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Feasibility and Transferability Analysis of energy-efficient and sustainable freight logistics solutions in Burgos

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1. Burgos context

Burgos is a medium-sized city (180.000 inhabitants) situated in the North-central part of Spain in the region of Castilla y León.

The core urban area is 108,26 km² and has a population density of 15,84 hb/ha. The agglomeration area has an extension of 175 km² with 248.000 inhabitants.

Burgos is an important commercial and touristic city, known world-wide because of its cultural, monumental, and artistic heritage including 3 sites declared Human Heritage by UNESCO. Its Gothic Cathedral; The Pilgrim's way Camino de Santiago; and the Atapuerca Prehistorical remains.

The layout of Burgos is determined by its 3 levels with a difference in height of 75 metres. The funnel effect of the river and the Castle hillside, the vast historic heritage, different narrow roadways and streets, complicate mobility and logistics in the historic centre.



Burgos is a Spanish city of great historical and cultural interest. Among its noteworthy buildings figure the cathedral, the Casa del Cordón, the churches of San Esteban, San Gil, Santa Águeda and San Nicolás among others, the walls of the medieval city, the arch and bridge of Santa María, etc.

Its historic centre extends over 320,000 m² and houses 14,041 residents. In recent years, a great effort has been made to conserve and restore many of the buildings whose stone facades have suffered damage due to air pollution produced in part by heating systems and traffic.

With a view to reducing pressure in the urban zone arising from various economic and social factors, different activities have been carried out over time and in an orderly manner: traffic has been limited to certain streets, pedestrian areas established over 3% of the surface area, energy substitution introduced in buildings, parking areas built for 8% of the residents, etc.

1.1 Mobility and traffic figures

Moreover, Burgos is a city that has been steadily growing around its historic centre and along the Arlanzon River. The area of the old city occupies 32 km², measuring 8,500 m by 4,000 m. If the outskirts of the city are taken into consideration, the area could be said to be 12.5 km long and 8.5 km wide, which represents a surface area of 104 km². There are 6 bridges within the city for the circulation of automobiles and pedestrians, concentrated principally in the oldest part of the city. N-S traffic has to pass over one of these bridges, 3 of which are situated in the historic centre. Currently, travel through the city involves driving as close as 300 metres to the historic centre and traffic jams are frequent during rush hours.

Furthermore, heavy vehicles circulate around the principal thoroughfares of the city. This high volume of traffic is principally due to the position of the city that lies at a crossroads between the North and South of Europe, for traffic passing through Madrid and, in addition, is crossed by traffic travelling from the East to the West of Spain. The high volume of heavy vehicles obstructs the flow of traffic and considerably increases air pollution in specific areas of the city. Moreover, their parking in the city is a contentious issue as there is no specific parking zone for heavy vehicles, which are left with little or no choice other than to park in the main roads and streets of the city.

Ring roads around the city are still incomplete and some phases are currently under study or being drafted, principally by the Ministry of Development and the Development Council of Castilla and León. The progressive completion of these construction projects, scheduled over the next 10 years, is expected to culminate in a strategy that will mitigate many of the negative effects of traffic and pollution currently experienced in the city, principally due to the passage of heavy vehicles.

In conclusion, the movement of people in the historical centre is very high because the number of tourists visiting the area has increased by 20% over the last 5 years, added to which there are numerous small businesses and administrative offices located in its streets, as well as a large number of hotels, restaurants and bars surrounding each tourist attraction. Traffic in the historic centre is dense and continuous, resulting in frequent traffic jams during rush hours. In short, demand within the historic centre has increased considerably in recent years while the area has yet to adapt to its changing circumstances.

1.2 Main mobility and transport systems

The flows of people in the historical centre is high due to the number of tourists visiting the area, which has increased during last years, added to which there are numerous small businesses and administrative offices located in its streets, as well as a large number of hotels, restaurants and bars surrounding each tourist attraction. Traffic in the centre is dense and continuous, resulting in frequent traffic jams during rush hours. This flow of traffic produces widespread parking problems and parking violations within the urban centre. In short, demand within the historic centre has increased considerably in recent years while the area has yet to adapt to its changing circumstances.

Since 2006 the Municipality established clean areas in the historic city center, covering 2,5 km, by controlling the pedestrian areas with bollards and phones and cameras surveillance 24 hours a day. Since the same year in the historical center freight urban transport (loading and unloading areas and routes) is regulated with an access control system.

Within the city centre, the conservation of monuments of great artistic and patrimonial value and their protection from all forms of pollution is a highly important issue. In this area, air pollution due to unclean vehicles has been reduced by the means of mechanical controls to restrict access and 30% of its surface area was limited to pedestrian traffic.

In addition, a policy on information and management was developed (i.e. electronic access systems, identification cards) with residents in the area, which allowed them access to their homes. The system is monitored from a control centre.

In order to reduce the commercial vehicles traffic, in April 2012 a pilot test for using loading and unloading areas in two delivery routes in the historic centre (restricted area) has been conducted, and will be the base for a new freight traffic regulation within the restricted area.

Based on the positive results of test, the City Council is very interested to develop a Sustainable Urban Logistics Plan (SULP) and support this by further testing of sustainable, energy-efficient logistics soft measures.

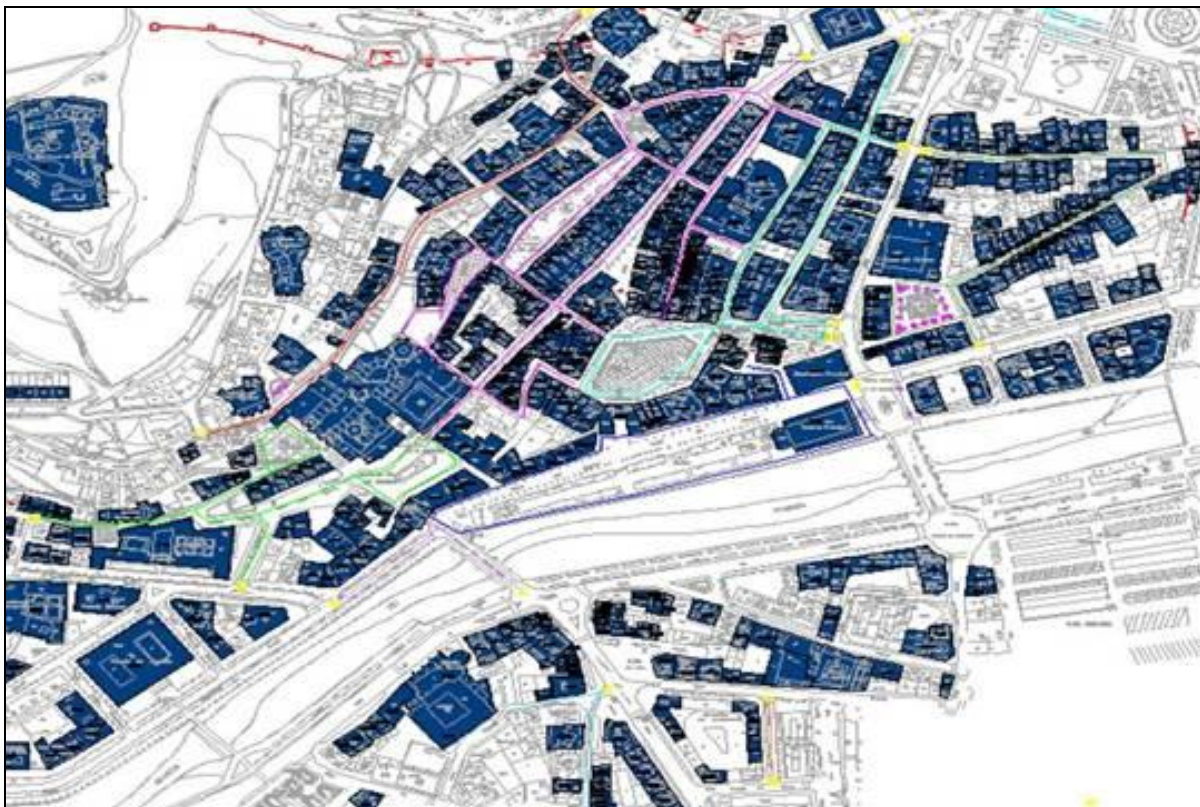
In the following sections an overview of the main mobility and transport measure done in the last years, which could be suitable (with different modalities and roles) for the implementation of the logistics solutions analyses in the study, is provided.

1.2.1 Access Restriction Strategy

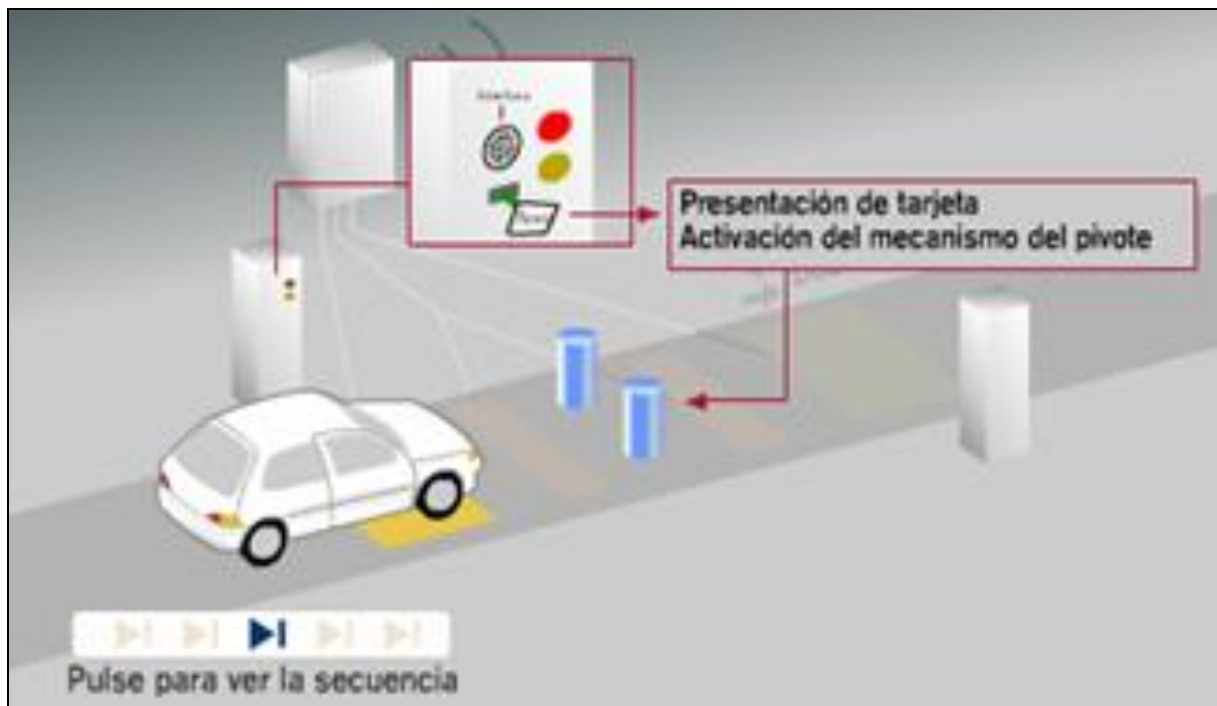
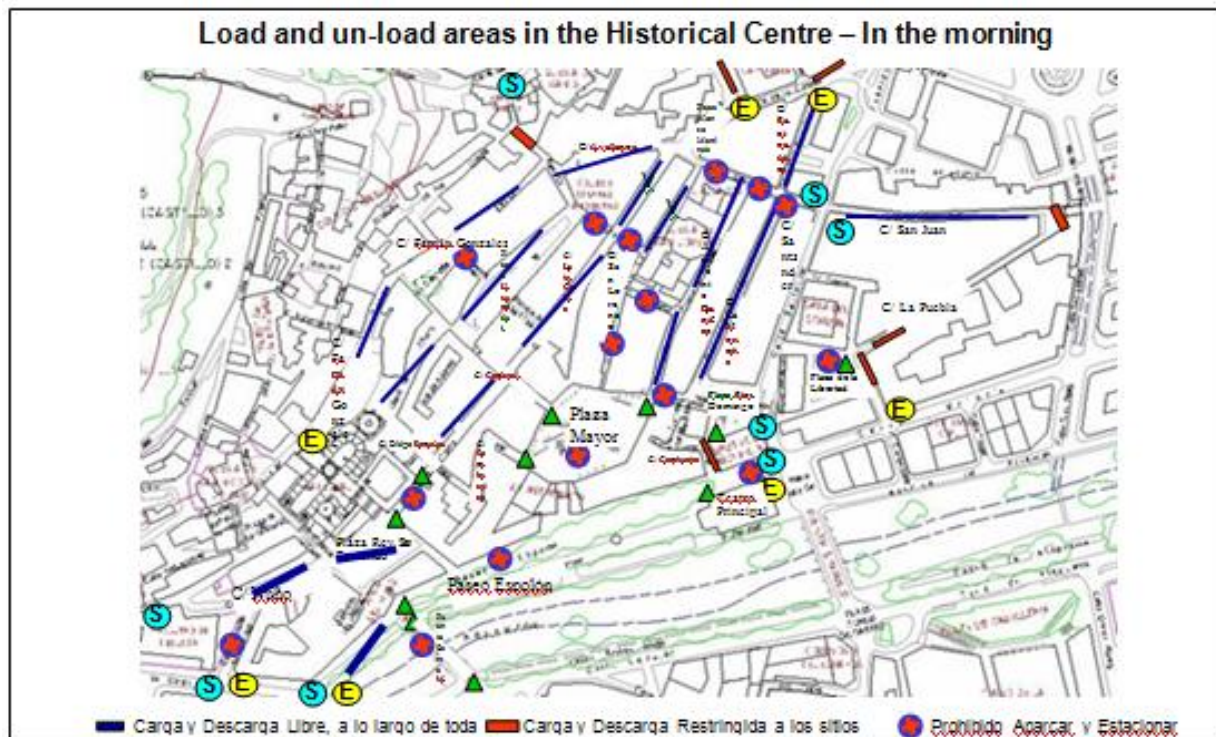
The objective was to develop integrated actions within the city centre and its surrounding areas that relieved the pressure produced by social and economic demands, with special emphasis placed on clean and sustainable urban transport.

The activities were developed within the tasks of the CIVITAS developed in the “Historical city centre” of Burgos.

Within the city centre, the conservation of monuments of great artistic and patrimonial value and their protection from all forms of pollution was a highly important issue. In this area, air pollution due to unclean vehicles will be reduced by means of mechanical controls to restrict access and 30% of its surface area was limited to pedestrian traffic.



In addition, a policy on information and management was developed (i.e. electronic access systems, identification cards) with residents in the area, which allowed them access to their homes. The system was monitored from a control centre.



At the same time, pedestrian traffic was encouraged around the city centre by providing its streets with comfortable and safe areas for walking, resting and enjoying to achieve this, the priority areas for pedestrians was analyzed and will continue to be developed until pedestrian zones constitute 25% of the city centre.

To accompany these measures, the traffic department drew up new itineraries for heavy vehicles, design traffic signs for the outer ring roads including electronic message signs and prepared various training sessions for relevant sectors throughout the project.



Demonstration activities were established and the following actions were developed in the historical city centre and surrounding areas:

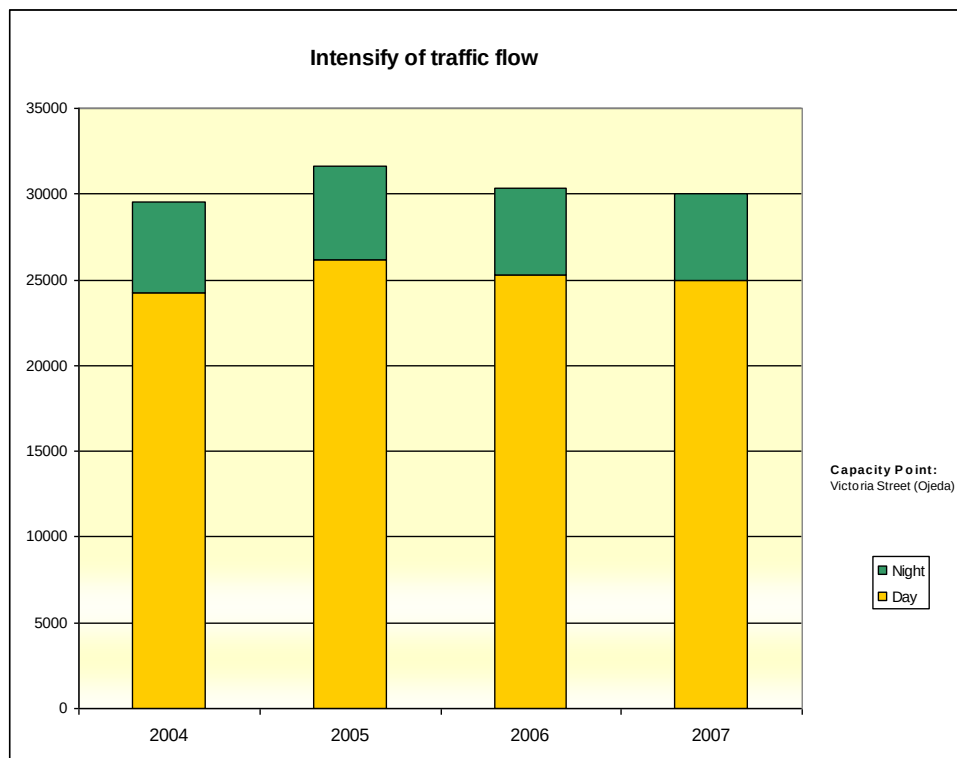
- Development of infrastructure required for different levels of pedestrian zones
- Enhancement of pedestrian walkways
- Development of access to pedestrian zones for residents
- Introduction of mechanical systems to restrict access
- Implementation of access and parking measures for residents (actively involving neighbourhood associations in drawing up procedures for stakeholders, permits, secure methods etc)
- Design of access schedules for delivery vehicles and communication of such measures to relevant organisations and collectives
- Promotion of restricted access for heavy vehicles in the city centre
- Modifications to traffic directions around the inner city to reduce congestion

The measure results regarding traffic are listed below:

- Average vehicle speed peak/off peak indicator: The vehicle speed was realized through speed radars which were included next to Historical Area, in a street where the mayor

number of vehicles used this street to arrive the town. The data was an average of the data obtained during one day using the speed radars. The results obtained were 65 km/h in 2004 (obtained of Police statistics) and 61 km/h in 2007 with the speed radars. A short reduction of the velocity was observed in the period of the project; however it is 11 km/h beyond what the law stipulates in urban environments (50 Km/h).

- Car reduction in restriction area indicator: The data reflected as the number of vehicles were reduced in the internal trips inside the restriction area. This data shown as in the baseline data (2004) the number of internal trips by vehicle was very high (20%) respect the results obtained in 2007 (97%). It is due to the actions of access restriction and pedestrian areas which forced to reduce the impact of the particular vehicle and loading and unloading at the centre.
- Pedestrian/cyclists counts in restricted area indicator: The data were obtained through the counts in concrete streets, close to the town, where the bicycles and pedestrian used to arrive to the town. The counts were realized during eight hours in a labor day. The data obtained of baseline were obtained of a study of Council. The results were the following:
 - The number of cyclists counted was 30 in 2004 respect to 110 in 2007. The difference between 2004 and 2007 values was 80 cyclists more in the town.
 - The number of pedestrian counted was 8810 in 2004 respect to 14230 in 2007. The difference between 2004 and 2007 values was 5.420 pedestrians more in the town.
- Traffic flows in surrounding roads indicator: The data were obtained through the traffic capacity points in a specific point in surrounding road. The intensity of vehicles during the day was so constant in all period of study. Emphasize that intensity is close to 24.000 vehicles diary in the day and there was a short increase in 2005. The difference between baseline data in 2004 and 2007 was 722,8 vehicles.



Evolution of traffic flow Intensity in surrounding roads to the City Centre

- Modal split change for people travelling in Burgos indicator: it can be observed that there was a moderate change in the modal split for the people of Burgos, about all respect to split on foot and by Public Transport.

1.3 Main freight and good distribution figures

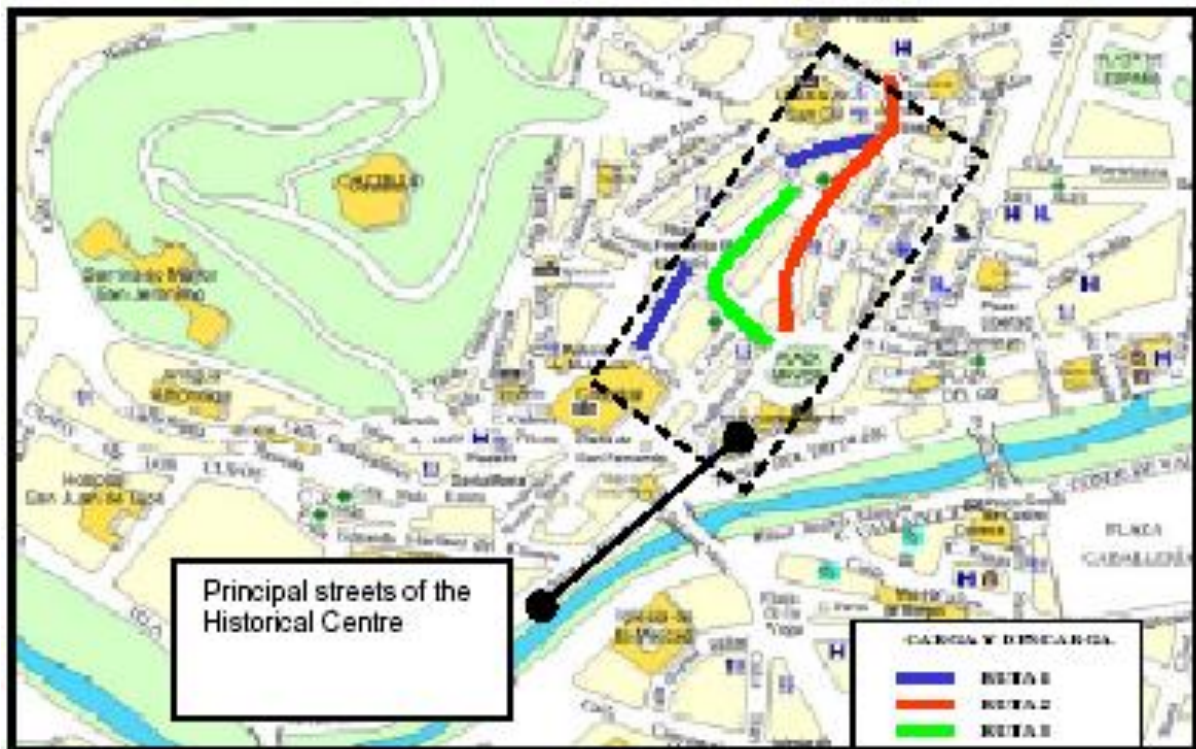
Goods were distributed from numerous central warehouses outside the city on a daily basis in small vans that circulate around the city. Some of the problems related to this type of distribution were:

- Numerous vehicles of various sizes dependent upon the goods they carry
- Circulation throughout the city worsens traffic problems and goods vehicles enter unique, sensitive zones in the historic centre
- Double parking during loading and unloading; although there were specific parking places and timetables for loading and unloading, these surfaces tend to be occupied by ordinary vehicles
- Access to pedestrian zones in the city endangering pedestrian safety

Above all, goods distribution currently exercises considerable pressure upon the historic and monumental centres, given that these areas were home to a large number of various small businesses. Delivery vehicles use a wide variety of routes and park wherever was most

convenient for them. The length of time spent parking was usually related to factors such as the type of outlet receiving the goods, the availability of storage space etc.

There were a large number of freight and delivery vehicles distribute goods to retail commercial outlets in the historic centre. These vehicles circulated throughout the day and, as a consequence, pedestrian areas are frequented by large vehicles for extensive periods during working hours



A small area of the historic centre was included in the mobility study of the city of Burgos and the following results were obtained:

- Shops and restaurants numbered 84 (bars, hotels, restaurants, shops). They have no backyards, garages or specific storage areas for their goods.
- Recorded operations numbered 62, of which 4 were for loading and 58 for unloading goods.
- Goods were distributed to food shops more frequently than to any others.
- 80% of loading and unloading took place during the morning and 20% during the afternoon. In the morning hours (07-14 h.), only 40% of the deliveries were undertaken before 11.00 am, a figure which represents a mere 30% of total operations.
- 94% of the operations lasted less than 15 minutes.
- Goods were distributed in vans (49%), lorries (47%) and cars (4%).

- 17% of the operations used zones reserved for loading and unloading and 83% used public streets away from the parking zones.
- Loading and unloading takes place at a distance of less than 15 m. from the commercial outlet.

This study indicated that regulation and control of goods distribution was a key project for the city. Such data gathered in the historic centre may be extrapolated to other areas of the city and is seen as standard practice by traders and distributors of goods.

1.3.1 Goods distribution scheme

The research activities involved the design and development of all aspects of an integrated regulation scheme activities were developed within the tasks of the CIVITAS in the “Historical city centre” of Burgos. This activity also implied the management of political discussion and consultation with all stakeholders affected by the adoption of these measures.

A parallel innovation action examined the social and economic impact on stakeholders. Particular attention was devoted to any eventual changes to the structure of goods distribution networks. Working methods were designed to organize transport between distributors and retail commercial outlets.

Distribution of deliveries in the city involved regulating the vehicles that enter the urban zone and assigning specific areas for distribution in the pedestrian and access restriction area. The end results are deliveries that are more methodical and less damaging to the surrounding environment.



The activities developed were as follows:

- 15

- Design routes, schedules, products and areas for the distribution of goods.

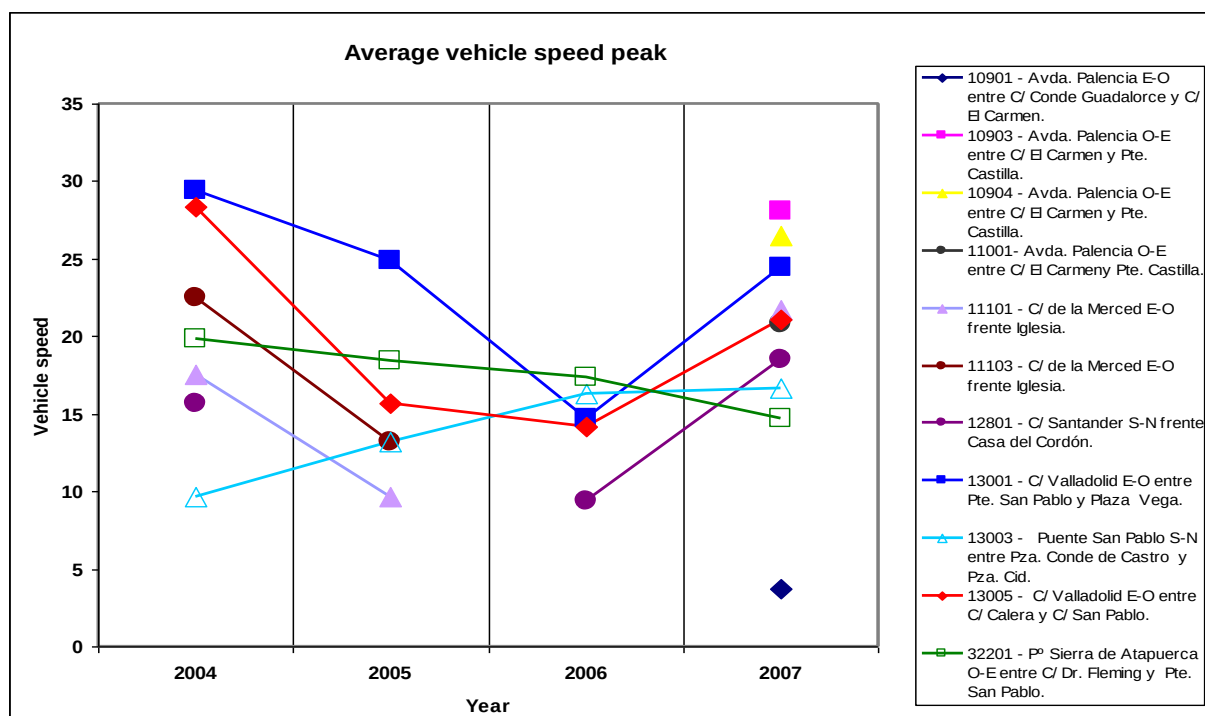
The results of transport indicators have been obtained from the traffic gauging took place from 2004 to 2007 in restricted access areas and surroundings.

Indicator – Average vehicle speed peak:

Indicator	Baseline Data	Data Result
	2004	2007
Average vehicle speed peak	20,42 km/h	19,63 km/h

The average vehicle speed peak has not suffered high differences between 2004 and 2007. The next graphic showed that the different average vehicles speed peaks have been obtained each year in different places of traffic capacity. Only it could be remarked, some big differences in 2006, where the most of average vehicle speed peaks were very reduced in comparison with others years because of the implementation of the access restriction area.

In conclusion, the small difference between the results of 2004 and 2007 is thanks to the new access restriction regulation and control in the pedestrian area, so that the freight distribution is performing in nowadays in a calmer way, respecting the citizens in the sensitive area. The average speed included all kind of vehicles in the surrounding area of the access restriction zone. The freight distribution vehicles have suffered a higher reduction of speed in the sensitive area, as the conditions are now more favourable for pedestrians, not for vehicles.



Indicator – Freight movements:

Indicator	Baseline Data	Data Result
	2004	2007
Freight movements (nº movements per day)	460,6	240,3

The freight movements have been reduced in 2007 due to increased access restriction areas and its corresponding control through new organisational arrangements or relationships and physical infrastructure solutions.

This result is a clear consequence of the success of the new distribution scheme, which has allowed the companies to distribute the goods in a more sensible and intelligent way, saving unnecessary trips and stays in the city centre. The data has been provided by all the freight distribution companies, apart from some account methods. The trips are longer now and the distance covered by these vehicles is longer, but they disturb less to pedestrians, nevertheless.

1.4 Burgos Study Area

The area identified in Burgos for the analysis of commercial and logistic activities and possible solutions (hereinafter "study area"), is the vehicle restricted area of Burgos Historical City centre.

It is placed on the historical city centre, all around the cathedral, where about (estimation) 628 commercial activities are with this average breakdown: HO-RE-CA (32%), Food Commerce (9%), Personal Equipment Commerce (Clothing,...) (33%), Home Equipment Commerce (10%), Commerce with high service component (9%), Banks (5%), Pharmaceuticals (2%).

2. General logistics context

2.1 Specific regulations for commercial and freight vehicles circulation, entrance and parking

In order to stimulate and improve sustainable mobility, “clean areas” in the historic city center were created by controlling the pedestrian areas with bollards, phones and cameras surveillance 24 hours a day. This involved the reorganization of traffic by restricting to pedestrian several streets, the design of routes and neighboring access protocols, and other traffic and public road use.

The recent extinguished mobility regulation on freight urban transport (loading and unloading areas and routes,...) in the historical City Center comes from the 2007 Local Decree on access control system.

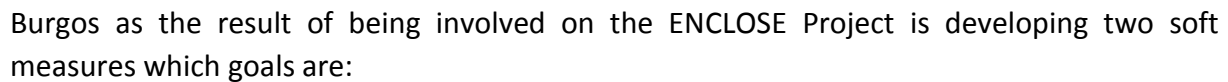
This regulation limited the vehicle maximum speed in pedestrian areas to 20 kilometers per hour. Freight transport vehicles could access the target area only in the time slot 7.00 - 11.30 and 16.30 - 17.30, with a maximum load mass of 3.5 tons (unless authorized) and a maximum stay of 20 minutes in the restricted area.

The City Council developed a new regulation, which was on public exhibition phase and entered into effect in February 2013.

2.2 Overview of characteristics and main types of city logistics flows

The city data on main flows and its types was being collected through surveys during the year 2012. For further data check chapter 3.2 of this document.

Figure below shows the Entrance and Exit Points. The area is divided in 9 sectors, and for the HO RE CA, sectors 1, 3 and 9, the exits are through C/San Gil; C/ San Juan and C/ San Gil, respectively, in order, to optimize deliveries in specific hostelry areas.



- The first measure is a **New regulation for the historical centre access, with special processing for loading- unloading tasks**. There was a previous one from 2007 that started to control the pedestrian areas with bollards, phones and cameras surveillance 24 hours a day. This involved the reorganization of traffic by restricting to pedestrian several streets, the design of routes and neighboring access protocols, and other traffic and public road use.

Vehicular access to the restricted area of Burgos historical city centre:

- 20



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4. Vehicles may be parked only in authorized areas for this.

5. You can only access by vehicles of less than 8,000 kg of PMA, except in the Plaza Mayor that its limit is 3,500 kg of PMA

Loading and unloading:

Vehicles for goods delivery tasks will upload and download exclusively on the schedule; outside it need special authorization. The route to be made by vehicles for goods delivery is set out in the resolution.

Vehicles carrying out loading and unloading tasks may park every day from Monday to Saturday morning, on the following schedule:

- Inputs and outputs of interested sectors: From 7:00 to 12:00 hours.
- For food and beverage distributors output will to 13:00 throughout the year, Monday, Tuesday or Wednesday depending on the street.
- The afternoon schedule for work of loading and unloading will be from 16:30 to 17:30 all year, Monday to Friday (apart from some areas).
- PMA for these areas will be 8,000 kg.
- Parking places concentrate for loading and unloading (Restrictions: Parking only on the side of the road specified)

General changes:

One-way circuits to circulate across the sectors

Area divided in 12 sectors (with a specific entrance/circuit/exit)

20 streets where it is not possible to park/stop

3 special treatment areas.

The second measure is a **Card system on loading and unloading for shop owners and hostelry owners (for non-labelled vehicles)**. The City Hall provides the Downtown Historic Merchants Association 20 unidentified registration cards, which will be distributed to members and non-members merchants of the historic centre, who need to work loading and unloading.

2.3 Infrastructures and facilities for city logistics

The loading and unloading areas are the only existing logistic infrastructures in the historical City Center.

About the realization of a logistics distribution centre near the target area (Plaza España-España Square) it was done a calculation about the resources and cost estimation needed to

implement the centre (There was a specific location planned for the centre). In the short term there are no specific plans for the centre implementation.

Burgos has an intermodal logistics center. The creation of "Centro de Transportes Aduana de Burgos" company (Freightage Facility Burgos Transit Customs) dates back to 1980, culmination of a long job period to fulfill the initiative. The setting up of the company is backed up by the Burgos vast industrial activity, its freightage and foreign trade business flow, its good communication networks (main roads and highways, railway, airport), and Burgos excellent geographic location within the region and Spain.



The success of the company led to its constitution in Public limited company with the following partners and institutions: the local banks, Burgos City Council, the local commerce and industry association, the Province Authority, and the Regional Authority.

“CT Burgos” services:

- Users and crews: Hotel, Coffee Bar, Restaurant, Bank Offices, Green areas and rest areas and Car park area
- Vehicle services: Car park area, Lorry park area, Service station and Garages
- Customs services: International Terminal and Customs Clearance, Free and Tax Depot, Phytosanitary Controls, Groupage, Break Bulk and Freight Storage Facilities
- Logistic services: Premises Available for Warehouse-Owners, Premises for Logistic Companies, Cold Stores, Temperature-Controlled Warehouses and Vehicle Warehousing

3. Setting logistics baseline

3.1 Commercial activities – Shop Owners

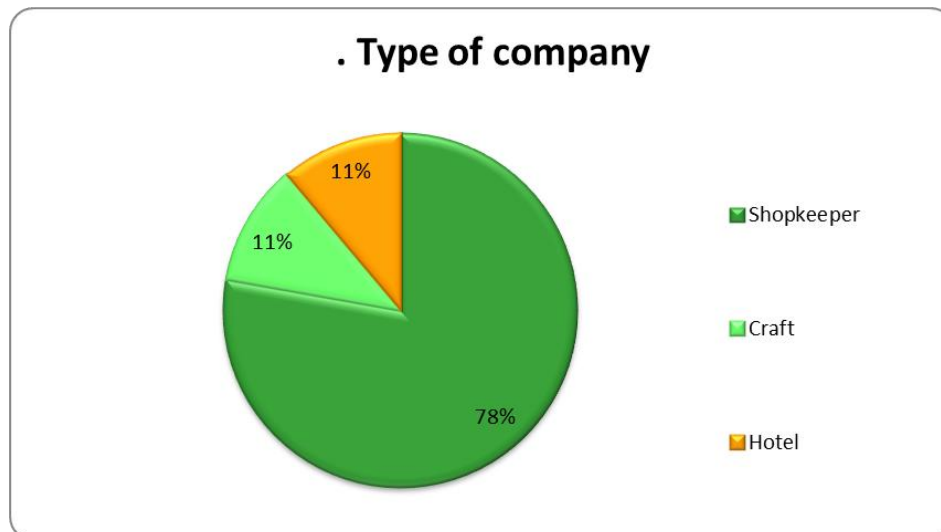
The following pie charts have been developed as a result of the shop owners questionnaires executed in the Burgos Historic Centre Area.

The target area, where logistic services are been analyzed is located in vehicle restricted area of the historical city centre, all around the cathedral, where about (estimation) 628 commercial activities are with this average breakdown: HO-RE-CA (32%), Food Commerce (9%), Personal Equipment Commerce (Clothing,...) (33%), Home Equipment Commerce (10%), Commerce with high service component (9%), Banks (5%), Pharmaceuticals (2%).

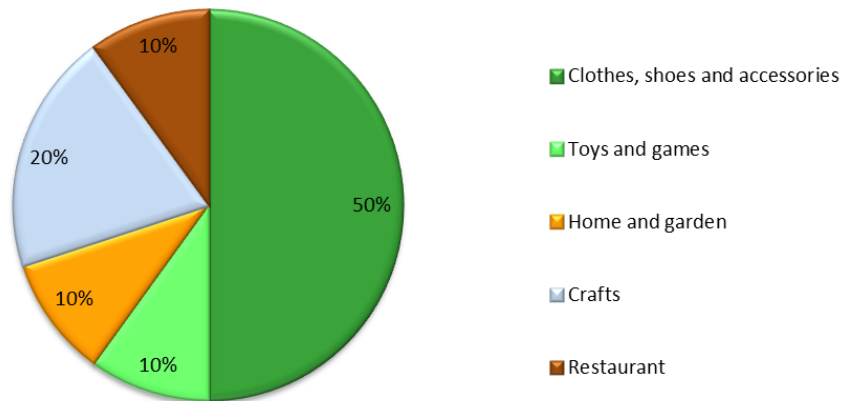
The following information has been analyzed: the kind of vehicles used, the actual load factor, number of trips per week/day/month, days of the week and transported freight type, etc.

Those interviews with local stakeholders (shop owners and transport operators) provide a more detailed analysis of freight and city distribution processes.

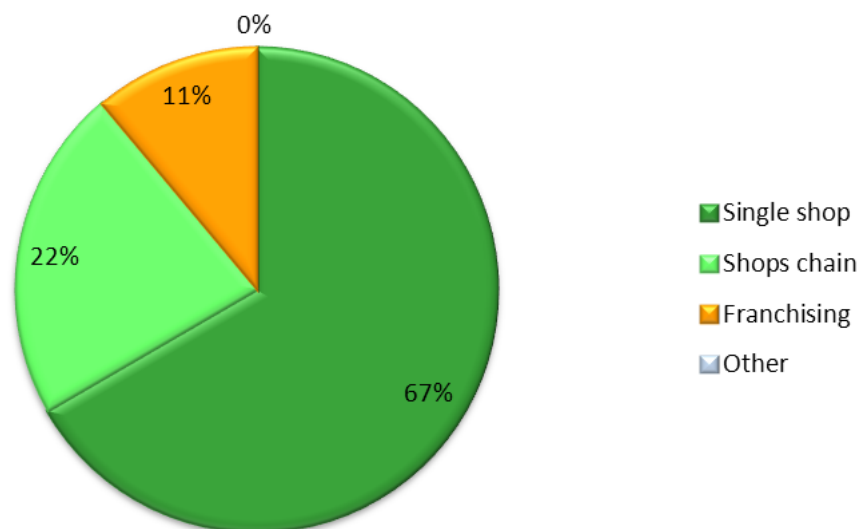
The Shop Owners surveys were carried out by email through the Asociación de Comerciantes Centro Histórico Burgos (Historical Centre Shop Owners Association).



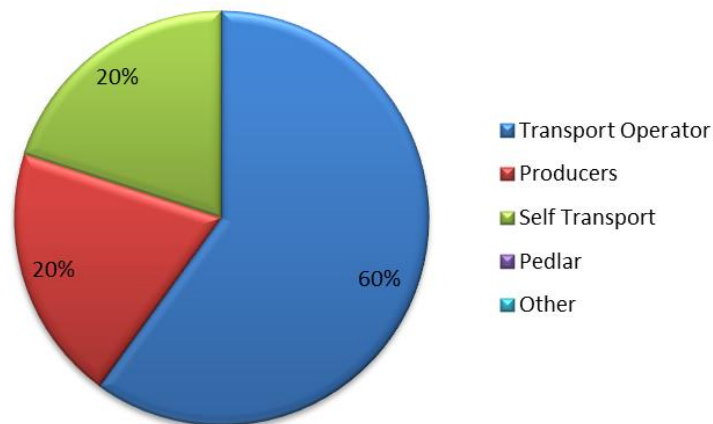
. Type of shop



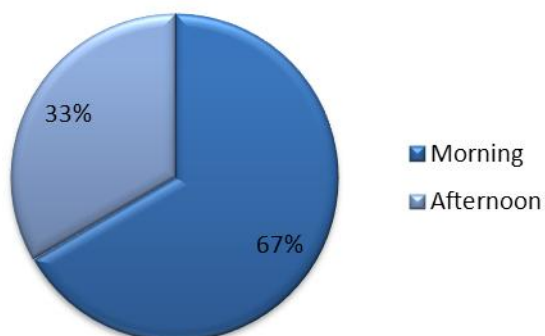
. Type of shop organization



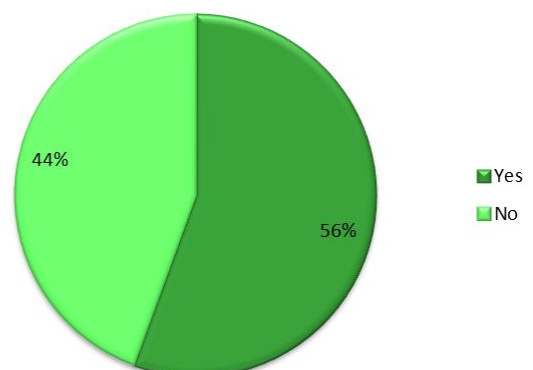
1. Supplies and deliveries



Delivery time



Reverse logistics



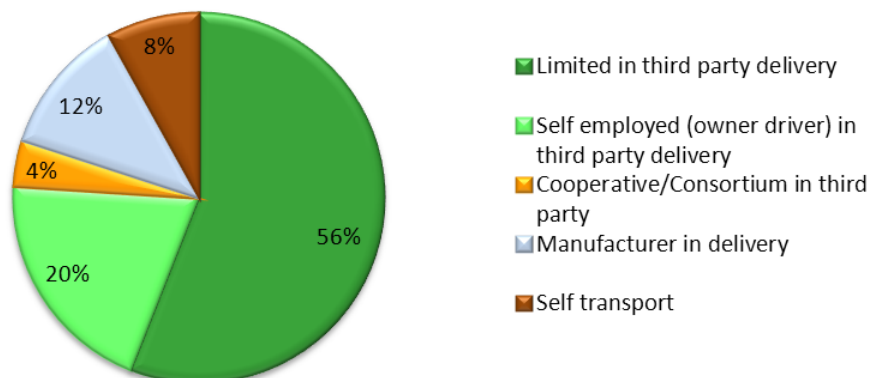
3.2 Freight transport operators

The following data have been developed as a result of the transport operator questionnaires executed in the Burgos Historic Centre Area.

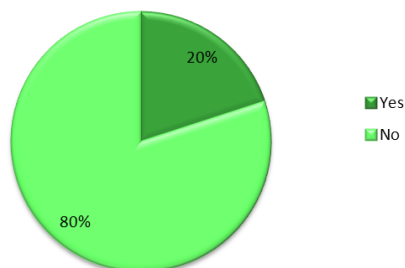
The target area, where logistic services are been analyzed is located in vehicle restricted area of the historical city centre, all around the cathedral, where about (estimation) 628 commercial activities.

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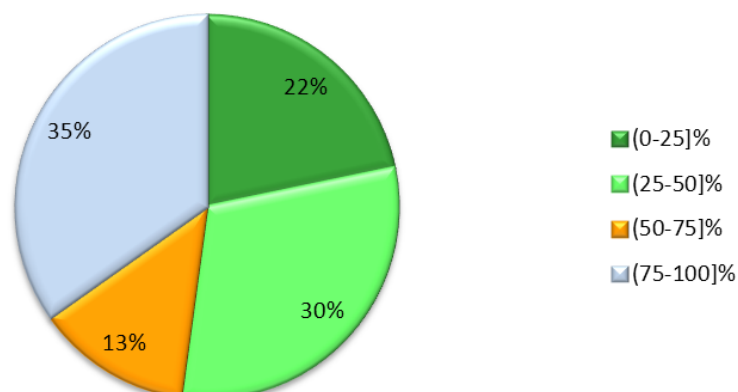
. Type of transport



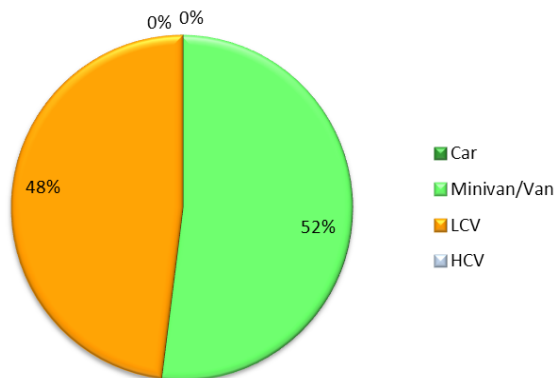
.. Do you collect goods from other companies' depots?



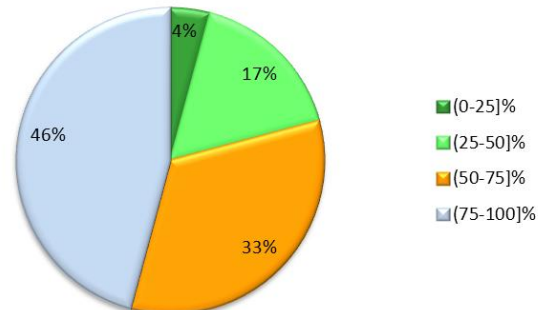
. Dimension of the fleet operating on the targeted area versus total



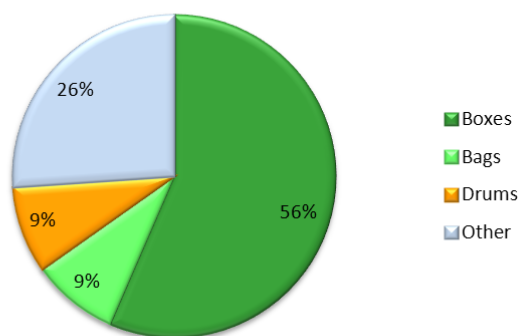
.. Sort of vehicle



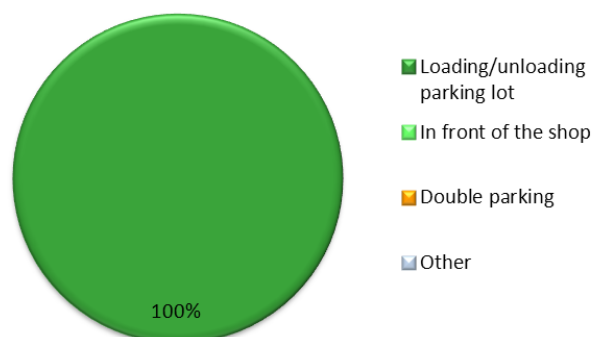
.. Average loading of the goods vehicle (in %)



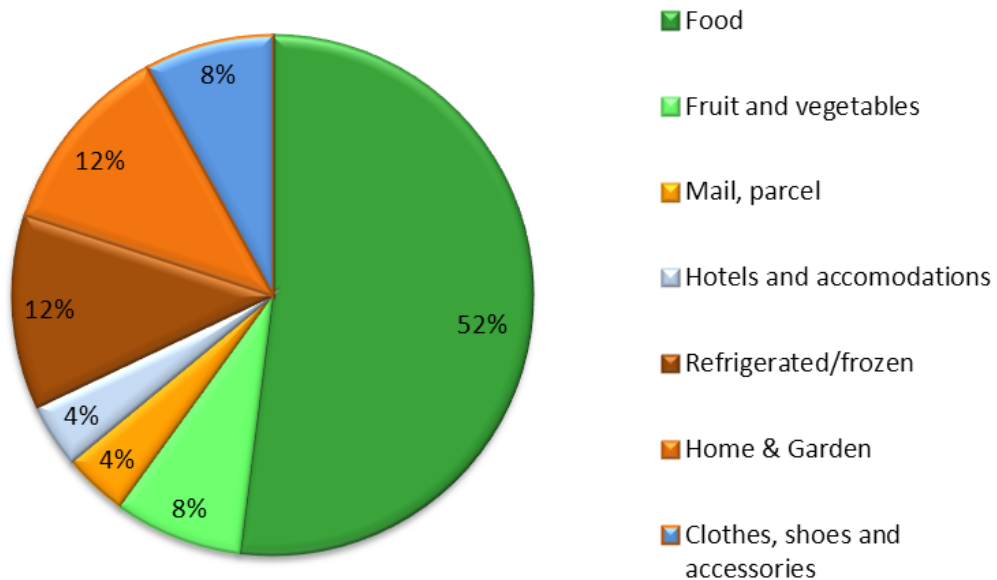
I. Describe how your products are packed



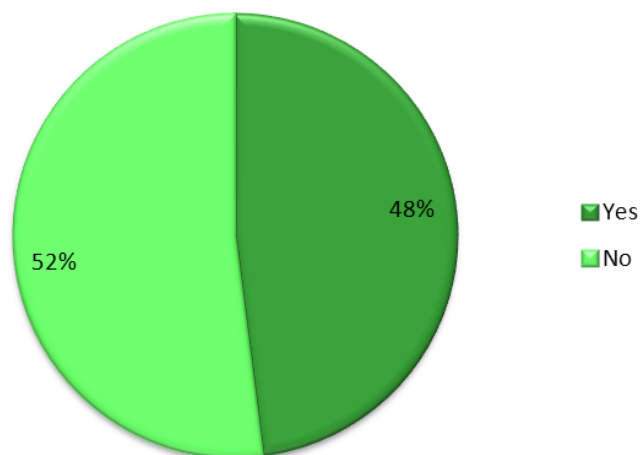
. Where do you stop the truck/van for the delivery



. Type of goods usually transported by the company (in % on the total and in weight units)

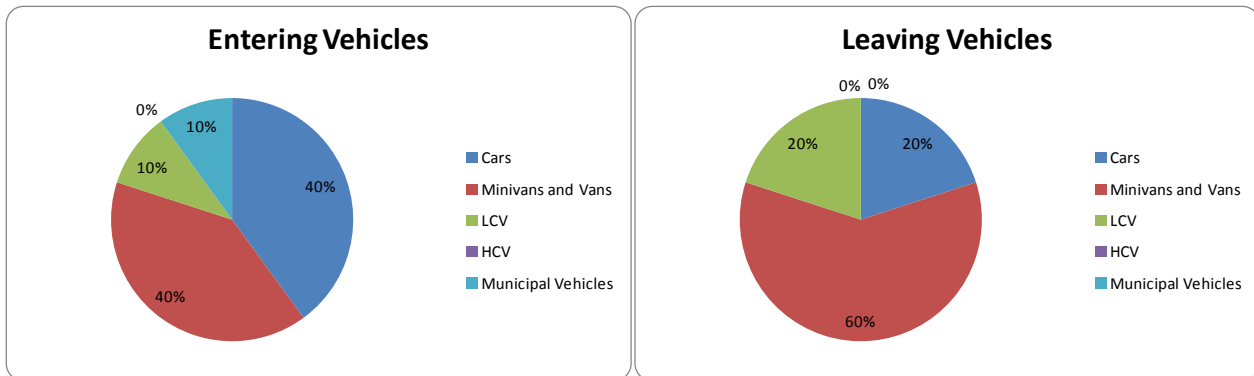


.. Reverse logistics

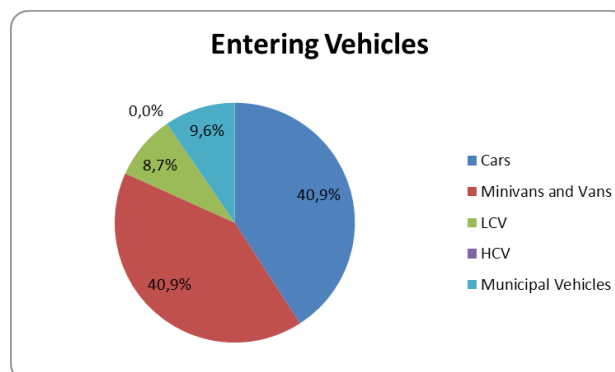


than 3.5 tons are not allowed to enter without permission by the regulation, and during the data collection no heavy vehicles were detected trying to access the area.

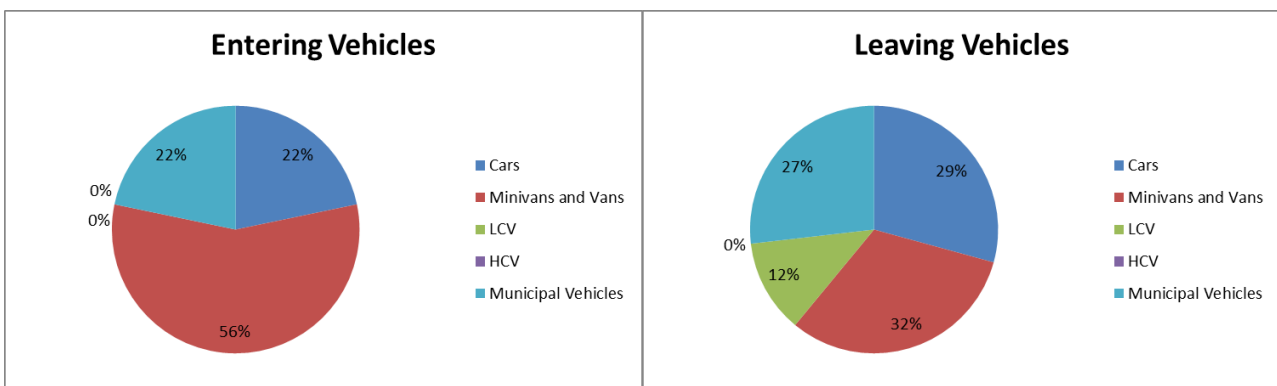
VEHICLE COUNTING POINT 1: C / Asunción de Nuestra Señora



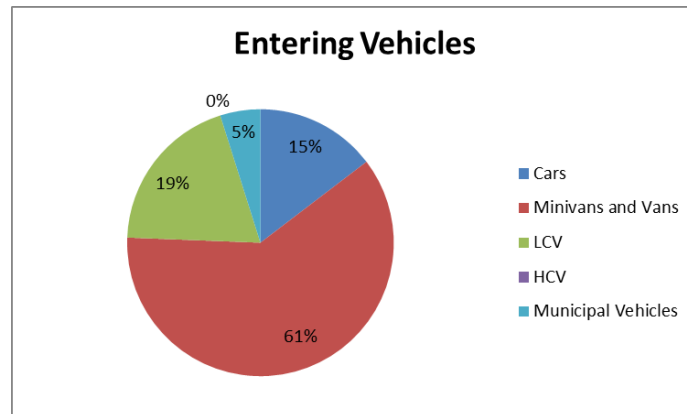
VEHICLE COUNTING POINT 2: C/ Concordia



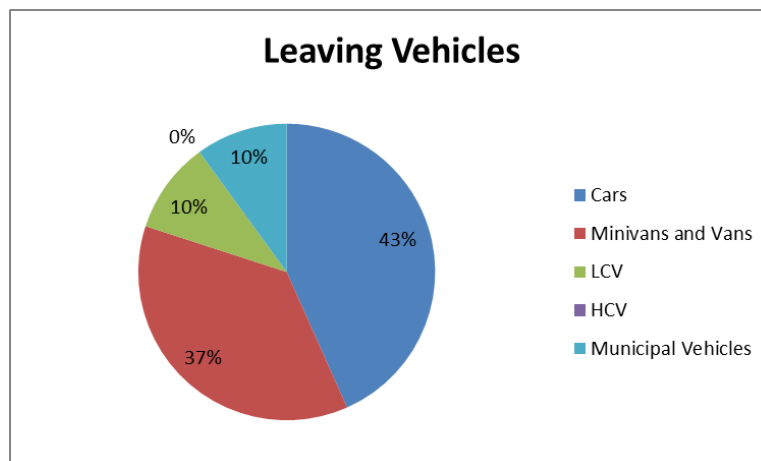
VEHICLE COUNTING POINT 3: Plaza Santo Domingo de Guzmán



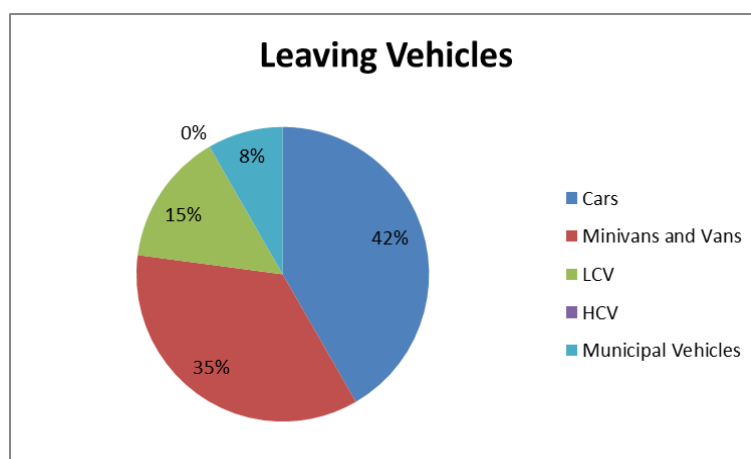
VEHICLE COUNTING POINT 4: C / Condestable



VEHICLE COUNTING POINT 5: C / San Juan



VEHICLE COUNTING POINT 6: C / General Sanz Pastor



3.4 Highlight logistics problems

According to the logistics baseline developed, it is important to highlight the critical logistics problems that can be identified in Burgos, although they are quite similar of the ones feature in many city centres of small/medium historic and touristic cities.

These critical issues are listed below:

- Raise the distribution of goods from a purely regulatory and legal prism: Strategic, social and ecological dimension course of this activity is not conceived in the city.
- Insufficient involvement of the stakeholders: Is needed to take advantage of all the stakeholders which are involve on the city logistics. Developing cities tend to have a very active and mobile private sector. Developers and occupants belong to the same class of private dealers. The public sector is not always the best equipped to deal with increased logistics measures.
- Lack of facilities regarding the support of intermodality around the historic city centre of the city.
- Low promotion of logistics to and within the touristic city centre: This objective should be achieved by coordinated actions involving public and private operators alike. Some measures, such as finding new services for tourists needs on the destinations, promoting the use of space and traffic controls to improve tourists' quality of visit, using information to fill the gap between final users and tourism and transport service providers, can be developed in Burgos.
- Lack of integration of energy efficient activities: is needed to minimize the accompanying environmental deterioration taking advantage of tics, FEVs ... promoting Burgos as a smart city.
- "Plaza de España Market": this space represents plainly the major problem of the inefficient utilization of freight vehicles in urban areas, which contributes significantly to congestion and environmental nuisances such as emissions and noise. A more efficient utilization of freight vehicles can be achieved by placing a "urban consolidation centre" in this area.

4. Candidate Measures/services identification and selection

In this Chapter a synthesis of the logistics solutions/services identified as suitable for Burgos context and needs is provided.

In particular, general approaches, infrastructural and operative aspects and strengths/weaknesses related to Burgos situation are described for the following measures/services:

- Urban Consolidation Center (UCC)
- Eco Van sharing
- Self-supply management
- Park and buy
- Pick-up points (PuP)
- e-Logistic

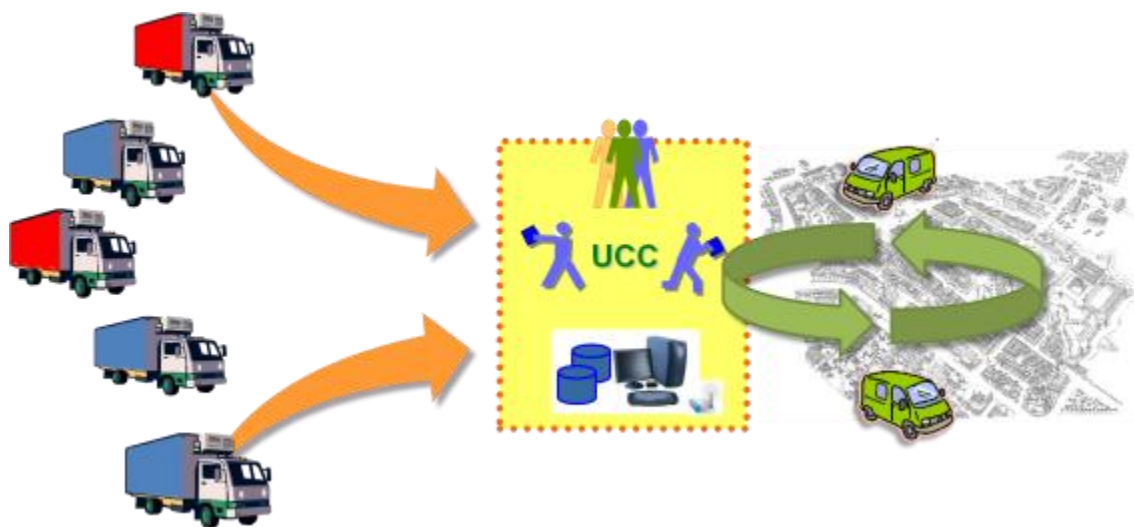
4.1 Urban Consolidation Centre (UCC)

The Urban Consolidation Centre (UCC) is a complex structure, based on a physical infrastructure (i.e warehouse) as a primary component (indicated also as Logistics Base) connected with a range of organization and service measures.

For this reason the UCC is also indicated with other different names and acronyms (i.e. Freight Consolidation Centre, Freight Transshipment Centre, Transit Point, Public Logistics Terminal, Urban Logistics Platform, Freight Collection Point etc.), but it substantially presents a common structure and approach: main reference point for rationalizing urban logistics processes and providing logistics services that can significantly improve the environmental sustainability of freight delivery in urban areas and city centres.

Freight consolidation management is the key activity of UCC. The expression “Freight consolidation” refers to a group of operation models and commercial relationships among the UCC and different logistics operators or between the UCC and shop owners, aiming at reducing the number of freight delivery trips within the urban area.

The UCC will act as base for gathering goods of different operators (groupage) and implementing “last mile” delivery services managed by UCC fleet. The next figure shows the operation model of the UCC solutions.



Normally the UCC can result from a private (i.e. an operator or a consortium of operators) or, more frequently, a public enterprise (i.e. Municipality or other Local Authority). In the latter case the Public Authority is in charge of setting-up the structures, purchasing the vehicles of the fleet (if possible eco-friendly) and managing the service, also availing itself of external staff.

At a following stage, once UCC experience consolidated, the Authority may also involve private actors in the overall UCC management, only maintaining the functions of control and regulation, thus establishing, in practice, some form of public-private partnership (PPP - public private partnership).

The UCC can operate, from the commercial point of view, basing on two different approaches:

1. the UCC makes an agreement with the main long range transport operators that often prefer avoiding to enter the inner city centre for delivering low volumes of freight. In this case the transport operator goes directly to the UCC bases leaving the parcels to be delivered in the city centre by the UCC fleet. The operator bears the cost of these last mile transport service. This scheme was implemented in several European cities (with different characteristics and dimensions), such as Berlin, Bremen, Bristol, La Rochelle, Malmo, Parma, Vicenza, Siena, Barcelona, Lucca, etc.
2. the UCC makes an agreement with the owners/responsible of the main commercial activities located in the city centre or urban area (shops, restaurants, cafés, minimarkets, etc.). This agreement foresees that the delivery of the ordered freight is to be made directly to the UCC address. In this case the shop bears the cost of last mile service but, at the same time, can also benefit from a lower delivery price applied by the freight

operator, thanks to the agreement that guarantees significant quantities of freight to deliver during the year.

In addition, shopkeepers do also benefit from added advantages, due that they can avoid the costs for other related logistics activities e.g storage management, reverse logistics processes (i.e. cartonboxes, pallets, plastics), etc. Moreover additional benefits can also be represented by the possible lower delivery prices got thanks to the possibility for the shopkeepers to order larger quantity of goods without any problem of storage.

This is the scheme adopted in 's-Hertogenbosch (NL) by the private company Eco2city.

The two different schemes detailed above highlight the fundamental characteristic of a successful UCC: for operators not having a logistics centre in the reference city the delivery of freight to UCC, upon payment of a fare, shall be more convenient than to overcome the difficulties for its-own vehicles to entre in the city centre.

Such a convenience can either be “pushed” by the Municipality (i.e. Vicenza, Lucca, etc.) imposing tight city access restrictions (i.e. time windows, parking time on l/u lots, vehicles sizes, vehicle emissions, one way streets, pedestrian areas, etc.), or be already present in the city morphology itself (i.e. Siena), where the characteristics of the historic centre, with narrow and steep streets and alleys, are a first deterrent for entering in the inner centre along with regulations and restrictions.

As already pointed out, the UCC is based on significant investments on infrastructures, fleet and organization, therefore this solution can be only the final step of a process aiming to identify the most suitable solutions and it can only result from a strong political willingness and from the capability to evaluate the different benefits and costs (directly and indirectly).

For this reason UCC are normally viable solutions for big cities or metropolitan areas, where these usually play the role of urban interports. As regards small/medium size cities these structures should, if possible, be based on existing infrastructures and operators.

The experience of two ENCLOSE towns can be taken as reference in evaluating the feasibility of a UCC in Burgos:

- Lucca, where the Municipality, taking advantage of significant European and National co-funding, realized its UCC (infrastructures and vehicles fleet) after a long process lasted 8-10 years, adopting as logistics base (during the experimental phase) an existing minor public warehouse;
- Trondheim where the system implemented by Posten Norge is composed by two hubs at the opposite sides of the city. Large vehicles bring freight to the hubs, from where electric vehicles collect goods to be delivered to the city centre.

Moreover, an interesting solution is given by the possibility to adopt a logistic "cross docking" approach consisting of a service operated by the UCC where the freights where

collected by the UCC vehicles directly at national operators warehouses and delivered to the shops in the city center for last mile distribution.

Whatever the chosen solution is, the implementation of a UCC usually produces several advantages, mainly dealing with freight flows and environmental sustainability of the logistics system. Among these, the most important are:

- Enhancement of the loading factor and reduction of half-load trips with lower transport unit cost;
- Reduction of fuel consumption (energy savings) and of polluting emissions (air and noise);
- Possibility to use low impact vehicles – electric, CNG or hybrid – for last mile deliveries management;
- Compatibility with different transport, environmental and social policies.

Moreover, logistics operators can also benefit from significant advantages by using UCC services, such as:

- Reduction of kms covered by freight vehicles;
- Reduction of time waste due to traffic congestions;
- Reduction of delivery times.

Finally, from the Burgos point of view, shop owners also enjoy positive advantages by using new delivery services:

- Possibility to receive useful delivery information from UCC (tracking) and to indicate specific hours for delivery;
- Possibility to enjoy other added-value logistics services based on UCC infrastructure (es. third party warehousing services, packaging collection, etc.).

The main problems concerning UCC dealing with economic sustainability, in particular:

- Costs for building the logistic base infrastructure (when already existing infrastructures cannot be utilized);
- Costs for supporting infrastructures and devices;
- Costs for purchasing commercial vehicles, in particular EVs, hybrids and low emission vans in general;
- Costs for freight transshipment.

Finally marketing problems could deal to the unwillingness of the national transport operator to allows deliver operation of "their" freight made with vans showing different brands.

4.2 Eco van sharing

Usually van sharing service is more focused on the needs and requirements of shopkeepers in self supply, than on those of transport operators, and can be implemented by adopting different approaches.

In any case this solution can be also suitable for those small transport operators that not having the economic possibility to directly buy commercial Electric Vehicles (characterized by high purchasing costs) but are in the needs to satisfy demand of freight deliveries in those cities having wide pedestrian zones or traffic restricted areas, and/or rules/normative allowing the access only to electric vehicles.

In order to adopt a van sharing solution the municipality, or better a transport operator consortium, purchases a fleet of electric vehicles (the number is to be defined based on local needs and area dimensions and funds availability) which are at freight operators disposal upon reservation. An advanced version of this service could includes an ICT platform to manage bookings and the use of electric vans (equipped with specific on board terminals and a smart card reader).

Electric vans can be located either at strategic points in the city or at the headquarters of one operator.

The cost of the service should be related to the effective time of usage and to the agreement criteria among transport operators (including, not last, the operation and maintenance costs). Some of the advantages of such a scheme for the operators are, among the others:

- No significant investment and management costs are needed;
- The courier is led to optimize the number of trips by trying to drive a full-load van (in order to reduce the cost for renting the electric vehicle);
- The historic centre is preserved from emissions and noise pollution.

Yet, the sharing concept also features disadvantages:

- It is not convenient for the transport operators based far from the city;
- Couriers are not often able to optimize shipments and may use half-loaded vehicles (i.e. in the case of urgent deliveries);
- Managing and maintaining the fleet;
- Need for a call-centre and/or suitable ICT platform (including development and maintenance costs) for managing booking, operation and revenues and the fleet.

4.3 Self-supply management

As pointed out in the previous section, one of the main mobility problems in the inner centre is related to the self-supply processes operated by shopkeepers using their own private vehicles (small vans and/or cars).

This problem is becoming even more evident due to the current economic crisis that is pushing many shop owners to economize on freight transport by using their own vehicles for transporting goods from and to the shops.

Because of this, really often shop owners enter illegally their vehicles (either vans or minivans) into the restricted area parking on loading/unloading areas for long periods.

In order to solve this issue some European cities set up restrictions on the number of vehicles that can circulate in the same time window in the restricted traffic area, by implementing specific measures such as: access control devices (i.e. bollards) operated under specific code/psw, a limited number of access permits issued to the shopkeepers (managed by their association) with specific rules both for booking the permits, the time period and for pick up and delivery the permits.

This measure has the advantage of regulating and limiting the number of shopkeepers vans/cars circulating of the in urban city centers, especially to those featuring large pedestrian areas, without penalizing shopkeepers too much.

4.4 Park and buy

“Park and buy” - P&B service is applicable to any tourist city having parking infrastructures (parking house) with presence of operators. The tourist who leaves his car in parking houses, usually at the border of the city centre, is not willing to buy bulky items as carrying such kind of goods during the visit is uncomfortable.

In order to solve this problem the P&B service, thanks to an agreement between shopkeepers and the parking manager, allow tourists to make shopping and find the purchased items later on directly at the parking house.

This service is based on a operative scheme allowing the shopkeeper to alert the P&B transport operator to collect the goods and to deliver it to the specific parking indicated by the client. Once the delivery is done an sms is sent to the customer for informing that the parcel is at the parking house. The same system can be used for delivery purchased items to hotels.

The following figure is related to park-buy scheme demonstrated in the Italian historic city of Siena some years ago.



The results of the service demonstration implemented in Siena showed that the dedicated infrastructure and organization for the parking house are relevant (security boxes, electric van, booking system, personnel presence, goods insurances, etc.) and can be successful faced only if this service is one of several logistics services provided by a transport operator or is one of the services provided by an UCC.

4.5 Pick-up Points (PuP)

B2C commerce, and in particular Web commerce, is constantly growing, implying an increase of the volume of delivery services requested to the transport operators (mainly express couriers). One of the main problems that these operators have to face in this process is represented by the absence of addressees at the final destination (usually home) during working hours.

This implies that the transport operator shall do one or more unsuccessful trips to attempt the delivery and often the customer is obliged to go to the depot for collecting the item(s), thus generating additional traffic.

In order to avoid (or minimize) this problem, several interesting experiences were implemented in Europe, usually consisting in the setup, by the main freight operators, of some pick-up points either in public areas or at commercial activities (i.e. fuel stations, railway stations, etc.) with a h24 operating time.



The courier delivers the parcel(s) at PuP (usually located in close peripheral and easy accessible areas) and sends an sms to the consignee providing the reference number to self-collect the freight. This way freight operators avoid useless trips within the city and customers do not need to travel to the courier warehouses, that are frequently far from the city and have opening times coinciding with customer working hours.

One of the main successful PuP service experience in Europe (and in particular in Germany) is represented by the Packstation™ service operated by DHL/Deutsch Poste, characterized by a specific technological infrastructure (advanced boxes with IT) directly managed by the courier.

The main limit of this solution, from the operation point of view (apart relevant costs, area to be reserved to the infrastructure, etc.) is represented by the fact that the boxes "fulfillment" can be only operated by one courier.

Despite the willing of the different transport operator to reach an agreement for a common and integrated solution, the real possibility to share this infrastructure among different couriers is very low, due the different information systems and flow integration required.

Other minor experiences have been developed in the last few years (i.e. Kiala services), based on similar concept, but although foreseeing more practicable solutions, these require in any case a specific agreements among transport operators and the PuP responsables, that limit their diffusion..

4.6 e-Logistic

In some European cities, on the basis also of significant pilot experiences developed under EU programmes (i.e. eDRUL Project - "eCommerce Enabled Demand Responsive Urban Logistics", FAMS Project - "Flexible Agency for Collective Demand Responsive Mobility Services" - 5th Framework Programme R&D EU-IST) the concept of the e-Logistics Agency for the provision of urban logistics services is emerging.

The e-Logistics Agency involves four main components:

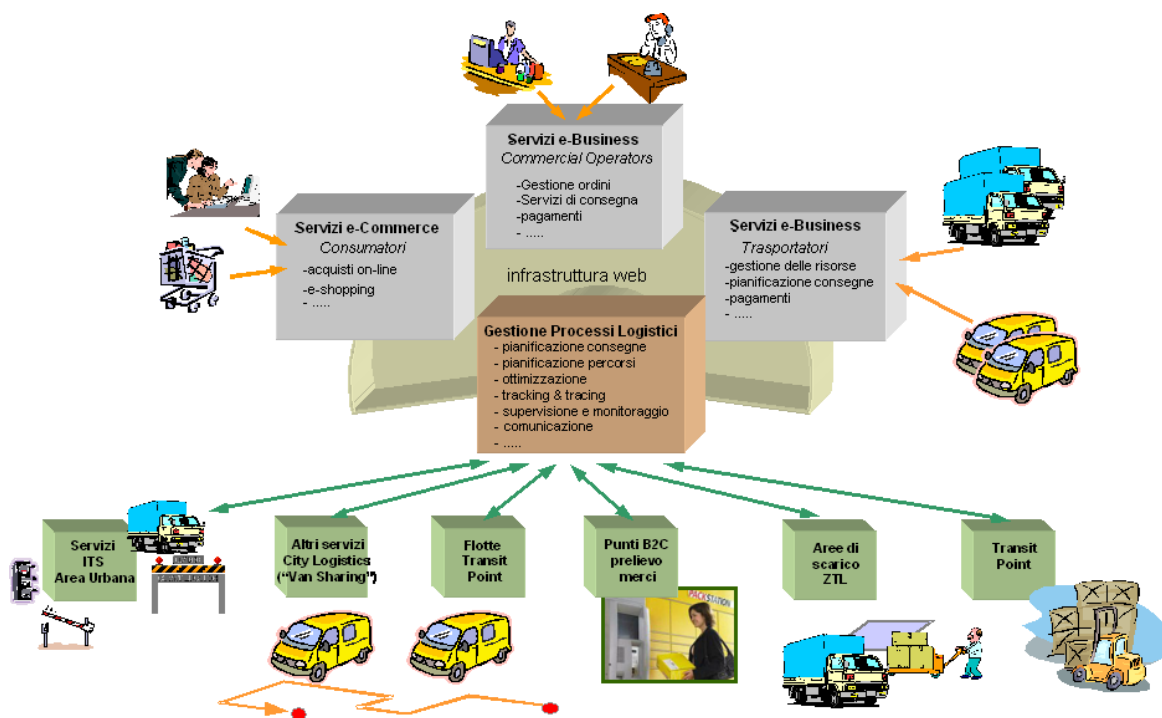
- **B2C services**, enabling interaction among the customers and the goods retail/distribution system (last mile, added value service and eCommerce interface);
- **B2B services**, enabling the networking and collaboration of the different actors of freight distribution chain (goods delivery operators, transshipment and logistics platform operators, retail operators, etc.) and allowing dynamic cooperation among these actors;
- **B2A City oriented services** in order to realize flexible, under mobility constraints, demand-driven goods distribution schemes integrated (if exists) with the ITS urban scenario and the mobility policies.
- **Base Planning services** to enable optimal management of the available resources related to freight distribution process (fleets and available capacity, logistics bases, consolidation, routing, etc.)

The e-Logistics Agency concept has been often developed (and in some pilot case demonstrated) as an extension of the existing demand responsive transport services operate for people (DRTS), as carried out in Almada with the FLEXIBUS service, where passengers can book their trip and choose the hour and the meeting point for pick-up.

DRTS services are based on a Travel Dispatch Center (TDC), for managing reservations and planning optimised trips.

In a perspective of enhancement towards the e-Logistics Agency concept, the TDC should be also involved in city logistics management as a "tool" for collecting requests and planning deliveries (preferably operated by FEV) in an optimized way.

In order to perform these tasks the e-Logistics Agency needs to be equipped with a specific web based ICT platform.



4.7 Selection of the most suitable measures

Based on the characteristics of Burgos study area, on the Project Deliverable D2.2 - “Sustainable logistics in European small-/mid-size historic towns: stakeholders goals and User Needs Analysis” and on the exchange of experiences with the other ENCLOSE towns, a selection of the most suitable measures that could be implemented in Burgos was made.

The selected measures, that will be described in detail in the following, aim to enhance the overall management of city logistics, in order to improve and optimize these processes, thus producing significant benefits not only from a logistics/commercial perspective, but also from the eco-sustainability point of view and in particular for energy saving and CO2 emissions reduction.

Moreover, such kind of measures will also imply positive effects on the overall city mobility, as these will contribute to lowering traffic congestions (and related problems) depending on logistics processes.

The selected measures are following:

1. Urban Consolidation Center (UCC) - this measure is deemed feasible in Burgos context, due that a suitable area, with an easy access to/from the main road axis exists and locating it on the city centre. Moreover, due to freight volumes, a “light” infrastructural/operational solution was preferred, in order to enhance the economic sustainability of this measure.
2. Re-urbanization of “Plaza de España Market” area - closely related to the previous measure.

3. ECO-VAN-SHARING for city centre shop owners - Thanks to the availability of a specific location in the UCC suitable to the set up of this service, this measure is feasible in Burgos context and sustainable from the economic point of view, also in case of (initially) low freight quantities.
4. Web management for the -nonlabelled- cars card system - This measure is focused on the new Municipality regulation for commercial vehicles entering into the access control system of the study area. The preliminary pilot application of these actions was implemented as a “soft measure” in the frame of ENCLOSE project.
5. Last mile service for the city centre (Park&Buy by bike)- This measure was deemed particularly useful for Burgos, as it has the specific characteristics that a city shall have for making this scheme a successful one.

The other measures described were not selected because they are not sustainable from the economic point of view and would not have a significant impact of pollution reduction and energy saving in the study area.

5. Feasibility of the selected measures

An analysis of requisites and operating conditions of the measures identified above is provided in the following section, along with a description of infrastructures/equipment, staff, operation schemes and supporting regulation. Also, an analysis of investment and operation costs is given.

Finally, specific benefits in terms of mobility, energy savings and emission reductions are discussed.

5.1 Urban Consolidation Centre (UCC)

5.1.1 Burgos needs pro UCC

The main advantages that make it suitable for the city of Burgos are:

- Optimization of distribution trips
- Reduction of trips and vehicles in the centre
- Possibility to serve both direct and reverse logistics
- Possible support for 3rd party logistics services
- Enhanced safety and liveability of the historic centre.

5.1.2 Measure requirements

Critical success factors to be considered for the implementation in Burgos (ENCLOSE site) include:

- Study of the location and accessibility of the UCC (e.g. close to the main transport network, city access areas, etc.);
- Adequate support by public authorities and regulations (restrictions, incentives, impacts on competition, etc.)
- Tight cooperation between public and private entities
- Collaboration between small independent, local and national transport operators
- Consultation and consensus among the key stakeholders associations (transport operators, small independent carriers, shops and retailers, businesses, consumers, etc.)
- Fund raising mechanisms (private project financing) and synergies with public funding programs (e.g. Structural Funds in eligible areas)

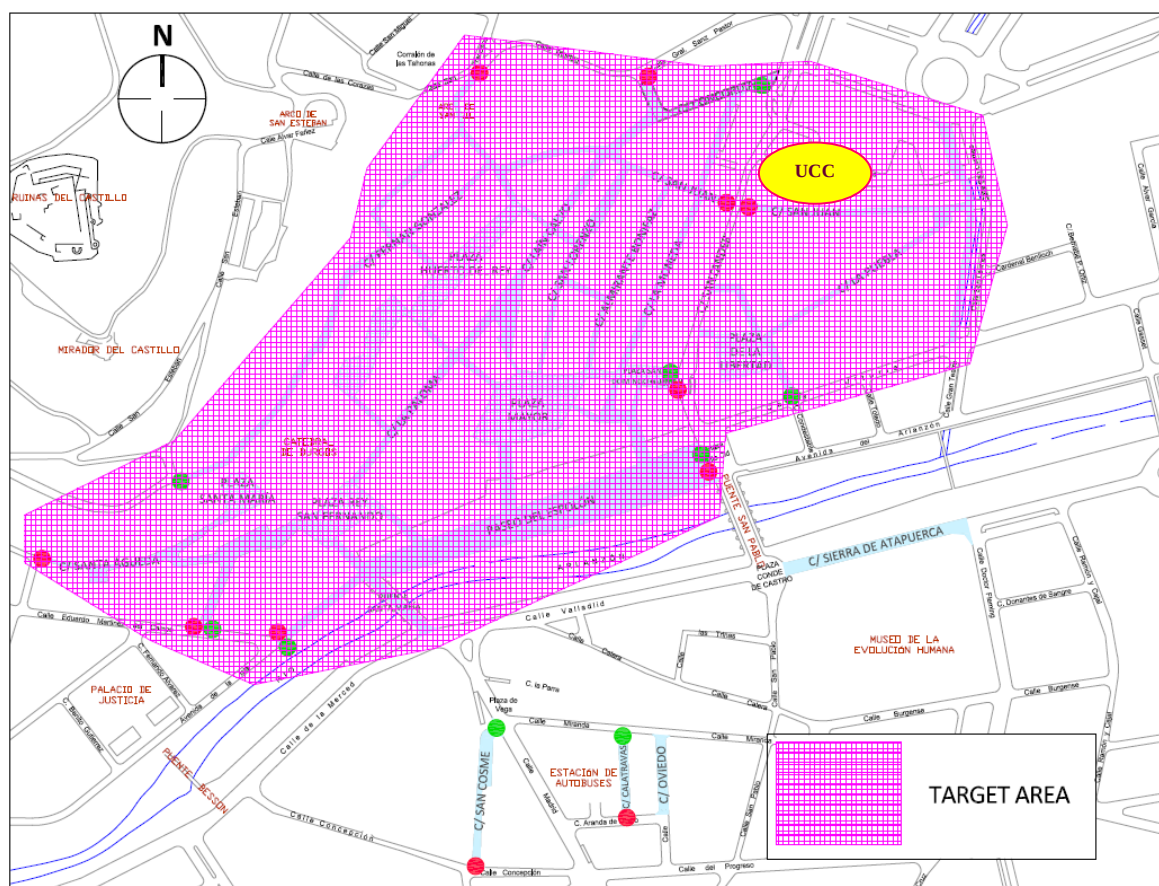
5.1.3 Location

When choosing the UCC location, some key requisites are to be considered:

- Easily accessible for long range operators (i.e. close to main roads and/or railways);
- Not too far from the main city delivery area (in order to avoid excessive-length trips, enhancing trips/day, also for having the possibility to adopt electric vehicles).

According to these, an initial study of location and accessibility was already done and pointed out that the reform of an existing building in the city center for the establishment of the Urban Freight Terminal was the best option.

The picture below shows the target area with the mentioned location of the UCC.



5.1.4 Normative/rules and legal constraints

A new normative scenario should be made in order to prevent the long range transport provider not to enter in the centre and to promote the use of the new installations.

5.1.5 Infrastructure: general features and dimension

In principle the first elements to be considered in planning an UCC basic structure are a warehouse (including offices) and a loading/unloading operation external area.

Warehouse

In order to keep the initial investment as low as possible it would be important to place inside the existing building of the “north market” of the city a small/medium warehouse, which could be enlarged in order to satisfy any future need for a wider space.

As the area is currently an active market, it is provided with suitable loading areas that could be enough for the UCC, and would be used for both loading and unloading freight vehicles.

An aerial photograph of the area is showed on the right of these lines.

External area

An external maneuvers area is available on the existing facility providing the minimum space required for allowing trucks operations in front of the downloading areas.

The selected Burgos UCC location, well meets all these requirements in terms of available space. It is important to highlight that this area is at present a Market with a complementary open car parking space (mainly used by citizens going shopping or for personal business to the city centre). The UCC would occupy a minimum area of the existing parking space.



5.1.6 Eco-fleet typology

The delivery services could be preferable partially operated by a fleet of eco-sustainable commercial vehicles.

The suitable options shall be found among one of the following (featuring a decreasing environmental impact):

- New generation diesel vehicles (i.e. Euro 5 with DPF - Diesel Particulate Filter)
- Bi-modal (diesel/electric) vehicles
- Hybrid vehicles
- Electric vehicles (FEVs)

Logistics base location and operating conditions for the Burgos UCC (the average distance between the UCC and the delivery area of the city centre is rather 1,5 km) and the total distance to be covered by each van (from 30 up to 40 km considering 6 trips/day), are fully compatible with FEVS (electric vehicles), which are the most suitable solution, in terms of pollution reduction.

Considering the peculiar characteristics of the reference area, vehicle fleet, at least at an initial phase, could consist of n. 2 electric vehicles of 3,5 tons mgw - 1,1-1,2 tons of loading capacity, and operating on distances up to 120 km full-load.

At a following stage the possibility to widen UCC fleet, in order to diversify vehicle typology and satisfy different needs, could be considered. For instance, deliveries in the narrowest roads could be performed by means of electric mini-vans.

5.1.7 ICT support tools/system

Although in the initial phase and in case of a limited activity all the procedures can be essentially managed manually, it would be important for an UCC to be equipped with an ICT system for managing freight services and planning, thus ensuring a fundamental support all along the delivery process phases: from freight collection, to trip planning, parcels and final delivery tracking despite the accounting report and administrative documents.

5.1.8 Key Stakeholders

The main stakeholders to be involved for UCC activities are: freight transport operators, shopkeepers in the reference area, local authorities and Citizens and commercial associations.

All of these groups shall be met before making any decision on UCC, in order to make clear that, despite adding transshipment costs to delivery processes, the UCC is also an important opportunity for achieving a more efficient and sustainable freight delivery system, producing benefits for both freight transport operators (time saving avoiding access to the inner city center for small deliveries, possibility to use bigger vehicles, etc.) and for shopkeepers (more

delivery flexibility, reverse logistics for carton box packaging, better urban environment, better accessibility and safety for pedestrians, increase the possibility of parking, possibility to use the UCC as third party warehouse with ecosustainable delivery on shop demand, etc.).

Finally, it is important to outline that the introduction of an UCC should be a participative process involving several public and private stakeholders. Several unsuccessful experiences stressed that innovative logistics services like UCCs can be implemented only with a close collaboration and agreement among Public Authorities, Logistics and Transport Operators, Shopkeepers, Citizen Associations, etc.

5.1.9 Preliminary organization/operation dimensions

This UCC will have as main service the last-mile delivery, but other freight and logistics services under mobility restriction policies set up by the Local Authority, such as:

- Full implementation of optimized city center reverse logistics services extended to the regular collection and transport of packaging and wasted elements from shops
- Complementary logistics services for special issues (e.g. transport of heavy/bulky goods for customers)
- 3rd party warehousing and support services for shop keepers and small business

Usually, for the last-mile delivery service, the main national long-range freight transport companies/operators, that in many cases have a depot in the surrounding city areas avail themselves of small local operators, owning one vehicle, or of small local transport cooperatives.

In the starting phase it is important to set-up a light structure and collaborates with local small operators, to use their vehicles. In this phase the following resources (in terms of staff, equipment, etc.) will be required: 2 - 3,5 tons trucks, 1 - electric Pallet truck, 2 - truck drivers, 1 - loading/uploading responsible person and 1 - administrative employee

At a later stage on the basis of the real development of the UCC activities the vehicle fleet, the warehouse space, and the staff resources should be redefined.

As regards the management structure, at the beginning a full public (Municipal) management is to be preferred while, at a later stage, the management could be behalf of a public owned company, a public-private partnership or a service procurement partnership.

In any case a detailed “Management Performance Chart” between the Municipality and the operator contracted for UCC management should be defined, in order to clearly define since the beginning not only contractual issues (in terms of rights and obligations) but also the level of performances that the operator shall guarantee for the whole contract duration.

5.1.10 Cost and impact dimensions

5.1.10.1 Management model and investment costs

As the previous paragraphs describe, Burgos UCC initially will have as main service the last-mile delivery and the corresponding freight storage. Due to the easy adaptation of an existing facility to this purpose the general measure could start with a low investment cost, this will be helpful to make the activity economically self-sustainable.

Needed human resources: should be required both, administrative and operational resources. The minimum staff necessary to develop all the services on the UCC could involve:

- 1 administrative employee: who can plan and administrate the warehouse activity;
- 2 truck drivers: with knowledge on operating the loading and unloading machinery.

The management model should foresee the "classic" operational schemes dealing with freight collection (direct or cross-docking), consolidation, delivery, track and tracing (using GPS equipped vehicles), management, administration, etc.

Needed infrastructure: as the new UCC will be fitted on a public Market (Municipal area), minimum changes should be done:

- Warehouse refit (reach suitable temperatures and guarantee freight safety);
- Furnishing an administrative office.

Needed mechanical equipment: the minimum equipment should be bought:

- 1 Pallet truck
- Accurate freight handling and safety equipment
- 2 EVs (3,5 tons trucks)

Costs detail (in €) – maximum estimation

1. Staff operation costs in the initial phase

	Costs/year €
1 administrative person	35.000
2 drivers	50.000
TOTAL	85.000

2. Warehouse refit

	Costs/year €
- Construction insulation works	40.000
- TC and electrical system	<u>5.000</u>
TOTAL	45.000

3. Administrative Office furnishing

	Costs/year €
- <u>Furniture and equipment</u>	<u>10.000</u>
TOTAL	10.000

4. Pallet Truck

	Costs/year €
- Electric Pallet Truck <u>(with ergonomic lift Capacity 1600 and 800 kg)</u>	<u>3.000</u>
TOTAL	3.000

5. Freight handling and safety equipment

	Costs/year €
- <u>Slings, chains, pins, gloves, jackets,....</u>	<u>1.000</u>
TOTAL	1.000

6. Electric vehicles

	Costs/year €
- <u>2 electric commercial trucks - 3,5 tons</u>	<u>140.000</u>
TOTAL	140.000

7. Maintenance costs

	Costs/year €
- <u>10% of 2.+3.+4.+5.+6. Costs</u>	<u>19.900</u>
TOTAL	19.900

The estimated initial management and investment amount should be around 303.900 €, +25% unexpected costs, for a total of around **380.000 € the first year.**

5.1.10.2 *Energy, environmental and social impacts*

The required investment, which may be high in relation to the size of the physical infrastructures and technical installations involved, pays off in terms of several benefits for the environment and population: optimizing vehicle load and runs, reducing the number of trips, direct goods mobility towards less environmental impact conditions, etc.

The support from the local administration should be necessary to ensure the economic sustainability of UFT. Also strong efforts in marketing may be required.

It is relevant the fact that in the last months the newspapers showed news about the area described in this section, thought for the implementation of the UFT. Thus cited below a summary thereof:

“The analyzed and chosen location is one of the -whole sale fruit- markets of the city, placed in the inner city –Plaza España Square- (out of the pedestrianized area). This market needs several structural refurbishments: the building dates from 1968, one entire floor (out of 3) is out of use, due to structure conservation and does not have its own indoor parking/load area (shop owners and customers share outdoor parking area in Hortelanos Square, with limited space, deficient urban conservation and traffic conflicts). The mentioned needed refurbishment have been postponed last years due to political and economic reasons. In this framework, different private initiatives have emerged to offer different possibilities for a new market building. One of the most solid emerged during 2013, a private company offered themselves to undertake an investment of 18 million euro to build a new building for the Market (ending with the idea of a traditional market, and combining a new philosophy: gastro-market, gastronomy + market). In addition to rebuilding and reserve the entire ground floor for the retail activity, proposes the creation of linked dining areas and a number of services that revitalize the building. In exchange for paying the cost of the whole work, the company would have reserve the use of space for a given period and the commitment to building a car park underground in the area of influence and even to study its connection to a near car park. The company has already successfully undertaken similar projects. Last but not least, the proposal would include the development of urban refurbishing of the close streets (Hortelanos Square), one of the most degraded sites of the city center. This framework opens a financial possibility for an urban freight terminal.”

5.1.11 Implementation plan

Several positive European experiences, such as the relevant UCC created in Lucca (CEDM UCC, now known as LuccaPort), highlight that a reasonable time needed for implementing an UCC, until its full operation phase, amounts to around 3 years.

According to this indication the following table provides feasible implementation timing for the Burgos UCC.

PERIOD (Term)	1 st YEAR	2 nd YEAR	3 rd YEAR
Study of the UCC location and accessibility (close to the main transport network, city access areas, etc.)	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
Stakeholders meetings (transport operators, shopkeeper associations, citizens association, Municipality)	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
Support by public authorities and regulations (restrictions, incentives, impacts on competition, etc.)	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
UCC infrastructural implementation	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
UCC operational implementation	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
UCC developed	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■

5.2 Re-urbanization of “Plaza de España Market” area

5.2.1 Burgos needs pro Re-urbanization measure

The main advantages that make it suitable for the city of Burgos are:

- Optimization of the UCC services
- Improvement of mobility in the area, enhancing intermodality, safety and liveability of the historic centre.
- Parking lots regulation encouraging a shared use during the day, combining market customers, UCC users and residents.
- Lower emissions and energy consumption, leading to an overall improvement of the quality of life in the area.

5.2.2 Measure requirements

Critical success factors to be considered for the implementation in Burgos (ENCLOSE site) include:

- Study of the location and accessibility of the UCC (e.g. close to the main transport network, city access areas, etc.);
- Adequate support by public authorities and regulations (restrictions, normative, etc.)
- Consultation and consensus among the key stakeholders associations (transport operators, small independent carriers, shops and retailers, businesses, consumers, residents, etc.)

5.2.3 Location

The picture below shows the allocated parking area surrounding the planned UCC, currently Northern Market of the city.





The solution could be defined around the following possible main elements/rules:

- From 7:00 am to 11:00 am parking allowance only for freight vehicles with limited minutes;
- From 11:00 am to 8:00 pm parking allowance only for UCC and market users vehicles with limited minutes;
- From 8:00 pm on parking allowance only for residents;
- Electric vehicle, will park in special areas for free, so that the sustainability could be promoted in the area.



5.2.4 Normative/rules and legal constraints

A complementary normative scenario should be made in order to include a special treatment of this area.

5.2.5 Key Stakeholders

The main stakeholders to be involved for the re-urbanization measure are mainly the Local authorities, Shops owners, UCC users and Residents,...

5.2.6 Constraints and costs

Envisaged possible problems can be identified in:

- Not suitable parking time windows during the operational phase, due to the services that the UCC will cover. This initial planned times could be changed if it is necessary after the UCC will start in a fully operative level.
- Opposition of shopkeepers and residents to accept the new planned measures. This aspects should be addressed by a strong involvement activity (meetings with market shopkeepers, transport operator associations, citizens association, Municipality, etc.).

This measure affects only an existing public infrastructure and consists on a regulatory measure principally, thus no significant costs are foreseen. There will be no initial devices to be purchased, but for a future phase some charging dots for EVs could be achieve.

5.3 Eco-van-sharing for city centre shop owners

5.3.1 Burgos needs pro Eco Van-sharing measure

The main advantages that make it suitable for the city of Burgos are:

- Integration of zero-emission vehicles in the overall urban mobility
- Social benefits (more employment, education, air quality, noise, etc.)
- Significant public acceptance.

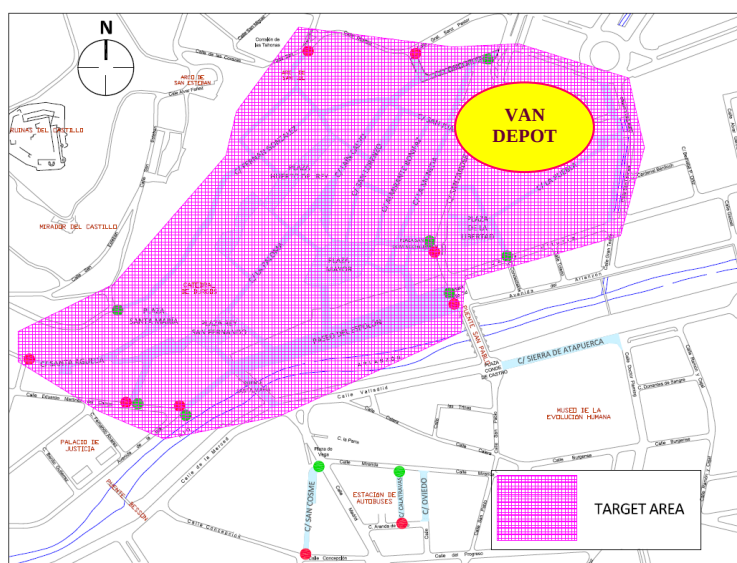
5.3.2 Measure requirements

Critical success factors to be considered for the implementation in Burgos (ENCLOSE site) include:

- Study of the potential demand on the use of this type of vehicles among the city centre shop owners.
- An Electric vehicle can replace operationally conventional freight vehicle for last mile services and is technically reliable and accepted by the drivers.
- Depot point and management sharing system.
- Availability of electric charging points for the new EV, to ensure that full use of this vehicle can be achieved as EVs are still limited by the vehicle range due to the battery.

5.3.3 Location

The picture below shows the target area with the mentioned location of the UCC, where from the activity of this measure could be coordinated.



5.3.4 Infrastructure: general features and dimension

In principle the first elements to be considered in planning a VAN-SHARING basic structure are a parking (loading/unloading zone) area and a located charging point.

The selected surrounding area of Burgos UCC location, well meets this special need. The van-sharing depot/parking area would occupy a minimum area of the existing parking space.

5.3.5 Eco-fleet typology

Considering the peculiar characteristics of the reference area, vehicle fleet, at least at an initial phase, could consist of n. 1 electric van of 3,5 tons mgw - 1,1-1,2 tons of loading capacity, and operating on distances up to 120 km full-load.

At a following stage the possibility to widen the van-sharing fleet, in order to diversify vehicle typology and satisfy different needs, could be considered. For instance, deliveries in the narrowest roads could be performed by means of other types of FEVs, like the cargocycles used in the Petite Reine scheme in Rouen (FR) or GnewtCargo scheme in London. One of these FEVs can be used in a long-term phase of this measure to support the sustainable own-transport services (for shops, businesses and citizens) of van sharing schemes in Burgos.

5.3.6 ICT support tools/system

Although in the initial phase and in case of a limited activity all the procedures can be essentially managed manually, it would be interesting for the van-sharing scheme to be equipped with an software/web for both, ECO-VAN and CARD management. The ICT system for managing freight services and planning thus ensures a fundamental support all along the delivery process phases: from freight collection, to trip planning, parcels and final delivery tracking. Complete information of this ICT – technology could be finding on part 5.4 of the present chapter.

5.3.7 Key Stakeholders

The main stakeholders to be involved for Van-sharing activities are: Local authorities, Shops owners, Business and service operators, Citizens and commercial associations, Residents,...

5.3.8 Preliminary organization/operation dimensions

The suitable depot point to locate the ECO-SHARED-VAN should be on the UCC (Urban Consolidation Centre), where a perfect control of the vehicle can be done.

Electric driving has new issues around road safety and daily use (i.e. recharging strategies), that is why charging point for the van have to be implemented on the depot area.

A booking web system to manage the use of the van-sharing scheme is needed.

The Public financial support in the context of an overall program involving environmental targets could fit this measure.

5.3.9 Cost and impact dimensions

Due to the easy adaptation of the surrounded area of an existing facility to this purpose the general measure could start with a low investment cost, this will be helpful to make the activity economically self-sustainable.

Needed mechanical equipment: the minimum equipment should be bought:

- 1 EVs (3,5 tons trucks)

Costs detail (in €) – maximum estimation

1. Electric vehicles + charging dot

	Costs/year €
- 1 electric commercial trucks - 3,5 tons	70.000
- <u>1 charging dot</u>	<u>6.000</u>
TOTAL	76.000

2. Maintenance costs

	Costs/year €
- <u>10% of 1. Cost</u>	<u>7.600</u>
TOTAL	7.600

The estimated initial management and investment amount should be around 83.600 €, +25% unexpected costs, for a total of around **105.000 € the first year** (the cost of a ICT system is not included on this initial phase, although the cost can be checked on the next section 5.4).

Some of best practices operating FEVs have shown that electric vehicles bring clear benefits as regards the abatement of exhausted gases, CO₂ and noise emissions. Not least, although the use of (local/regional) renewable energy is still difficult.

FEVs are accepted by the public and have an “image” which may be a helping factor for the introduction of new sustainable logistics services introduction in a site.

5.4 Web management for the -nonlabelled- cars card system

5.4.1 Burgos needs pro card management system measure

ITS and technologies have also gained an almost indispensable role in the operation of advanced city logistics solutions. Over 50% of surveyed best practices involve the implementation and operation of ITS and various technical facilities, from load and delivery planning software, to fleet monitoring systems, track-and-trace solutions, vehicle occupancy/transit detection technologies, automated vehicle identification (e.g. number plate reading), monitoring and enforcement systems.

The introduction of ITS and ICT services to optimize logistics, fleet and delivery operations has been also expressed as a main technological requirement by the ENCLOSE towns.

5.4.2 Measure requirements

Critical success factors to be considered for the implementation in Burgos (ENCLOSE site) include:

- Create a specific traffic module for the city to manage loads, vehicles and users.
- Place a GPS Card Management could help on:
 - Locate cards in real time locating them on a map, recording his travels and stops.
 - Send and receive messages from predefined based on vehicle and back via GPS device in the vehicle.
 - Show routes to the driver.
 - Receive information start and end load, consumption, and incidents.
 - Have a system of warnings and alerts of events, messages, etc..

5.4.3 Location and infrastructure

The system controller can use a small office inside of the UCC facilities, described on part 5.1 of this chapter. From this office all the management of the system can be done: card distribution, software/web maintenance, awareness campaigns....

5.4.4 Normative/rules and legal constraints

The City Council developed a new regulation, which was on public exhibition phase and entered into effect in February 2013.

The new regulation for the historical centre access, with special processing for loading-unloading tasks replaces the previous one from 2007 that started to control the pedestrian areas with bollards, phones and cameras surveillance 24 hours a day.

This involved the disposal by the City Hall for the Downtown Historic Merchants Association of 20 unidentified registration cards, which will be distributed to members and non-members merchants of the historic centre, who need to work loading and unloading.

5.4.5 ICT support tools/system

A management program for land transport of goods by road offers increased productivity, efficiency and management control, allowing simultaneous control of several shop owners with nonlabelled- cars.

Accurate information can be obtained through specific manager listings: traffic, control, administration... etc. This type of ITC gadgets can have the information needed in the appropriate time and place.

This web/software application could be used also for managing the booking of the electric vehicle, as is described on the previous chosen service (5.3 ECO-VAN-SHARING FOR CITY CENTRE SHOP OWNERS).

5.4.6 Key Stakeholders

The main stakeholders to be involved for Van-sharing activities are: Local authorities (including policy makers and urban planners), Shops owners, retail operators, Business and service operators, Freight transport/distribution service providers,...

5.4.7 Preliminary organization/operation dimensions

The Downtown Merchants Association needs to create a historical record that attest to whom delivered card holding period of the card and any incident arising thereon, to realize what the area of Public Safety and Emergency.

The web/software transport management system will help the Downtown Merchants Association in this issue and also can control the Eco-Van-Sharing system which was described previously.

5.4.8 Cost and impact dimensions

Needed human resources: should be required administrative resources. The minimum staff necessary to develop all the services on the management system could involve:

- 1 administrative employee: who can administrate the system;

Needed infrastructure: as the office will be fitted on the new UCC, minimum changes should be done:

- Furnishing an administrative office.

Costs detail (in €) – maximum estimation

1. Staff operation costs in the initial phase

	Costs/year €
<u>1 administrative person</u>	<u>35.000</u>
TOTAL	35.000

2. Administrative Office furnishing

	Costs/year €
- <u>Furniture and equipment</u>	<u>10.000</u>
TOTAL	10.000

3. ICT systems

	Costs/year €
- <u>SW logistics platform</u>	<u>15.000</u>
TOTAL	15.000

7. Maintenance costs

	Costs/year €
- <u>10% of 2.+3. Costs</u>	<u>2.500</u>
TOTAL	2.500

The estimated initial management and investment amount should be around 62.500 €, +25% unexpected costs, for a total of around **78.000 € the first year.**

The web/software manager system investment should be done by Downtown Merchants Association, although is recommended a Public financial support in the context of an overall program involving environmental targets.

The required investment pays off in terms of several benefits for the shop owners, environment and population: optimizing vehicle load and runs, reducing the number of trips, direct goods mobility towards less environmental impact conditions, etc.

Also several campaigns in marketing and awareness may be required although no in the initial phase of development.

5.5 Last mile service for the city centre (*Park&Buy by bike*)

A number of relevant experiences in this area of city logistics has been done in European cities and towns – including Siena (eDRUL project) with an electric fleet, experience with Via Collect in Rotterdam that shows that price setting is crucial to the success of the concept, etc.

5.5.1 Burgos needs pro “Park&Buy by bike” measure

Regarding the B2C services for citizens, travelers and tourists we find listed some of the available implementations:

- B2C services for citizens and tourists using dedicated Pick-up-Points and delivery services
- Freight operations integrated with leisure mobility: “Park&Buy”-type services providing freight delivery at parking stations for tourists and travelers, luggage transport to/from hotels, etc.;

This service helps with a “hands free walking/shopping” to customers purchasing heavy or bulky products during shopping or sightseeing and having the problem of carrying their goods to the car parked outside a limited access zone or to the hotel where they’re lodging.

5.5.2 Measure requirements

Critical success factors to be considered for the implementation in Burgos (ENCLOSE site) include:

- Study of the potential demand on the use of this type of services among the city centre shop customers.
- A Bike delivery fleet organize as an small Bike Logistic Agency to deliver the goods from the shops to the destination selected points (parking, hotels ...)
- Acceptance of the parking managers to implement this service on their parking and allow having a small area of their facilities to be used as a temporary stockroom.
- Web service system with wireless technology and hand held computers to make possible the communication among the shop owners, the Bike Logistic Agency and the customers.

5.5.3 Location and infrastructure

The Bike Logistic Agency can be placed inside of the UCC facilities, described on part 5.1 of this chapter.

From this office all the management of the service can be done: routes planning and schedule, temporary stockroom for goods in case shops close before the customer leaves the parking, bike fleet parking, bikers toilettes/showers areas...

5.5.4 Eco-fleet typology

Deliveries could be performed by means of FEVs, like the cargocycles used in the Petite Reine scheme in Rouen (FR) or GnewtCargo scheme in London.

5.5.5 ICT support tools/system

An ICT system for managing freight services and planning ensures a fundamental support all along the delivery process phases: from freight collection, to trip planning, parcels and final delivery tracking. Complete information of this ICT – technology could be found on part 5.4 of the present chapter.

That system should be implemented with a web service system with wireless technology and hand held computers.

5.5.6 Key Stakeholders

The main stakeholders to be involved for Van-sharing activities are: Local authorities (including policy makers and urban planners), Shops and retail operators, Business and service operators, Parking managers, Citizens associations, Customers,...

5.5.7 Preliminary organization/operation dimensions

P&B by bike service will offer this chance for any customer that shop in the city centre (citizen, tourist...). He can buy an item in a shop and have the parcel delivered at the parking house or hotel he wants.

If the customer is interested, he selects the time within and the place where the goods have to be delivered. After paying a fee he gets a code for collection. When the customer accepts this service the shop owner contacts the Bike Logistics Agency with the web system and provides information about the pick-up place, the delivery place, and the expected delivery time.

The Bike Logistics Agency plans an optimized route due to the load, available biker, delivery customer restrictions and provides the shop owner with some choices about the calculated trips' delivery schedule. When the shop owner confirms one of the solutions proposed by the Bike Logistics Agency, the new route will be uploaded to the urban delivery biker using wireless technology and hand held computer.

At the given time the urban delivery biker will pick up the goods from the shop and will deliver them to the selected place. When the parcel has been delivered the Biker, using its own hand held computer, will communicate with the Bike Logistics Agency. The Agency transfers this information to the end customer notifying that his parcel has been delivered by sending an SMS. Finally the customer presents the code when paying for the parking or when entering the hotel and collects the goods.

5.5.8 Cost and impact dimensions

Due to the potential sharing of resources among the previous measures to this purpose the general measure could start with a low investment cost, this will be helpful to make the activity economically self-sustainable.

Needed human resources: should be required operational resources, cyclist-deliverers. The minimum staff necessary to develop the services on could involve:

- 1 administrative employee: who could be share with the UCC administrative;
- 1 ICT/planning employee: who could be share with the card management employee;
- 4 cyclists: with knowledge on operating the loading and unloading machinery.

Needed infrastructure: as the office could be the same planned for the ICT management system located on the UCC, no costs will be required.

Needed mechanical equipment: the minimum equipment should be bought:

- 4 cargocycles.

Costs detail (in €) – maximum estimation

1. Staff operation costs in the initial phase

	Costs/year €
<u>4 deliverers</u>	<u>72.000</u>
TOTAL	72.000

2. Vehicles

	Costs/year €
- <u>4 cargobikes</u>	<u>6.000</u>
TOTAL	6.000

7. Maintenance costs

	Costs/year €
- <u>10% of 2.Costs</u>	<u>600</u>
TOTAL	600

The estimated initial management and investment amount should be around 78.600 €, +25% unexpected costs, for a total of around **98.000 € the first year**. (The costs of the technical

employees and the ICT system are not included as they would be share and can be checked on sections 5.1 and 5.4).

The new Bike Logistic Agency as well as the place to develop their activity investment should be done by Downtown Merchants Association and parking managers, although is recommended a Public financial support in the context of an overall program involving environmental targets.

6. Chosen measure priority

Table below provides a summary view of the five measures chosen for the city of Burgos for the feasibility study done for the ENCLOSE project. These are grouped into the four investigation categories – socio-economic, commercial, operational, technical – related to each site and show the corresponding relevance: strong development (□□□), development (□□), moderate development (□).

ENCLOSE Investigation Categories	CHOSEN SERVICES/MEASURES - BURGOS			
	UCC and REURBANIZATION	ECO-VAN-SHARING	WEB CARD MANAGEMENT	PARK&BUY BY BIKE
SOCIO-ECONOMIC	□ □ □	□ □	□ □	□ □
COMMERCIAL	□ □ □	□ □ □	□ □	□
OPERATIONAL	□ □	□ □ □	□	□ □
TECHNICAL	□ □ □	□ □	□ □	□ □

7. Conclusions

The feasibility study for city logistics measure in Burgos city centre shows that all the selected measures cover the four investigation categories – socio-economic, commercial, operational, technical in which the ENCLOSE project focus its purposes and by all means represent an added value in environmental and energy terms.

The temporal diagram recommended to develop the measures could come of the section 6. of the present Feasibility and Transferability Analysis of energy-efficient and sustainable freight logistics solutions in Burgos.

The first measure to set up would be the adaptation of the Plaza España Market and transformation into an UCC, that along with the use of electric vehicles for freight delivery, could lead to an overall improvement of urban city centre life quality.

Straightaway any of the other three measures could be implemented; despite the Eco Van-sharing system covers more categories, as the table shows, it is suggested to set up the three of them concurrently as they can share some of the resources and this would achieve an optimum economical balance.

In short, it is important to highlight that however in Burgos there are some logistics problems, this feasibility analysis enhances the progress on the habitability of this historical and touristic city centre, which could be reached with the close collaboration and agreement among Public Authorities, Logistics and Transport Operators, Shopkeepers, Associations and Citizens.