

COVID-19 Mobility Insights

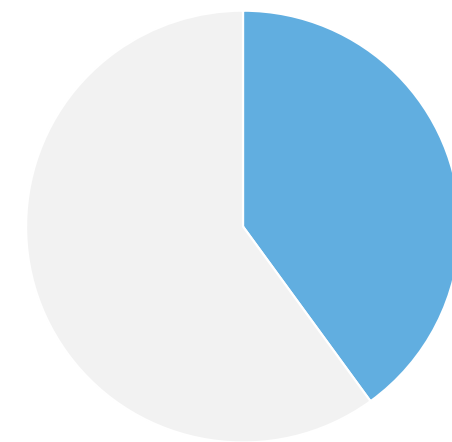
Rebuilding Resilient Cities



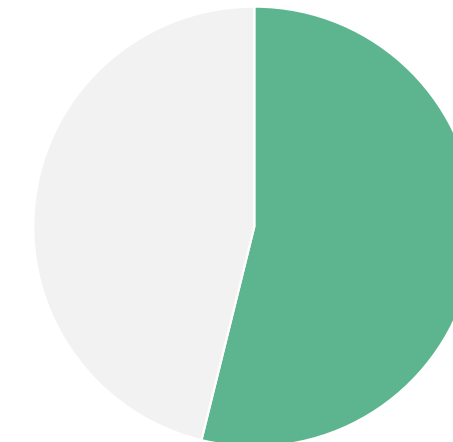
Executive Summary



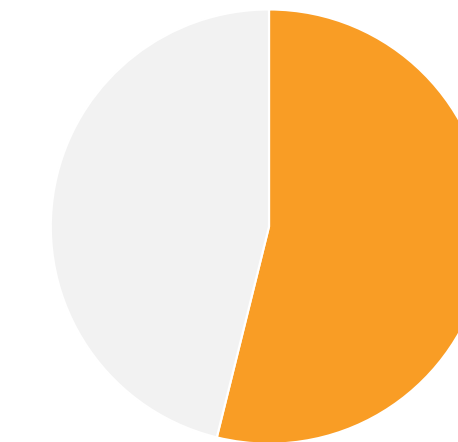
44%
of respondents think that their mobility will be reduced thanks to working remotely



40%
of respondents think they will maintain their pre-COVID-19 mobility habits



70%
of respondents were able to work remotely



70%
of respondents who expect to change mode of transport cited health as the reason

While Milan, Madrid and Dublin are very different European cities, with a variety of transport options, the current global pandemic has created a unity of disruption across them all. Arup surveyed residents across the three urban locations to determine sentiment – not only about working from home, but also regarding how people intend to travel.

Responses indicated that more people are willing to adopt walking and cycling as commuting options. However, the fear of infection will reduce public transport use and increase car demand as respondents displayed a preference for physical distancing. This re-balancing of demand by mode poses a significant challenge to transport planning, as all three cities have limited spatial capacity to facilitate cycling and walking with safe spacing, while motorists are demanding more network space.

As a potential way to offset this concern, it is worth noting that nearly half of those surveyed expected to travel less due to the ability and willingness to work from home.

Arup urges caution due to confirmation bias. People tend to place higher value on their current options and habits. However, when cities reopen and schools, crèches, restaurants, cafés and workplaces pull people towards them, there will be significant challenges to the new habits developed during lockdown. Increased traffic levels may cause stress for new cyclists and stretch the capacity of footpaths. The need to accompany or assist children on journeys will generate movement. Public transport operators are already trying to increase the frequency of public transport services to allow for less crowding. Will those efforts reduce the strongly expressed reluctance to use public transport? What safe options are available, if not the car, for those with longer commutes? These and other questions will inevitably be challenges faced across Europe until an effective vaccination is introduced.

The challenges presented by COVID-19 may also provide us with opportunities. How can we encourage more people to work from home, or closer to home, without their physical and mental health suffering? How can the transport resources and systems that have been built over decades be actively modified to incorporate the best aspects of changes to mobility and working that the survey hints are possible?

Until now, our infrastructure reflected our daily, unbreakable routines. As such, there was an inevitability of growth and congestion. Who knew that our behaviour could be modified so rapidly and to such an extent?

With lockdowns implemented across the globe, people are discovering new and more convenient ways to shop online, students are finding new ways of learning from home, companies are realising the cost savings and high productivity of their staff working remotely and the fear of infection is making people rediscover the joy of living locally.

Inevitably, these new habit(at)s are having a huge impact on our existing transport systems, already under pressure but at the same time oversized to meet the demand during two short periods of time: the peaks. Similarly, we never thought our routines could be changed – could these new trends completely reshape and optimise future urban mobility? Have these the potential to flatten the (peak) demand curve and drive us towards a more sustainable new normal?

As we navigate through the pandemic, it is critical to understand and foresee the impact of users' behavioural changes on the most sustainable modes: public transport, walking and cycling, and new mobility solutions, and how authorities and operators have quickly reacted to this unprecedented situation. As extraordinary problems require extraordinary solutions, this situation has pushed forward the implementation of valuable initiatives around the world. While some of them may quickly vanish with the pandemic, others may remain and define our new normal. These are the choices of the guardians of public space, cities and governments, and of citizens who would rail against the congestion that they created through other choices.

This report provides insights into the opportunities that people and their representatives can collectively undertake to create a new set of habits – habits in behaviour and habits in decision making.



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With every threat to our community, there is an opportunity to be grasped.

Understanding which mobility behaviours are gaining ground, which work behaviours are changing and what actions are happening in our transport systems allows us to identify how to achieve long-term benefits for our society.

COVID-19 has temporarily disrupted systems and has introduced or reacquainted people to walking, cycling and the potential to work from home.

It has also created a sense of apprehension and a wish to cocoon in a car, if possible, and avoid public transport crowding.

Our research identifies potential solutions to invest in retaining post-pandemic, options to be avoided and the behaviour changes that should be encouraged.

If we could collectively reduce the cost of providing peak transport network capacity and re-invest that in more resilient, attractive and carbon neutral solutions that better connect our people with opportunity, some good could come from disaster.

Flattening the (peak demand) curve is an aspiration for transport authorities globally. Here are some considerations to achieve that.

SECTION 1

Highlights from a survey in 3 EU Cities

Methodology

EVOLUTION OF MOBILITY DEMANDS IN A POST-COVID-19 WORLD

The COVID-19 pandemic is a major shock to the world. As many have observed, a crisis is often also an opportunity to reflect and apply expertise in radical new ways. Globally, Arup is exploring what these changes to the ways we plan and design the built environment might look like.

Mobility, especially in relation to our openness to behavioural changes, is a central issue to rethink our daily lives in cities. Our research, which was carried out by surveying people simultaneously in three EU cities, highlights the willingness and possibilities inhabitants and city users have to change their habits in relation to mobility modes, while also referring to examples of possible solutions implemented globally.



THREE CITIES

In order to understand potential changes in user behaviour post-pandemic, an online survey was distributed in three cities, Milan, Madrid and Dublin. The survey aimed to trace the effects of COVID-19 on mobility trends and user behaviour, through the collection of data regarding modal split, commuting times, remote working, and how they expect these will change from pre-lockdown, to the present situation to post-pandemic. The survey has been structured in four main sections:

- 1** PROFILE QUESTIONS
- 2** SECTION 1 | Mobility before COVID-19 emergency
- 3** SECTION 2 | Mobility during COVID-19 lockdown
- 4** SECTION 3 | Mobility after the phasing out of COVID-19 lockdown measures

The data gathered in the three cities, in comparison with the official modal split of the city, demonstrates changes in mobility demand. Models generated show not only forecasts of changes in the preferred mobility mode, but also their distribution in time, focusing on daily and weekly forecasts. The ultimate aim was to record insights to support the identification of scenarios and related potential actions to be implemented.

Setting the frame

TRANSPORT AND MOBILITY

The three European cities analysed are Milan, Madrid and Dublin. Features and maps related to the cities' demography, economy and mobility are provided to define the contexts for the survey and analysis.

MILAN



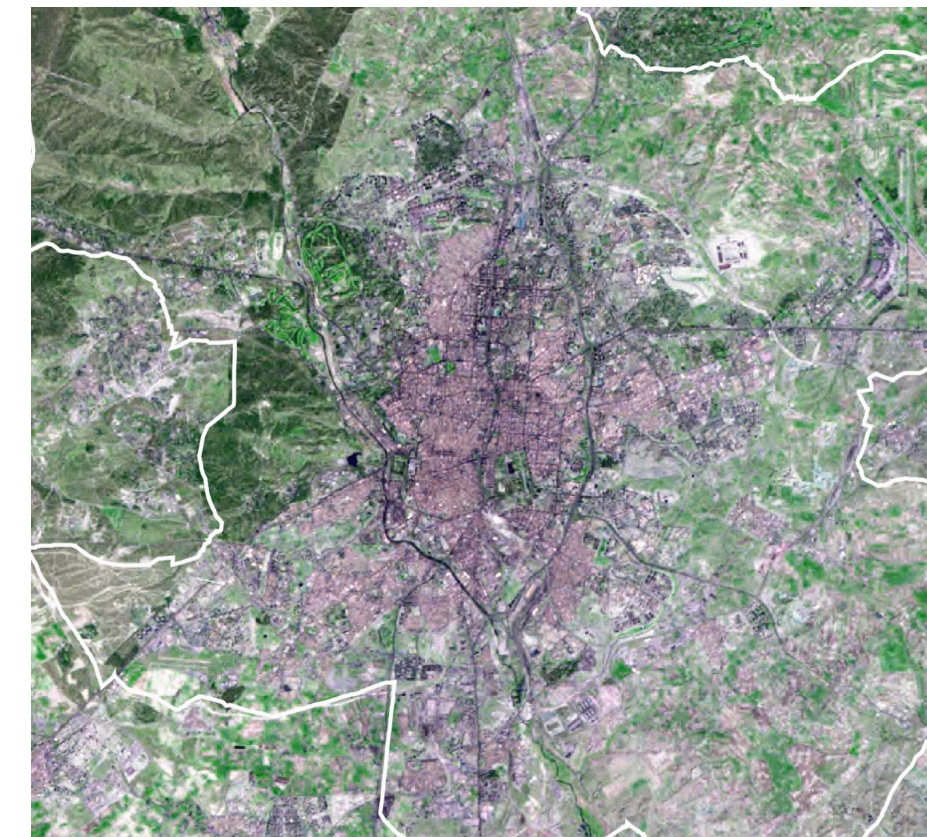
 **1,366,180**
inhabitants (Eurostat, 2018)


 **182**
sq km

 **\$41,147**
GDP per capita (PPP)
(2014, metro area, Brookings)

 **5.9%**
Unemployment Rate
(2019, metro area, Istat)

MADRID



 **3,223,334**
inhabitants (Eurostat, 2018)


 **606**
sq km

 **\$39,288**
GDP per capita (PPP)
(2014, metro area, Brookings)

 **10.6%**
Unemployment Rate
(2020, Instituto Nacional de Estadística)

DUBLIN



 **554,554**
inhabitants (Central Statistics Office,
Irish Census, 2016)

 **115**
sq km

 **\$51,319**
GDP per capita (PPP)
(2014, metro area, Brookings)

 **4.6%**
Unemployment Rate
(2020, Dublin Economic Monitor)

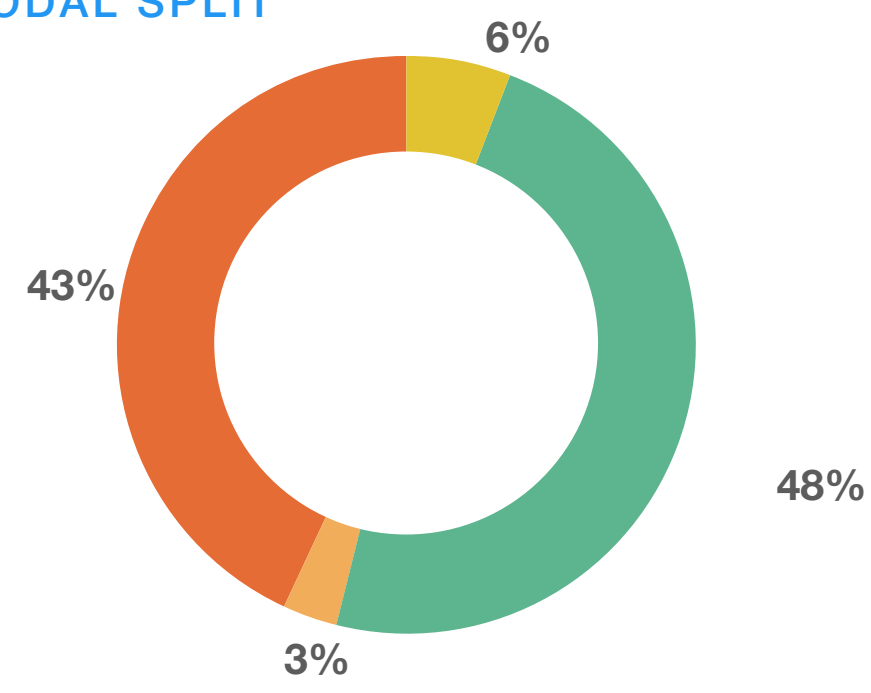
MILAN



MOBILITY INFORMATION

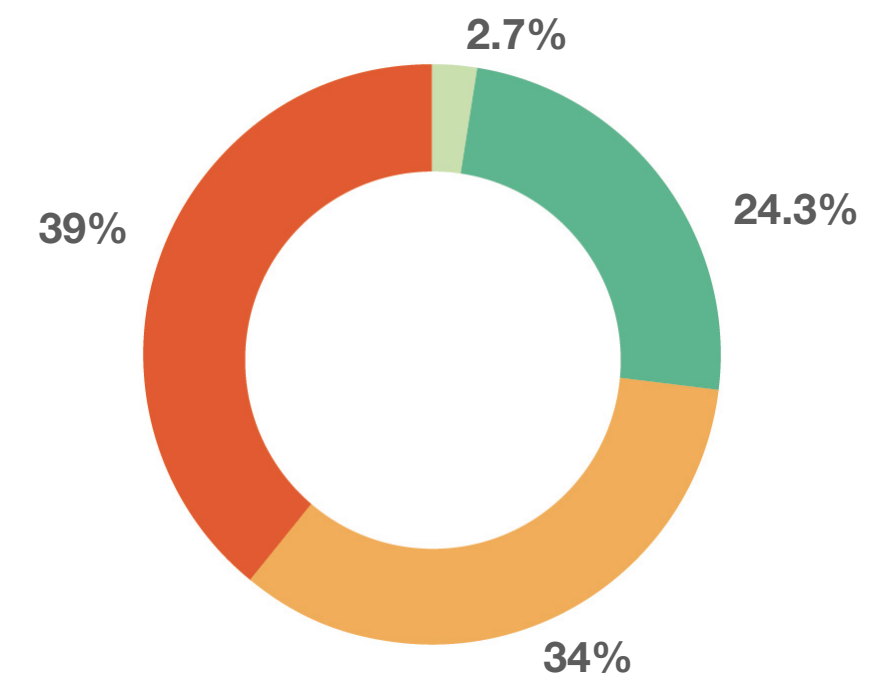
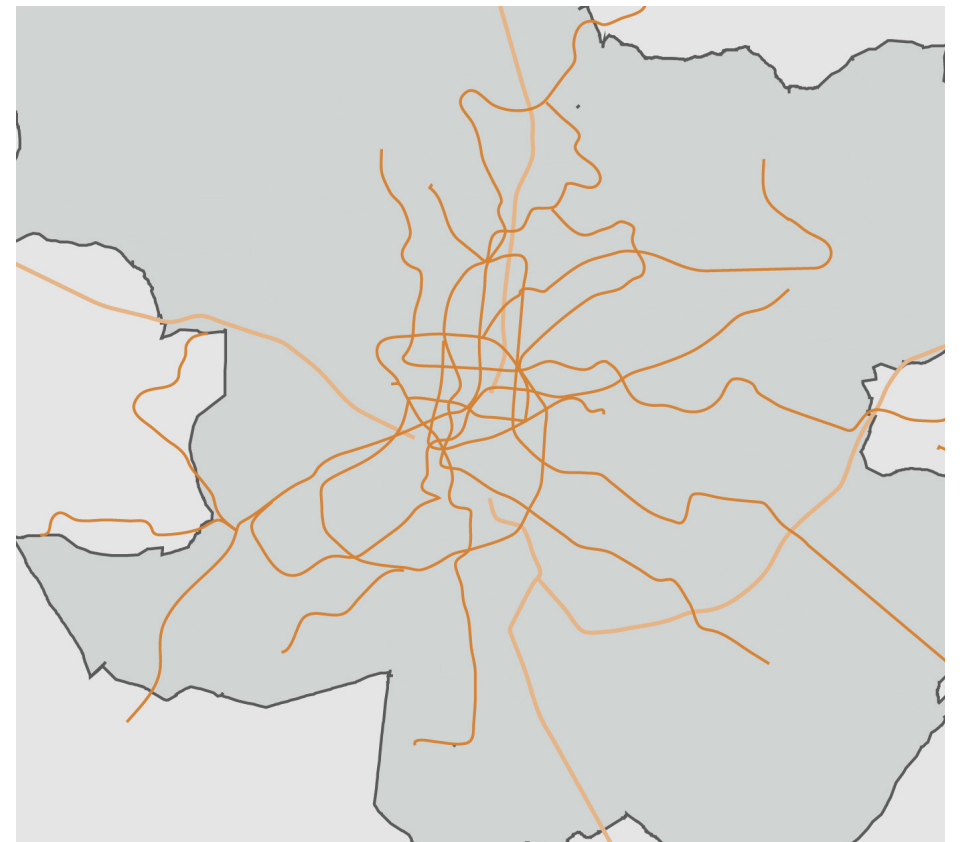


MODAL SPLIT



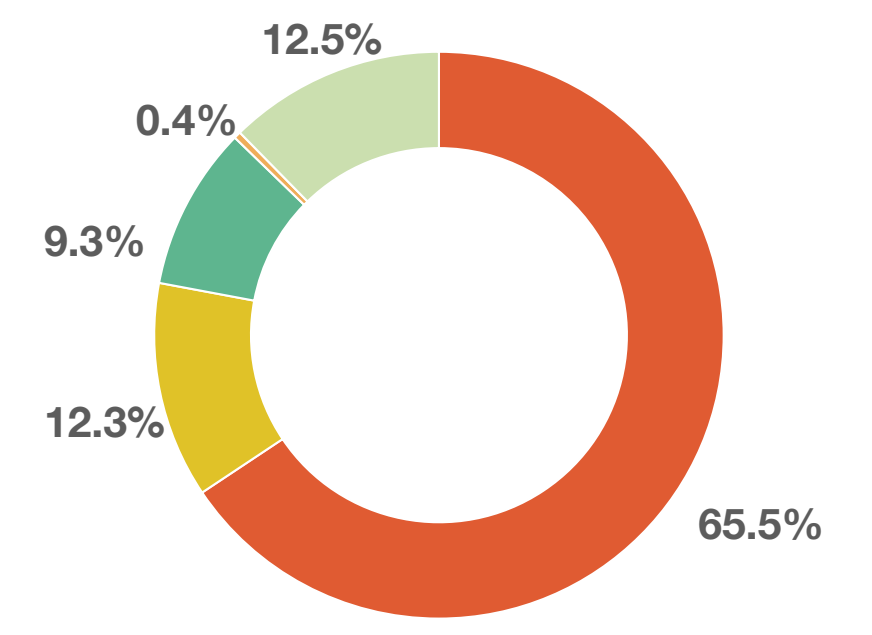
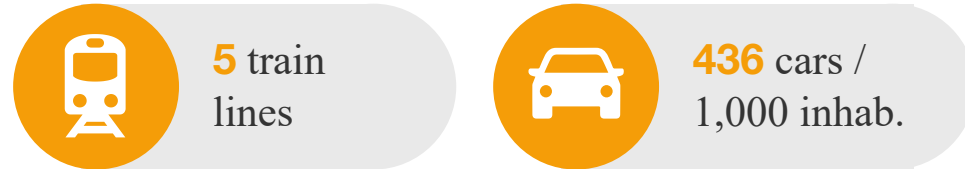
*AMAT, internal and external movements, 2013

MADRID



* Consorcio Regional de Transportes de Madrid, 2018

DUBLIN



*Central Statistics Office, trips to work, 2016

Railway
Metro Lines

- Private car
- Walk and bicycle
- Public transport
- Other
- Motorcycle



COMPARISON OF RESPONDENTS' PROFILES

The total number (considering the 3 cities Milan, Madrid, Dublin) of valid answers analysed is 854. For each city, a data sheet, with a summary of respondents' profiles, has been developed for comparison.

MILAN



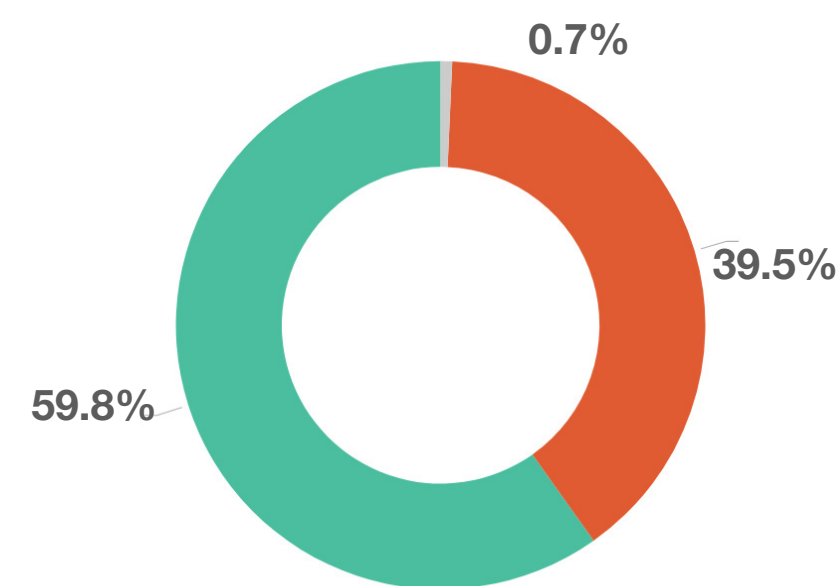
428 respondents



66.6% of respondents are aged 25 to 44 years

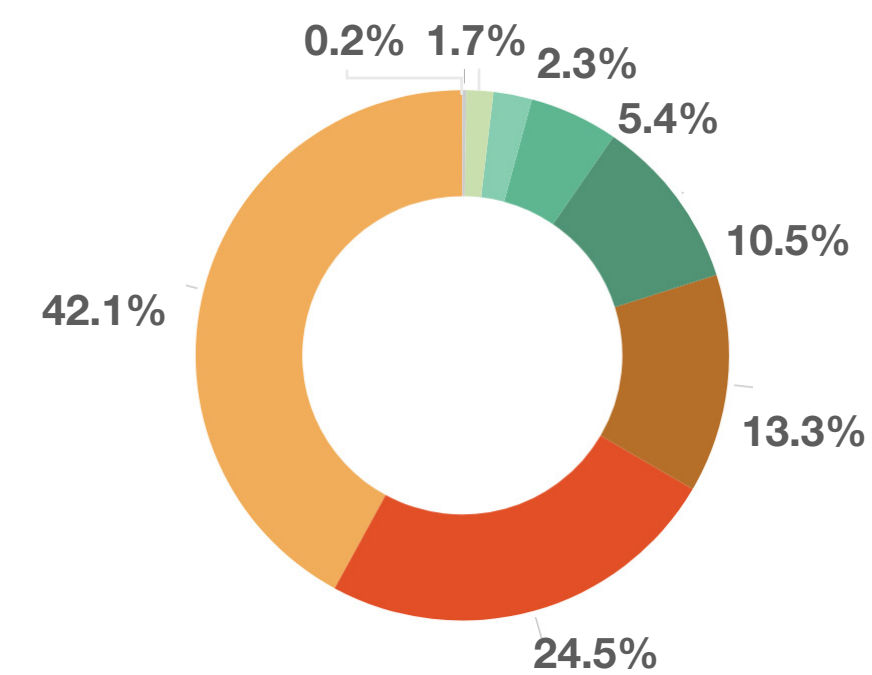


77.5% of respondents are employed full-time



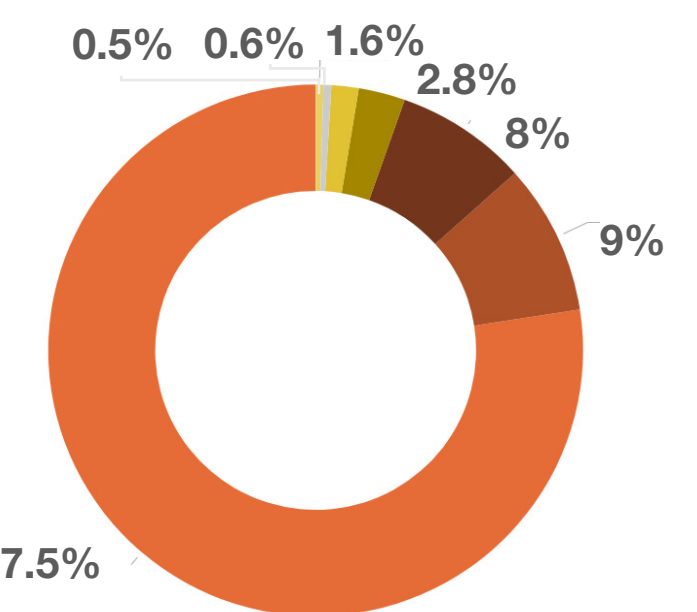
GENDER

Man Woman not disclosed



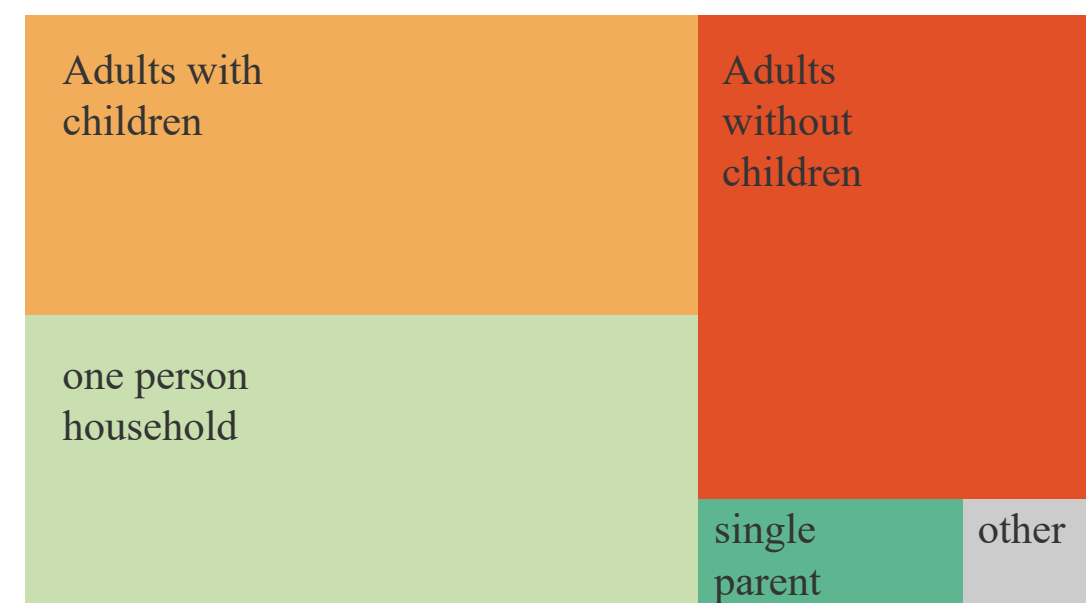
AGE

<18 25 35 45 55 >65 Years

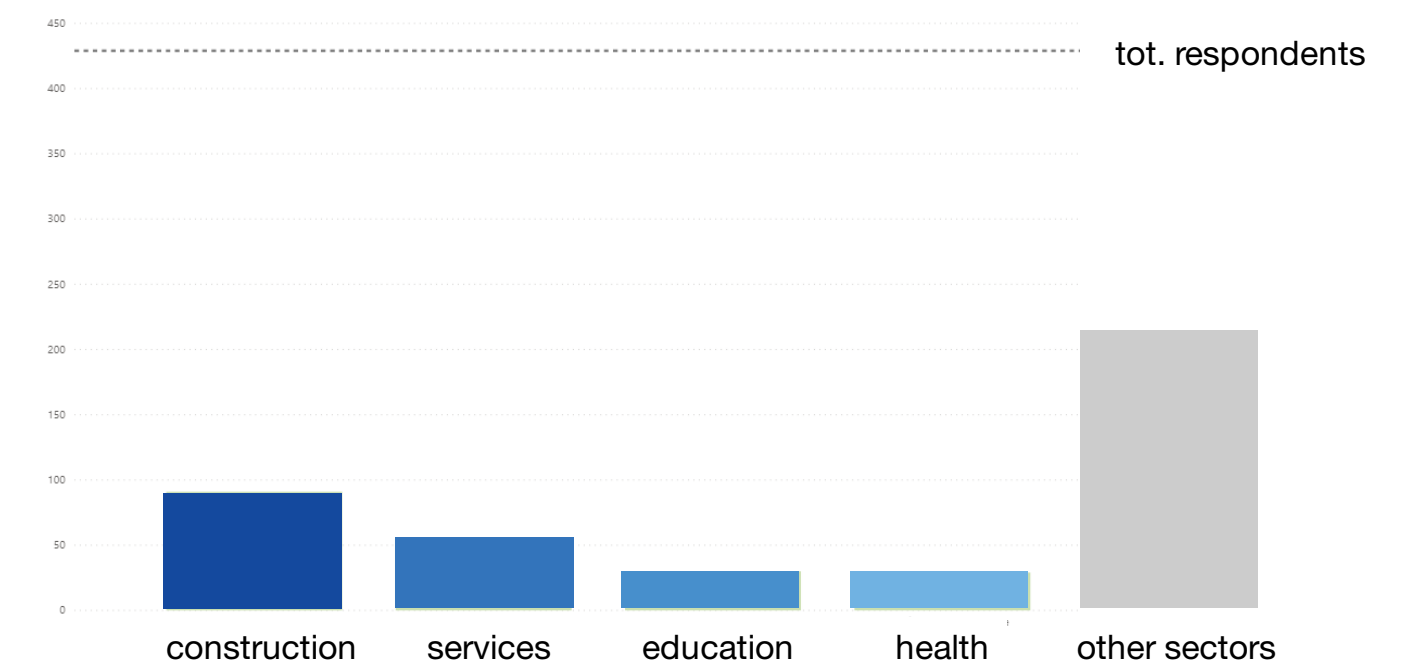


EMPLOYMENT

not disclosed retired student unemployed, not looking for work unemployed, looking for work employed part-time employed full-time

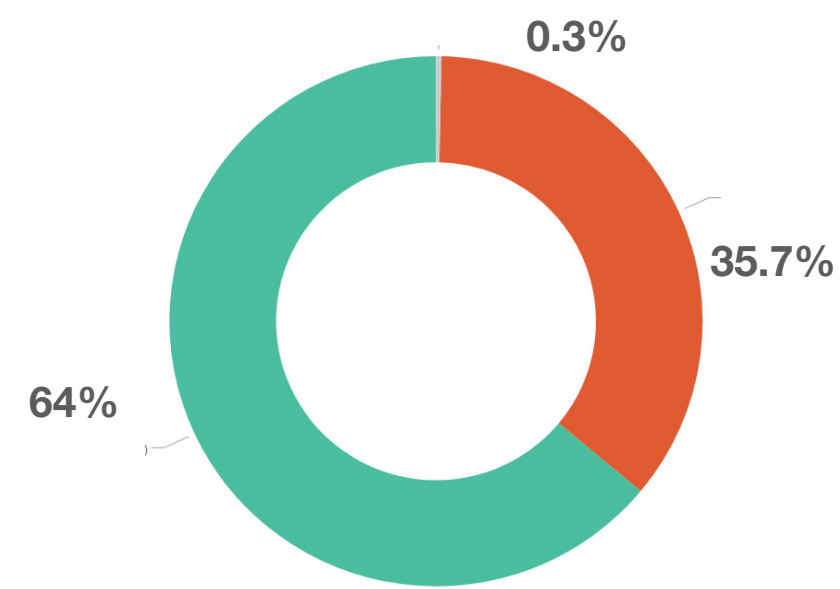
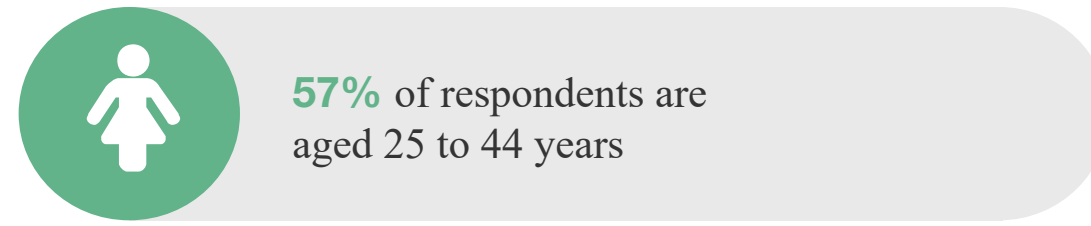
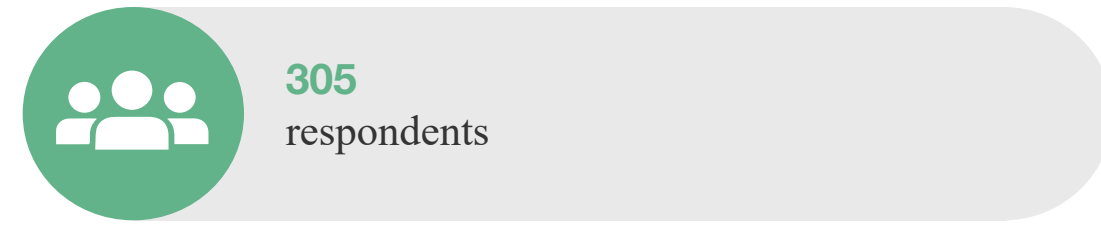


HOUSEHOLD COMPOSITION



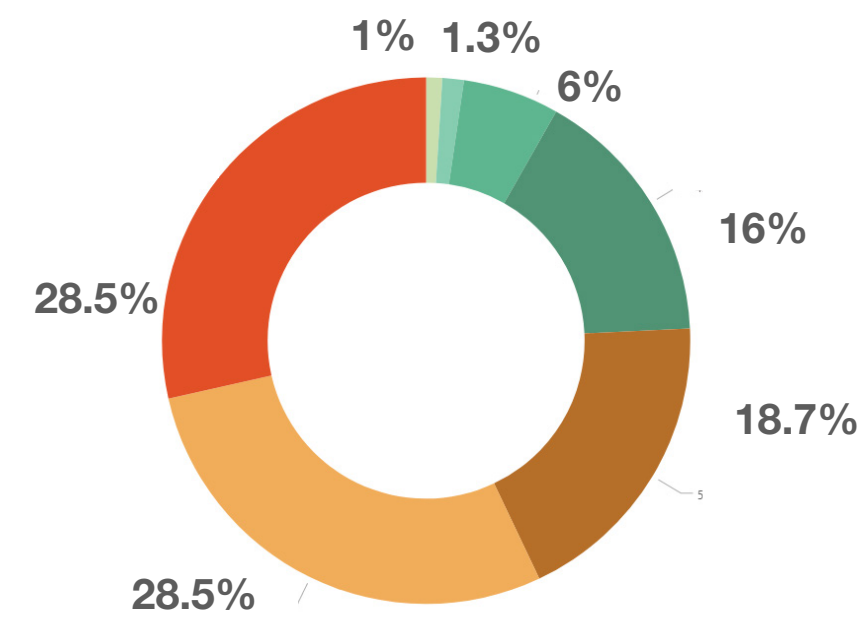
JOB SECTORS

MADRID



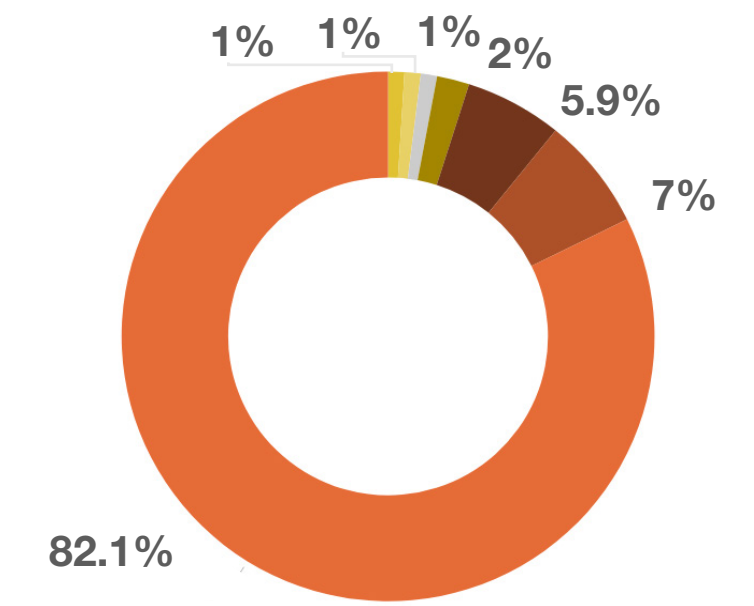
GENDER

Man Woman not disclosed



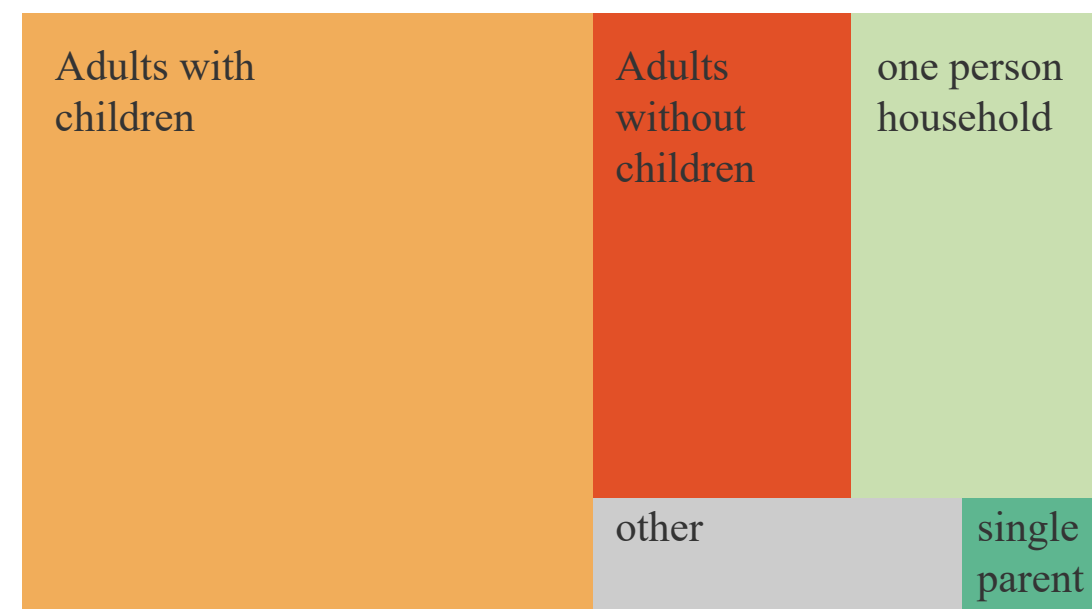
AGE

<18 25 35 45 55 >65 Years

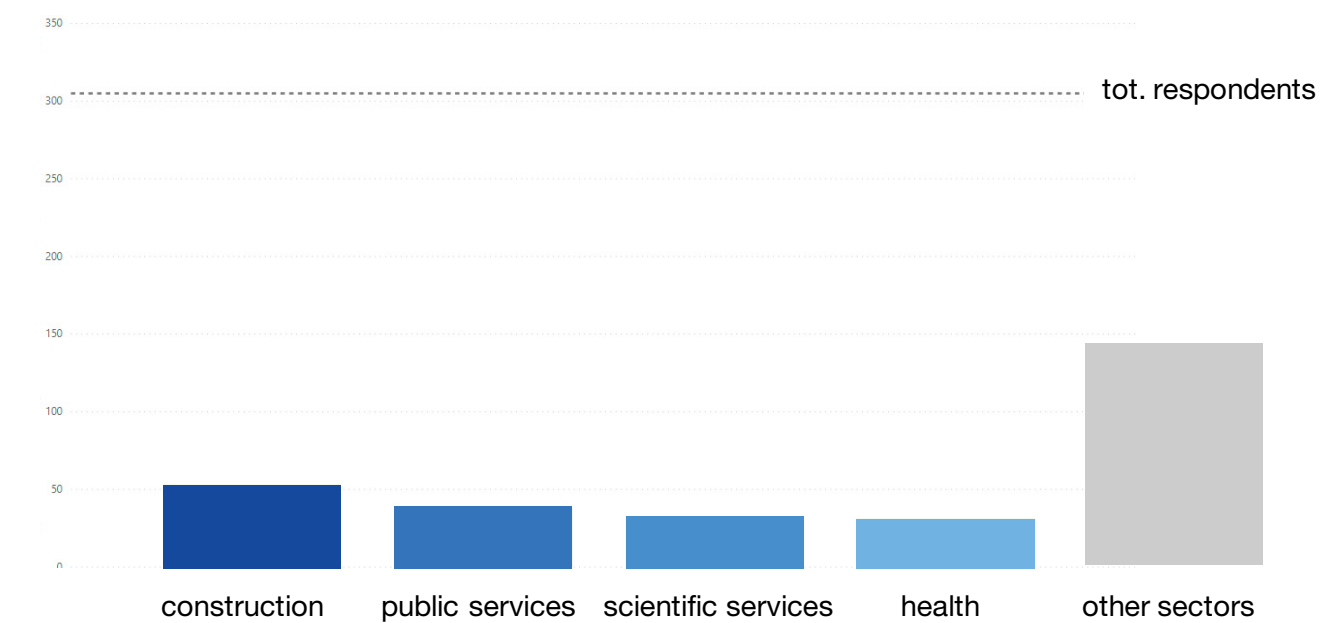


EMPLOYMENT

not disclosed retired student unemployed, not looking for work unemployed, looking for work employed part-time employed full-time



HOUSEHOLD COMPOSITION



JOB SECTORS

DUBLIN

121 respondents

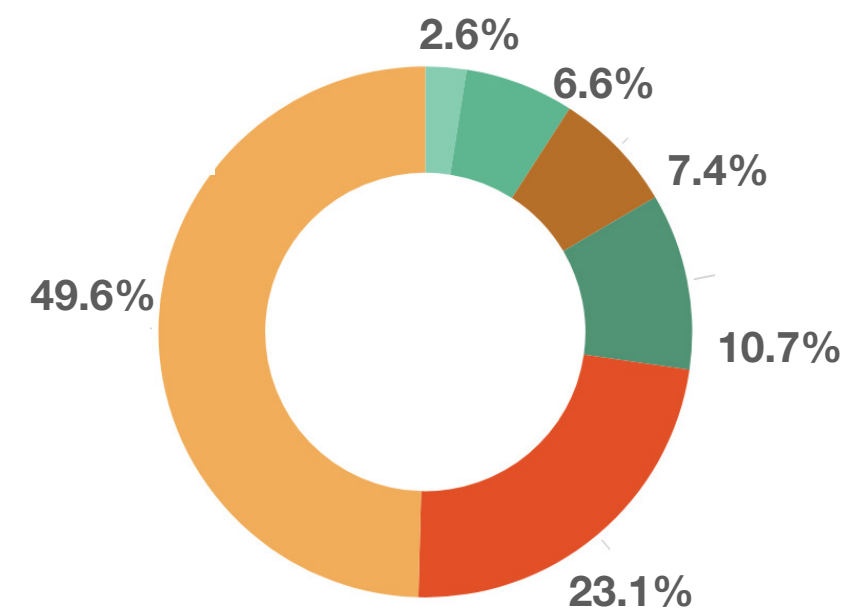
72.7% of respondents are aged 25 to 45 years

94.3% of respondents are employed full-time



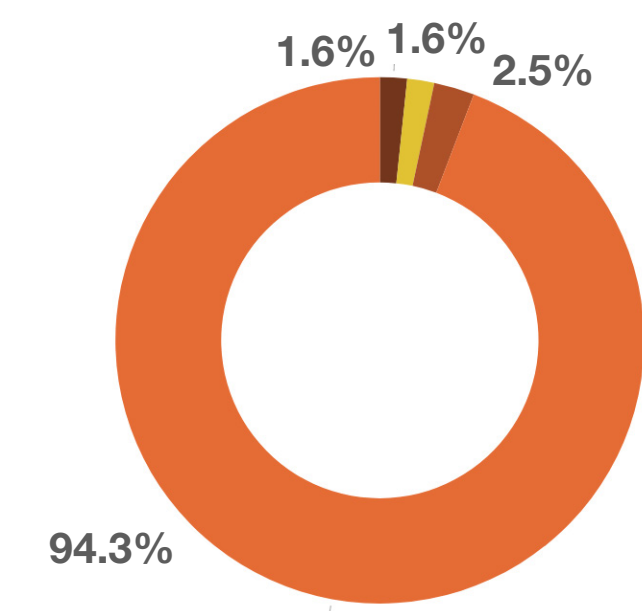
GENDER

Man Woman



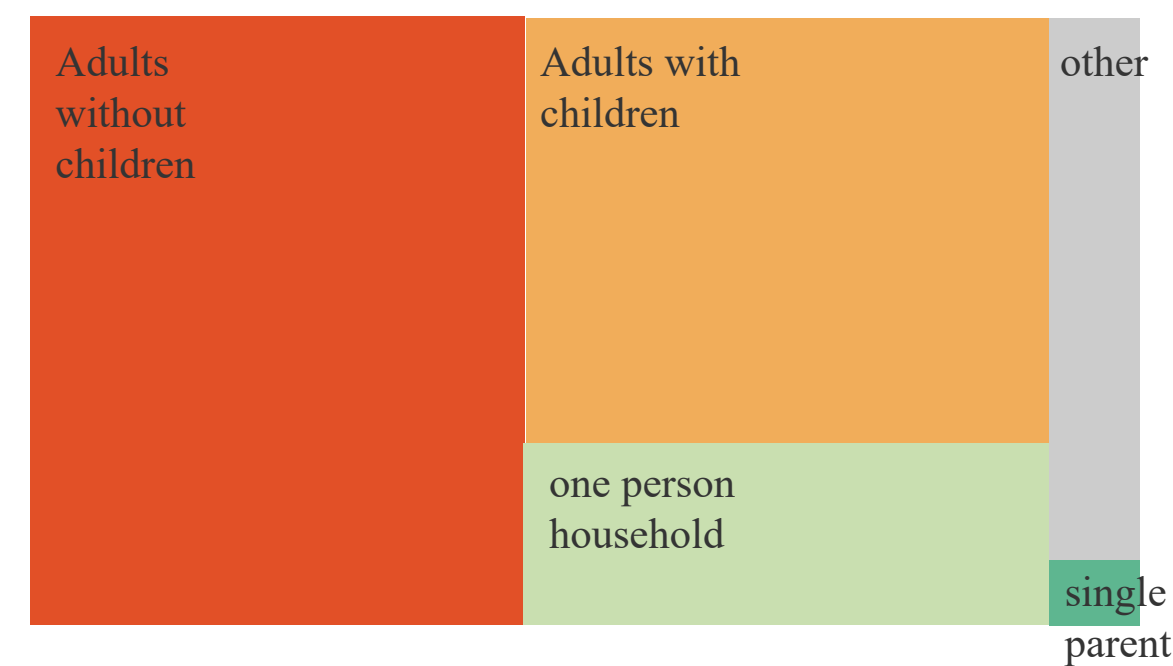
AGE

<18 25 35 45 55 >65 Years

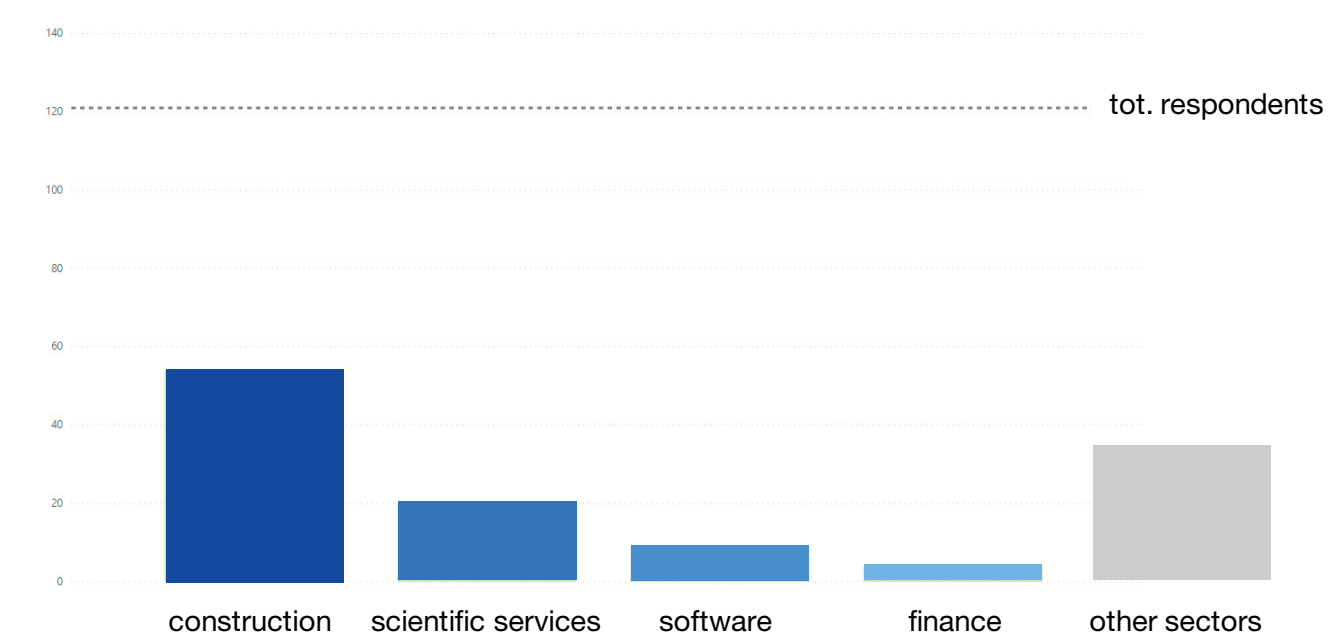


EMPLOYMENT

unemployed, looking for work employed part-time student employed full-time



HOUSEHOLD COMPOSITION



JOB SECTORS

Understanding the change

MILAN

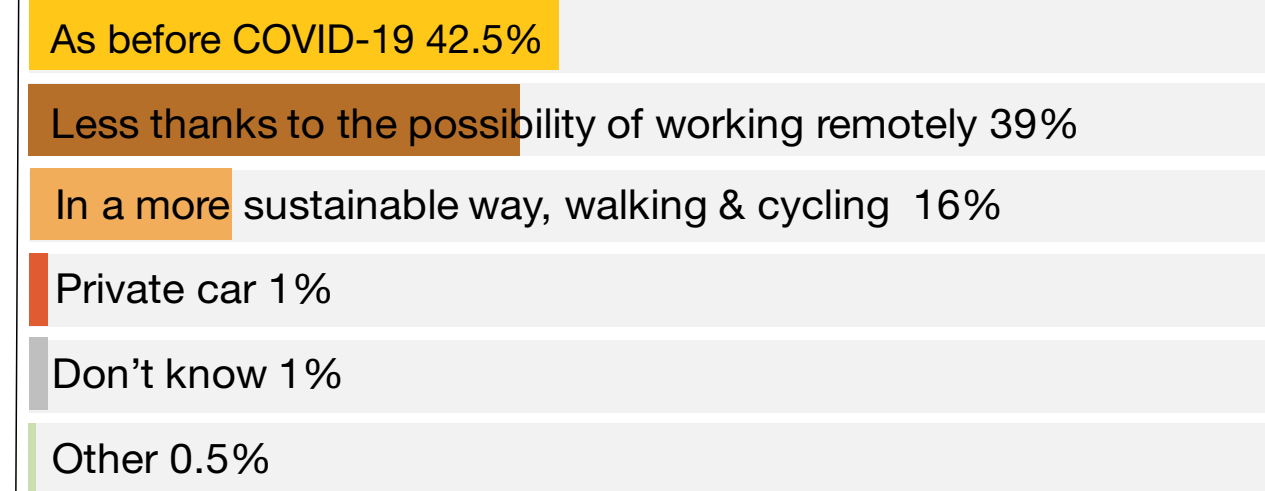
While Milan has been severely impacted by COVID-19, normality in the city is slowly returning as key facets of daily life begin to restart.

The survey collected data from 428 respondents – providing information about behaviour during this pandemic and thoughts and expectations for the future.

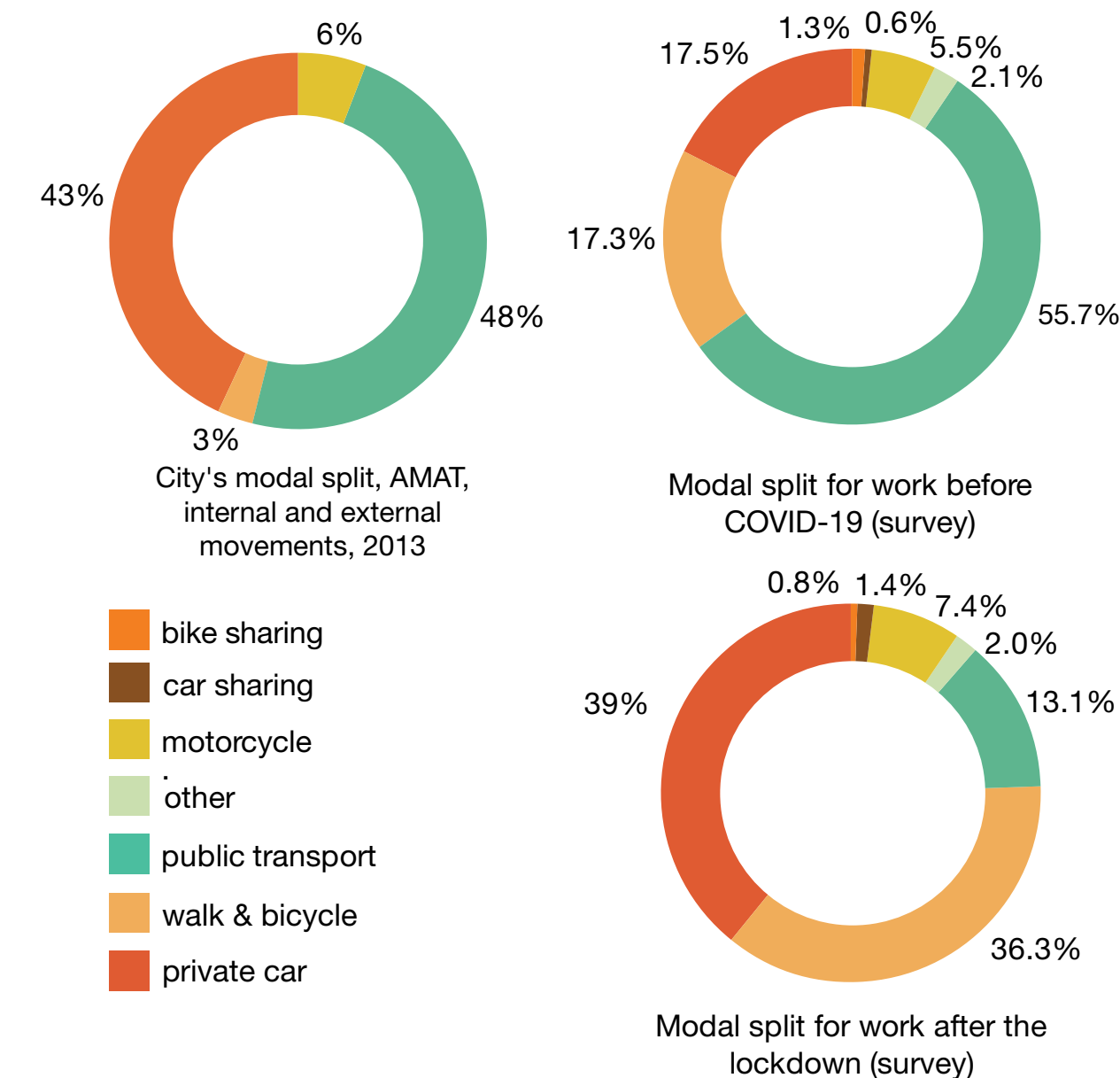
This chapter on Milan highlights the changes in modal split preferences, illustrates the geographies of respondents, and highlights people's times of movement and their willingness to change in favour of remote working.

The data comes from a varied sample of people living and working or studying in the city. Before entering the analysis, the following is worth noting regarding the distribution and diversity of the people surveyed:

- 42.1% of respondents are among 25-34 years; followed by people aged 35-55 years (24.5%).
- The majority of respondents (77.5%) work full-time, and mainly in the construction (22%) and services (13%) sectors.
- Respondents had a variety of household compositions, with the majority comprising either adults with children (30%), adults without children (30%) or one-person households (30%).



Expectations of movement after COVID-19



CHANGE IN THE MODAL SPLIT

The research shows opportunities regarding changes in the total number of daily trips in the city, not only during the different phases of the COVID-19 response, but also registering a reduction in expected trips in the future.

55% of respondents believe their mobility habits will change permanently after the COVID-19 emergency. More than 39% think their mobility will be reduced thanks to working remotely and 16% stated that their mobility will be reduced and will become more sustainable.

Looking at the modal split expressed in the survey before and at the end of lockdown, the city of Milan showed a significant decrease in the use of public transport of more than 75% due to COVID-19.

The change is registered in favour of the use of sustainable modes (bikes), but also considerably in favour of the private car. Walking and micro mobility become the most popular trends for the city, with an increase of 1.110% from pre-COVID-19 (City's modal split). Milan confirms a high percentage of private car use, at 39%, becoming the most preferred mode of transport. Managing this change is and will be a major challenge, especially in relation to long-distance commuting.

To evaluate the results, the data from the survey was analysed in comparison with data from the city's mobility plans. It is important to note that the metro, with its four lines, usually carries over one million passengers in the city daily from a total population of more than 1.3 million. According to AMAT, Mobility and Environment Agency of Milan, the aggregate demand for mobility in Milan is about 5.3 million movements per weekday; in particular, from 2005 to 2013, overall mobility

demand grew slightly, by 0.6%. The mobility exchange between Milan and the external municipalities represents 43% of the total movements of the city. Looking at the 2013 modal split for the city, the public transport share represents 48% of the total movements; considering just the exchange movements, the share remains high at 37%.

Analysing the reasons for expected changes in transport mode, over 69% of the respondents stated that it was due to health reasons, while 11% declared that journey time savings caused this change. Only a little over 9% responded that environmental concerns and sustainability were taken into consideration as reasons to change their mode of transport. Of the people who indicated environmental concerns in their responses, over 90% were below 54 years of age.

NEW GEOGRAPHIES

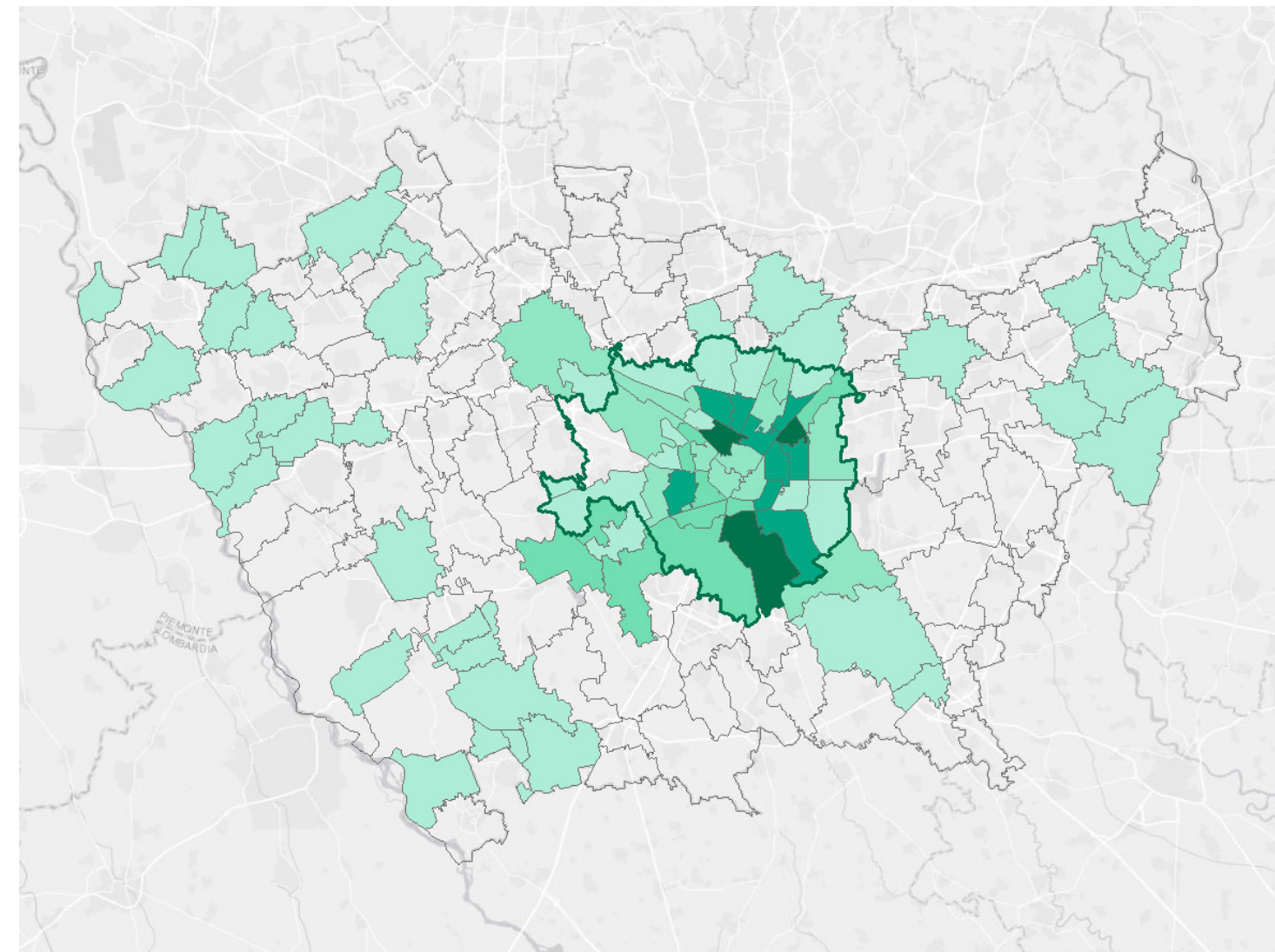
Following an origin destination analysis, it was possible to trace movements identifying the geographies of the respondents, thus deepening the level of understanding of city internal and external movements.

A first consideration is that data gathered confirms the relevance of considering the city with its wider metropolitan boundaries when rethinking mobility and future scenarios. The surveyed population reinforces the findings from the AMAT study in 2013: 57% internal movements, 43% exchange movements. In fact, almost 72% of respondents live within 10km of their work/study places. Overall, internal movements represent 64%, whilst the exchange movements are 36% – equally split between “from Milan” (50%) and “to Milan” (50%).

The study demonstrates that remote working is a fundamental opportunity to consider in future scenarios, for the reduction of not just internal, but also exchange movements.

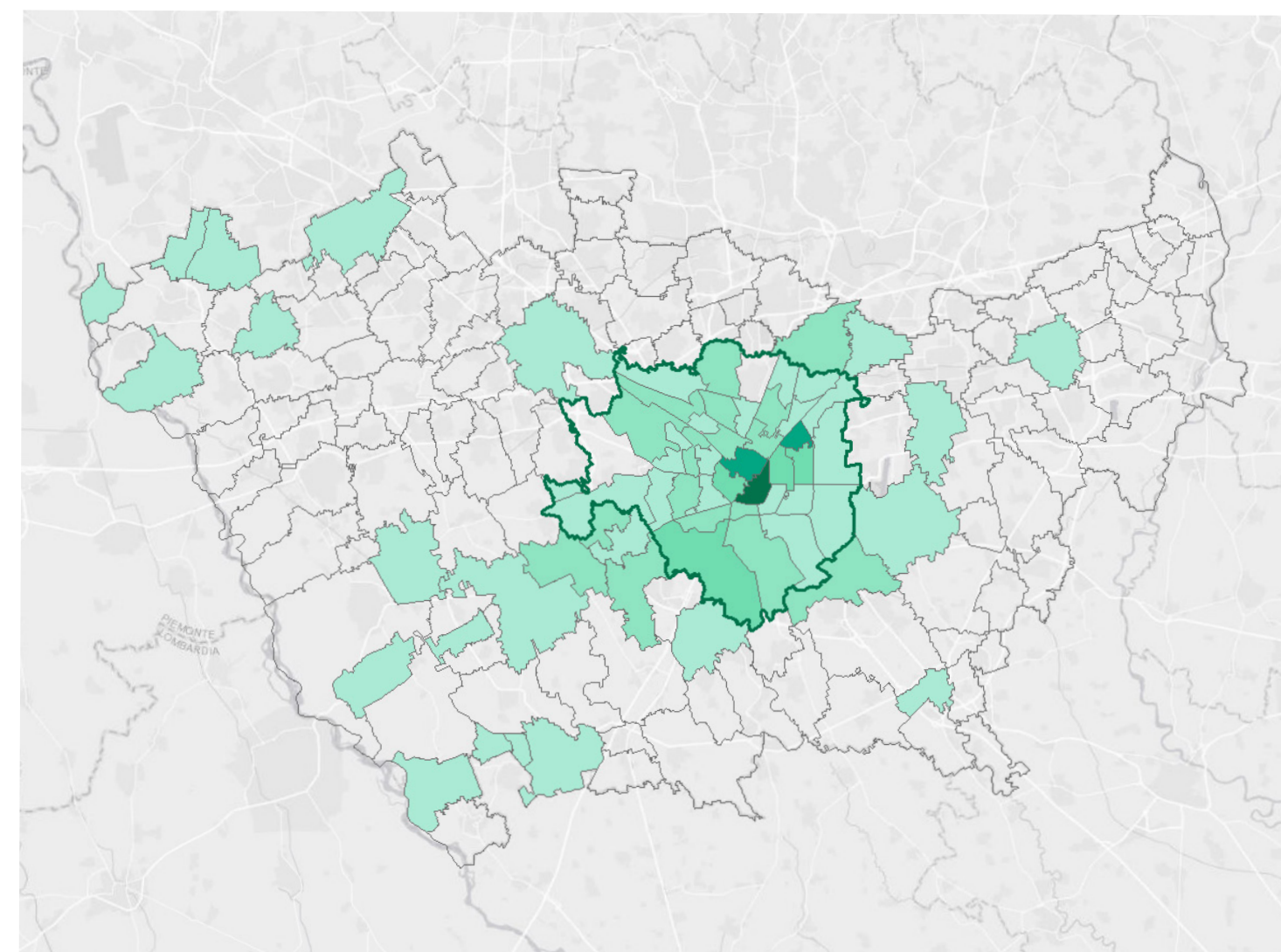
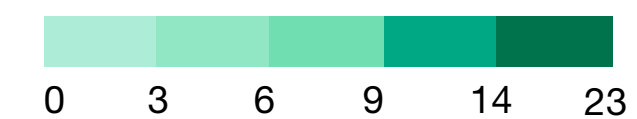
Considering the forced introduction of remote working due to the emergency, it is interesting to understand also how the trend spread. Over 68% of those surveyed have been able to work and study remotely during the COVID-19 emergency. The main constraints specified relate to the type of work (e.g. health vs. commercial sectors).

In relation to the preferred way of working in the future, over 50% would like to be able to continue working remotely part-time after the emergency. Another 27% stated they would like to work remotely full-time (this preference being equally split between commuters travelling distances above and below 5km to their work/study places). Only 17% indicated they would prefer to attend the workplace rather than continuing any level of remote working.



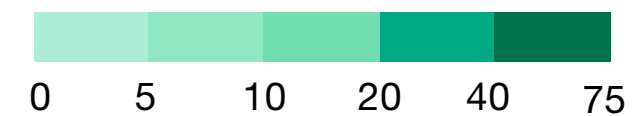
ORIGIN OF THE RESPONDENTS' MOVEMENTS, PLACE OF LIVING

number of respondents



DESTINATION OF THE RESPONDENTS' MOVEMENTS FOR WORK/STUDY

number of respondents



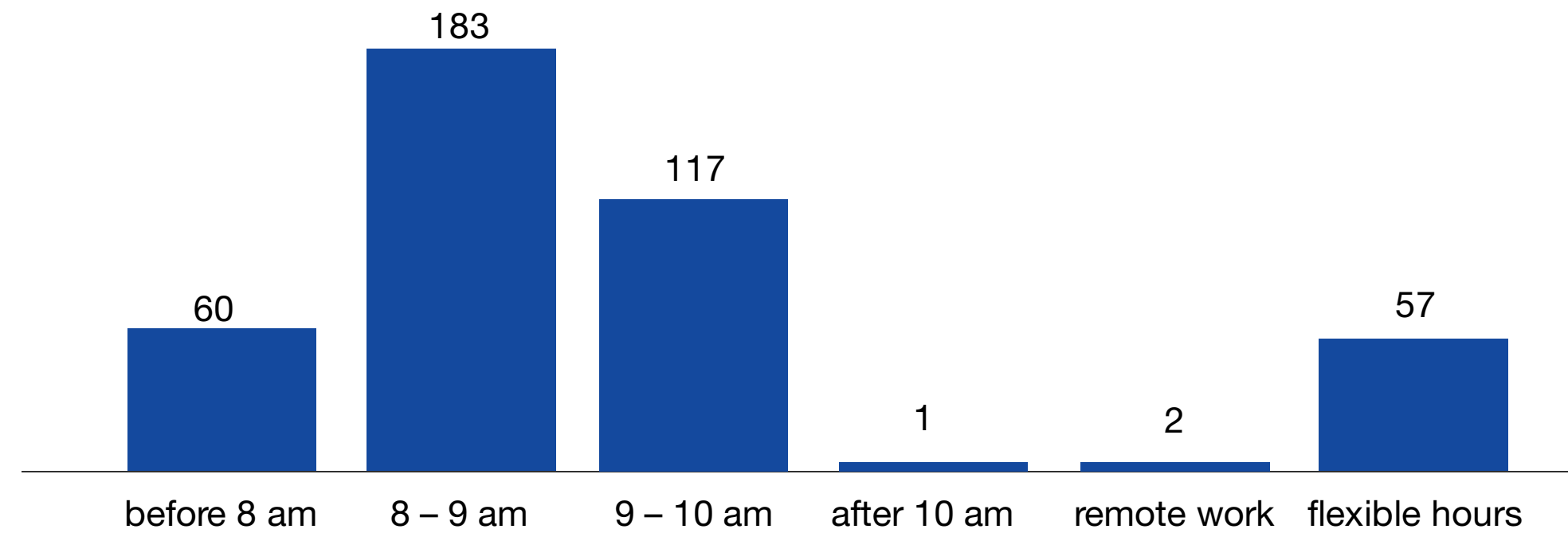
TIMES OF THE CITY

Understanding the times of the city strictly relates to people's behaviour and habits. The survey investigated, in particular, the movements to and from work/study places. Not surprisingly, and in line with AMAT data from a mobility survey conducted in 2005-2006, the maximum peak hour is in the morning (8-9 am). It is interesting to note that flexible hours are quite prevalent.

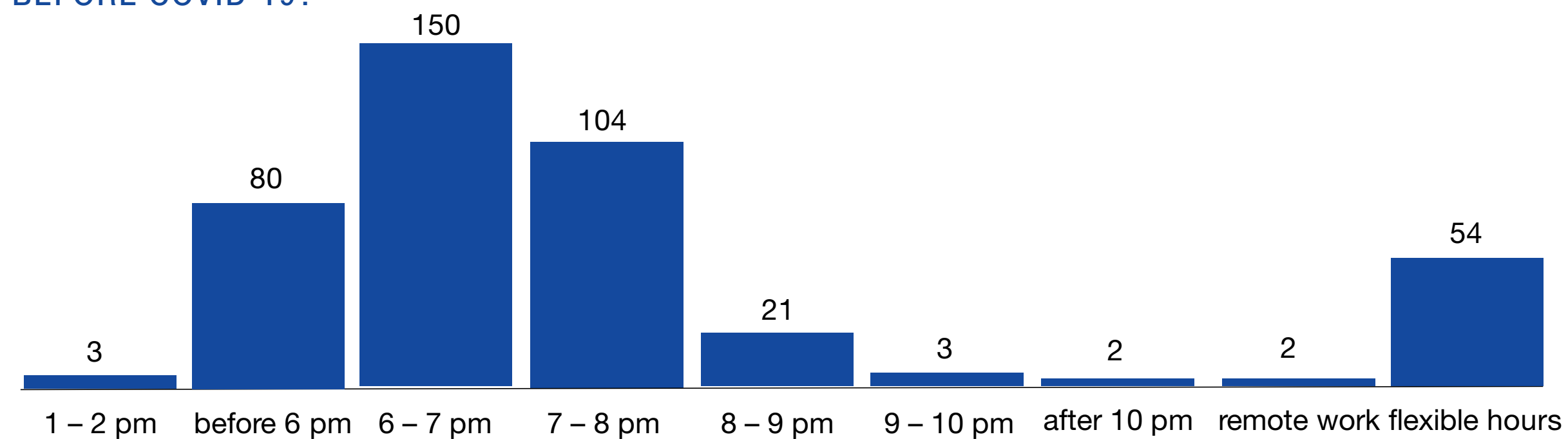
Observing the data related to how much time is spent commuting, it is relevant to highlight that roughly 50% of respondents spend less than 30 minutes; this aspect highlights that rescheduling working times for companies, and subsequently, public services, would probably impact a lot on previous work time trends, potentially supporting a reduction in peaks, and fostering a better distribution.

86.5% of respondents that selected the morning peak (8-9 am) would be interested in continuing working remotely: 56.5% part-time, 30% full-time. This presents a major opportunity for the city and the region.

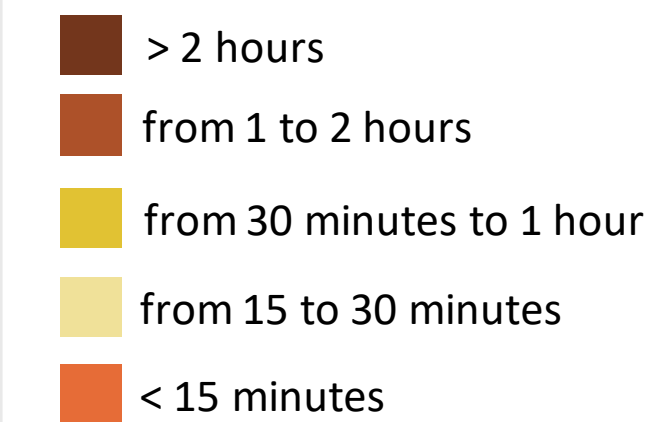
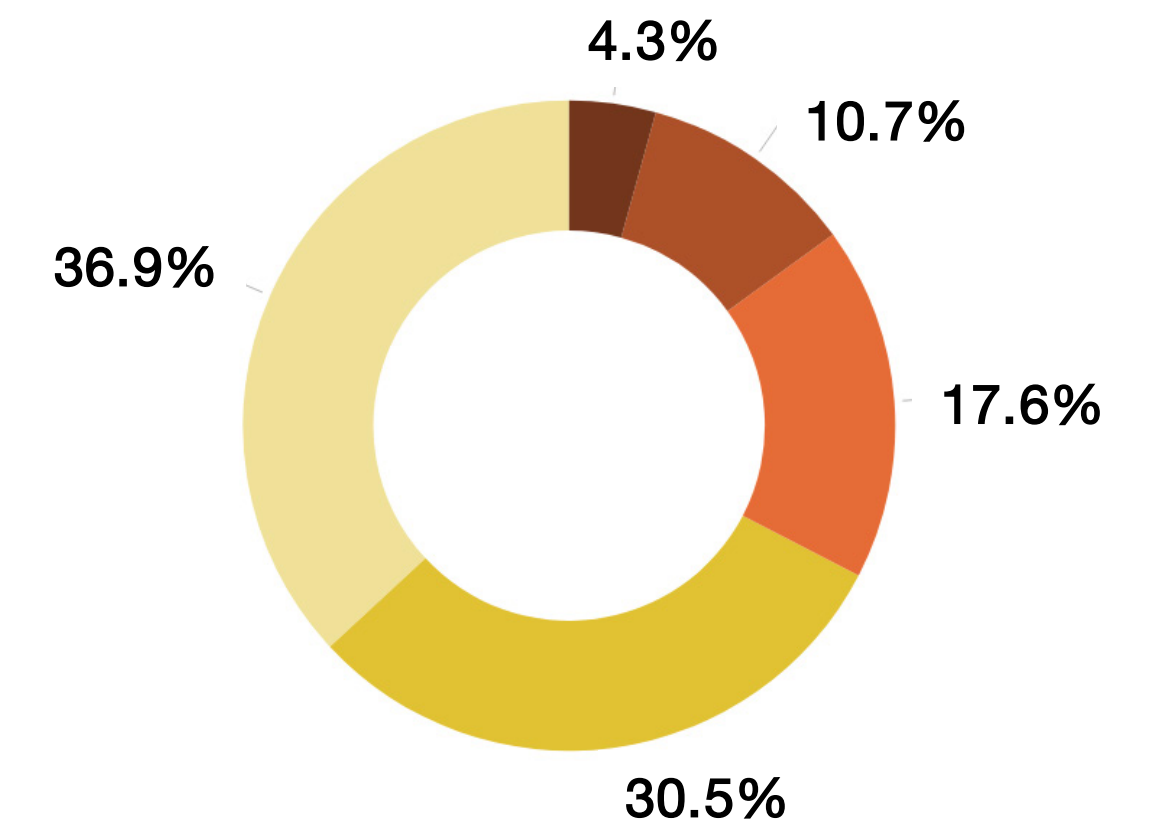
WHAT TIME DID YOU GO TO WORK/STUDY BEFORE COVID-19?



WHAT TIME DID YOU LEAVE WORK/STUDY BEFORE COVID-19?



HOW MUCH TIME DID YOU SPEND COMMUTING DAILY TO GET TO AND RETURN FROM WORK/STUDY BEFORE COVID-19?



Understanding the change

MADRID

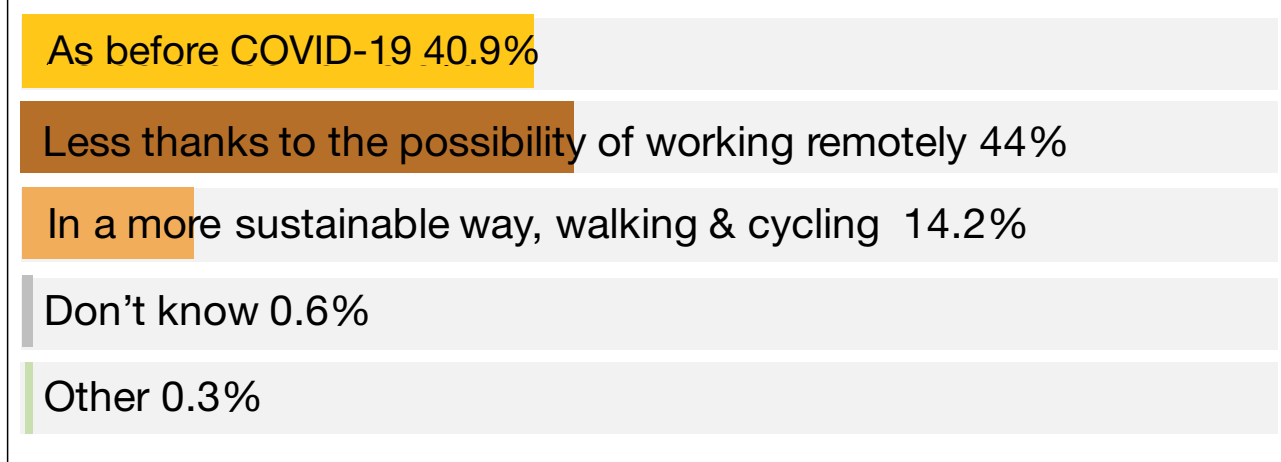
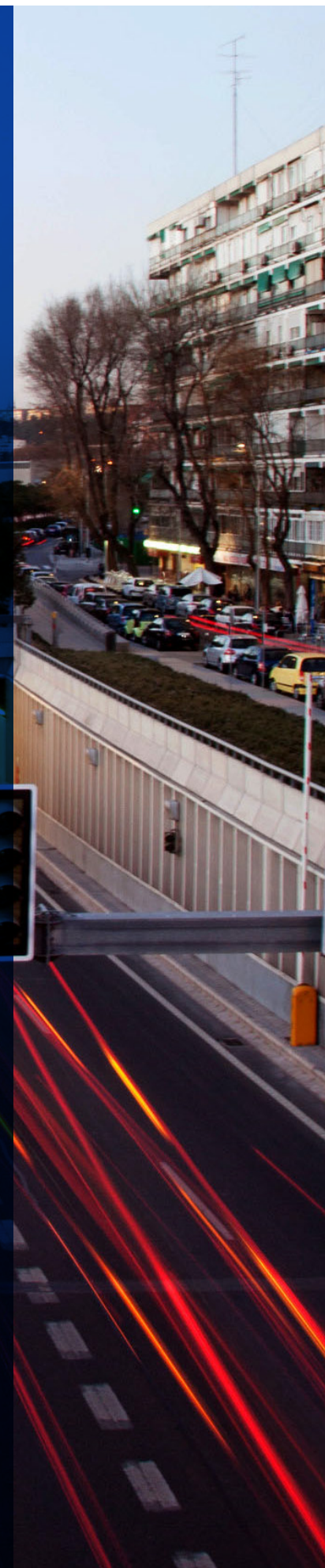
Madrid, a city severely affected by COVID-19, is slowly starting to see restrictions lifted and its population is adapting to the so called 'new normality'.

The survey collected relevant data from 305 respondents – providing information about Madrid's population and their behaviour in pre-, during- and post-COVID-19 scenarios.

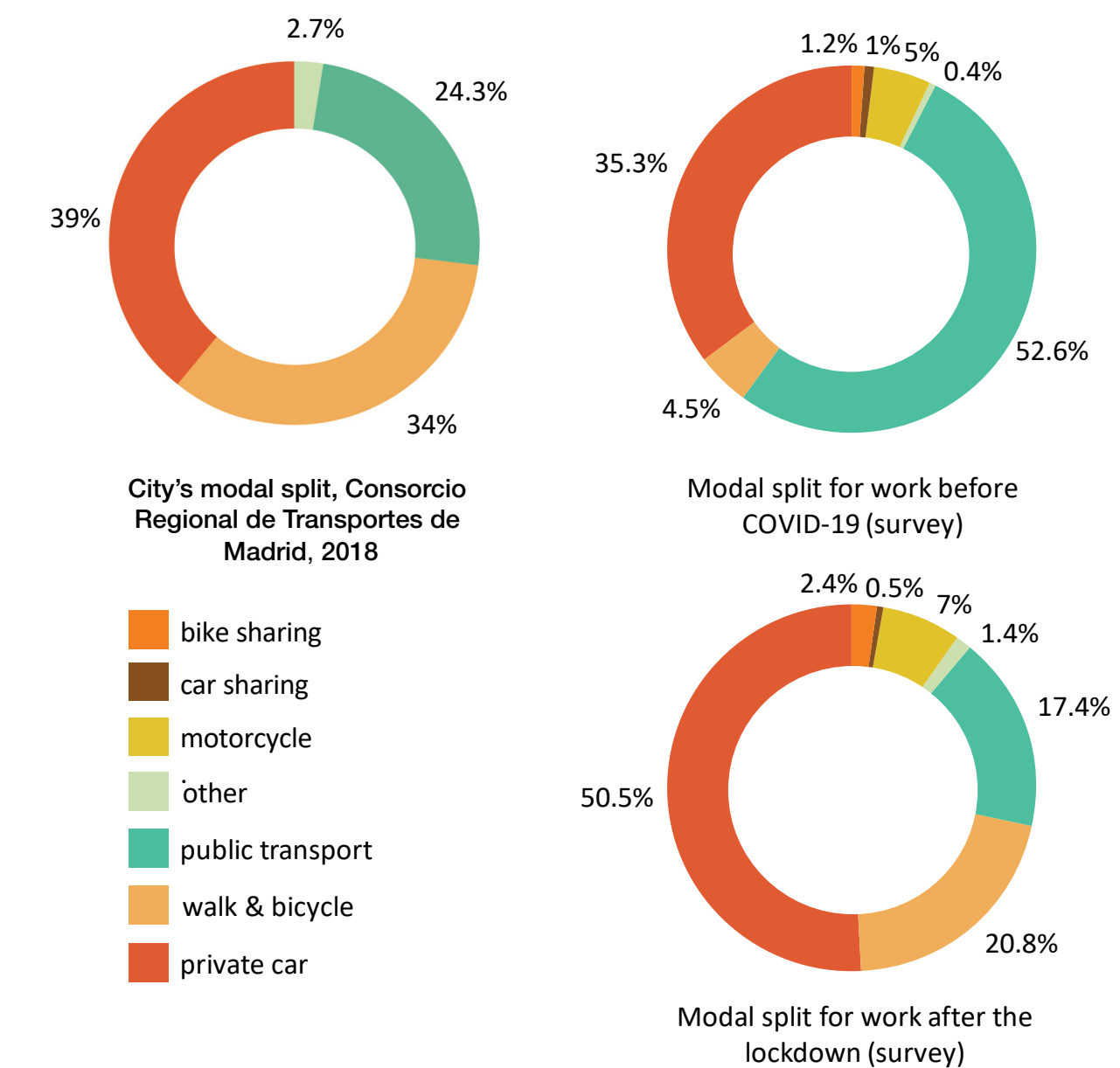
In this section focused on the city of Madrid, modal split changes and the reasons for these new preferred modes of transport provide insights into possible trends regarding the future of mobility. Those surveyed also stated their preferences in relation to remote working and how they envisaged the future working culture and the digitalisation of it.

Before entering the analysis, the following is worth noting regarding the distribution and diversity of the people surveyed:

- 57% of respondents are among 25-44 years of age; followed by those between the ages of 45-54 (18.7%).
- The vast majority of respondents (82.1%) work full-time, and mainly in the construction (17%) and public (12.5%) sectors.
- Household composition varies, but with a big representation of adults with children (53%). One-person households are also well-represented in the study (18%).



Expectations of movement after COVID-19



CHANGE IN THE MODAL SPLIT

The analysis of the survey carried out in the city of Madrid has provided interesting results on transport and mobility and how these could change due to the situation and evolution of COVID-19.

The restrictions implemented by governments due to COVID-19 have caused the population to change their everyday lives and social habits, including the mode of transport chosen for travel.

The data shows a drop in the use of public transport of more than 65% in the city of Madrid. This is quite significant, taking into account that, in 2017, public transport in Madrid registered more than 1.5 billion trips according to the Madrid Regional Transport Consortium. Our research indicates that a large number of people every day may decide to use another mode of transport or to work and study remotely, thus reducing the number of trips.

It is also significant that the trend of car sharing has fallen by almost 60% due to COVID-19. In a macro-survey, composed of 36 questions, carried out by the 'Centro de Demoscopia de Movilidad de Madrid' in 2019, in which nearly 8,500 people from all provinces of Spain participated, it was found that the use of car sharing has increased from 12% to 43% of Spaniards using this service in the last year. This shows that this service has grown considerably every year since it was first introduced in Madrid in 2015, when there were barely 350 cars for the service. By 2018, this figure was soaring with four major companies offering car sharing services – Car2Go, Wible, Emov and Zity – creating a fleet of over 2,500 cars and more than half a million users.

The downward trend in the use of public transport and car sharing due to COVID-19 is remarkable, and it is logical to think that this decline must represent a rise in other modes of transport. Thus, the analysed results of the survey show a dramatic increase in the preference for walking, as well as more than 50% opting for micro mobility such as bicycles, bicycle sharing, electric scooters and other small, private means of transport. The private car also saw a 25% increase in the preference for this mode of transport.

More generally, respondents were asked how they think their mobility will evolve post-COVID-19. Almost 41% of respondents believe that their mobility will be the same as it was before the emergency, while roughly 44% believe that their mobility will be reduced thanks to the possibility of working or studying remotely. On the other hand, about 14% of respondents believe that their mobility will be reduced due to sustainable reasons and an increase in environmental awareness. It is possible that the limitations that COVID-19 has presented in mobility and travel have forced changes in citizens' habits, leading them to rethink the way they travel and consider other means of transport that they did not use before.

These possible new trends in the use of different modes of transport will need to be adapted to the new demand in order to satisfy the transport and mobility needs of the population.

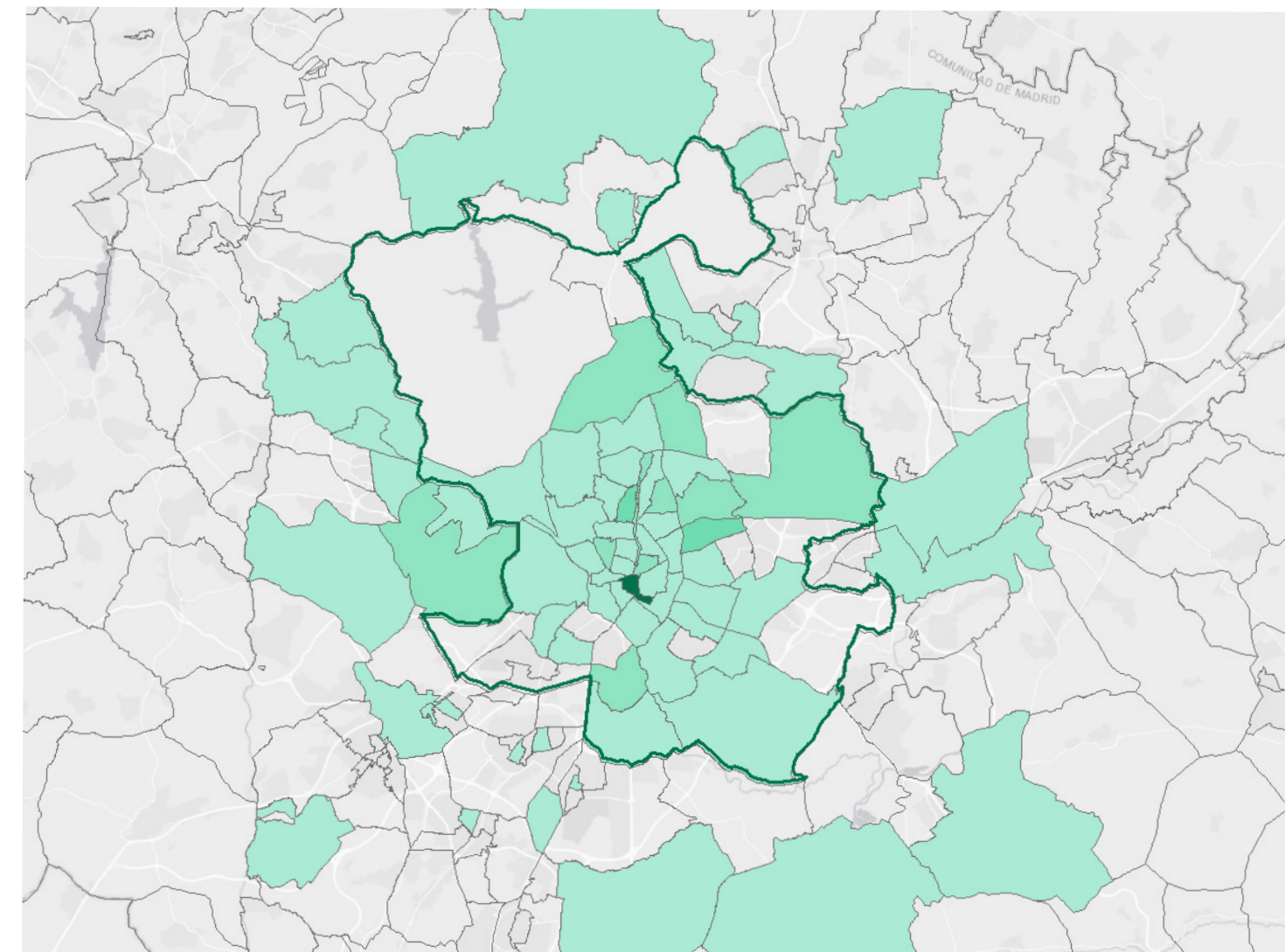
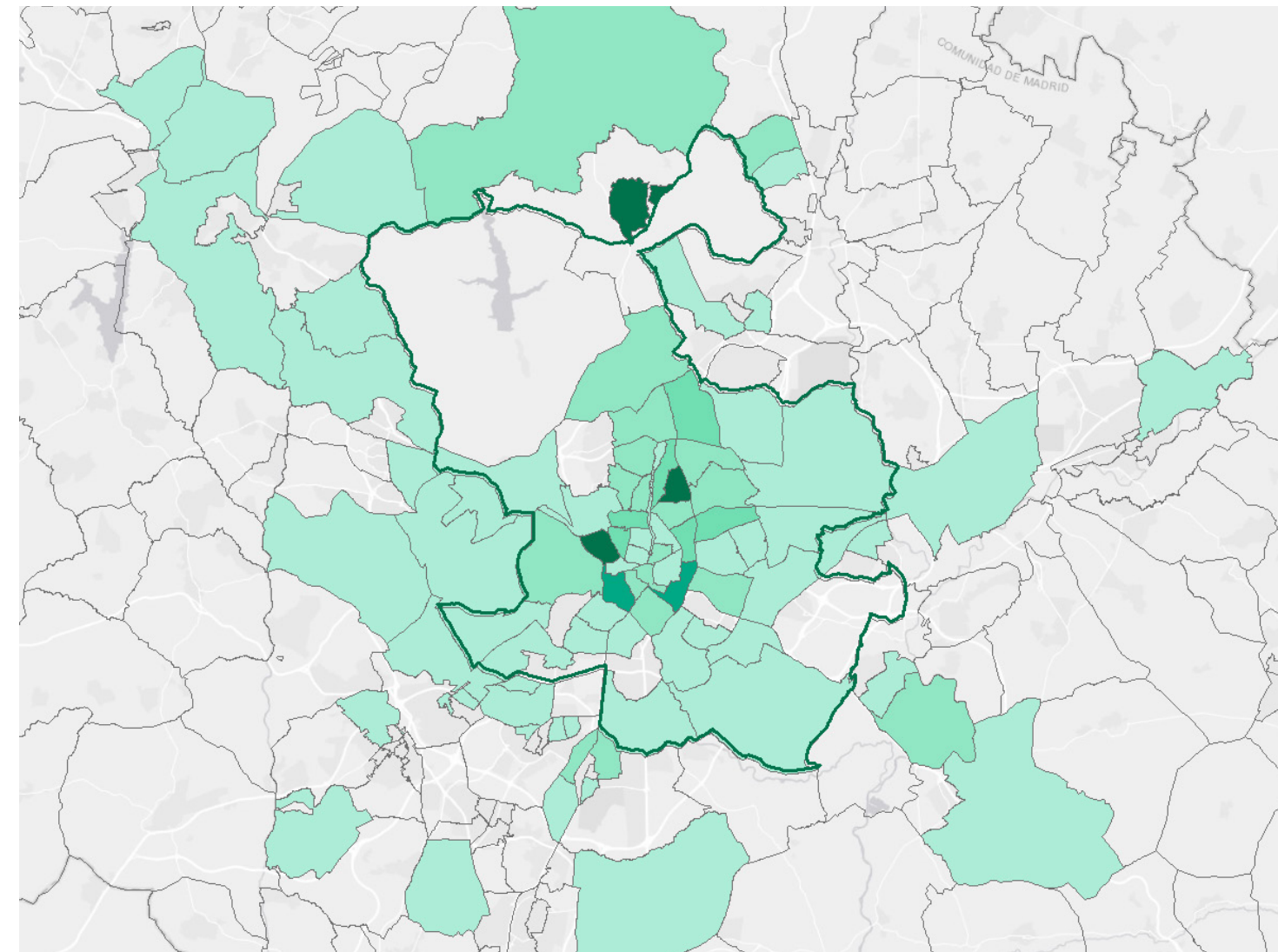
NEW GEOGRAPHIES

Around 65% of those surveyed have their origin in the neighbourhoods of Madrid and almost 70% of trips to places of work or study were also made within the municipality of Madrid.

Looking at the reasons for the change of mode of transport, more than 43% will do so for health reasons (68% are women, but it is important to take into account that almost 64% of those surveyed in the city of Madrid are women). The second reason is related to journey time savings. Only 7% of respondents take sustainability and the environment into account when changing their mode of transport and only a few (2%) mention that they will change the mode of transport for economic reasons or cost savings. As might be expected, 75% of those who responded to cost savings as a reason to change the mode of transport have a lower average salary and shorter distances to their places of work or study.

After this analysis, it is clear that the most important reason why people expect to change their mode of transport is related to safety. This may be due to the inability or greater difficulty in maintaining the recommended physical distance on public transport, such as the metro, bus or train, and the insecurity that car sharing presents to users due to issues of disinfection and cleanliness. It will be important for public transport to implement protocols and capacity limits that ensure the health of the population and disinfection and cleaning systems for car sharing.

COVID-19 has brought about many changes in people's lives. One of these changes is working and studying remotely. COVID-19 has challenged countries' economies and businesses, forcing them to adapt to new circumstances. More than 68% of those surveyed in the city of Madrid have had the opportunity to work remotely. Almost 53% of the people surveyed would like to work remotely part-time once restrictions are lifted after lockdown ends. 19% said they would like to work remotely daily and 21% prefer to attend the workplace. This allows us to rethink the way we work and study and the potential to shape a future with more flexible schedules and less travel demand/time.



TIMES OF THE CITY

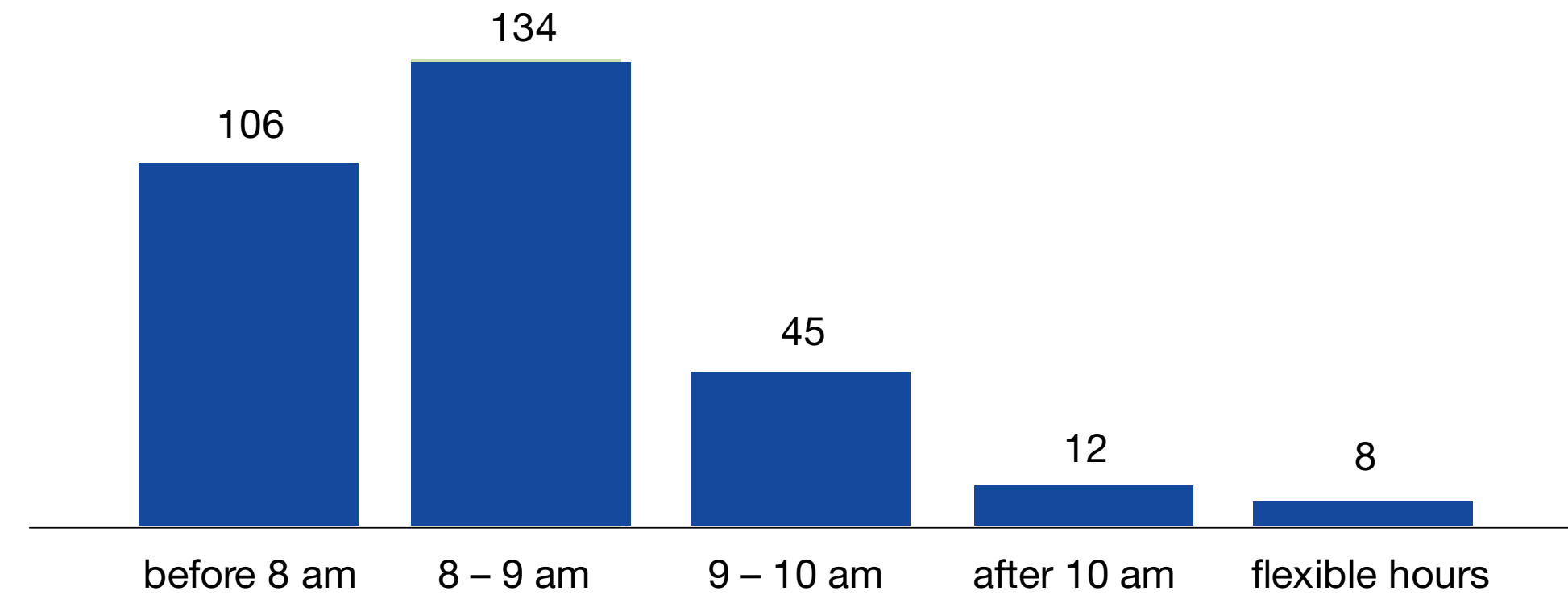
The peak hours in the morning for those who go to work and study in Madrid are before 8am and up to 9am. This is similar to Milan but with a slightly higher percentage of the population in Madrid leaving to work or study before 8am.

It was found that the majority of people in Madrid leave work before 6pm. This may be due to the common 9am to 3pm working shifts in Spain. A small percentage of the respondents are able to work flexible hours without following a strict working schedule, but working flexible hours seems more common in Milan where almost 12.5% are able to do so, compared to less than 6.5% in Madrid.

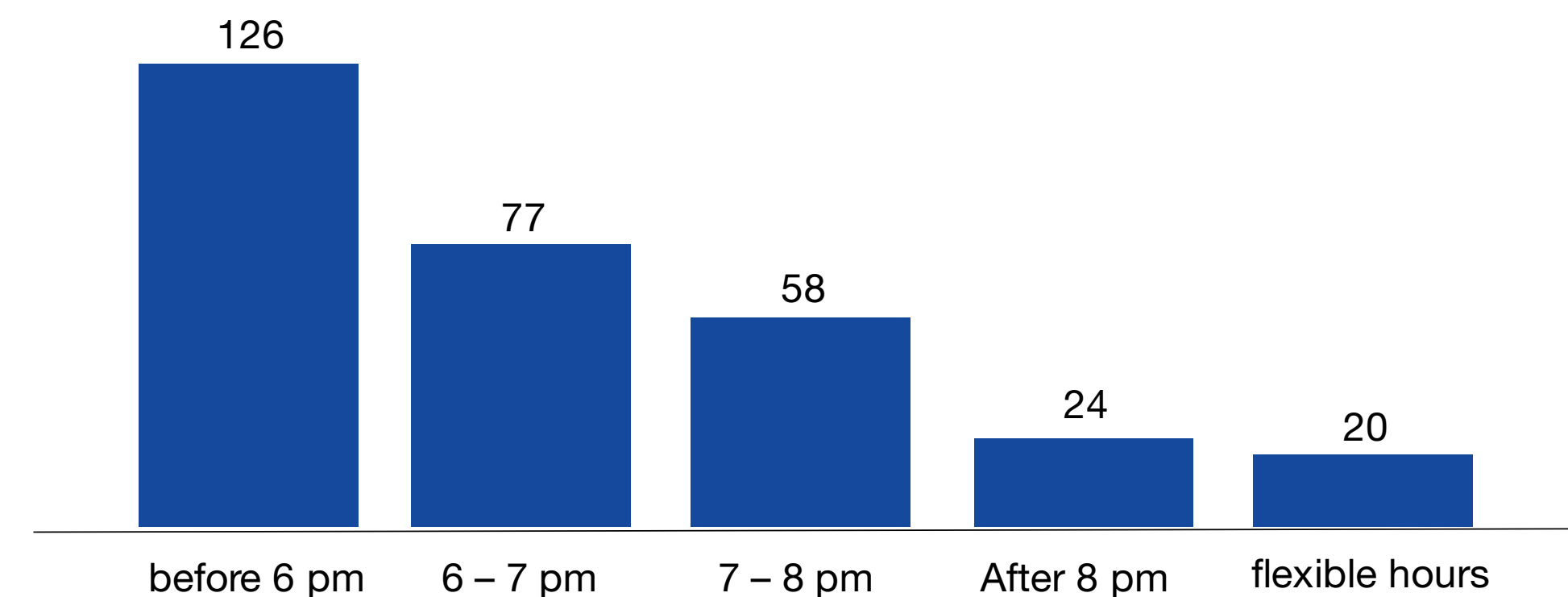
Most people spend less than 1 hour commuting in Madrid. Milan and Madrid present similar commuting times where the vast majority of those surveyed spend less than 1 hour per day commuting. Can this be thanks to a good public transport offering and well-connected areas of the city? What will change if people are reluctant to use public transport? Travel times may increase with modal shifts causing road, footpath and cycleway congestion.

Or does it mean that people in Madrid prioritise living close to their work and study locations even though it presents a higher cost of living? If more people start working from home, will this change the pattern of living in the city centre?

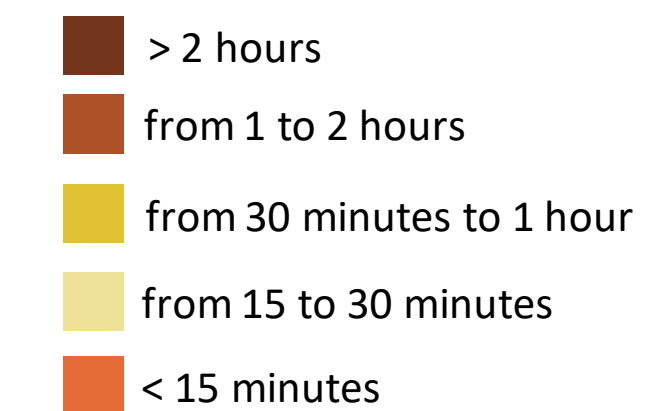
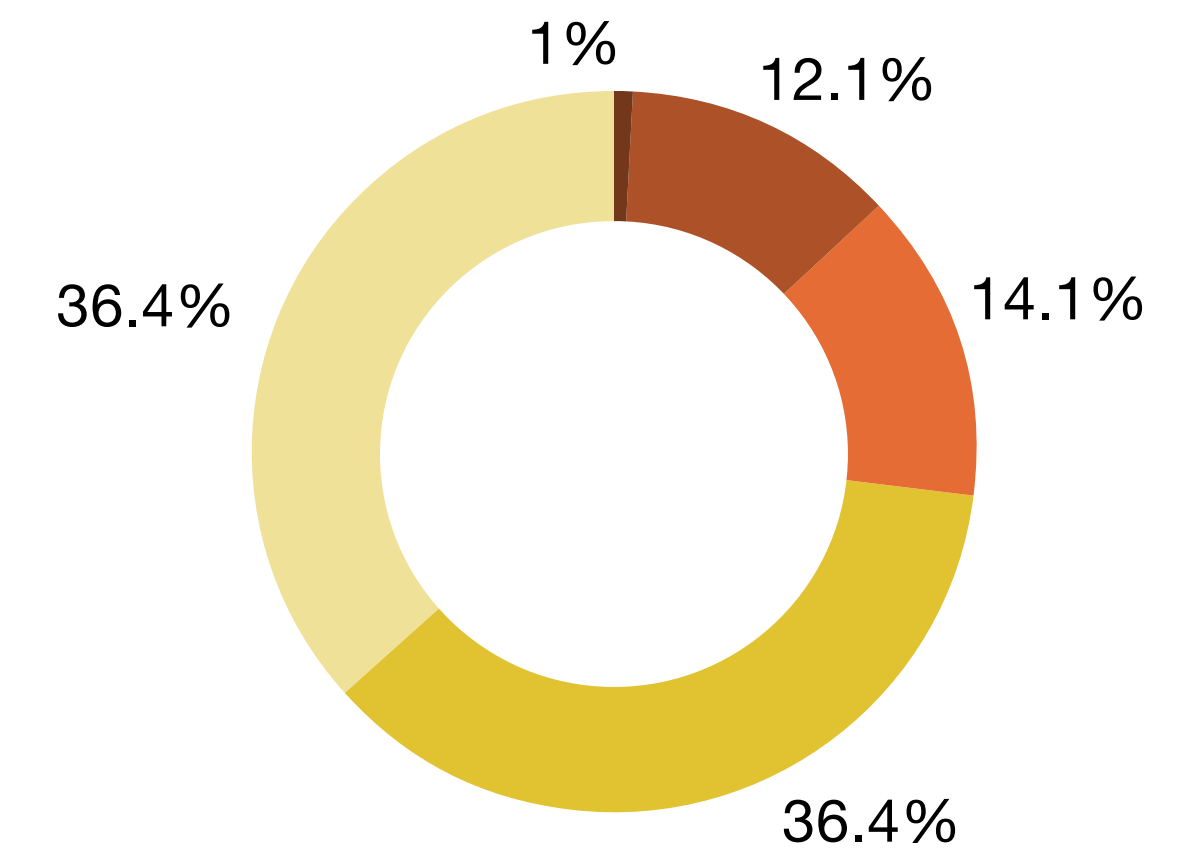
WHAT TIME DID YOU GO TO WORK/STUDY BEFORE COVID-19?



WHAT TIME DID YOU LEAVE WORK/STUDY BEFORE COVID-19?



HOW MUCH TIME DID YOU SPEND COMMUTING DAILY TO GET TO AND RETURN FROM WORK/STUDY BEFORE COVID-19?



Understanding the change

DUBLIN

After concluding a detailed analysis, it has become clear that Dublin presents different data and statistics when compared to the cities of Milan and Madrid. Dublin is significantly smaller in population and geography, has far less density, and much more distributed employment.

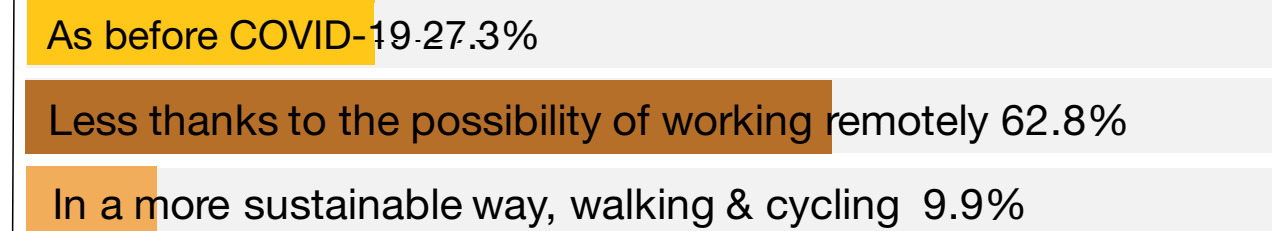
It is also worth noting that Dublin is the only city studied in this research where its population did not experience a total lockdown or restrictions as severe as the other two cities. Milan and Madrid experienced total mobility restrictions where its citizens were only allowed on the streets to fulfil essential needs, such as going to the supermarket to buy food or for health emergencies. Dublin is also the least severely impacted by COVID-19 out of the three cities in this study, which leads to believe that its population and mobility were impacted the least.

The survey collected relevant data from 121 respondents – providing information about transport behaviour. There are some limitations due to a smaller representation of different groups.

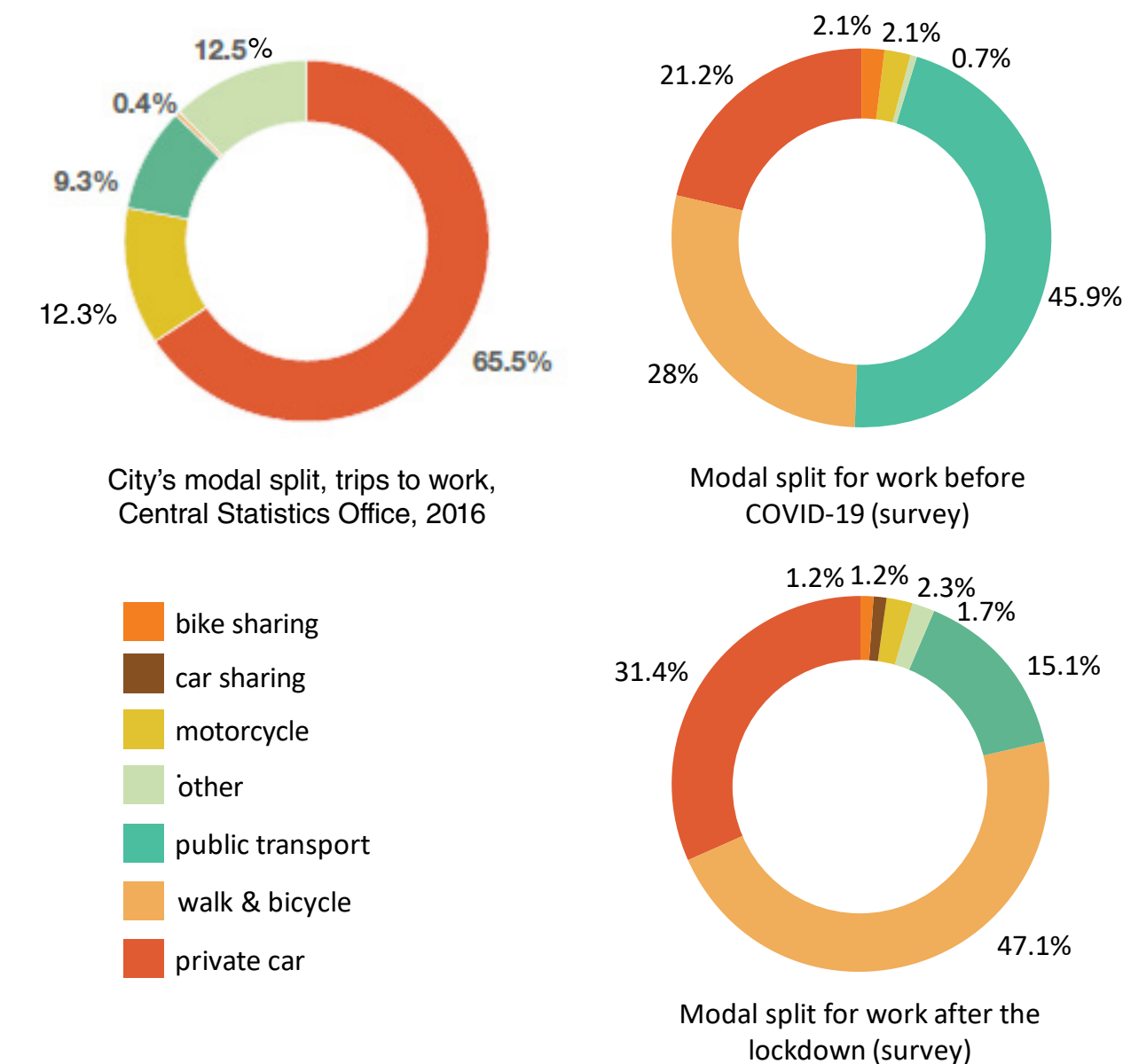
The change in modal split due to COVID-19 and the reasons for that change are explained in this section. The new mobility trends that Dublin displays differ significantly in some modes of transport than the results shown in Milan and Madrid.

Before entering the analysis, the following is worth noting regarding the distribution and diversity of the people surveyed:

- As opposed to the other two cities, males have a higher representation of the total respondents than females.
- The vast majority of respondents (49.6%) are between the ages of 25 and 34 years old.
- Almost 45% of respondents work for the construction sector. Adults without children represent the most common household composition (44.6%).



Expectations of movement after COVID-19



CHANGE IN THE MODAL SPLIT

The city of Dublin presents more differences in the modal split trend in comparison to the results in Milan and Madrid. Dublin data shows a downward trend in the use of public transport, but the decrease is less significant than in the other two cities. In Dublin, this drop is just over 40%.

Micro mobility displays the highest trend with over 80% of respondents citing this mode as their preference. Use of private car was the preference for over 40% of respondents. In a city where it rains an average of 150-225 days a year and the average temperature ranges from 5°C to 15.5°C, it is surprising to see that biking or electric scooters are among the top preferences. This could be a cultural matter, e.g. Dubliners being accustomed to this kind of weather or setting different priorities for the mode of transport they use. This could also be due to the challenging road network in Dublin city, where it is very common to experience congestion, resulting in longer commuting times.

When asked why they expect to change their mode of transport, almost 65% stated that this is due to health reasons. Only 11% take into account journey time savings, of which 60% are men. Taking account of the environment and sustainability, only a little over 7.5% intend to change their mode of transport.

Almost 63% of respondents stated that their mobility will probably reduce post-pandemic due to working remotely. Only 10% cited sustainability and the environment as reasons for a reduction in travel.

Regarding mobility, 27% responded that this will remain similar in a post-COVID-19 scenario in comparison to their behaviour before lockdown.

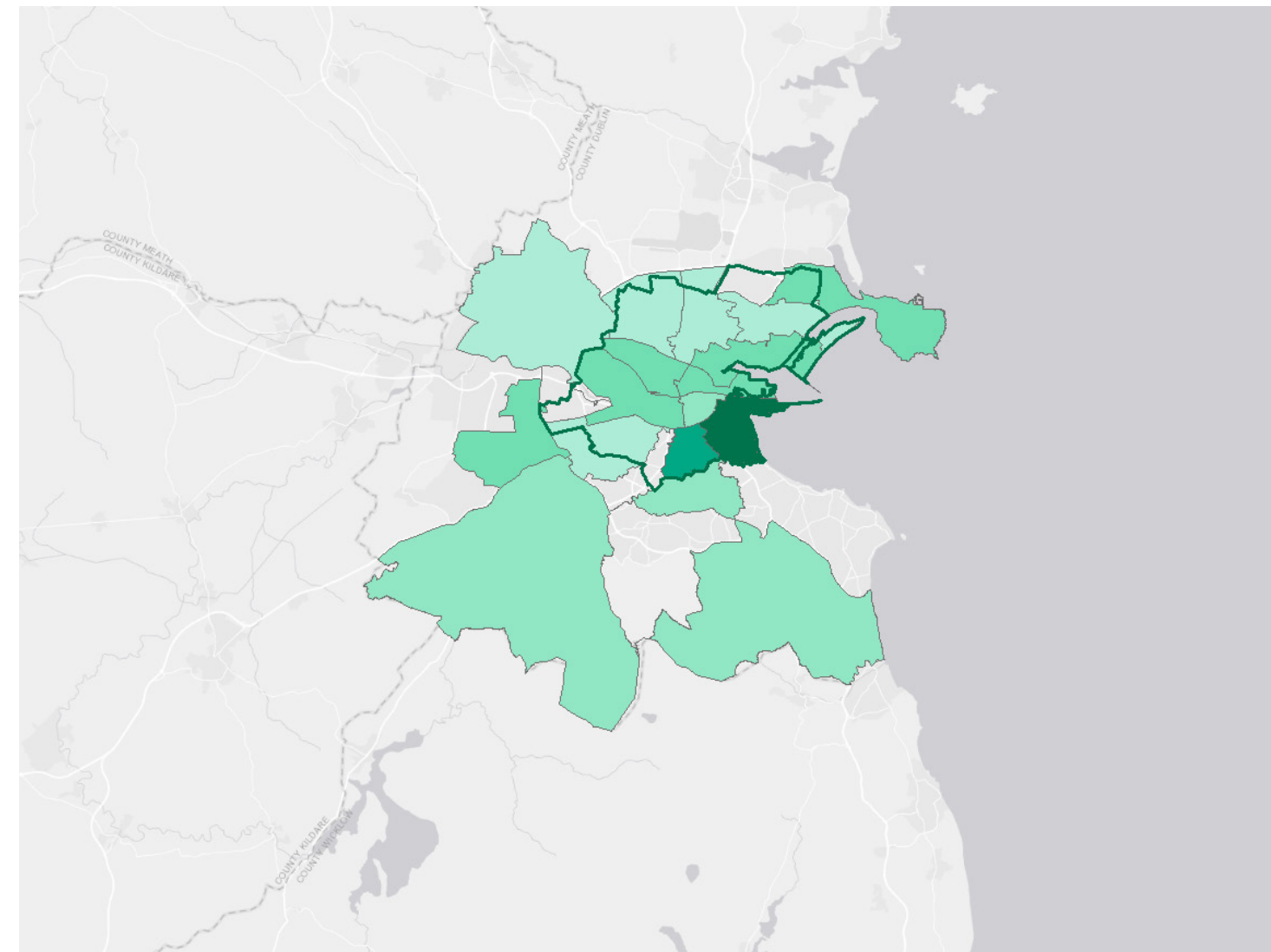
Of those surveyed in Dublin, 87% were able to work from home. Out of those, over 65% would like to work from home part-time and more than 24% would like to do it daily. Only 8% indicated they would not like to incorporate any element of remote working in the future. This data shows a similar tendency to the cities of Milan and Madrid. COVID-19 has forced many to work remotely, with flexible working hours causing a possible revolution to the way we work today due to the push for digitalisation in just three months. This digitisation seemed unthinkable just a few years ago. While people's perceptions of flexible work practices seem highly positive at the moment, caution is required due to these exceptional circumstances. Further studies are needed to forecast longer term trends.

NEW GEOGRAPHIES

The analysis of origin destination has provided data identifying the geography of movements in Dublin. This analysis helps to understand the correlation between where people live and where they work/study and to target areas of the city that need good mobility networks to satisfy the demand.

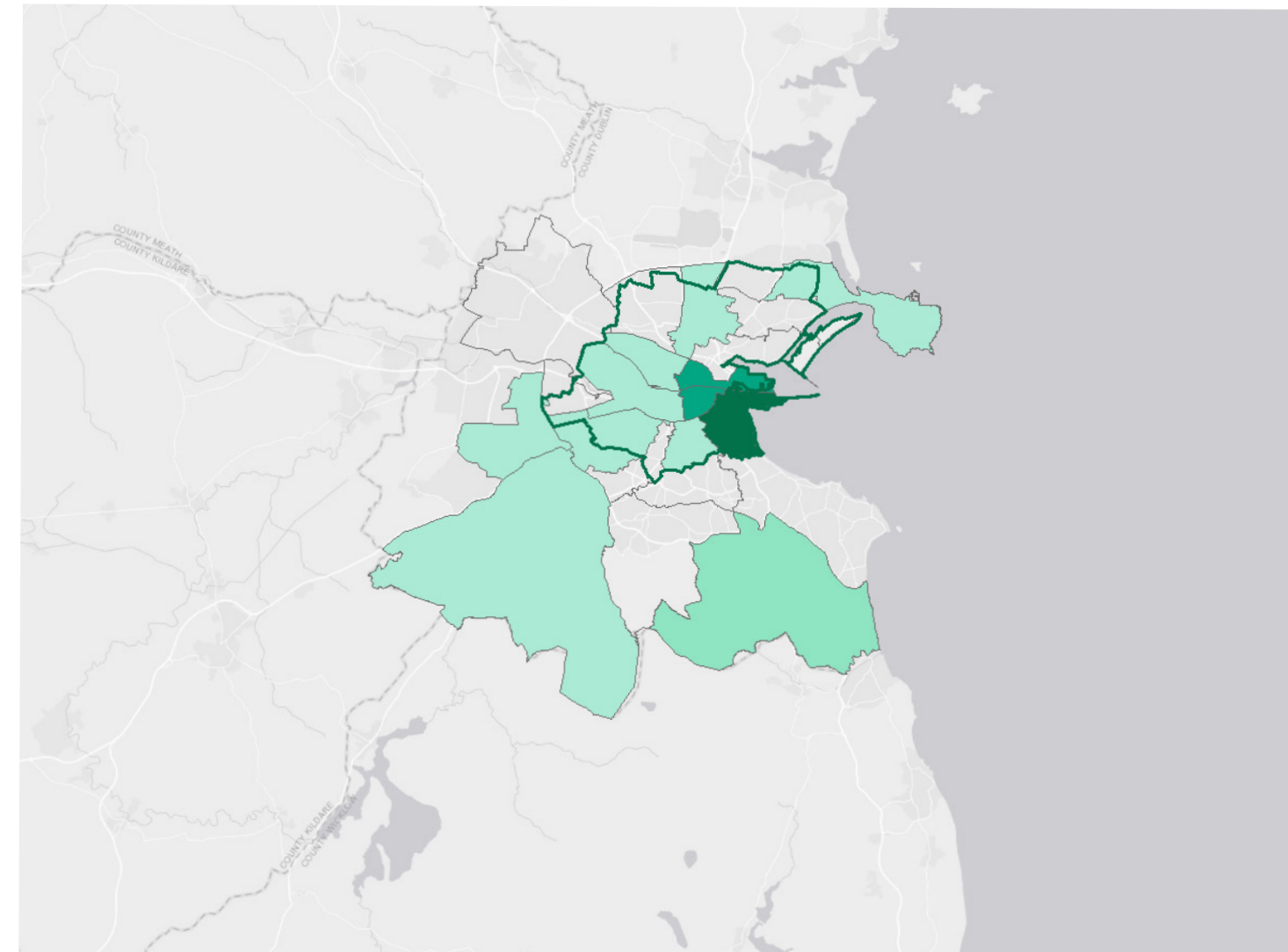
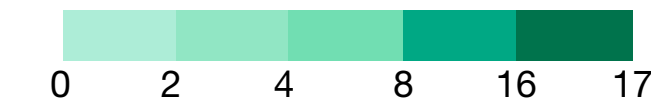
In Dublin, 62% of respondents live within 10km of their work/study locations and 11.5% live over 20km away. It is important to remark that Dublin ranks negatively at 35th position out of 38 cities in a traffic flow and congestion rates study completed by Urban Mobility Index. Dubliners spend the most time on the road compared to Milan and Madrid, which indicates that distance to work is not the main issue, but the time spent on the road due to congestion and traffic flow is. Later, it will be shown how micro mobility seems to become the main trend of transport for Dubliners, despite being a rainy and humid city. It seems Dubliners avoid congestion by not being part of it, although COVID-19 will challenge this due to concerns about using public transport. Can congestion be solved in Dublin if less people are using public transport? Can micro mobility or other similar transport solutions supply the demand for efficient mobility? Will the many new cycleways increase the micro mobility trends further and open opportunities to solve or reduce the congestion issue?

The forced introduction of remote working has pushed Dubliners to reduce their travel habits. This becomes a fundamental aspect to consider in future scenarios, including Mobility as a Service (MaaS) or the reshaping and supplementation of the city's transport network.



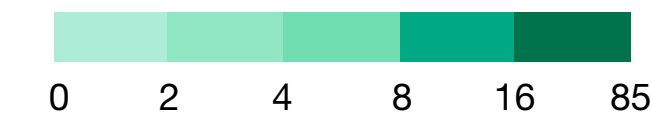
ORIGIN OF THE RESPONDENTS' MOVEMENTS, PLACE OF LIVING

number of respondents



DESTINATION OF THE RESPONDENTS' MOVEMENTS FOR WORK/STUDY

number of respondents

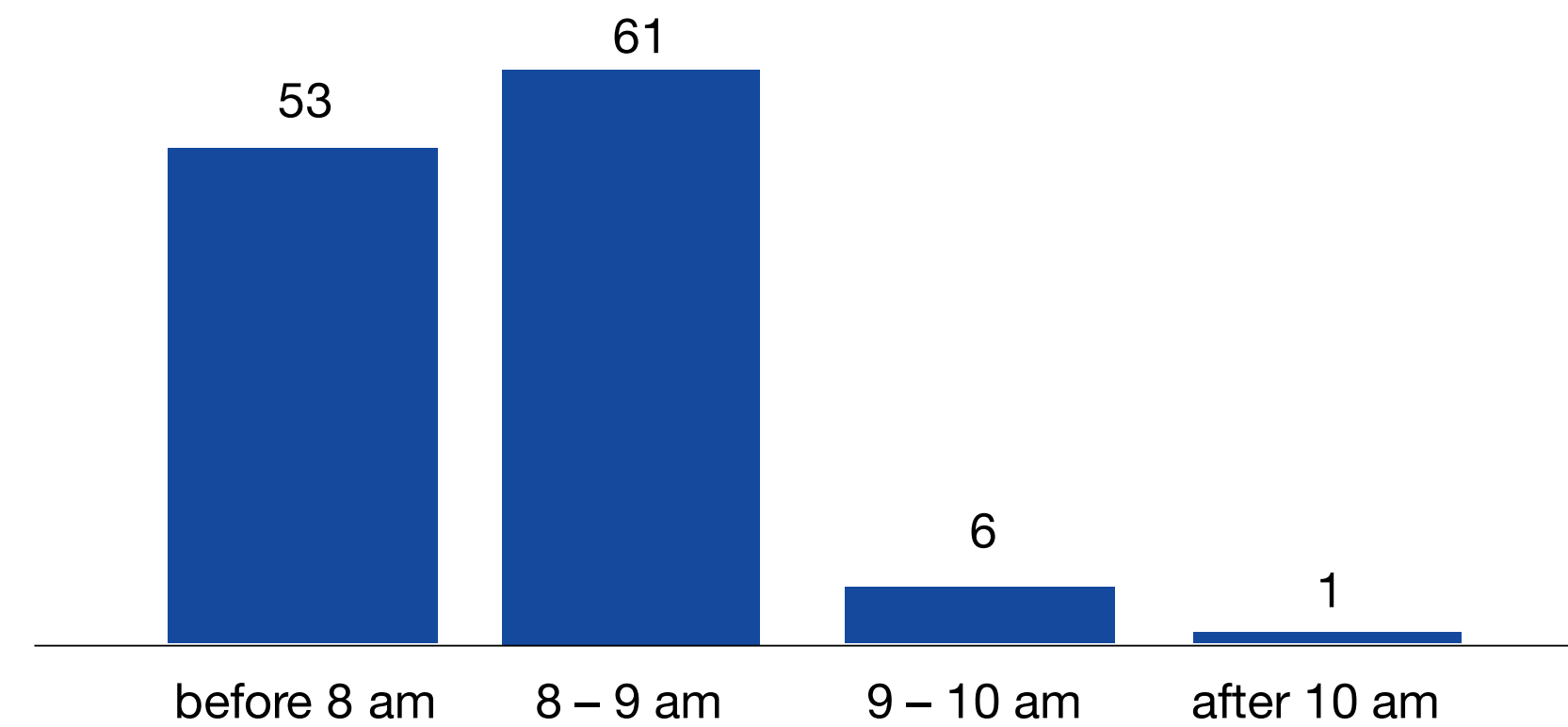


TIMES OF THE CITY

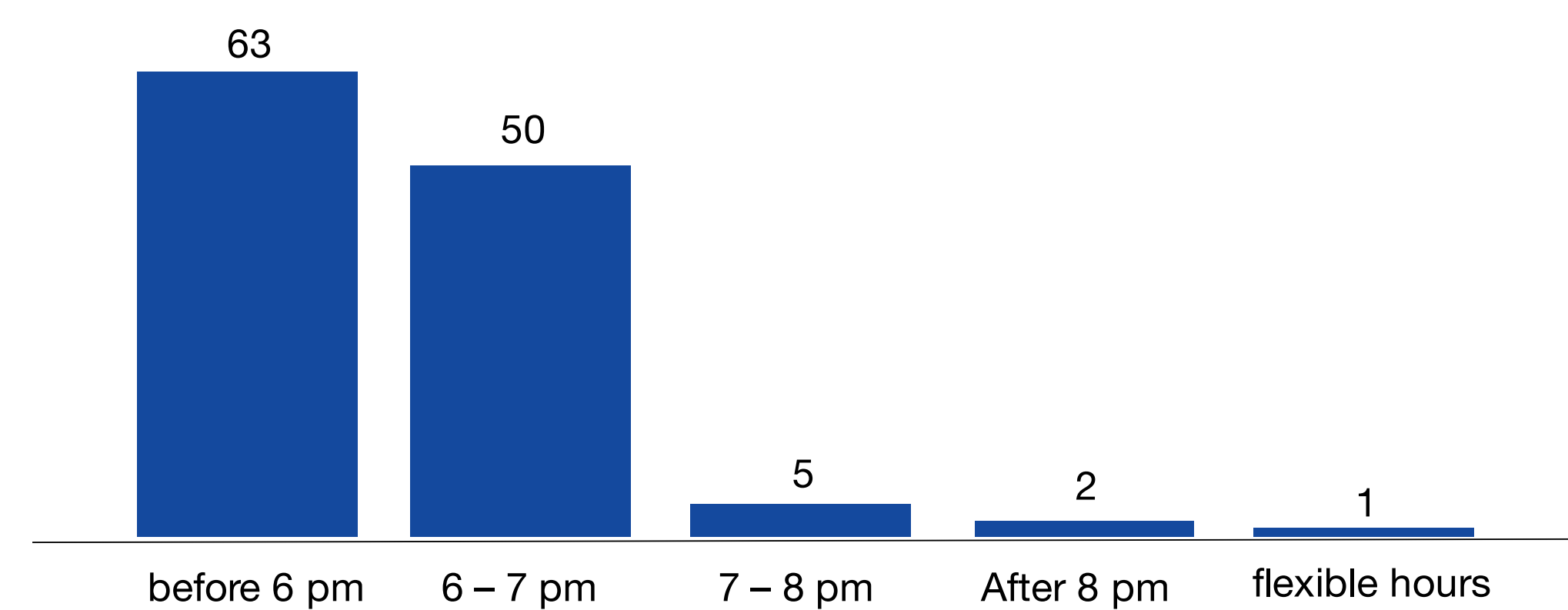
Dublin's peak hours follow the same fashion as Milan and Madrid, but with fewer numbers of people working flexible hours. What could be the reason for Dublin to display such a low representation of people working flexible hours? Is it company and employment policies? Or could it be something more cultural and related to Ireland's living habits? Or simply that the technology platform hadn't been tested before lockdown and that there was no real experience of the benefits?

When looking at time spent commuting daily, many Dubliners use less than an hour to get to work or study, but a much larger percentage than those in Milan and Madrid spend over an hour commuting. Over 37% of those in Dublin spend a lot of time to go to and return from work, while barely 26% do so in Madrid, but why is this happening? Is this due to a lower public transport offering or the quality of the road network? It is worth noting that Dublin is the only city of the three that does not have a metro or underground. But it also has a much lower density and it does not have a dominant central business district. Can a metro network make such a big impact in a city like Dublin as it grows? These questions allow us to think that further consideration and data is needed to reach conclusions, but definitely opens the door for discussion and provides insights into the city's mobility trends.

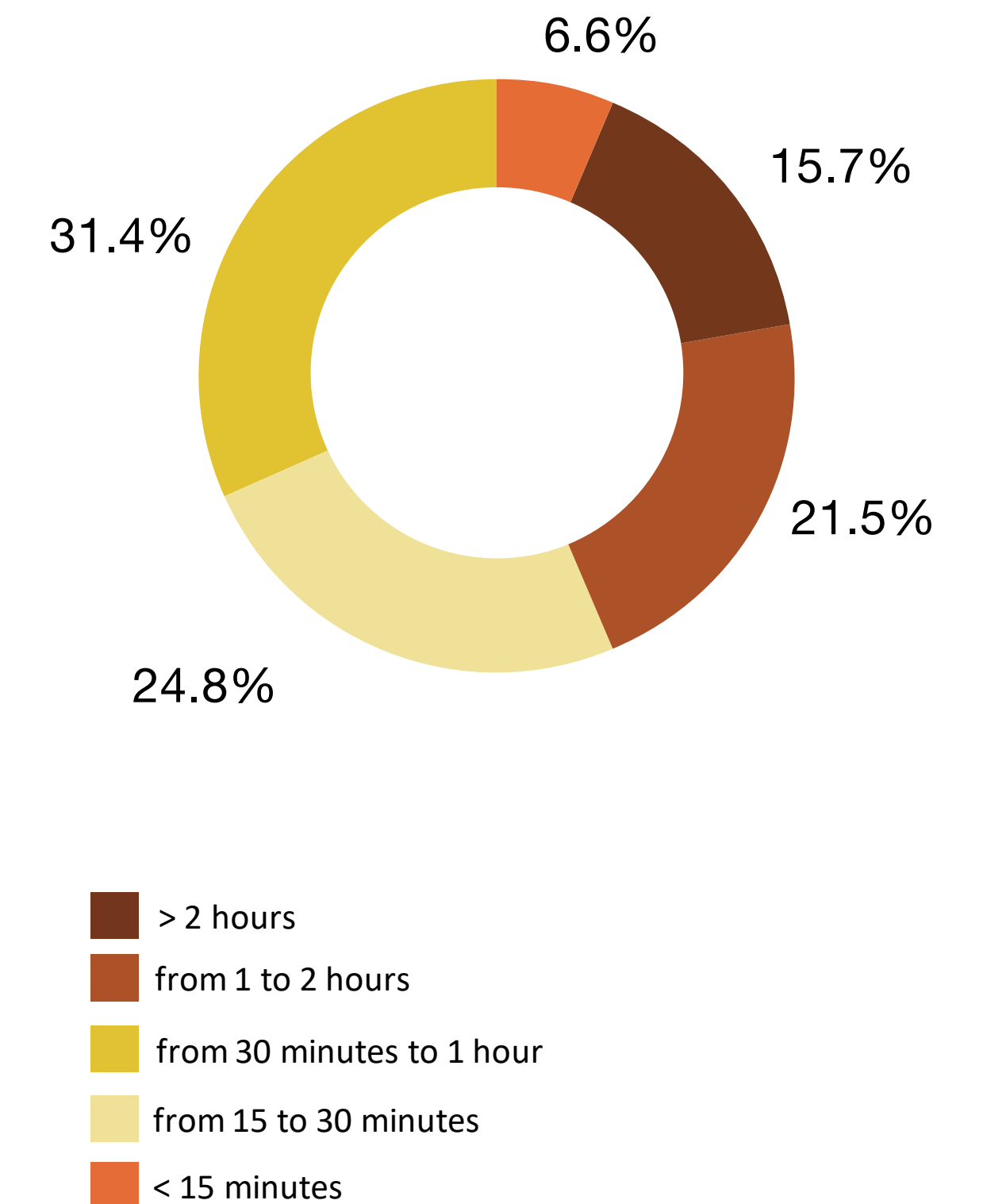
WHAT TIME DID YOU GO TO WORK/STUDY BEFORE COVID-19?



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HOW MUCH TIME DID YOU SPEND COMMUTING DAILY TO GET TO AND RETURN FROM WORK/STUDY BEFORE COVID-19?



Overall comparison

MILAN - MADRID - DUBLIN

Once the results of the three cities were analysed individually, we proceeded to group all the answers, while maintaining the same criteria for the joint analysis.

The result is the analysis of 854 responses, which gives a more comprehensive view of the trend in the choice of transport mode after the pandemic.

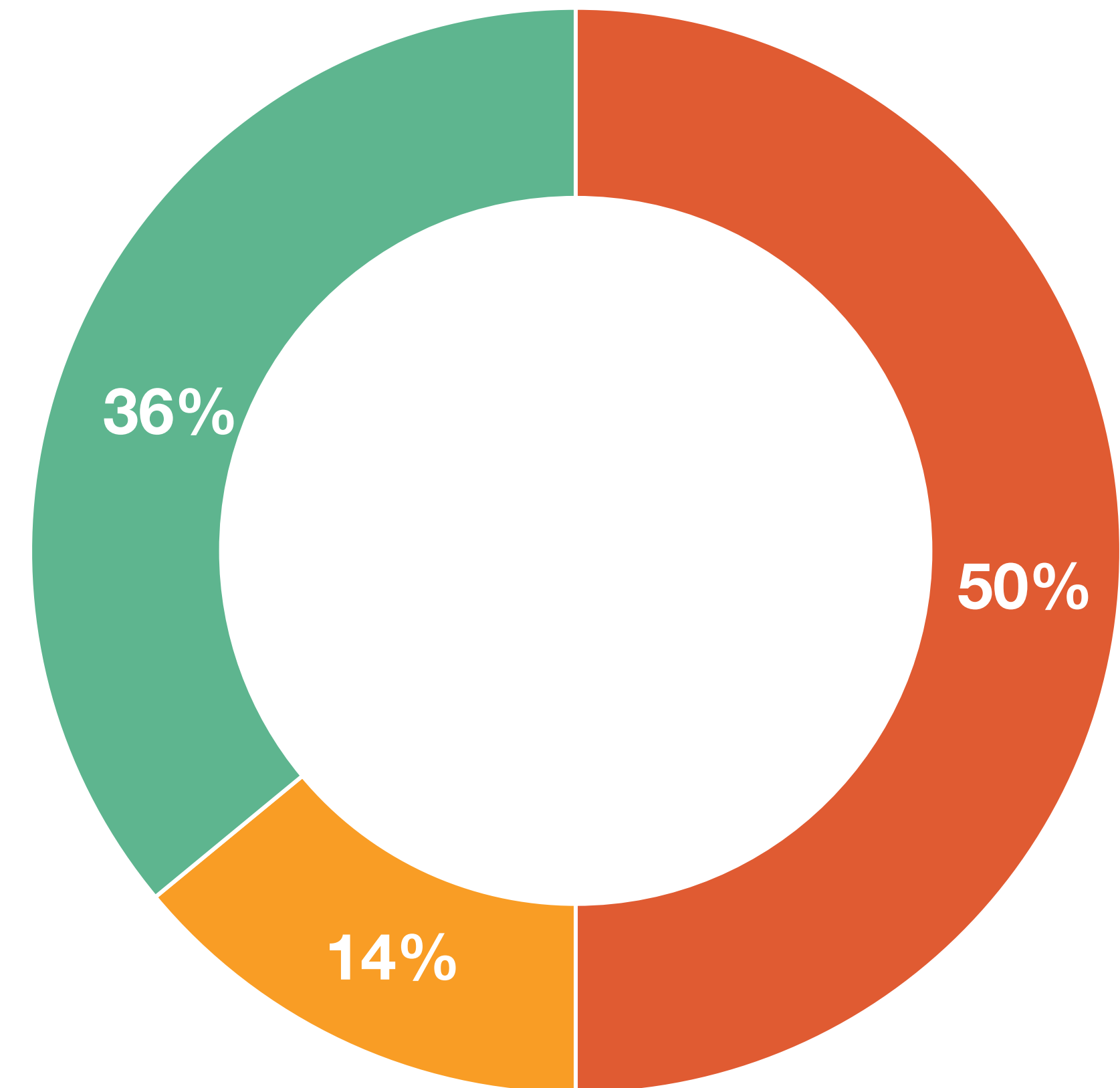
Public transport, as identified in the individual analyses, continues to show a strong downward trend.

42% of respondents said that the change in choice of mode of transport is due to health issues, while 5% do so to save time on their journeys.

Nearly 40% of total responses estimate that their mobility will remain the same once the restrictions associated with the pandemic have subsided. Some 44% of respondents say that their future mobility will be reduced, probably by remote working.

Following the findings of the three separate surveys, strong increases are identified in people's expected mobility in terms of walking (+102.3%), use of micro mobility (+96.1%) and use of the private car (+69.7%).

Micro mobility is shown to be the most popular option for people who declared to travel to their places of work/study five days a week, with journeys lasting up to 30 minutes. The use of a private car is more common among users who have longer journeys and who go to their places of work/study five times a week. Walking is also a strong trend for those respondents who make short or medium length trips to their destination.



ORIGIN OF THE SURVEYS



3 CITIES



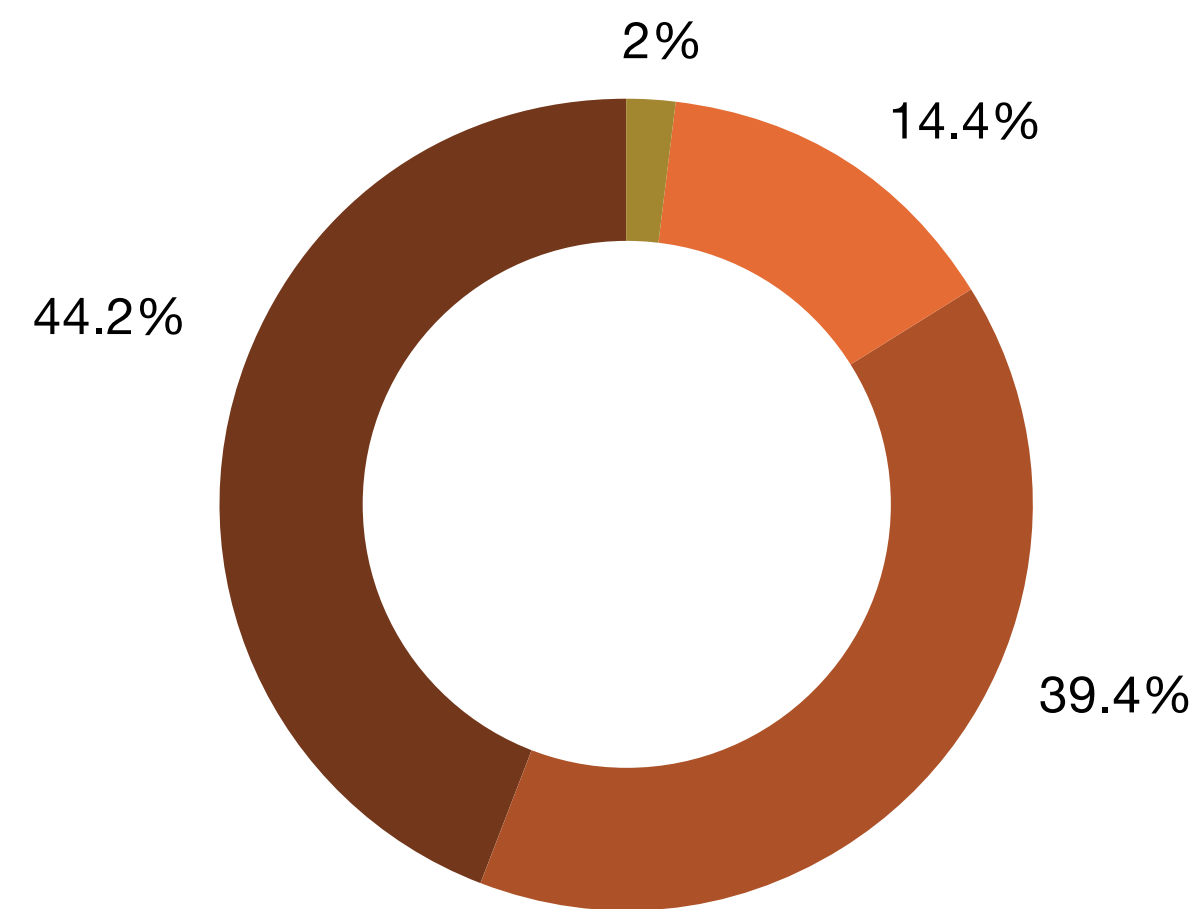
854
respondents



69.5% of respondents changed their mode of transport for safety reasons

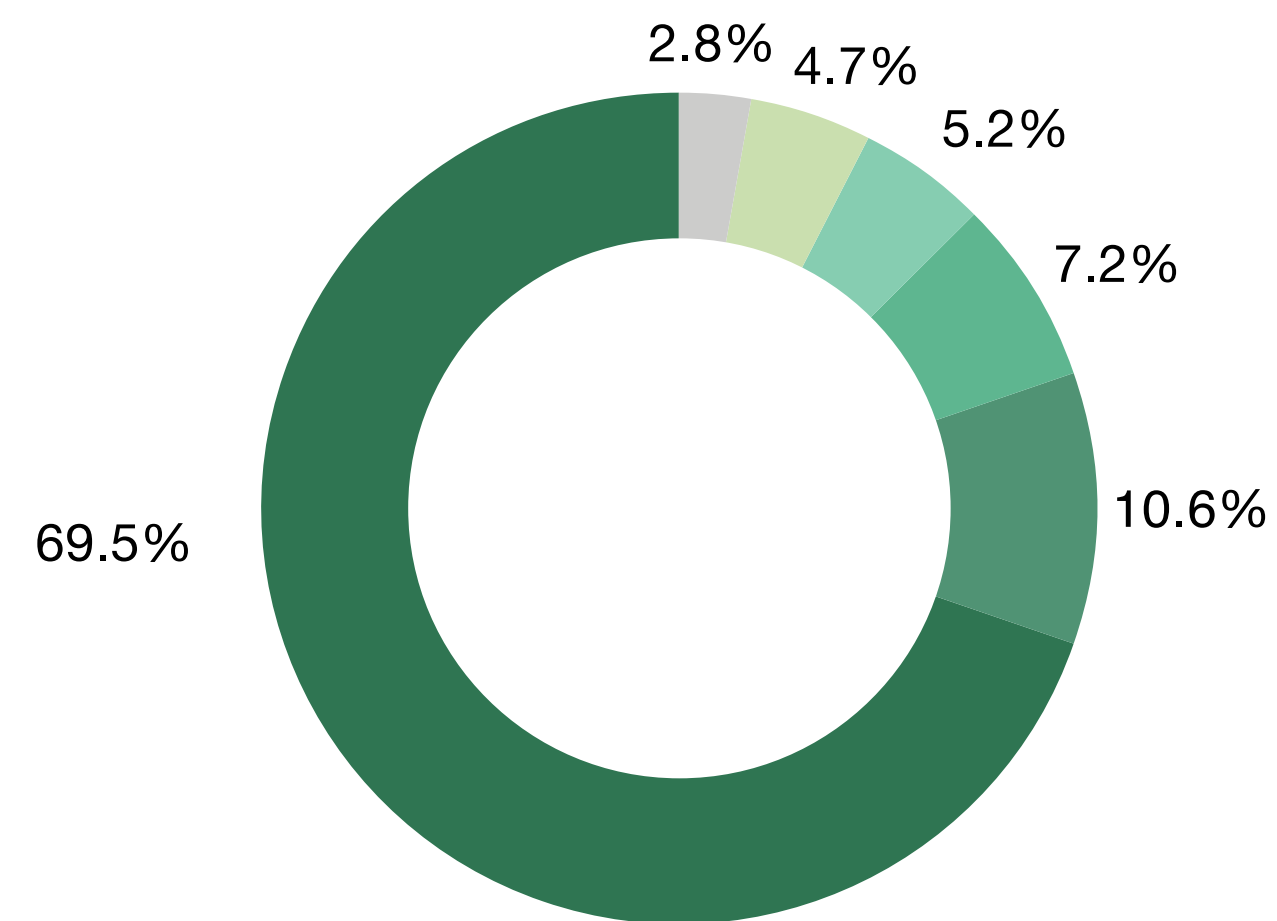


70.3% of respondents were able to work remotely



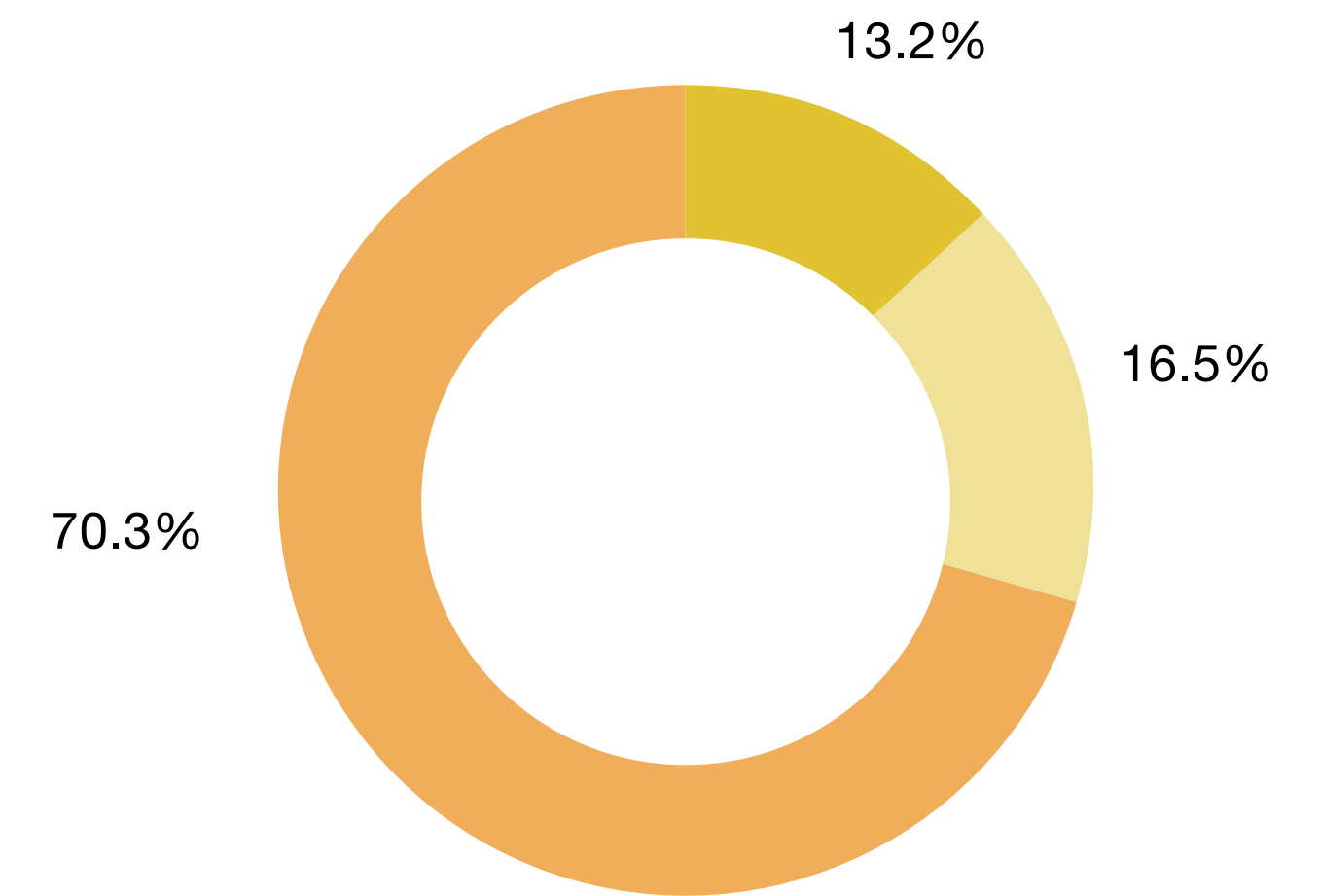
FUTURE MOBILITY

- Don't know
- Mobility will be reduced and more sustainable
- The same as before COVID-19
- Reduced due to being able to work remotely



REASONS FOR CHANGING MODE OF TRANSPORT

- Cost savings
- Reduction of public transport's offer
- No change
- Environmental driven
- Time savings
- Health driven



ABILITY TO WORK REMOTELY

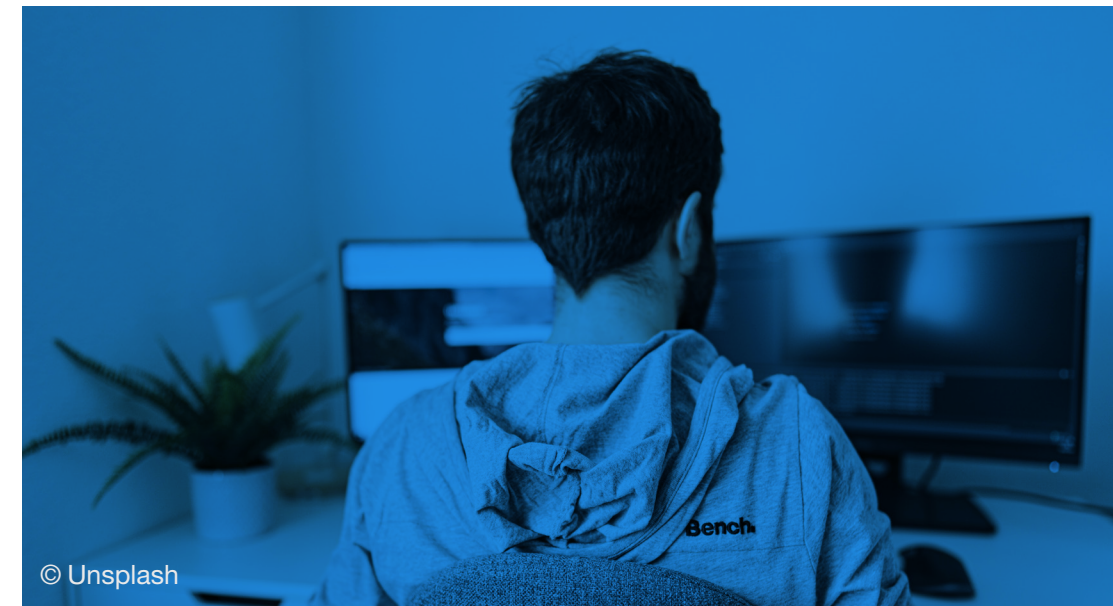
- Not able to work from home
- Does not apply due to working on shifts or other reasons
- Able to work from home

FUTURE CHALLENGES AND OPPORTUNITIES



REDUCTION IN PUBLIC TRANSPORT

In the cities surveyed, a common aspect identified is the reduction in using public transport in a post-COVID-19 environment, in favour of more sustainable modes of transport, while also maintaining the use of private cars. Not surprisingly, the principal reason that guided this shift relates to health and safety issues. Most respondents (69%) feel uncomfortable using public transport. Therefore, how do we encourage the safe use of public transport? This represents a major challenge that cities should consider carefully in order to prevent traffic congestion, while continuing to guarantee proper connections with close external municipalities without relying on the use of private cars.



INCREASE IN REMOTE WORKING

Another common trend, observed in the three cities, relates to remote working. The majority of respondents were able to work remotely; and the large majority would like to continue working from home in some respect after the end of the pandemic. In particular, 54% of respondents highlighted their preferences for working remotely part-time. Thus, COVID-19 has forced governments and businesses to shift towards a more digital world, but are all sectors ready to make this change? How do we support public and private companies in promoting this transformation? What kinds of legal and business arrangements do urban areas need to facilitate in order to change the current situation? Which public and private stakeholders will be involved? The predisposition for working remotely represents a major opportunity for cities to change and diversify their times, preventing peak hours and making movements safer.



MOBILITY HABITS WILL CHANGE

In the three cities, another common thought – connected to increases in remote working – is that mobility habits will change in the future. The large majority of respondents (44.8%) believe that remote working, and a higher concern for environmental issues, will lead towards a reduction in mobility in comparison to the situation before COVID-19. This is an interesting finding, confirming that the majority of respondents anticipate and are prepared for a change, opening the possibility for cities to propose novel and challenging solutions. Therefore, how can planners and designers support cities to take advantage of this opportunity?



MICRO MOBILITY AS AN OPPORTUNITY FOR FURTHER DEVELOPMENT

The use of micro mobility differs in the three cities analysed; however, some of the respondents indicated an interesting opportunity to better differentiate mobility offerings. In particular, electrical bicycles and scooters would contribute to preventing the increase in the use of private cars and, consequently, enhance the environment. However, this poses a major challenge in relation to system coverage and extension, in particular considering exchange movements from cities to the closest external municipalities. Thus, considering that safety emerged as the main reason for changing the mode of transport, how do we promote micro mobility to encourage safer and more efficient mobility for people and the environment? How do we ensure that long distance commuters can also take advantage of micro mobility modes?

DISCLAIMER

The results of the surveys in Milan, Madrid and Dublin are limited by the following factors:

STRATIFICATION OF THE SOCIAL SAMPLE AND SELECTION BIASES:

As the survey was distributed online, some social groups did not appear in the results. The survey reached people with similar socioeconomic profiles, which justifies the selection bias of the study sample and does not include a stratified sampling by population groups.

SAMPLE SIZE - NUMBER OF RESPONSES:

Because the number of valid responses obtained in the Madrid (305) and Dublin (121) city surveys is low, the sample analysed may not correctly represent trends in public transport mode choice during the COVID-19 pandemic, and the results obtained cannot be used to accurately infer future behaviours of representative social groups, although they can be used as likely indications of modal choice.

DECLARED PREFERENCES:

The responses we obtained on how respondents anticipated their mobility after COVID-19 are stated preferences (future), not revealed preferences (verified and contrasted based on past data) and have taken into account the pandemic scenario at the time of responding to the survey. Since the duration and course of the pandemic may vary from initial forecasts, responses may also vary in the future.

CONCLUSIONS:

Considering the limitations mentioned, this research work does not represent a scientific study that can be considered to determine the population's behavioural trends regarding choice of public transport mode during the COVID-19 pandemic. However, it clearly defines a direction worth considering in policy shaping and determining future measurement of potential behaviours.

OVERWEIGHTING OF TRANSPORT RESPONSES:

In those multiple choice questions about the modes of transport used before and after the COVID-19 pandemic, no weights have been defined to differentiate the main modes of transport from the alternative or optional ones, so the analysis considers all of the answers with equal weight. In order for it to be possible to provide different weights, the survey would have asked with some complexity about, and differentiated between, main modes of transport and those that are used alternatively.



SECTION 2

Flattening the (peak demand) curve



THE 21ST CENTURY ROUTINE

Like clockwork, we reliably ready ourselves and engage with the day, travelling to work and education at peak times. We collectively create congestion, crowding and costs – punishing ourselves, our taxation systems and our society. The majority don't enjoy it; however, every weekday, we proceed to do it all over again. And, we then repeat on the way back to our sanctuary of home, where we collapse in exasperation at the effort of movement.

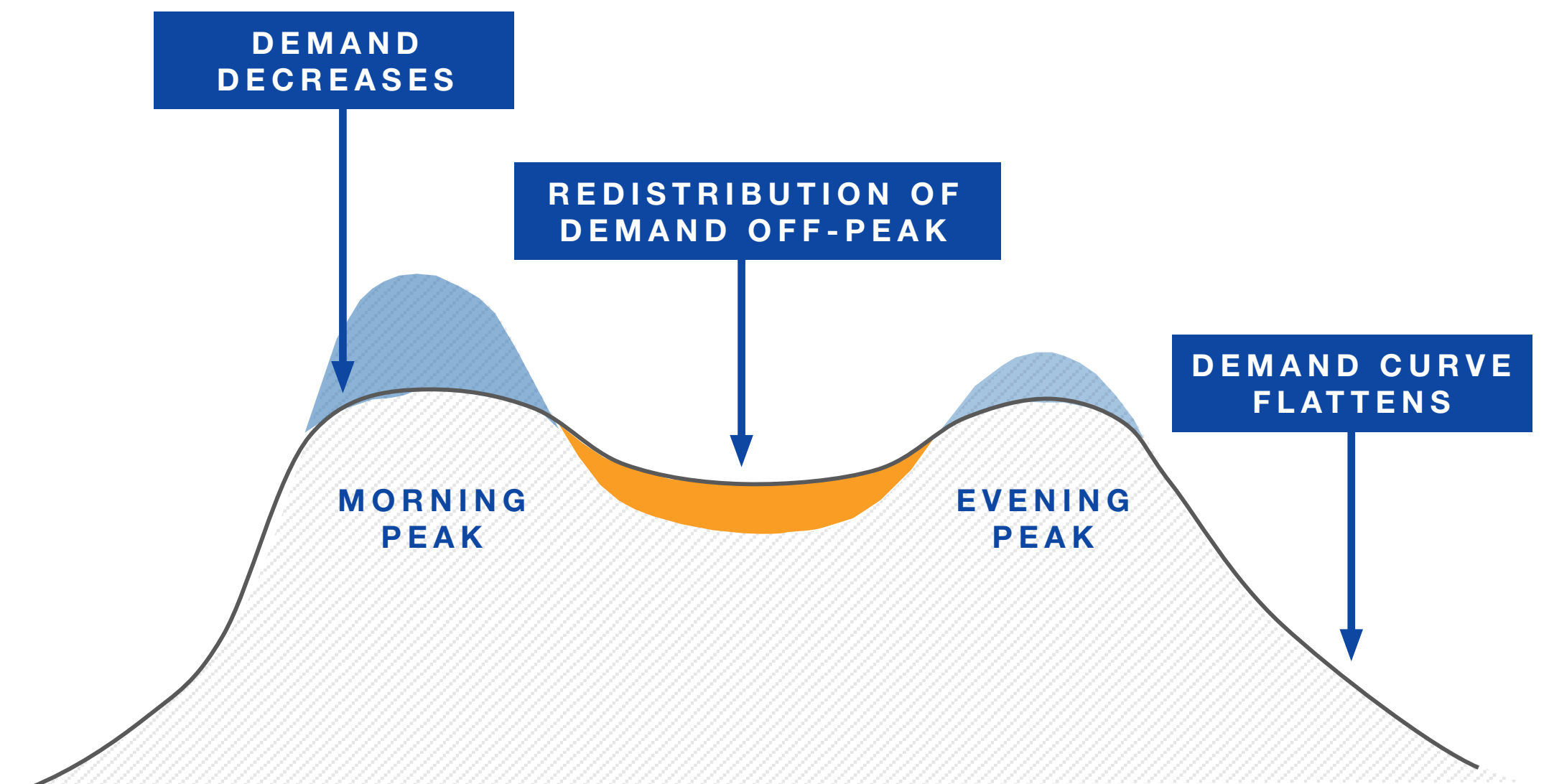
It is very difficult to change what is an international habit, no matter how bad, until we have to...and suddenly we have more time, less stress, lower costs, less pollution and our sanctuary becomes multi-functional. Lockdown removed the dominant traffic, causing cycling and walking to flourish.

As lockdowns lift, we have new choices to make. Do we keep cycling and walking? What about the cars? Can we be safe on public transport and do we have a choice? Should we take the plunge and drive on the less congested roads, despite the cost, for our health? Should we do it in the same rhythm again – the mythic return to “normal”.

What if normal meant the commute was a few days a week, and only when it was more useful to be at work than at home? What if you travelled outside the peak if your situation enabled it? The knowledge workers could modify their routines to start later and end earlier in the physical office and spread their day with some virtual work as well. Freeing the network for those who have to travel to provide key services would be an act of solidarity.

Rather than struggling to change the times that schools operate or the core functionalities of systems with hundreds of major stakeholders having to align, instead, allow the flexibility for those for whom travel time is really optional to exercise that option.

Could we then take those resources needed for just a few hours per day and redistribute that public investment to provide a better, more regular, more reliable and more available set of services?



Note: Hypothetical scenario of travel demand redistribution. By flattening the curve, we could optimise the infrastructure already in place while providing a better service all day long.

NEW HABIT(AT)S

We have had 90 days or more of adapting rapidly to new situations, and it seems we have done so effectively for those able to continue working remotely. While the economic devastation has been global, it is uneven. For many people who work using computers, driving a car suddenly seems unnecessary.

If the common maxim that it takes 21 days to gain a new habit is true, then we have proved that the very rapid advances in cloud computing, video-based communication and working remotely can be sustained. If planned and with proper equipment and frequent human interaction with our colleagues and friends, remote working could even be enjoyable when not constant.

While we might crave the human interaction that we have in the workplace, already we can see that we do not crave the typical crowding of stretched public transport services in peak hours.

The cycling and walking trends have been enhanced in many places, with tactical urbanism delivering separated infrastructure at a rate not previously imagined as possible. Some cities have taken this space which was previously dedicated to the car or its unproductive on-street storage.

The proportion of people who can and wish to work from home, and with what frequency, is still open for debate. That people can and will is not. But when they leave the house for the inevitable access to social interaction, what practices will stick that would be regarded as a good legacy?

As we recover from the pandemic, we will witness the acceleration of some pre-existing trends, as well as some fleeting trends which will vanish.



1. WORKING FROM HOME

COVID-19 has been the greatest working from home experiment of all time. Nearly four-in-ten people in the EU began working from home during the pandemic, a 1,000 percent increase in some countries compared to 2019, despite the ability to telework being restricted to certain types of employment. This situation is showing that working remotely, a utopia for many workers to date, is actually a real possibility. Commuting has never been easier for these people.

Over the last few years, we have seen some companies, particularly tech and start-ups, making use of the latest digital tools and reporting the potential cost savings, even with only a quarter of the workforce at home. This alternative could be a lifeline for companies which, after this crisis, are going through a tough financial situation. Not only can companies benefit from remote working, but also their employees could enjoy greater flexibility and a better work-life balance.

While not every job can be performed from home, around 35%, as per some studies, could. As this percentage depends on the type of work, it would vary across cities based on the distribution of economic activity, but it seems clear that a huge part of this percentage corresponds to 9-5 office workers, or the so-called “white collars”.

If this trend is here to stay, it will have a large impact on our demand curve, as commuting usually represents a huge percentage of rush hour trips. Understanding these impacts and developing potential scenarios will be critical for transport authorities and operators to maximise the efficiency of the existing transport network while flattening the demand curve.

2. SHOPPING FROM HOME

Online shopping was already gaining ground progressively, but with most of the population at home, the COVID-19 pandemic saw it skyrocket worldwide. For those mistrustful or unsure of the technology, familiarising themselves with the vast array of online goods and convenience from the comfort of their own homes has proved revelatory, making it likely that it will prevail beyond the crisis.

The pandemic has hit small businesses particularly hard. Moving online in order to cut costs might be not only the last resort for many, but a smart move. With rents on the increase in city centres and this trend on the rise, maintaining or setting up a new brick-and-mortar shop could be a risky option from now on.

However, it will be difficult to completely replace the personal experience of shopping in-store with the convenience of the internet, and while huge logistic centres and warehouses in the outskirts will increase in number, urban shops will continue offering customers the physical experience in reduced spaces.

Although shopping trips do not generally contribute to the peak, the way this trend will impact travel demand and congestion remains to be seen. While, in principle, it can reduce an important amount of (often) car-based trips, logistic companies will need to re-think their models to ensure that their delivery vans will not clutter our kerbs and city centres.

3. LEARNING FROM HOME

In an effort to contain the spread of COVID-19, most countries around the world have temporarily closed schools and universities, resulting in over 1.3 billion students being out of the classroom. Consequently, the concept of education has had to dramatically change and adapt to these new and unusual circumstances, and it has found in e-learning the perfect alternative.

Online learning has shown several benefits for some students, who now can decide their own timetables, study at their own pace and rewind and revise what they didn't understand from the lectures. These aspects are especially relevant for university students, but for junior and secondary students, remote learning could be a different story. Gaining knowledge is just a small part of going to school for kids, and other essential aspects developed from social interaction with teachers and classmates could not be covered by caregivers at home.

There is great potential for online learning to become an important part of education, and some universities are already moving their 20/21 lectures online. However, there are some key challenges that should be addressed and carefully considered by institutions, including the potential lack of computers, internet or an adequate learning environment and space for students at home.

The way education trips will change will depend on several factors. For young kids, it will be strongly linked to parents' arrangements for working from home and, if these are in place, more parents may choose a school within walking distance from home, increasing active travel and decreasing the impact on peak trips. Secondary and university students may benefit from an uptake in online learning and flexibility, attending only relevant lectures, workshops or tutoring sessions.

4. LIVING LOCALLY

This long lockdown forced us to spend more time at home, making us realise that what may be a convenient place to live may not be the best place to work. If working from home is a new normal, people's location choices may change completely. This may leave "commuting time" at the bottom of the list against the space and quality of life generally offered by a place, which may trigger a shift in values between urban and suburban, disrupting property markets and investment flows.

The movement restrictions imposed have not only made us discover our own homes, but our sometimes-unknown neighbourhoods. While some had relearned the joy of buying local and enjoyed the vibrant sense of community and lack of crowds, others have realised that they don't have everything they need within a 15-minute walk or cycle from their home.

The days of zoning in urban planning, which separates residential areas from business, commercial, industry and leisure, may be over. Soon, cities may be following the lead of Paris or Sydney with their so called "15 and 20-minute neighbourhoods" respectively. These neighbourhoods promise to meet the majority of people's daily needs within a 15/20-minute walk by creating a mix of land uses and housing types connected by safe cycling infrastructure and high-quality public transport.

The redistribution of demand from city centres to local areas will have an impact on employment which may increase locally, further reducing the total number of people commuting. Behind all the benefits of living locally for our quality of life, this trend has huge challenges ahead for urban planning, employment, real estate and especially for transport planning to understand how and when people will move around cities.



PUBLIC TRANSPORT

In cities, public transport is the most spatially efficient and sustainable option to move a large number of people travelling within the same corridor. It plays a key role in improving accessibility for all users, providing people with essential access to employment and social activities. High quality public transport needs to be reliable, frequent, comfortable, safe and convenient. It needs to provide an attractive alternative for those who could be tempted by the comfort of their cars, and an affordable and accessible choice for those who have no other option.

However, this efficiency cannot be achieved everywhere. In those places where demand is sporadic or very widely distributed, such as low-density areas, the private car is the preferred choice and a more efficient mode of distribution when the trip cannot reasonably be achieved by active travel.

Due to its increased frequency, low cost and reliability, public transport usually attracts peak users following a daily fixed travel routine, such as commuters or students. With the rise of new trends which increase people's flexibility and remove fixed routines, there may be a potential decrease in public transport demand, as it may be unable to be responsive to the increasingly changing needs of its users. Unfortunately, other less sustainable modes, such as private cars, may capture these trips due to its inherent convenience, increasing the pressure on an already constrained road network that would struggle with any additional demand.

COVID-19

COVID-19 has caused disruptions in industries around the world, with transport being no exception. In Europe, the use of public transport has plunged more than 80% due to lockdowns, health concerns and physical distancing measures. Even though its demand has dramatically decreased during the pandemic, the pressure on public transport operators has only increased.

In an effort to avoid public transport becoming a hotspot for mass contagion, governments have imposed physical distancing measures, which inevitably have resulted in a huge reduction in capacity, removing the inherent essence of mass transport. These measures, which reduce capacity by up to 90%, have been feasible while people remained at home. However, meeting the demand is proving challenging as life gets back to normal. There is simply not enough fleets available or the infrastructure to operate it to sustain this situation long-term and, while some remote working will be maintained, it is critical to understand how the 9 in 10 passengers who cannot be accommodated would travel.

This lack of "mass" capacity, plus the stigmatisation of collective transportation, is inducing modal shift towards individual alternatives. The question remains whether our cities are prepared for that. Boosting active transport by relocating road space is proving efficient, but prioritising car travel would cause further disruption in our cities. With this in mind, how do we avoid crowding, while meeting the recovering peak demand while a vaccine is developed? It seems essential to enforce the use of masks, but this may not be enough to disregard physical distancing. What if we no longer had the peaks? Changing our routines may sound inconceivable, but we've been doing it for the last few months, and it has been successful.

Promoting working from home or even staggered hours schemes for those who need to be present could be a huge relief for our public transport systems. Additionally, the benefits of flattening the (demand) curve may extend beyond that.

THE NEW NORMAL

As we approach the new normal, there is a huge opportunity to use the lessons from this global crisis to challenge and rethink our transport systems towards a more sustainable and low carbon future.

As more people start working from home, the era of the city with the traditional business districts may become a thing of the past. Cities will need to provide residents with opportunities within their neighbourhoods to fulfil all their needs and, while active travel will be preferred for local trips, a high-quality public transport system would be essential to guarantee connectivity within the city.

Moreover, a new culture of allowing more flexible working models will inevitably disrupt the system by bringing additional choices to people who may now decide their routines on a daily basis. Using these trends to flatten the peak demand should be the target, so we could optimise the infrastructure already in place, while providing a better service all day long.

One of the biggest challenges for public transport will be this resulting fluctuating and unpredictable demand, which may complicate the determination of the optimal and most efficient fleet size. Therefore, the existing models will need new assumptions and calibrations, and scenarios will need to be regularly challenged as we navigate through these uncertain times. Fortunately, technology will keep advancing and public operators should utilise its potential to better understand and forecast the impact of these changing habits on transport demand.



KNOWING NOW IS NOW CRITICAL

Data analysis is already changing the world and has proven to be a game-changer to provide valuable insights in rapidly changing conditions, such as those we've been witnessing in the last few months. Collecting and analysing this data will be key in the new normal to understand the impact of the new trends and provide a high-quality and efficient service.

Through data, public transport authorities could understand their customers' preferences and use of the system, internal performance and operations, mobility patterns and even external conditions impacting the network, such as the weather, disruptions or even a pandemic. This information will be important to decision makers and will be used not only to reduce costs through predictive maintenance, but to optimise the service and enable predictions of changing demand levels.



FIT THE SYSTEM TO THE PEOPLE

If public transport systems were already complex, the new normality may bring an even more convoluted and unpredictable demand across the day and the week – in contrast to what we are used to.

So far, operators have successfully identified demand patterns by using surveys, data and transport modelling, but this may not be efficient in the changing times ahead. The increasing use of smartphones, sensors and ICT are opening a wide range of possibilities to apply Artificial Intelligence (AI) or big data analytics to drive real-time insights and better demand forecasting, enabling operators and authorities to improve a planning process that may become obsolete soon.

AI can provide a new and proactive approach while dealing with volatile demand and travel times, increasing the operations resilience as it can provide predictions and recommendations before a disruption occurs. In the future, AI will also remove the rigidity of the current dispatching process, improving its efficiency and pushing fleet optimisation with real-time corrective actions.



SEAMLESS TRAVEL EXPERIENCE

This pandemic has inevitably raised some concerns among users who now expect agile responses from authorities to guarantee their personal health and wellbeing while using public transport. This situation has pushed forward the business case for the implementation of technology-driven solutions, such as contactless payment, automated infrastructure or crowdedness optimisation, which besides minimising contagion risk are already increasing efficiency and travel experience.

As we move towards a more flexible world, users' expectations will rise, so we need to provide an attractive, reliable and seamless public transport alternative if we want to encourage people to use it over cars. Again, the digital era is providing numerous opportunities to improve the travel experience. Solutions such as real-time push notifications, crowdedness predictions or smart ticketing could improve the overall image, accessibility, efficiency and trust in public transport.



PUBLIC TRANSPORT INTEGRATION

The existing integration of our public transport systems has been put to the test during this crisis. With travel restrictions in place, some routes ran on a reduced schedule, changed timetables or even were suspended. For those with no access to a car and who had to travel, the level of uncertainty and trust in public transport was particularly damaged, especially if they relied on more than one mode.

The increased flexibility of the new normal would require us to improve the entire door-to-door journey, so the sustainable alternative is as seamless as the car. This can be done through the integration of public transport, which has proven to increase user satisfaction, ridership and efficiency.

To achieve this, it would be required to guarantee physical connectivity between modes by planning and designing coherent networks, complementing each other and supplemented by quality walking and cycling infrastructure for first and last-mile trips. Integrated ticketing can provide fare savings and increased ease of travelling when transferring across different modes. Finally, it is crucial to have a single authority responsible for managing and integrating the different modes, including scheduling, smart ticketing and a single app to provide users with a full set of options.

ACTIVE TRAVEL

Walking and cycling are the most sustainable and healthy ways to get around the city, having clear benefits for air quality, carbon emissions and people's wellbeing.

Besides the direct benefits for health and the environment, creating cycle-friendly and walkable places triggers other indirect advantages, such as social equity or increased safety and it improves cities' resilience, making them more attractive and liveable.

The inherent space-efficiency of active transport, up to 20 times more than the average car, has the potential to completely redefine the urban environment. However, despite its numerous benefits, some cities still report a high number of short trips done by private car, as crowding on narrow footpaths or sharing road space with vehicles is definitely not for everyone.

To make walking and cycling attractive alternatives to car use, cities need to give space back to these sustainable modes and guarantee safety, comfort and convenience in order to drive a culture change around active travel.

COVID-19

As the world recovers from the pandemic, we are witnessing unprecedented levels of walking and cycling. Boarding a packed bus or train does not sound like a good idea anymore and concerned users have found their safe space on these individual modes. Moreover, governments and authorities around the world are encouraging their citizens to shift towards these sustainable modes in an effort to relieve pressure on public transport and to avoid a massive shift towards lower capacity modes of transportation, such as private cars, which would collapse our network.

In order to increase the attractiveness of active transport and meet increasing demand, cities have been completely reshaped in favour of these modes, proposing solutions such as pop-up bike lanes, widened footpaths, reduced car speed limits, dedicated queuing areas, pedestrianised avenues, additional bike parking or cycle-only roads which have been built in record time.

This unique situation has allowed us to rediscover our neighbourhoods, to avoid non-essential long trips and to try, not always successfully, to meet our essential needs within a short walk or bike ride. Inevitably, our cities' resilience and the ability to meet habitants' demand levels have been put to the test. Proximity and connectivity have been more important than ever, and people living in compact mixed-use neighbourhoods have experienced a higher sense of community and a more inclusive and healthier situation than those living in separated residential areas designed through traditional single-use planning.

THE NEW NORMAL

People's mobility habits have changed dramatically during the pandemic. The key question that arises is whether these new habits will last when we forget about the virus. Cities certainly have an opportunity to proactively encourage active travel and prevent people from reverting back to cars, and the good news is that they have already come a long way during the last few months.

As new accelerating trends such as working from home are emerging, neighbourhoods will be renovated to provide workers with anything they may need during the day within a short walk or ride. Cafés, parks, high-quality schools and crèches, sitting areas, restaurants or markets will reinvigorate our streets and will encourage people to turn to their own feet or bike and live locally.



DRIVING THE MODAL SHIFT

Modal shift ultimately relies on human behaviour, so if we want to encourage people to shift towards active travel, we need to make sure that these modes are safe, easy and convenient for them. Unfortunately, even in the most bike-friendly and walkable cities, urban space is disproportionately allocated to cars and the general lack of trip end facilities does not make it any easier to travel sustainably. Overcoming these issues requires cities to rethink and redesign the urban landscape – putting sustainable mobility at the heart of its strategy and creating a strong walking and cycling culture.

- **High-quality infrastructure:** it is key to provide appropriate infrastructure and to ensure that it is in high-quality condition. Wider footpaths and pedestrian streets encourage walking and make cities, particularly city centres, more liveable and attractive. For cyclists, wider and segregated lanes are key to improve safety.
- **Improved connectivity and permeability:** these are essential to connect people with their destinations, including other modes such as public transport, in an easy, pleasant and convenient way.
- **Bike-sharing options:** these schemes provide higher flexibility to users and offer a sustainable alternative to those who may not otherwise cycle. Besides, it removes the costs and responsibilities of owning a bike.

INVESTING IN ACTIVE TRAVEL INFRASTRUCTURE

Several cities around the world are using this opportunity to reshape their transport networks and are already announcing huge investments in permanent cycling and walking infrastructure. These infrastructure projects are relatively simple to implement, and they are much cheaper and quicker to develop than any other transport investment.

Besides the direct benefits for those who cycle and walk, there is also a high return on investment from promoting these sustainable modes:

- In terms of land use, active travel saves much road and parking space in comparison to the use of cars, resulting in reduced congestion and air pollution.
- Active travel has great benefits for both our physical and mental health, resulting in fewer sick days at work and important savings to the health system.
- A walking and cycling culture creates more vibrant streets and increases retail sales, boosting local economic activity.
- Road deaths associated with cars could be reduced considerably, and the improved infrastructure and environment could consequently reduce cycling casualties.

SLOW STREETS

In an effort to guarantee social distancing while providing enough space for the growing demand for sustainable modes, several authorities have rolled out initiatives in their urban areas, such as the ‘Slow Streets’ movement.

The main idea of these initiatives is to create a shared space for cyclists and pedestrians on specific residential streets by restricting through traffic to local use only. While the initial objective was to avoid overcrowding, this new configuration is allowing people to rediscover their neighbourhoods and find new ways of enjoying their streets through walking, skating, running, playing or cycling.

Although most of these programmes were designed to be temporary, there are opportunities to see how they work in the long term, to understand the demand implications and, potentially, to make them permanent.

CHANGING CITY CENTRES

As cities’ populations keep growing, the traditional monocentric city may not be feasible anymore. The age of the car-centric design, suburban-style zoning may be over, and several cities around the world are already exploring the concept of the “polycentric city”, based on density, mixed-use and urban proximity.

In these neighbourhoods or “cities within a city”, people should be able to meet their needs within a short walk or bike ride, so the role of active travel is key. This means that a high percentage of shopping, entertainment, educational or cultural trips will be done by active travel. Of course, if we want this to work, these neighbourhoods should give the space back to the people to make these options attractive versus the comfort of the car. Besides, these final destinations should provide well-planned bicycle parking facilities and even chargers for e-bikes to make trips as convenient as possible.

City logistics will need to be rethought if we want to prevent the increasing number of delivery trucks from cluttering our kerbs and streets. Cargo e-bikes offer great potential within these short-distance districts, as they can provide last mile delivery from a single truck or flexible storage system.

NEW MOBILITY SOLUTIONS

In the last decade, the transport industry has experienced a shift in its modal format. New mobility trends, such as shared mobility (ride hailing, carpooling and short-term car lease), micro mobility (mopeds, e-bikes and e-scooters) and micro-transit, have experienced rapid growth, resulting in a modal shift of traditional transport as we know it. However, some of these new trends face key challenges around policy and regulations in some European cities, such as Dublin, London and Amsterdam.

According to a study by the McKinsey Centre for Future Mobility, about 60% of car trips in the European Union, China and the U.S. are for journeys with a distance of less than 8km. These new mobility options have the potential to become the solution to the first and last mile problem – shifting from driver-only vehicles to cycling, walking and other forms of healthy travel.

COVID-19

COVID-19 restrictions introduced by local authorities have forced many cities to significantly reduce or even cut their public transport services. Although part of the population can rely on their private cars for mobility, a proportion rely on public transport to access essential services, with many of these people being essential workers (according to U.S. census data, 30% of regular transit riders are essential workers). The critical need for transportation during this pandemic has forced transport providers to adapt or provide new services to address users' needs and changes in demand.

These rapid changes have been unprecedented within the transport industry. The initial wave of measures taken by operators was focused on sanitisation protocols to ensure safe cleanliness standards of vehicles and PPE for drivers. However, when lockdown measures were mandated, service providers saw a direct impact on demand and different utilisation patterns were put in place around the world after exploring new business opportunities. These new opportunities ranged from providing free journeys or special rates for essential workers, pivoting their services from moving people to delivering food and products, expanding/modifying their route areas to cover hospitals, grocery stores or food banks addressing gaps in existing networks or replacing their fixed routes system with on-demand services. Governments and cities have also had to adapt to this pandemic and ease some of their policies. Some cities have lifted their restrictions to allow micro mobility operators to do delivery services that were prevented before COVID-19. Cities are also starting trials for new micro mobility solutions, such as e-scooters.

THE NEW NORMAL

Now that government restrictions are gradually being lifted, commuting and travelling is returning, albeit in different ways than was experienced prior to COVID-19. Physical distancing requirements will reduce capacity on public transport and commuters are rethinking their ways of travelling, showing preferences for individual means of transport.

To address these challenges, new mobility solutions are starting to be seen as potential alternatives to keep people moving around cities.



LEGISLATION

During COVID-19, we have seen governments easing or reviewing their regulations. Changes that previously took a long time to review and assess were implemented quickly. The UK government brought forward the consultation on legislation to allow trials of rental e-scooters to commence more rapidly and in more areas than initially planned, as well as the NYC mayor suspending a planned e-bike crackdown to allow delivery workers to use e-bikes.

It is clear the potential benefits offered by micro mobility devices, such as active travel, improving air quality and reducing traffic congestion. Ireland is one of the countries that continues to prohibit the use of e-scooters on public roads. With the current constraints that this “new normal” has on our public transport, should the government take this opportunity to review their legislation and allow their use? Could this crisis be used to accelerate the transition towards a sustainable mobility future and promote the use of new mobility trends?

EXPANDING BORDERS

New mobility operators rapidly made changes to networks, expanding their operation zones to include hospitals, grocery shops and essential services. Some of them temporarily replaced an “all fixed-route bus system” with on-demand services that both reduced costs and serviced essential rides. Other mobility providers that previously restricted their users from accessing far-off regions of the city increased their range to allow users to access hospitals and essential businesses within the region.

If the new working from home trend is here to stay as part of a normal week, it might have an important impact on reducing user commuting hours and changing the types of movement. Rather than moving from/to the city, for many users, mobility will equally be around their houses and local areas (the peri-urban or suburban areas and rural communities). Nowadays, these areas are highly car dependant and there is a lack of other types of mobility services, but if there is something we have learned from lockdown, it is that users prefer an active type of mobility. New mobility services could open or extend their markets to these areas, as a result of increased demand as our lives become more suburb/rural-based. This will present a governance challenge, moving beyond large city control into many municipalities.

REPURPOSING THE FLEET

In response to falling ridership and restrictions on shared mobility due to this pandemic, private mobility operators have considerably repurposed their fleets and readjusted their services according to where there is more demand. E-commerce and food delivery demand have drastically increased because of lockdown restrictions, and therefore, ride-hailing companies and shared mobility providers have switched from moving people to delivering products and food.

It is hard to know if the exceptional measures taken by these companies will remain in place once physical distancing restrictions are lifted. However, it has demonstrated that a new agile method of delivery service is possible. Options of e-cargo bikes or combined services (people and products) could take some conventional delivery vans off the road, reducing road traffic, noise and pollution, while still providing an efficient means of delivery. Delivery vehicles are the fastest growing class of motor vehicle.

AUTOMATED VEHICLES (AVS)

Exceptional safety measures have been put in place by transport agencies to keep transit operators safe from the virus. These range from contactless payment to installing panels next to the driver, significantly reducing driver exposure. This pressing risk of exposure, as well as the strain on existing delivery services due to drastic increases in e-commerce, could potentially be alleviated by automated delivery vehicles.

During this pandemic, some companies have turned to autonomous vehicles to help solve delivery issues and prevent drivers from being exposed to the virus. AVs have been used to carry critical testing supplies to and from medical facilities (JTA – Mayo Clinic in Jacksonville), as well as contactless delivery services being launched to distribute groceries and medical supplies (JD.com and Meituan Dianping in Wuhan).

Over the short to mid-term, the COVID-19 crisis might delay the development of advanced technologies, such as AVs. However, with a growing demand for e-commerce delivery resulting in 36% more delivery vehicles in inner cities by 2030 and seeing some great examples of the use of AVs during the pandemic, there is an opportunity for cities to trial the new technology and accelerate its deployment in controlled and well-mapped environments.



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LOOKING AHEAD

COVID-19 has changed the way we live our lives and interact with our cities. We have also realised the huge impact that we, as humans, have on the environment.

With intense growth in urban population, now is the time to rethink our cities by putting people at the heart of urban development, improving their health by facilitating active travel and increasing its overall resilience. It is time to reshape and optimise public transport by encouraging the innovative trends seen during this pandemic and flattening the peak demand curve, building a high-quality and successful backbone for our cities. And, naturally, it is time to make better use of the opportunities offered by digital technologies to face the existing challenges and navigate towards a more sustainable future.

Case Studies

CASE STUDIES

These unprecedented times have inevitably changed user behaviour and have led to a number of creative solutions proliferating in our towns and cities. Public authorities are thinking outside the box to meet the new demand patterns while keeping essential services, goods and workers moving safely. Similarly, private mobility companies are finding innovative ways to provide essential support for their customers while repurposing their fleet to cope with rising operating costs and falling ridership. Whether these solutions will survive beyond the pandemic remains to be seen. However, keeping these lessons is key as they can lead to essential global best practices that may define a sustainable and resilient new normal.

PUBLIC TRANSPORT

UNLOCKING THE VALUE OF DATA



Automatic Passenger Counting (APC) System

Rhein-Neckar-Verkehr-GmbH (rnv), Mannheim, Heidelberg and Ludwigshafen, Germany

The data and information from APC are not only used for planning and earnings distribution purposes, but also serve as a basis for decision making on the presently planned extension of the route network.



Open Wi-Fi @ MRT Stations

Singapore

Data collected from Wi-Fi hotspots are used to generate rich and useful insights on crowd behaviour and improve the delivery of our public transport services.

FIT THE SYSTEM TO THE PEOPLE



Computer vision sensors at bus stops to optimise bus dispatching – DonostiaBus (Dbus)

San Sebastian, Spain

Dbus has implemented a novel system that estimates the number of people waiting at the stop in real-time to dispatch additional buses when required.



Swiss Federal Railways – Reinforcement learning for dispatching

Switzerland

Digital twin of SBB railway network where historic and simulated data can build infinite scenario variations and learn from these outcomes to generate automated real-time suggestions to optimise dispatching and scheduling.

SEAMLESS TRAVEL EXPERIENCE



TfL social media TravelBot

London, UK

This social media tool, powered by artificial intelligence, can “chat” with customers and instantly tell them when their bus is due to arrive, provide service updates and Tube maps.



Crowdedness predictions, Google Maps

Argentina, Australia, Belgium, Brazil, Colombia, France, India, Mexico, Netherlands, Spain, Thailand, United Kingdom and the U.S.

Google Maps has introduced a series of new features to better inform travellers and commuters about how their trips may be impacted by COVID-19 — including travel restrictions, COVID-19 checkpoints or even just the crowdedness of public transport.

PUBLIC TRANSPORT INTEGRATION



Jelbi: The multimodal journey planner

Berlin, Germany

The app displays not only the best options for BVG’s buses and trains, but also for rental bikes, e-scooters, e-mopeds, car-sharing stations and a total of 25 other transport partners.



Octopus Card, Hong Kong

Hong Kong

The add-value card allows people to travel cash-free on all major transport systems and can also be used at convenience stores and some shops.

ACTIVE TRAVEL

DRIVING THE MODAL SHIFT



Pedestrianised streets

Barcelona, Spain

Barcelona's plan for a return to mobility includes the closure of major streets to vehicular traffic.



"The Street is Yours" and "Cycling Lisbon" initiatives

Lisbon, Portugal

About 200 kilometres of bike paths across the city in 2021, plus parking and support to buy bicycles, larger sidewalks and terraces and even new pedestrian-only streets.

INVESTING IN ACTIVE TRAVEL INFRASTRUCTURE



UK £2bn package to put walking and cycling at the heart of Britain post-coronavirus transport plan

UK

The UK government strives to double cycling and increase walking by 2025 with a national cycling plan being developed.



Dutch level of cycling funding for Ireland

Ireland

€360 million per year to be spent on walking and cycling. Plan for major increase in children using active transport to school. Push for segregated cycle routes will not be confined to cities under plan.

SLOW STREETS



Slow Streets Program

San Francisco, USA

The Slow Streets program is designed to limit through traffic on certain residential streets and allow them to be used more as a shared space for foot and bicycle traffic. Throughout the city, twenty corridors have been planned or implemented as Slow Streets.



Healthy Streets

London, UK

This programme aims to improve air quality, reduce congestion and help make London's diverse communities greener, healthier and more attractive places to live, work, play and do business.

CHANGING TOWN CENTRES



DHL Express Cubicycle

Copenhagen, Denmark

The DHL cubicycle is an electric, four-wheel cargobike which has a container that can transport up to 125kg of goods.



The 15 Min City

Paris, France

Urban planners approaching the philosophy believe that every neighbourhood should be able to fulfil our basic needs within a 15-minute walk or bike ride.

NEW MOBILITY

LEGISLATION



UK Government legalise rental e-scooter trials

UK

Rental e-scooters have been legalised in the UK to ease pressure on public transport and introduce a new type of low-carbon, socially-distanced transport to the nation's roads.



NYC suspends e-bike crackdown

New York, USA

The city will allow delivery workers to use e-bikes as the restaurant industry shifts to takeout and delivery-only due to coronavirus concerns.

REPURPOSING THE FLEET



Voi scooters used to deliver food to people's homes

Stockholm and Oslo (Sweden and Norway)

In several Nordic cities, Voi supports the restaurant industry offering e-scooters for increased home delivery demand.



Uber Connect

Australia and USA

Uber will expand beyond its core ride-hailing and food-delivery services with a broader courier service for packages, medication and pet supplies.

EXPANDING/MODIFYING SERVICE AREA



Berlin's BerlKönig on-demand service

Berlin, Germany

The Berliner Verkehrsbetriebe (BVG) rapidly made changes to its on-demand public transportation network BerlKönig, expanding their zone to include access to 75% of all hospitals in Berlin.



Santander Cycles scheme expansion

London, UK

TfL has set out plans to expand the Santander Cycles scheme to keep up with unprecedented cycling demand during the pandemic.

AUTOMATED VEHICLES (AVs)



Beep and NAVYA autonomous vehicles used to transport medical supplies and COVID-19 tests

Florida, USA

The Jacksonville Transportation Authority (JTA) has partnered with Beep and NAVYA to use autonomous vehicles to facilitate transporting COVID-19 tests collected at a drive-thru testing location at Mayo Clinic in Florida.



Chinese ecommerce giants are ramping up their deployment of robots to deliver orders to avoid human-to-human contact during the COVID-19 pandemic

China

Delivery app Meituan Dianping started using autonomous vehicles to send grocery orders to customers in Shunyi district in Beijing and Beijing-based JD.com announced that it was delivering medical supplies to Ninth Hospital and groceries to local communities via autonomous vehicles in the city of Wuhan.

REFERENCES

- AMAT, 2013.** *La domanda di mobilità complessiva*. [Online]
Available at: <https://www.pgt.comune.milano.it/vasraall2-quadro-di-riferimento-territoriale-e-ambientale/2-analisi-dei-fattori-determinanti/23-mobilita-e-trasporti/237-la-domanda-di-mobilita-complessiva>
- BBC, 2020.** *Cambridge University: All lectures to be online-only until summer of 2021*. [Online]
Available at: <https://www.bbc.com/news/education-52732814>
- Borges de Carvalho, R., 2020.** *Coronavirus: Is working from home going to be a legacy of lockdown?*. [Online]
Available at: <https://www.euronews.com/2020/05/15/coronavirus-is-working-from-home-going-to-be-a-legacy-of-lockdown>
- Brookings, 2014.** *Global Metro Monitor Map*. [Online]
Available at: <https://www.brookings.edu/research/global-metro-monitor/>
- Burridge, T., 2020.** *Coronavirus: Is social distancing on trains here to stay?*. [Online]
Available at: <https://www.bbc.com/news/business-52394835>
- Carpani, J., 2020.** *Trains will be 90 per cent empty after lockdown as Government announces £2bn package for cycling*. [Online]
Available at: <https://www.telegraph.co.uk/politics/2020/05/09/trains-will-90-per-cent-empty-lockdown-government-announces/>
- Central Statistics Office, 2016.** *Census 2016 Place of Work, School or College - Census of Anonymised Records (POWSCAR)*. [Online]
Available at: <https://www.cso.ie/en/census/census2016reports/powscar/>
- Connor, D., 2020.** *Social distancing sees changes to public transport capacity*. [Online]
Available at: <https://www.rte.ie/news/coronavirus/2020/0512/1138021-coronavirus-public-transport/>
- Consortio Regional de Transportes de Madrid, 2018.** *ENCUESTA DE MOVILIDAD DE LA COMUNIDAD DE MADRID 2018*. [Online]
Available at: https://www.crtm.es/media/712934/edm18_sintesis.pdf
- Dingel, J. & Neiman, B., 2020.** *How Many Jobs Can be Done at Home?*. [Online]
Available at: <https://bfi.uchicago.edu/working-paper/how-many-jobs-can-be-done-at-home/>
- Dublin Economic Monitor, 2020.** *Issue 21*. [Online]
Available at: https://issuu.com/256media/docs/dem-may_2020?fr=sZDFiNDE1MTY1NA
- Eurofound, 2020.** *Living, working and COVID-19 dataset*. [Online]
Available at: <http://eurofound.link/covid19data>
- Eurostat, 2018.** *Metropolitan regions database*. [Online]
Available at: <https://ec.europa.eu/eurostat/web/metropolitan-regions/data/database>
- Holgersen, H., Jia, Z. & Svenkerud, S., 2020.** *Who and how many can work from home in Norway? Evidence from task descriptions*. [Online]
Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3580674
- Homeland Security Today, 2020.** *First Capacity App for Rail Travelers in North America to Help Social Distancing*. [Online]
Available at: <https://www.hstoday.us/subject-matter-areas/transportation/first-capacity-app-for-rail-travelers-in-north-america-to-help-social-distancing/>
- Instituto Nacional de Estadística, 2020.** *Resultados provinciales. Población en viviendas familiares (incluye parados). (Tasa de paro de la población, Ambos sexos, Madrid, 2020T1)*. [Online]
Available at: <https://www.ine.es/jaxiT3/Tabla.htm?t=3996>
- Istat, 2019.** *Tasso di disoccupazione - livello provinciale*. [Online]
Available at: <http://dati.istat.it/Index.aspx?QueryId=20745>
- Pons Seguridad Vial, 2019.** *VII Informe “Españoles ante la nueva movilidad”*. [Online]
Available at: <https://www.ponsseguridadvial.com/vii-informe-espanoles-ante-la-nueva-movilidad/>
- UNESCO, 2020.** *1.37 billion students now home as COVID-19 school closures expand, ministers scale up multimedia approaches to ensure learning continuity*. [Online]
Available at: <https://en.unesco.org/news/137-billion-students-now-home-covid-19-school-closures-expand-ministers-scale-multimedia>
- United States Census Bureau, 2018.** *U.S. Census Bureau Releases 2013-2017 ACS 5-Year Estimates (section 2)*. [Online]
Available at: <https://www.census.gov/programs-surveys/acs/news/updates/2018.html>
- Urban Mobility Index, 2018.** *See Dublin in motion*. [Online]
Available at: <https://urbanmobilityindex.here.com/city/dublin>

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