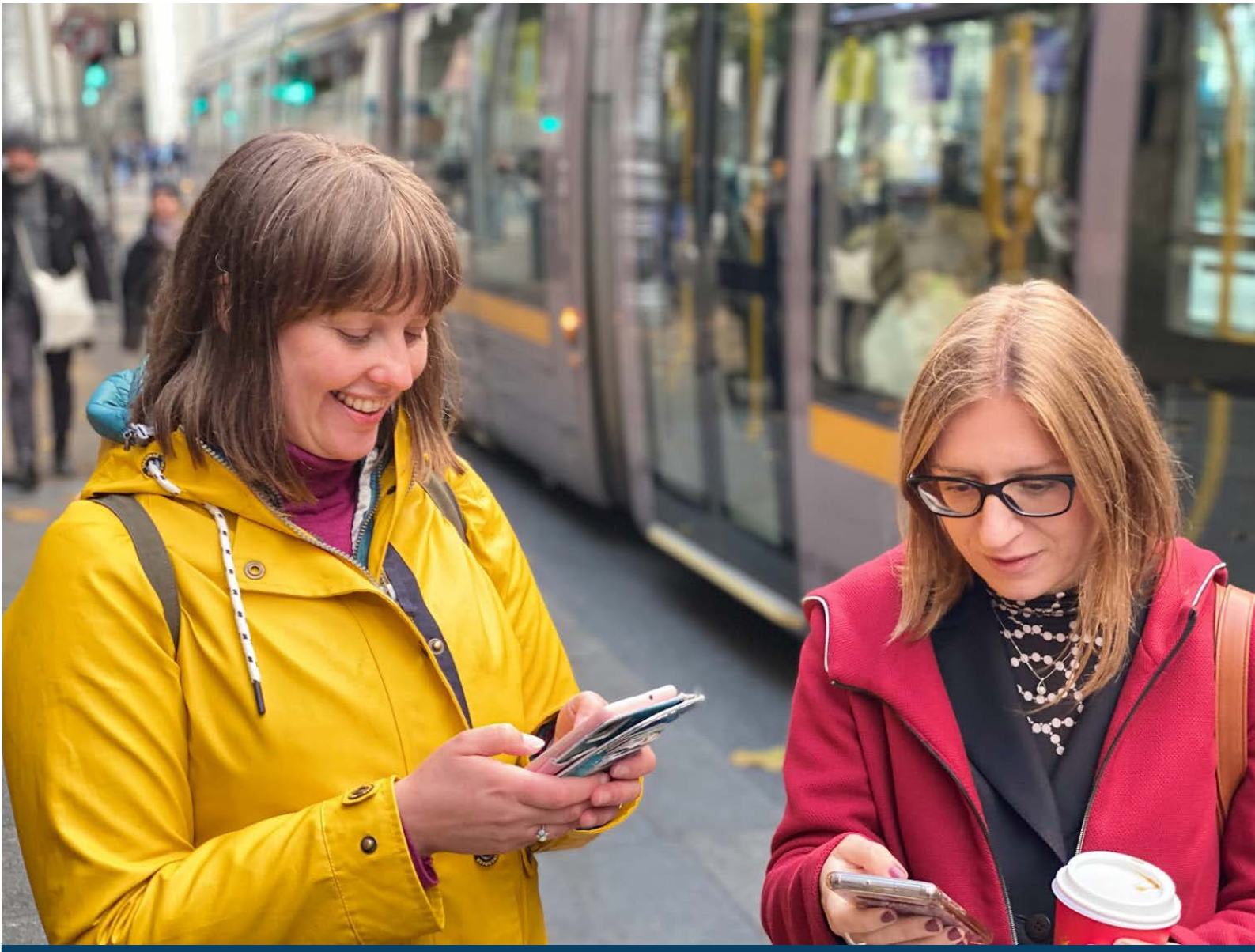

Women's perceived walkability

at the Luas Tram catchment area in Dublin

A data evaluation report using the Walkability.App

WALK21 LEADING THE WALKING MOVEMENT

IRISH PEDESTRIAN NETWORK

OLLSCOIL TEICNEOLAÍOCHTA BHAILE ÁTHA CLIATH
DUBLIN
TECHNOLOGICAL UNIVERSITY DUBLIN

Dublin City
Baile Átha Cliath

ALSTOM FOUNDATION

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1. Abstract

Recent studies with a focus on demographic groups in transport have highlighted the need to differentiate between age and gender, when it comes to use and perceptions of public transport (Sagaris and Tiznado-Aitken 2020). Factors such as the availability of transport modes (e.g. car vs. public transport), the trip purpose (e.g. transport, leisure, or combined), company (walk with dependents), and vulnerability to crime (harassment), seem to promote differences in travel choices and experiences among gender, age and personal abilities. A study on the use and perception of Dublin's "Luas" light rail tram network has shown that women hesitate to use it due to safety concerns (Cahill et al. 2020). A partnership between the Walk21 Foundation, Alstom Foundation, Dublin University of Technology, and CEDEUS - the Chilean Centre for Sustainable Urban Development, developed a project with the goal to map (through content and spatial analysis) women's concerns related to walking from and to the Luas tram stops. To enable this, the project developed a mobile phone application that collects location-based information on pedestrian's experiences while identifying the elements and characteristics of the public space that influence such experiences. A field survey was carried out. In which, 64 women shared 487 walking experiences, linked to 858 observations of the public space. This report outlines the methods and results of this project, giving insights into the locations for possible interventions on some parts of the tram line corridor. Investments that respond to the concerns raised at these locations have the potential to impact the use and perceptions of public transport by women in Dublin.

2. Objectives of the Case Study

The goal of the project is to understand and locate the concerns of women while walking to and from Luas network tram stops. For that a map was required to display positive and negative walking experiences by women. A ranking of the most frequently reported positive and negative concerns is elaborated and spatial clusters of concerns identified to inform possible interventions that allow improvements in perceptions and potentially increase in use of the tram network.

3. Methods

3.1. Walkability.App: Background

This study was carried out with the Walkability.App, a mobile phone application developed specifically for this project. The application was designed in a three-month phase based on previous general experiences on walkability assessments by the project's team members and an international interest group of experts. The design stage was also informed by experiences made during the development of, and case studies carried out, with STRIDE.App, a mobile phone app that was developed in 2018 and 2019 as a first prototype. However, given the design choices and requirements, the Walkability.App is a completely new development. The Walkability.App is freely available for Android-based mobile phones in Google Play Store and for iOS mobile phones in Apple Store since November 2021 and May 2022 respectively.

Google Play (https://play.google.com/store/apps/details?id=com.walk21.walkability&hl=en_GB&gl=US)
Apple Store (https://apps.apple.com/us/app/walkability-app/id1604263879).

The Walkability App is a participatory mapping tool for pedestrians to share their (positive and negative) walking experiences and identify environmental determinants that influenced them. Pedestrians can include further information about themselves and their walks, such as pedestrian's

age and gender or walk's purpose and familiarity. Also, each observation contains information on the time, date, location and weather conditions.

The app has been designed as a tool to assist walkability research and policy. It provides valuable insights on the relationships between public spaces and pedestrians' experiences, both in a positive and negative way. The resulting fine-grained and geo-located data, allows the development of detailed and updated walkability assessments that show which areas are considered more or less pedestrian-friendly and why. This can help policymakers to promote and replicate areas with more positive experiences, while drawing attention and prioritising areas that require specific interventions and improvements.

Observations on the public space and related experiences can be desegregated by pedestrian's age, gender and personal abilities. Thus, policymakers can better understand the needs and barriers of specific populations and be inclusive when designing and managing their interventions in the public space. The app presents a systematic method to collect, analyse and present data, while taking into consideration the particularities of the population and place under study. This makes it a useful tool for walkability case studies and to re-evaluate the impact of walkability interventions.

3.2. Walkability.App: Use and functionalities

Before using the Walkability.App, participants can set up their pedestrian profile and walk context. This information is attached to their ratings and observations in the walkability survey for further content analysis. With regards to the pedestrian profile, participants self-define their gender (woman, man, other), age (children, teenager, adult, elder), and ability (able, impaired, assisted). In the case of walk context, participants can self-define the decision (necessity, choice), purpose (transport, leisure), company (alone, with a dependant, group), and familiarity (local, visitor).

The two main pieces of information collected by participants while walking are their experience and observations on the public space related to such experiences. To rate their experiences, participants can click on three coloured symbols at the bottom of the screen. Following a traffic light scheme, the red symbol represents a negative or bad walking experience associated with issues that require intervention for fixing. The amber symbol represents experiences with concerns that need to be address. The green symbol represents positive or good walking experiences associated with pedestrian-friendly elements and characteristics of the public space.

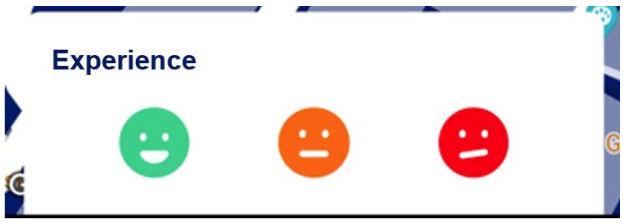

Figure 1. Coloured (green-amber-red) symbols to rate walking experiences.

After sharing their experience, participants can further explain why they feel that way. Each experience can be linked to observations of one or more elements and characteristics of the public space that influence such experiences. By clicking on the previously mentioned red, orange or green

symbols, a pop-up window displays a series of symbols with pre-defined categories representing some environmental determinants known to influence pedestrian experiences.

The pre-defined categories liked to positive experiences are:

- Appropriate traffic speed
- Clean and peaceful
- Designed for people
- Lighting, seating or ramps
- Path quality
- Protection from weather
- Safe crossing
- Secure
- Sufficient space
- Supported and directed
- The path
- Trees and visual interest

The pre-defined categories liked to concerns or negative experiences are:

- Designed for traffic, not people
- Dirty, noise or poor air quality
- Driver behaviour
- Fear of crime
- Harassment
- Insufficient space or poor path quality
- Insufficient trees or visual interest
- No lighting, seating or ramps
- No path
- Poor drainage or protection from weather
- Speed of traffic
- Unsafe crossing

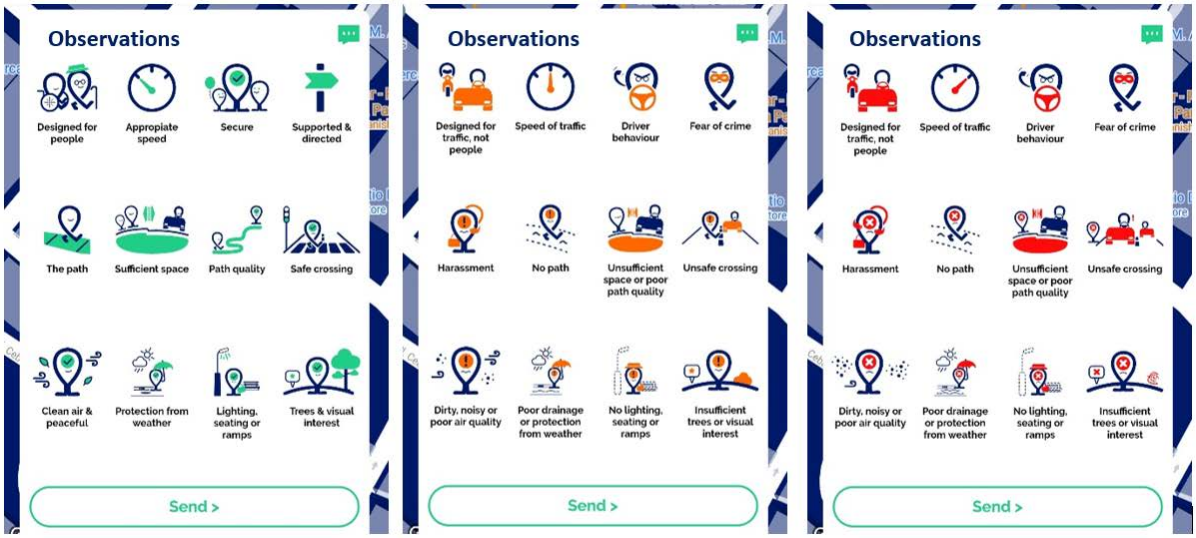

Figure 2. Symbols to describe elements and characteristics of the public space.

Participants can also add comments to their observations to include further elements or characteristics of the public space that may not be fully represented by the predefined categories due to the complex and context-specific nature of walkability determinants. As a summary, *Figure 3* shows the Walkability.App's main usability and functionality aspects.

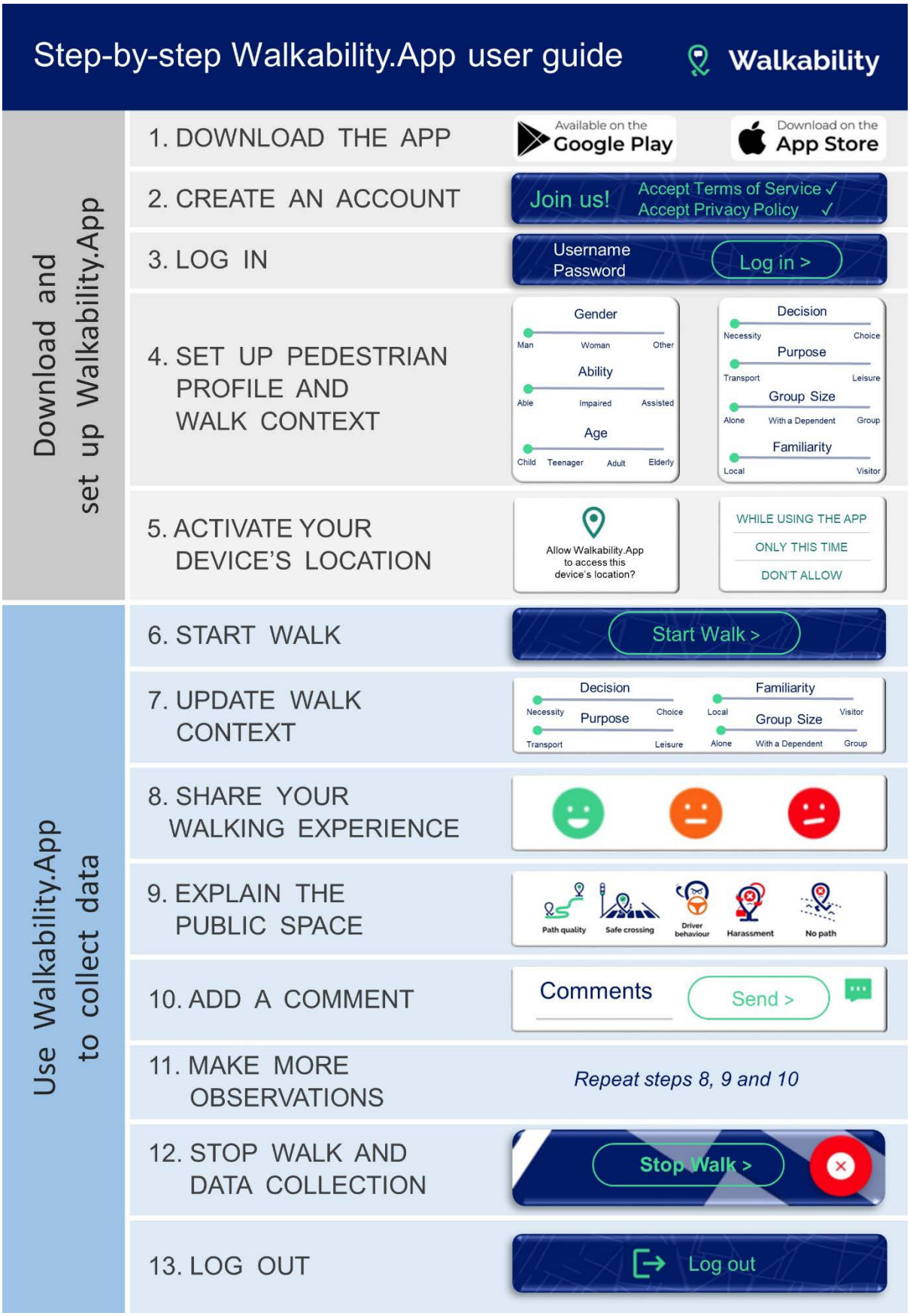

Figure 3. Step-by-step app user guide.

4. The study

4.1. Area and date

The study took place in the inner-city area of Dublin, Ireland. Dublin has 550,000 inhabitants, with 1.4 million people living in its metropolitan area (Wikipedia, 2022). Dublin's transport mode share in 2017 showed a 51% for public transport, 29% for cars, 12% for walking and 6% for cycling (Department of Transport 2018). Considering a mode share for Dublin's public transport of 51% in 2017, for the same year Dublin's City Council (2020) "Canal Cordon Report" informs of a 6% share for the Luas Network.

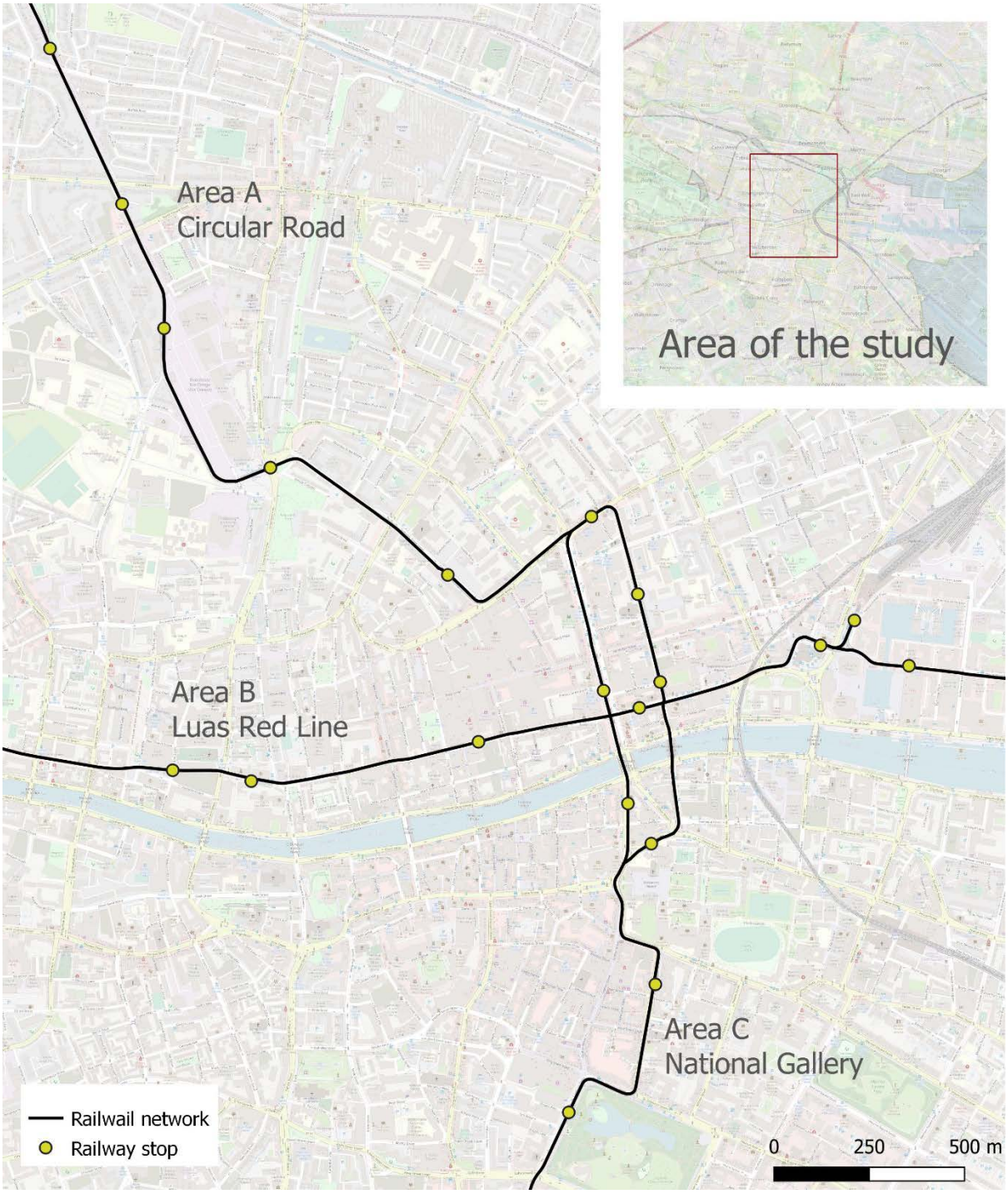

Figure 4. Area of study.

Two areas were preselected for the survey in Dublin's inner city, a section of the Luas Red Line running east-west (Area B), and a part of the northern section of the Circular Road (Area A). Additionally, a walk was taken around the area south of the river, which is home to the National Gallery and the National Museum (Area C). The survey took place in spring 2022, from March 31st to April 21st, 2022.

4.2. Survey method, sample size, pedestrian profile and walk context

The study was designed as an intercept survey, with a female surveyor approaching women on the street and asking if they would be willing to participate in the survey. No incentives for participation were given. If the person agreed, the surveyor walked together with the pedestrian and recorded perception data when the participant identified a relevant experience, both in a positive or negative way. In the survey, 64 women recorded 67 walks, shared 487 experiences, which were linked to 858 observations of the public space. This represents an average of 7.6 experiences and 13.4 observations on the public space by participant.

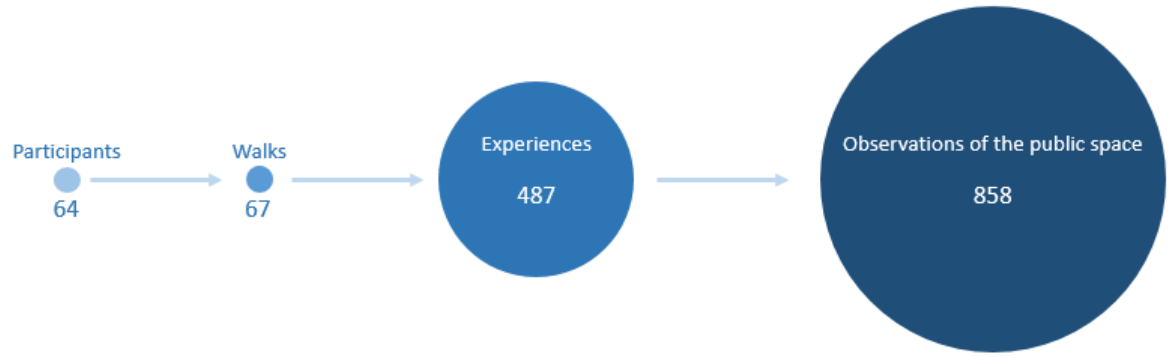

Figure 5. Number of participants, walks, experiences and observations in the study.

With regards to the pedestrian profile of the participants, all of them were women (n=64), most of them adults (n=53) with some teenagers (n=7) and elders (n=4) and one participant had assisted mobility (n=1) while the rest defined themselves as able (n=63). Looking into the walk context, most walks were taken by choice (n=49) instead of out of necessity (n=18). The main purpose of the walk was transport (n=42) compared to leisure walks (n=25). The majority of participants walked alone (n=34), while others walked in a group (n=17) or with a dependent (n=16). Finally, most participants were familiar with the place as locals (n=59) compared with fewer visitors (n=8).

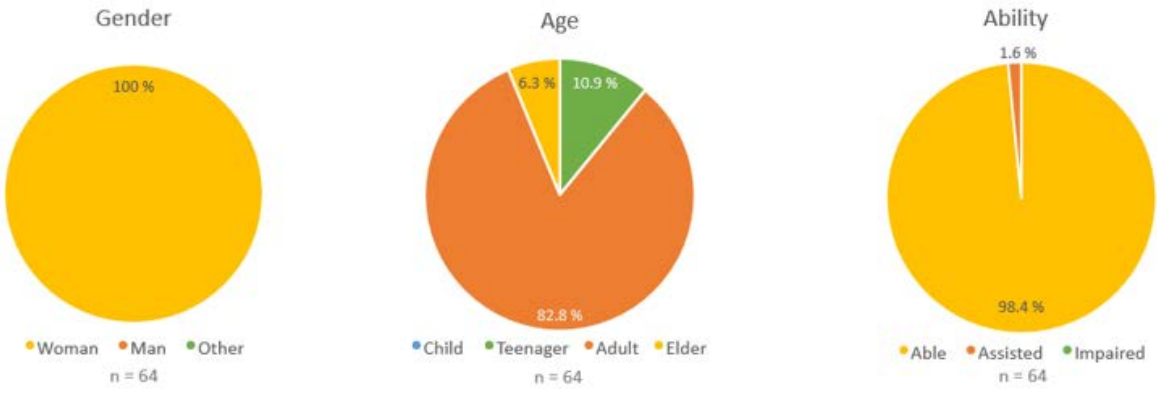

Figure 6. Pedestrian profiles of participants.

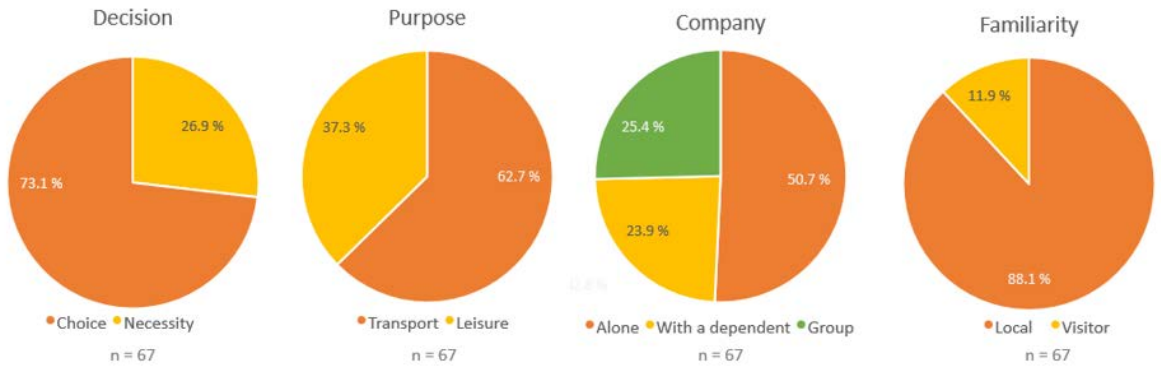

Figure 7. Walk context of the study.

Figure 8 shows an overall share of the distribution of participants' profile and walk context.

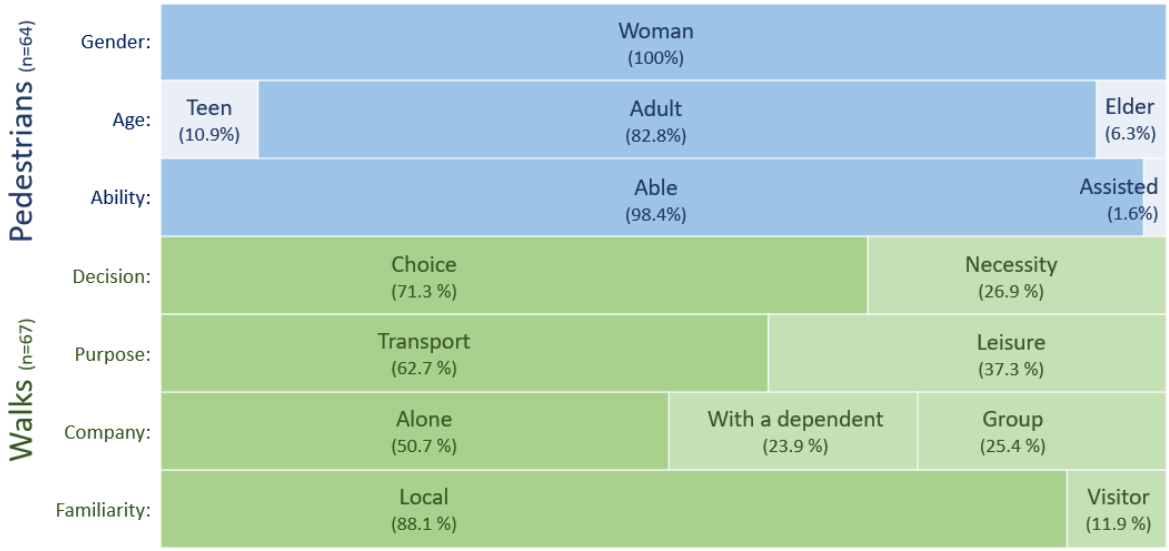

Figure 8. Share of pedestrian profiles and walk contexts in the study.

4.3. Pedestrian experiences

Looking into the 487 shared pedestrian experiences, the majority were linked to concerns (n=205, 42.1%), followed by positive experiences (n=183, 37.6%) and negative ones (n=99, 20.3%). *Figure 9* shows a map with all the observations by type of experience, as well as a pie chart with their percentages.

By disaggregating the types of experiences by pedestrian profile and walk context, teenagers and adults present a similar share, while elders identified more positive and negative experiences compared to experiences with some concerns. Elders seem to repot more intense experiences, both in a positive and negative way. Regarding ability to walk and use the public space, participants self-defined as assisted show a relevant increase in negative experiences compared to able pedestrians (assisted pedestrians: 42.9% of negative experiences, able pedestrians: 20% of negative experiences). The same public space seems to present more negative experiences and challenges to assisted pedestrians.

Looking into the walk context, the share of type of experiences across different variables is rather similar to the whole sample. If we focus on the percentage of negative experiences, the public space is perceived more challenging to pedestrians walking out of necessity (26.3% of negative experiences) than by choice (18.1% of negative experiences), more challenging to pedestrians walking for transport (21.8% of negative experiences) than for leisure (17.3% of negative experiences), more challenging to visitors (25.9% of negative experiences) than locals (19.6% of negative experiences), and more challenging to pedestrians walking in a group (26.7% of negative experiences) than walking with a dependent or alone (21.1% and 17.3% of negative experiences respectively). A complete graph with the share of all experiences by pedestrian profile and walk context can be seen in *Figure 10*. Pedestrians walking out of necessity, for transport, as visitors and in a group report higher negative experiences than pedestrians walking by choice, for leisure, as locals and alone.

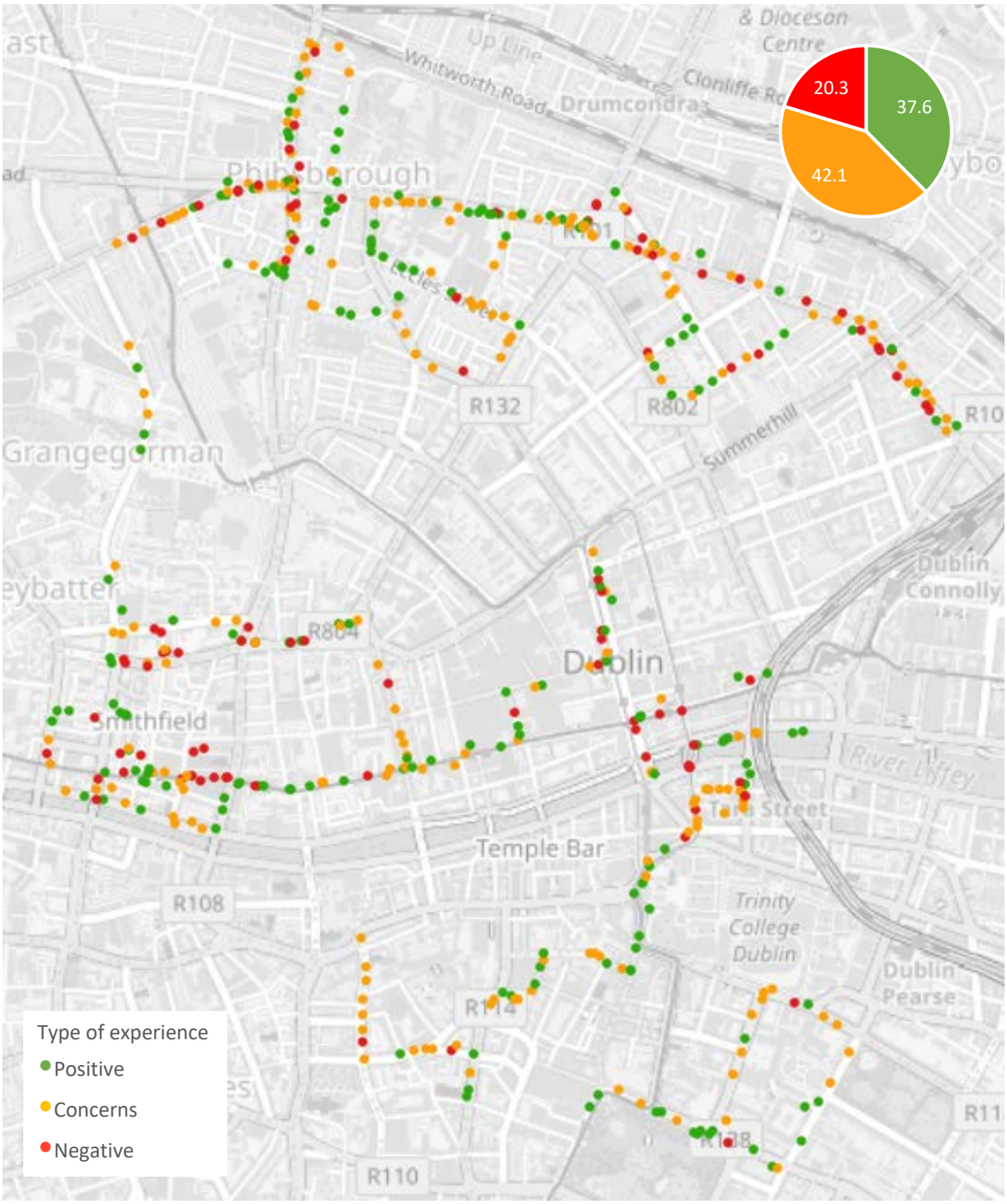

Figure 9. Location of all pedestrian experiences (n=487) by type. Positive experiences (n=183, 37.6%), experiences with concerns (n=205, 42.1%), and negative experiences (n=99, 20.3%).

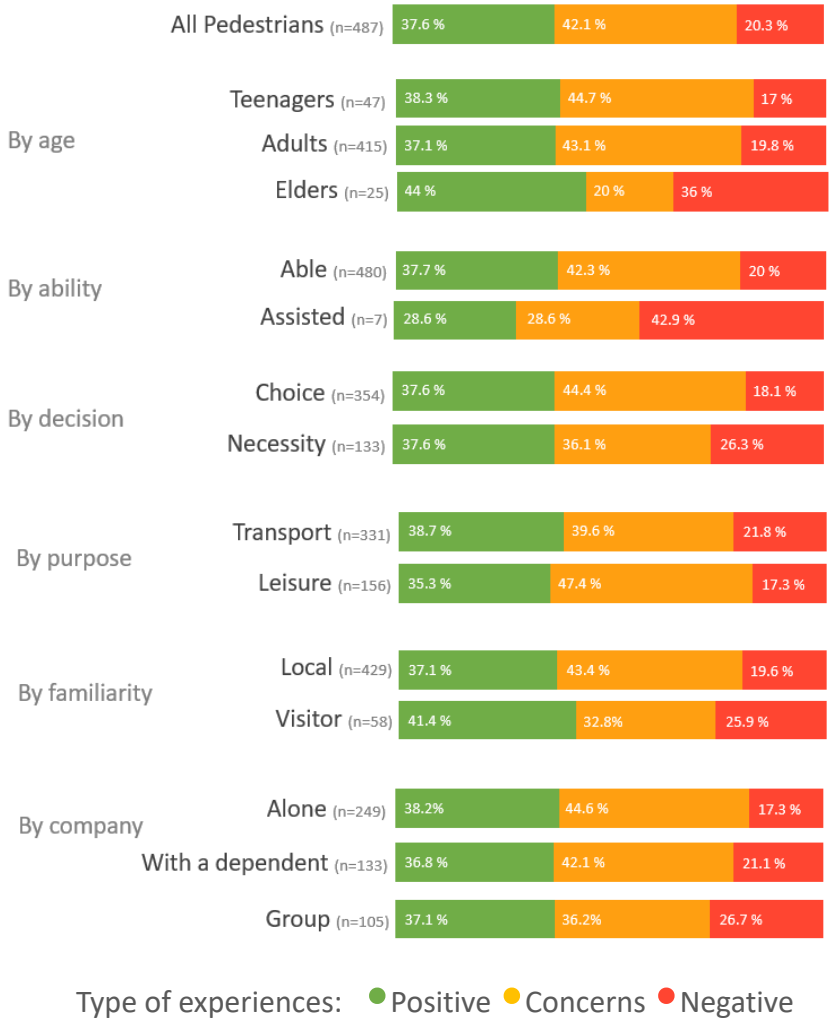

Figure 10. Type of experience by pedestrian profile and walk context.

By aggregating nearby observations and looking into different types of experiences, a series of maps can show the spatial distribution of concerns, positive, negative experiences.

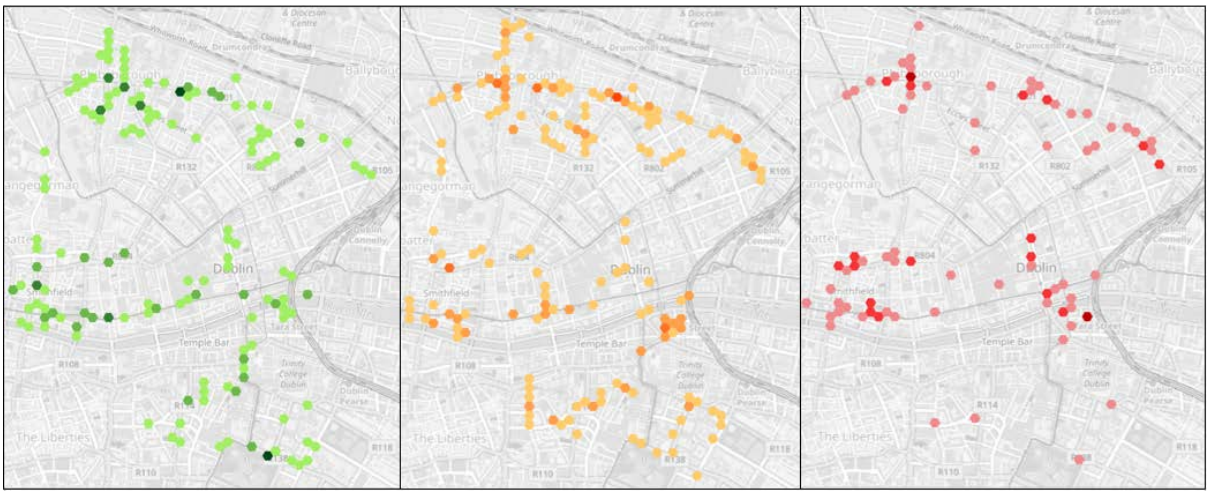

Figure 11. Clusters of concerns, positive and negative experiences.

Positive pedestrian experiences

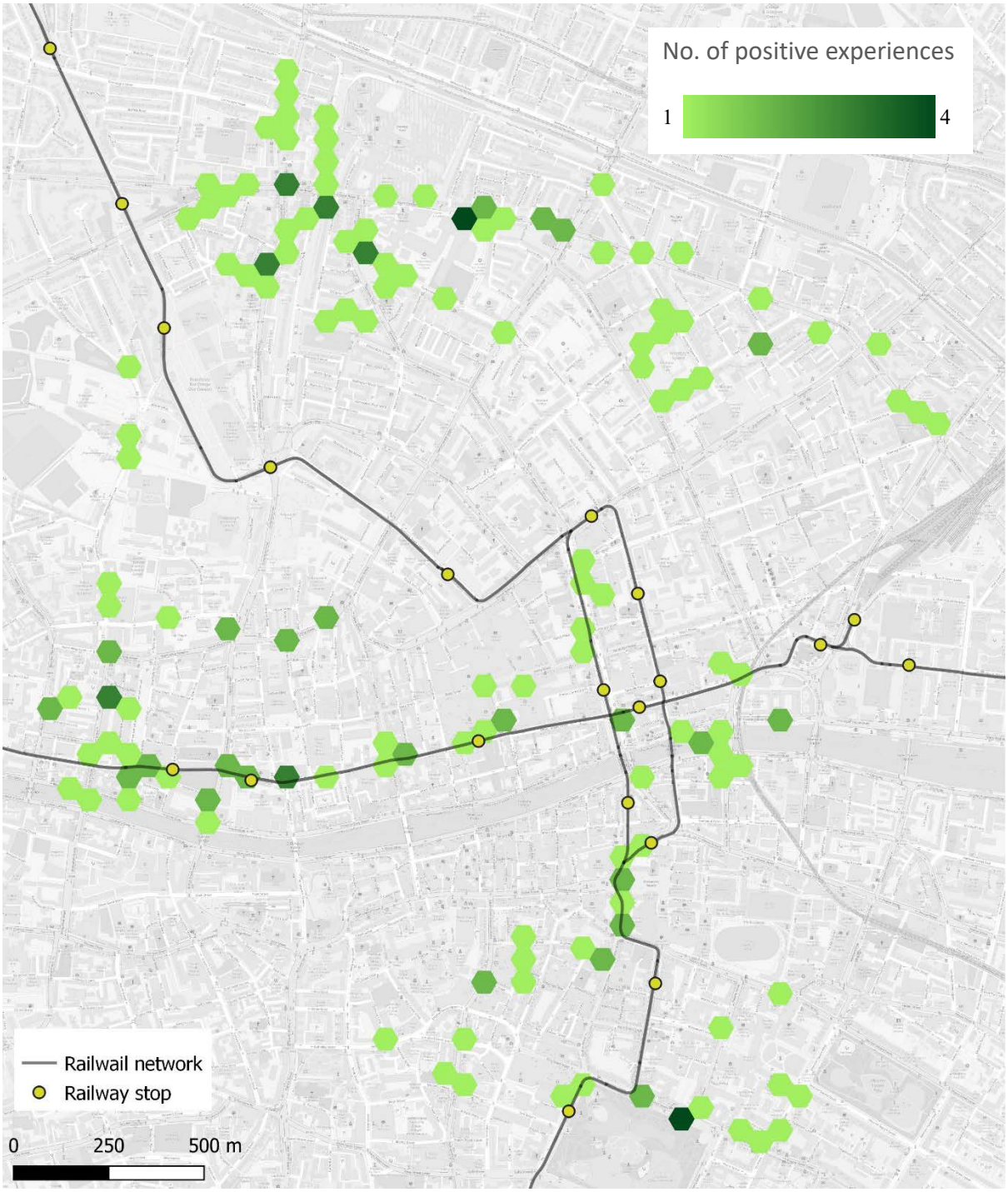

Figure 12. Clusters of positive pedestrian experiences.

Pedestrian experiences with concerns

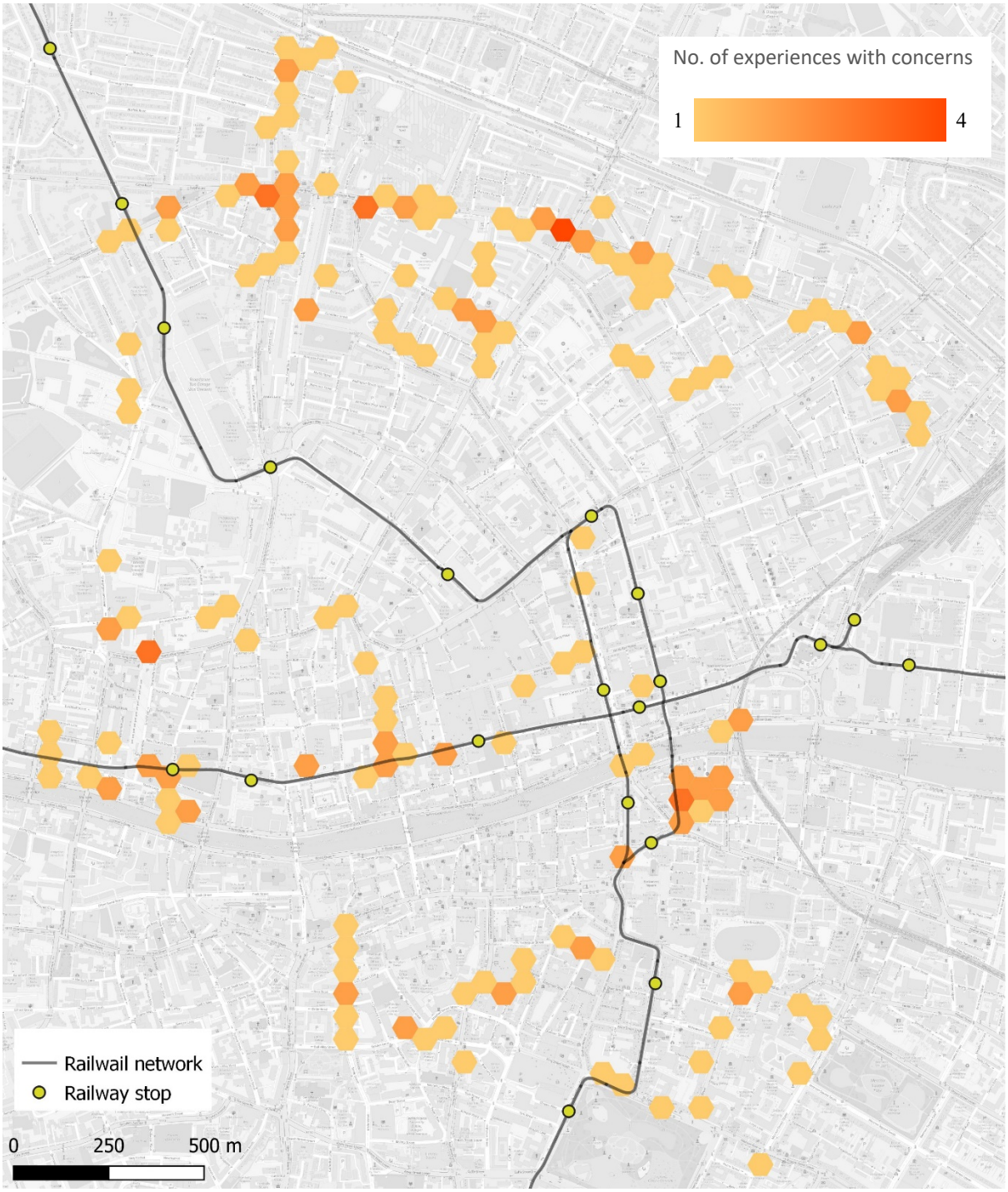

Figure 13. Clusters of pedestrian experiences with concern.

Negative pedestrian experiences

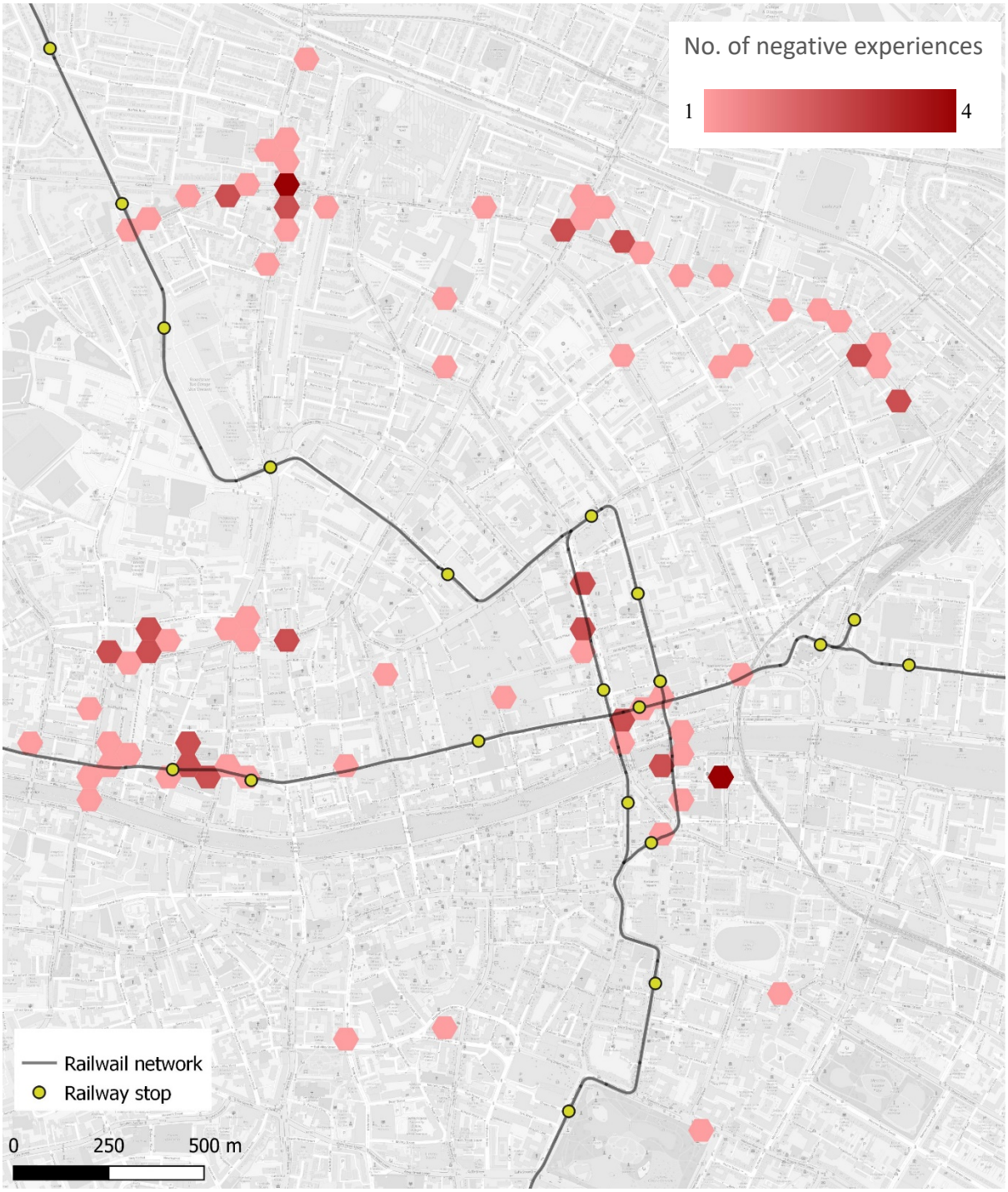

Figure 14. Clusters of negative pedestrian experiences.

4.4. Environmental determinants linked to pedestrian experiences

As participants can use some predefined categories to identify the elements and characteristics of the public space that influence their experiences, further content analysis shows the most relevant environmental determinants linked to each type of experience, based on their frequency in the resulting dataset.

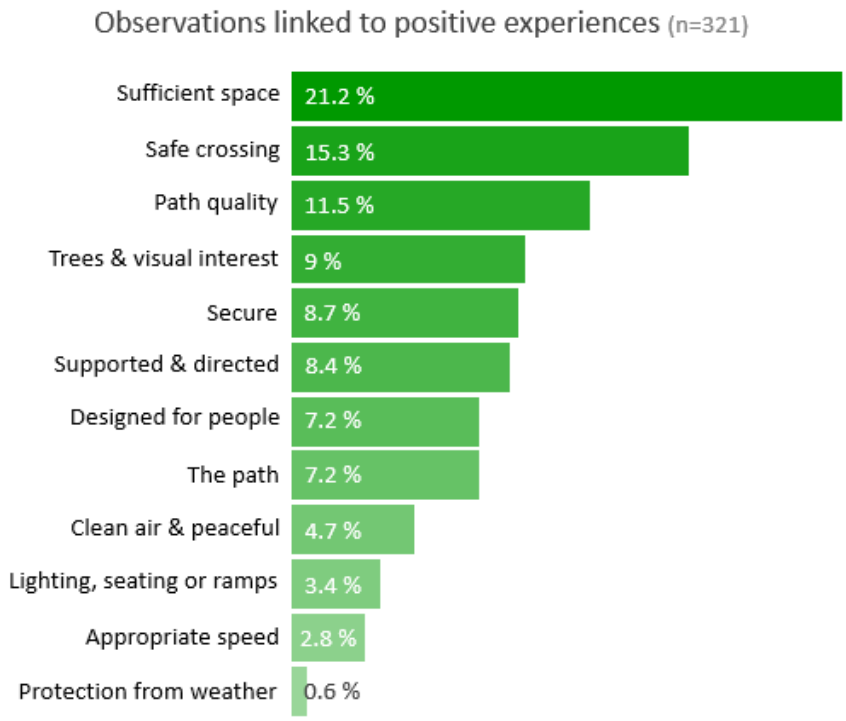

Figure 15. Environmental determinants linked to positive experiences.

The three more frequent and relevant environmental determinants linked to positive experiences are 'sufficient space' (21.2%), 'safe crossing' and 'path quality' (11.5%). These are followed by a group of five determinants present within the 10% and 7% of all positive experiences, which are 'trees and visual interest' (9%), 'secure' (8.7%), 'supported and directed' (8.4%), 'designed for people' (7.2%) and 'the path' (7.2%). Finally, the list ends with four less represented determinants linked to fewer than 5% of positive experiences, which are 'clean and peaceful' (4.7%), 'lighting, seating or ramps' (3.4%), 'appropriate traffic speed' (2.8%) and 'protection from weather (0.6%).

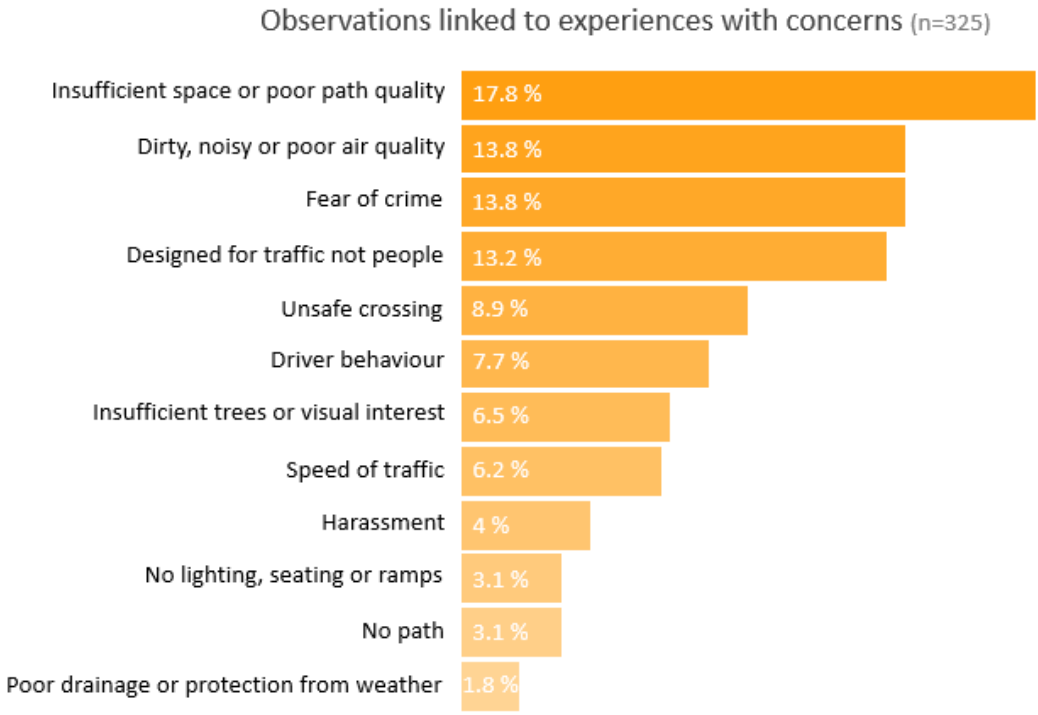

Figure 16. Environmental determinants linked to experiences with concerns.

The most frequent and relevant determinant linked to experiences with concerns is 'insufficient space or poor path quality' (17.8%), followed by three determinants with similar weight, which are 'dirty, noisy or poor air quality' and 'fear of crime' (both with 13.8%) and 'designed for traffic, not people' (13.2%). In the middle of the list there are four determinants present within the 9% and 6% of all experiences with concerns, which are 'unsafe crossing' (8.9%), 'driver behaviour' (7.7%), 'insufficient trees or visual interest' (6.5%), and 'speed of traffic'. Finally, closing the list there are four determinants linked to fewer than 5% of experiences with concerns, which are 'harassment' (4%), 'no lighting, seating or ramps' (3.1%), 'no path' (3.1%), and 'poor drainage or protection from weather' (1.8%).

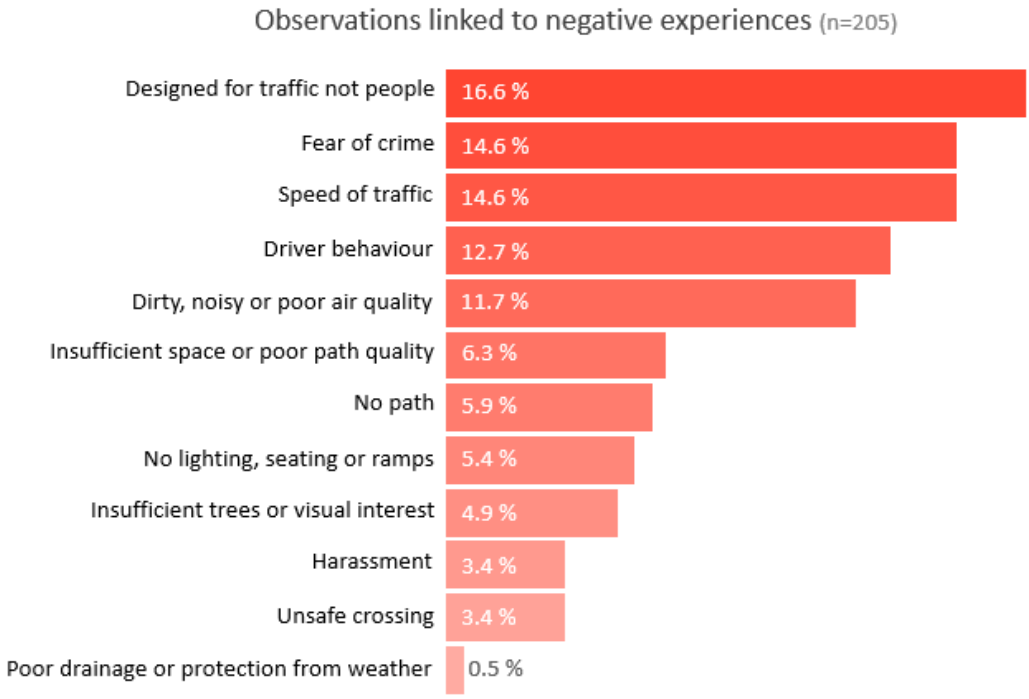

Figure 17. Environmental determinants linked to negative experiences.

The most frequent and relevant determinant linked to negative experiences is 'designed for traffic, not people' (16.6%), followed by four determinants with similar but descending weight, which are 'fear of crime' and 'speed of traffic' (both with 14.6%), 'driver behaviour' (12.7%) and 'dirty, noisy or poor air quality' (11.7%). The second half of the list contains determinants present within the 6% and 3% of all experiences with concerns, which are 'insufficient space or poor path quality' (6.3%), 'no path' (5.9%), 'no lighting, seating or ramps' (5.4%), 'insufficient tress or visual interest' (4.9%), 'harassment' and 'unsafe crossing both with 3.4%). Finally the list ends with 'Poor drainage or protection from weather' (0.5%).

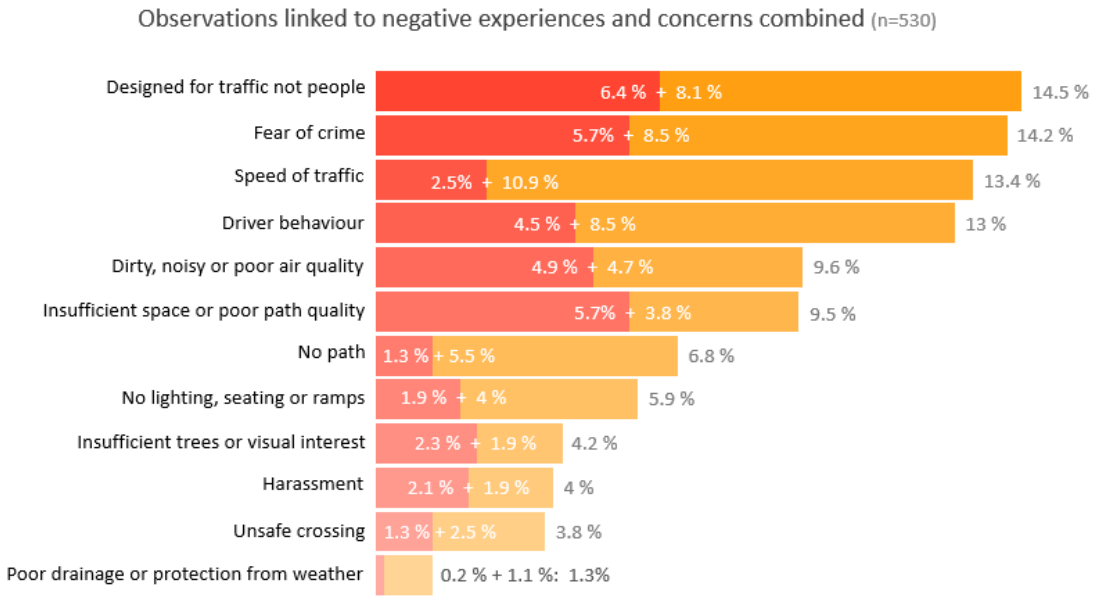

Figure 18. Environmental determinants linked to negative experiences and concerns combined.

If we combined the observations linked to negative experiences and concerns, the two most frequent and relevant dominants are 'designed for traffic, not people' (14.5%) and 'fear of crime' (14.2%), closely followed by 'speed of traffic' (13.4%) and 'driver behaviour' (13%). In the middle of the table we can see 'dirty, noisy and poor air quality' (9.6%) and 'insufficient space or poor path quality' (9.5%) followed by 'no path' (6.8%) and 'no lighting, seating or ramps' (5.9%). Finally the table ends with 'insufficient trees or visual interest' (4.2%), 'harassment' (4%), 'unsafe crossing' (3.8%) and 'poor drainage or protection from weather' (1.3%).

The following graphs (*Figure 19* and *Figure 20*), show the frequency of observed environmental determinants by all three types of experiences. *Figure 19* orders them from most to less frequent. We can observe that 'designed for traffic not people', 'fear of crime' and 'insufficient space or poor path quality' are the most frequent observations and are negative experiences. Interestingly, 'sufficient space', 'safe crossing' and 'path quality' are also in the top ten of reported experiences from a positive view point which suggests targeted investments could improve the consistency of street quality and improve the reliability of a positive walking experience in Dublin.

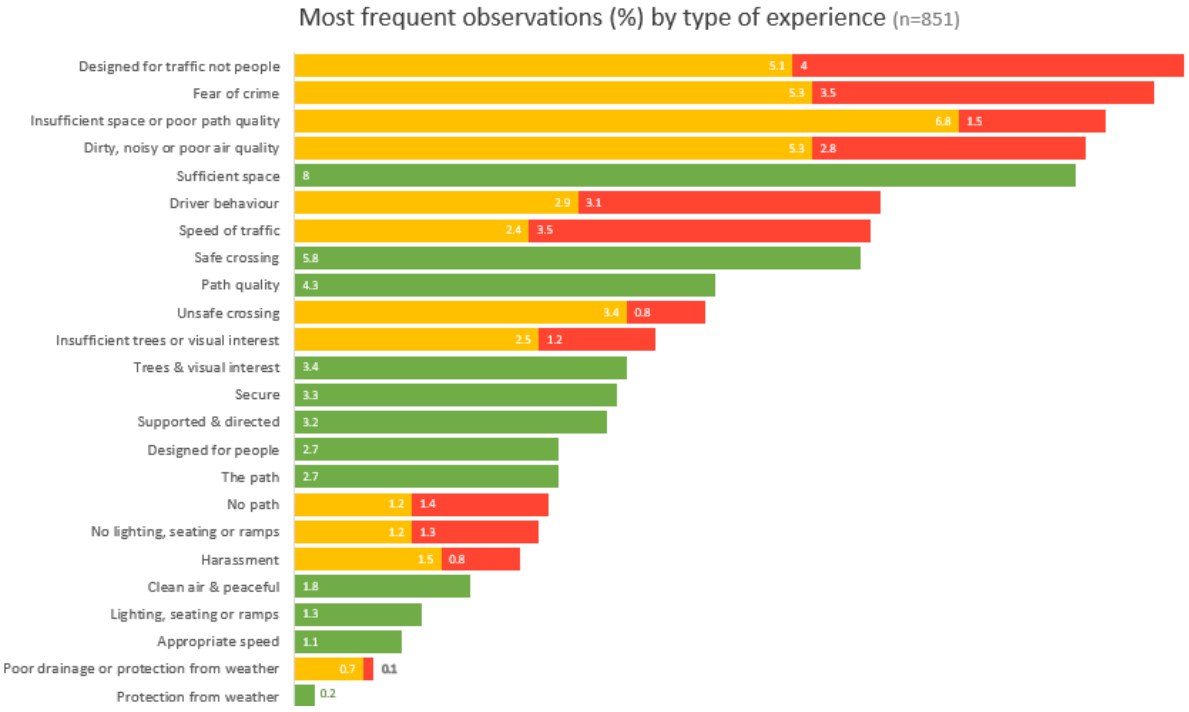

Figure 19. Most frequent environmental determinants by type of experience.

Figure 20 groups them into opposing situations. We can observe that the number of observed determinants linked to the combination of negative experiences and concerns is generally higher than the number of determinants linked to positive experiences. For instance, the number of observations linked to 'speed of traffic' and 'driver behaviour' is higher than observations on 'appropriate traffic speed'. Similarly, there are more observations on 'fear of crime' and 'harassment' than 'secure'. The same happens with more observations on 'dirty, noisy or poor air quality' than 'clean air and peaceful', amongst other examples. However, there are two important exceptions, observations on 'safe crossing' and 'sufficient space and path quality' outnumber observations on 'unsafe crossing' 'insufficient space or poor path quality'.

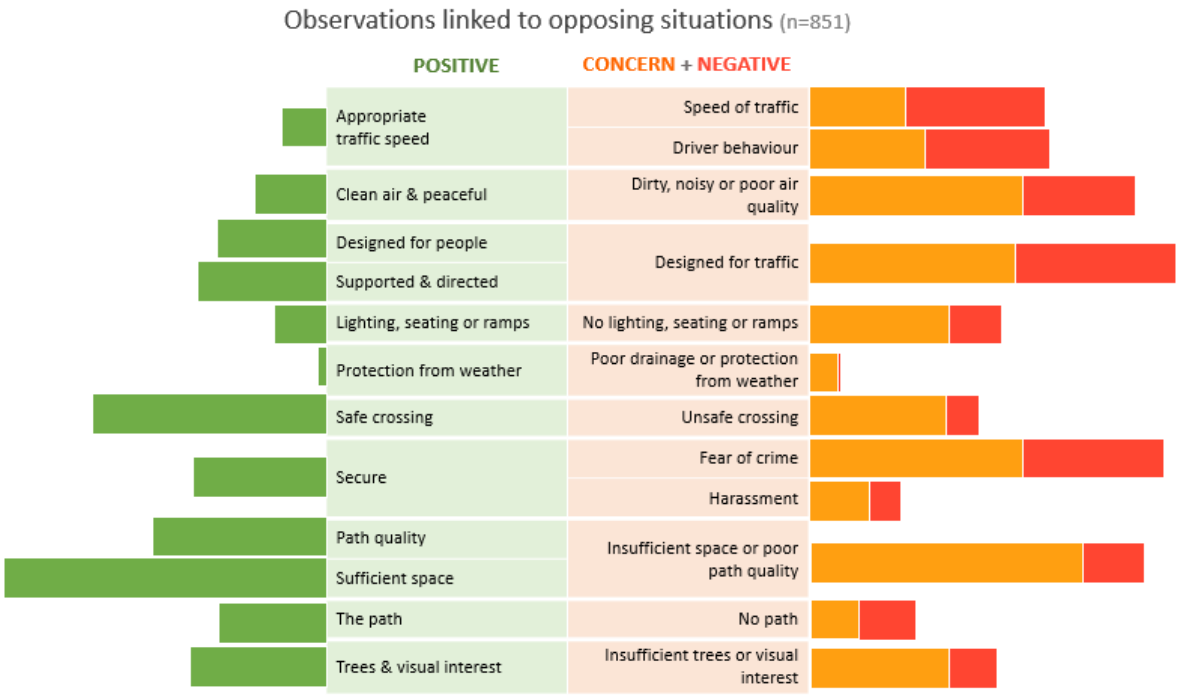

Figure 20. Observations linked to opposing situations.

4.5. Pedestrian accessibility, safety and comfort

The combination of certain categories used in this walkability study can provide valuable insights into relevant walkability concepts for policy, such as pedestrian accessibility, safety and comfort.

Pedestrian accessibility

If we investigate the environmental determinants that could define 'pedestrian accessibility' (see *Figure 21*), observations linked to positive experiences represent the majority of the share (50.2%), outnumbering observations linked to concerns (35.5%) and negative experiences (14.3%). From the positive experiences, the most frequent observation is ''sufficient space' (22.6%), followed by 'safe crossing' (16.3%0, 'the path' (7.6% and 'lighting, seating and ramps' (3.7%). On the other side, from the combination of concerns and negative experiences, the most frequent observation is 'insufficient space or poor path quality' (23.6%), followed by 'unsafe crossing' (11.9), 'no path' (7.3) and 'no lighting, seating or ramps' (7%).

Pedestrian safety

If we investigate the environmental determinants that could define 'pedestrian safety' (see *Figure 22*), observations linked to experiences with concerns represent most of the share (40.6%), followed by observations linked to negative (31.7) and positive (27.7) experiences. From the combination of concerns and negative experiences, the most frequent observation is 'fear of crime' (21.5%) followed by ''driver behaviour (14.5%), 'speed of traffic' (14.3%), 'unsafe crossing' (10.3%), 'no lighting, seating or ramps' (6%) and 'harassment' (5.7%). From the positive experiences, the most frequent observation is 'safe crossing' (14%) followed by 'secure' (8%), 'lighting, seating and ramps' (3.1%) and 'appropriate traffic speed' (2.6%).

Pedestrian comfort

If we investigate the environmental determinants that could define 'pedestrian comfort' (see *Figure 23*), observations linked to experiences with concerns represent most of the share (43.5%), followed by positive (34.3%) and negative (22.1%) experiences. From the combination of concerns and negative experiences, the most frequent observation is ''designed for traffic, not for people' (18.3%, followed by 'insufficient space or poor path quality' (16.9%), 'dirty, noisy or poor air quality' (16.4%), 'insufficient trees or visual interest' (7.4%), 'no lighting, seating or ramps' (5%) and 'poor drainage or protection from weather' (1.6%). From the positive experiences, the most frequent observation is 'path quality' (8.8%), followed by 'trees and visual interest' (6.9%), 'supported and directed' (6.4%), 'design for people' (5.5%), 'clean and peaceful' (3.6%), 'lighting, seating or ramps' (2.6%) and 'protection from weather' (0.5%).

Figure 21. Insights on pedestrian accessibility.

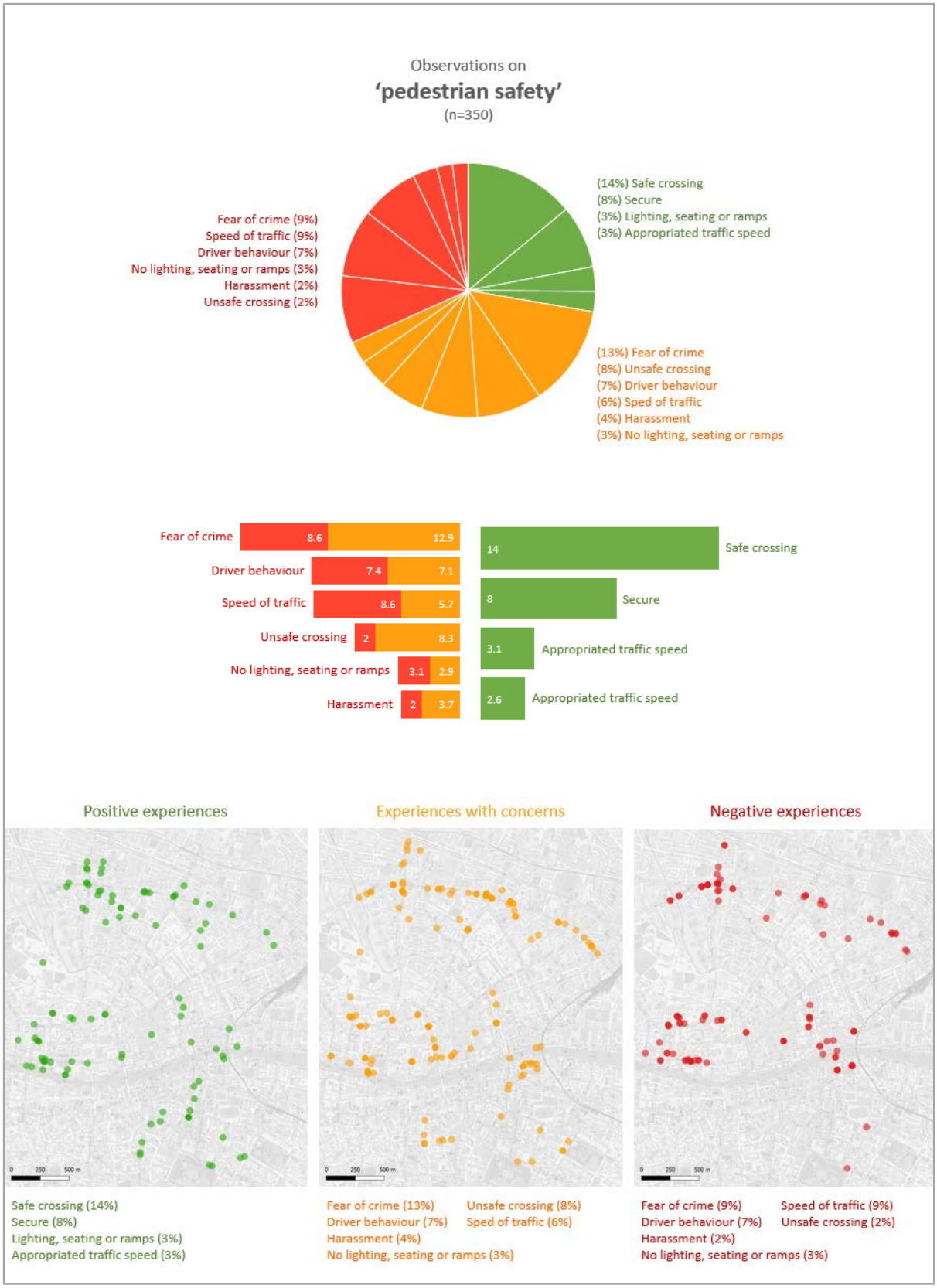

Figure 22. Insights on pedestrian safety.

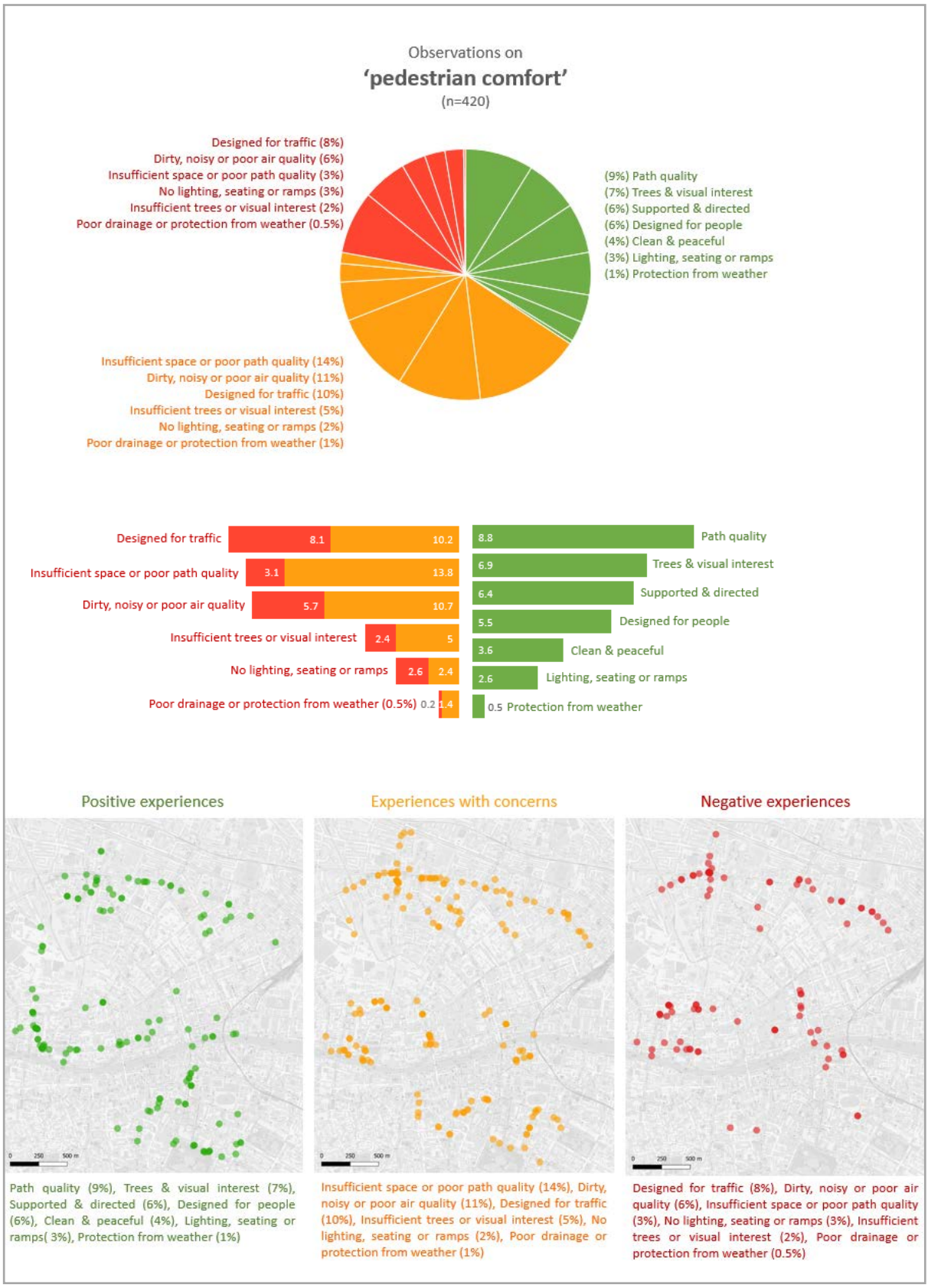

Figure 23. Insights on pedestrian comfort.

5. Conclusions

The study provides an insight on Dublin city environments that present positive and negative experiences for pedestrians. It draws on reports from 64 women who shared 487 experiences, which were linked to 858 observations of the public space. The results confirm that the application is an effective tool for enabling citizens to share their experiences in sufficient detail. The geo-located data also provides an opportunity for city planners and engineers to invest in a programme of works more confidently so that more local needs are met and better safety, accessibility and comfort outcomes for people walking are more likely.

The analysis has focused on clusters of concern and groupings of negative problems, however there is value in looking at the individual reports of missing sidewalks, speeding traffic/dangerous driving behaviour and unsafe crossings too. By exporting the Walkability data onto other existing data layers of road crashes, slips, trips and falls and road attribute data it is likely that street level changes can also be prioritised to ensure future investments provide the best holistic return to support healthy, happy and sustainable transport choices.

More than a third of observations were positive reports (37%). This suggests that the City of Dublin and transport authorities are doing many things right and know how to deliver and manage safe, accessible and comfortable walking networks, Footpaths are, in many places, built well, are wide enough for people to use and there is an appreciation of the investment in street trees and safe crossings.

The distribution of negative reports along key corridors suggests that linear and area treatments to issues such as speed and poor driver behaviour may be more effective than spot solutions at junctions or crossings.

The study focuses on the needs of women, and it was assumed, based on previous studies, that personal safety would be their main concern. Security was an identified priority but equally strong was the negative impact of traffic in terms of street design priority and air/noise intrusion too. Choosing to respond to these concerns has the potential to benefit women and other users in the public space too.

Within the project area are several hospitals/doctor surgeries as well as schools and colleges and places of worship. Future studies may wish to target these destination communities to explore the quality of their catchment areas using the same methodology. It might be assumed that the mobility needs of those visiting hospitals for instance need to be given priority by making sure there is sufficient crossing time and level access within 500m. Around schools, perhaps traffic speed and driver behaviour will require additional specific measures, as well as wider footpaths and a clear priority for pedestrians before other traffic.

The Department for Transport in Ireland adopted a transport hierarchy principle putting pedestrians at top of the decision-making priorities in 2020 design guidance[1]. The results of this survey suggest a lag in the implementation of this policy and provide a focus for knowing where resources can be targeted, and on what measures, to rebalance the local reality of the walking experience.

The Walkability data was shared with Dublin City Council in September 2022. It is hoped that the Active Travel team, who have access to budgets and expertise that could address many of the issues raised

[1] https://www.lawsociety.ie/gazette/top-stories/2020/06-june2/street-user-hierarchy-to-prioritise-walkers

by women in this report, will lead the investment required to improve the consistency of the walking experience in the City.

It is too early to know the impact of any responsive investment that there might be on increasing the satisfaction of women walking in Dublin, but the Walkability App remains available as an evaluation tool, post works, to help value the benefits. It is logical that any investment would also influence Luas ridership numbers overall and the proportion of women using the service too but further studies, once works are underway, will be needed to confirm this. Equally important, could be to study the impact of works on the prevalence of private vehicles once the re-balance in favour of people walking has been better communicated and delivered more consistently on the streets across the city.

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