

EVOLUTION OF MOBILITY DURING THE COVID-19 CRISIS IN THE REGION OF MADRID

Abid Al Akioui Sanz

Transport Research Centre (TRANSyT), Universidad Politécnica de Madrid

Andrés Monzón de Cáceres

Transport Research Centre (TRANSyT), Universidad Politécnica de Madrid

Lucas Álvarez del Valle

School of Architecture (ETSAM), Universidad Politécnica de Madrid (UPM),

ABSTRACT

The World Health Organization (WHO) declared COVID-19 a pandemic on March 11, 2020. Three days later, the Spanish Government declared a state of alarm, which lasted until June 20. This state consisted of a two-month lockdown with mobility restrictions and a two-month phased easing of lockdown.

This paper analyses the evolution of mobility patterns in the Region of Madrid through statistical information to study the impact of the COVID-19 crisis based on data from the Spanish National Statistics Institute (INE).

The results obtained in this paper show that, during the lockdown, trips made in the Region of Madrid fell by 70% compared to the usual scenario. However, the variations in mobility were very different in each area of the territory. For example, trips to San Sebastián de los Reyes were reduced by more than 90%, while trips from San Fernando de Henares decreased by only 30%.

Once the easing of lockdown phases began, there was an increase in trips in the Region of Madrid of more than 60% compared to trips made during the lockdown. This growth was also very irregular. For example, travels from Arganda del Rey increased by more than 260%, while trips to the same municipality only increased by 13%.

The mobility study is complemented with the analysis of socioeconomic variables, land use, and transport network to clarify the evolution of the different areas in the Region of Madrid during the COVID-19 crisis

1. INTRODUCTION

This document analyzes the evolution of mobility in the Region of Madrid during the state of alarm declared by Royal Decree 463/2020, of March 14, to manage the health crisis caused by the COVID-19, extended until June 21, 2020.

As a data source, the information provided by the Spanish National Statistics Institute (INE) is used, whose collection and preparation methodology is analyzed and discussed in the first section of this document.

With these data, the intra-areal and inter-areal movements in the Region of Madrid during the different phases of the state of alarm will be studied. Finally, a study of socioeconomic variables, land use, and transport network will be carried out to characterize how the state of alarm has affected the mobility of each territory of the region.

2. METHODOLOGY

2.1 Geographical and temporal scope

INE divides the national territory into 3,200 mobility areas. This unit comprises between 5,000 and 50,000 inhabitants, being much more homogeneous than the municipalities. Thus, in sparsely populated areas, an area of mobility will be the union of several municipalities, and in large cities, these areas will be districts or neighborhoods. The data are added from mobility areas, obtaining results at provincial, regional, and national levels.



Fig. 1 – Mobility areas. Source: Own elaboration from INE

Because the data is based on the positioning of mobile devices, it is worth mentioning the precision of this method to analyze the data. According to sources, the accuracy will be tens or hundreds of meters in urban areas and kilometers in rural areas.

The temporal scope dealt with exclusively comprises the state of alarm, offering data from March 16 to June 20, 2020. On the other hand, the reference week to contrast the mobility data used is the week from Monday 18 to Thursday 21, November 2019, taking the average of this week's data as the mobility of a “normal” day.

2.2 Data sources, preparation, and supply of information

The primary data source for this study is anonymized mobile phone records, working with more than 80% of mobile phones throughout Spain in collaboration with the three leading mobile phone operators (Orange, Telefónica, and Vodafone). Regarding demographic data, these are obtained from the Municipal Register of Inhabitants on January 1, 2019.

In the technical project of the study, it is specified that the areas of residence are identified as the areas in which the telephone spends most of the time between 12 a.m. and 6 a.m. Destination areas are calculated as the most frequent area where the phone is between 10 a.m. and 4 p.m. as long as the device has been in that area for more than two hours.

Operators offer movements between areas as long as there are more than 10 or 15 movements, depending on the operator, to protect their users' privacy. For its part, the INE aggregates this information and offers the flows as long as it exceeds 100 movements.

This information allows knowing which part of the population remains in their area of residence most of the time, taking into account that movements within the area of residence are not counted.

The INE offers the population and its movement by mobility areas, provinces, regions, and the national total and data and origin-destination flows between mobility areas.

3. MOBILITY STUDY

3.1 Geographical and temporal scope

INE divides the Region of Madrid into 293 mobility areas. In this way, the most populated municipalities, such as Madrid or Móstoles, are divided into smaller areas. Similarly, the less populated municipalities are united in the same larger mobility area.

This study will work with the most significant territorial unit in each case. In the case of Madrid, for example, the 141 areas proposed by INE will be joined. In contrast, in the less populated areas, the INE mobility area will be used. In this way, the Region of Madrid will be divided into 102 study areas.

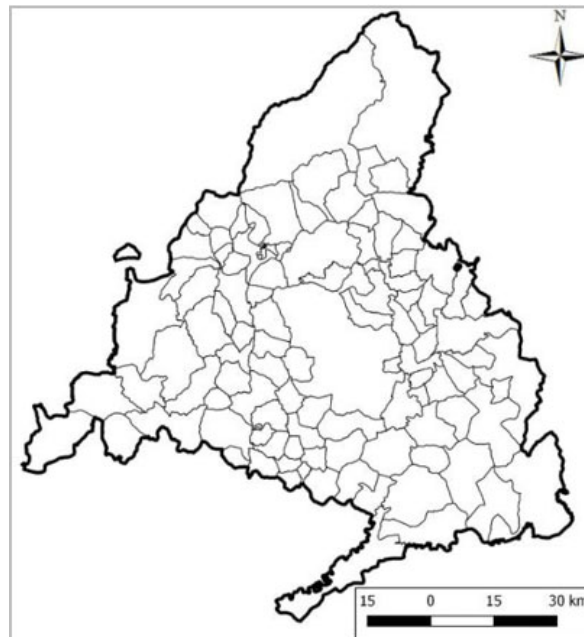


Fig. 2 – Study areas. Source: Own elaboration from INE

Before starting with the mobility data analysis, the different phases that the Region of Madrid went through during the state of alarm should be clarified:

- Lockdown: from March 15 to May 10, 2020.
- Phase 0: from May 11 to 24, 2020.
- Phase I: from May 25 to June 7, 2020.
- Phase II: from June 8 to 21, 2020.

To carry out an analysis throughout the different phases of the state of alarm, six dates have been selected for which an analysis of the origin-destination flows is made:

- Normality: average of data from November 18 to 21, 2019.
- Lockdown: average of data from March 26 and April 30, 2020.
- Phase 0: data from May 21, 2020.
- Phase I: data from May 28, 2020.
- Phase II: data from June 18, 2020.

3.2 General mobility

First, the number of total trips made with origin in the Region of Madrid will be analyzed.

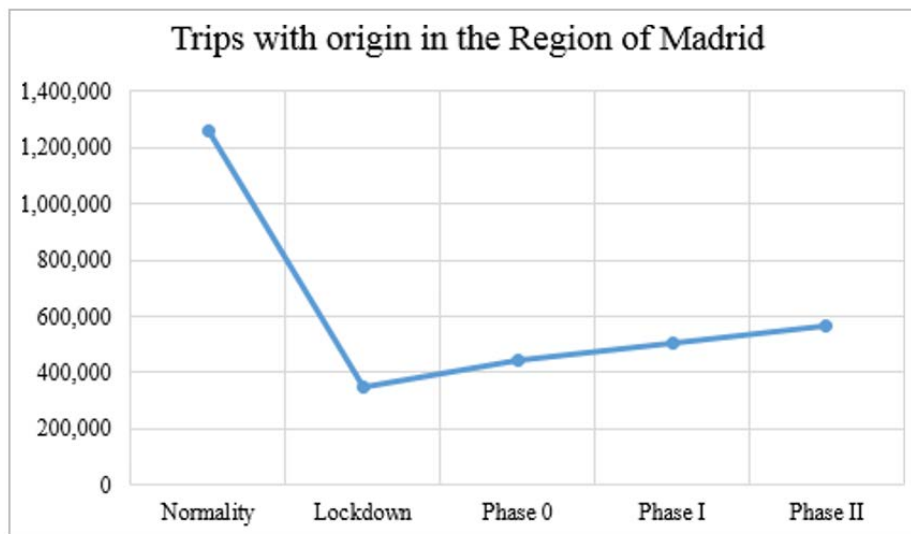


Fig. 3 – Evolution of trips with origin in the Region of Madrid during the state of alarm. Source: Own elaboration from INE

As shown in the previous figure, the data analysis allows us to see that the number of trips made in the Region of Madrid during a normal period is more significant than 1,250,000 trips. During the lockdown, this amount fell by more than 70%, with just over 350,000 trips. With the easing of lockdown, trips increased progressively but did not reach 50% of the trips made during a normal period

3.3 Intra-areal mobility

The analysis of intra-areal mobility consists of the study of movements within the same study area. For this reason, this analysis is only carried out in areas that are divided into several mobility areas, these being the most populated areas of the Region of Madrid.

Before entering into the data analysis, the particular case of Alcalá de Henares and Los Santos de la Humosa should be discussed. The municipality of Alcalá de Henares is divided into five mobility areas, the last of which is linked to Los Santos de la Humosa, so these two municipalities will be analyzed together as Alcalá de Henares.

STUDY AREA	MOBILITY AREAS	POPULATION (2019)
Alcalá de Henares	5	198,239
Alcobendas	3	117,040
Alcorcón	4	170,514
Aranjuez	4	59,607
Coslada	3	81,661
Fuenlabrada	9	193,700
Getafe	4	183,861
Leganés	7	189,861
Madrid	141	3,266,126
Majadahonda	2	71,826
Móstoles	6	209,184
Parla	3	130,124
Pinto	2	52,526
Pozuelo de Alarcón	2	86,422
Rivas-Vaciamadrid	3	88,150
Las Rozas de Madrid	3	95,814
San Sebastián de los Reyes	3	89,276
Torrejón de Ardoz	4	131,376
Valdemoro	2	75,983

Table 1 – Study areas in the intra-areal mobility analysis. Source: Own elaboration from INE

Intra-areal movements of the study areas correspond to approximately 70% of the trips made in the Region of Madrid. That is, 70% of the people do not leave their area of residence.

These intra-areal movements decreased by 68% during the lockdown, and during the easing of lockdown, they gradually increased until reaching 47% of the mobility of the normal period.

Analyzing the evolution of mobility in the different areas, the effect of mobility restrictions has not been uniform in all areas. Thus, the most affected areas have been Alcalá de Henares, Aranjuez and Madrid and the least affected Leganés, Móstoles and Torrejón de Ardoz.

LEVEL	DECREASES INTRA-AREAL	STUDY AREAS
Very high	> 70%	3
High	60-70%	5
Moderate	50-60%	8
Low	< 50%	3

Table 2 – Decreases in intra-areal mobility during the lockdown. Source: Own elaboration from INE

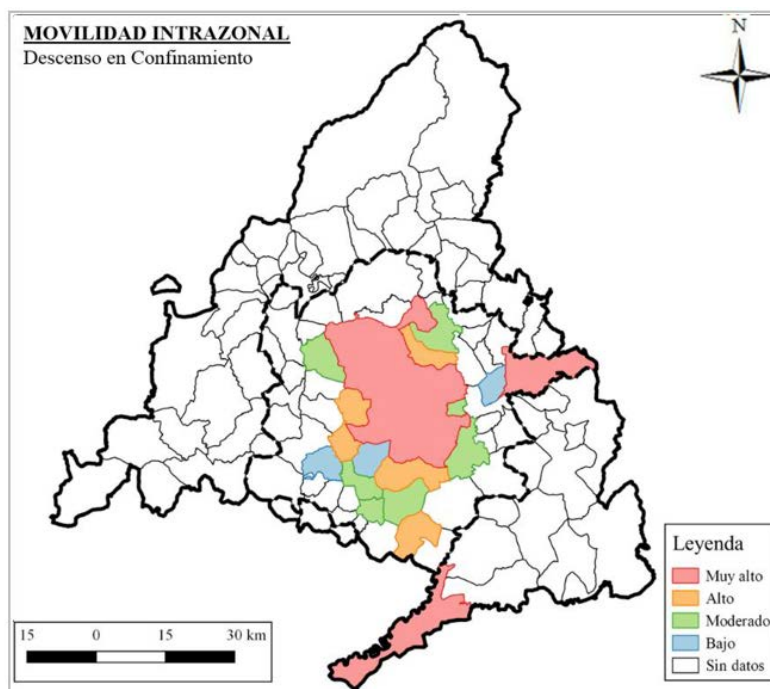


Fig. 4 – Decreases in intra-areal mobility during the lockdown. Source: Own elaboration from INE

In the same way, the increase in mobility that occurred in the different phases of the easing of lockdown was not the same in the areas, with recoveries of between 4% and 30%, being the most pronounced in Alcalá de Henares and San Sebastián de los Reyes.

LEVEL	INCREASES INTRA-AREAL	STUDY AREAS
Very high	> 25%	2
High	20-25%	6
Moderate	15-20%	5
Low	< 15%	6

Table 3 – Increases in intra-areal mobility during the easing of lockdown. Source: Own elaboration from INE

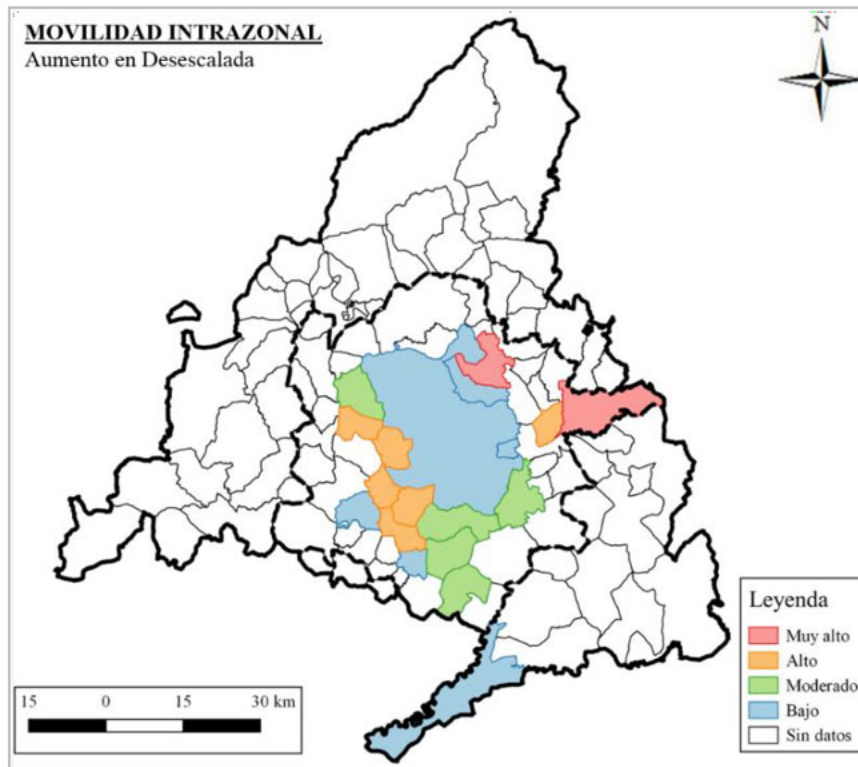


Fig. 5 – Increases in intra-areal mobility during the easing of lockdown.

Source: Own elaboration from INE

3.4 Inter-areal mobility

The analysis of inter-areal mobility consists of the study of the incoming and outgoing movements of each area. In this case, all study areas of the Region of Madrid are taken into account, and different areas of the Region of Castilla-La Mancha, which receive trips from Madrid.

The inter-areal movements of the study areas correspond to approximately 30% of the trips made in the Region of Madrid. That is, 30% of the people leave their area of residence.

These inter-areal movements decreased by 80% during the lockdown, and during the easing of lockdown, they gradually increased until reaching 42% of the mobility of the normal period.

3.4.1 Flows

To understand the evolution of the relationships of the study areas during the state of alarm, six flow maps have been made.

The first of them corresponds to the period of normality, in which it can be seen that the trips are concentrated in the capital and the north, west, and south sectors and, to a lesser extent, in the Henares Corridor. Most of the trips are located within the metropolitan area,

with more superficial relationships in the provincial area, from which trips are made to the municipalities of Guadalajara and Toledo, adjacent to the Region of Madrid.

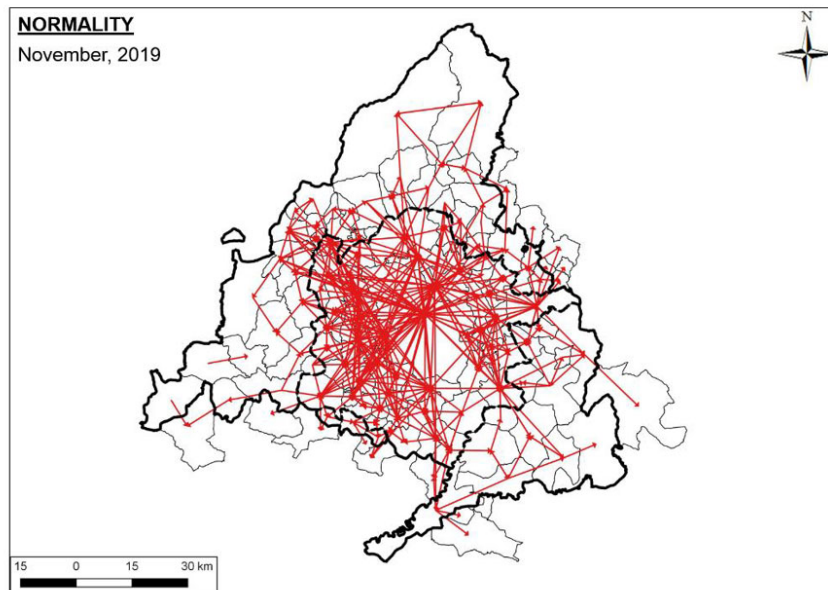
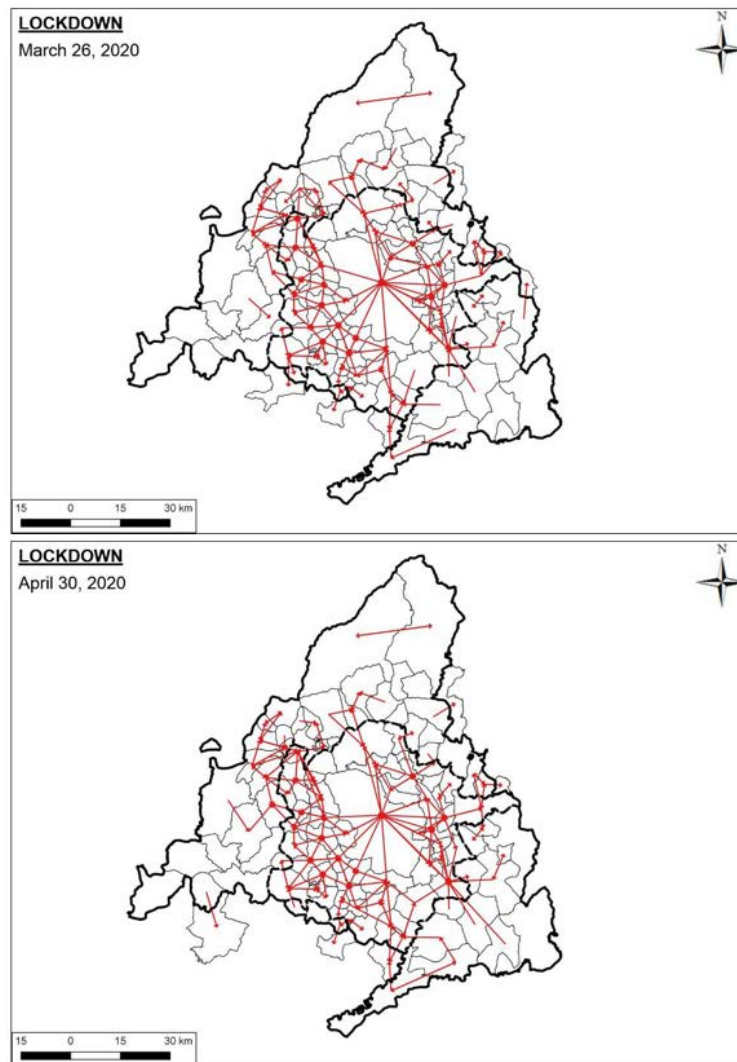


Fig. 6 – Origin-destination flows during the normality period (November 2019).

Source: Own elaboration from INE

The flow maps of the trips made during lockdown are shown below. In these, it can be seen that the volume of flows is considerably reduced; practically disappearing trips in the provincial area, as well as in the foreign area.



**Fig. 7 – Origin-destination flows during the lockdown (March and April 2020).
Source: Own elaboration from INE**

Finally, flow maps have been made for each phase of the easing of lockdown. It should be noted that, despite the increase in mobility, the provincial and foreign areas do not increase their relationships.

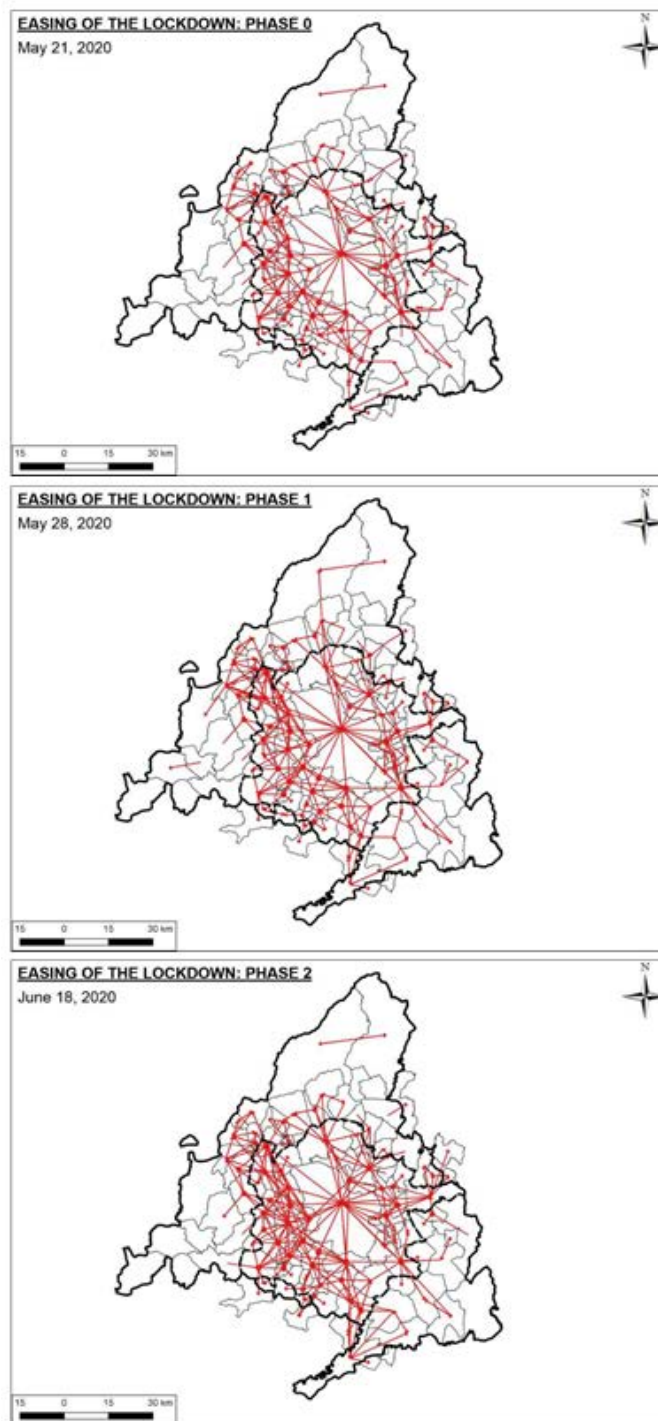


Fig. 8 – Origin-destination flows during the easing of lockdown (May and June 2020). Source: Own elaboration from INE

3.4.2 Outgoing movements

The evolution of the outgoing inter-areal movements has not been uniform in each study area of the Region of Madrid. To see how the effect has been in each area, the same methodology used in the intra-areal movements is followed.

According to the data structure, only flows in which more than 100 trips are made are shown. Due to this restriction, the study areas of Fuentidueña de Tajo and other municipalities, Navalagamella and other municipalities, and Navas del Rey and Chapinería do not have data on outbound trips, so they will not be taken into account in this analysis.

In the analysis of the outgoing inter-areal movements, it can be seen that the most affected areas during the lockdown, for the most part, are within the metropolitan area, in addition to some areas of the northeast of the region and the most rural areas of the southwest.

LEVEL	DECREASES INTER-AREAL	OUTGOING	STUDY AREAS
Very high	> 90%		15
High	80-90%		28
Moderate	60-80%		38
Low	< 60%		18

Table 4 – Decreases in outgoing inter-areal mobility during the lockdown. Source: Own elaboration from INE

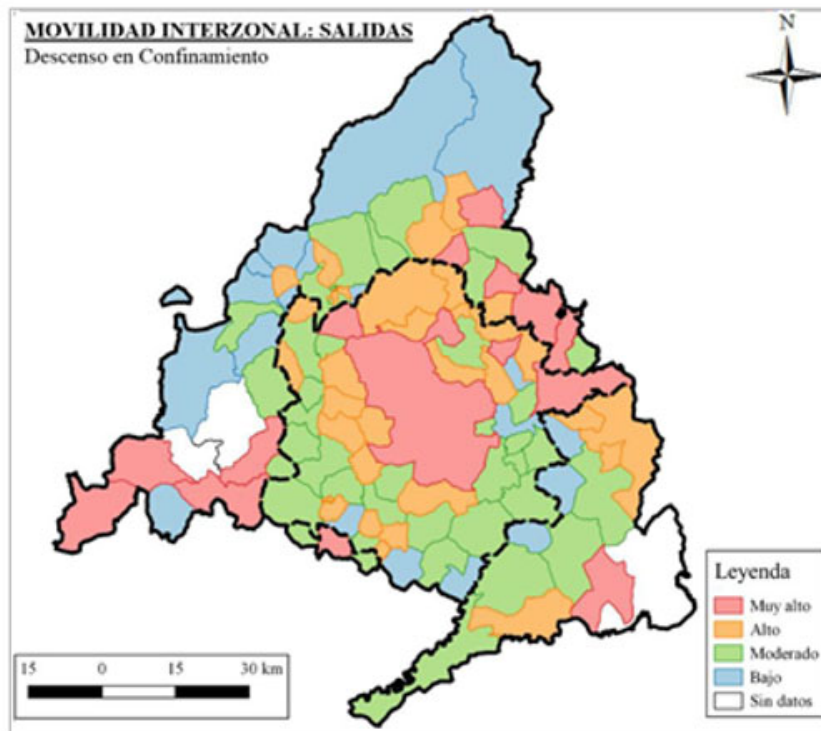


Fig. 9 – Decreases in outgoing inter-areal mobility during the lockdown. Source: Own elaboration from INE

Outgoing movements increased in a high-moderate way in the metropolitan area during the easing of lockdown, with very high data in Arganda del Rey and San Martín de la Vega.

There were significant increases in the north of the provincial area, contrasting with the low increases in the east and west.

LEVEL	INCREASES INTER-AREAL	OUTGOING	STUDY AREAS
Very high	> 50%		9
High	25-50%		30
Moderate	10-25%		32
Low	< 10%		28

Table 5 – Increases in outgoing inter-areal mobility during the lockdown. Source: Own elaboration from INE

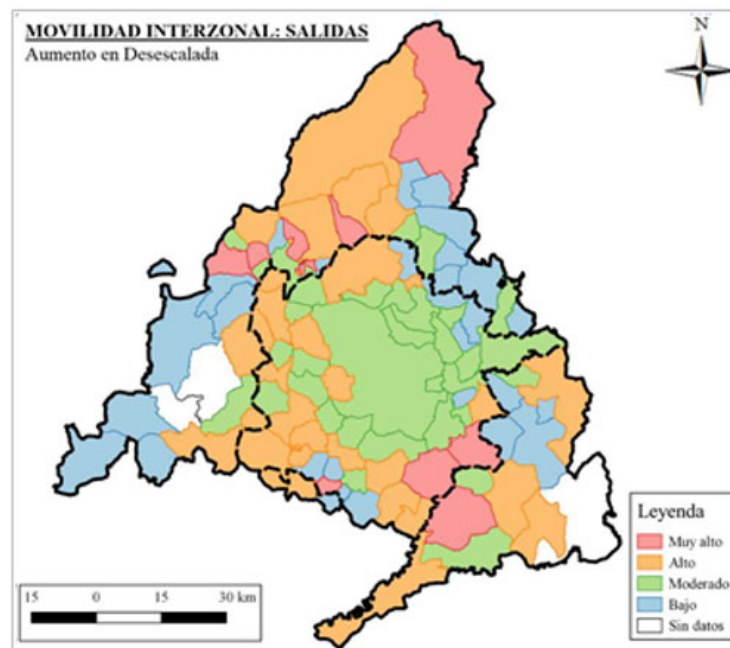


Fig. 10 – Increases in outgoing inter-areal mobility during the easing of lockdown. Source: Own elaboration from INE

3.4.3 Incoming movements

The evolution of the incoming inter-areal movements has not been uniform in each study area of the Region of Madrid. To see how the effect has been in each area, the same methodology used in the intra-areal movements is followed.

According to the data structure, only flows in which more than 100 trips are made are shown. Due to this restriction, the study areas of Aldea del Fresno and Villamanta, Cadalso de los Vidrios and other municipalities, Pedrezuela, San Martín de Valdeiglesias and Pelayos de la Presa, Sevilla la Nueva and Valdetorres de Jarama do not have travel data for input, so they will not be taken into account in this analysis.

The lockdown brought a high decrease in incoming trips in the central and south-eastern areas of the region. It should be noted that the southern regions of the metropolitan area did not undergo significant changes, remaining at low-moderate levels of decrease.

LEVEL	DECREASE INCOMING INTER-AREAL	STUDY AREAS
Very high	> 90%	23
High	80-90%	13
Moderate	60-80%	33
Low	< 60%	27

Table 6 – Decreases in income inter-areal mobility during the lockdown. Source: Own elaboration from INE

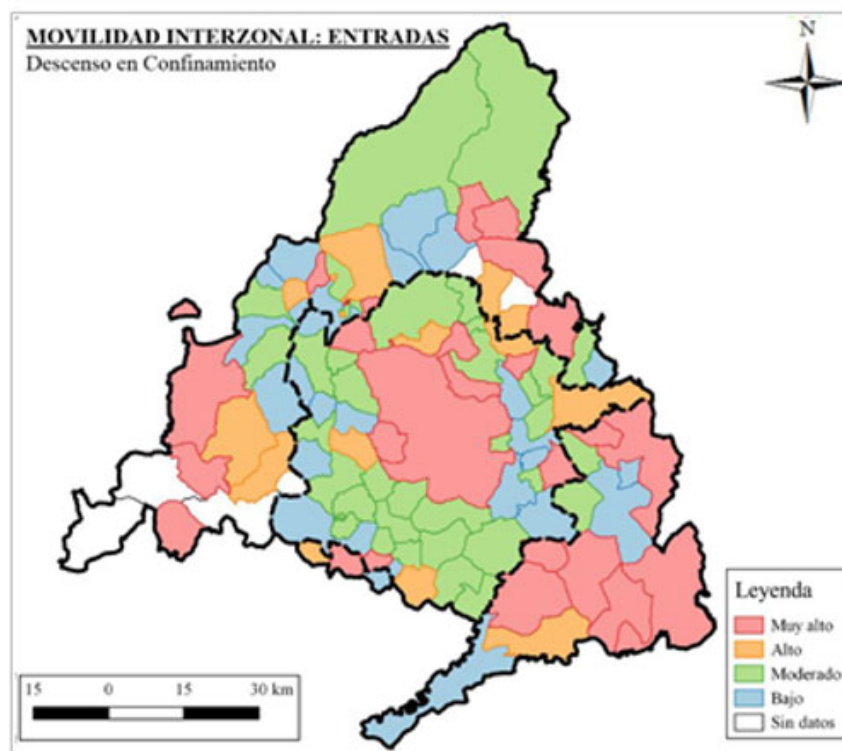


Fig. 11 – Decreases in income inter-areal mobility during the lockdown. Source: Own elaboration from INE

The increase in incoming trips during the easing of lockdown was generally moderate- high. In contrast to the trend of low changes in the south of the region, these areas suffered high increases during the easing of lockdown.

LEVEL	INCREASES INCOME INTER-AREAL	STUDY AREAS
Very high	> 50%	16
High	25-50%	29
Moderate	10-25%	29
Low	< 10%	22

Table 7 – Increases in incoming inter-areal mobility during the easing of lockdown.
Source: Own elaboration from INE

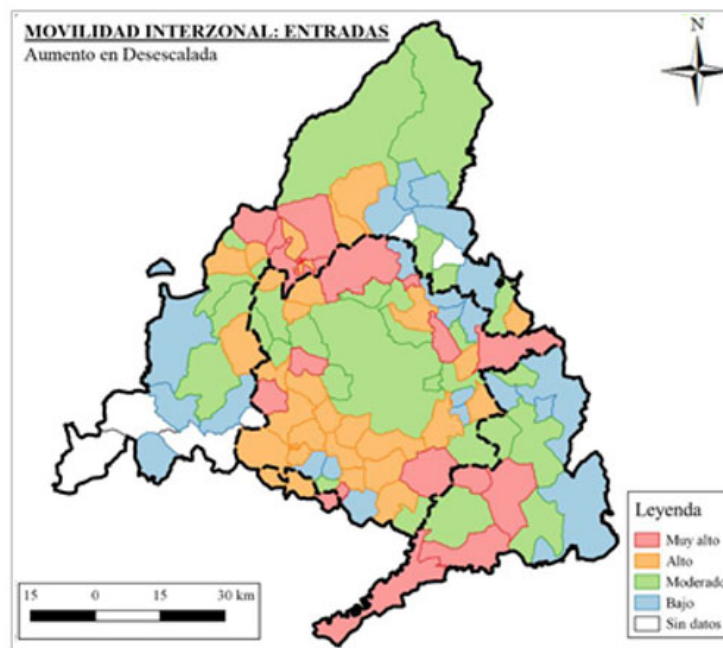


Fig. 12 – Increases in incoming inter-areal mobility during the easing of lockdown.
Source: Own elaboration from INE

4. SOCIOECONOMIC, LAND USE AND TRANSPORT STUDY

4.1 Introduction and methodology

The socioeconomic analysis of the different study areas of the Region of Madrid is carried out to contextualize the condition of the lockdown and the easing of lockdown in mobility.

Different socioeconomic variables that will characterize each study area have been analyzed. In the same way that the mobility analysis has been carried out, these variables will be discretized into four categories.

The data that have been used in the analysis have been extracted from ALMUDENA Municipal and Zonal Data Bank of the Region of Madrid and National Geographic Institute (IGN), and it has been added to calculate the data of the study areas used by INE in the collection of mobility data.

4.2 Population density

The Region of Madrid is the most densely populated region with a density of 829.72 people per km² in 2019. Focusing on the study areas, these densities range between 10 and 7,000 people per km², concentrating the most densely populated within the metropolitan area.

LEVEL	POPULATION DENSITY	STUDY AREAS
Very high	> 900 people per km ²	27
High	300-900 people per km ²	22
Moderate	100-300 people per km ²	30
Low	< 100 people per km ²	23

Table 8 – Population density. Source: Own elaboration from ALMUDENA

4.3 Per capita income

The Region of Madrid has the highest per capita income data at the national level, with more than 35,000 € per inhabitant. The per capita income data for the region oscillate between 11,000 and 70,000 € per inhabitant, also concentrating the areas with the highest income in the metropolitan area.

LEVEL	PER CAPITA INCOME	STUDY AREAS
Very high	> 25,000 € per inhabitant	27
High	20,000-25,000 € per inhabitant	18
Moderate	15,000-20,000 € per inhabitant	29
Low	< 15,000 € per inhabitant	28

Table 9 – Per capita income. Source: Own elaboration from ALMUDENA

4.4 Employment data

Employment data is a crucial variable to consider since 20% of trips made in the Region of Madrid are associated with work, according to the Home Mobility Survey of the Region of Madrid (EDM2018).

The percentage of the population of each study area affiliated with Social Security has been calculated to see the level of employment of the same. These percentages range from 30% to 50%.

LEVEL	POP. AFFILIATED SOCIAL SECURITY BY RESIDENCE	STUDY AREAS
Very high	> 45%	6
High	40-45%	40
Moderate	35-40%	45
Low	< 35%	11

Table 10 – Population Affiliated to Social Security by Residence. Source: Own elaboration from ALMUDENA

On the other hand, the total number of workers attracted by each study area has been obtained, calculating their percentage concerning the area's population, which varies between 13% and 100%.

LEVEL	POP. AFFILIATED SOCIAL SECURITY BY WORK C.	STUDY AREAS
Very high	> 40%	19
High	25-40%	31
Moderate	20-25%	21
Low	< 20%	31

Table 11 – Population Affiliated to Social Security by Work Centre. Source: Own elaboration from ALMUDENA

From the data of the affiliations, the balance of each study area has also been obtained. This balance is defined as the difference between the workers received by the area and the workers residing in it. In this way, if the balance is positive, the analysis says that the study area needs to attract trips.

BALANCE	STUDY AREAS
Positive	19
Negative	83

Table 12 – Balance of Affiliates to Social Security. Source: Own elaboration from ALMUDENA

The unemployment rate is another variable taken into account as it directly influences the number of trips made in each study area. These rates range from 2.5% to 10%.

LEVEL	UNEMPLOYMENT RATE	STUDY AREAS
Very high	> 6.5%	25
High	5.5-6.5%	27
Moderate	4.5-5.5%	25
Low	< 4.5%	25

Table 13 – Unemployment rate. Source: Own elaboration from ALMUDENA

Finally, the data on the economic activities of each study area have been analyzed, obtaining the majority branches of activity in each of them. The Other Services branch includes Administration, health, education, recreational, personal and associative activities, and households.

BRANCH	RESIDENCE AREAS	WORK AREAS
Construction	1	0
Mining, Industry, and Energy	0	7
Other Services	36	37
Distribution and Hospitality Services	53	50
Business and Financial Services	12	8

Table 14 – Branches of activity. Source: Own elaboration from ALMUDENA

4.5 Land use

Land use in the Region of Madrid has been analyzed, as it is an excellent indicator of job creation and, therefore, of attracting trips.

This analysis has focused on the economic lands in the Region of Madrid: Agriculture, Industry and Mining and Construction.

LAND USE	STUDY AREAS
Agriculture	102
Industry	75
Mining y Construction	51

Table 15 – Land uses. Source: Own elaboration from IGN

Although Agriculture is present in all the study areas, most of it is concentrated in the southern and eastern parts of the region. Industrial land is concentrated in the metropolitan area and, lastly, Mining and Construction in the southeast.

It should be noted that Agriculture is not such an essential sector in the region, the Industrial and Mining and Construction areas attract more trips, on which this analysis will focus

4.6 Transport

The analysis of transport is based on two fundamental axes: motorization and the evolution of the use of Public Transport.

The first one is calculated using the Motorization Index. This index relates the vehicles in a specific area and the population that resides in it. The region is very heterogeneous when it comes to the Motorization Index, with values between 400 and more than 20,000 vehicles per 1,000 inhabitants.

Although it should be mentioned that there is a bias in this variable since the existence of differences in the tax regime between the areas means that in some of them, a large number of vehicles are registered, most of them belonging, for example, to fleets of car-sharing companies. Once this has been clarified, the discretization of the data is presented.

LEVEL	MOTORIZATION INDEZ	STUDY AREAS
Very high	> 750 vehicles per 1,000 inhabitants	18
High	650-750 vehicles per 1,000 inhabitants	24
Moderate	600-650 vehicles per 1,000 inhabitants	28
Low	< 600 vehicles per 1,000 inhabitants	32

Table 16 – Motorization Index. Source: Own elaboration from ALMUDENA

The second axis of this analysis is, as mentioned previously, the use of Public Transport. INE publishes data on passengers transported monthly by city bus and Metro System. It should be noted that around 85% of the trips made by bus are made within the municipality of Madrid.

The following graph shows the evolution of the use of these two modes of transport. This evolution shows a significant drop with minimum values in April. Mention that the March values are so high since no restrictions were applied to mobility in the first half of this month.

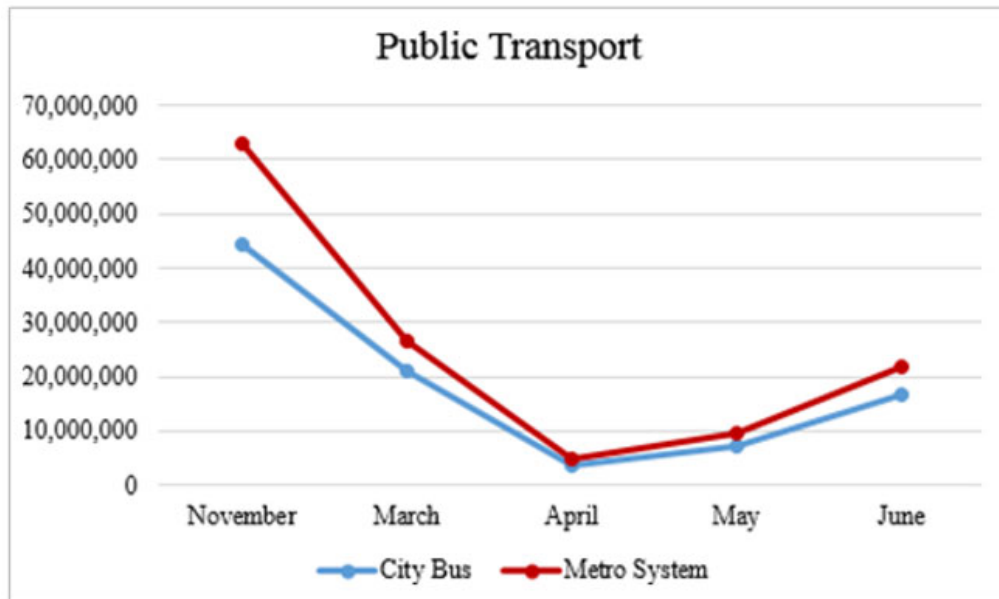


Fig. 13 – Evolution of the use of Public Transport during the state of alarm. Source: Own elaboration from INE

5. DISCUSSION OF RESULTS

This analysis will start from the employment data for mobility analysis, as the main reason for the trips.

The branch to which the population living in each study area is dedicated allows us to analyze the outgoing inter-areal mobility, so the generation of trips in each area.

Thus, it is observed that the areas in which the majority of the population is dedicated to Business and Financial Services, the most economically powerful (Madrid, Alcobendas, Majadahonda, Pozuelo de Alarcón, etc.), suffered a significant decrease during the lockdown and moderate increases after it. This is explained by the fact that the presence of these services was reduced and, after lockdown, a teleworking regime has continued.

On the other hand, the areas in which the population is dedicated to distribution were less affected in lockdown and, therefore, suffered more minor increases in the easing of lockdown. This happened since these services have a high degree of presence and are associated with negative balances, generating many trips.

Incoming inter-areal mobility is given by the branches in each destination area and is highly conditioned by their land uses.

In the same way, the areas that base their activity on business and financial services (Alcobendas, Pozuelo de Alarcón, Tres Cantos, etc.) lost a large percentage of trips and did not recover mobility primarily during the easing of lockdown.

These areas have in common that they present positive balances, that is, they attract many trips, and that they have large areas of industrial land.

Again, areas with heavy distribution services were not significantly affected by the lockdown, receiving practically the same trips as in a normal period.

The per capita income analysis shows that fewer resource areas suffered fewer decreases than those with higher incomes. This may reflect the high unemployment rates in areas with fewer resources, so people who did not work did not make as many trips during normality.

Finally, it should be mentioned that the Motorization Index does not have much impact on this analysis, as it is not an accurate reflection of people's mobility since the Region's Public Transport system is widely used and carries a large number of travelers. However, it has been seen that areas with high Motorization Index are associated with very high decreases and low increases, which leads to the conclusion that the abundance of vehicles in the areas does not ensure low conditions

6. CONCLUSIONS

With this analysis, it has been concluded that the state of alarm brought with it a change in the habits and mobility of the population of Spain and the Region of Madrid. Mobility was drastically reduced during March and April due to lockdown. With the easing of lockdown, mobility grew but, even so, at the end of the state of alarm, the mobility that occurred in normal periods, before the arrival of the pandemic and state of alarm, has not recovered.

Once the condition has been characterized, it has been seen that it is closely related to employment data. The sector most affected by the lockdown was the business and financial industry, which suffered significant declines and did not recover in the easing of lockdown due to the adoption of teleworking.

On the other hand, the distribution sector, the majority in the region, was not significantly impacted due to its degree of presence, so it suffered low decreases and increases, remaining very stable during the state of alarm.

Mention that the municipalities with fewer resources in the region had suffered fewer decreases, related to the high unemployment rates, which meant that the trips before the state of alarm were not very high.

Finally, it has been seen that highly motorized areas have been most affected by mobility restrictions, which can conclude that the abundance of vehicles does not lead to mobility stability.

These conclusions can lead to different strategies, adapted to each branch of activity and study area, to act in the face of new waves of the pandemic in the future

ACKNOWLEDGMENTS

The authors thank Ministerio de Transportes, Movilidad y Agenda Urbana for the agreement signed with Universidad Politécnica de Madrid (UPM), for the Metropolitan Mobility Observatory (MMO).

REFERENCES

ESPAÑA. REAL DECRETO 463/2020, de 14 de marzo, por el que se declara el estado de alarma para la gestión de la situación de crisis sanitaria ocasionada por el COVID-19. Boletín Oficial del Estado, 14 de marzo de 2020, núm. 67, pp. 25390 a 25400. <https://www.boe.es/buscar/pdf/2020/BOE-A-2020-3692-consolidado.pdf>

GOBIERNO DE ESPAÑA. PRESIDENCIA DEL GOBIERNO (21 DE JUNIO DE 2020). La Moncloa. Mapa de transición a la nueva normalidad.

<https://www.lamoncloa.gob.es/covid-19/Paginas/mapa-fases-desescalada.aspx>

INSTITUTO NACIONAL DE ESTADÍSTICA. (DICIEMBRE 2020). Análisis de la movilidad de la población durante el estado de alarma por COVID-19 a partir de la posición de los teléfonos móviles. https://www.ine.es/covid/exp_movilidad_covid_proyecto.pdf

INSTITUTO NACIONAL DE ESTADÍSTICA. Estudios de movilidad a partir de la telefonía móvil.

Límites geográficos de las áreas de movilidad. https://www.ine.es/covid/shapefiles_celdas_marzo2020.zip

INSTITUTO NACIONAL DE ESTADÍSTICA. Estudios de movilidad a partir de la telefonía móvil.

Movimiento de personas por comunidades autónomas y provincias. <https://www.ine.es/jaxiT3/Tabla.htm?t=35167>

INSTITUTO NACIONAL DE ESTADÍSTICA. Estudios de movilidad a partir de la telefonía móvil.

Datos origen-destino disponibles. https://www.ine.es/covid/datos_disponibles.zip

INSTITUTO DE ESTADÍSTICA DE LA COMUNIDAD DE MADRID. Banco de Datos Municipal y Zonal ALMUDENA. <http://www.madrid.org/desvan/Inicio.icm?enlace=almudena>

CONSORCIO REGIONAL DE TRANSPORTES DE MADRID. Encuesta Domiciliaria de Movilidad de la Comunidad de Madrid (EDM2018). Galería de resultados EDM2018. <https://datos.crtm.es/datasets/a60bb2f0142b440eadee1a69a11693fc>

INSTITUTO GEOGRÁFICO NACIONAL. Información geográfica temática. CORINE Land Cover. <http://centrodedescargas.cnig.es/CentroDescargas/index.jsp#>

INSTITUTO NACIONAL DE ESTADÍSTICA. ESTADÍSTICA DE TRANSPORTE DE VIAJEROS. Transporte urbano: metro y autobús en ciudades que dispongan de metro. <https://www.ine.es/jaxiT3/Tabla.htm?t=20193>