PREPARATION OF A LOGISTICS STUDY IN COMPLIANCE WITH THE REQUIREMENTS OF THE MEISTER PROJECT.

FINAL DOCUMENT.

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1 INTRODUCTION.

1.1 BACKGROUND AND OBJECT.

The project 'Mobility Environmentally-friendly, Integrated and economically Sustainable Through innovative Electromobility Recharging infrastructure and new business models' or MEISTER was submitted and approved in the framework of the 2017 call "Mobility for Growth" (H2020-MG-2017-Two-Stages), specifically the topic 'Supporting 'smart electric mobility' in cities' (MG-4.2-2017), of the European Horizon 2020 funding program for research and innovation. The Grant Agreemententered into force on June 8, 2018, being the official start date of the project on September 1 that year and its duration of36 months.

MEISTER has a partnership made up of a total of ten public and private institutions from Spain, Germany, Sweden and Greece, among which is the City Council of Malaga. The entities participating in the latter are the Foundation "Center for Strategic Research and Economic and Social Development of Malaga" (CIEDES), the Municipal Planning Department (GMU), the European Programs Service of the Urban Environment Observatory (OMAU)) and the Municipal Society of Parking and Services SA (SMASSA).

SMASSA is the promoter of the contracting for the "Preparation of a Logistics Study in compliance with the requirements of the Meister Project", object of this document, these requirements being the following:

i. The smart allocation and management of last mile distribution points for electronic commerce and urban logistics through interoperable charging points.

ii. The installation of solar panels for the supply of renewable energy (RES) to charging points.

iii. The use of the appropriate size of electric vehicles (EVs), that is, enough battery range to cover the distribution area.

iv. The environmental, social and economic impacts of last mile collaborative delivery with electric vehicles.

v. Recommendations to allow ultra-low emission zones in cities (restrictions on access to non-electric vehicles, loading / unloading regulation schedules).

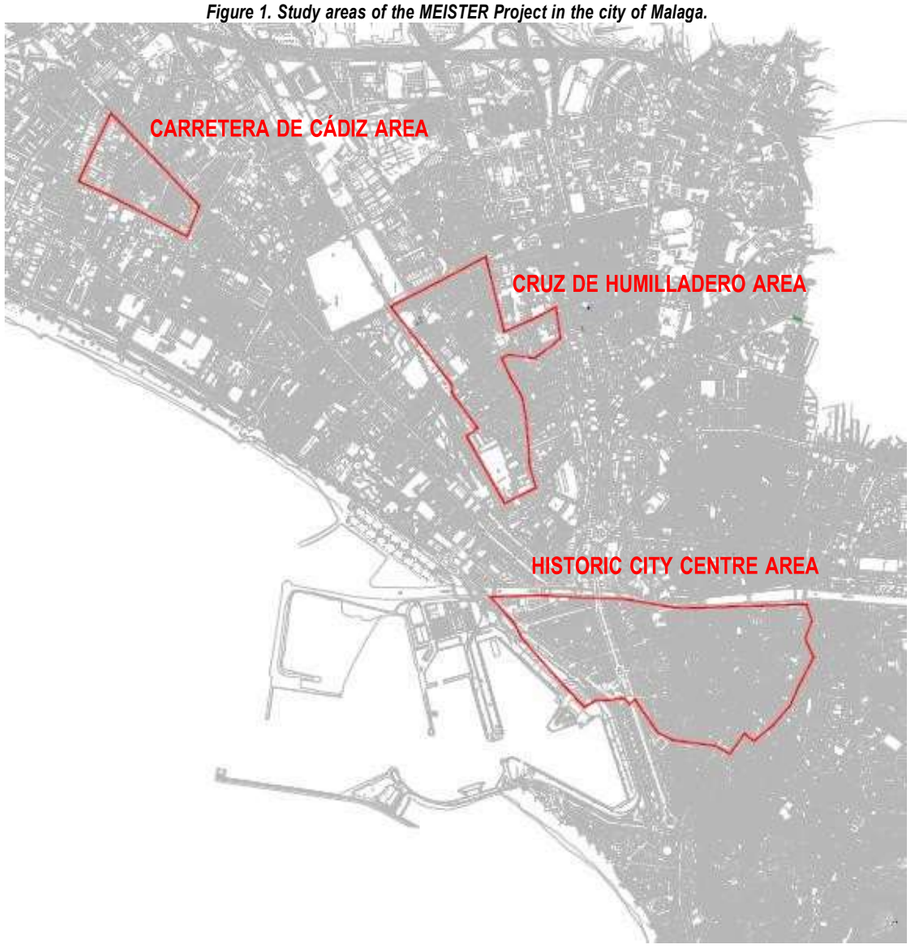
1.2 DESCRIPTION OF THE STUDY AREA.

The Malaga pilot, within the MEISTER project, focuses on three areas within the city: a priority one, in the Center, and two additional, in the Cruz de Humilladero and Carretera de Cádiz districts. The plan included below shows the delimitation of these areas.

The **Historic City Center** of Malaga has 35,000 inhabitants and a population density of 115 inhabitants / hectare. The problem of urban distribution in this area is due to the high demand of the food services sector (HORECA channel of hotel-restaurants-cafes) and shops. In addition, being a very tourist area, the oscillation of demand is influenced by the increase in the floating population due to this sector.

For its part, the areas of **Cruz de Humilladero**, with 90,000 inhabitants and a population density of 200 inhabitants / ha, and **Carretera de Cádiz**, with 115,000 inhabitants and 180 inhabitants / ha, are characterized by a high demand for supply to traditional businesses and parcel delivery related to e-commerce.

Figure 1. Study areas of the MEISTER Project in the city of Malaga.



1.3 THE URBAN GOODS DISTRIBUTION: OVERVIEW.

There are two types of agents involved in the urban distribution of goods (DUM):

- ***Direct agents***: transport operators (who manage and carry out the distribution) and recipients (merchants, hoteliers, homes and offices).
- ***Indirect agents***: neighbors (who do not want loading and unloading at night), the Administration (which must legislate this activity), customers (who demand all kinds of products at all times) and workers.

From the point of view of the transport operator, the trends of urban merchandise distribution are as follows:

- There is an increasing demand for delivery service.
- There has been a concentration of transport operators who, in addition, outsource the activities to self-employed professionals, who, being responsible for the goods arriving in good condition and on time, must minimize travel times, reducing the distance between the parking place to perform loading and unloading operations and the destination. Consequently, it is almost always parked in places not intended for it, which makes it very difficult for loading and unloading operations to be carried out legally in terms of parking.
- The use of logistics is increasing, especially in regard to distribution in the medium and large trade, as logistic platforms are used, route management and new technologies are being introduced in order to improve efficiency in the distribution.
- Smaller vehicles are increasingly used, in part because of the pressure exerted by neighbors, who do not want to see 12-ton vehicles "walking" through their streets. The maximum authorized weight is limited to 3,500 kilos in many cases, which is also convenient from the business point of view, since a vehicle of this characteristics can be driven by anyone who has a B1 class driving license, which eliminates the need for specialized drivers, which increase transport costs. However, the smaller vehicle size means less capacity (a medium-sized van has 10 m3 capacity, compared to 60 m3 of a trailer).

From the point of view of the recipient, the trends of urban goods distribution are as follows:

- Simultaneous concentration of trade in large peripheral areas and in tertiary urban areas.
- Growth of e-commerce (Internet sales), practically exponential, which means a significant increase in loading and unloading.
- Reduction of storage area in business premises. The square meter in tertiary centers is very expensive, and merchants prefer 5 weekly visits with one product each day to a daily distribution with 5 different products, which means considerably multiplying the number of loading and unloading operations, which means that the van or delivery truck become, at the same time, a warehouse, since it is cheaper.

1.4 METHODOLOGY.

To carry out this "Logistics study in compliance with the requirements of the Meister Project", the work has been divided into the following sections:

- **Assessment**, where the following sections are addressed:
  - Demand Analysis, so it will be studied:
    - Economic activities.
    - Boom of "e-commerce" and home delivery service.
    - Generation centers as far as goods transport vehicles are concerned.
    - Analysis of Goods Vehicle Traffic.
  - Supply Analysis, which includes:
    - Access control for heavy goods transport vehicles.
    - Inventory of parking places enabled for loading and unloading.
    - The Urban Center for Ecological Distribution (CUDE) located at C / Camas.
  - Diagnosis, where the results obtained are concluded and summarized.
- **Proposals for action**, which are:
  - Improvement of the Urban Center for Ecological Distribution (CUDE) at C / Camas.
  - New Urban Center for Ecological Distribution (CUDE).
  - Dedicated on-street loading and unloading places for goods electric vehicles.
- **Conclusions**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement Nº 769052.

2 ASSESSMENT OF THE CURRENT SITUATION.

2.1 ANALISYS OF DEMAND.

2.1.1 Economic activities.

The city of Malaga, the capital of the Costa del Sol, has traditionally been of the most important tourist destination, not only at national level, but also at European level. During the decades of the second half of the twentieth century, the Costa del Sol was configured as a reference tourist destination, consolidating a brand image associated with tourism called “sun and beach”.

Throughout this period, the second half of the twentieth century, both the city of Malaga and the rest of the municipalities that are part of the Costa del Sol, experienced remarkable population growth, which was accompanied by an even more notable urban development.

During this expansive process, the economy of the city was basically sustained by the boom in tourism and construction, and it is still happening today as far as the services and tourism sector is concerned. Linked to this same expansive activity, throughout these years there was a continuous and constant process of loss of resident population in the downtown area, at the same time that there was a degradation of the physical spaces in the Center, generating a situation of certain "abandonment" both at the urban level and at the social level.

To reduce or mitigate this effect as much as possible, during the last years of the 20th century and the beginning of the 21st century, initiatives for the integral refurbishment of the Historic City Center were developed, which sought, on the one hand, to revitalize public spaces, historic buildings, streets and squares, and on the other hand, recover resident population and promote economic revitalization of the entire environment.

With these renovation projects grouped under the name of Urban that began in 1995, the image of the Historic City Center was valued. To great performances from an urban point of view, joined others related to the promotion of cultural activity such as the opening of reference museums (Picasso, Carmen Thyssen ...) that helped make the Historic City Center of Malaga an attractive tourist destination, beyond the traditional sun and beach tourism characteristic of the Costa del Sol.

This new tourism, cultural or leisure in urban areas, has been growing in Malaga gradually, encouraged by the cultural offer of the city, located almost exclusively in the Historic Center, which is accompanied by an also growing offer of hotels, catering, bars and terraces located in this same historical and patrimonial space of the city, and which in turn have some supply needs that make them one of the main attraction points of the distribution of goods in this area.

The plans included below show the distribution of uses in the study area defined as a priority in the MEISTER, the Center, according to the “Analysis of Uses in Ground Floor in the Area of PEPRI Center (Malaga)” carried out in 2019, distinguishing the following:

- Commercial.
- Catering industry.
- Hotelier.
- Tertiary use / Offices.
- Equipment.
- Garage.
- Empty / unused premises.
- Logistic (warehouse).
- Front door / Plot Access.
- Residential.
- Technical systems.
- Lot.

The mentioned study distinguishes three macro zones within the scope of the PEPRI Center, which coincides practically with the Center zone identified in MEISTER:

- Historic City Center
- Soho
- Arrabales

The detailed plans of these macrozones are included in the “Economic Activities” Annex.

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Figure 2. General Uses in the Historic City Center macro-zone.

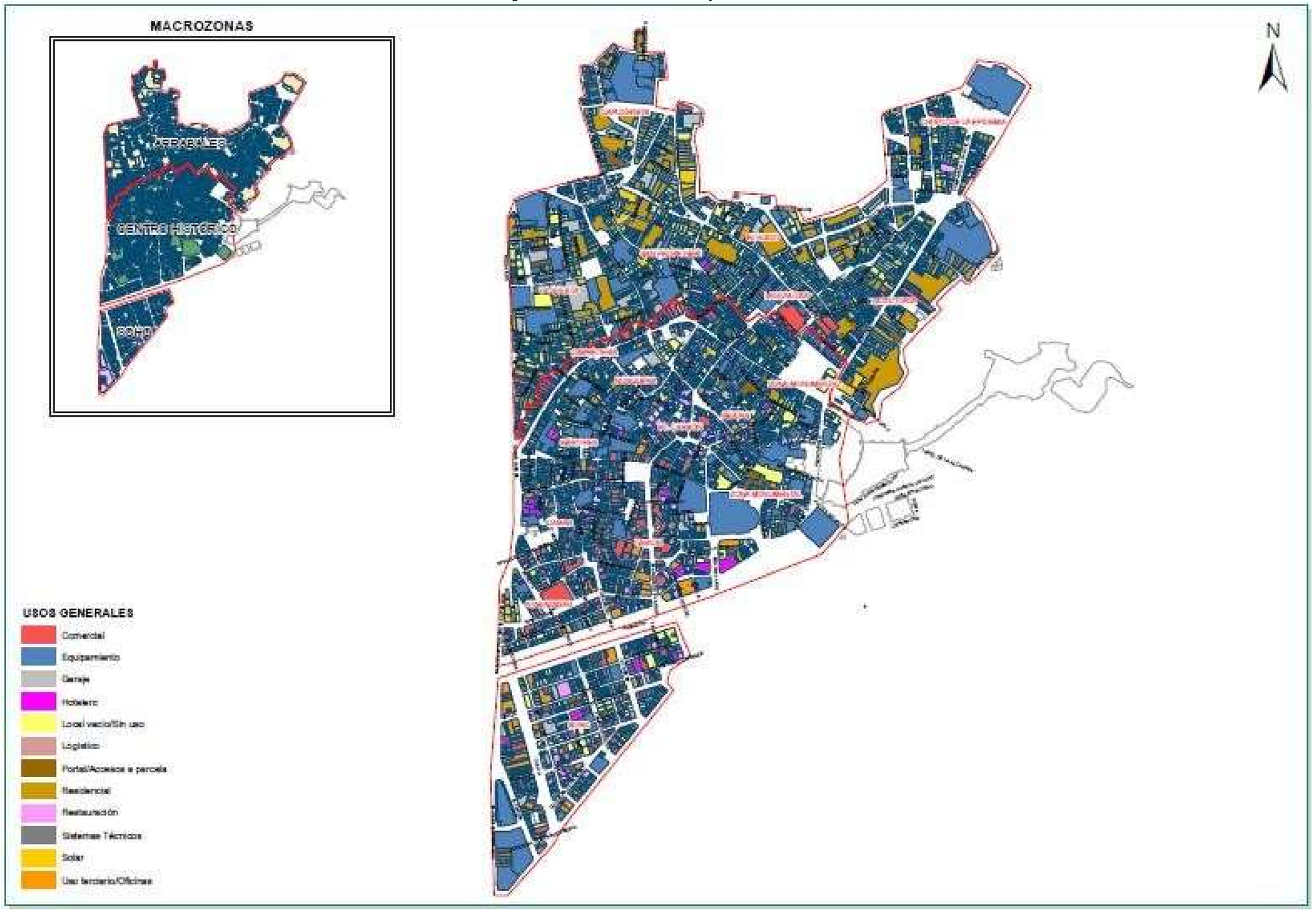

Figure 3. Commercial Use in the Historic City Center macro-zone.

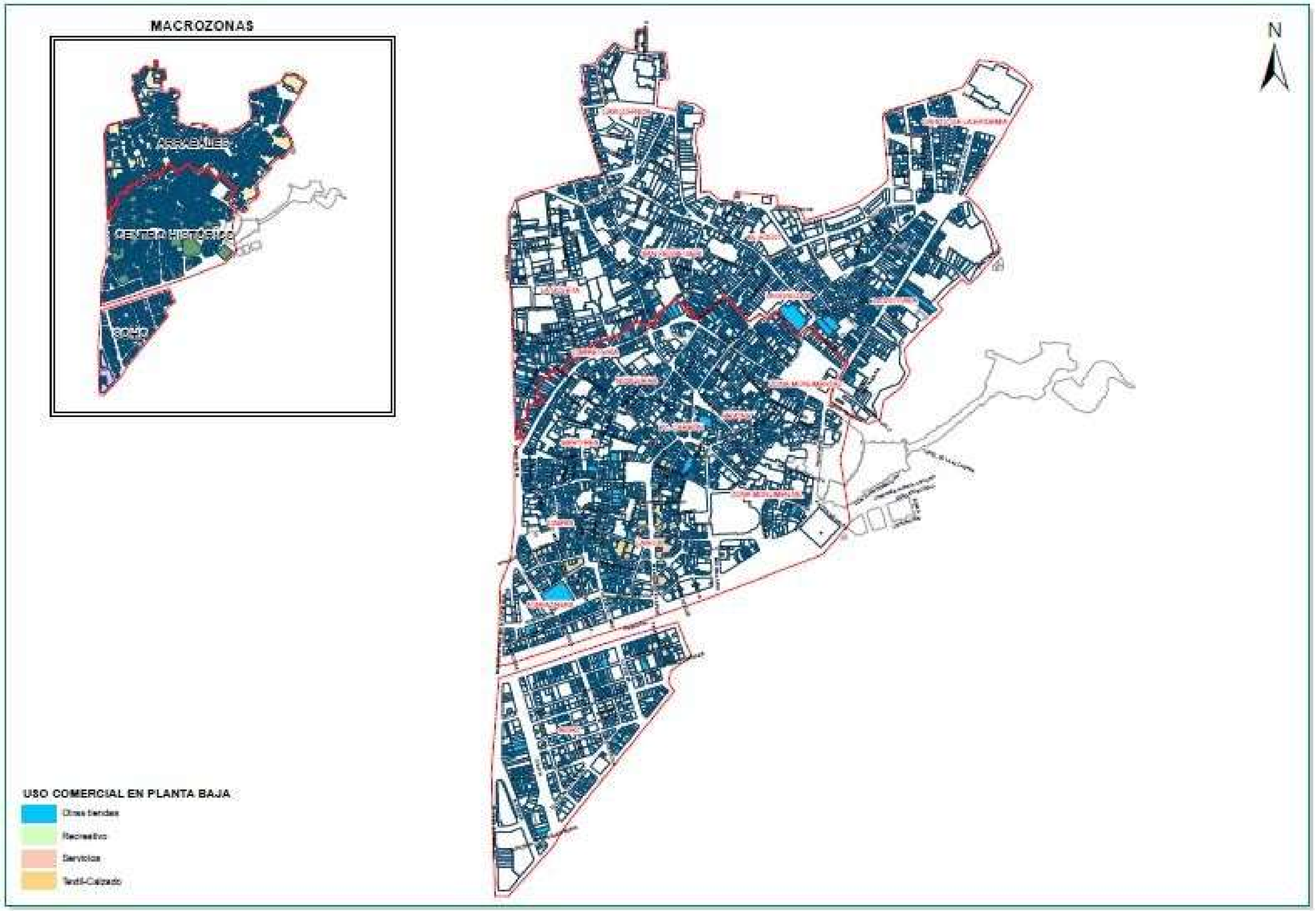

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Figure 4. Share of Commercial Use in the Historic City Center macro-zone.

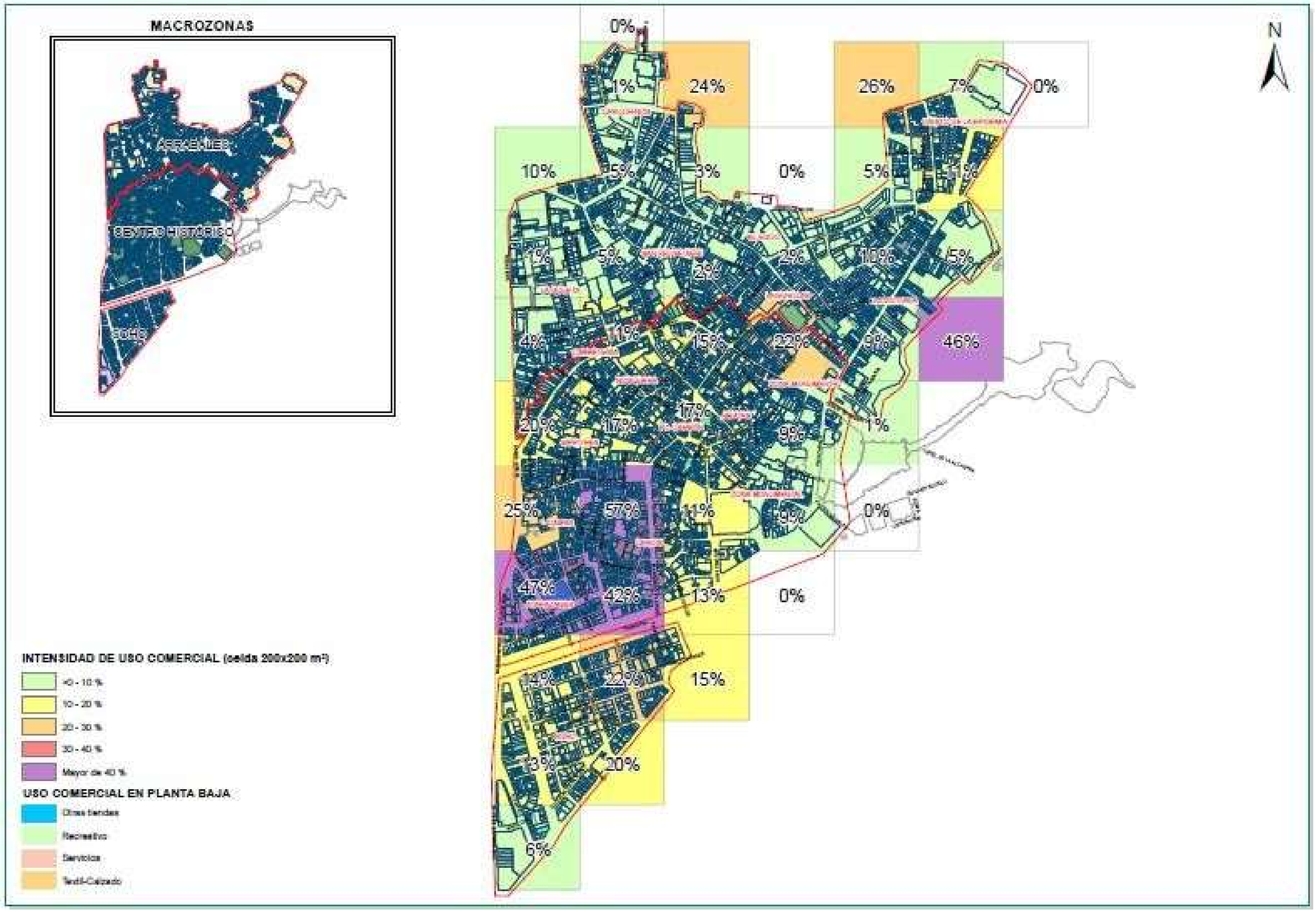

Figure 5. Catering industry Use in the Historic City Center macro-zone.

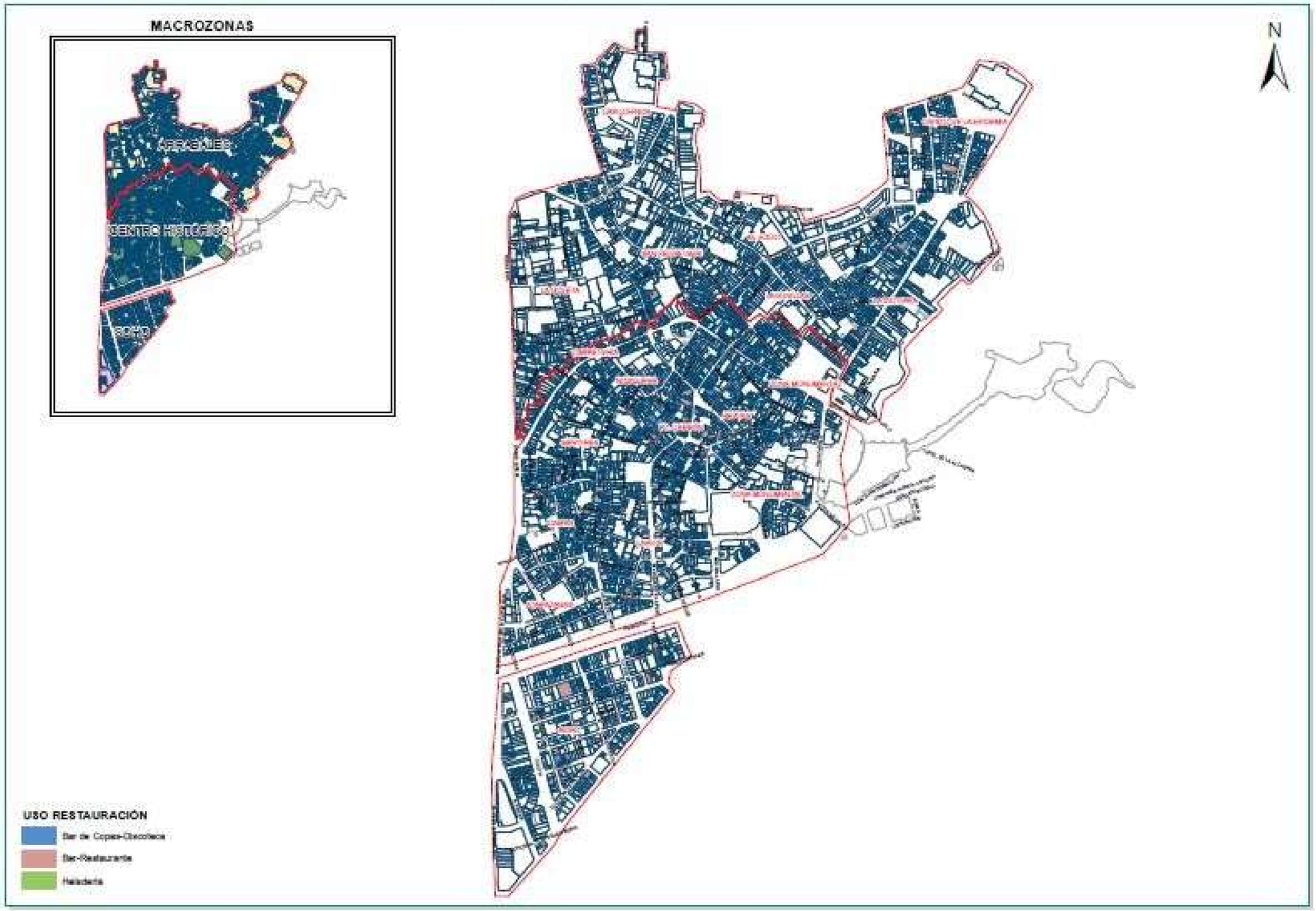

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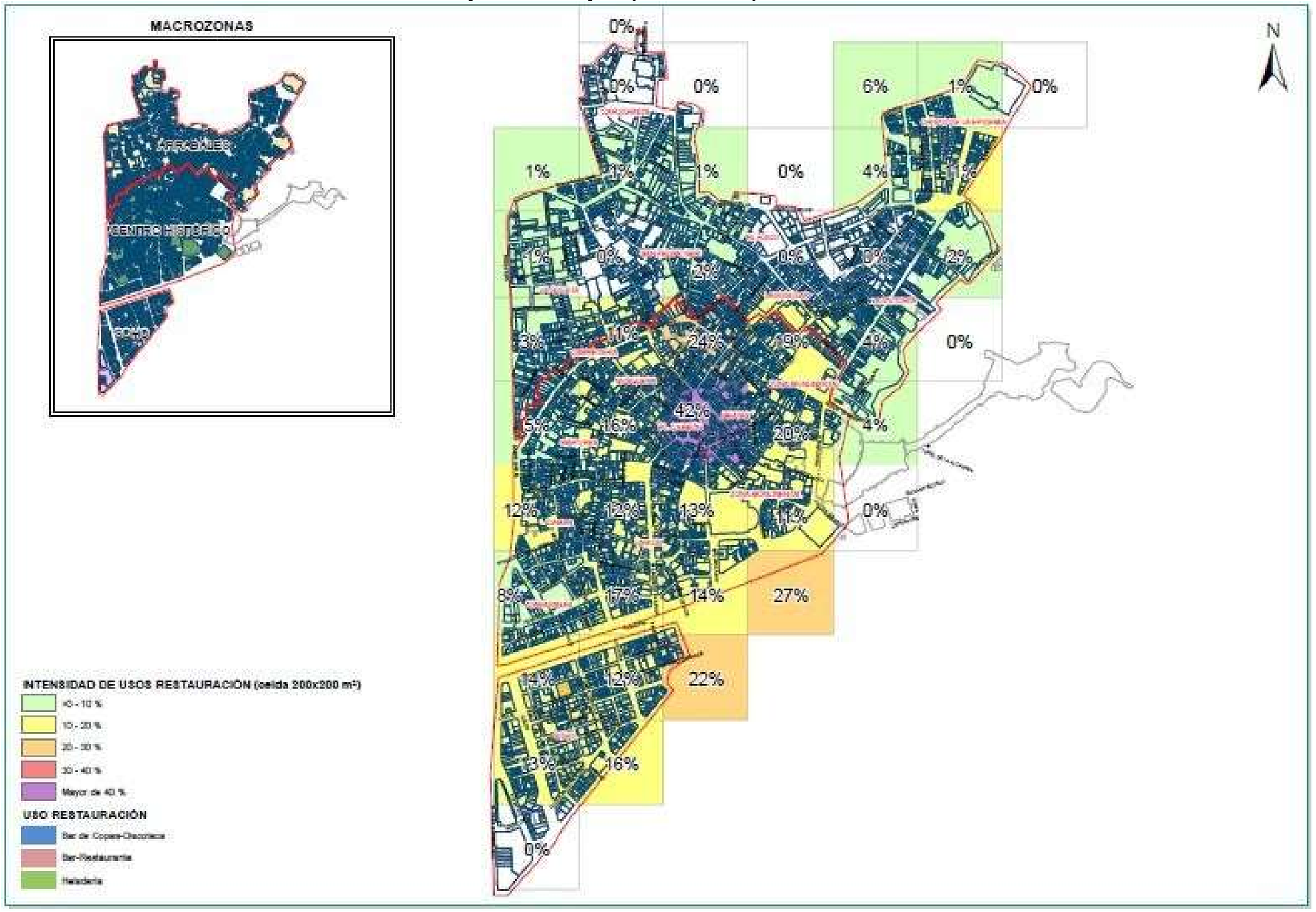
Figure 6. Share of Catering industry Use in the Historic City Center macro-zone.



2.1.2 Boom of "e-commerce" and home delivery service.

On the other hand, electronic commerce or "e-commerce" has experienced a considerable increase in recent years. This phenomenon, together with the distribution of shops' delivery services, even though it is especially advantageous for the customer and the entrepreneur, generates a series of characteristic effects on the operations of urban distribution of products that require innovative logistics solutions.

The main incidents in this regard are the following:

- An important number of deliveries cannot be materialized because the client is not present at their address.
- The delivery provided requires certain schedules of activity (outside working hours), which do not coincide with the time operational windows of the Historic City Center.
- The increase in the fragmentation of orders and deliveries (individualization) generates a greater number of trips (small vehicles) and journeys (km).
- The final distribution of products purchased in the store or online is usually "free", included in the purchase price itself.

2.1.3 Goods transport generation centers.

As main generation centers of freight transport in the city of Malaga, the following logistics centers are distinguished:

- Freight Transport Center of Malaga (CTM).
- MERCAMÁLAGA.
- The Port of Malaga, with an important commercial activity.
- Los Prados Railway Station.
- The Urban Center of Ecological Distribution (CUDE), located in the Underground Parking of Camas Street, in the Historic City Center.
- The area of industrial estates, located in the western part of the city. The following four groups of industrial spaces are distinguished:
    - Estates in Urban Areas, corresponding to those located within the belt delimited by the A-7 Highway, closer to residential areas than the rest of the estates. They are therefore estates that present more commercial activity than industrial.
    - Estates in the Guadalhorce Area, which is undoubtedly the one with the highest industrial activity.
    - Estates in the Churriana Area, near the Airport.
    - Estates in the Campanillas Area. Special mention in this area deserves the Technological Park of Andalusia (PTA), which despite having a classification of industrial space and, therefore, being included in this classification, presents, as its own name indicates, a technological activity (offices, with about 16,000 workers who attend daily), nothing similar to the activity carried out in the rest of the industrial estates.

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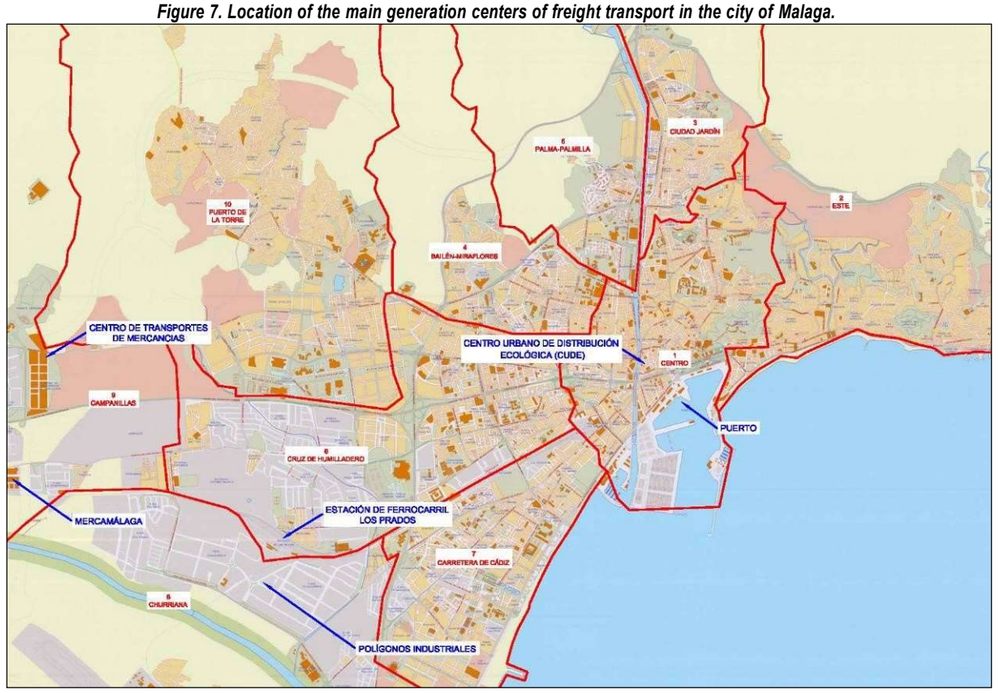
Figure 7. Location of the main generation centers of freight transport in the city of Malaga.



2.1.4 Analysis of Goods Vehicle Traffic.

The sources of information from the Mobility Department of the City of Malaga for the characterization of traffic are the following:

- ***Data Collection Stations (ETD)*** - there are 11 ETDs distributed throughout the city that, in addition to quantifying the number of vehicles that pass through them, they classify them, distinguishing, among other classes, that of "light vehicles" (with a Maximum Authorized Mass -MMA- <3,500 kg) and that of "heavy vehicles" (of MMA> 3,500 kg).

  However, having requested this information, as of the date of submission of this document it has not yet been received.

- ***Access control to the Historic City Center*** - movements of loading and unloading vehicles that access the Road Traffic Restricted Zone of the Historic City Center.

Access control to the Historic City Center

The data provided correspond to the week of July 23-28 2018, when a count was made of the loading and unloading vehicles that accessed the Road Traffic Restricted Zone of the Historic City Center.

The tables and graphs included below show the results obtained by time slots and grouped by day of the week and by access itinerary:

Table 1. Loading/Unloading Vehicle movements per day. Historic City Centre's Restricted Area.

TIME SLOT	Monday 23/07/18	Tuesday 24/07/18	Wednesday 25/07/18	Thursday 26/07/18	Friday 27/07/18	Saturday 28/07/18	TOTAL
7:00 - 8:00	23	26	26	22	29	10	**136**
8:00 - 9:00	27	33	35	36	33	11	**175**
9:00 - 10:00	41	41	43	46	47	14	**232**
10:00 - 11:00	36	45	46	46	50	27	**250**
TOTAL:	**127**	**145**	**150**	**150**	**159**	**62**	**793**

Figure 8. Loading/Unloading Vehicle movements per day. Historic City Centre's Restricted Area.

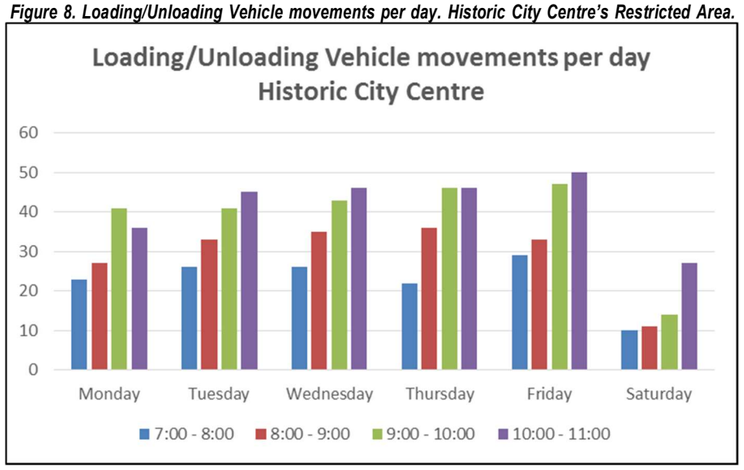


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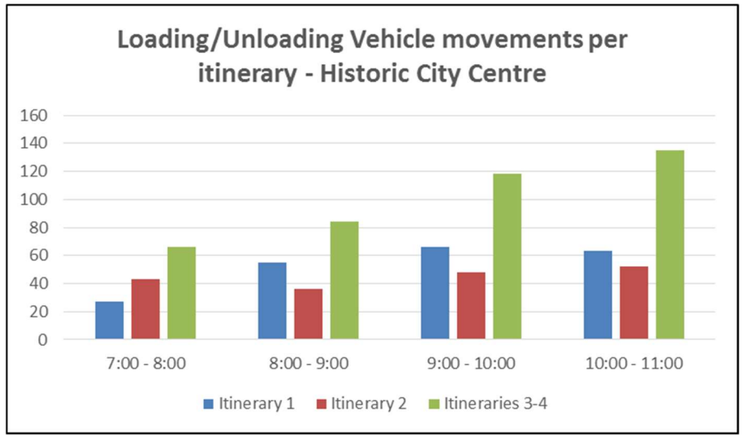
Table 2. Loading/Unloading Vehicle movements per itinerary. Historic City Centre's Restricted Area.

TIME SLOT	Itinerary 1	Itinerary 2	Itineraries 3-4	TOTAL
7:00 - 8:00	27	43	66	**136**
8:00 - 9:00	55	36	84	**175**
9:00 - 10:00	66	48	118	**232**
10:00 - 11:00	63	52	135	**250**
TOTAL:	**211**	**179**	**403**	**793**

Figure 9. Loading/Unloading Vehicle movements per itinerary. Historic City Centre's Restricted Area.



2.2 ANALYSIS OF SUPPLY.

2.2.1 Access control.

Within the Historic City Center of Malaga there is a Road Traffic Restricted Zone to which only the access of certain authorized vehicles is allowed, which can only go through a series of itineraries established in the "Decree about the System for Access Control to Road Traffic Restricted Zones, as Considered Protected Interest Environments" of the Malaga City Council Mobility Department.

In particular, authorized goods transport vehicles can only carry out loading and unloading activities on certain itineraries, the so-called itineraries from 1 to 4, and areas specified in said regulations:

Table 3. Itineraries and Loading / Unloading Spaces in the Road Traffic Restricted Area of the Historic City Center.

ITINERARY	DESCRIPTION	LOADING / UNLOADING SPACE
Itinerary 1:	One-way route. This itinerary will be accessed from Guillén Sotelo, and will be exited through Molina Lario, traveling through the following streets: Guillén Sotelo, Travesía Pintor Nogales, plaza de la Aduana, Císter, San Agustín, Duque de la Victoria, plaza del Siglo, Molina Lario, plaza del Obispo and Molina Lario.	A/ The whole C/ Císter.
		C/ C/ Molina Lario (from Pza. del Siglo to C/ Santa María).
Itinerary 2:	One-way route. This itinerary will be accessed from Puerta del Mar and will be exited through Molina Lario, with the same exit as itinerary 1, traveling through the following streets: Martínez, Sancha de Lara, Molina Lario.	C/ Martínez where signaling allows it.
Itinerary 3:	One-way route except for the section corresponding to Comedias Street (from Nosquera) -Santa Lucía- Jesús de la Pasión Square. This itinerary will be accessed from Plaza del Teatro and will be abandoned by Nosquera Street towards Carretería Street, passing through the following streets: Comedias, Santa Lucía, plaza Jesús de la Pasión, Santa Lucía, Comedias, Nosquera.	C/ Nosquera, according to the plan included below.
		C/ Comedias, in the section between calle Méndez Núñez and calle Nosquera.
		Additional space in Pza. Jesús de la Pasión, which will be accessed from C / Comedias and C / Santa Lucía, and vice versa for exiting the route.
Itinerary 4:	One-way route. This itinerary will be accessed, as well as itinerary 3, from the Plaza del Teatro towards Méndez Núñez and will be abandoned through Cárcer towards Álamos, traveling through the following streets: Méndez Núñez, Casapalma, Cárcer.	Additional space: L-shaped section between C/ Méndez Núñez, from its intersection with C/ José Denis Belgrano, and C/ Granada to Pza. del Siglo.

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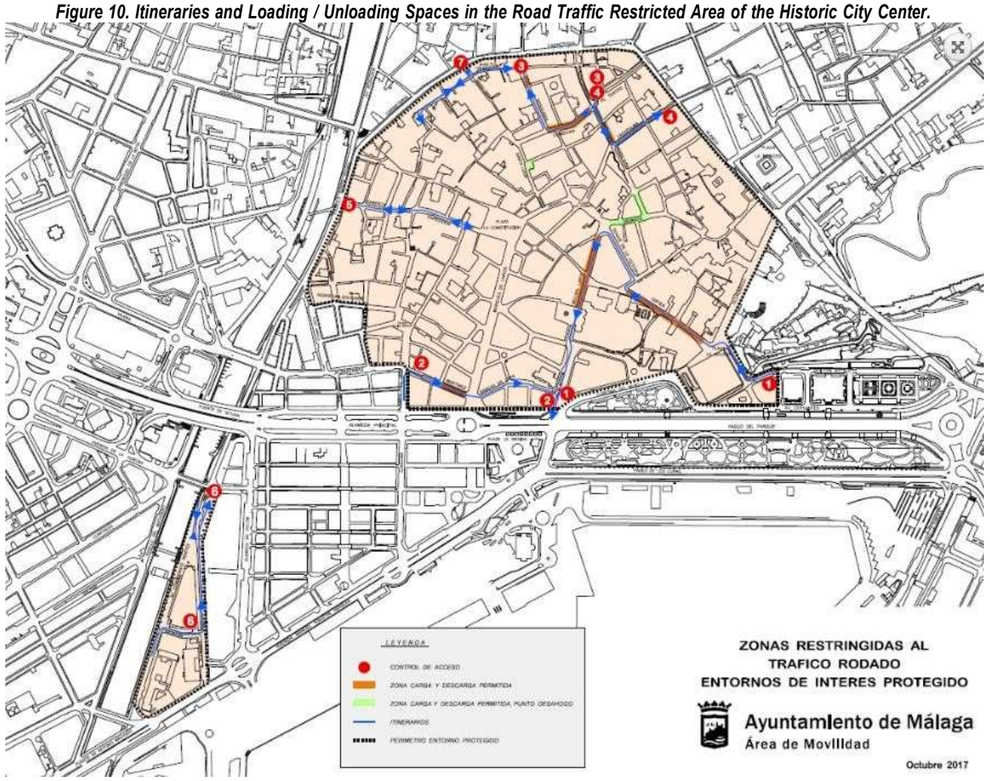
Figure 10. Itineraries and Loading / Unloading Spaces in the Road Traffic Restricted Area of the Historic City Center.



The following are considered AUTHORIZED VEHICLES FOR GOODS TRANSPORT:

- Vehicles associated with owners or lessees of commercial premises.
- Vehicles that carry out goods distribution activities within the restricted access zone of the city of Malaga, provided that the activity is not associated with the execution of a work, a removal or a specific job.
- Vehicles associated with delivery companies and home delivery of perishable products from the supermarket (referring to the need for to carry out work, tasks or activities in the area).

Access to areas restricted to road traffic in protected environments is not allowed for vehicles that exceed the limitations in terms of maximum authorized mass, that is, whose MMA is equal to or greater than 10,000 - 11,500 kg of MMA per axle, unless have special authorization.

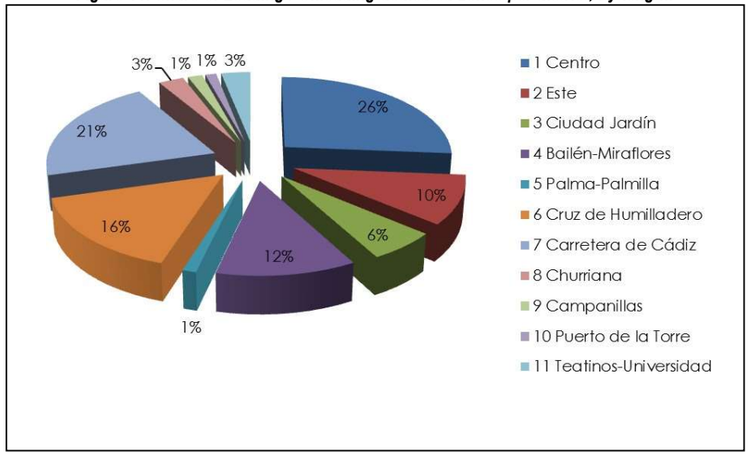
The goods distribution tasks will be carried out from 7:00 a.m. to 11:00 a.m. from Monday to Saturday, and must, in any case, have abandoned the itineraries before 11:00 a.m.

However, the carriers and distributors that operate in the area consider this time slot insufficient, especially considering many of the shops start their activity at 10:00 (see Annex "Meeting Minutes").

2.2.2 Loading and unloading spaces.

According to the Progress Document II of the Sustainable Urban Mobility Special Plan of Malaga (PEMUS), there are a total of 5,237 meters in the city reserved for loading and unloading, between angle and parallel parking spaces, spread over 255 different dedicated zones. As a matter of fact, the Center, Cruz de Humilladero and Carretera de Cádiz districts, with 67% of the total reserve (26%, 16% and 21%, respectively) stand out:

Figure 11. Share of Loading / Unloading dedicated zones per district, by length.



Most of the dedicated spaces correspond to parallel parking, which is the dominant type in all districts of the city.

In order to know the approximate number of loading and unloading places, the length of the existing of dedicated zones in each district have been used and an average dimension has been awarded for each type of parking, 5 meters in length for the parallel parking spaces and 2.2 meters for angle parking spaces. The share of places by district thus obtained are similar to those shown above, referring to meters of dedicated zones, with no significant differences:

Figure 12. Share of Loading / Unloading dedicated zones per district, by number of parking places.

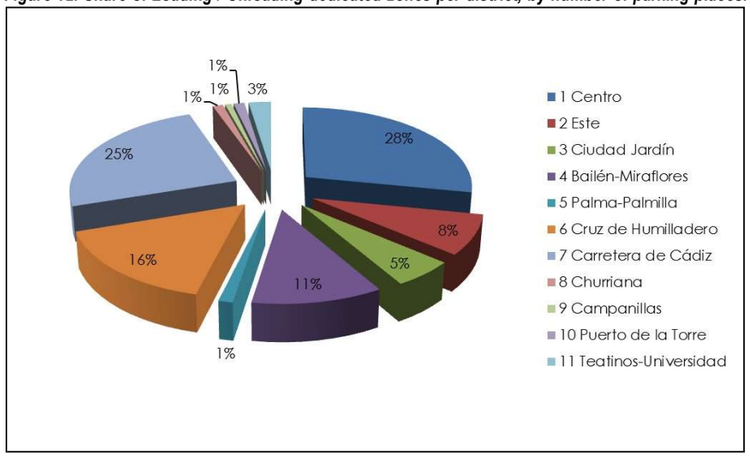


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Figure 13. Length of Loading / Unloading dedicated zones per district and type of parking.

Reserva en metros para la carga y descarga por distrito y tipo						
Distrito	Nº de reservas	Plazas aproximadas				Plazas/zona de reserva
		Batería	Línea	Desconocida	Total	
1 Centro	67	144	233	8	385	6
2 Este	25	27	61	22	110	4
3 Ciudad Jardín	15	12	54	7	73	5
4 Bailén-Miraflores	30	34	22	96	152	5
5 Palma-Palmilla	3	0	0	17	17	6
6 Cruz de Humilladero	40	114	99	7	220	5
7 Carretera de Cádiz	53	157	180	0	338	6
8 Churriana	7	2	14	0	15	2
9 Campanillas	4	0	10	0	10	2
10 Puerto de la Torre	3	0	11	5	16	5
11 Teatinos-Universidad	8	0	29	4	33	4
Total	**255**	**490**	**713**	**165**	**1.368**	**5**

Particularizing for the MEISTER areas within the Centre, Cruz de Humilladero and Carretera de Cádiz districts, the existing Loading / Unloading dedicated zones are shown below, with their codification according to PEMUS and its location:

Table 4. Loading / Unloading dedicated zones in the City Centre study area.

CITY CENTRE AREA		
Nº DEDICATED ZONE	**STREET**	**LOCATION OF DEDICATED ZONE**
2	Alameda De Colón	Esq. Pje. Valencia
3	Alameda De Colón	Esq. Barroso
8	Avenida De Manuel Agustín Heredia	Esq. Pl. Poeta Alfonso Canales
12	Calle Atarazanas	Esq. Pastora
15	Calle Carretería	Esq. Dos Aceras
16	Calle Carretería	Esq. Nosquera
17	Plaza Poeta Alfonso Canales	Esq. Avda. Manuel Agustin Heredia
31	Calle Duque De Rivas	Esq. San Bartolome
32	Calle Duquesa De Parcent	Esq. Tomas Heredia
35	Calle Frailes	Esq. Merced
36	Calle Gómez Pallete	
37	Calle Guillén De Castro	Esq. Sagasta
43	Plaza De Arriola	Esq. Atarazanas
48	Calle Olozaga	Esq. Sebastian Souviron
51	Calle Postigo De Los Abades	Fachada Catedral
53	Calle Sagasta	Esq. Pl Arriola
54	Calle Sagasta	Esq. Guillen De Castro
59	Calle Tejón Y Rodríguez	Esq. Carreteria
61	Calle Tomás Heredia	Esq. Barroso
63	Plaza De Arriola	Esq. Sagasta
64	Plaza De La Marina	Esq. Almda. Principal
256	Calle De Pinzón	Esq. San Lorenzo
257	Calle De Pinzón	Esq. San Lorenzo

Figure 14. Loading / Unloading dedicated zones in the City Centre study area.

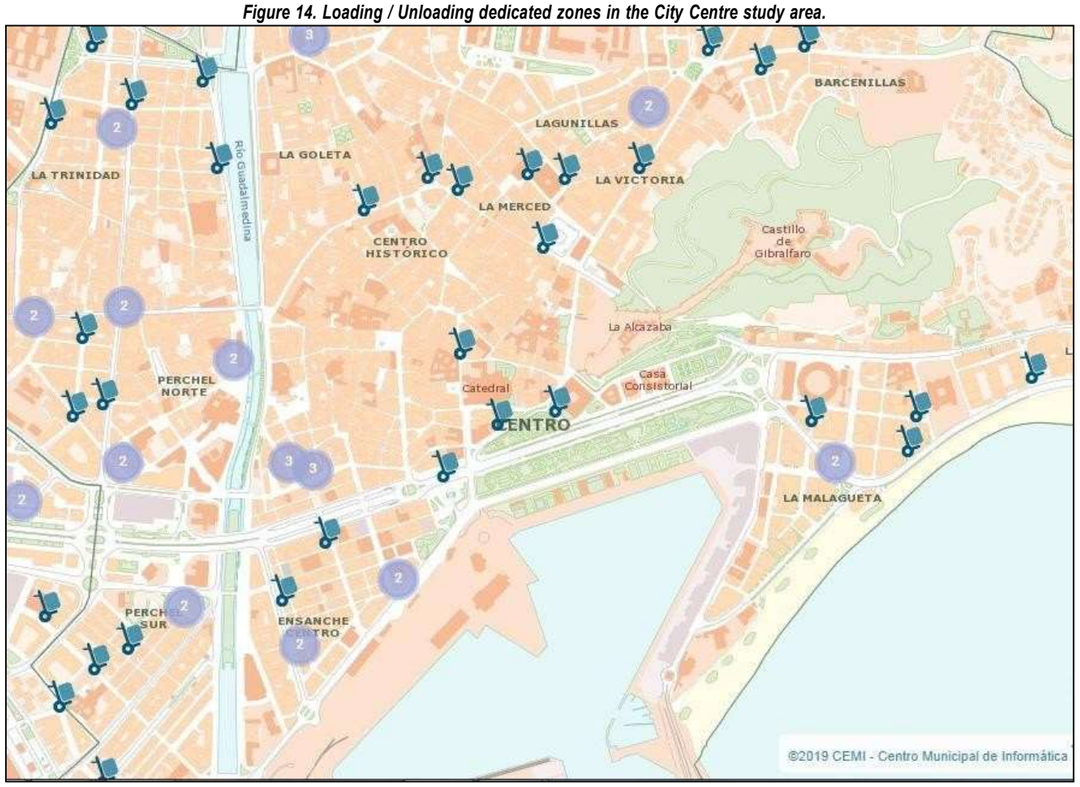

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Table 5. Loading / Unloading dedicated zones in the Cruz de Humilladero study area.

CRUZ DE HUMILLADERO AREA		
Nº DEDICATED ZONE	**STREET**	**LOCATION OF DEDICATED ZONE**
124	Paseo De Los Tilos	Esq. Diego De Almaguer
137	Paseo De Los Tilos	Esq. Edison
139	Avenida De La Aurora	Esq. Eduardo Carvajal
143	Calle Antonio Luis Carrión	Esq. Union
149	Calle Flores García	Esq. Pso. Tilos
151	Calle Gregorio De Frías	Esq. La Union
152	Calle Horacio Lengo	Esq. Fernandez Fermina
155	Calle Mauricio Moro Pareto	Esq. Pso. Tilos
158	Calle Reboul	Esq. Juan Bautista Barba
161	Calle La Unión	Esq. Pje. Dracma
168	Camino De San Rafael	Nº 20
169	Camino De San Rafael	Nº 8
170	Calle Santa Marta	Esq. Pl. Cruz Humilladero
245	Calle Conde De Guadalhorce	Esq. Plaza Cruz De Humilladero
274	Calle Edison	Esq. Union
275	Calle La Unión	Esq. Juan Barcena Mancheño
276	Calle Francisco De Sarriá	Esq. La Union

Figure 15. Loading / Unloading dedicated zones in the Cruz de Humilladero study area.

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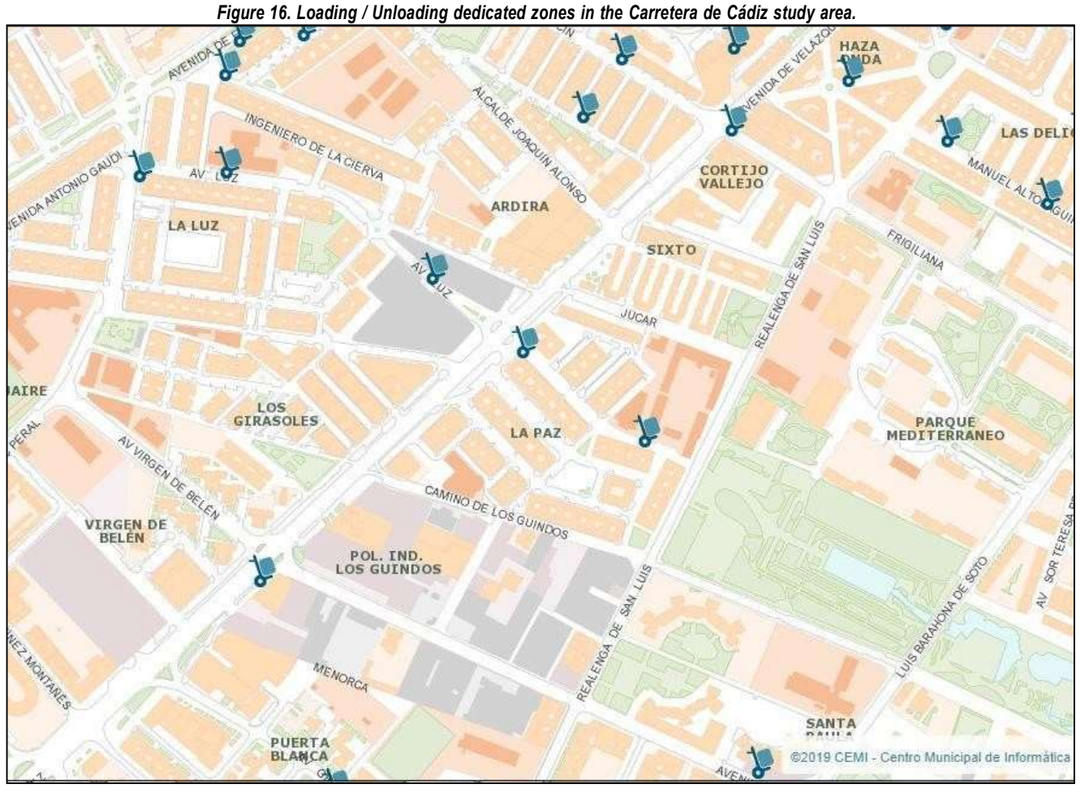
CARRETERA DE CÁDIZ AREA		
Nº DEDICATED ZONE	**STREET**	**LOCATION OF DEDICATED ZONE**
172	Calle Beethoven	Esq. Vivaldi
179	Avenida De Velázquez	Esq. Avda. Guindos
197	Calle Frigiliana	Esq. Avda. Velazquez
207	Calle Juan Sebastián Bach	Esq. Avda. Velazquez

Figure 16. Loading / Unloading dedicated zones in the Carretera de Cádiz study area.



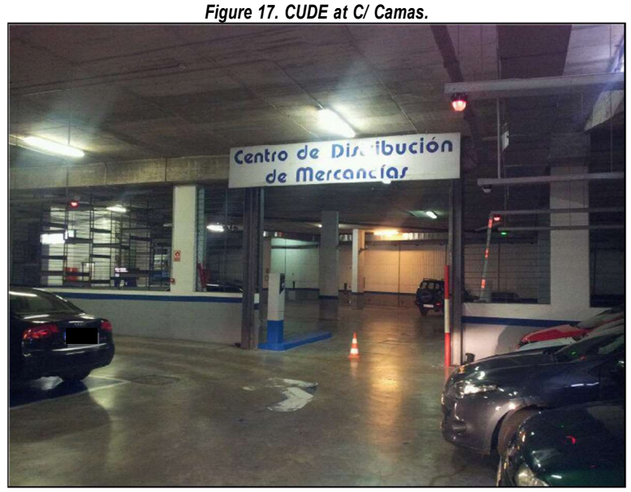
The general opinion among transporters and distributors, as stated in the meetings held with them (see Annex "Meeting Minutes"), is that while in Cruz de Humilladero and Carretera de Cádiz there is a sufficient supply of loading and unloading places to cover the demand of the area, the main problem of the Historic City Center and, in particular, of the Road Traffic Restricted Area, is the lack of space dedicated to carry out these operations, complaining that they are “always” occupied.

2.2.3 Urban Center for Ecological Distribution (CUDE) at C/ Camas.

Special mention should be made of the CUDE, the Urban Center for Ecological Distribution, located in an area of the first floor of the underground Municipal Public Car Park at Calle Camas.

In 2004, the City Council of Malaga in collaboration with the Federation of Transportation of Malaga (FETRAMA) launched this CUDE. Through this initiative, which is still working, Malaga became the first city in Spain to distribute the goods through a historic center with a system of these characteristics, where non-contamination of space is one of the main elements.

Figure 17. CUDE at C/ Camas.



The CUDE brings together the main industrial parcel companies that from there distribute the parcels daily through the Historic City Center with non-polluting electric tow trucks and bicycles. It is in this same Center where there are charging points for these vehicles to recharge their batteries.

Figure 18. Electric vehicles for last-mile distribution of goods from the CUDE at C/ Camas.

Notwithstanding the above, and despite starting with a very positive planning in terms of sustainable mobility (with the main advantage for this system of the Center's compactness, since an operator, once he parks his goods vehicle, can cross with a wheelbarrow the influence area in 10 minutes), the results have not been entirely as expected.

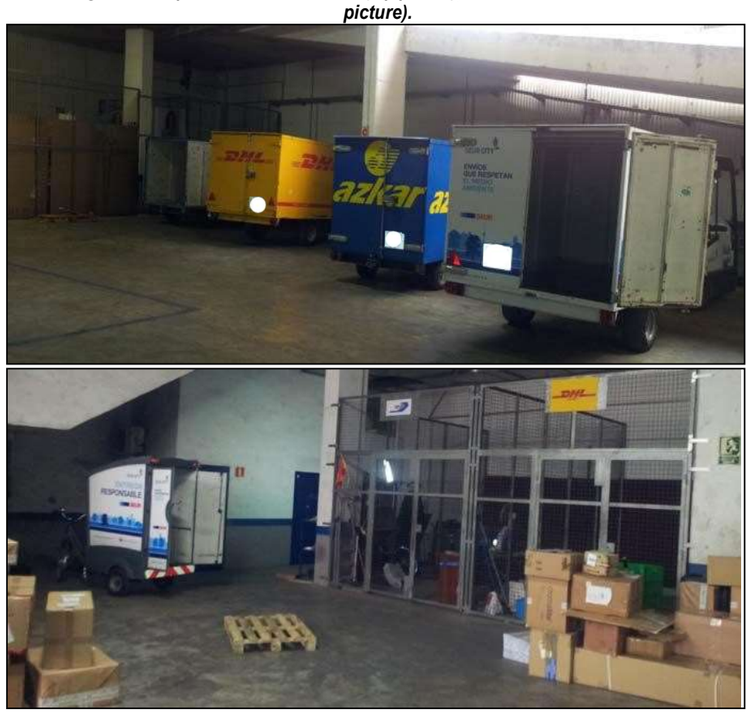
One of the main reasons for this lower use than expected could be in the on-street offer (coexistence of pedestrian mobility with motorized urban distribution of goods at the times and itineraries aforementioned).

Proof of this is that what was born as practically the entire first floor of the Calle Camas car park, has been reduced to 1/3 of what it was, replacing the remaining 2/3 with rotating parking places.

To this we must add the complaints of some carriers (drivers) for the steep slopes of entry to the parking, and especially of exit, which can cause damage to heavy vehicles in the long term (brakes, clutches, tires,...).

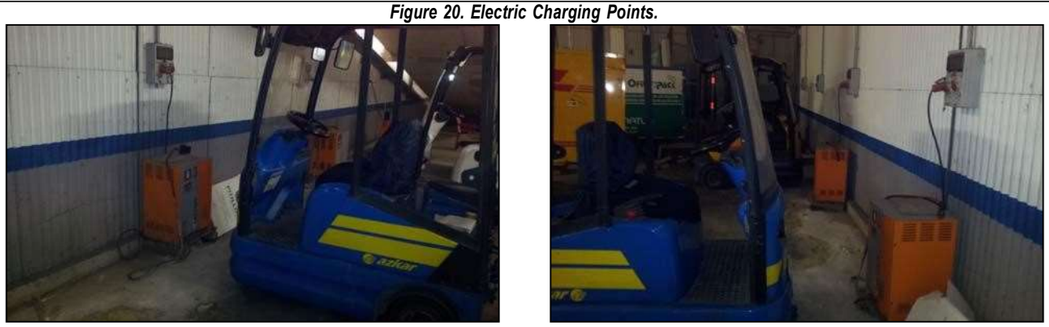
At present, user companies of the C / Camas CUDE transport their goods to it on vehicles of up to 3,500 kg (vans or trucks). Three of them (SEUR, DHL and DACHSER - formerly AZKAR -) have owned electric vehicles: one electric tow truck each, plus two electric tricycles in the case of SEUR. The rest have other means of their own.

Figure 19. Electric vehicles for goods transport of the main carriers (top picture), which also make sole use of a small warehouse (bottom picture).



Another strength to highlight in this urban goods management system is that these electric vehicles have in their parking spaces, as already mentioned, charging points, as shown in the following figures:

Figure 20. Electric Charging Points.



From all of the above, the following advantages and disadvantages of this Urban Center for Ecological Distribution located in C/ Camas can be inferred:

- Advantages:
  - It is unquestionable that its implementation is due to the idea of enabling a goods management system within the framework of sustainable mobility.
  - Very attractive in compact Historic Centers (10 minutes walking from one end to the other).
  - It has a higher demand at times when motorized access is restricted.
- Disadvantages:
  - The on-street offer is the main cause of loading and unloading vehicles not opting for the use of CUDE, since they can carry out loading and unloading operations in less time (closer to the destinations of the businesses premises) and without additional cost for the use of infrastructure.
  - Ramps of exit with high slope that hinder the maneuver and can produce mechanical damages of the vehicle in the long term.
  - Requires investment of electric vehicles estimated at about € 25,000. In this sense, some operators show complaints for allowing access for on-street loading and unloading, although in restricted hours, once they had already made the investment.

Despite the aforementioned drawbacks, the user parcel companies of this CUDE are generally satisfied with their location and their current configuration, considering them adequate to carry out the distribution of the last mile of their goods in a satisfactory way and which allows them to cover the daily demand of the area, composed mostly of shops and individuals.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement N° 769052.

3 DIAGNOSIS.

- The Historic City Center and, in particular, the Area of Restricted Access to Road Traffic, presents an offer of on- street loading and unloading spaces that is insufficient to cover the demand in the area. This, together with the limited hours established for this activity, from 7:00 to 11:00, which also does not coincide with the opening hoursof many of the premises (which is usually 10:00), requires freight vehicles to park in places far from the Center,some unsafe, or illegally.
- The current Urban Center for Ecological Distribution (CUDE), located in basement 1 of the C/ Camas public car park for the last mile distribution of goods using non-polluting vehicles, does not solve this problem, since the steep slopes of the ramps of entry and exit, which can cause damage to heavy goods vehicles, together with the coexistence of supply of on-street loading and unloading spaces closer to the final recipients, makes the use of CUDE not attractive or even possible for carriers.
- This CUDE is, however, suitable for the last mile distribution of parcels and other light goods to the Restricted Access Area of the Historic City Center. This is due, on the one hand, to its location, in the western part of said area, where most of the shops are concentrated, which are, along with individuals, the main recipients of these goods, On the other hand, as they are lighter merchandise, the inclination of the entrance and exit ramps does not pose a danger to the vehicles that transport them to the CUDE or to those who make the last-mile distribution, in terms of possible breakdowns or excessive wear on items such as brakes.
- Given the advantages of urban centers for ecological distribution, discussed above, and their suitability in compact urban centers, as is precisely the case of the Historic Center of Malaga, it is considered convenient to create within it a system with more than one CUDE, in which each of them specializes in different types of merchandise, as one of the optimal solutions to minimize or eliminate the negative impacts that urban merchandise distribution entails. Thus, while the existing CUDE could specialize in home parcel delivery and other low-weight merchandise to the shops of the Historic City Center, the implementation of a new CUDE destined for the distribution of heavy merchandise (something that the CUDE of the Camas street car park does not allow) would help to solve the problems of the DUM in the Center, where the catering and hotelier businesses, concentrated mainly in the eastern part of the Restricted Access Zone, represent a large part of the demand.
- On the other hand, demand in the areas of Cruz de Humilladero and Carretera de Cádiz is covered with existing on-street loading and unloading spaces. Given the higher population density present here, an important part of said demand is made up of parcel-type goods (electronic commerce).

4 PROPOSALS FOR ACTION.

4.1 IMPROVEMENT OF THE URBAN CENTER FOR ECOLOGICAL DISTRIBUTION (CUDE) AT C / CAMAS.

Because of the reasons stated in the "Diagnosis" section, it is proposed to dedicate the current CUDE, located at C / Camas, to the exclusive distribution of parcels. Its operation will also be improved by implementing an application for booking the existing resources there for last mile distribution by electric vehicles: parking space for loading and unloading of goods and storage space.

The mentioned application, developed within the MEISTER project, has two interfaces:

- ***User or driver interface*** - this is an app that will allow freight vehicle drivers to consult the resources that have been reserved for their vehicles for that day by their company.
- ***Management interface*** - this web app is designed to be used by management personnel within logistics / distribution companies, to request and manage the reservation of resources and assign them to their vehicles and drivers.

Also, this application will allow SMASSA to analyze the use of CUDE resources.

Of the parcel companies that distribute a greater volume of merchandise through it, four have expressed their interest in participating in the project: SEUR, DHL, TNT and CBL. The first two have their own EV based on the CUDE, so they require permanent parking spaces: one in the case of DHL for their electric tow truck, and at least two in the case of SEUR for their truck and two electric tricycles (these can use the same place). And all of them will need to reserve a space each day for the vehicle that transports their goods to the CUDE, at least for the duration of the loading and unloading operation.

The rest of the companies move smaller volumes, so no response has been received from them. However, they will be taken into account for their possible involvement in this measure in the future.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement N° 769052.

4.2 NEW URBAN CENTER FOR ECOLOGICAL DISTRIBUTION (CUDE).

4.2.1 Description.

As for the location of the new CUDE proposed, currently unused plots could be used that are located next to the Road Traffic Restricted Zone. In this sense, there is a plot at Gigantes Street that is also tangential to the axis formed by Carretería and Álamos streets, which separates the old "central almond", which practically coincides with the Road Traffic Restricted Zone, from the historic suburbs located further north, currently operating as service roads for the distribution of goods in most of the historic center.

Figure 21. Location of the CUDE proposed at C/ Gigantes.

The plot has an area of about 1,500 m2 and connects with Carretería Street through Gigantes Street.

The proposed center will constitute a logistics space for distribution of goods that will be accessed by transport vehicles, which due to their characteristics (dimensions, emissions or noise) are not possible or desirable to access the streets of the historic city center.

Once in the CUDE, the goods are unloaded and managed through an intelligent system for temporary storage and later distribution to final customers (last mile transport), through electric vehicles of adequate size and capacity.

The last mile transport, from the CUDE to the clients, is conditioned by the integration in the environment where the distribution will be made (narrow and pedestrianized streets) and by the optimal relationship between the transport capacity, and the range of the battery. For all these reasons, it is proposed to do so by means of five electric tow trucks for charging with a lithium-ion battery, extra elastic wheels and suspensions adapted for a ride as friendly as possible with the pedestrian environment.

This CUDE is delimited by narrow streets, so it will have a single access through C / Gigantes which is reached through C / Carretería, which will be semi-pedestrianized in the future. Therefore, it is not convenient that the inbound flows of the vehicles that transport the goods to the CUDE coincide with the outflows of the electric vehicles that distribute them to the final customer. For this reason, it would be recommended that the provisioning of the CUDE be carried out at night, recommending the period between 10:00 p.m. and 5:00 a.m., and that the distribution of the last mile in electric vehicles be carried out from 8:00 a.m. to 8:00 p.m., which is the current time slot established for the CUDE of C / Camas.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement N° 769052.

Figure 22. Access to the plot proposed for the CUDE at C/ Gigantes.

The centralization in a single installation of the storage, consolidation and distribution of last mile of the goods destined for the historic city center will produce an optimization and / or reduction of the necessary means: number of vehicles, personnel and energy consumption.

The use of the new CUDE will result in a reduction in the operating costs of the distribution companies that currently maintain large fleets of small-sized vehicles for the distribution in short and determined periods of time, especially of the heavy goods of the so-called channel HORECA (hotels, restaurants and cafes).

The reduction in operating costs derives from the characteristics of the new CUDE and the last mile distribution regulation project, which are, among others:

- The significant storage capacity of the new CUDE that will transform the way in which the stocks of the HORECA channel are managed in the historic center. Thus, in contrast to frequent trips downloading a small volume of merchandise - given the little storage space available in these premises -, in the new CUDE, non-perishable goods can be stored for longer periods of time, reducing the number of trips required from Mercamálaga, or another center, to the historic city center.
- The intelligent management of the warehouse will allow to transport merchandise to the same recipient or to recipients of the same area or street of the historic city center, as well as merchandise managed by different logistics operators, so that the number of trips necessary to each recipient will be reduced.
- Intelligent travel planning will optimize the use of CUDE electric vehicles, establishing routes that optimize the distribution capacity of each of these trips and minimize the kilometers traveled in said distribution.

4.2.2 Energy saving and environmental impact.

The impact that will produce the new scheme of operation of the distribution of goods to the Historic City Center of Malaga derived from the construction of this new CUDE in Gigantes street, will be due to the reduction of the distance traveled by the vehicles that currently make the distribution until the final customer in the Old City, which translates into lower fuel consumption and, therefore, lower energy consumption and carbon dioxide (CO2) and other pollutants emissions derivedfrom its combustion, as well as the reduction of trips and, therefore, the distance traveled by smaller vehicles, for the reasons stated in the previous section.

Given the location of the CUDE "Gigantes" and the autonomy of the electric vehicles that would do the last mile distribution from there to the customers, it is considered that they would be itineraries 3 and 4 of the Traffic Restricted Zone of the Old City and the vehicles currently using them those that would be within the area of influence of the new CUDE (see "Access Control" section).

In addition to the impact on energy consumption and CO2 emissions, the effect on emissions of other air pollutants has also been considered, either because of their relevance in the city of Malaga due to their current high concentration, or because of their harmful effects on health and / or architectural cultural heritage: nitrogen oxides (NOx), particulate matter (PM) and sulfur dioxide (SO2).

Thus, considering the Historic City Center of Malaga as the geographical scope for estimating the impact generated by the CUDE "Gigantes", the results set out below are obtained.

4.2.2.1 Energy consumption

Of the 140 vehicles per day that currently transport non-perishable goods to the Historic City Center, which is what the CUDE "Gigantes" would be used for, according to the information provided by the Association of Food, Beverage and Catering Supplies Distributors (ADISABES)), 60% (84 vehicles) correspond to vehicles of 3.5T, for which a fuel consumption ratio of 21 L / 100 km has been considered, according to the "Guide for Fuel Management in the Road Transport Fleets" prepared by the Institute for Diversification and Energy Saving (IDAE), while the remaining 40% (56 vehicles) are 1.5 T vehicles, having considered a ratio of 14 L of fuel consumed per 100 km, according to said Guide.

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BEFORE SITUATION (PRESENT)

Working day

ENERGY CONSUMPTION DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
3500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	84	a) ADISABES
1500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	56	b) ADISABES
Average round trip distance CUDE-access itineraries 3 and 4 to the Historic Center (km)	2,63	c) Prepared by the author, based on the "DECREE SYSTEM OF CONTROL OF ACCESS TO AREAS RESTRICTED TO ROADED TRAFFIC, FOR BEING CONSIDERED ENVIRONMENTS OF PROTECTED INTEREST" and of "Technical Assistance for the Mobility Management of the Transport of Goods and Heavy Vehicles in the City of Malaga "of the Mobility Area of Ayto. Málaga
Total distance traveled by 3500 kg vehicles (km / day)	221	d) = a) * c)
Total distance traveled by 1500 kg vehicles (km / day)	148	e) = b) * c)
Fuel Consumption Ratio of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / 100 km)	0.018	f) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption Ratio of 1500 kg Vehicles (Light Vehicles-Vans) (toe / 100 km)	0.012	g) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / day)	0.039	h) = (d) * f)) / 100

BEFORE SITUATION (PRESENT)

Working day

ENERGY CONSUMPTION DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
Fuel Consumption of 1500 kg Vehicles (Light Vehicles-Vans) (toe / day)	0.017	i) = (e) * g)) / 100
Total Fuel Consumption of vehicles per working day (toe / day)	**0.057**	j) = h) + i)
Conversion coefficient from annual to working day value	300	k) Estudio 7 estimate
Total Fuel Consumption of vehicles per year (toe / year)	**17**	l) = j) * k)

After the implementation of CUDE, it is considered that 25% of the cargo currently transported by 1.5 T vehicles would be transported by 3.5 T vehicles, which would reduce the total number of vehicles to 132, of which 90 would be of 3.5 T and the remaining 42 of 1.5 T.

Most of the freight vehicles that currently operate use diesel as fuel (1 toe equals 1,181 liters of automotive diesel, according to the “Final Energy-Primary Energy Conversion Factors and Emission Factors of CO2 ”published by the IDAE).

Taking all of the above into account, the following result is obtained:

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SAVING
Working day

SAVING IN ENERGY CONSUMPTION DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
3500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	90	a) ADISABES
1500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	42	b) ADISABES
Average distance saved per trip on access itineraries 3 and 4 to the Historic Center (km)	0.75	c) Prepared by the author, based on the "DECREE SYSTEM OF CONTROL OF ACCESS TO AREAS RESTRICTED TO ROADED TRAFFIC, FOR BEING CONSIDERED ENVIRONMENTS OF PROTECTED INTEREST" of the Mobility Area of Ayto. Málaga
Total distance saved by 3500 kg Vehicles on access itineraries 3 and 4 to the Historic Center (km / day)	52	d)
Total distance saved by 1500 kg Vehicles on access itineraries 3 and 4 to the Historic Center (km / day)	68	e)
Fuel Consumption Ratio of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / 100 km)	0.018	f) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption Ratio of 1500 kg Vehicles (Light Vehicles-Vans) (toe / 100 km)	0.012	g) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption Saving of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / day)	0.009	h) = (d) * f)) / 100

SAVING
Working day

SAVING IN ENERGY CONSUMPTION DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
Fuel Consumption Saving of 1500 kg Vehicles (Light Vehicles-Vans) (toe / day)	0.008	i) = (e) * g)) / 100
Total Fuel Consumption Saving of vehicles per working day (toe / day)	**0.017**	j) = h) + i)
Conversion coefficient from annual to working day value	300	k) Estudio 7 estimate
Total Fuel Consumption Saving of Vehicles per year (toe / year)	**5**	l) = j) * k)

Thus, an energy consumption of 12 toe / year is obtained after the execution of the actions, which means an energy saving of 5 toe / year and 30.40% with respect to the current situation.

ENERGY SAVING (toe/year)	% SAVING compared to the Before situation
5	**30.40%**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement N° 769052.

4.2.2.2 CO2 emissions

As a result of this reduction in fuel consumption, there would be a decrease in carbon dioxide emissions by these vehicles. Considering an emission factor of 3.09 tons of CO2 for each toe of diesel (IDAE), the following results are obtained:

BEFORE SITUATION (PRESENT)
Working day

CO2 EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
3500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	84	a) ADISABES
1500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	56	b) ADISABES
Average round trip distance CUDE-access itineraries 3 and 4 to the Historic Center (km)	2.63	c) Prepared by the author, based on the "DECREE SYSTEM OF CONTROL OF ACCESS TO AREAS RESTRICTED TO ROADED TRAFFIC, FOR BEING CONSIDERED ENVIRONMENTS OF PROTECTED INTEREST" and of "Technical Assistance for the Mobility Management of the Transport of Goods and Heavy Vehicles in the City of Malaga "of the Mobility Area of Ayto. Málaga
Total distance traveled by 3500 kg vehicles (km / day)	221	d) = a) * c)
Total distance traveled by 1500 kg vehicles (km / day)	148	e) = b) * c)
Fuel Consumption Ratio of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / 100 km)	0.018	f) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption Ratio of 1500 kg Vehicles (Heavy Vehicles-Trucks) (toe / 100 km)	0.012	g) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)

BEFORE SITUATION (PRESENT)
Working day

CO2 EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
Fuel Consumption of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / day)	0.039	h) = (d) * f)) / 100
Fuel Consumption of 1500 kg Vehicles (Heavy Vehicles-Trucks) (toe / day)	0.017	i) = (e) * g)) / 100
Ratio T CO2 / toe of fuel consumed by 3500 kg Vehicles (Heavy Vehicles-Trucks)	3.090	j) "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Ratio T CO2 / toe of fuel consumed by 1500 kg Vehicles (Light Vehicles-Vans)	3.090	k) "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
T CO2 emitted by vehicles per working day (T/day)	**0.18**	l) = h) * j) + i) * k)
Conversion coefficient from annual to working day value	300	k) Estudio 7 estimate
Total T CO2 emitted by vehicles per year (T/year)	**53**	l) = j) * k)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement N° 769052.

SAVING

Working day

SAVING IN CO2 EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
3500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	90	a) ADISABES
1500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	42	b) ADISABES
Average distance saved per trip on access itineraries 3 and 4 to the Historic Center (km)	0.75	c) Prepared by the author, based on the "DECREE SYSTEM OF CONTROL OF ACCESS TO AREAS RESTRICTED TO ROADED TRAFFIC, FOR BEING CONSIDERED ENVIRONMENTS OF PROTECTED INTEREST" of the Mobility Area of Ayto. Málaga
Total distance saved by 3500 kg Vehicles on access itineraries 3 and 4 to the Historic Center (km / day)	52	d)
Total distance saved by 1500 kg Vehicles on access itineraries 3 and 4 to the Historic Center (km / day)	68	e)
Fuel Consumption Ratio of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / 100 km)	0.018	f) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption Ratio of 1500 kg Vehicles (Light Vehicles-Vans) (toe / 100 km)	0.012	g) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption Saving of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / day)	0.009	h) = (d) * f)) / 100

SAVING

Working day

SAVING IN CO2 EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
Fuel Consumption Saving of 1500 kg Vehicles (Light Vehicles-Vans) (toe / day)	0.008	i) = (e) * g)) / 100
Ratio T CO2 / toe of fuel consumed by 3500 kg Vehicles (Heavy Vehicles-Trucks)	3.090	j) "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Ratio T CO2 / toe of fuel consumed by 1500 kg Vehicles (Light Vehicles-Vans)	3.090	k) "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Saving in T CO2 emitted by vehicles per working day (T/day)	**0.05**	l) = h) * j) + i) * k)
Conversion coefficient from annual to working day value	300	k) Estudio 7 estimate
Total saving in T CO2 emitted by vehicles per year (T/year)	**16**	l) = j) * k)

CO2 emissions after the implementation of CUDE would therefore be 37 ton / year, which represents a reduction of 30.40%.

REDUCTION OF CO2 EMISSIONS (ton/year)	% REDUCTION compared to the Before situation
16	**30.40%**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement Nº 769052.

4.2.2.3 NOx emissions

The nitrogen oxides emission factors have been taken from the "Study on Emissions Derived from the Consumption of Fuels in Road Transport in Spain" of the National Energy Commission: 11,621 g NOx / toe of fuel consumed for 1500 kg vehicles, and 22,450 g NOx / toe for 3500 kg vehicles.

The obtained results are showed next:

BEFORE SITUATION (PRESENT)
Working day

NOx EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
3500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	84	a) ADISABES
1500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	56	b) ADISABES
Average round trip distance CUDE-access itineraries 3 and 4 to the Historic Center (km)	2.63	c) Prepared by the author, based on the "DECREE SYSTEM OF CONTROL OF ACCESS TO AREAS RESTRICTED TO ROADED TRAFFIC, FOR BEING CONSIDERED ENVIRONMENTS OF PROTECTED INTEREST" and of "Technical Assistance for the Mobility Management of the Transport of Goods and Heavy Vehicles in the City of Malaga "of the Mobility Area of Ayto. Málaga
Total distance traveled by 3500 kg vehicles (km / day)	221	d) = a) * c)
Total distance traveled by 1500 kg vehicles (km / day)	148	e) = b) * c)
Fuel Consumption Ratio of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / 100 km)	0.018	f) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)

BEFORE SITUATION (PRESENT)
Working day

NOx EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
Fuel Consumption Ratio of 1500 kg Vehicles (Heavy Vehicles-Trucks) (toe / 100 km)	0.012	g) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / day)	0.039	h) = (d) * f)) / 100
Fuel Consumption of 1500 kg Vehicles (Heavy Vehicles-Trucks) (toe / day)	0.017	i) = (e) * g)) / 100
Ratio g NOx / toe of fuel consumed by 3500 kg Vehicles (Heavy Vehicles-Trucks) (g / day)	22,450	j) National Energy Commission (2013)
Ratio g NOx / toe of fuel consumed by 1500 kg Vehicles (Light Vehicles-Vans) (g / day)	11,621	k) National Energy Commission (2013)
Kg NOx emitted by vehicles per working day (kg/day)	**1.09**	l) = h) * j) + i) * k)
Conversion coefficient from annual to working day value	300	k) Estudio 7 estimate
Total kg NOx emitted by vehicles per year (kg/year)	**326**	l) = j) * k)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement N° 769052.

SAVING
Working day

SAVING IN NOx EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
3500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	90	a) ADISABES
1500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	42	b) ADISABES
Average distance saved per trip on access itineraries 3 and 4 to the Historic Center (km)	0.75	c) Prepared by the author, based on the "DECREE SYSTEM OF CONTROL OF ACCESS TO AREAS RESTRICTED TO ROADED TRAFFIC, FOR BEING CONSIDERED ENVIRONMENTS OF PROTECTED INTEREST" of the Mobility Area of Ayto. Málaga
Total distance saved by 3500 kg Vehicles on access itineraries 3 and 4 to the Historic Center (km / day)	52	d)
Total distance saved by 1500 kg Vehicles on access itineraries 3 and 4 to the Historic Center (km / day)	68	e)
Fuel Consumption Ratio of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / 100 km)	0.018	f) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption Ratio of 1500 kg Vehicles (Light Vehicles-Vans) (toe / 100 km)	0.012	g) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption Saving of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / day)	0.009	h) = (d) * f)) / 100

SAVING
Working day

SAVING IN NOx EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
Fuel Consumption Saving of 1500 kg Vehicles (Light Vehicles-Vans) (toe / day)	0.008	i) = (e) * g)) / 100
Ratio g NOx / toe of fuel consumed by 3500 kg Vehicles (Heavy Vehicles-Trucks) (g / day)	22,450	j) National Energy Commission (2013)
Ratio g NOx / toe of fuel consumed by 1500 kg Vehicles (Light Vehicles-Vans) (g / day)	11,621	k) National Energy Commission (2013)
Saving in kg NOx emitted by vehicles per working day (kg/day)	**0.30**	l) = h) * j) + i) * k)
Conversion coefficient from annual to working day value	300	k) Estudio 7 estimate
Total saving in kg NOx emitted by vehicles per year (kg/year)	**90**	**l) = j) * k)**

Thus, NOx emissions after the implementation of CUDE would be 236 kg NOx / year, which would mean a reduction of 27.70%.

REDUCTION OF NOx EMISSIONS (kg/year)	% REDUCTION compared to the Before situation
90	**27.70%**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement Nº 769052.

4.2.2.4 PM emissions

The particulate matter (PM) emission factors have also been taken from the "Study on Emissions Derived from the Consumption of Fuels in Road Transport in Spain" of the National Energy Commission: 1318 g PM / toe of fuel consumed for 1500 kg vehicles, and 777 g PM / toe for 3500 kg vehicles.

BEFORE SITUATION (PRESENT)
Working day

PM EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
3500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	84	a) ADISABES
1500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	56	b) ADISABES
Average round trip distance CUDE-access itineraries 3 and 4 to the Historic Center (km)	2.63	c) Prepared by the author, based on the "DECREE SYSTEM OF CONTROL OF ACCESS TO AREAS RESTRICTED TO ROADED TRAFFIC, FOR BEING CONSIDERED ENVIRONMENTS OF PROTECTED INTEREST" and of "Technical Assistance for the Mobility Management of the Transport of Goods and Heavy Vehicles in the City of Malaga "of the Mobility Area of Ayto. Málaga
Total distance traveled by 3500 kg vehicles (km / day)	221	d) = a) * c)
Total distance traveled by 1500 kg vehicles (km / day)	148	e) = b) * c)
Fuel Consumption Ratio of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / 100 km)	0.018	f) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption Ratio of 1500 kg Vehicles (Heavy Vehicles-Trucks) (toe / 100 km)	0.012	g) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)

BEFORE SITUATION (PRESENT)
Working day

PM EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
Fuel Consumption of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / day)	0.039	h) = (d) * f)) / 100
Fuel Consumption of 1500 kg Vehicles (Heavy Vehicles-Trucks) (toe / day)	0.017	i) = (e) * g)) / 100
Ratio g PM / toe of fuel consumed by 3500 kg Vehicles (Heavy Vehicles-Trucks) (g / toe)	777	j) National Energy Commission (2013)
Ratio g PM / toe of fuel consumed by 1500 kg Vehicles (Light Vehicles-Vans) (g / toe)	1,318	k) National Energy Commission (2013)
Kg PM emitted by vehicles per working day (kg/day)	**0.05**	l) = h) * j) + i) * k)
Conversion coefficient from annual to working day value	300	k) Estudio 7 estimate
Total kg PM emitted by vehicles per year (kg/year)	**16**	l) = j) * k)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement N° 769052.

SAVING
Working day

SAVING IN PM EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
3500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	90	a) ADISABES
1500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	42	b) ADISABES
Average distance saved per trip on access itineraries 3 and 4 to the Historic Center (km)	0.75	c) Prepared by the author, based on the "DECREE SYSTEM OF CONTROL OF ACCESS TO AREAS RESTRICTED TO ROADED TRAFFIC, FOR BEING CONSIDERED ENVIRONMENTS OF PROTECTED INTEREST" of the Mobility Area of Ayto. Málaga
Total distance saved by 3500 kg Vehicles on access itineraries 3 and 4 to the Historic Center (km / day)	52	d)
Total distance saved by 1500 kg Vehicles on access itineraries 3 and 4 to the Historic Center (km / day)	68	e)
Fuel Consumption Ratio of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / 100 km)	0.018	f) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption Ratio of 1500 kg Vehicles (Light Vehicles-Vans) (toe / 100 km)	0.012	g) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption Saving of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / day)	0.009	h) = (d) * f)) / 100

SAVING
Working day

SAVING IN PM EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
Fuel Consumption Saving of 1500 kg Vehicles (Light Vehicles-Vans) (toe / day)	0.008	i) = (e) * g)) / 100
Ratio g PM / toe of fuel consumed by 3500 kg Vehicles (Heavy Vehicles-Trucks) (g / toe)	777	j) National Energy Commission (2013)
Ratio g PM / toe of fuel consumed by 1500 kg Vehicles (Light Vehicles-Vans) (g / toe)	1,318	k) National Energy Commission (2013)
Saving in kg PM emitted by vehicles per working day (kg/day)	**0.02**	l) = h) * j) + i) * k)
Conversion coefficient from annual to working day value	300	k) Estudio 7 estimate
Total saving in kg PM emitted by vehicles per year (kg/year)	**5**	l) = j) * k)

The final emissions of particulate matter after the implementation of the CUDE would therefore be 11 kg PM / toe of fuel consumed, reaching a reduction of 33.20% with respect to the starting situation.

REDUCTION OF PM EMISSIONS (kg/year)	% REDUCTION compared to the Before situation
5	**33.20%**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement Nº 769052.

4.2.2.5 SO2 emissions

The emission factors of sulfur dioxide, which have also been taken from the "Study on Emissions Derived from the Consumption of Fuels in Road Transport in Spain" of the National Energy Commission, coincide for vehicles of 1500 and 3500 kg, being 14.76 g SO2 / toe of fuel consumed.

BEFORE SITUATION (PRESENT)
Working day

SO2 EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
3500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	84	a) ADISABES
1500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	56	b) ADISABES
Average round trip distance CUDE-access itineraries 3 and 4 to the Historic Center (km)	2.63	c) Prepared by the author, based on the "DECREE SYSTEM OF CONTROL OF ACCESS TO AREAS RESTRICTED TO ROADED TRAFFIC, FOR BEING CONSIDERED ENVIRONMENTS OF PROTECTED INTEREST" and of "Technical Assistance for the Mobility Management of the Transport of Goods and Heavy Vehicles in the City of Malaga "of the Mobility Area of Ayto. Málaga
Total distance traveled by 3500 kg vehicles (km / day)	221	d) = a) * c)
Total distance traveled by 1500 kg vehicles (km / day)	148	e) = b) * c)
Fuel Consumption Ratio of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / 100 km)	0.018	f) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption Ratio of 1500 kg Vehicles (Heavy Vehicles-Trucks) (toe / 100 km)	0.012	g) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)

BEFORE SITUATION (PRESENT)
Working day

SO2 EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
Fuel Consumption of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / day)	0.039	h) = (d) * f)) / 100
Fuel Consumption of 1500 kg Vehicles (Heavy Vehicles-Trucks) (toe / day)	0.017	i) = (e) * g)) / 100
Ratio g SO2 / toe of fuel consumed by 3500 kg Vehicles (Heavy Vehicles-Trucks) (g / toe)	14.76	j) National Energy Commission (2013)
Ratio g PM / toe of fuel consumed by 1500 kg Vehicles (Light Vehicles-Vans) (g / toe)	14.76	k) National Energy Commission (2013)
Kg SO2 emitted by vehicles per working day (kg/day)	**0.0008**	l) = h) * j) + i) * k)
Conversion coefficient from annual to working day value	300	k) Estudio 7 estimate
Total kg SO2 emitted by vehicles per year (kg/year)	**0.252**	l) = j) * k)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement N° 769052.

SAVING

Working day

SAVING IN SO2 EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
3500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	90	a) ADISABES
1500 kg vehicles for. non-perishables goods transport that use itineraries 3 and 4 to access to the Historic Center (veh / d)	42	b) ADISABES
Average distance saved per trip on access itineraries 3 and 4 to the Historic Center (km)	0.75	c) Prepared by the author, based on the "DECREE SYSTEM OF CONTROL OF ACCESS TO AREAS RESTRICTED TO ROADED TRAFFIC, FOR BEING CONSIDERED ENVIRONMENTS OF PROTECTED INTEREST" of the Mobility Area of Ayto. Málaga
Total distance saved by 3500 kg Vehicles on access itineraries 3 and 4 to the Historic Center (km / day)	52	d)
Total distance saved by 1500 kg Vehicles on access itineraries 3 and 4 to the Historic Center (km / day)	68	e)
Fuel Consumption Ratio of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / 100 km)	0.018	f) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption Ratio of 1500 kg Vehicles (Light Vehicles-Vans) (toe / 100 km)	0.012	g) Prepared by the authors, based on "Guide for the management of fuel in road transport fleets" and "FINAL ENERGY CONVERSION FACTORS - PRIMARY ENERGY AND CO2 EMISSION FACTORS" (I.D.A.E.)
Fuel Consumption Saving of 3500 kg Vehicles (Heavy Vehicles-Trucks) (toe / day)	0.009	h) = (d) * f)) / 100

SAVING

Working day

SAVING IN SO2 EMISSIONS DERIVED FROM 3500 KG AND 1500 KG VEHICLE JOURNEYS THROUGH ACCESS ITINERARIES 3 AND 4 TO THE HISTORIC CITY CENTER		
CONCEPT	**MEASUREMENT**	**SOURCE**
Fuel Consumption Saving of 1500 kg Vehicles (Light Vehicles-Vans) (toe / day)	0.008	i) = (e) * g)) / 100
Ratio g SO2 / toe of fuel consumed by 3500 kg Vehicles (Heavy Vehicles-Trucks) (g / toe)	14.76	j) National Energy Commission (2013)
Ratio g PM / toe of fuel consumed by 1500 kg Vehicles (Light Vehicles-Vans) (g / toe)	14.76	k) National Energy Commission (2013)
Saving in kg SO2 emitted by vehicles per working day (kg/day)	**0.0003**	l) = h) * j) + i) * k)
Conversion coefficient from annual to working day value	300	k) Estudio 7 estimate
Total saving in kg SO2 emitted by vehicles per year (kg/year)	**0.0765**	l) = j) * k)

Thus, the final SO2 emissions after the implementation of the “Gigantes” CUDE would be 175 grams of SO2 per toe of fuel consumed, reaching a reduction of 30.4%.

REDUCTION OF SO2 EMISSIONS (g/year)	% REDUCTION compared to the Before situation
77	**30.4%**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement N° 769052.

4.3 ON-STREET LOADING AND UNLOADING PARKING SPACES.

In addition to the last mile distribution centers described in the previous sections, the reservation of on-street loading and unloading spaces is proposed for their exclusive use by goods transport electric vehicles.

For the moment, the parcel company SEUR would participate in this measure. It already has two electric vans with a range of 150 km.

Based on the autonomy of the available e-vehicles and the location of the usual deliveries and pick-ups made by SEUR in the study areas, the proposed loading and unloading spaces are located in an intermediate point of these areas, in the case of those of Cruz de Humilladero and Carretera de Cádiz, in order to minimize the distance covered by the deliveryman from the vehicle to the final customer. Regarding the City Center zone, since SEUR is a user of the CUDE of C / Camas, located in the southwestern part of the Restricted Access Zone, from which it covers its demand, and that there is a semi-pedestrianization project of the axis composed of Carretería and Álamos streets, the proposed loading and unloading space is located in the north of this study area. Thus, the proposed places are in the following loading and unloading dedicated zones:

- **Historic City Center** - C / Duque de Rivas, corner San Bartolomé
- **Cruz de Humilladero** - C / Santa Marta, corner Pl. Cruz Humilladero
- **Ctra. Cádiz** - C / Juan Sebastián Bach, corner Av. Velázquez

Likewise, in order to promote the use of electric vehicles by transport and distribution companies, and given that vehicles with a maximum authorized mass of less than or equal to 3,500 kg are allowed to park in any area authorized to do so (article 73 of the Mobility Ordinance of the City of Malaga), it is proposed to extend for these EVs the hours established for loading and unloading in the selected spaces, which is currently from 9:00 to 13:00 in the Historic City Center one, from 8:00 to 14:00 and from 16:00 to 20:00 in the Cruz de Humilladero one, and from 9:00 to 14:00 and from 16:00 to 20:00 in the Carretera de Cádiz one. The new proposed schedule would be from 8:00 a.m. to 8:00 p.m. and there would be no limit on how long it would take place, as long as the activities of loading, unloading and delivering the merchandise to the end customer are being carried out.

For this measure, the resource booking app described in the section "Improvement of the Urban Center for Ecological Distribution (CUDE) at C / Camas" will also be implemented.

5 REGULATIONS.

5.1 LAND-USE PLAN OF MALAGA.

The Gigantes street lot in which the construction of the new CUDE is proposed is within the scope of the City Center's Special Plan for Protection and Interior Reform (PEPRI), which is part of the current Land-use Plan (PGOU) in the area called "Historic City", subzone C-1 "Historic Center". The City Center's PEPRI is currently under review, its Progress Document being submitted to public information.

The new uses permitted in this area, established in article 12.4.7 of the PGOU, include Productive Use, which includes, among other basic groups, Logistics Use, defined according to Chapter Three of Title VI as follows:

"*Activities dedicated to the storage, reception and wholesale distribution of goods and merchandise are typical of this group.*

It also includes freight transport activities and related services that guarantee its operation. "

Therefore, the implementation of the new CUDE would be allowed in this sense.

However, in the City Center's PEPRI Progress Document, this lot has been identified as the "Calle Gigantes Apple Opportunity Space", for which it is stated that "*it could combine residential uses with equipment uses*". So it would be necessary to discuss the matter with the Urban Planning Area.

5.2 MOBILITY ORDINANCE OF THE CITY OF MÁLAGA.

The reservation of the loading and unloading places indicated in the section "On-street Loading and Unloading Parking Spaces" for their exclusive use by goods transport electric vehicles will require its establishment by the municipal body responsible for mobility (the Mobility Area), in accordance with article 92 "Electric vehicle and charging points" of the Mobility Ordinance of the City of Malaga.

The dedicated space will be duly signposted, specifying the type of vehicle it is intended for.

The competent body in the field of mobility may issue identification cards that are enabling, with a determined validity, for the use of such spaces, once the documentation that proves the technical conditions of the vehicle has been provided. These cards must be displayed in a visible area of the vehicle, so that it is enabled to use them.

On the other hand, the extension of the loading and unloading hours established in these places for electric vehicles must also be approved by the Mobility Department, as well as the non-limitation of permanence within said hours.

Finally, in the event that in the future charging points are installed at these places, the competent municipal body may establish and authorize charging point reservations exclusively for electric vehicles. This must be properly marked, specifying the type of vehicle and activity for which it is intended.

5.3 DECREE ABOUT THE SYSTEM FOR ACCESS CONTROL TO ROAD TRAFFIC RESTRICTED ZONES, AS CONSIDERED PROTECTED INTEREST ENVIRONMENTS.

The proposed measures regarding the distribution of goods in the Historic City Center, specifically in the Road Traffic Restricted Area (improvement of the existing CUDE at C/ Camas and implementation of a new CUDE in C/ Gigantes), are in compliance with the Decree that regulates access control to it, since the time limits established in it for loading and unloading activities are not applicable to electric vehicles destined for last mile delivery in this area.

On the other hand, with regard to the stop time for carrying out these activities, the Decree only determines that this must be "the minimum necessary".

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5.4 ORDINANCE FOR THE PREVENTION AND CONTROL OF NOISE AND VIBRATIONS.

The Municipal Ordinance for the Prevention and Control of Noise and Vibrations by the Environment Department of the Malaga City Council, approved on March 26, 2009 and subsequently modified in 2011, establishes in section 1 of its article 43, dedicated to loading and unloading activities, the following:

"*The activities of loading and unloading of goods, handling of boxes and objects between 22:00 and 7:00 hours are prohibited, when they affect housing or residential areas, except those that have a space inside where vehicles can carry out loading and unloading operations or have silent electric means to perform them.*"

The loading and unloading activities to be carried out in the proposed CUDE in C/ Gigantes would meet these requirements, since they would be performed inside a closed building and, in addition, with electrical means. However, it would be advisable to review the noise levels emitted by the vehicles that transport the goods to the CUDE, in order to avoid possible inconvenience to residents and tourists.

6 CONCLUSIONS.

- The Historic City Center of Malaga and, in particular, the Area of Restricted Access to Road Traffic, currently presents a reduced offer of on-street loading and unloading spaces that, together with the limited hours established for these activities, from 7: 00 to 11:00, and the fact that it does not coincide with the opening hours of many businesses, at 10:00 in the morning, makes it insufficient to cover the demand in the area, which is also characterized by high seasonality due to the increase in the floating population of tourists and visitors during certain times of the year.

- The current Urban Center for Ecological Distribution (CUDE), located in basement 1 of the C / Camas public car park for the last mile distribution of goods, does not solve this problem, since the steep slopes of the entrance and exit ramps, which can cause damage to heavy goods vehicles, together with the coexistence of supply of on-street loading and unloading spaces closer to the final recipients, makes the use of CUDE not attractive or even possible for carriers.

- This CUDE is, however, suitable for the last mile distribution of parcels and other light goods to the Restricted Access Area of the Historic City Center. This is due, on the one hand, to its location, in the western part of said area, where most of the shops are concentrated, which are, along with individuals, the main recipients of these goods. On the other hand, as they are lighter merchandise, the inclination of the entrance and exit ramps does not pose a danger to the vehicles that transport them to the CUDE or to those that make the last-mile distribution, in terms of possible breakdowns or excessive wear on items such as brakes.

- Given the advantages that urban centers for ecological distribution have demonstrated and their suitability in compact urban centers, as is precisely the case of the Historic City Center of Malaga, it is considered convenient to create within it a system with more than one CUDE, where each of them specializes in different types of merchandise, as one of the optimal solutions to minimize or eliminate the negative impacts that urban merchandise distribution entails. Thus, while the existing CUDE could specialize in home delivery of parcels and other low-weight merchandise to the shops of the Historic City Center, the implementation of a new CUDE destined for the distribution of heavy merchandise (something that the CUDE of the Camas street car park does not allow) would help to solve the problems of the DUM in the Center, where the catering and hotelier businesses, concentrated mainly in the eastern part of the Restricted Access Zone, represent a large part of the demand.

- Based on the above, the proposed measure for the current CUDE at C/ Camas consists of its exclusive dedication to the last mile distribution of parcels and the implementation of an app for booking the resources for this DUM (loading and unloading spaces and warehouse). This app, developed within the MEISTER project, will have a user or driver interface that will allow them to consult the resources assigned to their vehicle, and a management one so that those in charge at distribution / transport companies can request and analyze reservations. It will also allow SMASSA to analyze the use of CUDE spaces. Four of the user companies of the CUDE (SEUR, DHL, TNT and CBL), which are the ones that move the largest volume of merchandise through it, have expressed their interest in participating in the project. Of the rest, which move small volumes, no reply has been received, but it will be considered to contact them again in the future.

- The new CUDE, for whose location the site located at C/ Gigantes 3-13 is proposed, is siutable for serving the catering establishments of the Historic City Center in the DUM of non-perishable merchandise of greater weight (mainly drinks). Given that this CUDE will have a single access, and that it is reached through C/ Carretería which will be semi-pedestrianized in the future, it is proposed to carry out the supply of this CUDE at night, from 22:00 to 5:00, and the last-mile distribution by EV between the hours of 8:00 a.m. to 8:00 p.m., so that the two types of flow do not coincide in the same period of time. On the other hand, the fact of unloading goods inside a closed area, which minimizes the inconvenience caused to neighbors and tourists by the noise and vibrations of the vehicles,

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favors the use of larger vehicles than "absorb" part of the load currently transported by lighter vehicles, thus reducing the total number of trips and, consequently, the negative impacts derived from them. For the distribution to the final customer, the use of 5 electric tow trucks is proposed. The resource reservation app described above will also be implemented.

- Finally, the reservation of on-street loading and unloading spaces is proposed for their exclusive use by goods transport electric vehicles in each of the study areas. The selected places are in the dedicated zones located at C/ Duque de Rivas, corner C / San Bartolomé (Historic City Center); C/ Santa Marta, corner Plaza Cruz Humilladero (Cruz de Humilladero); and C/ Juan Sebastián Bach, corner Av. Velázquez (Carretera de Cádiz). Likewise, in order to promote the use of EVs by transport and distribution companies, it is proposed to extend for these EVsthe hours established for loading and unloading in the selected places to the period between 8:00 and 20:00, and no permanence limit. The aforementioned resource reservation app will also be implemented. For the moment, a parcel company, SEUR, will participate, since it already has two electric vans[1].

7 AUTHORS.

Málaga, March 2020.

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[1] During the state of alarm declared by Royal Decree 463/2020, of March 14, for the management of the health crisis situation caused by COVID-19, perishable goods transport vehicles will have preference in the use of the spaces reserved for loading and unloading of goods, in order to guarantee the supply of basic necessities to the population. Therefore, the measures described in this document that are put in place during said alarm state will not have the effect that they would produce under normal conditions while this situation lasts.

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ANNEX I: ECONOMIC ACTIVITIES

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HISTORIC CITY CENTRE

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Figure 23. General Uses in the Historic City Center macro-zone.

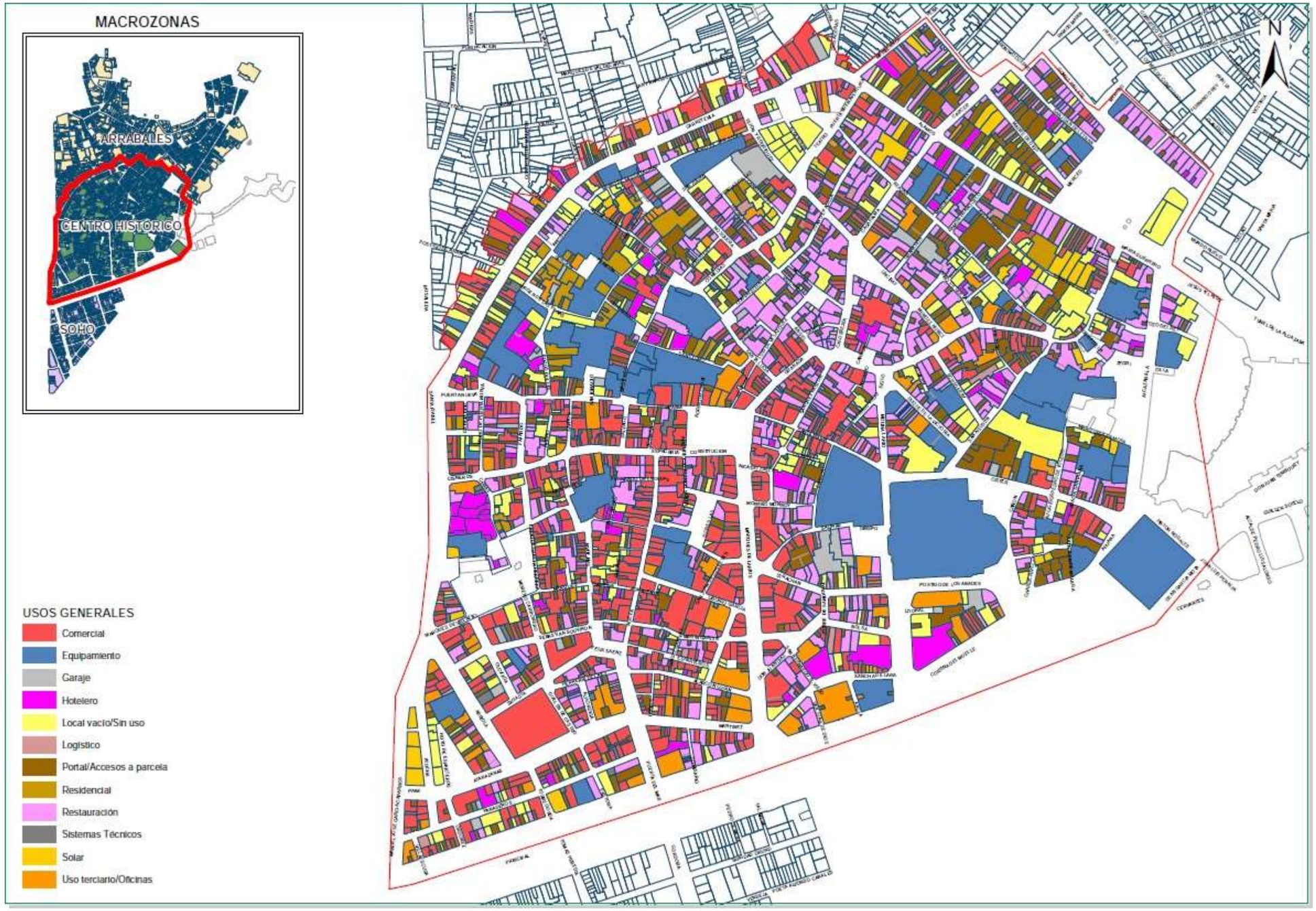

Figure 24. Commercial Use in the Historic City Center macro-zone.

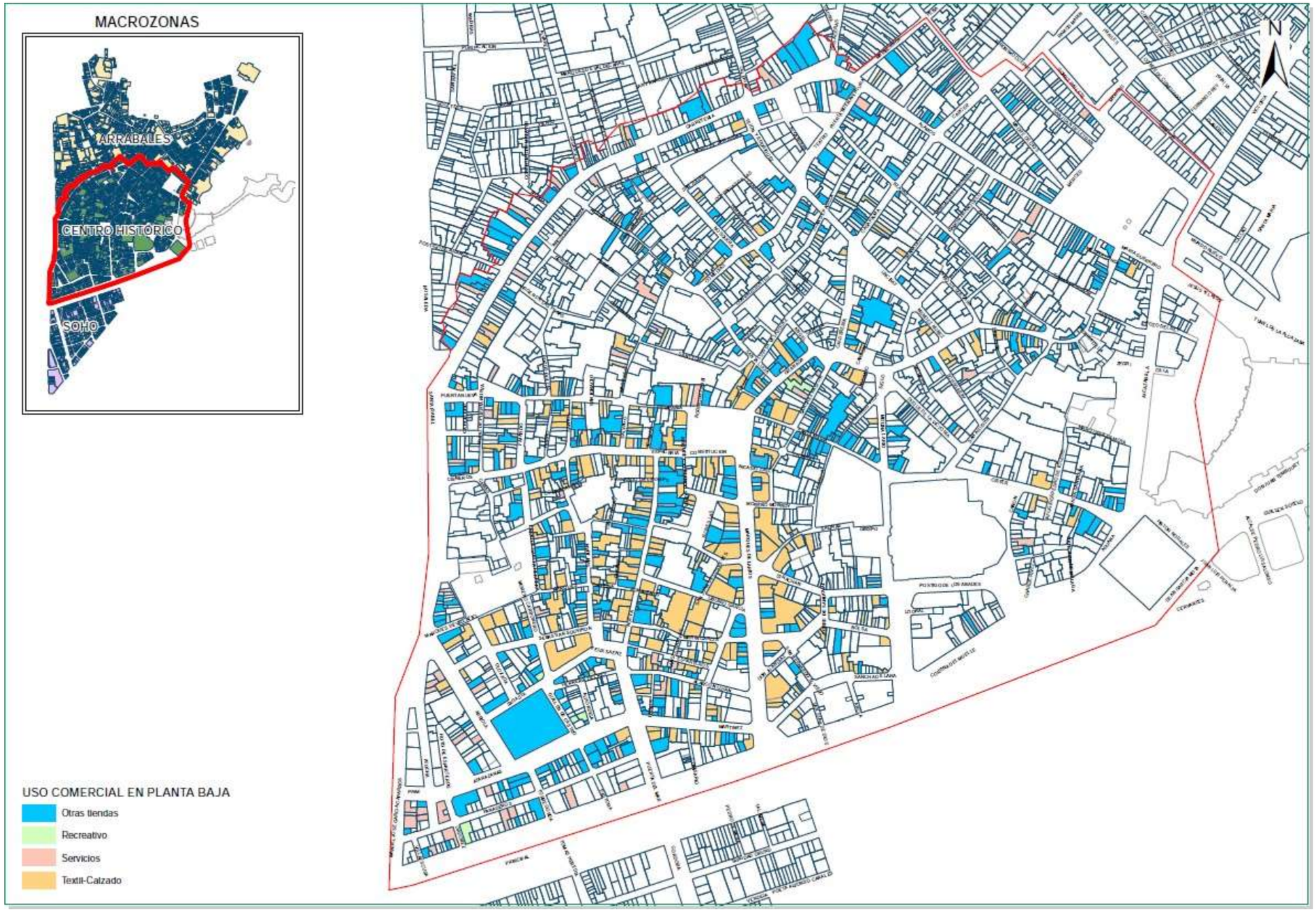

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Figure 25. Share of Commercial Use in the Historic City Center macro-zone.

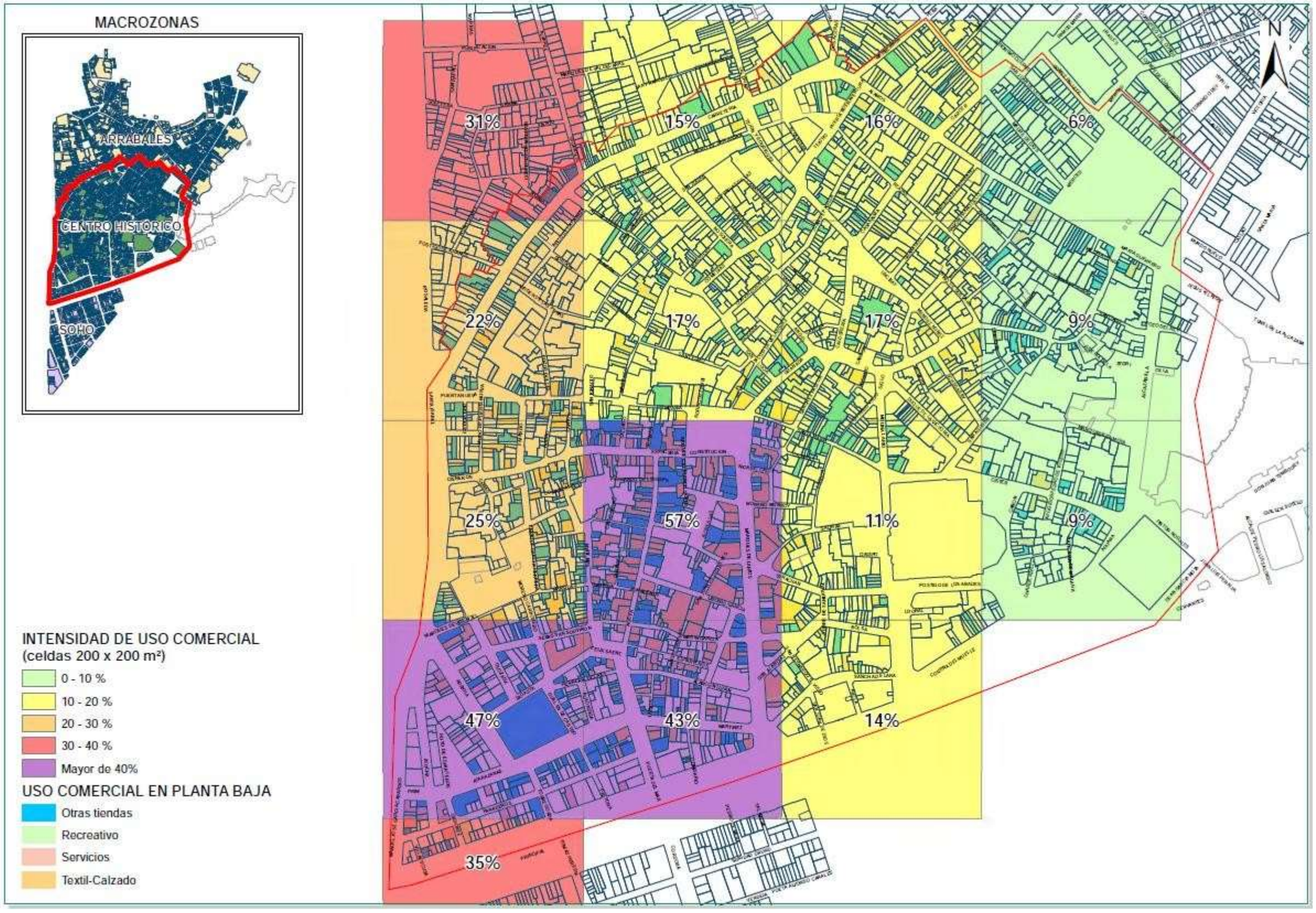

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Figure 26. Catering industry Use in the Historic City Center macro-zone.

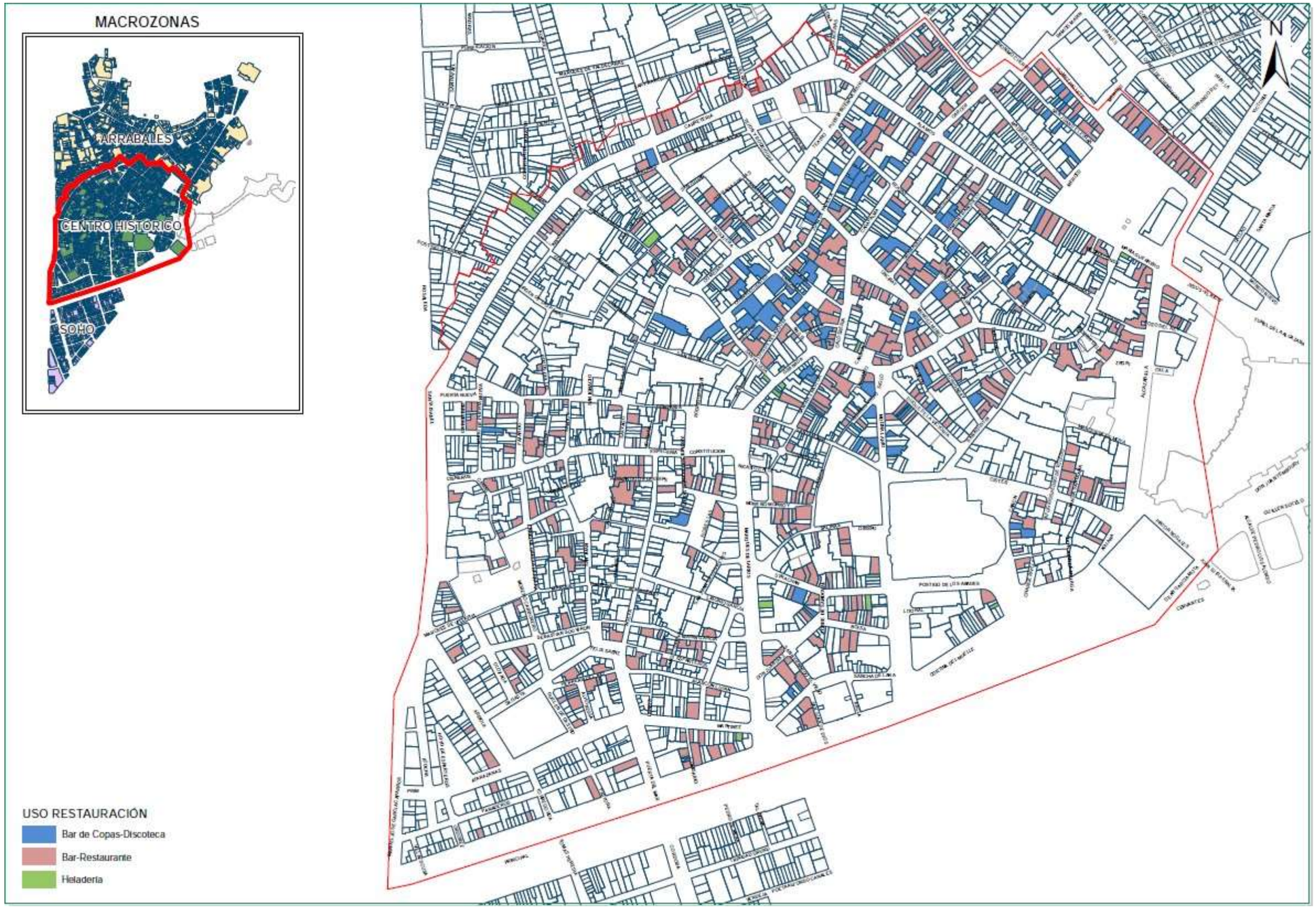
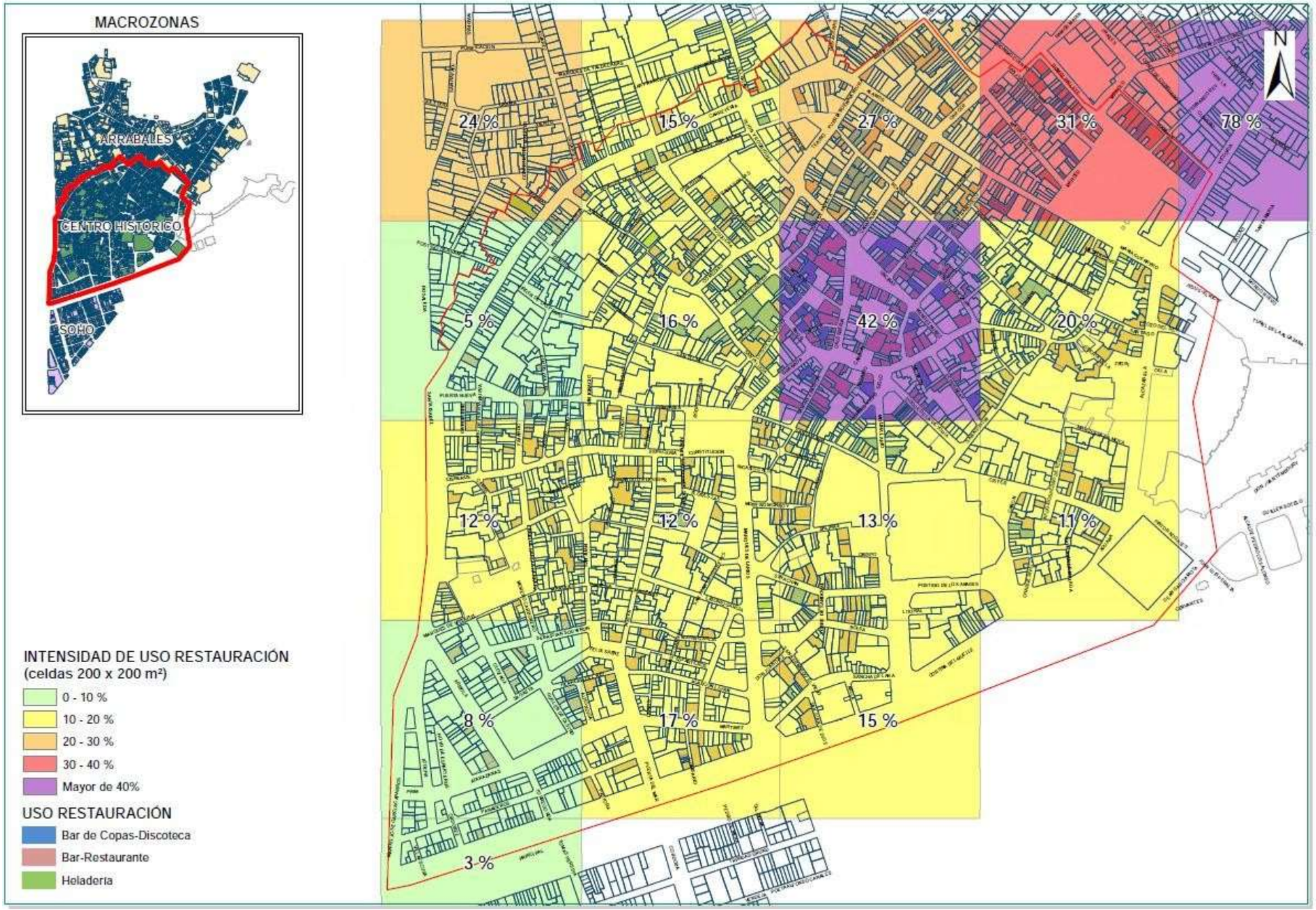


Figure 27. Share of Catering industry Use in the Historic City Center macro-zone.



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SOHO

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Figure 28. General Uses in Soho macro-zone.

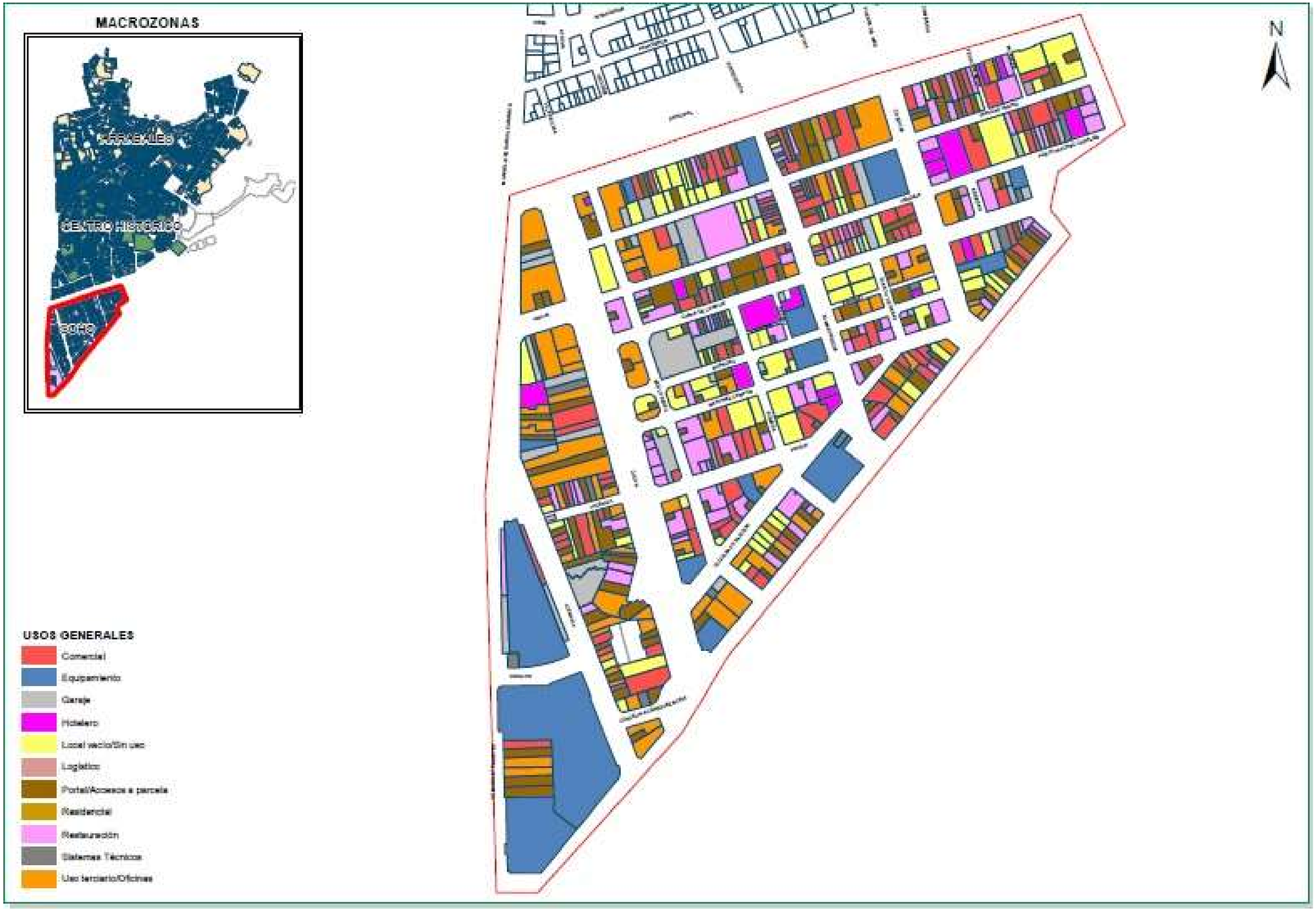

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Figure 29. Commercial Use in Soho macro-zone.

Figure 30. Share of Commercial Use in Soho macro-zone.

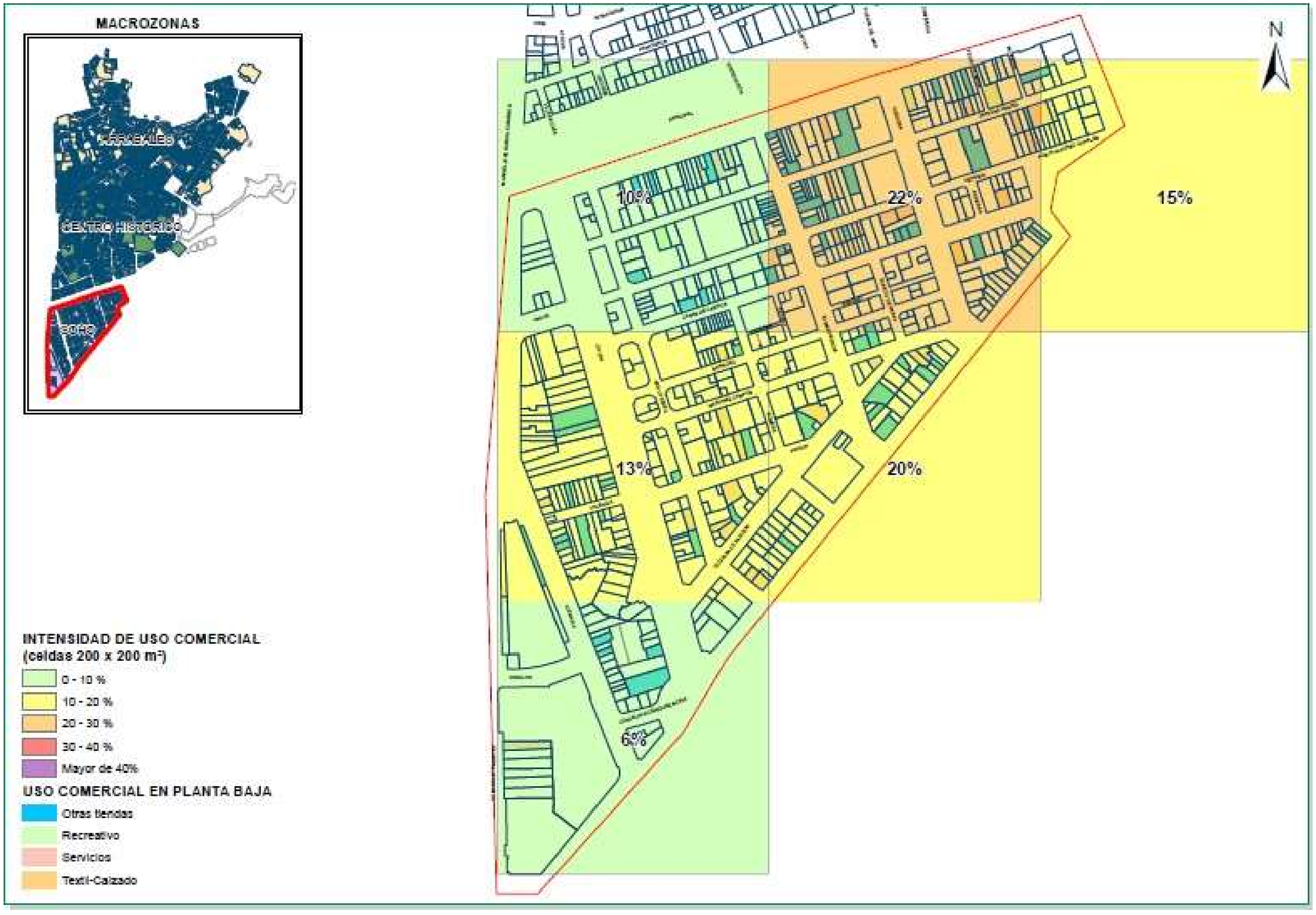

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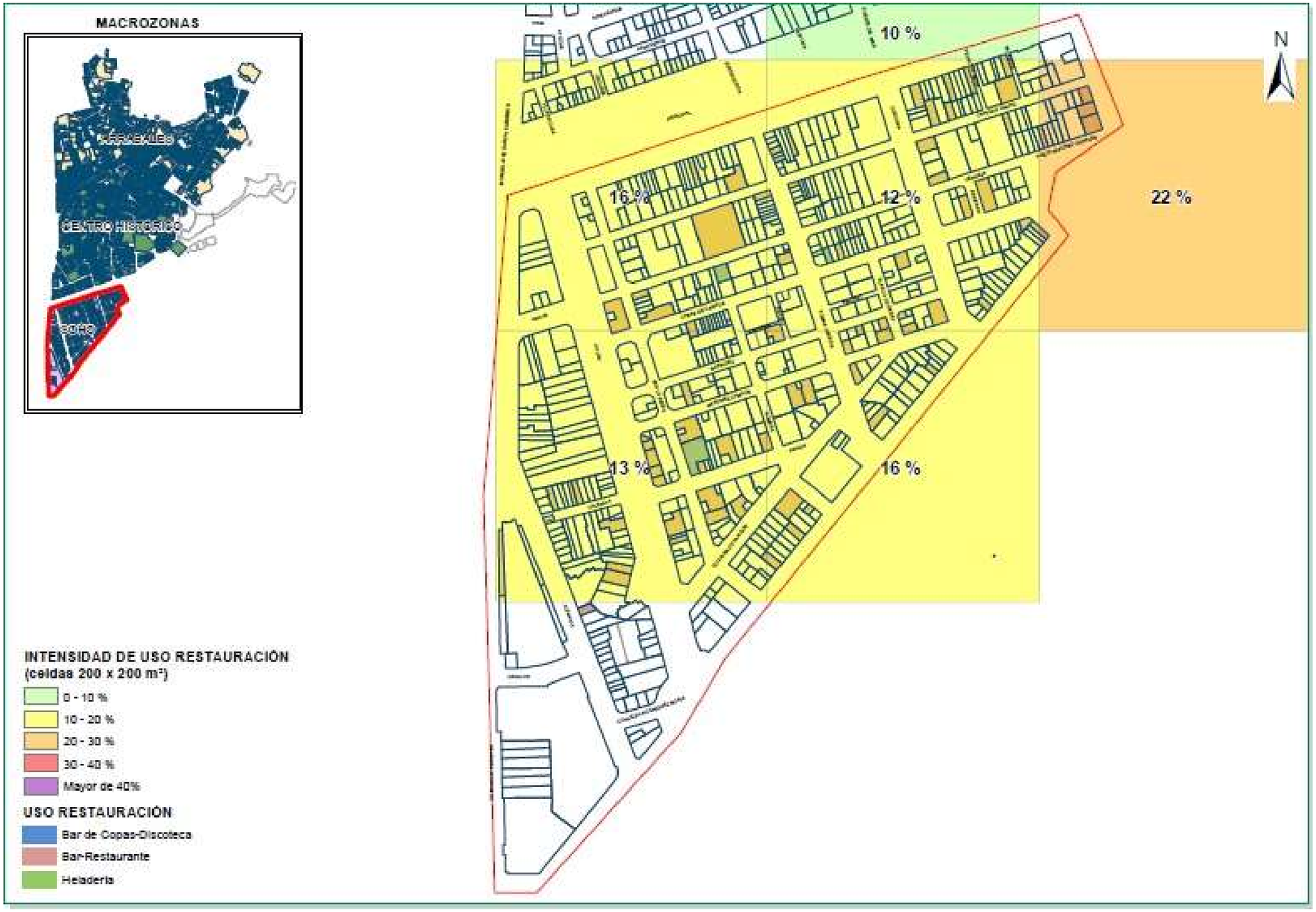
Figure 31. Catering industry Use in Soho macro-zone.

Figure 32. Share of Catering industry Use in Soho macro-zone.



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ARRABALES

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement Nº 769052.

Figure 33. General Uses in Arrabales macro-zone.

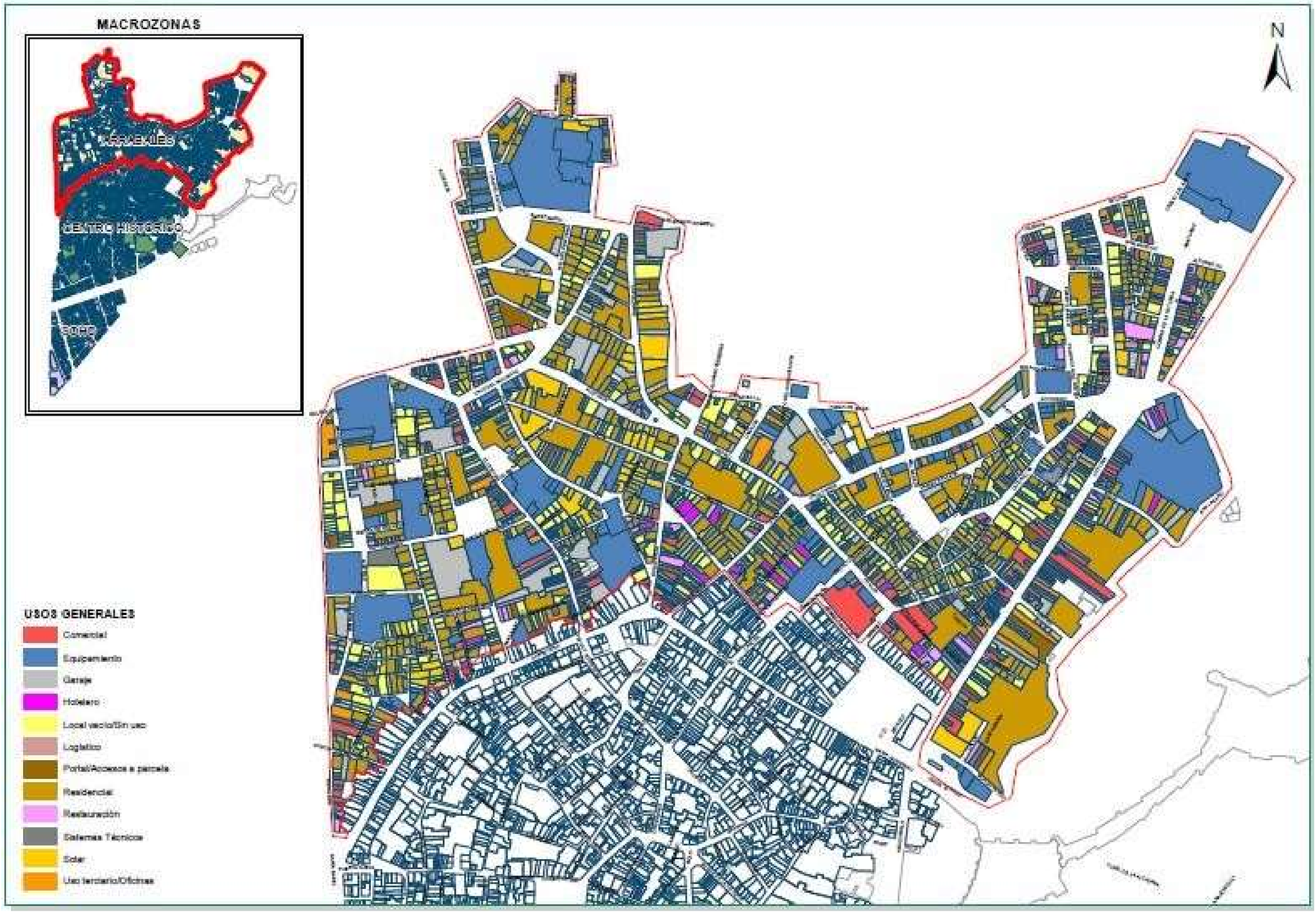

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Figure 34. Commercial Use in Arrabales macro-zone.

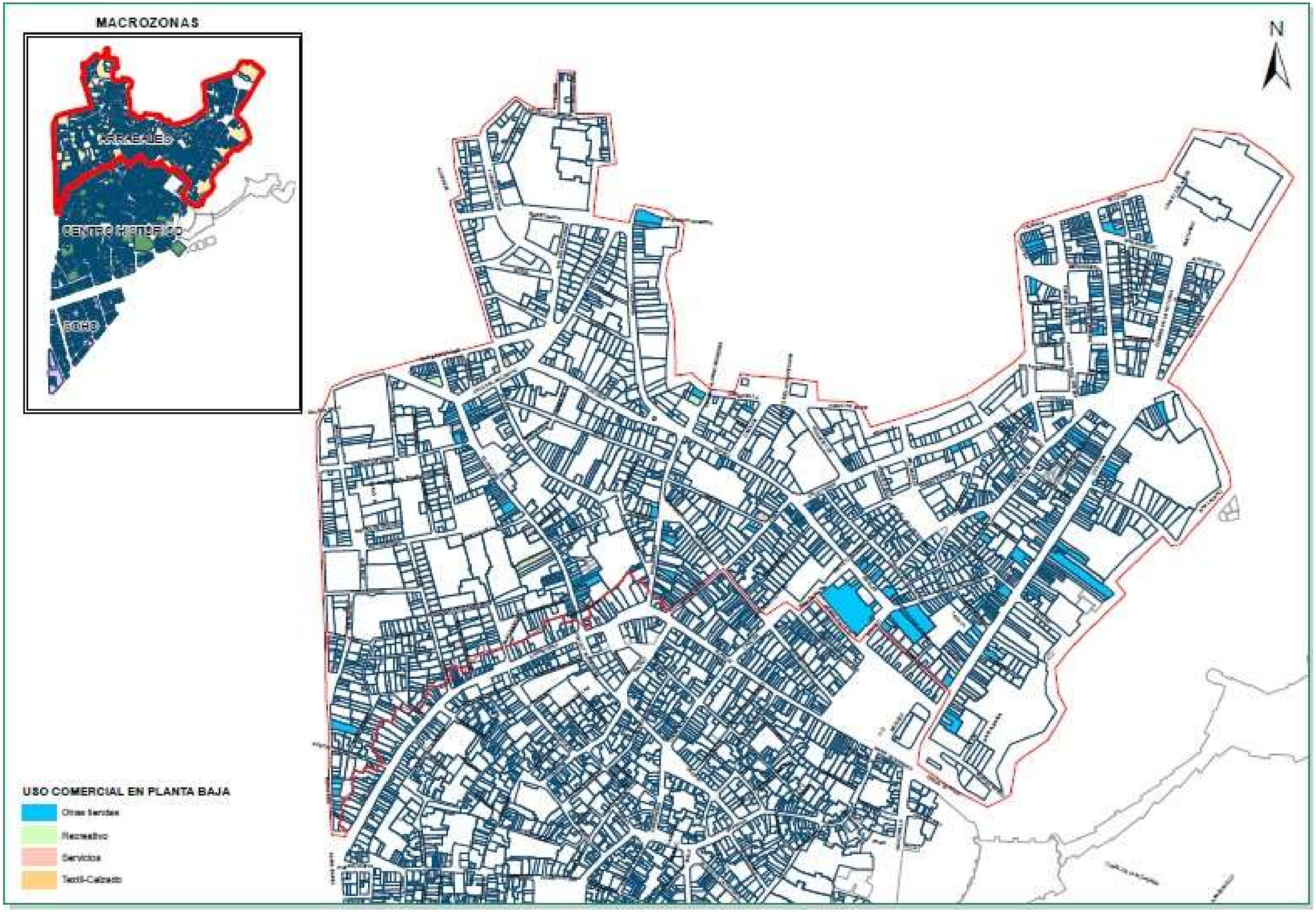

Figure 35. Share of Commercial Use in Arrabales macro-zone.

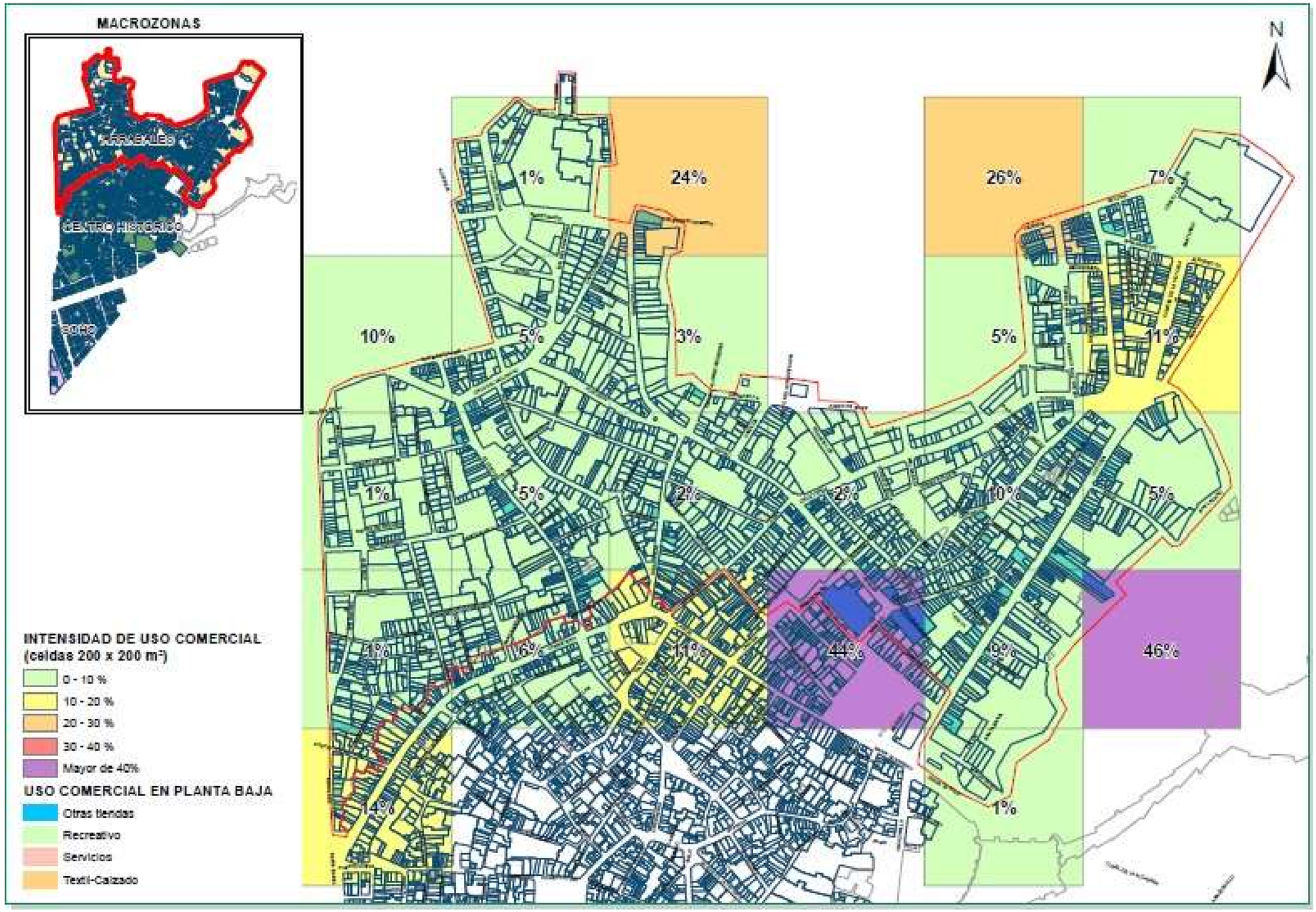

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Figure 36. Catering industry Use in Arrabales macro-zone.

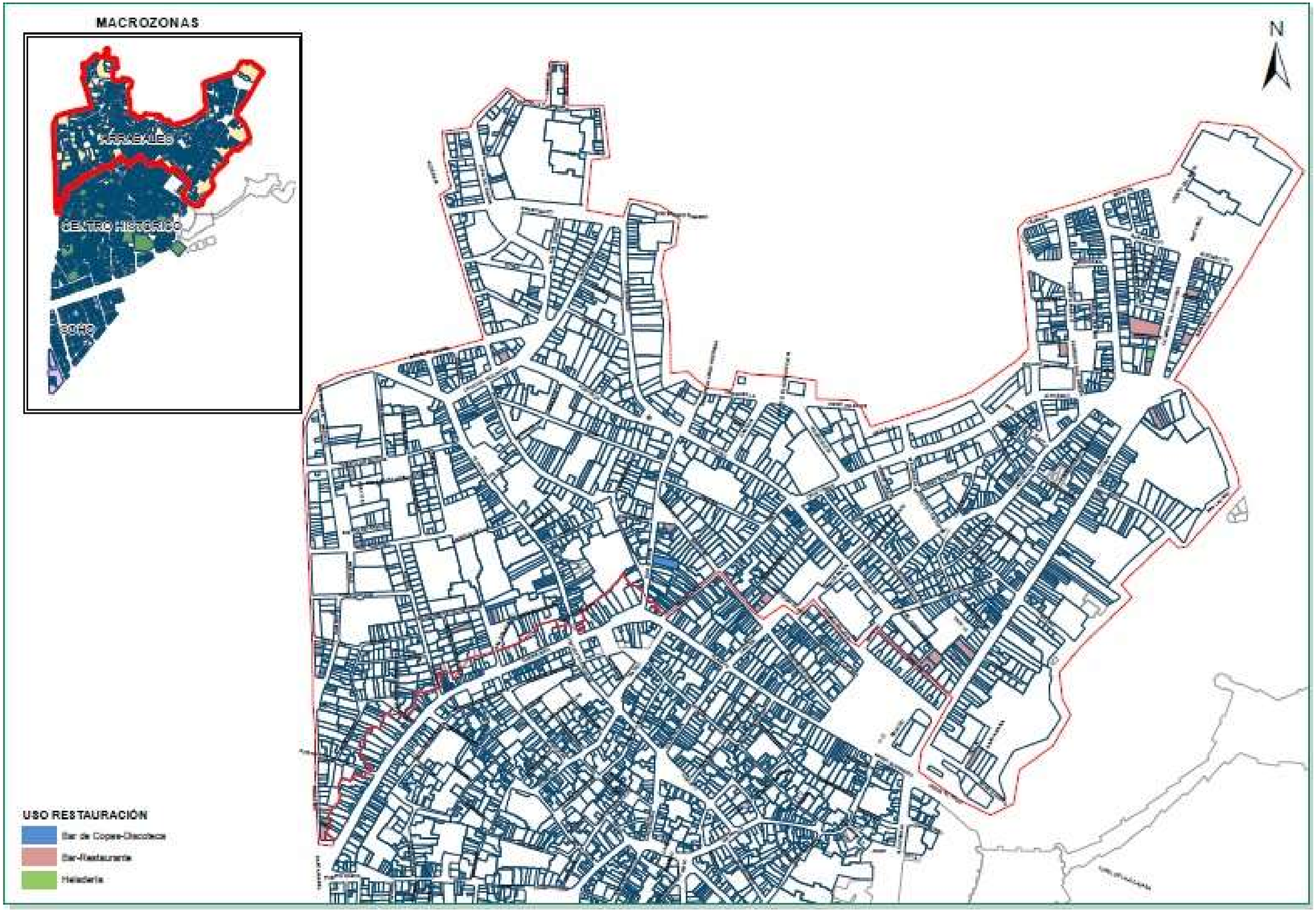

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Figure 37. Share of Catering industry Use in Arrabales macro-zone.